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James Doyle Sell Mining Collection

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JDS

ASARCO

Southwestern Exploration Division

November 20, 1990

Dr. F.T. Graybeal
Chief Geologist
New York City

Publication Request
Yarnell Paper

Dear Fred:

I attach a full copy of the Yarnell paper, which was given verbal approval by both Asarco and Norgold, to be in a field trip guidebook to the Waddell Dam - Mistic Prospect - Newsboy - Yarnell areas on December 8-9, 1990.

M.A. Miller, thru Steven Reynolds of the AZ Geologic Survey, also requests that this same paper be submitted for the Arizona Geological Society Digest 19 which is scheduled for release next year as: Proterozoic Geology and Ore Deposits of the Prescott-New River Area, Central Arizona, edited by Ed DeWitt and Karl Karlstrom (both USGS, Flagstaff). This will be a substantial volume updating the Proterozoic and expanding from what was included in AGS Digest 17 (Geologic Evolution of Arizona, 866 pages).

I concur that the present paper be cleared by the Publication Committee and the paper be presented for inclusion in Digest 19.

I have earlier sent you a note on the AIME program in Phoenix in 1992 where the Mining Geology section had requested a Yarnell paper from Tench Page who, in turn, wanted M.A. Miller to participate. Either Tench or Mark could present it and Mark wants the professional recognition from the preprint and presentation. Your comment(s) will be appreciated.

Miller will also verbally, with slides, present the Yarnell story to the AGS meeting on December 4, 1990, prior to the Fall Field Trip.

Sincerely,

James D. Sell

James D. Sell

JDS:mek
Att.

cc: W.L. Kurtz (cover letter only)
M.A. Miller (cover letter only)

Mr. James Sell
ASARCO
1150 N. 7 Ave.
Tucson, AZ 85705

ASARCO

OCT 2 2 1990

SW Exploration

October 16, 1990

Dear Jim:

Thank you for helping out with the Arizona Geological Society Fall Field Trip. Listed below is the itinerary for the trip. I would appreciate a short write-up about your part of the trip that I can include in the informal field trip guide handed out to participants. I need to receive this write-up no later than the middle of November to still have time to get the guide together. Thanks for agreeing to contribute something on such short notice. It looks to be a great trip.

Best Wishes,

Steve

Stephen J. Reynolds

LOGISTICS: On both days, cold soft drinks and snacks will be provided, but bring your own lunch. A high clearance or four-wheel drive vehicle is needed only for stop 1c, but we can park low-clearance vehicles and regroup into fewer vehicles for that stop. Cost of the trip and guidebook is $20, except for leaders who go free.

DAY 1 (DEC 8): Begin at 9am at the Bureau of Reclamation Field Headquarters, located north of the Carefree-Wickenburg Highway (AZ 74) and just east of the Agua Fria River bridge.

- STOP 1A: Geology of the New Waddell Damsite (Mike Pryor, US Bur. Rec.)
- STOP 1B: Middle Tertiary structure and rock units, Lake Pleasant area (S. Reynolds, AZGS)
- STOP 1C: Mystic-Clementine gold properties, Hieroglyphic Mtns. (David Wahl, Consultant)
- EVENING: Participants are on their own for dinner and accommodations at either Lake Pleasant Campground or in Wickenburg.

DAY 2 (DEC 9): Begin at 8:30am at the Rest Area several miles south of Wickenburg on US 89.

- STOP 2A: Gold mineralization, Newsboy Gold Mine(Fred Bickford, Newsboy Gold Min. Co.)
- STOP 2B: Lunch and overview of Nature Conservancy Hassayampa River Preserve (Holly Richter, Nature Conservancy)
- STOP 2C: Norgold's Yarnell Gold property (James Sell and Mark Miller, ASARCO)
- END OF TRIP: Finish mid-afternoon, leaving plenty of time to return to Tucson, Flagstaff, or wherever.

cc: J.D Sell ✓
M A Miller
H G Kreis

J J Mackeson
H Downey

report ASAP to Mary so she can make reservations at Rancho Grande — Best Western in Wickenburg.

JDS

11/14/90

FROM: J. D. SELL

TO: Mike Philpot - Norgold
FT Grayheal - ASARCO

Faxed (Norgold) or attached (ASARCO) you will receive a copy of the Field Guide to be published and distributed during the Arizona Geological Society Fall Field Trip as outlined on the Oct. 14, 1990 note from SJ Reynolds.

J D Sell

JDS

ASPECTS OF THE GEOLOGY, FAULTING, AND GOLD MINERALIZATION AT THE YARNELL DEPOSIT YAVAPAI COUNTY, ARIZONA

A FIELD GUIDE

M.A. Miller
J.D. Sell
November 1990

ABSTRACT

The Yarnell deposit, located in the Weaver District of Yavapai County, Arizona is a structurally controlled hydrothermally altered zone that hosts economic gold mineralization. The deposit is hosted by a Precambrian granite and mineralization occurs within and surrounding a low angle fault structure known as the Yarnell Fault. The hanging wall of the fault has been extensively fractured and altered to sericite (phyllic alteration). Gold mineralization is associated with iron oxides and the development of multiple quartz veins and quartz stockwork. The footwall of the fault is phyllicly altered, but unmineralized with respect to gold. The Yarnell Fault Zone (YFZ) continues both northeast and southwest from the main deposit and where exposed contains gold. However, the thickness of the zone and associated alteration envelope diminish away from the orebody. Ninety-six reverse circulation holes and four diamond drill holes outline a mineral inventory of plus four million tons at 0.055 opt gold. Estimated recovery by column leaching exceeds 70%. An additional 2.7 million tons at 0.017 opt gold occurs in a low grade zone above the mineralized zone.

LOCATION AND HISTORY

The Yarnell Gold Deposit is located in the Weaver Mining District on the southwest side of the Weaver Mountains, Yavapai County, Arizona (Figure 1). The deposit is situated very close to the drainage divided between the Yarnell/Peoples Valley watershed and the Congress Valley watershed. The deposit is one mile south of the Town of Yarnell. U.S. Highway 89 is within 300' from the downdip extent of the known economic deposit. Elevations within the deposit range from 4650' to 5100' above MSL and the climate is conducive for year round operation.

Historical production for the Yarnell Deposit was derived from underground and limited production from the open cut on the top of the hill. Winslow Mining Company operated the property from 1939 through 1942 and mined the majority of the 200,000 tons which is the total estimated production. Average grade of the ore was reported to be 0.2-0.3 opt gold mined exclusively from the Yarnell Fault Zone. The mine closed in 1942 due to L-208; the Federal gold mine closure order.

Asarco's interest in the property was initiated in 1988 when Norgold Resources, a Canadian company, published the results of rock chip sampling from the implied width of the mineralized zone. The resultant grade suggested a bulk tonnage open pit target. Asarco examined and sampled the property confirming Norgold's results. A letter of agreement was signed with Norgold in late January 1989 for an exploration option on the property. A mapping and detailed rock chip sampling program was completed at which time a nine hole drill program began. Drilling results confirmed the bulk tonnage open pit potential of the deposit. Three phases of drilling were completed totalling 25,662 feet. This consisted of 96 reverse circulation and four diamond drill holes (twins to the reverse circulation holes) which completed the drilling program.

GEOLOGY

The Yarnell gold deposit occurs within a granite/granodiorite intrusive body informally called the Yarnell Granite (Anderson 1989). The granite intrudes a sequence of meta-volcanics and meta-sedimentary rocks of the Bradshaw Mountains Group. Xenoliths and roof pendents of country rock are common with the granite and probably resulted from "stoping" and "rafting" as the granite intruded. A recently completed PhD dissertation by Anderson (1989 describes the Yarnell Granite as follows:

> "The Yarnell Granodiorite (new formal name), is a foliated, coarse-grained porphyritic granodiorite to monzogranite, ... The Yarnell Granodiorite follows the northwest edge of the Stanton-Octave metavolcanic-metasedimentary screen to as far north as Wilhoit, where dikes of unfoliated Yarnell Granodiorite intrude foliated granodiorite of the Wilhoit batholith .... The Yarnell Granodiorite is distinctly coarse-grained and weakly foliated, with large pinkish-tan K-feldspar phenocrysts in an equigranular matrix with biotite, plagioclase, uncommon hornblende, and abundant sphene .... Chemically the Yarnell body is metaluminous high-K, calc-alkaline, high Fe-Ti and high-total alkali rock ...."

Anderson places the age of the Yarnell pluton in the 1730-1710 ma range.

Table 1 compares the three samples of granodiorite (DeWitt, 1989) with samples taken at the Yarnell Mine. DeWitt's sample #72 was collected about one mile north of the mine area, sample #73 about one mile west, and sample #74 at the base of Weaver Mountain. Malusa's samples were collected in the freshest granite in the hanging wall and footwall of the Yarnell Fault.

Table 1. Major Element Chemistry - Yarnell Pluton

	Granodiorite (DeWitt)			Biotite Granite (Malusa)	
	72	73	74	HW	FW
SiO_2	67.4	66.3	65.1	70.0	69.8
Al_2O_3	14.5	14.1	14.3	14.3	14.4
Fe_tO_3*	4.98	5.45	6.65	4.76	5.02
MgO	1.17	1.22	1.52	1.00	1.10
CaO	2.57	2.84	3.43	2.60	2.30
Na_2O	3.08	3.10	3.14	3.20	3.10
K_2O	4.18	4.33	3.78	4.10	3.90
TiO_2	0.80	0.79	1.02	0.70	0.85
P_2O_5	0.27	0.34	0.39	0.45	0.55
MnO	0.12	0.11	0.13	0.11	0.13
Total	99.07	98.58	99.72	101.22	101.15

*Fe_tO_2, total iron as Fe_2O_3

DIKES

The Yarnell fault is cut by and associated with several types of dikes that are dioritic, felsic and andesitic in composition. Diorite dikes are found in both hanging wall and footwall of the Yarnell Fault. The most prominent dioritic dike trends N10°W and dips 80°SW and crosses the Yarnell Fault, but it does not offset nor is it offset by the fault. Andesitic and felsic dikes are proximal and subparallel to the Yarnell Fault and have been found only in the footwall of the structure.

The Yarnell Granite is bordered on the southeast by mafic metavolcanics and metasedimentary rocks of the Bradshaw Mountains Group. Mid-Tertiary flows of andesitic and basaltic composition cap the hills and ridges north and northeast of the deposit.

ALTERATION (Figures 2 & 3)

Alteration at the Yarnell Gold Deposit varies from propylitic to potassic. The strongest alteration is centered within the Yarnell Fault Zone and decreases outward in intensity into the footwall and hanging wall.

Propylitic Zone - This zone is characterized by chlorite, epidote, minor calcite veining (in the unoxidized footwall) with weak sericitic dusting and replacement by sericite along biotite edges and/or on plagioclase feldspars. In the hanging wall, the propylitic zone may extend up to 100' beyond the phyllic envelope. In the footwall, the propylitic zone is thinner and is usually marked by calcite gash veins.

Phyllic Zone - Biotite and plagioclase have been completely altered to sericite (Table 4, Honea 1990). Secondary iron oxides as limonite, goethite, hematite and leucoxene characterize the oxidized portion of this zone. The unoxidized portion (which occurs in the footwall of the structure) is characterized by extensive silica flooding and sericite which gives the rock a distinctly green color. The phyllic zone extends 30-100' into the hanging wall above the potassic zone and 10-45' into the footwall.

Potassic Zone - Alteration is strongest within the YFZ. Abundant secondary quartz, chalcedony, adularia and clays occur within this highly crushed and tectonized zone. X-ray diffraction studies by Malusa on the clay size fraction of the fault zone suggest the material is fine grained sericite (illite) and adularia. The potassic zone outward from the YFZ is defined by adularia occurring as phenocrysts and selveges to the quartz veins. The altered zone is noted 50-80' above the fault and up to 25' below.

STRUCTURE

The principal feature that localizes and controls alteration and gold mineralization is the Yarnell Fault Zone (YFZ); a N30-50°E, 30-50°NW dipping structure wholly contained in the Yarnell Granite. This zone is composed of strong gouge, mylonite, micro-breccia (tectonically derived), quartz veins and chalcedonic replacement within a 3 - 7+ foot zone. There is abundant clay in the zone probably as a result of the fault gouge. A sample of illite from the fault (Shafiqullah, 1990) gave an age of 69 million years; +/- 1.6 million years. This date is probably indicative of regional cooling and uplift and suggests that the mineralization is no younger than the illite date. Tertiary extension (detachment style faulting) is not related to this deposit.

The fault has been traced two miles to the southwest where it disappears under the valley alluvium. The fault can be traced to the northeast 1500' from the top of Yarnell hill before it is concealed by debris from the volcanic cap and valley fill which consists of large unmineralized Yarnell granite boulders.

The sheared and crushed zone of the Yarnell Fault complex varies from five to eighty feet in thickness within the drilled part of the deposit. As the structure is followed downdip and along strike the entire zone thins to less than ten feet. The alteration envelope and mineralization also diminish in thickness with the associated thinning of the Yarnell Fault.

There are numerous sub-parallel fractures in the hanging wall that appear to mimic the fault. There are also several northeast trending quartz veins that have been mapped on the surface in the hanging wall of the Yarnell structure. These structures appear to flatten and "roll" in the underground exposures and may merge with the Yarnell Fault at depth. This orientation suggests a listric nature to these structures. The felsic dikes as mapped on the surface sub-parallel the Yarnell Fault in both strike and dip and show similar but much restricted alteration and mineralization. This may represent a "halo" to the main Yarnell deposit.

MINERALIZATION AND OCCURRENCE

Gold mineralization is associated with several stages of quartz, iron sulfides and oxides (pyrite, specularite). Base metal sulfides have been seen in polished section and implied from trace element geochemistry. Copper minerals (azurite and malachite) are associated with quartz/hematite veins in the underground workings.

QUARTZ

Quartz occurs associated with the Yarnell Fault as discrete veins and stockwork. Quartz veins also occur subparallel to the fault.

Paragenesis of the quartz suggests that the Yarnell Fault and subsidiary structures were the earliest event with silica flooding from these structures into the surrounding rocks. Successive movement along the fault and fault-related structures crushed and sheared the quartz. There has also been some remobilization of silica into the YFZ as banded chalcedonic quartz. At least four generations of quartz veining have been identified.

1. Early grey quartz associated with specularite in vugs parallel to quartz veins.

2. Dark grey quartz with some brecciation in the vein; dark color is probably due to fine grained specularite.

3. Lighter grey quartz with disseminated limonite pseudomorphic after pyrite; usually on the margins of the vein.

These three generations of quartz are usually seen as small veins up to 1/4" thick, commonly up to a half inch and have been noted up to three inches thick in drill core.

4. White quartz has been recognized in at least two stages. These veins appear to cross cut all of the other stages. The white quartz veins have been measured from six inches to one foot in drill core and up to twenty feet thick in the field. These veins will consistently assay from 0.01 to 0.8 opt gold. Visible gold occurs in similar looking veins in diamond drill holes.

IRON OXIDES

Iron oxides occur within this deposit and all are intimately associated with gold mineralization.

Limonite pseudomorphic after pyrite is very common in the oxidized phyllic zone. It occurs as discrete crystals or as intergrowths associated with quartz veins. Polished sections show native gold locked within and at the edges of limonite pseudomorphs.

Goethite occurs as fracture/vein filling and fracture coatings. Goethite also occurs as discrete patches associated with pseudomorphs. The total amount of iron oxides (principally limonite and goethite) dramatically increase within the zone up to 4-5%.

Hematite is very common within the Yarnell Fault and when intersected in drill holes turns the cuttings brick red. Hematite is associated with the highest gold grade and visible gold occurrences. Hematite is also associated with pyrite cubes especially close to the Yarnell fault. The occurrence of hematite usually indicates increased grade; greater than 0.03 opt gold.

Visible gold is associated with quartz stockwork in association with grey quartz and quartz/specularite veins. The higher gold assays are related to quartz stockwork with adularia. Higher gold assays are also related to the occurrence of hematite and limonite pseudomorphic after pyrite. The highest grade assays are directly related to the Yarnell Fault and abundant (+10%) red hematite and quartz. This was the zone that the old time miners were following and ranged from .01-1.0 opt gold.

Base metals-copper, lead and zinc occur in the geochemical regime in recent soil within and around Yarnell deposit. Secondary copper as malachite and azurite is associated with late stage quartz/hematite veins.

Rasmussen completed a 15 element geochemistry survey over and around the deposit. The survey was designed to continuously sample rock and soils from the hanging wall zone through the footwall into fresh granite. Samples were collected from rejects of these reverse circulation holes that tested through the hanging wall and footwall zone and from the main haulage adit that was driven in the hanging wall.

Table 2 compares the values in the drill hole rock geochemistry from that of the soil surveys. Copper values (average) range from a low of 3.7 ppm in hole YM-6, to a high of 28.4 ppm from soil in the hanging wall. Lead and zinc also reflect low ppm values.

Table 2. Comparison of Trace Elements (ppm values) in Main Ore Zone rotary cuttings and Hanging Wall-Footwall soil samples.

	Ore Zone, Rotary Cuttings ppm			HW Soils ppm	FW Soils ppm
	YM-6	YM-26	YM-50		
No. of Samples	3	4	5	53	61
Cu, average	3.7	18.4	17.0	28.4	19.4
Cu, high	5.0	36.4	26.1	55.4	30.0
Cu, low	2.6	5.1	8.7	16.3	11.5
Pb, average	7.9	69.1	8.5	24.6	21.1
Pb, high	10.7	255.0	11.7	58.5	34.9
Pb, low	5.9	4.7	7.1	14.5	12.5
Zn, average	28.8	59.6	41.8	86.8	60.3
Zn, high	36.4	124.0	57.0	270.0	124.0
Zn, low	24.1	34.3	34.8	33.7	30.3

MINERAL INVENTORY

Ninety six reverse circulation holes have defined a mineral inventory which occurs in two zones. The main zone (B) is 20 - 155' thick and is closely coincident to the Yarnell Fault. The mineral inventory for the "B" zone is 4.1 million tons at .051 opt gold using a 0.02 opt gold cutoff. The mineral inventory is outlined on the attached geologic map. The "A" zone occurs above the "B" and contains a mineral inventory of 2.7 million tons at .017 opt gold using a 0.01 cutoff. Overall stripping varies from 1.7 to greater than 3.0 waste/ore depending upon the economic parameters.

METALLURGY

Numerous bottle roll tests and column leach tests were completed on the deposit. A fifteen ton sample was mined from the ore zone exposed in the open cut to provide run of mine ore for column leach testing. Results of the column testing are summarized on Table 3.

Table 3. Column Leach Data

80% Passing Size	Column Size	Leach Time Days	Head Assay Opt	Tail Assay Opt	Extraction
6 inch	24" dia. x 18 ft.	111	0.046	0.022	52.2%
2 inch	15" dia. x 18 ft.	102	0.051	0.015	70.6%
3/8 inch	12" dia. x 18 ft.	79	0.055	0.013	76.4%

Cyanide consumptions ranged from 0.56 to 0.79 pound per ton or ore. Consumption rates were fairly constant throughout the leaching cycles. The ten pounds of lime and cement (3/8 inch feed) per ton or ore added to the ore charges as the columns were filled was sufficient to maintain protective alkalinity at above pH 10.5 throughout the test period.

Flotation/Fine Grind/cyanide leach tests were conducted on the Yarnell composite sent to Tucson from McClelland Labs. This head sample of 35 pounds assayed 0.031 opt Au and 2.35% Fe.

In the two flotation tests, ground to -200 mesh, the recoveries were 75%-76% in the final concentrate and 79%-80% in the rougher concentrate.

In the two fine grind/cyanide leach tests, also ground to -200 mesh, the recoveries were 97% in 22 hours of agitated leach. The cyanide consumption was 0.21 pounds per ton or ore and the lime was 3.3 pounds per ton or ore.

The trade-off between high recovery by fine grinding agitated leach and lower recovery by coarse crush/heap leach is a matter of economics.

ACKNOWLEDGEMENTS

Appreciation is extended to the staff and management of ASARCO Incorporated and Norgold Resources for permission to publish this paper. A number of company reports were used and we would collectively thank those who contributed to the project. We would also thank Bill Gay, Steve Keehner, John Malusa, Tench Page and Jim Rasmussen for their contributions.

M.A. Miller
J.D. Sell

November 1990

REFERENCE

Anderson, P., 1989, Stratigraphic framework, volcanic-plutonic evolution, and vertical deformation of the Proterozoic volcanic belts of Central Arizona, p. 57-147 in Jenny, J.P., and Reynolds, S.J., 1989, Geologic evolution of Arizona : Tucson, Arizona Geological Society Digest - 17, 866 pages.

DeWitt, E., 1989, Geochemistry and tectonic polarity of Early Proterozoic (1700-1750 ma) plutonic rocks, north-central Arizona, p. 149-163, in Jenney, J.P., and Reynolds, S.J., 1989, Geologic evolution of Arizona : Tucson, Arizona Geological Society Digest 17, 866 pages.

Honea, R.M., 1990, Various Petrographic Studies - Internal Reports to Asarco.

Shafiqullah, M., Personal Communication, 1990.

Field Trip Stops Figure 2, Table 4

(1) Fresh Unaltered Granite - The road cut shows typical examples of weathered Yarnell granite surrounding unweathered core. Petrographic descriptions of the weathered vs. unweathered intrusive is virtually identical (Table 4).

(2) Propylitic Zone - We have moved from unaltered rock into weak propylitic alteration. Note the sericitic sheen and greenish "tint" to the plagioclase feldspars. The crumbly, decomposed weathering is characteristic of this zone. The haulage adit is driven across dip and ends at the Yarnell Fault. This also connects with additional underground workings (now inaccessible from caving).

(3) Phyllic Zone - The small adit driven into the phyllic alteration sub-parallels the strike of the Yarnell Fault zone. Note the absence of biotite, the complete sericitization of the plagioclase feldspars; abundant iron oxides, and limonite pseudomorphic after pyrite and silification as veining and silica flooding.

(4) This stop traverses along the drainage and follows the strike (N30-40°E 25-30°NW) of the Yarnell Fault. The two near vertical shafts explore the thickness of the mineralized zone. A sample taken from the shaft assayed .23 opt Au. Note the greenish silicified rock on the small dump above the shafts. This is from the unoxidized phyllic zone in the footwall of the Yarnell structure. Further up the drainage and along the northwest hillside the Yarnell Fault is exposed in small workings. The small adit at the head of the drainage is driven along the strike of the Yarnell Fault and used to connect with the main haulage tunnel. This is now badly caved and inaccessible. Note the highly fractured rock in the hanging wall of the fault and the amount of iron oxide that occurs within the mineralized zone. The amount of fracturing plus iron oxide is typical of the ore zone.

(5) Weathered diorite dike is exposed along the road. The dike trends N10°W dipping 80°SW. This dike crosses the Yarnell Fault. The greenish brown soil is typical of the weathering of the dike.

(6) Some of the larger quartz veins are exposed in the drill roads and road cuts. We are also standing on the outcrop of the upper altered zone. Underground the quartz vein steepens and then appears to flatten,, possibly merging into the Yarnell Fault at depth.

(7) The best surface exposure of the Yarnell Fault Zone and hanging wall structures is the open cut. High grade gold mineralization is confined to a 4-6' zone which assays 0.1-0.5 opt gold. Potassic alteration in the form of adularia occurs within this zone and in the footwall of the Yarnell Fault. Note the large amount of hematite and hematitic staining in the fault zone. The few timbers sticking up through the muck are from underground stopes that were "daylighted" by the open cut.

(8) This stop is in the oxidized footwall of the Yarnell Fault. The rocks are phyllicly altered and quartz veining is evident parallel to the structure. These rocks are weakly anomalous with respect to gold.

JDS

ASARCO

Exploration Department

TELECOPIER

DATE: 11/15/90

TO: 604-687-8789

NAME: Michael Philpot

Norgold Resources Inc.

LOCATION: Vancouver, B.C., Canada

copy also sent to FTG

FROM: M.A. Miller & J.D. Sell

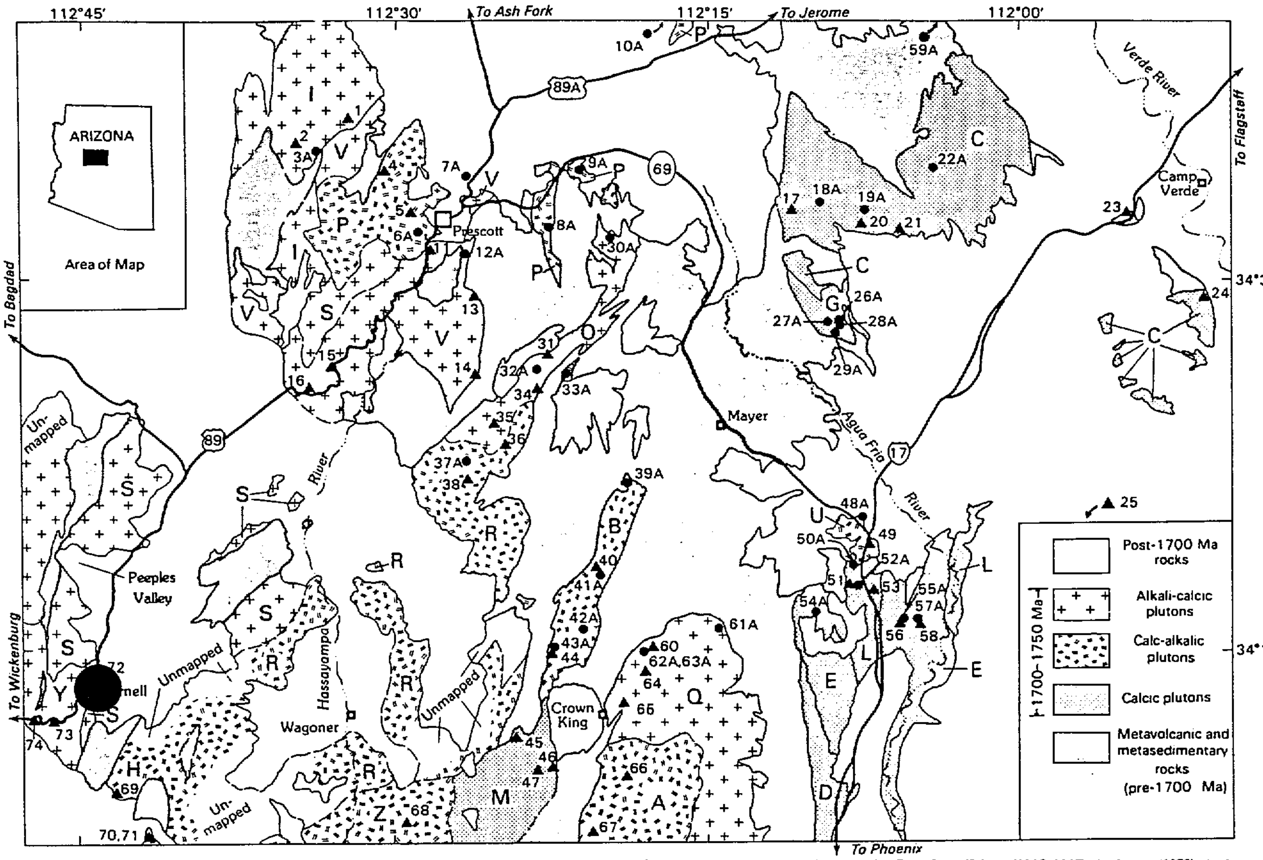
MESSAGE:

Maps will be forwarded at a later date.

You will receive 14 page(s) of copy including this sheet.

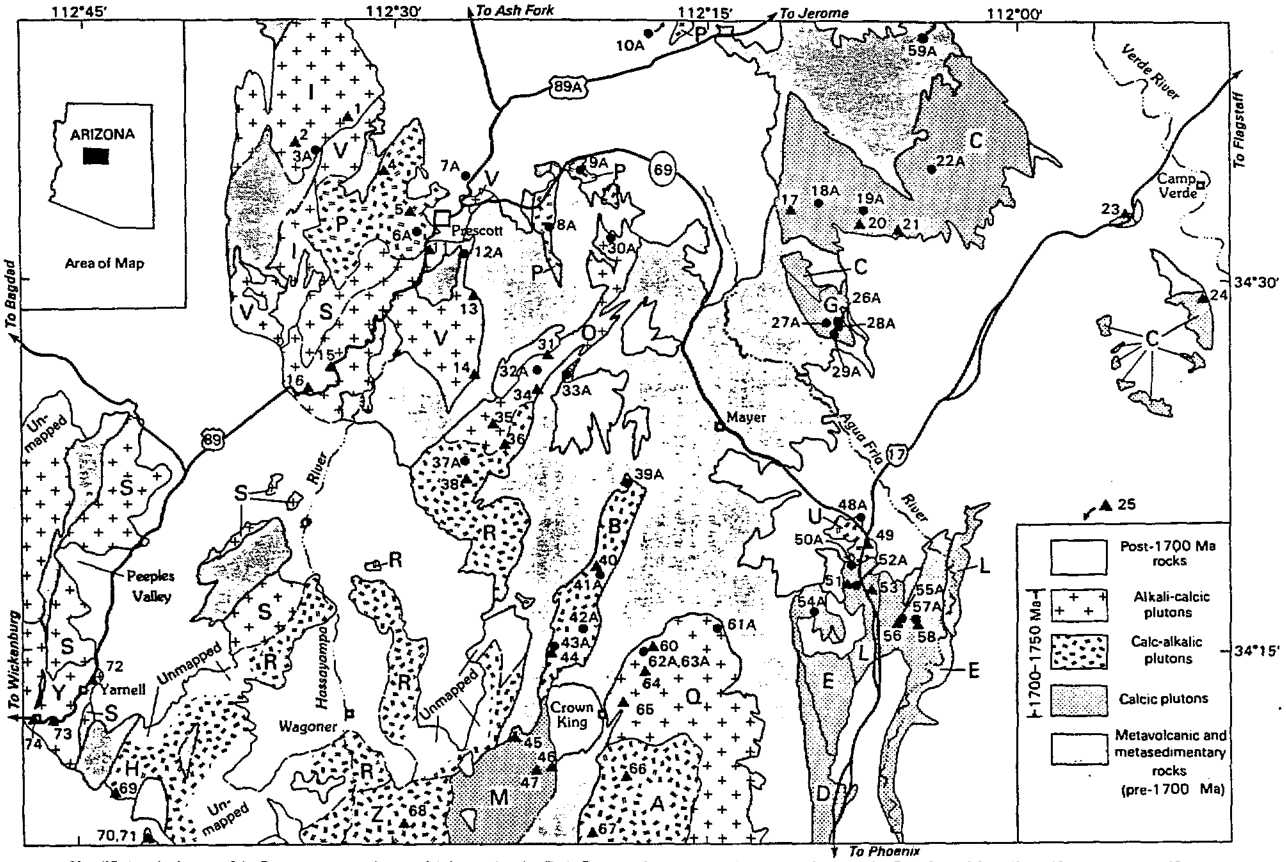
If you do not receive all pages, please call: 602-792-3010 Ext. 324

ASARCO Incorporated P.O. Box 5747 Tucson, Az 85703
1150 North 7th Avenue FAX (602) 792-3934 Phone (602) 792-3010

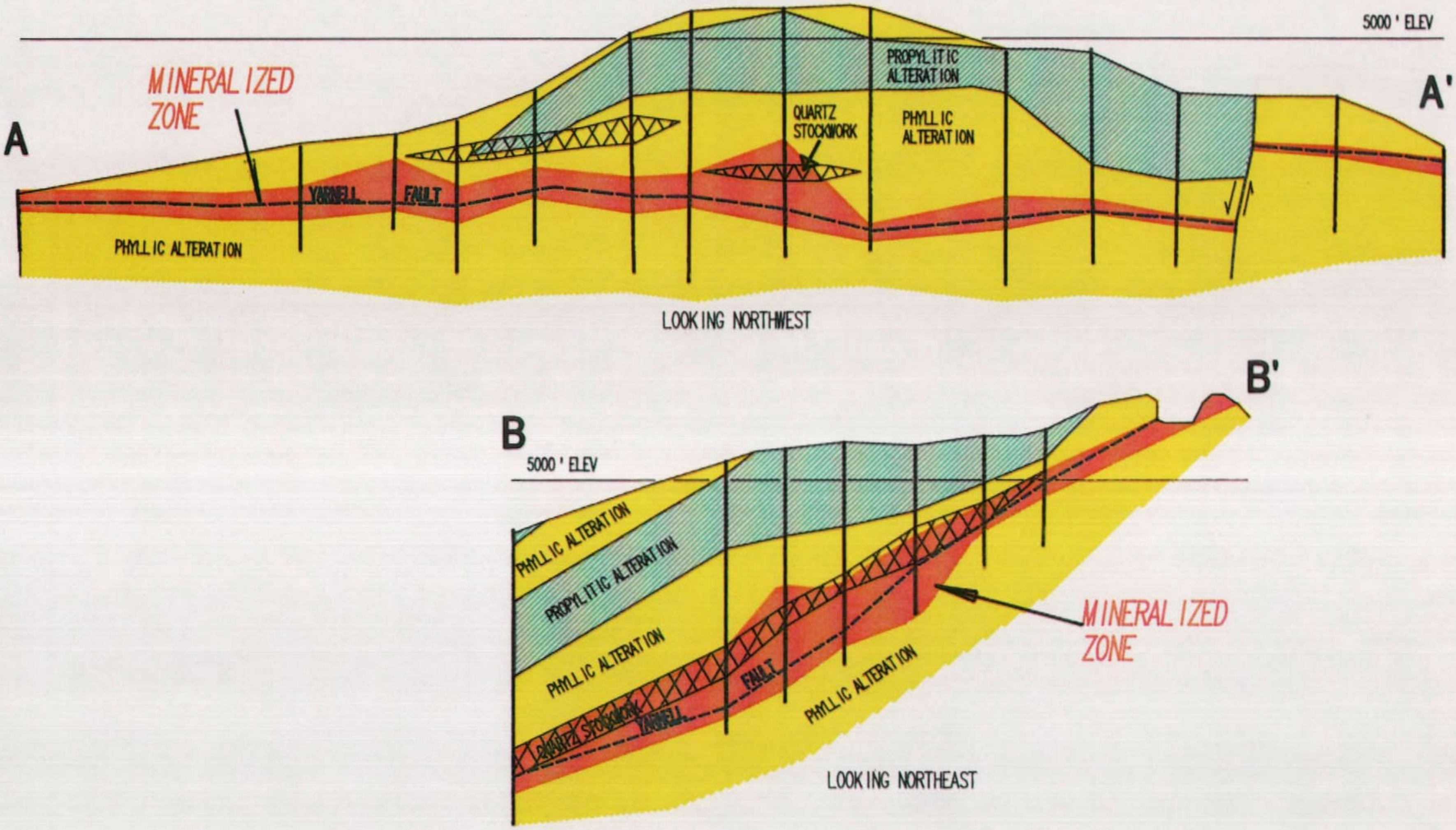


Simplified geologic map of the Prescott area, north-central Arizona, showing Early Proterozoic and post-Early Proterozoic rock units. Data from Krieger (1965, 1967), Anderson (1972), Anderson and Creasey (1958, 1967), Anderson and Blacet (1972a, 1972b, 1972c), DeWitt (1976, 1979), Jerome (1956), Light (1975), Hook (1956), Pflafker (1956), Wolfe (1983), and unpublished reconnaissance mapping by the author. All contacts, whether depositional, intrusive, or fault-related, are shown by the same kind of line. The Early Proterozoic metamorphic units (both pre- and postplutonic) consist of volcanic and sedimentary protoliths intruded by gabbroic masses. Sample numbers without an A are from this study. Sample numbers with an A are published and are from: Lee, 1984 (3A and 7A); Anderson and Blacet, 1972b (12A, 18A, 19A, 22A, 26A, 27A, 28A, 29A, 32A, 33A, and 37A); Anderson, 1972 (48A, 50A, 52A, 54A, 55A, and 57A); Krieger, 1965 (6A, 8A, 9A, 10A, and 30A); Anderson and Creasey, 1958 (59A); Blacet, 1968 (39A, 41A, 42A, 43A, and 62A), and Vrba, 1980 (61A and 63A). A, granodiorite of Lane Mountain; B, Brady Butte Granodiorite; C, tonalite of Cherry; D, quartz diorite of Bland; E, Badger Spring Granodiorite; G, granophyre of Cherry; H, granite of Rich Hill; I, granite of Iron Springs; L, Bumblebee Granodiorite; M, granodiorite of Minnehaha; O, Crooks Canyon Granodiorite [north]; P, Prescott Granodiorite; Q, Crazy Basin Quartz Monzonite; R, Crooks Canyon Granodiorite [south]; S, granodiorite of Wilhoit; U, granodiorite of Big Bug Creek; V, Government Canyon Granodiorite; Y, granodiorite of Yarnell; Z, granodiorite of Hozoni Ranch.

Figure 1. Yarnell Project and regional geologic map of north-central Arizona (DeWitt, 1989, p. 150)



Simplified geologic map of the Prescott area, north-central Arizona, showing Early Proterozoic and post-Early Proterozoic rock units. Data from Krieger (1965, 1967), Anderson (1972), Anderson and Creasey (1958, 1967), Anderson and Blacet (1972a, 1972b, 1972c), DeWitt (1976, 1979), Jerome (1956), Light (1975), Hook (1956), Pflafker (1956), Wolfe (1983), and unpublished reconnaissance mapping by the author. All contacts, whether depositional, intrusive, or fault-related, are shown by the same kind of line. The Early Proterozoic metamorphic units (both pre- and postplutonic) consist of volcanic and sedimentary protoliths intruded by gabbroic masses. Sample numbers without an A are from this study. Sample numbers with an A are published and are from: Lee, 1984 (3A and 7A); Anderson and Blacet, 1972b (12A, 18A, 19A, 22A, 26A, 27A, 28A, 29A, 32A, 33A, and 37A); Anderson, 1972 (48A, 50A, 52A, 54A, 55A, and 57A); Krieger, 1965 (6A, 8A, 9A, 10A, and 30A); Anderson and Creasey, 1958 (59A); Blacet, 1968 (39A, 41A, 42A, 43A, and 62A), and Vrba, 1980 (61A and 63A). A, granodiorite of Lane Mountain; B, Brady Butte Granodiorite; C, tonalite of Cherry; D, quartz diorite of Bland; E, Badger Spring Granodiorite; G, granophyre of Cherry; H, granite of Rich Hill; I, granite of Iron Springs; L, Bumblebee Granodiorite; M, granodiorite of Minnehaha; O, Crooks Canyon Granodiorite [north]; P, Prescott Granodiorite; Q, Crazy Basin Quartz Monzonite; R, Crooks Canyon Granodiorite [south]; S, granodiorite of Wilhoit; U, granodiorite of Big Bug Creek; V, Government Canyon Granodiorite; Y, granodiorite of Yarnell; Z, granodiorite of Hozoni Ranch.



YARNELL PROJECT GEOLOGIC SECTIONS

FIGURE 3

Yarnell Project

Petrographic Descriptions - Russ Honea

Thin Section		Primary Minerals %				Secondary Minerals %						Silica %		Iron Oxides %			
Sample No.	Alteration Zone	Plagioclase	Microcline	Quartz	Biotite	Sericite	Clay	Chlorite	Calcite	Epidote	Leucoxene	Quartz/Adularia	Chalcedony/Opal	Hematite/Magnetite	Limonite/Pyrite(Fresh)	Goethite	Fe Oxides (Undiff.)
150	Fresh (Weathered)	25	50	16	7	6	-	1+	-	3	-	-	-	1/1	-	-	-
151	Fresh (Unweathered)	25	45	18	10	-	3	3	-	-	-	-	-	-	-/<1	-	-
152	Weak	30	44	15	9	9	-	-	-	2*	<1	-	-	-	-	-	1+
162	Weak	28	38	20	8	18	-	-	-	-	1	4	-	-	-	3+	-
163	Weak/Moderate	(35)	40	15	(8)	17	-	-	-	-1	1	3	-	-	1+/-	-	3
164	Weak/Moderate	(32)	43	16	(6)	16	-	-	-	-	2	2	-	-	-	-	1+
165	Moderate	(44)	29	20	(5)	28	-	-	-	-	<1	5	-	<1	-	2	-
166	Moderate	(30)	55	10	(3)	8	-	-	-	-	1	15 (Veins)	-	2	-	2	-
154	Mod.Unoxidized	(35)	45	12	(6)	20	4	2	-	-	1	-	-	1	-/2	-	-
155	Mod. Oxidized	(35)	41	12	(10)	20	-	-	-	-	1	-	-	-	-	1**	2
	Moderate: Yarnell Fault Zone																
157	Syenite?	(27)	66	3	(2)	2	3	2	-	-	<1	-	-	-	-	1	2+
161	Potassic Rims	(24)	66	5	(2)	7	-	-	-	-	1	10/15	-	<1	-	-	-
158	Quartz Stockwork	(36)	40	15	(8)	27	-	-	-	-	1	5	-	-	-	2	3+
159		(38)	28	25	(7)	35	2	-	-	-	1***	15	-	-	-	-	2
160		(20)	62	12	(5)	10	10	-	-	1*	<1	22	<1/<1	-	-	2	4
161	Syenite?	(24)	66	5	(2)	7	-	-	-	-	1	10/15	-	<1	-	-	-
167	Mod.	(38)	32	20	(7)	20	-	-	-	-	2	3	-	-	-	3 (Hm)	-
168	Mod./Silic?	(39)	(33)	20	(6)	12	-	-	-	-	1	4	-	1	1	2	-

(27) - Original Mineral Now altered to Sericite

*(Clinozoisite)
**Pseudomorphs
***Rutile

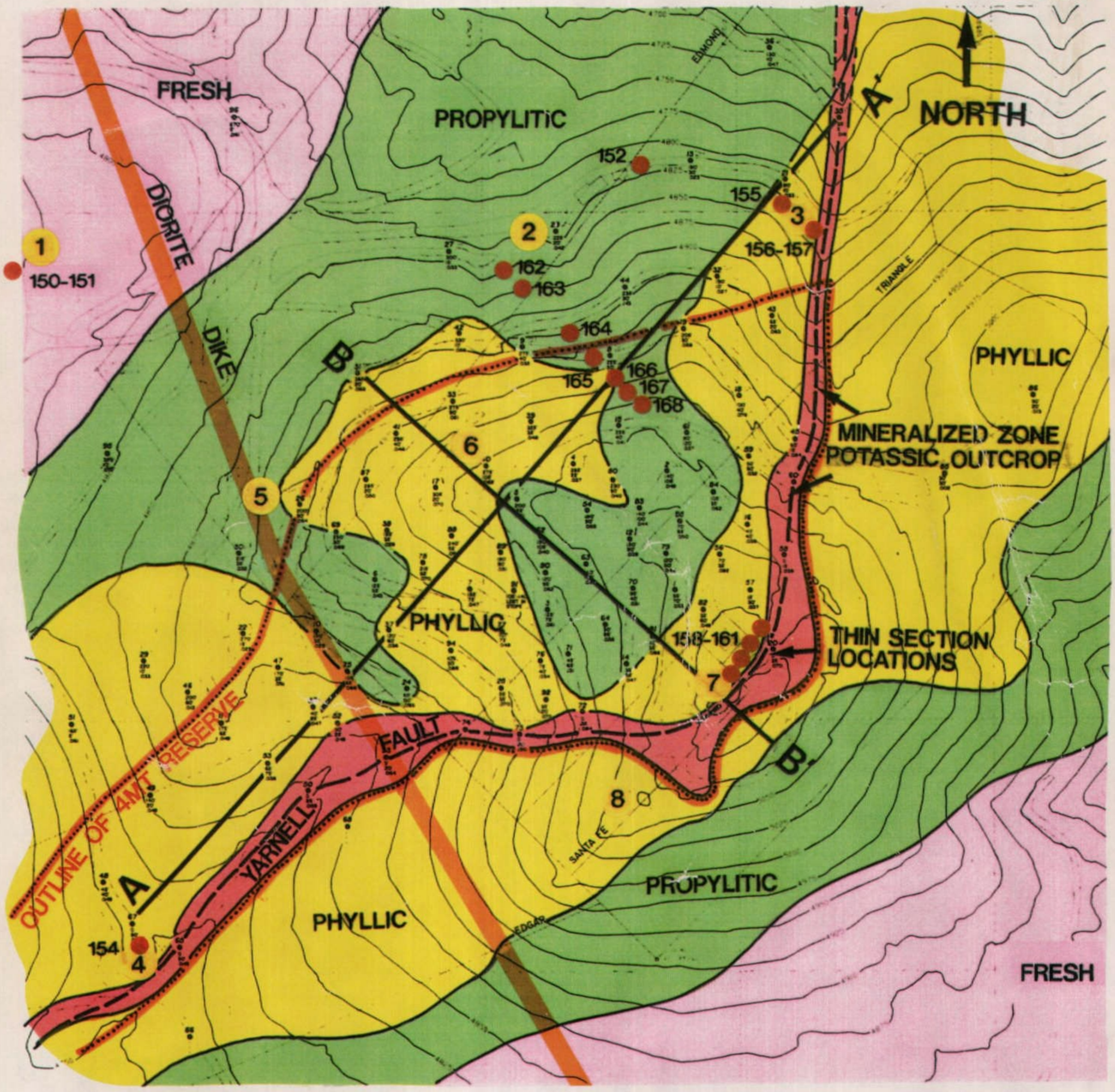
TABLE 4

ASARCO Incorporated
YARNELL PROJECT
INDEX MAP
YAVAPAI CO., ARIZONA

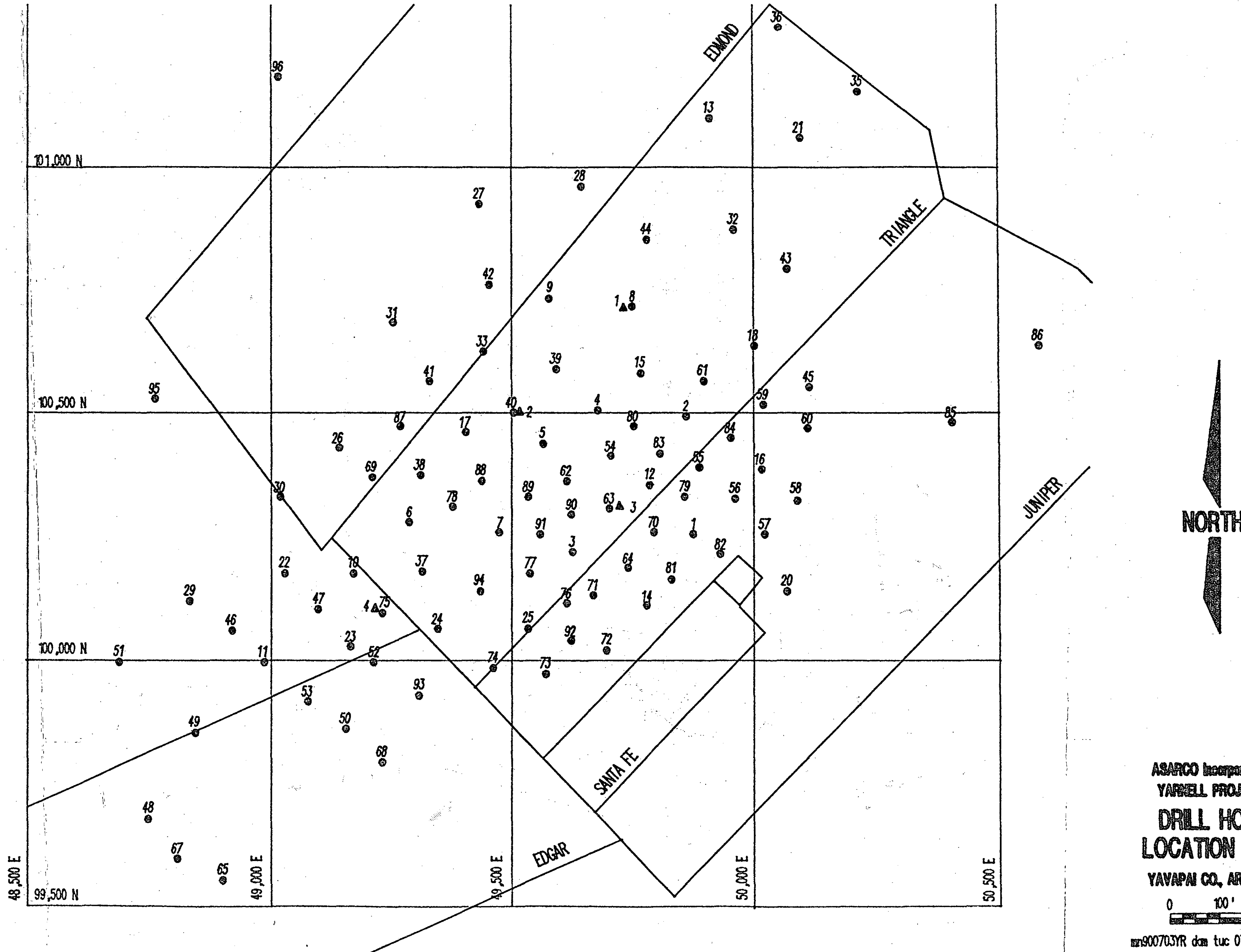
mn YR900701 MAM/dam tuc 07/02/90


ASARCO Incorporated
YARNELL PROJECT
GEOLOGY MAP
YAVAPAI CO., ARIZONA
mn6780 MAM/dam tuc 11-08-89
FRESH
WEAKLY ALTERED
biotite fresh to weakly altered
slight specularite psudomorphs after biotite
weak sericite replacement of feldspar
±silica veinlets
MODERATELY ALTERED
biotite absent
±specularite psudomorphs after biotite
moderate/strong sericite replacement of feldspar
±silica veinlets
STRONGLY ALTERED
argillic, kaolinite, clay alteration
specularite altered to hematite
AS ABOVE
overprint of interstitial to pervasive
silica with minor quartz veining
LIMONITE PSUDOMORPHS
limonite psudomorphs of pyrite and red/orange
hematite of oxidized specularite/pyrite
MAJOR QUARTZ VEINS, with strike and dip
YARNELL FAULT, as mapped with strike and dip
YARNELL FAULT, as projected
YARNELL FAULT, as inferred
MAJOR STRUCTURES, with strike and dip
JOINTING, with strike and dip
0
100'
200'
WEAK
MODERATE
STRONG
FRESH

FIGURE 2



YARNELL PROJECT GEOLOGY



ASARCO Incorporated
YARNELL PROJECT

DRILL HOLE LOCATION MAP

YAVAPAI CO., ARIZONA

0 100' 200'

mn900703YR dom tuc 07/06/90

ASARCO Incorporated
YARNELL PROJECT
INDEX MAP
YAVAPAI CO., ARIZONA

mn YR900701 MAM/dcm tuc 07/02/90

ASARCO Incorporated
YARNELL PROJECT
INDEX MAP
YAVAPAI CO., ARIZONA

mn YR900701 MAM/dam tuc 07/02/90

JDS

ASARCO

Exploration Department
R. L. Brown
Vice President

ASARCO Incorporated
NOV 1 6 1990
SW Exploration

November 13, 1990

Mr. James D. Sell, Manager
Southwest Exploration Department

Yarnell Project

I enclose herewith a special warranty deed and assignment, which is the document formally conveying the equity position Asarco now holds in the Yarnell claims back to Norgold. Please forward this document to Norgold. Please also note that Mr. Haggard was unable to learn whether or not you recorded any reference to the Yarnell Agreement in the Yavapai County Court House. I see no reference to such recordings in our files, but if you did record any documents then the deed will have to be re-drawn

Yours very truly,

R L Brown

R.L. Brown

RLB:lj

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

SPECIAL WARRANTY DEED AND ASSIGNMENT

For the consideration of Ten Dollars, and other valuable considerations, ASARCO INCORPORATED, the Grantor herein, does hereby convey and assign to NORGOLD RESOURCES (US) INC., the Grantee, the exclusive option of Grantor, pursuant to that Exploration and Option Agreement effective as of January 30, 1989 between Grantor and Grantee, to acquire an undivided fifty-one percent (51%) interest in the real property situated in Yavapai County, Arizona, together with all rights and privileges appurtenant thereto, described in Exhibit A hereto.

Subject to all taxes and other assessments, reservations in patents and all easements, rights of way, encumbrances, liens, covenants, conditions, restrictions, obligations and liabilities as may appear of record.

And the Grantor hereby binds itself and its successors to warrant and defend the title, as against all acts of the Grantor herein and no other, subject to the matters above set forth.

Dated this 13th day of November, 1990.

ASARCO INCORPORATED

By R. L. Brown

Its Vice President

STATE OF New York)
) ss.
County of New York)

The foregoing instrument was acknowledged before me this 13th day of November, 1990 by R L Brown Vice President of ASARCO Incorporated, a New Jersey corporation, on behalf of the Corporation.

Elizabeth J. Callow
Notary Public

My Commission expires:

3-30-91

Exhibit A

The following patented and unpatented lode mining claims, State of Arizona mineral lease and State of Arizona prospecting permits situated in Township 10 North, Range 5 West, G&SRB&M, Weaver Mining District, Yavapai County, Arizona recognizing, however that some of the said properties may be deleted from this Exhibit A pursuant to the terms of the Exploration and Option Agreement:

A. Patented and unpatented Mining Claims subject to Mining Agreement (With Option to Purchase) dated December 30, 1988 between Norgold and Western Building and Mining Co., Inc.

I. Patented Claims

1. The Juniper lode mining claim, mineral Survey No. 1112, patent whereof is recorded in Book 36 of Deeds, pages 229 through 232.

Except for that portion of said Juniper claim conveyed by Warranty Deed recorded in Book 235, page 8 and described as follows:

Commencing at corner No. 1 of said Juniper claim, thence North 44° 30′ West along the 1-5 line of said claim 237.56 feet to the Point of Beginning for the description of the herein described tract; thence continuing along said 1-5 line 150.0 feet; thence North 44° 30′ East parallel with the 5-4 line of said claim 500 feet; thence South 44° 30′ East parallel with said 1-5 line 150 feet; thence South 44° 30′ West parallel with said 5-4 line 500 feet to the Point of Beginning. Together with an easement for ingress and egress over an existing road from U.S. Highway 89 to the above described tract as described in the said Warranty Deed; (hereinafter the "Santa Fe Patented Land").

And Except for that portion of Juniper claim conveyed by Warranty Deeds recorded in Book 1265, page 694 and page 697 and described as follows:

Commencing at the Northeasterly end of the Northwesterly side line of the parcel of land conveyed in Book 235, page 8; thence North 44° 30′ East 75 feet along the Northeasterly prolongation of the Northwesterly side line of said parcel conveyed in Book 235, page 8; thence South 44° 30′ East 70 feet along a line parallel with the Northeasterly end line of said parcel conveyed in Book 235, page 8; thence in a Southwesterly direction to a point on said Northeasterly end line that is South 44° 30′ East 75 feet from the Point of Beginning for the herein described parcel of land; thence North 44° 30′ West 75 feet along the Northeasterly end line of said parcel conveyed in Book 235, page 8 to the Point of Beginning.

2. The Edmond lode mining claim, mineral survey No. 1114, patent whereof is recorded in Book 36 of Deeds, pages 236 through 240.

3. The Edgar lode mining claim, mineral survey No. 1113, patent whereof is recorded in Book 36 of Deeds, pages 240 and 241.

4. The Triangle lode mining claim, mineral survey No. 1115, patent whereof is recorded in Book 36 of Deeds, pages 233 through 236.

Subject to following:

(a) The conditions and the stipulations set forth in the patents to the Subject Patented Mining Claims recorded in Book 36 of Deeds, page 229 through 243 and Book 43 of Deeds, pages 296 through 300.

(b) An easement dated December 13, 1939 and recorded January 4, 1940 in Book 176 of Deeds, Page 176, for a right-of-way to the Mountain States Telephone and Telegraph Company for the right, privilege and authority to construct, operate and maintain telephone and telegraph lines and poles over an undescribed portion of the Edmond and Triangle patented mining claims.

(c) An easement for ingress and egress purposes over an existing roadway as reserved in that Joint Tenancy Deed dated March 29, 1973 and recorded in Book 1207, Page 425. (Affects the Edmond patented lode mining claim).

(d) An easement for ingress and egress purposes over an existing roadway, thirty feet in width, reserved in that Joint Tenancy Deed dated October 14, 1974 and that Warranty Deed dated August 21, 1982, recorded respectively in Book 1375, Page 64 and Book 1485, Page 769. (Affects the Edgar patented lode mining claim).

(e) An easement for ingress and egress over the Edmond and Triangle patented lode mining claims from U.S. Highway

No. 89 as set forth in Warranty Deed dated September 28, 1979 recorded in Book 1265, Pages 694 through 705. Said easement being twelve feet in width, 6 feet on each side of the center line described in said documents.

(f) Taxes which constitute a lien but which are not yet due and payable.

II. Unpatented Claims

Claim Name	Date Located or Amended	Recorded Book	Recorded Page	Recorded Date	BLM Serial No.
Alvin J.	11/21/1975	991	423	11/21/75	AMC 33458
Amended	11/21/1975	996	261	1/2/76	AMC 33458
Kathryn A	11/21/1975	991	419	11/21/75	AMC 33459
Amended	11/21/1975	996	263	1/2/76	AMC 33459
Kathryn B	11/21/1975	991	421	11/21/75	AMC 33460
Amended	11/21/1975	996	265	1/2/76	AMC 33460
Pennsylvania No. 1	6/26/1981	1392	661	6/30/81	AMC 134462
Sun #1	9/9/1988	2079	476	9/13/88	AMC 288941
Sun #2	9/9/1988	2079	478	9/13/88	AMC 288942
Sun #3B	9/9/1988	2079	480	9/13/88	AMC 288943
Amended	10/25/1988	2091	499	10/26/88	AMC 288943
Sun #6B	9/9/1988	2079	486	9/13/88	AMC 288946
Amended	10/25/1988	2091	501	10/26/88	AMC 288946
Sun #7B	9/9/1988	2079	488	9/13/88	AMC 288947
Amended	10/25/1988	2091	503	10/26/88	AMC 288947
Sun #8	9/9/1988	2079	490	9/13/88	AMC 288948
Sun-8B	10/25/1988	2091	505	10/26/88	AMC 288948

Sun #9	9/9/1988	2079	492	9/13/88	AMC 288949
Sun #10	9/9/1988	2079	494	9/13/88	AMC 288950
Sun #11	9/9/1988	2079	496	9/13/88	AMC 288951
Sun #12	9/9/1988	2079	498	9/13/88	AMC 288952
Sun #13	9/9/1988	2079	500	9/13/88	AMC 288953
Sun #14	9/9/1988	2079	502	9/13/88	AMC 288954
Sun #15	9/9/1988	2079	504	9/13/88	AMC 288955

B. Unpatented mining claims subject to Option Agreement dated September 16, 1988 between Norgold and Don Jenkins.

Claim Name	Date Located or Amended	Recorded Book	Recorded Page	BLM Serial No.
Y-1B	8-8-88	2078	422/423	AMC 288934
Amended	10-25-88	2091	489/490	
Y-2B	8-8-88	2078	424/425	AMC 288935
Amended	10-29-88	2091	491/492	
Y-3B	8-8-88	2078	426/427	AMC 288936
Amended	10-25-88	2091	493/494	
Y-4F	8-8-88	2078	428/429	AMC 288937
Amended	10-25-88	2091	495/496	
Y-5B	8-8-88	2078	430/431	AMC 288938
Amended	10-25-88	2091	497/498	
Y-6	8-8-88	2078	432/433	AMC 288939
Y-7	8-8-88	2078	434/435	AMC 288940

C. Unpatented mining claims and State of Arizona mineral lease subject to Option to Purchase dated April 21, 1989 between Norgold and D.C. Layton et ux.

Claim Name	Date Located or Amended	Recorded Book	Recorded Page	Recorded Date	BLM Serial No.
Victoria #1	8/5/1974	924	198	8/5/74	AMC 78219
Amended	3/2/1980	1287	763	3/25/80	AMC 78219
Victoria #2	3/2/1980	1287	765	3/25/80	AMC 98902

Victoria #3	3/2/1980	1287	767	3/25/80	AMC 98903
Victoria #4	3/2/1980	1287	769	3/25/80	AMC 98904
Victoria #5	8/20/1985	1751	484	9/4/85	AMC 244644
Rim Rock 1		154	550		AMC 82449
Thunder Hill		941	750		AMC 78227
Black Dike 1		153	17		AMC 74727
Black Dike					
Kachina Doll 1		937	596		Arizona State Mineral Lease #11-31009

D. State of Arizona Prospecting Permits

Prospecting Permit No. 08 - 96868 - E 1/2 Section 14, Township 10 North, Range 5 West, G&SRB&M, Yavapai County, Arizona. Contains 268.25 acres

Prospecting Permit No. 08 - 96869 - NE 1/4 Section 22, Township 10 North, Range 5 West, G&SRB&M, Yavapai County, Arizona. Contains 154.74 acres.

ALL OF WHICH claims, leases and permits are SUBJECT TO:

(a) Paramount title of the United States, with respect to the unpatented mining claims;

(b) All roads, rights-of-way and easements existing, and those of record in the office of the Recorder of Yavapai County, and those of record in the Arizona State Office of the Bureau of Land Management and those of record in the office of the Arizona State Land Department;

(c) All leases, permits, approvals and other rights and privileges granted by or obtained from the United States in the administration of its paramount title and granted by or obtained from the State of Arizona in its administration of its title;

(d) The effect of conflicts (if any) with unpatented mining and mill site claims heretofore initiated under the mining laws of the United States;

(e) Taxes (if any), which by law constitute a lien but which are not yet due and payable; and

(f) The terms, conditions and provisions of the above-described Western Mining Agreement, the Jenkins Option Agreement and the Layton Option to Purchase.

JDS

ASARCO

Exploration Department
Southwestern United States Division

James D. Sell
Manager

December 6, 1990

Mr. Michael Philpot
NORGOLD RESOURCES INC.
210-475 Howe Street
Vancouver, B.C. V6C-2B3
Canada

<u>Assignment</u>

Dear Mike:

Attached is Mr. Brown's letter and the signed Special Warranty Deed and Assignment for the agreement/option on the Yarnell property, Yavapai County, Arizona.

Mr. Gay has rechecked our files and can find no information suggesting that the Deed was recorded in the Yavapai County courthouse, and thereby this document should close the Asarco interest in the Yarnell Project.

Asarco appreciates the close work and cooperation with you and Norgold during the various phases of exploration, and wish you the best success on furthering the project.

Sincerely,

James D. Sell

JDS:mek
Att.

cc: R.L. Brown (w/o att.)
W.L. Kurtz (w/o att.)
W.D. Gay (w/att.)

JDS

APKER, APKER, HAGGARD & KURTZ, P.C.
P. O. Box 10280
Phoenix, Arizona 85064-0280
(602) 381-0085

Exploration Department
Southwestern U.S. Division
P.O. Box 5747
Tucson, Arizona 85703-0747

September 1, 1990
Page 1
Client: 111
Matter: 12

Matter: Re: Norgold Resources, Inc.

Date	Professional Services Rendered
08/27/90	Office conference; research on authority to withdraw state lands; telephone conferences with Mr. Kurtz; review termination provisions of Norgold and Western Building agreements; telephone conferences with Mr. Brown; draft termination and extension letters to Norgold; prepare correspondence to Mr. Brown.
08/29/90	Telephone conferences with Mr. Kurtz and review Norgold agreement.

Total Services 782.00

Disbursements

Long distance telephone 1.96

Total Disbursements 1.96

Current Charges 783.96

~~2950-4~~
444-04
620-753

Dec. 1990 chg.

[redacted]

NORGOLD RESOURCES INC. (NGR-V)

[redacted]

BLUE EMERALD RESOURCES INC. (BER-V)

[redacted]

GOLD CANYON RESOURCES INC. (GCU-V)

[redacted]

ADRIAN RESOURCES LTD. (ADL-V)

[redacted]

INC.

[redacted]

NAPIER INTERNATIONAL TECHNOLOGIES INC. (NIR-V)

[redacted]

YEAR ENDED AUGUST 31	1990	1989
[redacted]	[redacted]	[redacted]

Cover sheet of MSG4FYAR - 14 pgs.

ASPECTS OF THE GEOLOGY, FAULTING, AND GOLD MINERALIZATION AT THE YARNELL DEPOSIT YAVAPAI COUNTY, ARIZONA A FIELD GUIDE

M.A. Miller
J.D. Sell
November 1990

Timing of mineralization in the Martinez and Rich Hill metallic mineral districts, west-central Arizona

Ed DeWitt U.S. Geological Survey, MS 905, Denver Federal Center, Denver, CO 80225

SUMMARY

Although tentatively classified as Tertiary in age by Keith and others (1983), vein deposits in the Martinez and Rich Hill metallic mineral districts are most likely Middle Proterozoic in age and related to emplacement of mafic dikes that are chemically and mineralogically identical to ~1.1 Ga diabase in the Sierra Ancha Mountains of central Arizona. Gold-rich veins at the Congress and Alvarado mines parallel mafic dikes that strike northwest and dip shallowly northeast. Hydrothermal alteration related to vein formation has turned the mafic dikes into mixtures of chlorite, biotite, and calcite. At those deposits in the Martinez and Rich Hill districts where mafic dikes are not present (Yarnell and Octave mines), gold-rich veins strike northwest to northeast, dip northeast to northwest, and occupy minor shear zones or fractures that have the same orientation as the mafic dikes in the region. The mafic dikes crop out extensively to the west and northwest, throughout the Weaver Mountains and to the Santa Maria River. To the southeast and east the dikes are less numerous. Similar deposits in northwestern Arizona may include those in the Music Mountains metallic mineral district where gold-rich quartz veins are spatially associated with east-trending, high-angle mafic dikes that cut Early Proterozoic granitic rocks but are truncated by Paleozoic strata of the Grand Was Cliffs (Karen Wenrich, oral commun., 1990).

VEIN SYSTEMS

Quartz veins containing pyrite, galena, minor chalcopyrite, and electrum are typical of deposits in the Martinez and Rich Hill districts (Shaw, 1909; Dinsmore, 1912; Watson, 1918; Staunton, 1926; Metzer, 1938; Herald and Russ, 1985). The veins range from several centimeters to about a meter thick, normally have well-defined walls, and are characterized by very little altered material in the surrounding Proterozoic bedrock. Ratios of precious metals are incredibly constant; very few deposits have Ag/Au ratios less than 0.5 or greater that 1.5. The average Ag/Au of the Martinez and Rich Hill districts is 0.95. The age of mineralization in the districts was assumed only to be Tertiary or older, as rich placer deposits on the top of Rich Hill were assumed to have been derived from the underlying lode deposits.

GEOCHRONOLOGY

In the late 1980's, Echo Bay Exploration Inc. began producing gold ore from a previous unmined part of the Niagara vein structure of the Congress mine. During their mapping and production, the company noted two post-mineral dikes, one mafic and one felsic that cut perpendicularly across the gold-bearing vein on the second development level drift, west of the main haulage decline. The 2-ft-thick, fine-grained, equigranular mafic dike was oriented N.

43^0E and dipped 45^0 southeast. In thin section the dike was composed of intermediate plagioclase, hornblende, clinopyroxene, and minor biotite and calcite. Importantly, this dike was not the "diabasic" main mafic dike at the Congress mine that paralleled and was extensively altered by the vein system, but was a younger dike, oriented perpendicular to the vein system. On the surface, Echo Bay geologists recognized the cross-cutting mafic dike, but were unable to map any significant number of them.

Hornblende was separated from the dike and analyzed by the $^{40}Ar/^{39}Ar$ step heating technique. A plateau date of 103.7 +/- 2.1 Ma was determined for 88.6 percent of the gas from the hornblende (DeWitt, unpub. data, 1989). This mafic dike, which clearly cross-cuts the mineralized Niagara vein in the Congress mine area, is Early Cretaceous and indicates that gold mineralization must pre-date 103.7 Ma. The gold-bearing veins at the Congress and Alvarado mines cut the granodiorite at Yarnell (DeWitt, 1989), which is a 1.4 Ga pluton (J.L. Wooden, unpub U-Pb zircon data, 1990). Therefore, mineralization is younger than 1.4 Ga and older that 103.7 Ma. Obviously, the assumption that vein mineralization at the Congress mine (and therefore in the Alvarado mine in the Rich Hill district--and probably in much of the Rich Hill district, including the Yarnell mine) is incorrect. Further studies are underway by the author to more precisely determine the age of mineralization in the two districts.

The possibility remains that vein mineralization, although spatially associated with the "diabasic" mafic dikes in the Martinez and Rich Hill districts, bay be of a younger age and not genetically related to the assumed 1.1 Ga emplacement of mafic dikes in the region. The author considers this to be a remote possibility, but it cannot be dismissed with the present data.

ACKNOWLEDGEMENTS

I thank Ralph Rupp and Scott Petsel of Echo Bay Exploration for their help in sample collection at the Congress mine.

REFERENCES CITED

Arizona Geological society, 1985, Geology of the Vulture and Congress mines, Maricopa and Yavapai Counties, Arizona: Field Trip Guidebook, 53 p.

Dinsmore, C.A., 1912, The Congress Junction mining district, Arizona: Mining Engineering World, v. 36, p. 1006-1007.

DeWitt, Ed, 1989, Geochemistry and tectonic polarity of Early Proterozoic (1700-1750 Ma) plutonic rocks, north-central Arizona, in Jenney, J.P., and Reynolds, S.J., eds, Geologic evolution of Arizona: Arizona Geological Society Digest 17, p. 149-164.

Herald, C.E., and Russ, M.D., 1985, Geology and mineralization of the Congress mine, in Geology of the Vulture and Congress mines, Maricopa and Yavapai Counties, Arizona: Arizona Geological Society 1985 Spring Field Trip Guidebook, 5 p.

Keith, S.B., Gest, D.E., DeWitt, Ed, Woode Toll, Netta, and

Everson, B.A., 1983, Metallic mineral districts and production in Arizona: Arizona Bureau of Geology and Mineral Technology Bulletin 194, 58 p., 1 plate, scale 1:1,000,000.

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Shaw, S.F., 1909, Operation and production of the Congress mines: Mining World, v. 30, p. 387-388.

Staunton, W.F., 1926, Ore possibilities at the Congress mine: Engineering and Mining Journal, v. 122, p. 769-771.

Watson, H.B., 1918, Rich Hill observations: Arizona Mining Journal, v. 2, no. 7, p. 8-10.

GEOLOGIC ROAD LOG, WICKENBURG TO YARNELL

253 - 0.0 Start log at mile marker 253 on US highway 89/93 heading west from Wickenburg.

255.3 - 2.3 Left turn leads to Vulture Mine about 15 miles south of Wickenburg.

257.7 - 4.7 Right turn onto U.S. Highway 89, Congress, Yarnell, Prescott Highway.

The mountain range on the right side of the road is the Weaver Mountains. They are composed of Yavapai series metasediments and metavolcanics intruded by Proterozoic Yarnell and Rich Hill granite/grandodiorites. The intrusive complex is also the host for a number of gold occurrences and deposits. Gold occurs in low angle quartz veins and structural zones in the granites. Some of the more important deposits that occur in this setting are: Stanton-Octave district which includes the Octave Mine, the Leviathan mine, and the Alvarado Mine. The Yarnell mine occurs in this same setting, however, the size of the structure is much larger.

262.3 - 9.3 Dirt road on the right leads to the Red Tail mill; a privately owned custom and experimental gold mill.

268 - 15.0 Turnoff for 71 South. The congress Gold mine owned and operated by Malartic Hygrade is located about three miles from Congress.

The Congress mine is situated on the southeast edge of the Date Creek Mountains. The deposit lies almost entirely within the proterozoic batholith and is locally intruded by younger dikes of rhyolite, latite porphyry, andesite porphyry, and "greenstone" dikes which trend east-west and dip moderately to the north. The main historical producers were the Congress and Niagara Vein. current production is from the Niagara Vein. Gold mineralization is associated with sulfides localized in a quartz vein. The gold is in the micron size range (3-15 microns). Malartic recently completed the construction of a CIL (carbon in leach) mill with a capacity of 350 TPD of ore. Reserves are currently 490,000 T @ 0.29 opt gold which is enough for four years of operation.

269.1 - 16.1 Cross Martinez Creek

269.3 - 16.3 Green frog on left side of road.

270.0 - 17.0 Road on the right leads to the Stanton-Octave district approximately 8 - 10 miles east. The Conveyors on the right are the remains of an ilmenite recovery plant.

272.5 - 19.6 Roof pendant or "rafted" piece of Yavapai series rocks. These are common on the margins of the intrusive.

272.6 - 19.7 Local contact between granitic intrusive and metasediments.

273.0 - 20.0 Large "rafted" block of metasediments in roadcut on the left. Adits on the right side of the highway are the Elephant Curve prospects which are developed along the dip of a low angle fault structure; possibly the southwestern extension of the Yarnell fault. Mineralization is hosted in a quartz vein/fault complex.

273.8 - 20.8 Alvarado mine is over the hill on the right side of the highway. The Alvarado mine is typical of most of the quartz vein dominated deposits which occur in this district. Mineralization is hosted in a low angle fault zone striking northeasterly and dipping to the north. Gold associated with sulfides was mined underground in the past. The property is presently under the control of Conquistador Gold.

274.6 - 21.6 The Yarnell Fault is exposed in the roadcut on the left side of the highway. Note the alteration zones which show increased iron oxides. Samples taken across the fault zone assayed 0.04-0.05 opt gold.

275.0 - 22.0 Yarnell fault crosses the road.

275.4 - 22.4 Surface exposure of the Yarnell Fault on the left side of the highway. Note the hematitic staining and the disseminated sulfides that occur in the fault zone. Assays across the fault assayed up to 0.06 opt gold. Note how the fault splits and then rejoins itself.

276.0 - 23.0 Turn right onto dirt road. This is the Yarnell mine and the start of the field trip.

To Sell

Date 5-3 Time 1:25 ☐ AM ☑ PM

WHILE YOU WERE OUT

M Patrick Breslin

of

Phone ( ) 945-6600
Area Code Number Extension

TELEPHONED		PLEASE CALL	
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	

RETURNED YOUR CALL ☐

Message Has land adjacent to the Yarnell mine

re Yarnell mine

Operator

AMPAD EFFICIENCY®

REORDER #23-000

Rich Hill Area

Will send data package Tri-Cor (Canadian) diff leach work

ASARCO

Exploration Department
Southwestern United States Division

December 12, 1990

Mr. Alvin J. Roman
Western Building and Mining Company, Inc.
P.O. Box 4006
Reading, PA 19606

Pennsylvania Claim
Mineral Survey

Dear Mr. Roman:

The U.S. Mineral Land Surveyor that surveyed the Pennsylvania No. 1 called me today and said the Mineral Survey No. 4876 is in process by the Bureau of Land Management, and approval will probably take from three to six months.

You will be sent the plats and field notes when completed by the Bureau of Land Management and at that time you can file a Mineral Patent Application.

Enclosed for your use are a copy of Guidelines for Mineral Patent Applications in Arizona, documents that are required with a mineral patent application,and three certified copies of the original Location Notice, three certified copies of Amended Notice of Location dated July 17, 1990, and three certified copies of Amended Notice of Location dated August 22, 1990.

If you have any questions, please call.

Very truly yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
encs.

cc: W.L. Kurtz
J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

JDS

NORGOLD RESOURCES (U.S.) INC.

4600 Kietzke Lane Suite G-177 Reno, Nevada 89502
(702) 827-1755 FAX (702) 827-1802

December 12, 1990

ASARCO Inc.
1150 North 7th Avenue
Tucson, Arizona 85703

Attention: Jim Sell

Jim, Echo Bay Minerals has expressed their interest in the Yarnell Project and as such Norgold Resources would appreciate your facilitating their review of both the core and any other relevant information that ASARCO may have concerning the project.

It is my understanding that Jeff Wilson and company will be in Tucson on the 13th or 14th of this month and would like access to the information and the core at that time.

~~[illegible]~~

Wilson reviewed core Friday Dec. 14.
JDS

Tench will arrange to take core to Yarnell by end of year.

Regards,

Tench C. Page

Tench C. Page
Exploration Manager

ASARCO Incorporated
DEC 12 1990
SW Exploration

702-1751

JDS

ASARCO

Southwestern Exploration Division

December 12, 1990

W.L. Kurtz

K/Ar Data - Illite
Yarnell Fault Zone
Yarnell Project
Yavapai County, AZ

I submit Mr. J.J. Malusa's report on the illite K/Ar age date of 69.1 ma ± 1.6 ma from fault gouge at the Yarnell Mine.

The sample was carefully collected by M.A. Miller and J.J. Malusa and the best pieces of illite (sericite) that could be found by visual estimate were collected. This was then further checked by the binocular microscope to remove any foreign pieces noted, such as quartz and microcline.

The sample was then processed as reported by Malusa.

The age is probably a minimum with the actual quartz-gold emplacement being slightly earlier. Since the illite is known to form between 150°-230°C, and this is roughly the range of other gold deposit numbers, I would believe that the date is very good and reflects a Laramide mineralization-alteration age.

James D. Sell

JDS:mek
Att.

cc: R.L. Brown
Norgold Resources
M.A. Miller
J.J. Malusa

ASARCO

Southwestern Exploration Division

JDS

December 11. 1990

J.D. Sell

K/Ar Data
Illite
Yarnell Fault Zone
Yarnell Project
Yavapai County, AZ

Introduction

K/Ar dating of the clay mineral illite found within the Yarnell Fault gouge was performed to establish some parameter to the age of the gold mineralization event. Illite clay is used because of its low crystallization temperature of 150 to 230°C. This temperature range is within the range determined by fluid inclusion work on other epithermal gold deposits; therefore, making illite the ideal mineral to use in this environment.

The sample analyzed was obtained from a pillar in the underground working accessed from the northwest corner of the open cut. The fault gouge is approximately 5 feet thick at the place of sampling and is located at Asarco coordinates 50,000E, 100,150N.

Before the K/Ar dating procedure was performed, the presence of illite was confirmed through X-ray diffraction. The values of the peaks from the X-ray diffractogram (Attachment 1) were entered into a computer program (accessed at the UofA Geosciences Department) which determines the phases present in the sample. The computer printout (Attachment 2) confirmed the presence of illite; therefore, the K/Ar dating proceeded.

The results of the K/Ar dating are included on Attachment 3. To help clarify the analytical data, I have numbered the columns 1 through 4 on the attachment and explained their units in the following text:

1. Percent K in sample.
2. Radiogenic Ar in pico moles/gram.
3. Percent atmospheric Ar in sample.
4. Millions of years ± error in millions of years.

Discussion

The date of 69.1 ma ±1.6 ma reflects the time elapsed since the ambient temperature within the fault fell below 150°C. Whether or not this date reflects the actual time elapsed since mineralization is open to some question.

Mainly, there are two factors that could contribute to the inaccuracy of the illite date estimation of the age of the gold mineralization event:

1. Contamination of the sample by the unaltered Precambrian Yarnell Granite. This would cause the illite date to be too old.

2. The illite formation/alteration event dated by the illite may postdate the gold mineralization. Thereby making the illite date too young.

In the following text, I will attempt to expand upon the two "problem factors" in hopes of establishing a feeling for the legitimacy of the illite date with respect to the actual gold mineralization event.

Factor #1, contamination of the sample by unaltered Precambrian Yarnell Fault would cause the illite age date to increase.

This could occur due to the fact that the sample is prepared for analysis by employing a centrifuge to separate particles by the criteria of particle size rather than mineralogical identity. It is important to have particles of less than 0.1 microns in size to ensure that the illite is authigenic. Unfortunately particles of this size cannot be separated on a mineralogical basis due to the complication of surface tensions while trying to implement the standard method of heavy liquid mineral separation techniques; therefore, the sample analyzed consists of any mineral that is less than 0.1 microns in size. Subsequently, this "flaw" in the sample preparation opens the way for the possibility that submicron grains containing radiogenic Argon derived from the Precambrian Yarnell Granite may be incorporated into the sample analyzed.

The most likely candidate for this contamination would be microcline incorporated into the fault gouge from the Precambrian granite. This is due to the microclines characteristic of being resistant to alteration while other K-bearing minerals are altered to sericite in the Yarnell System.

The Precambrian granite is approximately 20 time older than the illite; consequently, a slight bit of contamination introduces an enormous error. Dr. Shafiqullah estimated that a 1% contamination of Precambrian granite would result in an increase of 1 million years to the illite date. However, Dr. Shafiqullah also stated that given the thickness of the fault gouge and the extent of alteration that "chances are good that there is little contamination," and the illite date is valid.

Factor #2, illite formation is a result of alteration that postdates the gold mineralization. The possibility of this scenario is supported by evidence obtained from apatite fission track analyses of the Yarnell Granite between Congress and the Peeples Valley (EOS, VOL. 71, No. 43, October 23, 1990).

Apatite fission track dates increase in age from 27 ±2 to 44 ±4 Ma over an elevation increase of 540 meters within the Precambrian Yarnell Granite. The apatite fission tracks only form when the ambient temperature of the apatite crystals fall below approximately 80°C. Above 80°C former tracks are erased, or if the ambient temperature of apatites remained >80°C since the time of apatite crystallization, no tracks will have begun.

The fission track data suggests that the Yarnell Granite cooled below 80°C approximately 44 ma near the Yarnell Mine, and approximately 27 ma near the town of Congress . Furthermore, the clay assemblage detected by the X-ray diffraction is indicative of a K-rich volatile solution that reached temperatures greater than 230°C. This is concluded mainly due to the absence of chlorite and smectite which would be present if temperatures did not reach greater than 230°C.

From the available data one could infer that there has been a continuous cooling from a temperature greater than 230°C at an unknown time to less than 150°C approximately 69 ma, and to less than 80°C approximately 44 ma near the Yarnell Mine. If this is the case, an older mineralization/alteration event would have been overprinted by this cooling.

Conclusions & Recommendations

The illite at Yarnell is undeformed, suggesting it formed after any movement along the fault. But this doesn't necessarily mean that the main phases of gold mineralization occurred at this time. What does appear to be certain is that due to good sampling conditions the illite date is probably correct and reflects a minimum age for the gold mineralization at Yarnell.

John J. Malusa

JJM:mek
Atts.

cc: W.L. Kurtz

Attch. 1

John Malusa (ASARCO)
60
55
50
45
40
35
30
25
20
15
10
5
100%
26.8°
58.5%
8.85°
40.74%
45.45°
47.61%
34.85°
18.8%
37.60°
32%
19.80°
32%
17.75°
SIEMENS
horizontal 1cm = 2θ degree

Attch 2

6 - CHANGE COMMENT

ENTER OPTION # OR RETURN FOR MAIN MENU > 1
2J H ** OBSERVED PATTERN DISPLAY **

DISPLAY DATA AS 2-THETA OR D [D:D] > d-spacing

2J H SHAFI

1	9.992	58
2	4.997	32
3	4.484	32
4	3.889	29
5	3.739	27
6	3.493	37
7	3.327	100
8	3.255	51
9	3.209	37
10	2.998	37
11	2.871	29
12	2.793	24
13	2.574	48
14	2.392	19
15	1.996	41

ENTER RETURN TO CONTINUE >

6 - CHANGE COMMENT

ENTER OPTION # OR RETURN FOR MAIN MENU > 1
2J H ** OBSERVED PATTERN DISPLAY **

DISPLAY DATA AS 2-THETA OR D [D:D] > 2-THETA
ENTER ELEMENT SYMBOL FOR RADIATION [D:CU]>

2J H SHAFI 2θ

1	8.850	58
2	17.750	32
3	19.800	32
4	22.870	29
5	23.800	27
6	25.500	37
7	26.800	100
8	27.400	51
9	27.800	37
10	29.800	37
11	31.150	29
12	32.050	24
13	34.850	48
14	37.600	19
15	45.450	41

ENTER RETURN TO CONTINUE >

2J H DISPLAY DATA AS D OR 2-THETA [D:D] >
2J H 31 1045   KO .6 (MG, LI)3 SI4 O10 F2   I/IC=   .0(

TAENIOLITE 1

1	9.950	85	21	2.143	12
2	4.982	35	22	1.995	30
3	4.512	25	23	1.742	2
4	4.480	25	24	1.728	2
5	4.331	10	25	1.711	4
6	4.120	6	26	1.656	12
7	3.874	8	27	1.619	6
8	3.612	20	28	1.590	4
9	3.325	100	29	1.509	12
10	3.107	30	30	1.350	10
11	2.883	25	31	1.304	8
12	2.681	12	32	1.248	4
13	2.602	20			
14	2.575	25			
15	2.493	10			
16	2.468	8			
17	2.396	35			
18	2.257	6			
19	2.236	6			
20	2.207	4			

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

2J H DISPLAY DATA AS D OR 2-THETA [D:D] >
2J H 7   42   K AL2 (SI3 AL) O10 (O H)2   I/IC=   .0(

MUSCOVITE 3T

1	9.973	100	21	1.966	8
2	4.990	55	22	1.885	2
3	4.492	20	23	1.654	10
4	4.460	20	24	1.638	4
5	3.874	10	25	1.614	4
6	3.597	8	26	1.551	2
7	3.331	100	27	1.521	6
8	3.110	10	28	1.502	12
9	2.884	16			
10	2.590	16			
11	2.564	25			
12	2.499	12			
13	2.457	8			
14	2.384	8			
15	2.254	6			
16	2.222	4			
17	2.197	4			
18	2.136	12			
19	2.056	4			
20	1.999	45			

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

2J H DISPLAY DATA AS D OR 2-THETA [D:D] >
2J H 19 814 K (AL, V)2 (SI, AL)4 O10 (O H I/IC= .0(

MUSCOVITE 2

1	9.973	90	21	2.128	30
2	4.990	20	22	1.994	40
3	4.480	80	23	1.733	10
4	4.292	20	24	1.668	10
5	4.132	50	25	1.647	80
6	3.880	50	26	1.602	10
7	3.740	50	27	1.524	10
8	3.490	60	28	1.504	90
9	3.341	90	29	1.247	20
10	3.201	60			
11	2.991	60			
12	2.862	30			
13	2.791	30			
14	2.602	20			
15	2.569	100			
16	2.493	10			
17	2.395	30			
18	2.251	20			
19	2.209	10			
20	2.151	30			

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

OR SKIP FOR NEXT CARD

2J H DISPLAY DATA AS D OR 2-THETA [D:D] >
2J H 26 911 (K, H3 O) AL2 SI3 AL O10 (O H) I/IC= .0C

ILLITE 2MO

1	10.006	90
2	5.021	50
3	4.480	16
4	4.440	14
5	3.890	8
6	3.720	12
7	3.461	14
8	3.341	100
9	3.201	16
10	2.989	18
11	2.867	12
12	2.800	12
13	2.558	12
14	2.510	8
15	2.463	8
16	2.241	4
17	2.005	50
18	1.499	14

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

```
2J H DISPLAY DATA AS D OR 2-THETA [D:D] >
2J H  6  263     K AL2 ( SI3 AL ) O10 ( O H, F )2        I/IC=   .O
              MUSCOVITE 2MO
```

1	9.950	95	21	2.466	8
2	4.971	30	22	2.450	8
3	4.471	20	23	2.398	10
4	4.302	4	24	2.384	25
5	4.111	4	25	2.254	10
6	3.950	6	26	2.236	4
7	3.880	14	27	2.208	8
8	3.731	18	28	2.189	4
9	3.481	20	29	2.149	16
10	3.341	25	30	2.132	20
11	3.320	100	31	2.070	4
12	3.191	30	32	2.053	6
13	3.121	2	33	1.993	45
14	2.988	35	34	1.972	10
15	2.859	25	35	1.951	6
16	2.790	20	36	1.941	4
17	2.596	16	37	1.894	2
18	2.567	55	38	1.871	4
19	2.506	8	39	1.822	4
20	2.491	14	40	1.746	4

ENTER RETURN TO CONTINUE; R TO REDISPLAY >

Attch. 3

University of Arizona
Isotope Geochemistry Laboratory
Date of Report: October 8, 1990

Project: Yarnell deposit
John Malusa
ASARCO

Sample Number
UAKA 90 054

Sample Information
Submicron illitic clay
Fault gouge within altered Precambrian biotite granites
Mineralized fault zone, 2-10' wide, dips ~35 NE
Hangingwall is oxidized, highly limonitic

Location Information
Yarnell precious metal deposit
Weaver District. Yavapai Co., AZ
Lat. 34 12.30' N
Long. 112 44.58' W

Analytical Data

1) Potassium Data	Potassium Mean	2) Radiogenic Ar pm/g Data	Radiogenic Ar pm/g Mean	3) % Atm. Ar Data	% Atm. Ar Mean	4) Reported Date +/- Err
5.400	5.455	670.2	665.8	3.6	6.0	69.1 +/- 1.6
5.458		666.1		5.9		
5.442		670.0		5.8		
5.519		657.0		8.5		

ASARCO Incorporated
OCT 16 1990
SW Exploration

ASARCO Incorporated
OCT 16 1990
SW Exploration

JDS o.k but when does it stop?

ASARCO

Southwestern Exploration Division

January 11, 1991

All SWED people have been told not to charge any expenses to Yarnell. JDS.

R.L. Brown
New York Office

4th Quarter 1990
Clean-up Costs
Yarnell Project
EA-0444
Yavapai County, AZ

but as you note Norgold is still asking for data & this should be charged to Yarnell JDS.

At your request I am detailing the expenses accrued against the Yarnell Project for the 4th Quarter of 1990.

October 1990

McClelland Labs (Leach Studies)	$4,586.00
Skyline Labs (Assays)	762.00
Legal Expense, deferred charges	3,020.32
Salary, Overhead, Travel, Expense: M.A. Miller & W.D. Gay	2,375.98
Travel Expense: S.L. Lakosky	471.70
Tucson Blueprint (abundant material copy sent to Norgold)	325.87
Total October	$11,541.87

November 1990

UofA Age-dating Lab.	$ 500.00
Surveying for Patent of Pennsylvania Claim	4,535.00
Wickenburg Pump & Electric (repair)	188.75
Salary, Overhead; Yarnell Talk, M.A. Miller	752.61
Tucson Blueprint (as above)	156.01
Total November	$6,132.37

December 1990

Legal, deferred charges	$1,377.96
Bureau of Land Management, Claim payments	395.00
Taxes, State Property	3,006.74
Salary, Overhead, Supplies: M.A. Miller & D.A. Melhado	1,919.59 — finishing off his report
Tucson Blueprint	66.45
Total December	$6,765.74

James D. Sell
James D. Sell

JDS:mek

cc: W.L. Kurtz

JDS

ASARCO

Southwestern Exploration Division

January 11, 1991

R.L. Brown
New York Office

4th Quarter 1990
Clean-up Costs
Yarnell Project
EA-0444
Yavapai County, AZ

At your request I am detailing the expenses accrued against the Yarnell Project for the 4th Quarter of 1990.

October 1990

McClelland Labs (Leach Studies)	$4,586.00
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November 1990

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Surveying for Patent of Pennsylvania Claim	4,535.00
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Salary, Overhead; Yarnell Talk, M.A. Miller	752.61
Tucson Blueprint (as above)	156.01
Total November	$6,132.37

December 1990

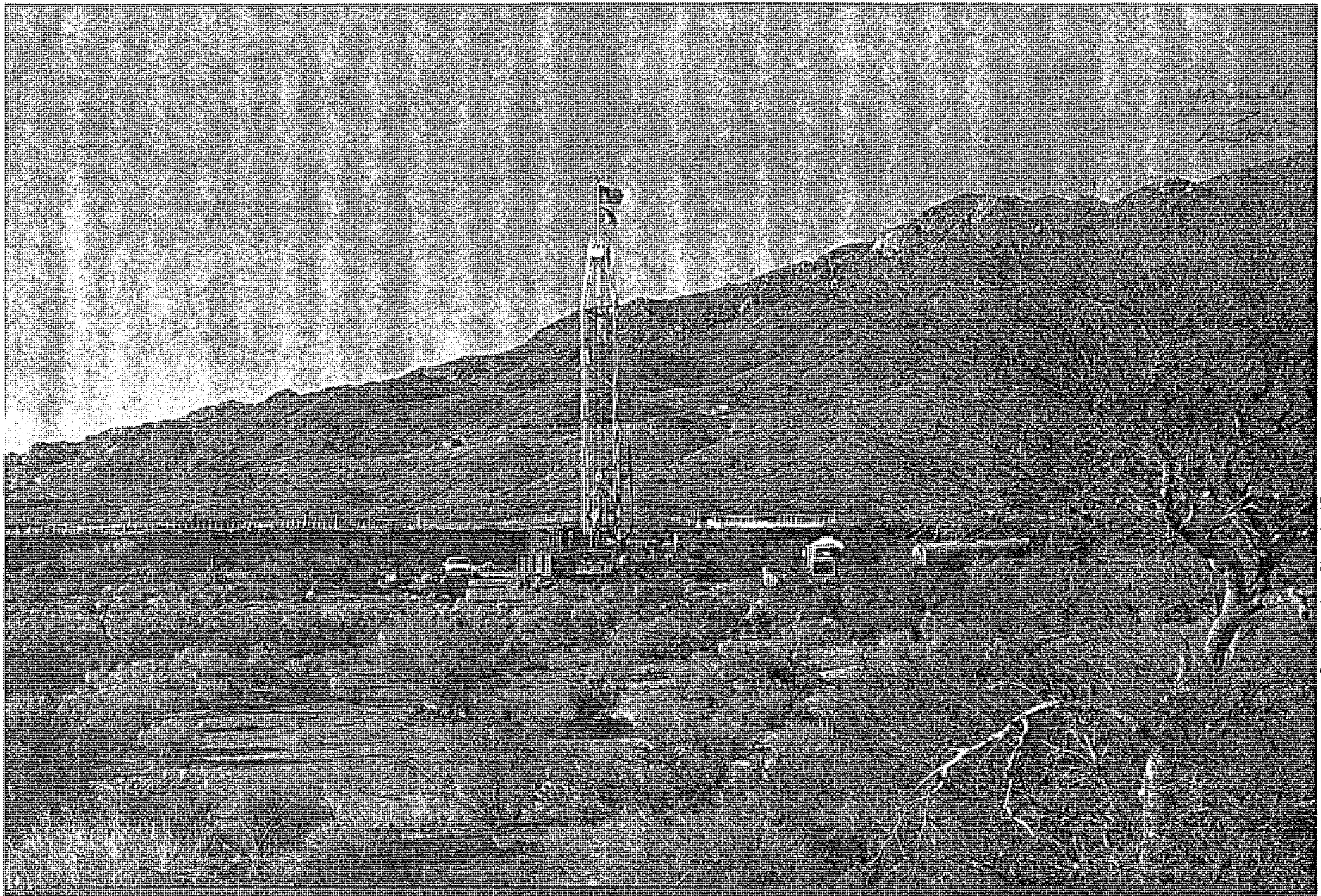
Legal, deferred charges	$1,377.96
Bureau of Land Management, Claim payments	395.00
Taxes, State Property	3,006.74
Salary, Overhead, Supplies: M.A. Miller & D.A. Melhado	1,919.59
Tucson Blueprint	66.45
Total December	$6,765.74

James D. Sell

James D. Sell

JDS:mek

cc: W.L. Kurtz



An Arizona dairy received additional water supplies after completion of this drilling project. Layne serves a variety of industrial, municipal and agricultural customers.

Photo courtesy of Layne-Western Company, Inc., Phoenix, AZ.

1991 Calendar January Picture

ASARCO

Southwestern Exploration Division

JDS

January 16, 1991

J.D. Sell

Yarnell Fault Dating

Attached is the abstract from EOS, Vol. 71, No. 43, October 23, 1990, that I used in my K/Ar illite paper dated December 12, 1990.

The title of the abstract is "Apatite Fission Track Analyses from Metamorphic Core Complexes and the Transition Zone, Arizona, U.S.A.

John J. Malusa

JJM:mek

cc: W.L. Kurtz

Force Geophysics Laboratory, the US Geological Survey, the Geological Survey of Canada, and several universities on a variety of seismograph systems. Seismographs were installed in the Grand Canyon with the cooperation of the National Park Service. Three large shots provide reversed coverage in the distance range 0-225 km.

In this paper, we will discuss preliminary travel-time modeling of the merged data set for the three largest shots. The 1-D model illustrates the salient features of the travel time curve: (a) a prominent Pg arrival with a uniform velocity of 6.0 km/sec over the distance range 0-150 km; (b) the Pn phase at 8.0 km/sec seen as a first arrival at ranges beyond 200 km; and (c) the PmP reflection in the distance range 90-140 km. Results of 2-D modeling will be presented which clarify lateral variations in travel time and amplitude.

T22C-4 1330h POSTER

LONG-RANGE OBSERVATIONS OF PACE SHOTS ON THE COLORADO PLATEAU

Susan D'Annolfo, John Cipar, and Lorraine Wolf (Air Force Geophysics Laboratory, AFGL/LWH, Hanscom AFB, MA 01731)

During the 1989 Pacific-Arizona Crustal Experiment, The Air Force Geophysics Laboratory operated a linear array of 30 3-component seismographs north of the Grand Canyon, on the Colorado Plateau of northern Arizona. The array was oriented NNW-SSE with a maximum aperture of 70 km for shooting nights 1 and 2, and 36 km for night 3. Each station consisted of a Terra Technology DCS-302 cassette recorder and a Sprengnether S-6000 2-Hz triaxial seismometer. The data were sampled at 100 samples per second with a bandwidth from the lower seismometer cutoff to 30 Hz. Acuurate timing was achieved by recording WWVB radio time simultaneously with the data. Backup timing was done by comparing the recorder internal clock to GOES satellite time. Amplitude calibrations were done by driving the seismometer calibration coil with a step current and recording the system output.

The largest PACE shots (over 2700 kg) provide coverage in the distance ranges 184-284, 316-356, and 390-427 km. Observed phase velocities will be compared to existing structural models of the Colorado Plateau to elucidate the deep structure. Frequency content of Pn, Pg, Lg and other phases will be measured to obtain estimates of signal-to-noise characteristics at regional distances and anelastic attenuation. Lg excitation will be examined in the light of the source characteristics of each shot.

T22C-5 1330h POSTER

The PACE 1989 Seismic Experiment: Initial Results from the Cross Profile

MONTANA, CARLOS, KELLER, G.R., DOSER, D.I., and BAKER, M.R. (All at: Department of Geological Sciences, University of Texas at El Paso, El Paso, TX 79968)
HARDER, STEVEN (Department of Geophysics, Texas A & M University, College Station, TX 77843)

The 1989 PACE seismic experiment in northern Arizona included a recording along a cross-profile which extended from the north rim of the Grand Canyon southeastward to the area of Meteor Crater, Arizona. The purpose of this effort was to provide controls on three-dimensionality and provide crustal structure constraints for a long profile being recorded from NTS to White Sands Missile Range. Ten shots were recorded into this profile at shot-receiver offsets extending to over 150 km. Pg arrivals indicate an upper crustal velocity of approximately 6.0 km/s, a relatively thin cover of sedimentary rock, and a basement structure which is complex. This observation is in agreement with the presence of northeast-trending aeromagnetic lineaments which have been interpreted in the area. Prominent but complex wide-angle reflections (PmP) are observed from the Moho from the northwesternmost shotpoint. This phase is weaker from the southeasternmost shotpoint. In both cases, interesting arrivals follow PmP. Prominent intracrustal arrivals are also observed. These data will be tied with the main profile to provide an integrated interpretation of the entire data set. In addition, stations were deployed around the San Francisco Mountains in order to provide a tomographic analysis of deep structure associated with the igneous features. A short detailed profile was recorded near Meteor Crater in order to provide information on upper crustal structure and a tie to COCORP profiles.

T22C-6 1330h POSTER

Laramide Displacement between the Colorado Plateau and the North American Plate: Structural Evidence from the Gunnison Region of Colorado

R C Lamons, Department of Geology and Geophysics, University of Minnesota, Mpls., MN 55108 612-624-1333

The Gunnison region is on the western border of the Rocky Mountains Foreland tectonic province. Uplift and convergence occurred along this boundary during the Laramide. There are several lines of evidence to suggest that this boundary was obliquely convergent with a dextral sense during the Laramide orogeny.

The most convincing evidence for dextral offset comes from slickenlines on a series of sub-vertical faults sub-parallel to the boundary. Slickenlines plunge shallowly indicating strike-slip movement and slickensides show surface fractures characteristic of dextral offset. The strongest trend of slickenlines from all faults in the area indicates a NNE-SSW displacement.

Other evidence for a strike-slip component of movement comes from comparisons with structures found along modern wrench faults such as the San Andreas in California, and the Alpine fault zone in New Zealand. Thrusts and folds occur at left-stepping bends and terminations. Horsts occur between convergent splays and grabens occur between divergent splays. The strata in some grabens has been folded. Folding may be a result of convergence or of drag folding along the faults. Folded strata in grabens may characterize oblique tectonic convergence. Two major faults change dip direction along strike as is typical of strike-slip faults. The faults in the Gunnison area show an anastomosing pattern over a wide zone rather than the narrow zone typical of purely strike-slip faults. Convergence may have increased the width of the fault zone.

The Laramide age is bracketed by faults which cut late Cretaceous intrusions and are overlain by Oligocene tuffs. Most faults cannot be so bracketed in time, but are parallel in trend and style to the few that can be dated.

Maps, cross-sections, and slickenside data consistently indicate dextral oblique convergence between the Colorado Plateau and the North American plate in the Gunnison region during the Laramide Orogeny.

T22C-7 1330h POSTER

A Positive Gravity Anomaly Along the Colorado River Extensional Corridor: Evidence for New Crustal Material?

R.W. Simpson, K.A. Howard, R.C. Jachens (USGS, 345 Middlefield Rd., Menlo Park, CA 94025)
J. Mariano (Dept. of Geosciences, Purdue University, West Lafayette, IN, 47907)

A 150-km long isostatic residual gravity high parallels the west bank of the Colorado River from the Eldorado Mountains in Nevada to the Whipple Mountains in California. It coincides with a belt of metamorphic core complexes that have been interpreted from geologic evidence to mark a corridor of extreme Miocene crustal extension, and it also overlies a mid-crustal upward bulge of higher velocities detected in two PACE seismic refraction profiles across the extensional corridor. Over most of its length, the gravity high has a width of approximately 20 km with an amplitude of 10-20 mGal above background levels on either side. Although gradients seem to require that the top of the source body lie within several kilometers of the Earth's surface, the causative rocks have been difficult to identify in spite of extensive density sampling. Tertiary mafic dikes and small intrusions are exposed along the anomaly in a number of ranges, though usually not in enough volume to explain the amplitude of the anomaly. Where dated, the Tertiary igneous rocks yield ages in the range 22-14 Ma. We speculate that more of these igneous rocks exist in the subsurface and that they were emplaced and uplifted as part of extensional processes that began when the Pacific plate contacted the North American plate. We cannot rule out the possibility that older dense lower-crustal rocks uplifted by the extensional process are causing or contributing to the anomaly, although such rocks are not exposed in significant quantities at the surface. To the west of the Colorado River gravity high, a belt of gravity highs trends south-southeast from the Death Valley region where extension is presently occurring. One gravity high in this belt is associated with an 11.6 Ma diorite intrusion in the Black Mountains adjacent to Death Valley reported by Asmerom and others (1990). They interpreted this intrusion to have been emplaced at mid-crustal levels and brought to the surface by the extensional process. If so, the Death Valley region may provide a modern analog to the Colorado River extensional corridor.

T22C-8 1330h POSTER

Gravity Anomalies in Western Arizona

KEVIN L. MICKUS (Dept. of Geosciences. S.W. Missouri St. Univ., Springfield, MO 65804-0089)

The recent PACE, COCORP, and CALCRUST seismic experiments have provided information on the structure and composition of the upper crust, lower crust and upper mantle in western Arizona. When combined with gravity data, a general crustal model from the Colorado Plateau to the Basin and Range Province can be made. The Bouguer gravity field in this area is dominated by a long wavelength gravity anomaly that corresponds to regional topography and probably reflects the thickening of the crust underneath the Colorado Plateau. The most dominent intermediate wavelength anomalies are gravity minima over the Castle Dome and Aquarius-Mohon Mountains. These lows are associated with Tertiary volcanics and high heat flow values. Many gravity maxima occur over metamorphic core complexes (e.g., Rawhide, Buckskin, and Harcuvar Mountains) which are due to mafic intrusions and/or higher density rocks within the mylonite zone. The transition zone between the Colorado Plateau and the Basin Range is characterized by a prominent northwest trending linear gravity gradient.

Using the above seismic data as constraints, a model has been constructed from the Colorado Plateau (crustal thickness 42 km) to Yuma, Arizona in the Basin and Range Province (crustal thickness 25 km). This 450 kilometer long transect indicates crustal structure variations that reflects the Phanerozoic history of the area. The most prominent anomalies are a gravity low over the Castle Dome Mountains (Tertiary volcanics) and a gravity maxima over the Colorado River extensional terrane that is interpreted to be caused by a mid-crustal lens (10-23 km in depth) of diortic material formed during the main phase of mid-Tertiary extension. The mid-crustal lens is modeled with density of 2.84 g/cc determined from seismic velocities.

T22C-9 1330h POSTER

Apatite Fission Track Analyses From Metamorphic Core Complexes and the Transition Zone, Arizona, U.S.A.

David A. Foster, Andrew J. W. Gleadow, and Gordon S. Lister (Victorian Institute of Earth and Planetary Sciences, GPO Box 2729X, Melbourne 3001, Australia)
Stephen J. Reynolds (Arizona Geological Survey, 845 N. Park Ave., #100, Tucson, Arizona 85719, U.S.A.)

Apatite fission track (FT) ages from basement rocks exposed in metamorphic core complexes (MCC) and the Colorado Plateau Transition Zone, west central Arizona, reveal information about heating during the Laramide followed by cooling/unroofing in the middle Tertiary. Seven apatite FT ages from the lower plate of the Buckskin MCC are between 10 ± 2 and 16 ± 3 Ma. Mean confined FT lengths for these samples range from 13.8 to 14.8 μm with standard deviations of 0.7 to 1.5 μm. Two samples from the Whipple MCC, California, give apatite FT ages of 14 ± 2 and 15 ± 1 Ma with mean track lengths >14 μm. Analyses of six samples from the Harcuvar MCC reveal apatite FT ages between 11 ± 2 and 16 ± 2 Ma and mean lengths of 13.6 ± 1.3 to 14.5 ± 0.9 μm. These ages are nearly concordant with published and unpublished K-Ar and $^{40}Ar/^{39}Ar$ ages of biotite and K-feldspar from mylonitic lower plate rocks. The concordant ages combined with mean track lengths >14 μm can only be the result of rapid cooling to below ~80°C followed by residence at or near the surface until the present. Apatite FT ages between Congress and Peeples Valley, AZ increase from 27 ± 2 to 44 ± 4 Ma over an elevation change of 540 meters. Mean FT lengths for these samples decrease from 13.4 ± 1.4 to 12.4 ± 2.2 μm. Track length distributions are unimodal and negatively skewed. An increase in age from 25 ± 2 to 47 ±2 Ma over 560 meters elevation is found between Wilboit and Preston. Although these two sequences yield similar ages, strongly negative skewed and moderately bimodal length distributions with means of 10.9 ± 3.8 to 12.0 ± 3.1 μm indicate more annealing in the Wilhoit/Preston suite. These two age sequences may represent an age/depth profile developed after the Laramide which was probably uplifted and repeated by Tertiary high angle faulting. We have analyzed apatites from basement rocks collected from beneath the Cambrian unconformity near Cherry, AZ and found ages of 80 ± 5 to 107 ± 11 Ma and bimodal track length distributions with means of 10.2 ± 3.7 to 11.6 ± 3.2 μm. This suggests a high degree of annealing which likely occurred during both the Laramide and Tertiary.

T22C-10 1330h POSTER

A Thermomechanical Model of the Colorado Plateau Lithosphere

Juan Homero Hinojosa (Department of Geological Sciences, The University of Texas at El Paso, El Paso, TX 79968)

The Colorado Plateau (CP) is a coherent and elastically strong lithospheric block surrounded in part by the weaker extensional regimes of the Basin and Range Province and the Rio Grande Rift. The CP has experienced a Cenozoic uplift of about 2 km. The exact physical mechanism responsible for isostatic uplift is still unclear. Previously proposed uplift mechanisms for the CP include, in general, some form of (i) thermal expansion, (ii) crustal thickening, and (iii) phase changes. An alternative thermomechanical uplift mechanism is proposed here. A finite difference solution to both the axisymmetric, time-dependent heat conduction equation with heat sources and the elastic flexure equation has been obtained. Heat flux boundary conditions are used at the base and sides of the model, while the upper boundary is isothermal. The time-dependent elastic thickness of the CP lithosphere model is computed at each time step, and the buoyancy produced by the heated material is used as the thermally-derived normal stress acting on the elastic lithosphere. The initial results of this study appear to indicate that the 2 km of uplift of the CP were produced by at least two sources of uplift: the first associated with the regional heating of the western Cordillera, and the second associated with the flexural response of the CP lithosphere to radial heating at the sides.

This page may be freely copied.

ASARCO

Jlos

FILE

Yarnell Proj. -
Yavapai Co., AZ

Exploration Department
R. L. Brown
Vice President

MAM - I do not have time to redo this. As no more time is to be charged to the project & I do not think you should use company time, then I'd say its in your ball park to do it at home & Sat-Sun-holidays. JDS.

ASARCO Incorporated
DEC 27 1990
SW Exploration

December 19, 1990

Mr. James D. Sell

Dear Mr. Sell:

I attach hereto the draft Yarnell paper authored by Miller and yourself which is proposed for publication in the Arizona Geological Society Digest 19. I recall also that Norgold is still pushing you for a written geological description of the Yarnell deposit.

I quickly reviewed the paper which I return to you with my marginal comments. If those marginal comments are incorporated in the paper, it will then be in shape to give to Norgold.

I have much greater difficulty authorizing its publication in a professional journal identified as the product of Asarco geologists. It will need extensive reworking before such publication can be authorized. If you still choose to attempt such publication, please work the comments I've made into the paper and send me another draft.

Yours very truly,

R. L. Brown

R.L. Brown

RLB:lj

cc: W.L. Kurtz

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

JDS

ASARCO

Exploration Department
Southwestern United States Division

James D. Sell
Manager

December 11, 1990

Mr. Thomas C. Batchelor
P.O. Box 1463
Hawthorne, NV 89415

Yarnell Mine Project

Dear Mr. Batchelor:

Thank you for your letter and resume for possible work at the Yarnell Mine.

Asarco has returned the project to the owner/lessor, Norgold Resources, Vancouver, Canada, and they would be the company interested in your qualifications.

Sincerely,

James D. Sell

James D. Sell

JDS:mek

cc: W.L. Kurtz

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

NORGOLD RESOURCES INC.

NEWS RELEASE

SYMBOL: NGR EXCHANGE: V.S.E.

FEBRUARY 04, 1991 **FOR IMMEDIATE RELEASE**

WKK, JDS, WDG

BEMA GOLD PROPOSED TAKEOVER OF NORGOLD RESOURCES INC.

Norgold Resources Inc. is pleased to announce that certain shareholders of the Company, including all shares owned by officers and directors of the Company, have entered into a lock-up agreement with Bema Gold Corporation. The lock-up agreement provides that, subject to a due dilligence review which must be completed by February 13, 1991, Bema is to make an offer, by way of a takeover bid, for all outstanding common shares of Norgold on the basis of 1 common share of Bema for each 2.5 common shares of Norgold. The takeover bid is to be made on or before February 26, 1991 to all Norgold shareholders on the same terms as provided in the lock-up agreement.

Over the past 3 years, as a public company, Norgold has developed an advanced stage gold project, the Yarnell Deposit, and several exciting exploration projects, including the General Grant and Nevada Chance Properties.

The Yarnell Gold Project, located 72 miles northwest of Phoenix, Arizona is the primary asset of the Company. Over the past two years Norgold and ASARCO Inc. conducted reverse circulation drilling, diamond drilling and metallurgical studies which to date have delineated 273,600 contained ounces of gold which are amenable to heap leaching and open pit extraction. It is Bema's objective to place Yarnell into production in 1992.

The General Grant Project is located near Wickenburg, Arizona and is comprised of 130 claims. This 2,600 acre project contains widespread gold/zinc mineralization and is in the early stages of exploration.

In Nevada, the Nevada Chance East Project, located adjacent to the LAC/Equinox Rosebud Discovery and directly southeast of Hycroft's Lewis Crofoot Mine, is an exploration program with LAC Minerals (U.S.A.) Inc. This project was recently successfully drilled by LAC/Norgold, with one hole returning gold mineralization averaging .030 opt over 300 feet. The Nevada Chance West property is located south of the Lewis Crofoot Mine in an area which covers the continuation of the north-south range front fault which controls the mineralization of the mines to the north.

Several months ago, Norgold management was approached by several major mining companies in regards to potential joint venture or sale of the Yarnell Project. The key criteria which Norgold's management sought in reviewing the various business proposals from interested parties were as follows: 1) an established company with a successful record of gold production and exploration; 2) a proven operating/management record; and 3) potential for future appreciation in share price.

With Bema Gold Corporation becoming the successful candidate, management feels that the above criteria will be met and the shareholder group have committed 1.77 million Norgold common shares to Bema under the terms of the lock-up agreement.

FOR MORE INFORMATION CONTACT CORPORATE RELATIONS

Head Office: 210 - 475 Howe Street, Vancouver, British Columbia V6C 2B3
Telephone: (604) 681-5566 Fax: (604) 687-8789

Bema has a production record with the Champagne Mine in Idaho, with 1990 production at 27,000 ounces gold or gold equivalent. Bema is currently undertaking pre-contruction work on the Buffalo Gulch Project, in Idaho, which is scheduled for production in late 1991.

In Northern Chile Bema has experienced exceptional success with its 50% owned Refugio Project. The Verde Deposit, which is part of Refugio, has recently been evaluated by an independent study. This Preliminary Feasibility Report indicates a geological reserve of 5.6 million troy ounces and forecasts annual gold production of approximately 225,000 ounces, and an initial mine life of 9.4 years. The report, completed by Mineral Resources Development Inc., has concluded that the Verde Deposit is both technically and financially viable as a large scale open pit mine. A Final Feasibility Study is expected shortly and discussions for project financing are now underway. In addition, the Pancho Deposit, located within 2 kilometers of the Verde Deposit, has a similar geological signature and will likely prove to be of future interest as exploration work is continued.

Shareholders will be advised when the due diligence condition has been removed. Subsequent to the date of the delivery of the takeover bid circular, the directors of the Company will be delivering a director's circular to all shareholders with their recommendation relating to the bid.

On Behalf of the Board of Norgold Resources Inc.

Michael D. Philpot
President and C.E.O.

The Vancouver Stock Exchange has neither approved nor disapproved the contents of this release.

FEDERAL EXPRESS

JDS

ASARCO

Exploration Department
Southwestern United States Division

James D. Sell
Manager

January 25, 1991

Mr. Harvey Smith
Del Tierra E&M Co.
4310 North Brown Ave., Suite #3
Scottsdale, Arizona 85251

Quit Claim Deed
Asarco to Norgold
Yarnell Project
Yavapai County, AZ

Dear Harvey:

Attached is the original Quit Claim Deed conveying the Black Dike #3, and the YAR-1 through -39, and YAR-41, -42, -43 from Asarco to Norgold.

Note that a typo error was corrected for YAR-14 AMC Serial Number, which I have initialed. A representative of Norgold should also initial the correction.

Sincerely,

James D. Sell

James D. Sell

JDS:mek
Att.

cc: R.L. Brown
W.L. Kurtz
W.D. Gay
Norgold Resources

QUITCLAIM DEED

For the consideration of Ten Dollars, and other valuable consideration, ASARCO INCORPORATED, a New Jersey corporation, hereinafter called the Grantor, hereby remises, releases, relinquishes and quitclaims to NORGOLD RESOURCES (US) INC., a Nevada corporation, hereinafter called Grantee, all right, title and interest in the unpatented mining claims located in Sections 14, 15, 22 and 23, Township 10 North, Range 5 West, Yarnell/Weaver Mining District, Yavapai County, Arizona, the location notices of which are recorded in the Official Records of Yavapai County, Arizona and filed in the Arizona State Office of the Bureau of Land Management as described in Exhibit A attached hereto.

TO HAVE AND TO HOLD the same unto Grantee, its successors, and assigns forever.

ASARCO INCORPORATED

By R. L. Brown

Its Vice President

STATE OF New York)
) ss.
County of New York)

This instrument was acknowledged before me this 21st day of January, 1991, by R. L. Brown, Vice President of ASARCO Incorporated, a New Jersey corporation, on behalf of the Corporation.

Elizabeth J. Callow
Notary Public

My Commission Expires:
3-30-91

EXHIBIT A

The unpatented mining claims located in Sections 14, 15, 22 and 23, Township 10 North, Range 5 West, Yarnell/Weaver Mining District, Yavapai County, Arizona as follows:

Name of claim	Recording Data Book	Page	AMC Serial No.
Black Dike #3	153	393	72445
YAR #1	2131	587-588	294316
YAR #2	2131	589-590	294317
YAR #3	2131	591-502	294318
YAR #4	2131	593-594	294319
YAR #5	2131	595-596	294320
YAR #6	2131	597-598	294321
YAR #7	2131	599-600	294322
YAR #8	2131	601-602	294323
YAR #9	2131	603-604	294324
YAR #10	2131	605-606	294325
YAR #11	2131	607-608	294326
YAR #12	2131	609-610	294327
Amended	2135	263-264	
YAR #13	2131	611-612	294328
YAR #14	2131	613-614	~~204329~~ 294329 JWS
YAR #15	2131	615-616	294330
YAR #16	2131	617-618	294331
YAR #17	2131	619-620	294332
YAR #18	2131	621-622	294333
YAR #19	2131	623-624	294334
YAR #20	2131	625-626	294335
YAR #21	2131	627-628	294336
YAR #22	2131	629-630	294337
Amended	2174	858-859	
YAR #23	2131	631-632	294338
YAR #24	2131	633-634	294339
YAR #25	2131	635-636	294340
Amended	2174	860-861	
YAR #26	2131	637-638	294341
Amended	2174	862-863	
YAR #27	2131	639-640	294342
Amended	2174	864-865	
YAR #28	2131	641-642	294343
Amended	2174	866-867	
YAR #29	2131	643-644	294344
YAR #30	2131	645-646	294345
YAR-31	2155	256	296357
Amended	2158	895-896	
YAR-32	2155	257	296358
Amended	2158	897-898	
YAR-33	2155	258	296359
Amended	2158	899-900	
YAR-34	2155	259	296360
Amended	2158	901-902	
YAR-35	2155	260	296361
Amended	2158	903-904	
YAR-36	2155	261	296362
Amended	2158	905-906	
YAR-37	2155	262	296363
Amended	2158	907-908	
YAR-38	2155	263	296364
Amended	2158	909-910	
YAR-39	2155	264	296365
Amended	2158	911-912	
YAR-41	2178	170	298732
YAR-42	2178	169	298733
YAR-43	2189	128	299488

Note: Norgold should also initial the correction. JWS.

ASARCO

ASARCO Incorporated

NOV 9 1990

SW Exploration

Exploration Department
Frederick T. Graybeal
Chief Geologist

November 6, 1990

Mr. J.D. Sell
Manager, Southwestern Exploration Division
Tucson Office

Yarnell Project Report
<u>Arizona</u>

Dear Mr. Sell:

I have reviewed your report on the Yarnell Project which you forwarded to New York under cover of your September 27, 1990 note to W.L. Kurtz. Norgold has requested from both you and I that they be provided with a copy of this report. I have read the report rather quickly and have made a number of editing notations where I think the wording might be more clearly written or certain items could be eliminated. In particular I suggest that you eliminate all references to Asarco reports. Your summary report includes all this previous work and use of the standard bibliographic reference technique, although appropriate for a manuscript to be published, is not necessary here. Your report summarizes all this previous work. You can also eliminate both bibliographies other than references to reports such as Anderson's thesis or a George Cross newsletter which are external from the Asarco files. I did not proof your tables or your maps but I assume you have.

I hope this report is still in your word processor so the changes can be made on the double space draft rather than retyping the entire text. If you have any questions let me know.

Very truly yours,

F.T. Graybeal

F.T. Graybeal

Enclosure

FTG:mev

ASARCO Incorporated 180 Maiden Lane New York, N.Y. 10038 (212) 510-2000
Telex:RCA 232378 Cable: MINEDEPART Fax: (212) 510-1978

ASARCO

Southwestern Exploration Division

September 27, 1990

F. T. G.

NOV 6 1990

W.L. Kurtz

Report on Yarnell Project
Yavapai County, Arizona

As requested by R.L. Brown, I submit my synopsis of the studies and results at the Yarnell Project.

The text has been double spaced to facilitate the corrections and additions of yourself, Graybeal, and Brown.

James D. Sell

JDS:mek
Att.

James D. Sell

cc: R.L. Brown
F.T. Graybeal

RECEIVED
OCT 01 1990
EXPLORATION DEPT.

ASARCO Southwestern Exploration Division

September 27, 1990

W.L. Kurtz

Report on Yarnell Project
Yavapai County, Arizona

I submit my report on the Yarnell Project which was drilled in 1989 as a potential open-pit gold mine.

Seventy-three reverse-air circulation drill holes, on approximately 100-foot centers, were drilled to define the present configuration of the mineral zone. Four diamond drill core holes were also drilled adjacent to rotary holes to provide a complete geologic-structural-mineralization profile through the deposit and to serve as an assay check on the adjacent rotary holes.

Numerous studies have been undertaken such as bottle roll leach tests, large column percolation leach tests, a vat low-grade leach test and numerous computer runs involving various economic parameters.

At present a geologic inventory of a study pit outlines a potential of plus four million tons of plus 0.05 oz/ton gold. Several partially tested to untested areas remain which when drilled may add from one-half to one million or more tons at a similar grade and favorable stripping ratio. It is recommended to carry out the southwest extension drilling as the first phase of the expansion drilling to add more ounces gold to the inventory and be incorporated in a mining plan. Perhaps the majority of the waste dump could be restacked in the area of the southwestern extension and decrease mining costs. Should all three recommended drill expansion areas be successful in developing added tonnage and grade, the mining plans might be altered from the economic pit design as now suggested.

As developed in the report, I believe all initial assays within the main mineralized B Zone can be used uncut in any reserve calculation. Other high grade assays in the hanging wall area (A Zone) are likely to be associated with high-angled shears, which cannot be used in reserve calculations, but can and should be used in the day-to-day mining plan as the benches become subparallel to the strike of these structures.

Noted in the report is my heavy reliance upon the observations by the field project geologists, M.A. Miller and J.J. Malusa of the SWED Staff, and the numerous reports prepared on the various phases of the project, both in house and by outside consultants.

James D. Sell
James D. Sell

JDS:mek
Atts.
cc: R.L. Brown
F.T. Graybeal

RECEIVED
FEB 11 1991
EXPLORATION DEPARTMENT

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FEBRUARY 5, 1991

NO.25(1991)
FEBRUARY 5, 1991

WESTERN CANADIAN INVESTMENTS

BEMA GOLD CORP. (BGO-V,T)

PROPOSED TAKEOVER BID - Clive T. Johnson, chairman, reports Bema Gold Corp. proposes to make a takeover bid for all the shares of Norgold Resources Inc. on the basis of one Bema share for every 2.5 Norgold shares. Bema has reached a lockup agreement with certain Norgold insiders, including all the directors, regarding the tendering of their 1,772,815 shares, approximately 37% of Norgold's issued shares.

Bema will mail its circular bid by 26Feb91, subject to Bema due diligence study and regulatory approval. The bid will not be made in the U.S. and will be subject to certain conditions: including a minimum 75% of Norgold shares be tendered; no adverse material change; that all stock options, warrants or similar rights be cancelled or transfered to Bema and that Bema is not required to issue more than 2,200,153 shares.

Bema intends to sign private agreements with holders of stock options, warrants and other rights on terms similar to the bid proposal.

Norgold currently has 4,782,776 shares outstanding. Norgold's primary assets are the Yarnell and General Grant properties in Arizona and the Nevada Chance property in Nevada.

YARNELL PROPERTY: The claim group is located in western Yavapai county, Arizona, 16 miles north of Wickenburg. ASARCO has completed 24,000 feet of reverse circulation drilling and outlined an oxide deposit 1,800 by 500 feet with an average depth of 140 feet. The deposit is open to the southwest and northeast. An independent study calculated a geological reserve of 7,600,000 tons grading 0.036 oz.gold/ton containing 273,600 ounces at a cut-off grade of 0.01 oz.gold/ton. More drilling is planned to add reserves. Metallugical studies demonstrated Yarnell ore is amenable to heap leaching with gold recoveries of 71% at a crush size of -2 inches.

Bema carried out an initial review that suggested the Yarnell property could be placed into production at 33,000 to 40,000 ounces of gold per year. If the takeover bid is successful, Bema would immediately start permitting and a feasibility study with a view to placing the property into production in 1992.

NEVADA CHANCE PROPERTY: This property is immediately south of the Lewis-Crofoot mine in Pershing county, Nevada, and is divided into the Chance-East and Chance-West claim blocks. The 15 Chance-East claims are under option to LAC Minerals which has drilled nine reverse circulation holes. Hole RL-13 cut 100 feet of 0.052 oz.gold/ton, hole RL-153 cut 125 feet of oxide grading 0.031 oz.gold/ton. The Chance-West comprises 40 claims 100% controlled by Norgold. LAC has a first right of refusal until Aug/91. The claims cover a continuation of the north-south range front fault which controls mineralization at the Lewis-Crofoot mine.

GENERAL GRANT PROPERTY: This property comprises 130 lode claims and one State section located 20 miles southwest of Wickenburg in Maricopa county, Arizona. A trench across a low-angle shear zone returned 4.28% zinc and 0.043 oz.gold/ton over 65 feet.

Bema is currently conducting an evaluation of the Nevada Chance and General Grant properties. The addition of the Yarnell property to Bema's existing U.S. and Chilean projects would increase the company's total mineable reserves to about 2,600,000 ounces. Bema's current projections of annual gold production is as follows: 1991 - 30,000 ounces, 1992 - 80,000 ounces, 1993 - 185,000 ounces and 1994 - 190,000 ounces. Bema currently has 30,868,846 shares outstanding. (SEE GCNL No.8, 12Jan91, P.1 FOR OTHER PROJECT INFORMATION)

GOVERNMENT OF BRITISH COLUMBIA

GAS STORAGE SITES BANNED - Caroline Gran, Government Services Minister, reports the Government of B.C. has banned the underground storage of natural gas in the Fraser Valley, located east of Vancouver, B.C.

A commission of inquiry reported that exploration itself poses little risk to the environment. B.C.GAS INC., CONOCO CANADA LTD. and DYNAMIC OIL LTD. wish to drill three wells to explore for natural gas and evaluate the geology as a possible storage area for gas. B.C. Gas has spent some $18,000,000 on the project to date. Local residents in the Fraser Valley, mainly an agricultural region, formed an organization, Friends of the Fraser Valley, to oppose both exploration and storage of gas.

David Anderson, Commissioner, stated in his report that underground storage of gas needs more study. He also stated banning of exploration for gas could cost the government hundreds of millions of dollars in compensation for mineral rights. In Oct/89, the government of B.C. auctioned off subsurface mineral rights on 7,285 hectares for $5,600,000 to Conoco and Dynamic Oil. Friends of the Fraser Valley plan to oppose exploration for gas.

ADRIAN RESOURCES LTD. (ADL-V)
THIOS RESOURCES INC. (THI-V)

1990 EXPLORATION SUMMARY - William Campbell, secretary, reports Adrian Resources Ltd. and joint venture partner Thios Resources Inc. have compiled their 1990 exploration work on the Ruby silver project located 21 km north of Stewart, B.C. The property comprises one claim totalling 20 units and five reverted crown grants wholly owned by the companies with 50% each.

A $150,000 program was carried out including line cutting, soil geochemical sampling, geophysical surveying and geological mapping. Two old adits were inspected and sampled. The adits expose two zones of quartz-carbonate veining hosting pyrite and chalcopyrite mineralization. No significant assays were returned from vein samples. Soil sampling indicated a number of spot highs up to 570 parts per billion gold, 13 parts per million silver, 1,400 ppm copper, 2,500 ppm lead and 480 ppm zinc. No geochemical trends were identified. VLF-EM surveying detected several conductors unrelated to any geochemical highs or bedrock mineralization.

The road-accessible property was worked in 1929 when three major adits were driven as well as some trenching and short adits. (SEE GCNL No.118, 19Jun90, P.1 FOR PREVIOUS RUBY SILVER PROJECT INFORMATION)

KRL RESOURCES CORP. (KRO-V)

CLAIMS ADJOINING ROCK & ROLL ACQUIRED - Seamus Young, president has reported KRL Resources has agreed to acquire 100% interest in the GUY 1- 4 claims which adjoin to the northwest along the mineralized trend on the Rock & Roll claims being explored by Eurus Resources and Thios, 4 km northwest of the Snip mine recently placed in production by Cominco and Prime Resources.

cc JCB PGV

ASARCO Inc.

JAN 4 1991

SW Exploration

FACSIMILE TRANSMISSION

DATE: January 4, 1991

TO: ASARCO Incorporated

ATTENTION: Mr. Jim Sell

TOTAL NO. OF PAGES 2 (Including this page)

FROM: Michael Philpot NORGOLD RESOURCES INC.
Suite 206/210 - 475 Howe Street
Vancouver, British Columbia
V6C 2B3 Canada

Telephone: (604) 681-5566

Facsimile No.: (604) 687-8789

****

IF THIS TRANSMISSION IS NOT FULLY OR LEGIBLY RECEIVED

PLEASE TELEPHONE (604) 687-4144

NOTES:

Jim during the process of cleaning up business affairs between Norgold and ASARCO regarding the Yarnell Project could you assist us in forwarding the information request in the letter to our Vancouver office. I would like to request that Tench meets you and Bill Gray at your office to review whatever land work / survey work that was conducted by ASARCO so Norgold can ensure the same standard of quality control that ASARCO maintained. Tench will also look after shipping the Yarnell ore out of your warehouse.

Thank you Michael Philpot

HEAD OFFICE:
210-475 HOWE STREET
VANCOUVER, B.C. V6C 2B3
TEL: (604) 681-5566
FAX: (604) 687-8789

January 03, 1991

ASARCO :

JAN 4 1991

SW exploration

Mr. Richard L. Brown
ASARCO Incorporated
180 Maiden Lane
New York, NY 10038

Dear Dick:

Re: Yarnell Project

Norgold received ASARCO's special warranty deed and assignment with regards to the assignment to Norgold, the Grantee, the exclusive option of ASARCO, pursuant to the Exploration and Option Agreement effective January 03, 1989, to acquire a 51% interest in the real properties as per Exhibit A. Please note that Norgold has not received a quit claim deed for lode mineral claims, YAR #1 thru YAR #43, staked by ASARCO on behalf of the Yarnell project. It has also been brought to my attention that Norgold has not received the following information and technical data with regards to the Yarnell project:

1) geologic report;
2) all assessment filings (mineral lode and state lease) made that pertain to the project area;
3) all the location notices for all claims filed by ASARCO within the joint venture area;
4) a map showing the location of every YAR claim filed by ASARCO; maps to date only show YAR #1 thru YAR #30 and YAR #39;
5) ground magnetics data generated during the evaluation program;
6) sample sites and soil geochemistry generated during the evaluation program;
7) airborne geophysics including magnetic and EM (DIGHEM) data and interpretation pertaining to the area of interest;
8) all sampling data from within the joint venture area of interest;
9) a metallurgical report indicating recoveries via flotation, fine grind, et al. reported in field guide to AGS trip;
10) any other filings, reports etc. pertinent to the project, yet not currently held by Norgold

As you can appreciate it is imperative that Norgold has the up-to-date information regarding the property as to ensure that the quality of good standing is continued. It is my understanding that the Tucson office may require your approval to release the information as identified above. It would be greatly appreciated if this information can be sent to our Vancouver office or alternatively, Mr. Tench Page, Norgold's geologist, could pick the information up at your office.

We thank you very much for your cooperation during this transition period. Wishing you and ASARCO a prosperous New Year.

Sincerely,

Michael D. Philpot
President

cc: Mr. Jim Sell, Asarco, Tucson

U.S. EXPLORATION OFFICE:
SUITE G-177 4600 KIETZKE LANE, RENO, NEVADA USA 89502 TEL: (702) 827-1755 FAX: (702) 827-1802

ASARCO

Exploration Department
Southwestern United States Division

January 3, 1991

Mr. J.L. Haggard
Apker, Apker, Haggard & Kurtz, P.C.
P.O. Box 10280
Phoenix, Arizona 85022

Quit Claim Deed
Asarco Unpatented Claims
to Norgold Resources

Dear Mr. Haggard:

As we discussed by telephone this morning, please prepare a Quit Claim Deed to Norgold for the unpatented claims listed on the attachment to this letter.

Sincerely yours,

William D. Gay

William D. Gay
Land Engineer, SWED

WDG:mek
Att.

cc: W.L. Kurtz
J.D. Sell

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

WDG

AFFIDAVIT OF LABOR PERFORMED AND IMPROVEMENTS MADE

STATE OF ARIZONA)
) ss
County of Pima)

George H. Myers, being first duly sworn, deposes and says that he is a citizen of the United States and more than twenty-one (21) years of age, and resides in Tucson, County of Pima, State of Arizona, and is personally acquainted with the mining claims situated in the Yarnell/Weaver Mining District, Yavapai County, Arizona, the names and books and pages of record in the office of the County Recorder of Yavapai, Arizona, and the Bureau of Land Management serial number of the Notices of Location whereof are as follows:

Name of claim	Recording Data Book	Page	AMC Serial No.
Black Dike #3	153	393	72445
YAR #1	2131	587-588	294316
YAR #2	2131	589-590	294317
YAR #3	2131	591-502	294318
YAR #4	2131	593-594	294319
YAR #5	2131	595-596	294320
YAR #6	2131	597-598	294321
YAR #7	2131	599-600	294322
YAR #8	2131	601-602	294323
YAR #9	2131	603-604	294324
YAR #10	2131	605-606	294325
YAR #11	2131	607-608	294326
YAR #12	2131	609-610	294327
Amended	2135	263-264	
YAR #13	2131	611-612	294328
YAR #14	2131	613-614	204329
YAR #15	2131	615-616	294330
YAR #16	2131	617-618	294331
YAR #17	2131	619-620	294332
YAR #18	2131	621-622	294333
YAR #19	2131	623-624	294334
YAR #20	2131	625-626	294335

YAR #21	2131	627-628	294336
YAR #22	2131	629-630	294337
Amended	2174	858-959	
YAR #23	2131	631-632	294338
YAR #24	2131	633-634	294339
YAR #25	2131	635-636	294340
Amended	2174	860-861	
YAR #26	2131	637-638	294341
Amended	2174	862-863	
YAR #27	2131	639-640	294342
Amended	2174	864-865	
YAR #28	2131	641-642	294343
Amended	2174	866-867	
YAR #29	2131	643-644	294344
YAR #30	2131	645-646	294345
YAR-31	2155	256	296357
Amended	2158	895-896	
YAR-32	2155	257	296358
Amended	2158	897-898	
YAR-33	2155	258	296359
Amended	2158	899-900	
YAR-34	2155	259	296360
Amended	2158	901-902	
YAR-35	2155	260	296361
Amended	2158	903-904	
YAR-36	2155	261	296362
Amended	2158	905-906	
YAR-37	2155	262	296363
Amended	2158	907-908	
YAR-38	2155	263	296364
Amended	2158	909-910	
YAR-39	2155	264	296365
Amended	2158	911-912	
YAR-41	2178	170	298732
YAR-42	2178	169	298733
YAR-43	2189	128	299488

Located in Sections 14, 15, 22 & 23, T10N, R5W.

That all of said mining claims are owned by ASARCO Incorporated, the mailing address for which is P.O. Box 5747, Tucson, Arizona 85703; that between September 1, 1989 and August 31, 1990, in excess of $4,300 worth of work and improvements were done and performed for the benefit of the aforementioned claims. Work and improvements consisted of drilling by Drilling Services Company, 12030 East Riggs Road, Chandler, Arizona 85249; and Boyles Bros. Drilling Company, 975 Industrial Way, Sparks, Nevada 89431; and road work by Yannuzzi Overland Unlimited, 527 South Church St., Hazelton, Pennsylvania 18201.

JDS

ASARCO

Exploration Department
Southwestern United States Division
James D. Sell
Manager

February 14, 1991

Mr. Michael D. Philpot, President
NORGOLD RESOURCES INC.
210-475 Howe Street
Vancouver, B.C. V6C-2B3
Canada

Data Packet
Yarnell Project
Yavapai County, AZ

Dear Mike:

At long last I believe the contents requested in your letter of January 3, 1991 (copy attached) have been collated and are being sent to you by Federal Express.

I have also included a copy of the letter to Mr. Moat (January 16, 1990), which discussed part of the problem of Roman-Gooding which you asked about by phone. Obviously, Asarco did not follow-up on the question but had brought it to Norgold's attention.

Sincerely,

James D. Sell

James D. Sell

JDS:mek
Att.

cc: W.L. Kurtz
R.L. Brown
F.T. Graybeal

NORGOLD RESOURCES INC.

HEAD OFFICE:
210-475 HOWE STREET
VANCOUVER, B.C. V6C 2B3
TEL: (604) 681-5566
FAX: (604) 687-8789

January 03, 1991

Mr. Richard L. Brown
ASARCO Incorporated
180 Maiden Lane
New York, NY 10038

ASARCO Incorporated
JAN 17 1991
SW Exploration

Dear Dick:

Re: Yarnell Project

Norgold received ASARCO's special warranty deed and assignment with regards to the assignment to Norgold, the Grantee, the exclusive option of ASARCO, pursuant to the Exploration and Option Agreement effective January 03, 1989, to acquire a 51% interest in the real properties as per Exhibit A. Please note that Norgold has not received a quit claim deed for lode mineral claims, YAR #1 thru YAR #43, staked by ASARCO on behalf of the Yarnell project. It has also been brought to my attention that Norgold has not received the following information and technical data with regards to the Yarnell project:

← sent previously Jun 3 to Hassard.

✓ 1) geologic report;
✓ 2) all assessment filings (mineral lode and state lease) made that pertain to the project area;
✓ 3) all the location notices for all claims filed by ASARCO within the joint venture area;
✓ 4) a map showing the location of every YAR claim filed by ASARCO; maps to date only show YAR #1 thru YAR #30 and YAR #39;
✓ 5) ground magnetics data generated during the evaluation program;
✓ 6) sample sites and soil geochemistry generated during the evaluation program; on Geol. maps.
✓ 7) airborne geophysics including magnetic and EM (DIGHEM) data and interpretation pertaining to the area of interest;
✓ 8) all sampling data from within the joint venture area of interest; see Geol. maps
✓ 9) a metallurgical report indicating recoveries via flotation, fine grind, et al. reported in field guide to AGS trip;
✓ 10) any other filings, reports etc. pertinent to the project, yet not currently held by Norgold
Survey points for air photos
Mitcon bottle roll leach amenability evaluation.
McClelland Heap Leach

As you can appreciate it is imperative that Norgold has the up-to-date information regarding the property as to ensure that the quality of good standing is continued. It is my understanding that the Tucson office may require your approval to release the information as identified above. It would be greatly appreciated if this information can be sent to our Vancouver office or alternatively, Mr. Tench Page, Norgold's geologist, could pick the information up at your office.

We thank you very much for your cooperation during this transition period. Wishing you and ASARCO a prosperous New Year.

Sincerely,

Michael D. Philpot
President

cc: Mr. Jim Sell, Asarco, Tucson ✓

Minus
Plates &
Figures

see JDS report

↑

JDS

ASARCO

Exploration Department
Southwestern United States Division

James D. Sell
Manager

February 4, 1991

Mr. Michael D. Philpot, President
NORGOLD RESOURCES INC.
210-475 Howe Street
Vancouver, B.C. V6C-2B3
Canada

Report on Yarnell Project
Yavapai County, Arizona

Dear Mr. Philpot:

I submit the report on the Yarnell Project which was drilled as a potential open-pit gold mine.

Seventy-three reverse-air circulation drill holes, on approximately 100-foot centers, were drilled to define the present configuration of the mineral zone. Four diamond drill core holes were also drilled adjacent to rotary holes to provide a complete geologic-structural-mineralization profile through the deposit and to serve as an assay check on the adjacent rotary holes.

Numerous studies have been undertaken such as bottle roll leach tests, large column percolation leach tests, a vat low-grade leach test and numerous computer runs involving various economic parameters.

At present a geologic inventory of a study pit outlines a potential of plus four million tons of plus 0.05 oz/ton gold. Several partially tested to untested areas remain which when drilled may add from one-half to one million or more tons at a similar grade and favorable stripping ratio.

As developed in the report, it is stated that all initial assays within the main mineralized B Zone can be used uncut in any reserve calculation. Other high grade assays in the hanging wall area (A Zone) are likely to be associated with high-angled shears, which should not be used in reserve calculations.

James D. Sell
James D. Sell

JDS:mek
Atts.

cc: R.L. Brown (w/o atts.)
F.T. Graybeal (" ")
W.L. Kurtz (" ")

ASARCO Incorporated P. O. Box 5747 Tucson, Az 85703-0747
1150 North 7th Avenue (602) 792-3010

REPORT ON YARNELL PROJECT

YAVAPAI COUNTY, ARIZONA

LIST OF PLATES, FIGURES AND TABLES

REPORT ON YARNELL PROJECT

Yavapai County, Arizona

SUMMARY AND CONCLUSIONS

The Yarnell Deposit is a structurally controlled (and prepared) hydrothermally altered zone that hosts economic gold mineralization in a configuration and thickness amenable to an open pit operation. The deposit is hosted in a Precambrian granite and occurs in and surrounding a low angle fault structure - the Yarnell Fault. The hanging wall of the fault has been extensively fractured and altered to sericite (phyllic alteration). Gold mineralization is associated with shattered multiple-stage quartz veins within the Yarnell Fault and in quartz stockwork zones in the hanging wall. Various iron oxides are abundant in the zones of better mineralization. The footwall of the mineralized zone (below the Yarnell Fault) is phyllicly altered, but is usually unmineralized with respect to gold. The Yarnell Fault Zone continues both northeast and southwest from the main deposit and where exposed it contains gold mineral-ization; however, the thickness of the zone and the associated alteration envelope appears to be considerably less. Ninety-six reverse circulation and four diamond drill holes have been completed. A mineral inventory of 4.1 million tons at .055 opt gold has been estimated with a recovery by leaching of +70%. In addition there is 2.7 million tons at .017 opt Au in a low grade zone above the main mineralized zone.

RECOMMENDATIONS

Asarco has drilled off, on approximately one hundred foot centers, an inventory of +4 million tons at +.05 opt gold. This is based upon 73 drill holes from a total of 96 holes. The remaining 23 holes are too far down dip to be included in the reserve calculations, too far away from other holes, or collared in the footwall of the mineralized zone. Projections of mineral trends and geologic mapping on 100 and 200 scale over the deposit indicates other areas of untested mineral potential that could be included in the mine plans and should be tested. The areas of interest are listed below, and recommended for further expansion of the mineral reserve (Plate 1).

AREA 1: SOUTHWEST EXTENSION OF THE MINERALIZED ZONE.

A potential for 600,000 - 800,000 tons of similar grade as the mineral inventory is indicated southwest of the last drilled fence of holes (YM-48, -64, -65). The alteration zone has been mapped along the projected trend of the Yarnell Fault. Scattered assays in this zone indicate that gold mineralization is continuous within the zone. The majority of the hanging wall zone is on a dip slope and difficult to accurately sample.

AREA 2: NORTHEAST EXTENSION OF THE MINERALIZED ZONE

Mapping and sampling of the area (and particularly the small knob northeast of the proposed pit) has indicated a zone of gold mineralization similar in occurrence to the main deposit. Mineralization appears to be related to a low angle fault structure; possibly a splay of the Yarnell Fault. Detailed rock chip sampling and trenching (on the structure) along the exploration roads that traverse the knob have indicated spotty values of +.01 opt gold with a zone in the trench averaging thirty feet at .048 opt gold. This trench was cut across the strike of the structure. Alteration is continuous from the base of the hill to the top with abundant sericite, moderate silification, and occasional quartz veining. RDH-96 collared near the top of the hill had an interval of twenty feet which averaged .013 opt gold. A potential for +/-200,000 tons of similar grade to the mineral inventory is indicated.

AREA 3: DOWN DIP EXTENSION OF THE MINERAL INVENTORY

Additional drilling is recommended to test the downdip limits of the mineralized zone intersected in RC hole YM-26 (90' at .054 opt gold) and YM-33 (90' at .051 opt gold). A potential for 600,000 tons at >.05 opt gold exists with a waste to ore ratio above 3/1. A number of holes should be drilled along the entire downdip perimeter of the indicated ore zone to define the economic pit which may allow the increased pit depth to secure the downdip potential.

INTRODUCTION

The Asarco-Norgold Resources joint venture project, in north-central Arizona, is located 1-1/2 miles south of the town of Yarnell in Yavapai County. Yarnell is located 72 miles northwest of Phoenix, or 16 miles on Highway 89 northeast of Wickenburg, or 29 miles on Highway 89 southwest of Prescott (Figure 1).

The Yarnell project was named after the Yarnell Mine centered on the small hill named Yarnell.

Historical production from the Yarnell mine was from the early 1900's and was operated intermittently until the Gold Mine Closure Order L-208 of 1942. The underground workings exploited the higher grade gold values located along the major Yarnell Fault structure. The Yarnell

Fault strikes N30°-45°E and dips 30°-45°NW. Minor production was also removed from an open cut along the surface trace of the fault at the top of Yarnell hill.

Asarco became interested in the property through a Norgold press release (George Cross News Letter, 1988), and a private report to Norgold by Philpot (1988). Philpot stated that the area contained a potential open pit tonnage of 4 million tons with an anticipated recoverable grade of 0.05 opt gold.

Asarco geologist, M.A. Miller, sampled the area and recommended further work.

After agreeing to a letter of intent Asarco drilled 96 reverse circulation rotary drill holes and four diamond core holes. Evaluation of the drill/assay data suggested an open-pit potential of 4.1 million tons at 0.051 opt gold with a 3/1 waste/ore ratio.

GEOLOGY

Biotite Granite. The Yarnell project is within the Yarnell granite immediately south of the town of Yarnell (Figure 2).

At the project area, the granite is a medium-grained phaneritic, equigranular biotite granite. The petrographic studies (Honea, 1990 a) indicate a compositional range of minerals as follows from fresh granite:

Plagioclase ($\pm An_7$) 25-35% with Carlsbad and Albite twinning
Microcline 40-65% with grid twinning and microperthitic texture
Quartz 12-16%
Biotite 5-10%

Anderson (1989) recently completed a PhD at the University of Arizona and describes the Yarnell granite mass as belonging to the "Group 4: Late (Late-Tectonic) Porphyritic Monzogranite-Granite Pluton and Batholith" class.

To paraphrase Anderson (1989):

> "The Yarnell Granodiorite (new formal name), is a foliated, coarse-grained porphyritic granodiorite to monzogranite, ... The Yarnell Granodiorite follows the northwest edge of the Stanton-Octave metavolcanic-metasedimentary screen to as far north as Wilhoit, where dikes of unfoliated Yarnell Granodiorite intrude foliated granodiorite of the Wilhoit batholith ... The Yarnell Granodiorite is distinctly coarse-grained and weakly foliated,

> with large pinkish-tan K-feldspar phenocrysts in an equigranular matrix with biotite, plagioclase, uncommon hornblende, and abundant sphere ... Chemically the Yarnell body is metaluminous, high-K, calc-alkaline, high Fe-Ti and high-total alkali rock ..."

Anderson places the age of the Yarnell pluton in the 1730-1710 ma range.

DeWitt (1989) further states under the heading:

> "Suite 4: Syn-to posttectonic biotite granodiorite to granite plutons: ... The granodiorite of Yarnell is equigranular to slightly porphyritic, alkali-calcic biotite granodiorite and is the westernmost foliated pluton in this study area ... although the pluton is undated, it is assumed to be 1700-1750 ma because of its foliated nature. L.T. Silver (personal communication, 1986) suggested on the basis of unpublished U-Pb zircon data that the granodiorite may be 1400 ma ... The pluton is the most magnetic rock in the region, averaging 8.0 percent magnetite ... Another distinguishing feature is the moderate iron-rich nature of the pluton, a characteristic restricted to this group of plutons ..."

Table 1 compares three samples of granodiorite of Yarnell (DeWitt, 1989, Table 2) with samples taken at the Yarnell Mine. De Witt's sample 72 was collected about a mile north of the Yarnell Mine area, sample 73 about a mile to the west, and sample 74 at the base of the mountain on the west (Figure 2), all being collected near the highway 89.

The Yarnell Mine samples were collected in the freshest granite available in the hanging wall (HW) and footwall (FW) of the Yarnell Fault at Yarnell Hill.

As noted in Table 1, all five samples have the same major element chemistry, with the major difference being the 3% extra silica in the biotite granite at the Yarnell Mine area.

Dikes. The Yarnell pluton has few dikes within it. At the Yarnell mine area, four types of dikes/sills have been mapped: aplite, andesite, felsic and diorite. The dike/sills are very minor in extent and volume.

a. Aplite. The aplite is yellow-white in color, fine to very fine grained, granular texture, quartz feldspar composition. It occurs as less than four inch wide streaks wandering through the Yarnell pluton in all directions and with all degrees of dip. The aplite is probably a syn-Yarnell granodiorite melt phase.

b. Andesite. Andesite is medium grey to dark grey, aphanitic with occasional biotite (?) grains, commonly weathers to green brown in clay developed zones. The andesite occurs as four to eight foot thick dikes widening to fifteen to twenty feet, in elongated lenses. They strike east-west to 70°-80° northeast and dip 25-40° northerly. The andesite dikes can be followed for one half-two thirds mile. They often have associated quartz veins on one or the other wall. The quartz is generally only three to five inches wide, but may become up to fifteen inches thick. Sericitic halos of six inches to two feet wide generally occur on either side of the dike with or without the associated quartz.

c. Felsic. The felsic dikes are yellow to orange-yellow to white, granular texture, quartz feldspar composition, with quartz eyes (elongated-stretched), often sheared appearance throughout. They strike east-west to 80° northeast, all nearly vertical in dip, are three to five feet thick and up to twenty feet thick, and can be followed up to half mile along strike.

c. Diorite. The diorite is dark grey to black, weathers to green-brown with clay development. The main diorite dike is a prominent photo linear in the west central part of Yarnell Hill. It is ten to twenty feet thick, strike N10°W, dips 80°W to vertical. The dike has a sheared appearance, and is magnetic.

Comment. The andesite sills and felsic dikes do not appear in the hanging wall of the Yarnell Fault. The main diorite dike is found within the Yarnell Fault structure, as well as both in the hanging wall and foot wall of the structure, but does not appear to offset the Yarnell Fault nor be offset by the Yarnell Fault.

To the southeast of the project area, the Yarnell pluton is bordered by a sequence of mafic metavolcanics and metasediments of the Bradshaw Mountains group - Stage 1 (Anderson, 1989). This mafic volcanic screen occurs between the Yarnell pluton and the Rich Hill pluton further to the southeast (Figure 2).

The only other rock unit sequence nearby is the mid-Tertiary ash and andesite-basalt units which cap the hills to the northeast.

STRUCTURE

The main structure in the Yarnell Project area is the Yarnell Fault (Plate 1, 1.A). The Yarnell Fault strikes N40°-50°E and dips 25°-30°NW in the mine area. The main gouge zone of the fault varies from inches to several feet in width and is within a larger five to twenty foot zone of a crushed and sheared zone within the granite.

The gold at the Yarnell deposit lies within the Yarnell Fault zone and within an associated alteration halo which contains quartz veining and quartz stockwork in and above the Yarnell Fault.

The Yarnell Fault can be traced to the northeast only fifteen hundred feet from the top of Yarnell Hill before it is concealed by debris from the basalt cap and valley fill with large unmineralized granite boulders.

The sheared and crushed zone of the Yarnell Fault varies from five to twenty feet within the drilled part of the deposit. As the structure is followed downward and laterally the Yarnell Fault zone becomes thinner and may be only two to five feet in thickness. As will be noted in later sections of this report, the alteration halos and mineralization zones also decrease in thickness with the associated thinning of the Yarnell Fault zone.

As previously discussed in the GEOLOGY Section, the andesite dikes occupy east-west to N70°-80°E, dipping 25°-40° northerly structures subparallel to the Yarnell Fault structure.

This system of northeasterly striking, shallow-dipping to the north structures are widely distributed in the greater Yarnell area. They often contain dikes, quartz, alteration halos and mineralization. Besides the half dozen structures of the Yarnell Fault trend found on the Yarnell claims, the shallow-dipping structures are found to the west both above and below the trace of the Yarnell Fault for several miles.

Similar trends are found at the gold mines at Congress, Octave, and Vulture.

A conjugate system of structures trending northeasterly, dipping steeply (often occupied by felsic dikes) and trending north or slightly northwesterly and also dipping steeply (often occupied by diorite dikes) is found throughout the Yarnell area.

Both the conjugate sets appear to offset the shallow-dipping Yarnell Fault. In the open cut, several north-trending, steep dipping faults offset the Yarnell Fault with the east side being down-dropped four to eight feet.

The main diorite dike at Yarnell is north northwest trending and is readily followed on aerial photographs and can be traced from the footwall side into the Yarnell fault zone and continuing in the hanging wall. However, the diorite dike is found as an isolated block within the Yarnell Fault zone and is not observed to cut either the base nor the top of the Yarnell fault structure. Obviously, the diorite dike does cut the Yarnell fault as it is found in both the hanging wall and footwall in a line of disconnected outcrop.

The east-west striking set of fractures is not observed to cut the Yarnell Fault structure, but several drill holes intercepts are best resolved by placing an east-west structure within the sequence of events.

On the surface, several northeasterly striking, steep dipping, narrow veins can be seen in the hanging wall of the Yarnell Fault. Underground, in the hanging wall, these mineralized structures dip steeply to the north and roll into structures which sub-parallel the Yarnell Fault, then re-steepen and disappear into the wall of the workings. It is probable that these structures are listric in nature and do sole into the main Yarnell Fault zone.

A number of drill holes have intercepted a single sample length of high-value gold in the hanging wall, and these are believed to belong to the easterly trend, steep dipping structure system.

In the footwall of the Yarnell Fault in the main drilled area, six drill holes have intercepted a five to ten foot assay of interesting values at depth. In three adjacent holes the intercept can be resolved to indicate being along a thin, subparallel zone to the Yarnell Fault, whereas the remaining three holes are isolated from other holes which do not have a lower intercept, and these may be indicating a steep dipping narrow structure(s).

The present drill spacing and the lack of many samples much beyond the base of the main mineralization preclude a rigorous analysis of these individual sample values, either in the hanging wall or the footwall, as to their associated fracture set or their relation to the mineralization system.

ALTERATION

Alteration at Yarnell follows a variation of the hydrothermal series from central to peripheral : potassic, phyllic (sericitic-argillic) and propylitic.

The three assemblages are noted in the surface outcrops and in the diamond drill core holes.

Alteration is strongest and central with the Yarnell Fault structure and decreases in intensity as alteration halo envelopes outward in both the hanging wall and footwall (Figure 2.A).

Within the Yarnell Fault zone the granite is highly crushed and sheared (Figure 3). Noted is abundant secondary quartz, chalcedony, secondary K-spar (adularia), secondary sericite, and secondary clay development.

Outward from the crushed fault zone, the potassic zone is characterized by the pink feldspar in the phenocrysts as well as along selvages to the quartz veins. Pinking (Figure 4) of feldspars and K-spar selvages can be noted fifty to eighty feet above the fault gouge, and may extend twenty-five feet down into the footwall. This zone is also noticeable in the surface exposures.

The potassic zone grades outward into the phyllic zone where sericite is widely and pervasively developed. Complete replacement of the plagioclase and biotite by sericite characterizes the phyllic zone (Figure 5). Secondary iron oxide as hematite and geothite is a by-product of this alteration phase.

The sericite zone extends as an intermediate envelope in thickness of thirty to one hundred fifty-five feet above the potassic zone, and extends only ten to forty-five feet into the footwall below the footwall potassic zone.

The argillic zone was not noticeable as a hanging wall envelope, but exists as a fine-grained dusting of the feldspars (Figure 6).

In the footwall, fine-grained clays were noted in the core holes.
The two eastern holes had up to thirty feet of sericitic alteration with no noticeable clay-argillic alteration, whereas the two western holes had no noticeable sericitic alteration, but did have up to forty-five feet of the clay-argillic alteration. Subsequent studies have indicated that much of the clay is fine grained sericite and argillic alteration may again be restricted to dusting of feldspars.

The rotary hole distribution is more extensive than the core holes, but the rotary chips have not been studied in sufficient detail to separate out the difference between fine-grained sericite and fine-grained clays (which now are suggested to be more finely-grained sericite) in the footwall intercepts, nor to suggest any distribution trends to the two types logged during drilling.

The propylitic zone is characterized by the occurrence of chlorite, epidote, minor calcite veining, with weak sericite alteration along biotite edges, and is the far outer alteration envelope (Figure 7).

In the hanging wall the propylitic envelope may extend up to one hundred feet beyond the phyllic envelope, but, in general, is a five to fifty foot transition zone between the phyllic and fresh granite. In the footwall it may be indicated by calcite filled gash veins in the lower part of the phyllic zone.

MINERALIZATION

General Statement. The mineralization events appear simple within the Yarnell system. Gangue minerals of silica, pyrite, and specularite; ore minerals of gold with trace amounts of silver, lead, zinc, and copper. However, the interplay of events with the alteration system appears much more complex.

Gangue Minerals.

a. Silica is found as banded chalcedonic quartz and opal within the Yarnell Fault zone, and as an early pervasive flooding-type overprint on all the alteration zones including propylitic. The silica is found as at least three stages of quartz with pyrite and specularite, and as two stages of late quartz, often with visible gold.

   The silica occurs as discrete quartz veins, as veins in quartz stockwork, and as the flooded quartz textures.

   The field-core paragenesis indicates the Yarnell Fault and the sub-parallel structures system was the earliest event, with massive silica flooding out into both the hanging wall (further penetration) and footwall (lesser penetration). Continued movement along the shallow dipping fault structures crushed and sheared the quartz in the vicinity of the structures.

   Within the developing silica system at least three quartz vein types have been noted in the core. These quartz veins developed in structures both subparallel to the shallow dipping Yarnell Fault structure and as high-angled veins cutting upward into the hanging wall. Very few quartz veins developed below the Yarnell Fault zone in comparison to the volume in and above the fault zone.

The three types of quartz noted include:

1. Early, medium grey quartz, +/- associated with specularite in vugs aligned parallel to variously oriented quartz veins.

2. Dark grey quartz with some brecciated textures within the veins. The dark color is due to the fine specularite dusting within the quartz.

3. Lighter grey quartz with disseminated limonite pseudomorphs from pyrite, usually on the margins of the quartz veins.

These three generations of quartz development are generally noted as thin veins +/- one quarter inch in thickness, locally up to a half inch in thickness, and rarely up to a maximum of three inches thick.

Two later stages of white quartz cut one another and the three stages of grey quartz. The white quartz is found within the Yarnell Fault zone, the main mineralized zone, and up into the A zone mineralization and beyond into the hanging wall and peripheral to the deposit.

The white quartz veins range from six inches to two feet in thickness and form discrete veins peripheral to the mineral system as masses up to twenty feet thick of limited extent. A gold assay is invariably obtained from these white quartz veins and often visible gold has been noted.

The major quartz development of flooded and vein quartz occurs as a domed shaped mass sub-concordant to the outer alteration halo envelopes, thinning on the lateral extremities and downdip, with a flattish bottom not far below the Yarnell Fault zone.

b. <u>Pyrite</u> is found throughout the drilled area. It is nearly totally oxidized to various iron oxides from the surface to the base of the Yarnell Fault, whereas within the footwall massive silica the pyrite is unoxidized.

Pyrite forms occur as discrete cubic shapes in the wall rock of the various veins as well as within the light grey quartz veins.

Bands of 30-50%, massive, granular, pyrite in thin lenticular zones are found both in the hanging wall (oxidized) and footwall (sulfide).

Within the drill indicated reserve the pyrite and its oxidized equivalents are 2-4% by volume.

c. Specularite is very noticeable within the Yarnell deposit and may average 2% throughout, both in the hanging wall and the footwall.

Native and Base Metal Sulfide Minerals

a. Gold, the primary economic mineral at Yarnell is found in the native state within quartz and various iron oxides.

Table 2 tabulates the size of the gold-silver particles found. The size varies from very small dots 1/2 micron in size (Figure 8), up to the large elongate, 60 x 225 micron size (Figure 11). The figures are two-dimensional, with only limited expression of the depth factor. See Figure 11 for an example of three dimension aspect.

Even though Table 2 contains limited data, it does indicate the problem of having one of the large particles in a sample set. If it is assumed that the third dimension is equal to the short side of the exposed particle then the volumes of the particles can be calculated. In the example of Table 2, the total volume of all the forty gold particles from very small through medium plus is 511,000 cubic microns, while the single large particle calculates to be 810,000 cubic microns. The problem of particle size and its influence on assay grades will be discussed further under the sampling and assaying sections.

b. Silver has been found in the native state (Figures 12, 13), and as electrum in the solid solution state with gold.
Fire assays for silver show only a trace of silver, with most of the values less than 0.01 opt silver, with a few values as high as 0.06 opt silver.

c. Base metals, copper, lead, and zinc are noted only in minor amounts in both soil and rock within and around the Yarnell deposit.

Table 3 compares the values in the drill hole rock geochemistry from that of the soil. Copper values (average) range from a low of 3.7 ppm in hole YM-6, to a high of 28.4 ppm from soil in the hanging wall. Lead and zinc also reflect low ppm values from the Yarnell system area.

A few pieces of galena (35 micron) and pyrite were noted in drill hole YM-71 (Figures 14 and 15). In the logging of the rotary cuttings and the core, no lead or zinc sulfides were noted.

DRILLING

Rotary. The bulk of the drilling at Yarnell was by truck mounted rotary, reverse air circulation, down-the-hole hammer, with cyclone discharge over a three-tiered Jones splitter. The drilling was dry through the mineralized section and became damp to wet below the Yarnell Fault zone.

Drilling Service Company commenced drilling using a TH-100 drill with a 5 1/4 inch bit on March 20, 1989. After changing to a TH-60 drill, 5 1/4 inch bit, on drill hole YM-37, Drilling Services completed the drilling of 24,367 feet on October 3, 1989 (Table 4).

Mining of the main Yarnell Fault zone had begun in 1900 and continued intermittently until the Gold Mining Closure Order L-208 closed the mine down in 1942. A little pillar robbing and slabbing took place underground after that date when the gold mine closure was lifted, but the post-closure work was mainly concentrated in the open-cut at the top of the outcrop. The workings deteriorated from 1942 to 1989 and only a portion was available for inspection prior to the start of drilling. With no accurate map of the probable extent of the underground workings, it was not surprising that all five of the first holes drilled in the mined area intercepted stope openings.

From the drop in sample volume return, it soon became apparent that the down-the-hole hammer did not provide a good sample return after it penetrated the floor of the stope opening.

In viewing the action underground it was noted that the bit penetrated the floor and a cuttings pile cone was discharged onto the floor but as the sample intake ports on the hammer assembly are five feet above the bit, no sample was returned to the surface. It was after the intake ports had gotten a foot or so below the floor and cuttings pile before sufficient sample entered the intake ports and was transmitted to the surface to be processed.

At this time of the drilling activity a change of technique was initiated for adequate sample control after entering an opening. Upon hitting an opening with a hammer drill bit, the top and bottom footages of the opening were recorded and the drill string was removed from the hole. The hammer assemblage was removed and a tricone bit was installed. The tricone assemblage has only a short, six inch difference between the face of the bit and the intake skirt which transferred the cuttings into the reverse air column, thus providing a reliable sample after entering solid rock below an opening.

Several holes were observed in the underground workings after initiation of the new technique and it was confirmed that the bulk of the cuttings were transferred into the skirt collection shortly after the skirt passed below the floor of the opening.

Thirteen additional holes were drilled through the mine openings using the modified procedure with excellent drilling results and sample recovery. Seven rotary holes had also been drilled in the mine working area which intercepted pillars within the stopes (Plate 1).

Core. Four core holes were drilled as twins to the rotary holes, as follows:

Diamond	TD Feet	R.C.	TD Feet
DDH-1	350	YM-8	350
DDH-2	400	YM-40	400
DDH-3	325	YM-63	240
DDH-4	220	YM-75	220

The core holes were drilled by Boyles Brothers Drilling Company using aa Longyear 44 Hydraulic machine and coring NC size. In the four holes Boyles cored 1,295 feet (Table 4).

Core hole YDDH-3 intercepted a stope opening whereas its twin rotary hole YM-63 had hit a pillar and remained in rock all the way. When the opening was hit the hole was probed to bottom and the drill string pulled. The NC core barrel and bit was then replaced by a casing shoe and the NC drill string then was returned down the hole and set on "solid ground" at 187 feet. An NX drill string with core barrel and bit was made up and sent to bottom inside the NC string. The NX coring resumed at 187 feet, but recovered debris and muck with isolated blocks of rock down to 221 feet where solid core was obtained. Obviously a caved stope portion had been encountered to account for the thickness of debris and apparent large boulders cored through to the solid rock to the final depth at 325 feet.

Table 5 lists all the drill holes, both rotary and core, their coordinates and collar elevations and the total depths for the cumulative 25,662 feet of drilling.

SAMPLING

Rotary - General Statement

Samples were collected on five-foot intervals throughout the rotary reverse air circulation program. The drilling was momentarily stopped at the end of each five foot run to "blow" the hole clear and clean the sampling system.

From the drill pipe discharge, the cuttings passed into a cyclone which rapidly dropped the cuttings which cascaded through a three-tiered Jones splitter.

The third split collection pan of cuttings was again passed through a single Jones splitter and both sides, A and B, sacked into bags with the drill hole and footage marked on the bag.

A small sample was taken from the "A" pan side, washed, and placed in plastic trays. These samples were logged along with any comments noted during the drilling of the interval. The sample trays are stored in Tucson.

Rotary - Drilling thru Openings

As remarked under Drilling, the only problem encountered during the rotary drilling was the loss of some sample after penetrating an opening. As noted, after drill hole YM-5, the drilling sequence was changed by replacing the hammer with a tricone bit for drilling below the opening. As the same reverse air circulation drill pipe was used, the sample returned to the surface in the same manner as before.

A clean sample was secured by the time the tricone penetrated a foot below the new surface, whereas with the hammer, the sample was erratic for five to six feet before the collection ports were below the new surface.

When passing through an opening, the sample return was monitored at the surface to judge whether the return was from isolated blocks of mine rubble on the floor of the opening. The rubble material returned erratic volumes of material as the open spacing in the rock pile allowed sample and air to be dissipated into the rubble mass.

Sampling continued below the workings until sulfides appeared or the rock became very hard and dense suggesting a non-oxidized part of the system.

Assay results of samples below the main zone of mineralization show a sharp drop between mineralized (0.0XX opt gold) and the weakly mineralized footwall (0.00X opt gold).

Rotary - Holes Encountering Water

The majority of the holes were drilled dry in the oxidized portion of the zone. In the sulfide footwall, in the down-dip holes, the bottom would often become moist and water was added to facilitate the removal of cuttings. As this moist condition was generally at or below the base of the mineralized zone, no sampling/assay problem is attributed to the collection of a wet sample in the area of the geological reserve.

Table 6 lists the "wet" drill holes and the relation of the water level to the main mineralized zone and a note on the relationship to the down-dip extent of the geologic pit edge. Figure 16 plots this same information and lists the depth to the main mineralization, its thickness and grade.

Review of this data indicates that water had little impact on sample collection inside the geologic pit outline as only one hole encountered water within the main mineral zone (YM-33). The deep, thin, intercepts of mineralization outside the present geologic pit edge, precludes the expansion of the pit into the area of wet holes except in an improved cost scenario.

Core - General Statement

In logging the core, the core was marked for splitting. Splitting was by use of a diamond saw blade cutting of the core longitudinally. One half of the core was sent for assay, the remaining half is in storage for review.

Sampling was integrated with the rotary footages as closely as possible. Often the five-foot runs were further broken down so as to separate out obvious high-grade stringers. The assay was then recombined into the equivalent five foot intervals for comparison with the adjacent rotary hole values.

ASSAYING

General Statement. The primary assay laboratory was Triad Minerals Company, Cory Eddington assayer, P.O. Box 2754, Wickenburg, Arizona 85358.

Assays were also performed by Skyline Labs, Inc., Charles E. Thompson, Chief Chemist, P.O. Box 50106, Tucson, Arizona 85703.

All assays were fire-assay, gravimetric and reported as ounces per ton gold/silver.

Assay Checks. Checking of assay results was handled in a variety of ways: a. insertion of an Asarco standard within the sample runs, generally two per hole; b. rerunning same standard reject, returned by the assayer, with several different holes; c. inserting reject rock samples material from previous holes; d. multiple assays from same pulp; and e. comparing Triad assays with Skyline assays of same pulps.

a-b. Standard Checks. Two Asarco standards were inserted with most of the rotary drill hole samples. The values are 0.022 ±0.001 opt gold, and 0.006 ±0.0003 opt gold.

Table 7 lists the number of sample sets, the high value, the low value, and the average of the "A" & "B" samples broken down by drilling break sequence.

The high and low "spikes" were generally attributed to 1. mismarked field sample or 2. incorrect analysis at assayer.

With the average of the samples being within the sample error of all the labs it would appear that Triad had only a small problem as noted in the assay value drift during the several phases of the drilling.

In reviewing Table 7, the drift in the value reported for drilling holes YM-1 thru YM-64 was nominal and the averages were overall lower than the reported Standard "A." The Standard "B" drifted higher from the early drilling thru the later drilling.

The Standards "A" and "B" were used up at the end of drill hole YM-64. Thus from hole YM-65 to the end at YM-96, the reject from the previous standard samples were re-run through the assay procedure. As noted in Table 7, some of the samples were re-run the 2nd and 3rd time.

Again, the nominal drift was from a lower value in the early holes to a higher value in the later holes, but still below the reported value for Standard "A" and higher than in Standard "B." From this data it would indicate that the assayer was consistent in his reporting, and the variation is within the prepared standard. The one sample re-run the third time cannot be evaluated other than being a reported low value.

c. Rerunning previous rotary drill hole rejects as new hole sample. Ten holes scattered across the deposit were used for this study. Only the main zone mineralized portion was used. The reject sample of the hole was renumbered and sent to the assayer where new pulps were processed and the sample assayed. On eight of the holes, the new pulps were again split and a "refire" assay produced.

In the tabulation of the results (Table 8) it is noted that in the early holes (YM-3, -5) and the later holes (YM-40, -50, -56) the new reject assay was within 10% of the original assay, and generally lower in reported value, whereas in the remaining five holes the variation was in excess of 10% and generally reported a higher value. In the eight refires of new reject assays, all but two were within 10% of the original assay and all but one was lower than the new reject assay.

As the original assays were taken in sequence of drilling over a four-month period and the reject-refire assays were all taken within a few days, it would appear that the assayer variation is nominal.

d. Rerunning same pulp with multiple assays was undertaken to address the question of variability within the sample pulp.

Table 9 lists all the multiple assays from the pulps and a standard deviation was calculated from this data. As shown only two sample values out of twenty fell outside the 95% confidence figure, suggesting that the assay values are within 5% of the actual value based on the short sets used. The two outside samples may indicate a coarse gold variability but with the short set of values available for this study they probably do not change the validity of assay value as being indicative of the value in the sample.

e. Comparison of Triad with Skyline Labs. Seventy-five samples were collected of various grades of mineralization previously assayed by Triad from holes YM-10 - 32. The pulps were sent to Skyline for reassay. Prior to the assay, Skyline screened the pulp material and reported the +80 mesh, -80+200 mesh, and -200 mesh weight percent of sample. The sample was reground (-200 mesh), split and assayed.

The average of all samples for Triad is 0.053 opt gold vs. Skyline 0.055 opt gold (Table 10). The breakdown is also shown in various intervals of mineralization and these again show good correlation between Triad and Skyline. Although some five assays show Skyline appreciably lower than Triad, it is noted that these intervals had in general a +60% weight in the -80+2200 mesh size prior to Skyline repulverizing and reassaying and may reflect a non-homogeneous prepared sample and subject to a "nugget" problem when the assay ton was removed from the larger pulp.

Also, Table 10 indicates that few samples assayed by Triad and Skyline would have been placed in a different cut-off block if one or the other had been chosen as the "correct" assay. The two notable exceptions are the Triad .078 vs. Skyline .165 and Triad .093 vs. Skyline .016. Based on the remaining samples it would appear that the sample values are an assayer's "bust" and not a variation in the sample pulp.

The remaining conclusion is that overall Triad assay values are slightly conservative compared to Skyline and can be used in all calculations.

CUTTING OF ASSAYS

From the previous discussion it is concluded that the Triad Lab assay values are nominally within ±10% of the value within the sample and that Triad Lab values are slightly conservative from those reported by Skyline Labs. The bulk of the assays are from Triad.

No sample values were cut because of the grade reported.

Sample values were cut within the computer program, however, to prevent the spreading of values where they probably do not belong. The case in point is isolated samples high in the hanging wall which probably reflect high angle, relatively narrow vein structures.

It is believed that blast hole sample plotting will delineate these zones and contribute minor ounces to the overall zone of mineralization.

Also, for the rerun of the block model computer study, some blocks were eliminated or changed to reflect the structural and geologic-assay control on values where they were projected incorrectly into the footwall of the mineralization.

CONTINUITY OF VALUES

General Statement. Expressed in the drill hole assay data is a zone of lower grade values, 0.01 to 0.03 opt gold, overlying the main mineralized zone of higher grade, and amenable to open-pit calculations.

These values were separated into the upper or A Zone and the lower main B Zone of mineralization.

The A Zone values generally continue into the B Zone values with a usual sharp change in gold values. The previous mining was from within the main B Zone and along the Yarnell Fault where the highest grade of mineralization is generally found. Similarly the base of the B Zone is also a sharp gold value cut-off.

Table 11 lists the drill holes and tabulates the top and bottom assay of the B Zone with the next assay above or below. The sharp grade change across the B Zone interval is evident from the inspection of Table 11.

Within the B Zone, the continuity of the intercept values appear to be excellent when viewed from hole to hole for the entire B Zone intercept. Within the B Zone, higher and lower grade values occupy various levels within the intercept. This is a natural function of a multiple injection quartz system with strong affinity to the regional northwest dipping Yarnell Fault structure. With stockwork quartz veining at high-angles as well as undulating and braided quartz veining in the plane of the Yarnell Fault, the lateral change in assay grade may vary within the overall intercept, but continuity of values for the overall intercept is considered very positive and can be projected from hole to hole.

Comparison of B Zone assays in DDH vs. RDH holes. Four diamond drill holes were twinned next to previously drilled rotary holes for visual examination of the structural and mineralogical features and to evaluate the continuity of sample values.

Table 12 abstracts the comparative assays for the B Zone assays of the twinned pairs. The respective collar elevations and coordinates of the four twin holes are listed in Table 5.

Blast hole assays should be a part of the mining plan and mining along the strike of the mineralization will maximize the delineation of the northwest dipping mineralized zone.

METALLURGICAL STUDIES

General Statement. Four studies were undertaken for evaluation of the deposit:

1. Specific gravity determinations
2. Bottle Roll studies of leachability and check assays of intervals.
3. Large column leach tests of various ore types and grades.
4. Flotation/Fine Grind/Cyanide leach tests.

Specific Gravity. Twelve rock samples from the mineralized zone were collected and sent to McClelland Labs, Sparks, Nevada, for testing. The specific gravity ranged from 2.36 gm/cm^3 to 2.62 gm/cm^3, with an average of 2.55 gm/cm^3. The average converts to a tonnage factor of 12.57 $ft.^3$/ton.

Three pieces of mineralized core from YDDH-1 were collected and submitted to METCON Research, Tucson, for specific gravity tests using the graduated cylinder and the Torbal balance methods. The graduated cylinder method returned 2.64, 2.50, 2.58; average 2.57 gm/cm^3, which converts to 12.47 $ft.^3$/ton value. The Torbal balance method is considered the most consistent and accurate method and the three values were 2.67, 2.60, 2.70; average 2.66 gm/cm^3, which converts to 12.05 $ft.^3$/ton.

The tonnage factor of 12.0 cubic feet per ton has been selected for calculations.

Bottle-roll tests were initially completed by METCON Research, Tucson. This 24-hour test involved material from holes YM-2, -5, & -8. Results of hole YM-2 were low (23%), whereas holes YM-5 and -8 were encouraging at 60% and 70%, respectfully, for the gold and around 50% for the silver values in the calculated head assay. The low value was with a sample where METCON and Triad head assays were widely different and interpretation of the low value recovery was not made.

METCON continued the bottle-roll leach from 24 hours to 72 hours and the percent recovery increased to 70%, 68%, and 83% for the gold values. Silver is again around 50%, but with the calculated head value of less than 0.02 oz/ton silver, the effect on economics is minor. The late recovery increase of the low 23% test is encouraging that the values are determinable.

Four samples of rock from the open-cut were also submitted to McClelland Labs, Sparks, Nevada, for bottle-roll tests. The bottle-roll leach tests at 80% - 3/8 inch size for 96 hours obtained the following results.

	Open-Cut Composite	Open-Cut High Grade	Open-Cut Low Grade	Clay Gouge
96-hr Extraction	63%	69%	70%	74%

The cyanide-lime consumption was low and the encouraging results from the bottle-roll leach tests led to expanded column tests and an expanded bottle-roll test from throughout the deposit.

A composite B Zone mineralization sample was collected from twenty-four holes throughout the deposit and within the drill indicated reserve. This 72-hour cyanide bottle roll test by METCON ranged from 60% to 89% recovery, with an overall average of 73% recovery.

No strong variation was noted across nor down the zone of mineralization, though two of the lowest values returned were from holes near the downdip bottom of the drill indicated reserve.

Table 13 lists the twenty-four holes, their percent recovery, the METCON calculated head assay, Triad original assay and a Skyline head assay. As noted, the weighted average (based on feet- oz. divided by feet) of the METCON calculated head assay of 0.063 opt gold is 10% higher than the Triad original weighted assay of 0.057 opt gold. The Triad assay is a calculated value from the individual samples making up the composite. The Skyline head is an assay of a split from the pulp sent to METCON for the leach test. As noted, the Skyline head weighted average is slightly lower than Triad values, but with a variation on the individual assays.

Skyline was requested to assay as many splits as available in the pulps from six holes which indicated a Skyline variance with the other two assays. Eight repeat assays were secured by this method and the average is listed in Table 13 for the six holes. In all but one case, Skylines new composite average was within the ball-park of the original Triad and the METCON head assay.

At the start of the column leach tests, the core sample rejects of the B Zone composite was selected from the three diamond drill holes which cut the entire B Zone mineralization. McClelland Labs conducted a 96-hour leach test and these indicated recoveries of 67%, 65%, and 62%.

The average leach recoveries of all the bottle-roll tests suggest a recovery of 71% of the gold values.

<u>Large column percolation leach tests</u> were conducted from material collected from the open-cut and from underground. The open-cut surface samples were from four locations and amounted to about twelve tons of freshly blasted material from the walls of the pit. This included several tons of gougy material in the vicinity of the crushed zone of the Yarnell Fault structure. Some two tons of material of low-grade values were removed from the underground main adit by blasting the sides of the adit. The material was separately contained in 55-gallon barrels and shipped to McClelland Labs, Sparks, Nevada, where a bulk sample composite was made with the high grade/low grade material.

As noted previously, a sample of the open cut high-grade, the low-grade, the composite sample, and the clay gouge sample was run with a 96-hour bottle roll test for preliminary values.

Column percolation leach tests were conducted on the high grade/low grade bulk ore composite at 80% minus 6", 2", and 3/8" feed sizes.

The test data is as follows:

80% Passing Size	Column Size	Leach Time Days	Head Assay Opt	Tail Assay Opt	Extraction
6 inch	24" dia. x 18 ft.	111	0.046	0.022	52.2%
2 inch	15" dia. x 18 ft.	102	0.051	0.015	70.6%
3/8 inch	12" dia. x 18 ft.	79	0.055	0.013	76.4%

As noted the composite is amenable to heap leach cyanidation treatment in all three feed ranges with an increase in gold recovery with decrease in feed size. Gold recovery rates were fairly slow, but extraction was substantially complete in 60 days of leaching.

Cyanide consumptions were low and ranged from 0.56 to 0.79 pound per ton of ore. Consumption rates were fairly constant throughout the leaching cycles. The ten pounds of lime and cement (3/8 inch feed) per ton of ore added to the ore charges as the columns were filled was sufficient to maintain protective alkalinity at above pH 10.5 throughout the test period.

A vat leach test on the underground low-grade composite at run-of-mine feed size, along with a parallel column test using 80% minus 3/8 inch feed was conducted. The respective gold recoveries were 40% (vat) and 70% (column) in about 40 days of leach contact. This suggests that the low grade (0.010 opt gold) would be amenable for leaching if crushed to the smaller size. Cyanide and lime consumptions were within the previous column tests results.

Flotation/Fine Grind/cyanide leach tests were conducted on the Yarnell composite sent to Tucson from McClelland Labs. This head sample of 35 pounds assayed 0.031 opt Au and 2.35% Fe.

In the two flotation tests, ground to -200 mesh, the recoveries were 75%-76% in the final concentrate and 79%-80% in the rougher concentrate.

In the two fine grind/cyanide leach tests, also ground to -200 mesh, the recoveries were 97% in 22 hours of agitated leach. The cyanide consumption was 0.21 pounds per ton of ore and the lime was 3.3 pounds per ton of ore.

The trade-off between high recovery by fine grinding agitated leach and lower recovery by coarse crush/heap leach is a matter of economics.

MINERAL INVENTORY - RESERVE

General Statement. The Yarnell Project contains ninety-six drill holes of the reverse circulation rotary type, four diamond drill holes which twinned adjacent rotary holes, and a comprehensive sampling of the open-cut along the outcropping upper edge of the mineral zone. The rotary portion amounted to 24,367 feet of drilling with 1,295 feet of core drilled for a total of 25,662 feet of drilling (Plate 1 and Plate 2).

As noted in the drilling section, not all the footage contained assays, since some of the footage is through the open stopes while others were drilled in the footwall of the mineralization.

A packet of silicification, quartz veining, and quartz-sericite alteration sub-parallels the Yarnell Fault which strikes N40°E, and dips 30° northwesterly. The packet with the Yarnell Fault generally contains the highest grade of mineralization and varies in thickness and grade. This zone was designated the main or B Zone of mineralization.

Upward, a lower grade of mineralization is often found above the B Zone. Where adjacent drill holes indicated mineral continuity and grade, the zone was inventoried as the A Zone mineralization.

Evaluation of the reserve potential was performed by two methods:

1. A drill indicated reserve using approximately a 0.010 opt gold cut-off for the A Zone and an 0.020 opt gold cut off for the B Zone mineralization. The hand calculation method using the triangular method discussed below and

2. The computer, cone miner, method using a modified polygon configuration, as discussed below.

Exploration Department triangular method. The triangular method was selected and each drill hole leg assay values were scanned and the best interval of assays in the vicinity of the Yarnell Fault were selected for the B Zone calculation. Within this zone, some assay values were as low as 0.00X opt gold, but unless the grade and thickness was sufficient to be included within a proposed pit outline of the combined main B Zone, the inventory was not included in the drill indicated reserve. Also factored in was the parameter that any interval of twenty feet should average 0.20 opt gold within the intercept used.

Through the first pass review it was determined that the average grade of the deposit might be 0.051 opt gold. This value was then placed in all the open stope areas for a total thickness computation of the B Zone. The tonnage and grade estimated as previously mined was then subtracted from the calculated tonnage-grade for the entire B Zone drill indicated reserve.

Calculation of the upper or A Zone mineralization was taken to be that which was within the suggested pit outline determined by the B Zone calculations. A 50° back-slope was suggested to be adequate for the B Zone and the pit plan was smoothed into what might be an acceptable outline, with a waste/ore ratio of around 3 tons of waste per ton of ore. The value of the block within the A Zone needed to be within a minable plan with a 0.010 opt gold cut-off and a nominal thickness to be mined. Even though it was known that the material had to be moved to secure the B Zone mineralization, no economic parameters were placed in the calculation.

The previous Table 11 lists all the drill hole values broken down into A and B Zone intervals. Also noted are the holes not included in the drill indicated reserve as well as several other notes, such as, stope intercept, first and last value, and intervals projected from the areas.

Plate 2 plots the drill holes, the footwall outline of the mineralization, the downdip toe outline of the suggested pit, the crest outline of the proposed pit, the indicated outline of the underground workings and pillars, and the triangles used in the reserve study. Using a 12.0 tonnage factor, the following parameters were established:

Zone	Tonnage	Grade, opt Au	Waste/Ore
Waste*	12,670,000	--	--
B Total	4,360,000	0.051	--
Prev. Mined	250,000	0.051	--
B Remaining	4,110,000	0.051	3.08/1
Waste**	9,930,000	--	--
A Zone	2,740,000	0.017	--
B Zone (remaining)	4,110,000	0.051	--
A + B	6,850,000	0.038	1.45/1

*All material above B Zone inside pit parameters.
**Previous waste minus A Zone material.

Of the A Zone triangle blocks used, only two out of one hundred thirteen blocks averaged 0.010, all others were 0.011 or above, with a high of 0.025 opt gold.

In the B Zone the lowest grade block was 0.029, with a high of 0.114 opt gold.

Recalculation of previously removed stope tonnage/grade and recalculation of drilled mineral reserve.

Several questions had been raised as to the influence of the grade in the pillars, the near wall holes next to the stopes, and the configuration of the extracted stope perimeter, to the value of the remaining material in the B Zone.

The surveyed and estimated outline is plotted on Plate 2.

In a compilation the drill hole intercepts from the holes which intercepted pillars, 7 in number, and using the stope thickness calculations, separated out the equivalent stope interval. The average stope thickness was 21.4 feet with a grade of 0.090 opt gold. Also calculated was the similar stope thickness on the holes outside the stope configuration, but within 50 feet of the stope wall. Fourteen holes with an average thickness of 19.6 feet contained an average of 0.076 opt gold.

A calculation of the ore tonnage removed from the B Zone main mineralization was undertakenby using all the drill holes which penetrated the openings, the survey of the working, and the estimate of the openings as suggested from an old file map.

The calculations suggested a thickness of 20 feet of stope height with 230,000 tons of ore removed at a grade of 0.096 opt gold.

The values previously given for the waste and A Zone mineralization are not affected by the recalculation of values.

Table 14 lists the revised-main B Zone values. The bottom line indicates 4,130,000 tons at 0.055 opt gold remains in the B Zone area.

Computer evaluation with economic parameters has been undertaken by the ASARCO Engineering and Computer Service. Numerous scenarios of variable mining, milling, fixed and gold value costs have been used. One study, using a 0.053 opt gold value for the open stope values, compared the inventory using the Exploration Department pit design and B Zone configuration vs. the economic pit using the computer derived pit with a $400 gold value, and costs of $7.34 per ton of ore mined (Model 4796).

The summary of the data for Model 4796 is as follows:

	Tons*	Grade, oz-ton
Exploration Dept. Inventory	4,797,000	0.052
Economic Computer Inventory	3,755,000	0.060

*No adjustment for previously mined material.

	Adj.Tons**	Adj.Grade, oz-ton
Exploration Department	4,567,000	0.052
Economic Computer	3,525,000	0.060

*Not adjusted for stope tonnage previously removed.
**Adjusted by subtracting 230,000 tons at 0.096 opt gold previously mined as estimated.

The above figures compare favorably with the Exploration Department calculation reviewed in the previous section of the report.

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YARNELL PROJECT

Yavapai County, Arizona

Table 1. Major Element Chemistry - Yarnell Pluton

	Granodiorite (De Witt)			Biotite Granite (Yar.Mine)	
Sample #	72	73	74	HW	FW
SiO_2	67.4	66.3	65.1	70.0	69.8
Al_2O_3	14.5	14.1	14.3	14.3	14.4
Fe_tO_3*	4.98	5.45	6.65	4.76	5.02
MgO	1.17	1.22	1.52	1.00	1.10
CaO	2.57	2.84	3.43	2.60	2.30
Na_2O	3.08	3.10	3.14	3.20	3.10
K_2O	4.18	4.33	3.78	4.10	3.90
TiO_2	0.80	0.79	1.02	0.70	0.85
P_2O_5	0.27	0.34	0.39	0.45	0.55
MnO	0.12	0.11	0.13	0.11	0.13
TOTAL	99.07	98.58	99.72	101.22	101.15

*Fe_tO_2, total iron as Fe_2O_3

YARNELL PROJECT

Yavapai County, Arizona

Table 2. Size of Gold & Silver Particles

	Size	No.	Equidimensional in microns	No.	Elongate in microns
GOLD					
	v.small	7	"dot", 1/2	--	--
	small	9	1(1x2),2(2x2), 2(2x4),1(3x3), 1(3x6),1(4x4), 1(4x8)	6	1(2x8),3(2x12) 1(2x20),1(6x25)
	medium(-)	7	1(9x15),1(12x18), 2(13x19),1(15x30), 1(19x32),1(19x38)	4	1(10x35),1(10x45), 1(12x87),1(13x34)
	medium	3	1(25x33),1(25x38), 1(32x32)	1	1(26x70)
	medium(+)	3	1(35x60),1(45x60), 1(45x64)	--	--
	large	--	--	1	1(60x225)
		29	+	12	= 41 Subtotal
SILVER					
	v.small	--	--		--
	small	10	5(2x4),5(3x5)	2	1(2x6),1(5x19)
	medium(-)	--	--	--	--
	medium	--	--	--	--
	medium(+)	--	--	--	--
	large	--	--	--	--
		10	+	2	= 12 Subtotal
		39	+	14	= 53 TOTAL

YARNELL PROJECT

Yavapai County, Arizona

Table 3. Comparison of Trace Elements
(ppm values) in Main Ore Zone rotary cuttings
and Hanging Wall-Footwall soil samples.

	Ore Zone, Rotary Cuttings ppm			HW Soils ppm	FW Soils ppm
	YM-6	YM-26	YM-50		
No. of Samples	3	4	5	53	61
Cu,average	3.7	18.4	17.0	28.4	19.4
Cu, high	5.0	36.4	26.1	55.4	30.0
Cu, low	2.6	5.1	8.7	16.3	11.5
Pb, average	7.9	69.1	8.5	24.6	21.1
Pb, high	10.7	255.0	11.7	58.5	34.9
Pb, low	5.9	4.7	7.1	14.5	12.5
Zn, average	28.8	59.6	41.8	86.8	60.3
Zn, high	36.4	124.0	57.0	270.0	124.0
Zn, low	24.1	34.3	34.8	33.7	30.3

YARNELL PROJECT

Yavapai County, Arizona

Table 4. Drilling Contractors and Sequence

Contractor/ Equipment	Hole Numbers	Started	Completed	Footage*
Drilling Services Company, Reverse Air Circulation				
TH-100	YM-1 thru YM-9	3/20/89	4/1/89	3,022
TH-100	YM-10 thru YM-36	6/3/89	6/29/89	7,350
TH-60	YM-37 thru YM-96	7/19/89	10/3/89	13,995
			Subtotal	24,367
Boyles Bros., Core				
Longyear 44H	YDDH-1 thru -4	9/25/89	10/21/89	1,295
			Subtotal	1,295
			TOTAL	25,662

*Footage is to bottom of hole and includes footage in stopes where no samples were recovered.

YARNELL PROJECT

Yavapai County, Arizona

Table 5. Yarnell Drill Hole - Survey Data

ROTARY DRILL HOLE NUMBER	DEPTH FEET	COORDINATES NORTH	EAST	ELEVATION
YM-1	220	100,255.5	49,875.4	5,078.5
YM-2	350	100,490.7	49,860.6	5,063.0
YM-3	250	100,218.5	49,625.8	5,010.7
YM-4	440	100,505.3	49,675.8	5,052.3
YM-5	370	100,437.1	49,565.2	5,041.8
YM-6	400	100,278.7	49,286.7	4,949.0
YM-7	292	100,260.5	49,471.6	4,986.9
YM-8	350	100,717.9	49,749.2	4,957.9
YM-9	350	100,734.8	49,577.2	4,930.2
YM-10	300	100,177.0	49,171.1	4,893.9
YM-11	260	99,998.0	48,983.2	4,874.0
YM-12	240	100,356.5	49,788.4	5,073.6
YM-13	280	101,099.2	49,909.0	4,810.1
YM-14	160	100,110.1	49,780.1	5,050.5
YM-15	350	100,581.8	49,765.5	5,036.8
YM-16	150	100,383.9	50,017.0	5,057.1
YM-17	450	100,458.2	49,405.8	5,017.2
YM-18	250	100,637.8	50,002.4	4,990.8
YM-19	300	100,769.4	49,894.2	4,973.5
YM-20	200	100,136.5	50,065.9	5,074.7
YM-21	200	101,062.1	50,094.4	4,806.2
YM-22	380	100,172.6	49,027.2	4,884.0
YM-23	140	100,027.2	49,165.2	4,860.9
YM-24	150	100,062.9	49,349.4	4,893.5
YM-25	155	100,063.1	49,533.7	4,947.3
YM-26	450	100,427.5	49,139.4	4,911.0
YM-27	440	100,923.0	49,436.3	4,835.4
YM-28	350	100,959.3	49,648.0	4,817.0
YM-29	280	100,118.7	48,832.5	4,858.6
YM-30	315	100,331.8	49,022.5	4,894.1
YM-31	450	100,684.2	49,253.6	4,918.6
YM-32	260	100,873.5	49,960.0	4,920.2
YM-33	410	100,629.8	49,440.8	4,969.7
YM-34	150	101,468.1	49,898.0	4,671.9
YM-35	100	101,181.8	50,199.4	4,729.8

(Continued)

YARNELL PROJECT - Table 5. Yarnell Drill Hole - Survey Data (Continued)

ROTARY DRILL HOLE NUMBER	DEPTH FEET	COORDINATES NORTH	EAST	ELEVATION
YM-36	180	101,319.7	50,064.8	4,705.2
YM-37	240	100,178.0	49,314.9	4,925.1
YM-38	360	100,374.7	49,312.5	4,983.9
YM-39	360	100,587.8	49,594.9	5,010.7
YM-40	400	100,501.3	49,506.1	5,024.4
YM-41	460	100,564.3	49,330.1	4,978.4
YM-42	410	100,760.1	49,454.9	4,909.6
YM-43	140	100,793.2	50,066.0	4,907.9
YM-44	310	100,850.2	49,780.1	4,910.5
YM-45	120	100,551.4	50,110.8	4,980.4
YM-46	300	100,057.8	48,921.0	4,883.5
YM-47	320	100,104.5	49,097.3	4,873.4
YM-48	220	99,681.3	48,754.2	4,776.6
YM-49	220	99,853.3	48,847.1	4,827.6
YM-50	85	99,861.6	49,155.5	4,818.2
YM-51	240	99,994.7	48,694.1	4,789.0
YM-52	200	99,996.4	49,214.3	4,854.5
YM-53	150	99,916.2	49,077.7	4,844.7
YM-54	340	100,413.6	49,704.6	5,060.0
YM-55	220	100,391.2	49,885.2	5,073.8
YM-56	180	100,324.7	49,962.1	5,078.2
YM-57	120	100,254.5	50,021.2	5,090.1
YM-58	90	100,323.3	50,088.3	5,055.8
YM-59	180	100,517.2	50,020.0	5,019.0
YM-60	110	100,467.5	50,107.5	5,009.9
YM-61	250	100,564.3	49,899.7	5,036.1
YM-62	320	100,361.3	49,612.9	5,039.5
YM-63	240	100,306.6	49,701.4	5,045.0
YM-64	200	100,188.0	49,738.1	5,041.5
YM-65	135	99,551.4	48,903.2	4,765.6
YM-66	60	99,378.5	48,923.0	4,764.5
YM-67	90	99,597.7	48,811.0	4,776.5
YM-68	130	99,789.8	49,232.8	4,848.5
YM-69	400	100,371.2	49,213.1	4,951.2
YM-70	190	100,258.4	49,792.7	5,058.4
YM-71	160	100,129.8	49,664.8	5,010.7
YM-72	150	100,016.3	49,691.4	5,008.8
YM-73	90	99,972.5	49,569.8	4,947.4
YM-74	160	99,982.5	49,463.8	4,899.1
YM-75	220	100,096.1	49,233.7	4,880.3
YM-76	175	100,116.0	49,610.1	4,989.5
YM-77	215	100,175.7	49,536.7	4,982.1
YM-78	350	100,309.6	49,381.9	4,985.8
YM-79	220	100,327.0	49,857.7	5,076.2
YM-80	320	100,475.4	49,755.9	5,067.1
YM-81	170	100,165.3	49,829.4	5,067.4

YARNELL PROJECT - Table 5. Yarnell Drill Hole - Survey Data (Continued)

ROTARY DRILL HOLE NUMBER	DEPTH FEET	COORDINATES NORTH	EAST	ELEVATION
YM-82	140	100,217.1	49,927.8	5,091.9
YM-83	285	100,419.1	49,805.2	5,072.6
YM-84	200	100,449.6	49,950.0	5,051.8
YM-85	100	100,483.6	50,401.7	4,975.9
YM-86	155	100,636.9	50,574.2	5,010.2
YM-87	380	100,477.2	49,270.8	4,977.5
YM-88	400	100,365.6	49,438.8	5,012.3
YM-89	390	100,332.0	49,532.8	5.016.6
YM-90	320	100,292.0	49,620.8	5,027.0
YM-91	155	100,257.2	49,559.2	5,003.3
YM-92	160	100,040.8	49,620.6	4,984.9
YM-93	100	99,929.2	49,309.7	4,855.0
YM-94	195	100,137.6	49,436.6	4,939.9
YM-95	420	100,526.5	48,764.8	4,822.1
YM-96	575	101,187.1	49,017.0	4,846.3
Subtotal	24,367			

DIAMOND DRILL HOLES

DRILL HOLE NUMBER	DEPTH FEET	COORDINATES NORTH	EAST	ELEVATION
YDDH-1	350	100,715.1	49,740.7	4,956.8
YDDH-2	400	100,507.1	49,510.8	5,024.3
YDDH-3	325	100,316.1	49,723.0	5,045.4
YDDH-4	220	100,100.8	49,224.2	4,879.9
Subtotal	1,295			
GRAND TOTAL	25,662			

YARNELL PROJECT

Yavapai County, Arizona

Table 6. List of "Wet" Drill Holes

Hole No. YM-	Below Base of Main Zone	At or within 10' of Base of Main Zone	Above Base of Main Zone	Relation to downdip extent of geological pit reserve edge.
33		X		Inside pit
41	X			" "
87	X			" "
26	X			" "
47	X			" "
42	X			Near pit edge
31			X	" " "
30			X	" " "
22		X		" " "
29			X	" " "
51			X	" " "
34			X	Far outside pit edge
36			X	" " " "
13		X		" " " "
28		X		" " " "
27			X	" " " "
96			X	" " " "
95			X	" " " "

Table 7. Triad Assay Values Returned on Asarco Standards

Standard *	Hole Sequence	Number of Samples	Assay Returned, opt Gold High	Low	Average
A	1-9	8	0.026	0.014	0.01825
A	10-36	33	0.035	0.004	0.02388
A	37-64	48	0.033	0.004	0.02156
A	65-96**	43**	0.025	0.004	0.01993
B	1-9	20	0.015	<0.001	0.00555
B	10-36	41	0.014	<0.001	0.00654
B	37-64	42	0.022	0.004	0.00779
B	65-96**	58**	0.020	0.005	0.00738

*Standard A, 0.022 ±0.001 opt gold
*Standard B, 0.006 ±0.0003 opt gold.
**Drill Hole 65 thru 96 used rejects of standards used for previous holes as listed below.

Standard *	Hole Sequence	Number of Samples	Assay Returned, opt Gold High	Low	Average
1st Rerun					
A	1-9	2	0.022	0.015	0.01850
A	10-36	13	0.022	0.004	0.01838
A	37-64	21	0.025	0.016	0.02195
2nd Rerun					
A	1-9	1	0.020	--	0.02000
A	10-36	--	--	--	--
A	37-64	5	0.023	0.019	0.02140
3rd Rerun					
A	1-9	--	--	--	--
A	10-36	--	--	--	--
A	37-64	1	--	0.014	0.014.00
		43**			

(Continued)

Table 7. Triad Assay Values Returned on Asarco Standards (Continued)

Standard *	Hole Sequence	Number of Samples	Assay Returned, opt Gold High	Low	Average
1st Rerun					
B	1-9	1	0.008	--	0.00800
B	10-36	14	0.008	0.005	0.00693
B	37-64	19	0.020	0.005	0.00800
2nd Rerun					
B	1-9	1	0.006	--	0.00600
B	10-36	8	0.009	0.006	0.00713
B	37-64	12	0.009	0.006	0.00750
3rd Rerun					
B	1-9	--	--	--	--
B	10-36	1	0.007	--	0.00700
B	37-64	2	0.008	0.007	0.00750
		58**			

YARNELL PROJECT

Yavapai County, Arizona

Table 8. Original Assay vs. New Reject Assay and Refire Assay

Original Hole # (New Hole #)	Original Hole Assay	New Reject Assay	Refine New Reject Assay
YM-3 (1J)	.058	.058	.061
YM-5 (1A)	.033	.032	.032
YM-7 (1B)	.047	.055	.052
YM-8 (1C)	.041	.057	.055
YM-12 (1D)	.036	.045	.037
YM-20 (1E)	.070	.088	.076
YM-24 (1F)	.093	.121	.113
YM-40 (1G)	.062	.066	.059
YM-50	.064	.062	--
YM-56	.082	.077	--

YARNELL PROJECT

Yavapai County, Arizona

Table 9. Multiple Assays, Same Pulp, YM-55

Footage	Orig. Assay	Multiple Assay Splits Same Pulp				Avg.	Std. Dev.	95% of values should fall between high & low	
90-95	.015	.018	.016	.019	.022	.018	.003	.021	.015
95-100	.021	.023	--	--	--	.022	.001	.023	.021
110-115	.046	.063	.046	.044	--	.050	.010	.060	.040
125-130	.008	.011	.010	.012	.008	.010	.004	.014	.006
130-140	.142	.146	.131	.145	--	.141	.012	.153	.129

YARNELL PROJECT

Yavapai County, Arizona

Table 10. Assay Checks: Triad vs. Skyline
Values in oz/ton Gold

	Triad	Skyline	Triad	Skyline	Triad	Skyline	Triad	Skyline
	.000 to .020		.021 to .060		.061 to .080		.081 plus	
	.004	<.002	.021	.028	.061	.065	.083	.070
	.007	<.002	.023	.008	.061	.075	.093	.016
	.007	<.002	.023	.012	.062	.070	.093	.095
	.009	.010	.023	.030	.072	.075	.094	.105
	.010	.020	.025	<.002	.076	.050	.095	.105
	.011	.006	.025	.014	.078	.165	.099	.130
	.011	.010	.026	.022			.101	.110
	.011	.010	.027	.032			.111	.085
	.012	.010	.027	.038			.114	.125
	.012	.014	.031	.026			.116	.115
	.013	.012	.031	.030			.121	.170
	.013	.012	.032	.026			.132	.065
	.013	.014	.032	.030			.149	.240
	.014	.020	.032	.040			.229	.270
	.015	.016	.033	.022			.297	.290
	.015	.030	.033	.040			.331	.295
	.017	.010	.034	.032				
	.017	.020	.035	.036				
	.018	.024	.036	.016				
	.018	.046	.036	.030				
	.019	<.002	.036	.040				
	.019	.020	.038	.060				
	.019	.020	.039	.042				
			.042	.034				
			.044	.044				
			.045	.055				
			.046	.050				
			.046	.055				
			.053	.055				
			.059	.060				
# of Samples	23	23	30	30	6	6	16	16
Average	.013	.014	.034	.034	.068	.083*	.141	.143

Total Samples: 75
Triad Average: 0.053 opt Au
Skyline Average: 0.055 opt Au

*Dropping the high .165 value recalculates to .067 average.

YARNELL PROJECT

Yavapai County, Arizona

Table 11. Mineral Zone Interval Tabulation
With next assay above zone and next sample below zone.

Drill Hole YM-	Zone*	Last Assay Above	First Assay B Zone	Feet From	Feet To	Feet Footage	Last Assay B Zone	Head Assay Below	Grade (opt Au)
1	A			5	55	50			0.025
1	B	.014/.025		55	125	70	.062/.011		0.053, incl. 20' stope
2	A			45	140	95			0.017
2	B	.009/.076		140	245	105	.027/.002		0.049, incl. 40' stope
3	A			20	130	110			0.011
3	B	.013/.021		130	200	70	.129/.016		0.063, incl. 8' stope
4	A			15	230	175			0.013,40'low grade gap
4	B	.009/.016		285	310	25	.026/.007		0.037
5	A			150	200	50			0.005
5	B	.001/.029		200	355	155	.052/.006		0.041, incl. 35' stope
6	B	.012/.069		135	180	45	.155/.017		0.049
7	B	.007/.024		155	230	75	.022/.013		0.047 incl. 5' stope
8	A			30	225	195			0.022
8	B	.004/.047		225	275	50	.037/.004		0.041
9**	B	.006/.012		275	315	40	.020/.006		0.035
10	A			130	200	70			0.021
10	B	.015/.058		200	225	25	.041/.005		0.034
11	B	.015/.045		190	240	50	.103/.009		0.058
12	A			40	155	115			0.013
12	B	.013/.068		155	240	85	.030/***		0.041, incl. 15' stope

(Continued)

YARNELL PROJECT - Table 11. Mineral Zone Interval Tabulation (Continued)

Drill Hole YM-	Zone*	Last Assay Above	First Assay B Zone	Feet From	Feet To	Feet Footage	Last Assay B Zone	Next Assay Below	Grade (opt Au)
13**	B	.006/.021		180	210	30	.019/.004		0.022
14	B	.008/.038		15	90	75	.022/.010		0.040
15	A			25	140	115			0.015
15	B	.003/.132		140	295	155	.022/.008		0.034
16	A			0	40	40			0.017
16	B	.014/.036		40	80	40	.053/.007 after stope		0.039, incl. 5' stope
17	A			210	285	75			0.015
17	B	.007/.076		285	325	40	.020/.006		0.047
18	A			0	100	100			0.022
18	B	.013/.058		100	140	40	.028/.012		0.078
19	A			10	85	75			0.015
19	B	.005/.015		205	235	30	.083/.007		0.058
20	B	Surf./.044		0	35	35	.024/.004		0.070
21**	A			25	55	30			0.019
21**	B	.004/.034		80	90	10	.032/.001		0.033
22**	A			215	225	10			0.036
22**	B	.003/.032		270	285	15	.036/.005		0.025
23	B	.008/.116		40	125	85	.087/.006		0.047
24	B	.005/stope		65	115	50	.029/.006		0.093, incl. 10' stope
25	B	.002/.029		55	90	35	.058/.011		0.070
26	B	.003/.027		200	290	90	.051/.015		0.054
27**	A			35	265	90			0.015, 140' gap
27**	B	.007/.034		300	315	15	.028/.003		0.033
28**	A			95	225	130			0.022
28**	B	.006/.043		225	245	20	.049/.002		0.042
29**	B	.008/.046		220	230	10	.019/.008		0.033
30**	A			170	200	30			0.012
30**	B	.002/.030		215	250	35	.041/.009		0.032

YARNELL PROJECT - Table 11. Mineral Zone Interval Tabulation (Continued)

Drill Hole YM-	Zone*	Last Assay Above	First Assay B Zone	Feet From	To	Footage	Last Assay B Zone	Next Assay Below	Grade (opt Au)
31**	A			115	135	20			0.017
31**	B	.008/.093		365	385	20	.015/.005		0.055
32**	A			0	190	155			0.012, 35' gap
32**	B	.007/.027		190	200	10	.026/.001		0.027
33	A			15	55	40			0.015
33	B	.015/.074		280	365	85	.061/.008		0.053
34**	A			110	130	20			0.013
34**	B	Not reached -projected from other holes.							
34**	B			240	250	10			0.025
35	B	.004/.017		15	40	25	.016/.001		0.010
36**	A			35	55	20			0.023
36**	B	.013/.036		130	140	10	.059/.004		0.048
37	B	.007/.034		120	180	60	.030/.005		0.036
38	B	.009/.045		185	220	35	.024/.007		0.028
		Note: If no fault in area, then above may be "A" Zone.							
39	A			0	325	75			0.024, 250' gap
39	B	.004/.071		325	360	35	.062/***		0.048
40	A			20	80	60			0.014
40	B	.005/.023		275	380	105	.018/.005		0.062
41	B	.015/.054		300	335	35	.032/.004		0.050
42**	B	.003/.077		330	340	10	.035/.004		0.056
43	B	.001/.028		65	85	20	.032/.003		0.063
44**	A			115	235	120			0.024
44**	B	.009/.036		235	265	30	.191/.009		0.143
45	B	.001/.106		60	75	15	.041/.007		0.084
46**	B	.002/.010		200	260	60	.018/.008		0.012
47	A			120	170	50			0.014
47	B	.011/.041		170	205	35	.017/.010		0.031
48	B	.007/.045		45	85	40	.043/.004		0.049

YARNELL PROJECT - Table 11. Mineral Zone Interval Tabulation (Continued)

Drill Hole YM-	Zone*	Last Assay Above / First Assay B Zone	Feet From	Feet To	Feet Footage	Last Assay B Zone / Next Assay Below	Grade (opt Au)
49	B	.018/.048	140	160	20	.054/.013	0.049
50	B	Surf./.053	0	85	85	.173/***	0.059
51**	B	.001/.061	165	170	5	.061/.002	0.061
52	B	.003/.012	50	75	25	.015/.012	0.049
53	B	.007/.039	65	140	75	.031/.003	0.036
54	A		55	125	70		0.015
54	B	.012/.042	180	270	90	.021/.001	0.054
55	A		0	70	70		0.011
55	B	.013/.025	70	165	95	stope/.015	0.050, incl. 15' stope
56	A		0	45	45		0.012
56	B	.005/.083	70	105	35	.095/.015	0.082
57	A		0	15	15		0.011
57	B	.009/.027	15	60	45	Stope/.018	0.035, incl. 13' stope
58	B	Surf./.040	0	20	20	.018/.009	0.034
59	B	.004/.041	50	100	50	.025/.003	0.032
60**	In Footwall		-	-	-	-	-
61	B	.011/.087	80	200	120	.021/.002	0.037, incl. 15' stope
62	A		115	190	75		0.015
62	B	.003/.056	190	295	105	.043/.003	0.040, incl. 40' stope
63	A		10	140	120		0.011
63	B	.011/.073	140	240	100	.071/***	0.081
64	A		50	110	60		0.025
64	B	.014/.159	110	140	30	.038/.016	0.059
65	B	Surf./.091	0	50	50	.057/.005	0.049
66**	In Footwall		-	-	-	-	-

YARNELL PROJECT - Table 11. Mineral Zone Interval Tabulation (Continued)

Drill Hole YM-	Zone*	Last Assay Above	First Assay B Zone	Feet From	Feet To	Feet Footage	Last Assay B Zone	Next Assay Below	Grade (opt Au)
67	B	.013/.062		5	50	45	.044/.008		0.052
68**	In Footwall			-	-	-	-		-
69	A			185	250	65			0.011
69	B	.044/.077		250	280	30	.032/.012		0.069
70	A			60	95	35			0.011
70	B	.006/.041		95	135	40	.045/.007		0.031
71	B	.011/.085		45	110	65	.052/.011		0.131
72	B	Surf./.029		0	35	35	.143/.007		0.084
73	B	Surf./.087		0	20	20	.048/.008		0.190
74	In Footwall			-	-	-	-		-
75	A			65	85	20			0.016
75	B	.010/.026		85	170	85	.045/.010		0.058
76	A			0	75	75			0.012
76	B	.012/stope		75	110	35	.022/.015		0.039, incl. 15' stope
77	A			70	95	25			0.016
77	B	.016/.038		95	180	85	.117/.007		0.045, incl. 13' stope
78	A			130	215	85			0.011
78	B	.004/.125		215	270	55	.068/.011		0.070
79	A			10	120	110			0.019
79	B	.011/.027		120	170	50	.041/.008		0.046
80	A			140	230	90			0.023
80	B	.014/.028		230	280	50	.023/.014		0.040
81	A			5	55	50			0.015
81	B	.002/.119		55	90	35	.019/.013		0.066
82	A			0	35	35			0.015
82	B	.013/.029		35	95	60	.028/.009		0.049
83	A			0	140	140			0.014
83	B	.006/.088		140	240	100	.028/.004		0.044, incl 20' stope

YARNELL PROJECT - Table 11. Mineral Zone Interval Tabulation (Continued)

Drill Hole YM-	Zone*	Last Assay Above	First Assay B Zone	Feet From	Feet To	Feet Footage	Last Assay B Zone	Next Assay Below	Grade (opt Au)
84	A			10	105	95			0.017
84	B	.010/.019		105	140	35	.059/.011		0.062
85**	In Footwall			-	-	-	-		-
86**	B ?	.007/.016		50	70	20	.012/.006		0.013
87	A			245	285	40			0.010
87	B	.003/.086		285	305	20	.034/.010		0.050
88	A			180	240	60			0.020
88	B	.004/.023		240	295	55	.041/.008		0.064
89	A			40	180	140			0.010
89	B	.007/.032		180	270	90	.089/.017		0.051
89	Subzone			270	340	70			0.016
90	A			10	120	110			0.012
90	B	.009/.022		120	215	95	.077/.001		0.062
90	Subzone			215	235	20			0.019
91	A			10	95	85			0.010
91	B	Hole lost in Stope - projected from other holes.							
91	B	.007/.030		95	180	85	-		0.051
92	B	.003/.031		35	55	20	.032/.009		0.072
93	B	.013/.036		5	25	20	.051/.018		0.064
94	B	.006/.028		105	155	50	.023/.005		0.086, incl. 30' stope
95**	B	.006/.018		385	395	10	.011/.002		0.015
96**	B	.005/.061		570	575	5	.061/***		0.061

* Zone A - Upper low-grade Zone.
* Zone B - Main Yarnell Fault Zone and envelope.
** Hole not in drill indicated reserve.
*** Hole terminated in "ore" grade assay.

YARNELL PROJECT

Yavapai County, Arizona

Table 12, B Zone Assay Comparison, DDH vs. RDH

Drill Hole Pair	Thickness Feet	Composite Assay, opt Au	Recheck of Rotary Pulps, opt Au
YDDH-1	50	0.041	
YM-8	50	0.041	0.045
YDDH-2	105	0.070	
YM-40	105	0.062	0.066/0.080
	54		
YDDH-3*	27/stope/19	.036/stope/.047	
YM-63**	25/55/20	.054/.098/.045	.047/.112/.027
YDDH-4	85	0.066	
YM-75	85	0.058	0.068

*YDDH-3 intercepted stope from 167 to 221 feet.

**YM-63 intercepted the stope pillar, and later terminated in ore grade values.

YARNELL PROJECT

Yavapai County, Arizona

Table 13. Comparison of CN Results based on Assay of Interval

Hole Number	Triad Orig. Assay	Skyline Head	Skyline Check	Metcon Calculated Head Assay	CN %Recovery, Au	
47	.031	.020		.036	72	
15	.034	.028		.037	78	
53	.036	.034		.044	77	
					Sub-average	76
14	.040	.036		.051	81	
6	.042	.075	.042	.060	66	
8	.042	.055		.074	76	
79	.046	.032	.050	.056	61	
48	.049	.036		.045	78	
49	.049	.034		.039	69	
82	.049	.040		.052	65	
					Sub-average	71
87	.050	.036		.068	65	
33	.051	.050		.055	60	
54	.054	.055		.068	68	
					Sub-average	64
40	.062	.060		.074	67	
84	.062	.120	.067	.073	70	
90	.062	.055		.053	66	
43	.063	.055	.047	.066	88	
88	.064	.085		.086	74	
93	.064	.065		.075	79	
75	.066	.055		.065	81	
					Sub-average	75
25	.070	.065		.067	64	
18	.078	.080		.071	89	
63	.081	.046	.070	.077	71	
71	.131	.120	.127	.141	83	
					Sub-average	77
Weighted Average	.057	.054		.063		
					Overall average	73

YARNELL PROJECT

Yavapai County, Arizona

Table 14 - Revised "B" Zone Values

Using 12.0 $ft.^3$/ton factor

Triangle No.	Volume $ft.^3$	Thickness ft.	Tons	Grade oz/ton	Recalc. Grade	Recalc. Ton-oz.
1	87,375	23.3	7,281	0.037	--	269.397
2	208,250	35.0	17,354	0.057	--	989.178
3	382,500	30.0	31,875	0.068	--	2167.500
4	117,600	20.0	9,800	0.037	.043	421.400
5	182,250	30.0	15,188	0.035	.039	592.332
6	189,810	33.3	15,818	0.047	.056	885.808
7	149,184	33.3	12,432	0.051	.065	808.080
8	119,699	31.7	9,975	0.054	.057	568.575
9	232,187	56.7	19,349	0.054	.060	1160.940
10	221,130	56.7	18,428	0.050	.056	1031.968
11	191,403	41.7	15,950	0.043	.045	717.750
12	280,292	63.3	23,358	0.047	.051	1191.258
13	308,424	78.3	25,702	0.051	.057	1465.014
14	505,084	91.7	42,090	0.041	.046	1936.140
15	486,850	70.0	40,571	0.044	.048	1947.408
16	681,298	63.3	56,775	0.049	.053	3009.075
17	989,495	66.7	82,458	0.041	.045	3710.610
18	298,880	46.7	24,907	0.050	.053	1320.071
19	169,070	58.3	14,089	0.047	.055	774.895
20	255,500	50.0	21,292	0.054	.062	1320.104
21	190,515	51.7	15,876	0.057	.061	968.436
22	205,920	60.0	17,160	0.055	.062	1063.920
23	211,723	78.3	17,644	0.045	--	917.488
24	256,880	95.0	21,407	0.044	--	1134.571
25	373,700	100.0	31,142	0.048	--	1712.810
26	290,105	85.0	24,175	0.045	--	1257.100
27	280,740	93.3	23,395	0.046	--	1216.540
28	232,000	80.0	19,333	0.047	--	985.983
29	667,076	126.7	55,590	0.039	.043	2390.370
30	994,194	108.3	82,850	0.036	.039	3231.150
31	557,304	103.3	46,442	0.040	.042	1950.564
32	339,398	76.7	28,283	0.036	--	1018.188
33	180,290	55.0	15,024	0.047	--	706.128
34	490,428	71.7	40,869	0.037	--	1512.153

YARNELL PROJECT - Table 14 - Revised "B" Zone Values (Continued)

Triangle No.	Volume ft.^{3}	Thickness ft.	Tons	Grade oz/ton	Recalc. Grade	Recalc. Ton-oz.
						(Continued)
35	856,800	80.0	71,400	0.038	--	2713.200
36	188,100	55.0	15,675	0.054	.059	924.825
37	188,370	48.3	15,698	0.050	.055	863.390
38	154,837	53.3	12,903	0.045	.050	645.150
39	205,800	60.0	17,150	0.039	.044	754.600
40	331,840	76.7	27,650	0.056	.060	1659.000
41	438,510	93.3	36,543	0.059	.062	2265.666
42	474,789	98.3	39,566	0.058	.062	2453.092
43	551,291	116.7	45,941	0.044	.049	2251.109
44	535,500	90.0	44,625	0.045	.049	2186.625
45	532,950	95.0	44,413	0.048	.052	2309.476
46	402,050	55.0	33,504	0.055	--	1842.720
47	674,960	76.7	56,247	0.056	--	3149.832
48	728,660	78.3	60,722	0.055	--	3339.710
49	144,417	48.3	12,035	0.049	--	589.715
50	137,625	36.7	11,469	0.049	--	561.981
51	238,000	50.0	19,833	0.051	.053	1051.149
52	414,426	71.7	34,536	0.064	.065	2244.840
53	258,750	90.0	21,563	0.068	.070	1509.410
54	278,30	100.0	23,192	0.061	.064	1482.288
55	211,565	85.0	17,630	0.058	.063	110.690
56	233,700	95.0	19,475	0.051	.056	1090.600
57	324,684	93.3	27,057	0.047	.050	1352.850
58	436,458	116.7	36,372	0.043	.049	1782.228
59	547,500	100.0	45,625	0.048	.052	2372.500
60	639,450	105.0	53,288	0.052	.055	2930.840
61	350,175	66.7	298,181	0.060	--	17890.860
62	434,985	61.7	36,249	0.055	--	1993.695
63	371,371	58.3	30,948	0.083	--	2568.684
64	242,820	58.3	20,235	0.076	--	1537.860
65	153,643	46.7	12,804	0.092	.098	1254.792
66	263,749	58.3	21,979	0.085	.087	1912.173
67	340,303	71.0	28,359	0.078	.082	2325.438
68	124,115	59.3	10,343	0.075	.084	868.812
69	245,532	77.7	20,461	0.053	.060	1227.660
70	272,727	77.7	22,727	0.049	.053	1204.531
71	265,560	83.3	21,130	0.050	.051	1077.630
72	352,207	73.3	29,351	0.054	.055	1614.305
73	237,786	66.7	19,815	0.060	--	1188.900
74	181,125	48.3	15,094	0.058	--	875.452
75	243,563	43.3	20,297	0.049	--	994.553
76	213,553	33.3	17,796	0.047	--	836.412
77	205,416	31.7	17,118	0.041	--	701.838
78	145,745	28.3	12,145	0.048	--	582.960
79A	93,375	25.0	7,781	0.103	--	801.443
79B	81,250	25.0	6,771	0.109	--	738.039
80A	95,924	31.7	7,994	0.055	.065	519.610

YARNELL PROJECT - Table 14 - Revised "B" Zone Values (Continued)

Triangle No.	Volume ft.^{3}	Thickness ft.	Tons	Grade oz/ton	Recalc. Grade	Recalc. Ton-oz.
80B	79,123	31.7	6,594	0.060	.071	468.174
81	85,973	18.3	7,164	0.114	--	816.696
82	206,123	49.3	17,177	0.049	.061	1047.797
83M.	311,355	45.0	25,946	0.084	.085	2205.410
84	209,420	28.3	17,452	0.084	.084	1465.968
86M.	319,800	53.3	26,650	0.069	.070	1865.500
87M.	294,962	52.7	24,580	0.065	.069	1696.020
88	643,243	69.3	53,604	0.044	.049	2626.596
90M.	277,611	61.0	23,134	0.054	.059	1364.906
91	478,865	63.3	39,905	0.048	.052	2075.060
92	297,675	56.7	24,806	0.049	--	1215.494
93	200,445	48.3	16,704	0.049	--	818.496
94	192,000	40.0	16,000	0.045	--	720.000
95	349,800	58.3	29,150	0.063	.064	1865.600
96	313,031	53.3	26,086	0.047	--	1226.042
97	362,500	50.0	30,208	0.037	--	1117.696
98	360,000	40.0	30,000	0.045	--	1350.000
99	366,751	26.7	30,563	0.043	--	1314.209
100M.	39,000	30.0	3,250	0.069	--	224.250
101	215,129	23.3	17,927	0.085	--	1523.795
102	247,260	31.7	20,605	0.075	.076	1545.375
103	280,200	46.7	23,350	0.073	--	1704.550
104	157,643	58.3	13,137	0.054	--	709.398
105	315,040	61.7	26,253	0.051	--	1338.903
106	235,980	45.0	19,665	0.047	--	924.255
107	143,623	28.3	11,969	0.029	--	347.101
108M.	181,125	22.5	15,094	0.054	--	815.076
109	363,720	43.3	30,310	0.058	--	1757.980
110	431,653	61.7	35,971	0.048	--	1726.608
111	245,258	61.7	20,438	0.043	--	878.834
112	672,975	75.0	56,081	0.044	--	2467.564
113	502,238	61.7	41,853	0.045	--	1883.385
114M.	210,000	50.0	17,500	0.043	--	752.500
118	1,188,594	66.7	99,050	0.048	--	4754.400
119	765,000	45.0	63,750	0.042	--	2677.500
120	665,184	53.3	55,432	0.043	--	2383.576
121	415,911	48.3	34,659	0.034	--	1178.406
122M.	91,000	20.0	7,583	0.049	--	371.567
124	1,282,600	58.3	106,883	0.054	--	5771.682
127M.	388,890	30.0	32,408	0.049	--	1587.992
128	279,000	25.0	23,250	0.075	--	1743.750
129M.	125,000	25.0	10,417	0.060	--	625.020
135M.	77,520	40.0	6,460	0.057	--	368.220
136	468,000	40.0	39,000	0.065	--	2535.000
137	513,827	41.7	42,819	0.041	--	1755.579
138	607,200	55.0	50,600	0.046	--	2327.600
144	507,400	40.0	42,283	0.052	--	2198.716
145M.	118,300	65.0	9,858	0.049	--	483.042

YARNELL PROJECT - Table 14 - Revised "B" Zone Values (Continued)

Triangle No.	Volume ft.^{3}	Thickness ft.	Tons	Grade oz/ton	Recalc. Grade	Recalc. Ton-oz.
146M.	89,250	30.0	7,438	0.050	--	371.900
147M.	54,000	20.0	4,500	0.050	--	225.000
148	258,251	46.7	21,521	0.057	--	1226.697
149	92,364	56.7	7,697	0.049	--	377.153
150	751,162	56.7	62,597	0.049	--	3067.253
151M.	92,000	20.0	7,667	0.064	--	490.688
152M.	321,563	52.5	26,797	0.060	--	1607.820
153M.	813,484	68.0	67,790	0.055	--	3728.450
154M.	580,000	50.0	48,333	0.049	--	2368.317
156M.	172,500	50.0	14,375	0.049	--	704.375
162M.	389,034	18.0	32,420	0.072	--	2334.240
163M.	97,650	17.5	8,139	0.063	--	512.757
165M.	36,000	8.0	3,000	0.084	--	252.000
166M.	852,600	42.0	71,050	0.049	--	3481.450
167M.	693,000	42.0	57,750	0.053	--	3060.750
168M.	362,250	23.0	30,188	0.059	--	1781.092
169M.	2,835,000	45.0	236,250	0.048	--	11340.000
170M.	400,125	27.5	33,344	0.057	--	1900.608

	Original 12/20/89	Recalculated 2/19/90
Tons	4,361,005	4,361,005
Grade, opt Au	.051	.057
Total Oz	223,912	247,960
	Mined	**Mined**
Previously Mined	250,000	229,500
Grade, opt Au	.051	.096
Total Oz	12,750	22,032
Totals	**Remaining**	**Remaining**
Tons	4,111,005	4,131,505
Grade, opt Au	.051	.055
Oz	211,162	225,928

ASARCO

Southwestern Exploration Division

February 14, 1991

J.D. Sell

Yarnell Core

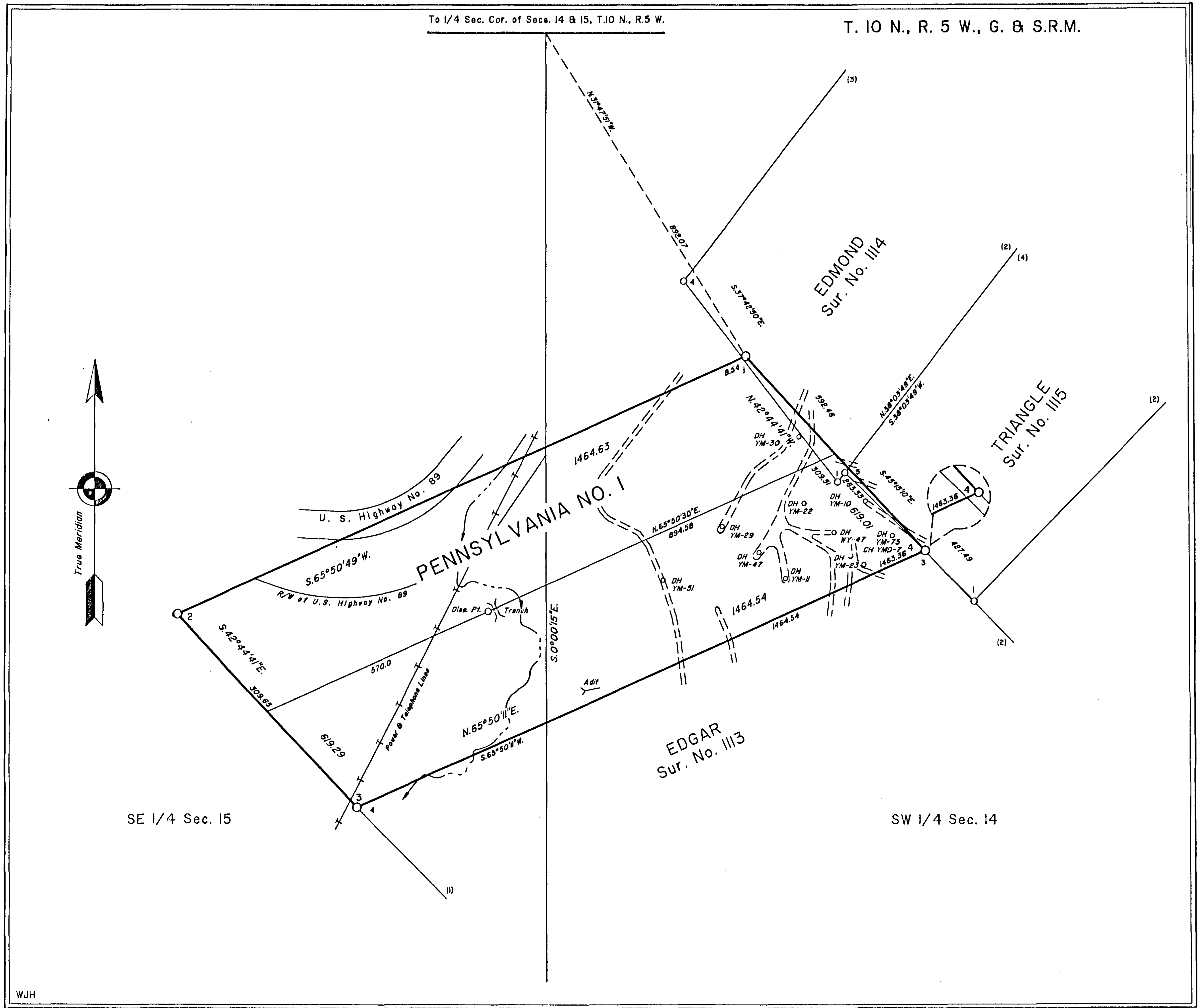
Mr. Steve Keehner left the Ventura Warehouse about 2:30 PM today with his pickup and a trailer to return the Yarnell Project core to the Yarnell Mine. The load consisted of five (5) pallets of core.

W. D. Gay

W. D. Gay

WDG:mek

cc: W.L. Kurtz
M.A. Miller



MINERAL SURVEY No. 4876 ARIZONA

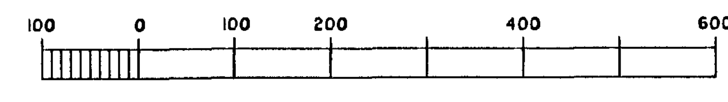
CLAIM OF

WESTERN BUILDING AND MINING CO., INC.

KNOWN AS THE

PENNSYLVANIA NO. 1 LODE

SITUATE IN
Secs. 14 & 15, T. 10 N., R. 5 W., G. & S.R.M.
YAVAPAI COUNTY
Weaver Mining District
Arizona Land District
Lat. 34°12'25"N., Long. 112°45'07"W., at Cor. No. 1, PENNSYLVANIA NO. 1 LODE



Magnetic Declination 14°30'E.

Surveyed Sept. 17, 1990, to July 19, 1993,
By Gordon W. McLain, Mineral Surveyor.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ARIZONA STATE OFFICE

Phoenix, Arizona October 26, 1993
I hereby certify that this plat of Mineral Survey No. 4876, Arizona, is strictly conformable to the field notes of said survey which have been examined and approved.

James P. Kelley

Chief Cadastral Surveyor of Arizona

[redacted]

NO.	FEET	FEET	OZ/T
[redacted]	[redacted]	[redacted]	[redacted]
Incl.	535 - 600	65	[redacted]
	625 - [redacted]	75	[redacted]
[redacted]	[redacted] 605	[redacted]	[redacted]
	700 - 705	5	[redacted]

[redacted]

BEMA GOLD CORP.

[redacted] GOLD RESOURCES INC. [redacted]

[redacted]

NORANDA INC.

[redacted]

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WLK - JDS

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NO.108(1991)
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George Cross News Letter

"Reliable Reporting"

WESTERN CANADIAN INVESTMENTS

NO.108(1991)
JUNE 5, 1991

JDS

APKER, APKER, HAGGARD & KURTZ, P.C.
P. O. Box 10280
Phoenix, Arizona 85064-0280
(602) 381-0085

Exploration Department
Southwestern U.S. Division
ASARCO Incorporated
P.O. Box 5747
Tucson, Arizona 85703-0747

February 1, 1991
Page 1
Client: 111
Matter: 12

Matter: Re: Norgold Resources, Inc.

Date	Professional Services Rendered
01/03/91	Telephone conference with Mr. Gay re Norgold property and mineral discovery requirements in wilderness areas.
01/04/91	Office conference and telephone conference with Mr. Jeannes re Norgold property.
01/08/91	Telephone conferences with Mr. Gay; prepare quitclaim deed for Norgold property and correspondence to Mr. Brown.
01/24/91	Telephone conference with Mr. Gay re quitclaim deed to Norgold.

Total Services 289.00

444-04
620-753

ASARCO Inc.
MAY 1 1991
SW Exploration

JDS

APKER, APKER, HAGGARD & KURTZ, P.C.
P. O. Box 10280
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(602) 381-0085

Exploration Department
Southwestern U.S. Division
ASARCO Incorporated
P.O. Box 5747
Tucson, Arizona 85703-0747

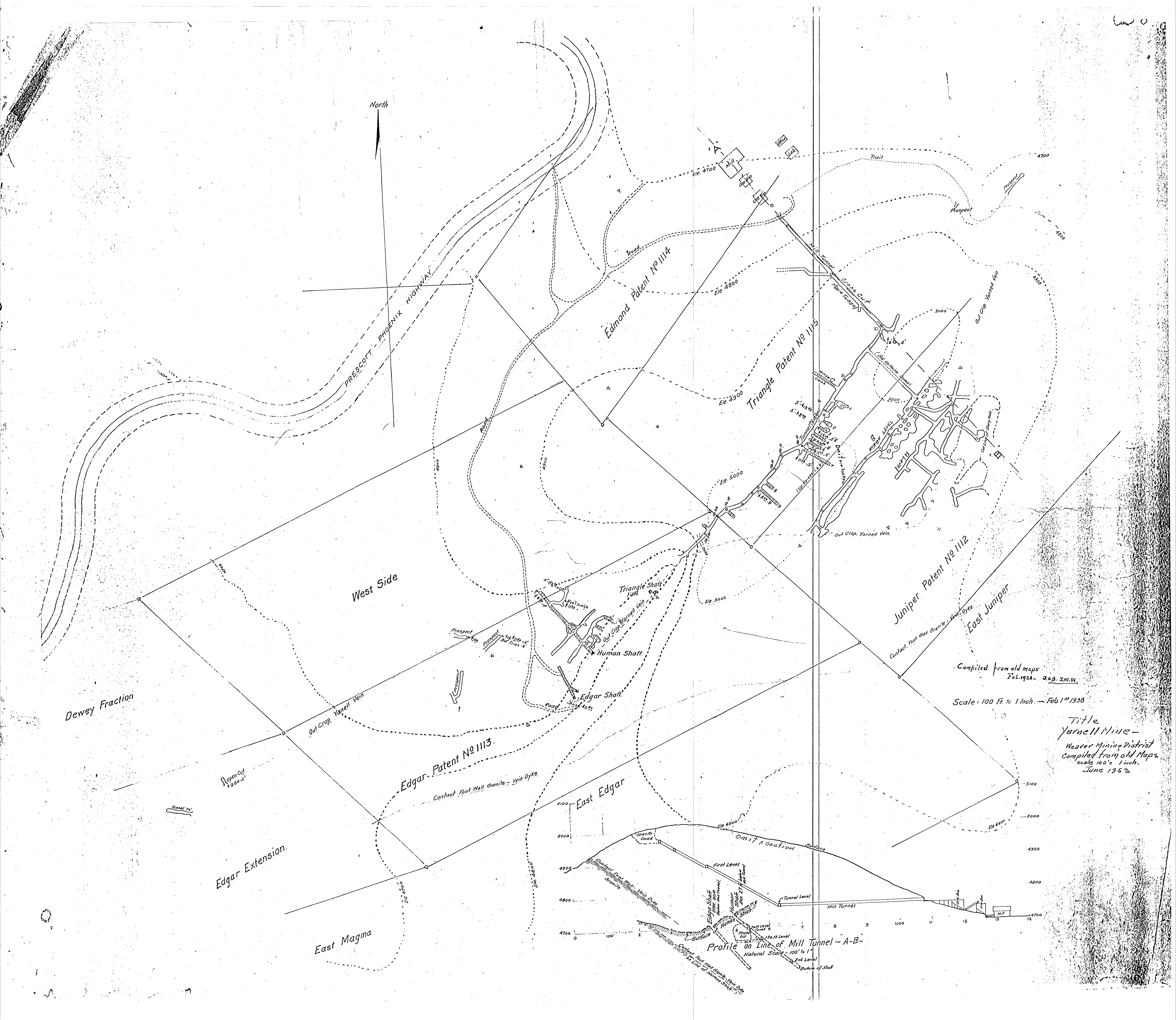
January 1, 1991
Page 1
Client: 111
Matter: 12

Matter: Re: Norgold Resources, Inc.

Date	Professional Services Rendered		
12/06/90	Telephone conference with Mr. Gay re recording special warranty deed to Norgold.		
	Total Services		34.00
	Disbursements		
	Long distance telephone	2.65	
	Total Disbursements		2.65
	Current Charges		36.65

144-04
620-753

ASARCO Inc.
MAY 1 1991
SW Exploration


North
Prescott Phoenix Highway
Mill
Office
Mill Tunnel
Cross Cut
Main Tunnel
Trail
Prospect
Road
Edmond Patent No 1114
Triangle Patent No 1115
Out Crop Yarnell Vein
First Level
Juniper Patent No 1112
East Juniper
Contact Foot Wall Granite - Vein Dyke
West Side
Triangle Shaft
Human Shaft
Edgar Shaft
Dewey Fraction
Out Crop Yarnell Vein
Edgar Patent No 1113.
East Edgar
Edgar Extension
East Magma
Open Cut
Tunnel 70'
Ele. 4700
Ele. 4800
Ele. 4900
Ele. 5000
Compiled from old maps Feb. 1938
Scale: 100 Ft. to 1 Inch. — Feb 1st 1938
Title
Yarnell Mine —
Weaver Mining District
Compiled from old Maps
scale 100's 1 inch.
June 1952
Omit X Section
Surface
Tunnel Level
Mill Tunnel
Profile on Line of Mill Tunnel ~ A-B-
Natural Scale - 100' to 1"
2nd Level
Bottom of Shaft