depth. Deep drilling has not yet been done to test for a gold source vent or breccia since gold grades at Copperstone have not been high enough to justify an underground mining operation. Some additional shallow drilling is necessary to determine the limits of an open pit Copperstone gold deposit. Testing for detachment and listric hosted gold deposits within the large Copperstone land position was done last year without success.

BUSINESS CONDITIONS

Land Status

The project area consists of 314 unpatented mining claims located on BLM land within sections 1, 2, 10, 11, 12, 14, 23, 24, 25, 26 and 27, T6N, R20W, and sections 6, 7, 18, 19, 20, 21 and 22, T6N, R19W. Sixty-five of the claims are leased from Dan and Maria Patch of Quartzite, Arizona, and 10 claims are leased from Willis and Ethel Rhea of Saline, Arizona. Thirty full claims and portions of six others lying in the northeastern corner of the claim block lie on land owned by the State of Arizona. These claims are in sections 6 and 7, T6N, R19W, which were deeded to the State in August 1983.

State prospecting permits have been obtained for those portions of sections 6 and 7 on which Amoco originally staked federal mining claims. Assessment work of $10 per acre is required by August 1, 1985 to keep these 36 claims in good standing. A $10 per acre work requirement will be necessary next year escalating to $20 per acre in the third year plus a $1 per acre rental fee to the State.

Goldfields Inc. holds claims and state prospecting permits on lands adjacent to the Copperstone claim block to the east and north. Last year they drilled a single hole which never reached bedrock. Former Amoco geologist Frank Mack staked claims adjacent to Copperstone's southern border. No drilling activity has been observed on these claims. All lands adjacent to the western boundary of the Copperstone claim block belong to the Colorado River Indian Reservation. Amoco is currently negotiating with the Indians to prospect some of their lands.

Business Terms and Other Financial Factors

An 8-year mining lease and option to purchase agreement was made between Amoco and Dan and Maria Patch effective May 1, 1980. Monthly advance royalty payments are $7,000 per

month until April 1, 1987. Thereafter, quarterly payments are $37,500 until production. By agreement, production must begin by April 30, 1988, but the mining lease can be extended due to poor market conditions with advance royalties continuing at $150,000 annually. Net value production royalty is 5 percent with a total buy-out of $7,000,000. The Willis and Ethel Rhea agreement requires a $7,000 per year payment that escalates annually until 1991 when the full purchase price of $200,000 will be paid. There is no production royalty in this agreement.

Infrastructure

The Copperstone project area lies 5 miles west of State Highway 95 and a major powerline that parallels the highway. Blythe, California is the largest of three local area towns. The others are Quartzite and Parker, Arizona. These towns could provide a large part of the needed labor pool. Amoco's mining operations at Bagdad are only 80 air miles to the northeast and might provide mining support for a new mine operation at Copperstone.

Water has been found in drill holes that penetrate 500 to 600 feet deep. The Colorado River runs by Parker and within a few miles of the property. A major supply center is located in Phoenix, a 3-hour drive to the east on U.S. Interstate Highway 10.

OTHER CONSIDERATIONS

Environmental Factors

The Copperstone gold deposit lies in a flat desert terrain of dune sands and sparse dry land vegetation. Unconsolidated surface sands and gravels restrict offroad vehicle travel. Summer temperatures reach 120°F, but the climate provides opportunity to operate a heap leach gold property the year around. The closest potential wilderness lands are 9 miles to the north.

CONCLUSIONS AND RECOMMENDATIONS

Project Status

A total of 223 holes have been drilled at the Copperstone project over the last 5 years. They confirm the presence of a hydrothermal Tertiary gold deposit associated with veining and several breccia types occurring in quartz latite welded tuff volcanics. Mineralization is associated with volcanic

formational breccias, hydrothermal breccias and possibly with moderately dipping pre-mineral faults. Abundant post-mineral faulting offsets mineralized zones in parts of the deposit.

Initial in-house polygon reserve calculations for tonnage and grade show that the Copperstone deposit contains 6.5 million tons grading 0.096 ounces gold per ton using a 0.025 ounce per ton cut-off and a 6.7 to 1.0 waste-to-ore stripping ratio and exists within a 360-foot open pit. Currently, sophisticated computer assisted ore reserve studies are underway by contractor Pincock, Allen and Holt with their results due by mid-April.

Fill-in drilling has been completed in a down dip projection for only a 400-foot pit limit. Lateral projections of the deposit along strike remain partially open, and some drilling is required to close off the deposit in these directions.

Proposed Program

The objective of this program is to maintain the project in good standing and complete the evaluation of the final results obtained from last year's drilling. Expenditures are required to complete ore reserve studies that are currently underway, complete on-going metallurgical studies, perform assessment drilling on lands covered by two state prospecting permits and maintain property payments. The proposed budget for this project in 1985 is $300,000.

COPPERSTONE DRILLHOLE DATA

This zip file, CS1097.ZIP, contains the drillhole database for the Copperstone mine, along with a topography file and a PKZIP file of Blasthole data. The data was sent to Mintec for the purpose of converting to standard MEDSYSTEM® drillhole and topography formats. Mintec did not produce or edit the data and is not responsible for the accuracy or correctness of the data. Mintec has verified that the data is in the correct format for use by MEDSYSTEM®. Questions about the data should be addressed to Kevin Leonard, Royal Oak Mines.

DRILLHOLE DATA

There are thirty-four (34) new holes and four hundred forty-four historical drillholes. There are three files associated with the drillhole database, OLD201.IA, NEW201.IB and DAT201.ALL.

DAT201.ALL has all the drillholes, new and historical and the assays are in the following order:

Item	Minimum	Maximum	Precision
FROM	.000	1305.000	.01
-TO-	5.000	1313.000	.01
-AI-	.300	500.000	.01
AU	.000	1.057	.001
PPB	.000	806270	1
ROCK	.000	95.000	1

OLD201.IA has four hundred forty-four (444) drillholes with FROM, -TO-, -AI-, AU and ROCK assays.

NEW201.IB has thirty-three (33) new holes with FROM, -TO-, -AI-, PPB and AU assays.

TOPOGRAPHY DATA

The file, 890902.VBM, has what appears to be the topographical contours, VBM feature code 902, and a pit design, VBM feature code 890.. It is unknown if the pit is the ultimate pit or the current phase pit.

BLASTHOLE DATA

The file BLASTHL.ZIP contains three non-MEDSYSTEM® database file containing blasthole data. The extensions of the files are RBF. The contents are uunknown.

336

COPPERSTONE
GEOLOGIC SUMMARY

The Copperstone gold deposit is located in an area of flat, dry, sandy terrain with several small knolls about 40 feet high and prominent longitudinal sand dunes. Only 17 outcrops with a total surface area of approximately one acre are exposed. At the southern end of the Copperstone claim block and beyond is exposed an igneous and metamorphic outlier of the Dome Rock Mountains. These rocks include granite, gneiss, schist, quartzite and amphibolite of uncertain age - Precambrian to Jurassic. A low angle fault (detachment?) separates these rocks from an upper plate consisting of a thick sequence of Jurassic age quartz latite welded tuffs (qlt). The upper plate sequence has been affected by weak green schist facies metamorphism in Cretaceous time. This fault probably extends beneath the Copperstone gold deposit, but drilling failed to confirm its presence.

No early prospect pits, shafts or adits were found at Copperstone. Prospecting began in 1968 with bulldozer trenching by a prospector to better expose weak copper mineralization. The property was submitted to Cyprus in 1980, and a lease was signed after initial field evaluation and sampling indicated 0.02 to 0.09 ounce per ton gold in a few small breccia outcrops. During 1981 through 1983 conventional percussion drilling in a 140 foot grid by Cyprus (Amoco Mineral Company) tested the limits of the Copperstone mineralization. Extensive induced polarization and ground magnetic surveys were run. Anomalous frequency effects outlined the gold deposit with considerable accuracy. Drilling from 1984 through 1986 further defined the deposit.

The Copperstone gold deposit is hosted by a thick sequence of foliated to massive and brecciated quartz latite tuffs. These rocks are correlated regionally with the Jurassic volcanics exposed in the Dome Rock Mountains to the south and throughout west-central Arizona. In the deposit area the quartz latite tuffs are at least 900 feet thick based on drilling formation. The tuffs are characterized by variable degrees of foliation defined by segregated bands of quartz - feldspar and sericite, probably developed along original primary laminations in the tuff. The foliations exposed in surface outcrops in the deposit area all dip 30-50° to the southwest. The indurated breccia dike that hosts the main gold zone within the deposit strikes approximately N45W and dips on an average of 30° to the northeast. These breccias continue along strike at least 2,500 feet and down-dip 1,500 feet. The breccias range in thickness from 50 to 200 feet and contain variably altered fragments of quartz latite in a hematite matrix. The main ore zone within the deposit generally occurs along the basal contact of these breccias with the underlying foliated quartz latite tuff. This mineralized zone is defined by an extensive multi-stage hydrothermal breccia zone. Fragments of quartz vein material, quartz latite tuff and earlier developed breccia are contained within a hematite - specularite matrix. Gold mineralization occurs primarily within this hydrothermal breccia zone and in quartz - amethyst veins cutting through the adjacent latite tuffs. Specular hematite, chrysocolla, minor malachite, and barite are the most common accessory minerals with lesser amounts of calcite, siderite, manganese oxide, flourite, adularia, magnetite,

BAN:RW209-01

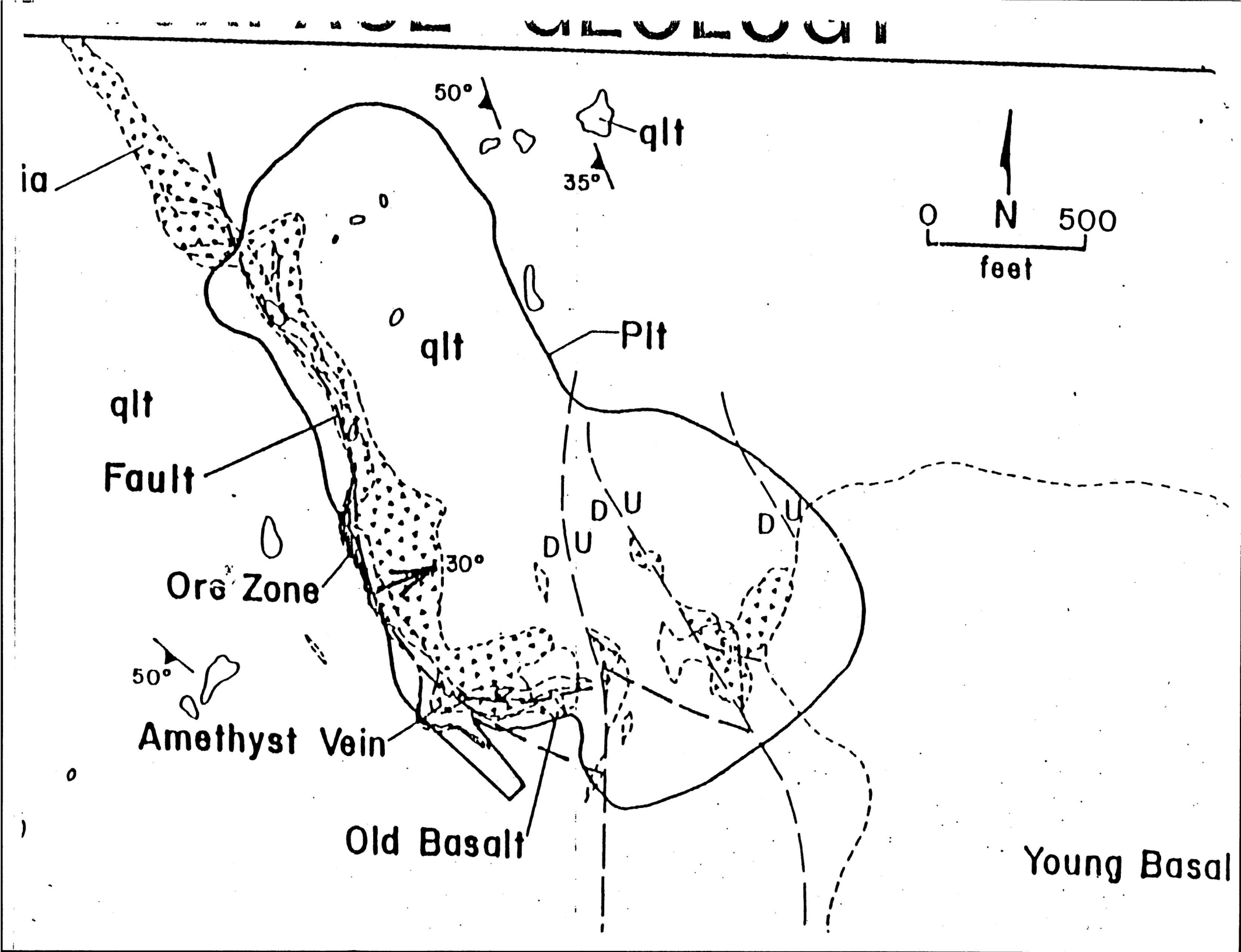
chalcopyrite and pyrite. Multiple episodes of mineralizing hydrothermal events and brecciation occurred at Copperstone.

Mineralizing solutions also formed local zones of alteration in and near the ore zones. Bleaching effects are caused by argillization and sericitization. Local secondary gray-green chlorite as wispy veining and minor chalcedonic silicification with small patches of chalcopyrite, pyrite and native gold have been seen. Microscopic examination of a gravity concentrate was made from a floatation concentrate of the ore. About 80 percent of the gold occurs in small flakes ranging between 4 and 40 microns. Coarse gold plates range from 50 to 150 microns. Most gold is free, but a small amount is locked within quartz and iron hydroxides.

The few mineralized outcrops at Copperstone contain highly anomalous gold, silver and copper. Initial sampling found subore and ore grade gold values that led directly to drilling. Several early core holes and a large suite of surface samples were analyzed for a broad spectrum of trace elements in an effort to characterize the deposit.

Copperstone is characterized by high barium, manganese, uranium and low arsenic, antimony, thallium and mercury. Barite and flourite are most abundant in the extreme southeastern end of the deposit where they occur in massive 4-5 foot veins.

Generally, gold mineralization is sharply defined within the mineralized breccia zone. It markedly decreases over a few tens of feet into hanging wall and footwall rocks where often no gold is detected by atomic absorption analysis. In higher gold grade zones within the deposit, silver values are higher and may provide some recoverable value. Copper ranges up to several percent within the gold zone, mostly as chrysocolla.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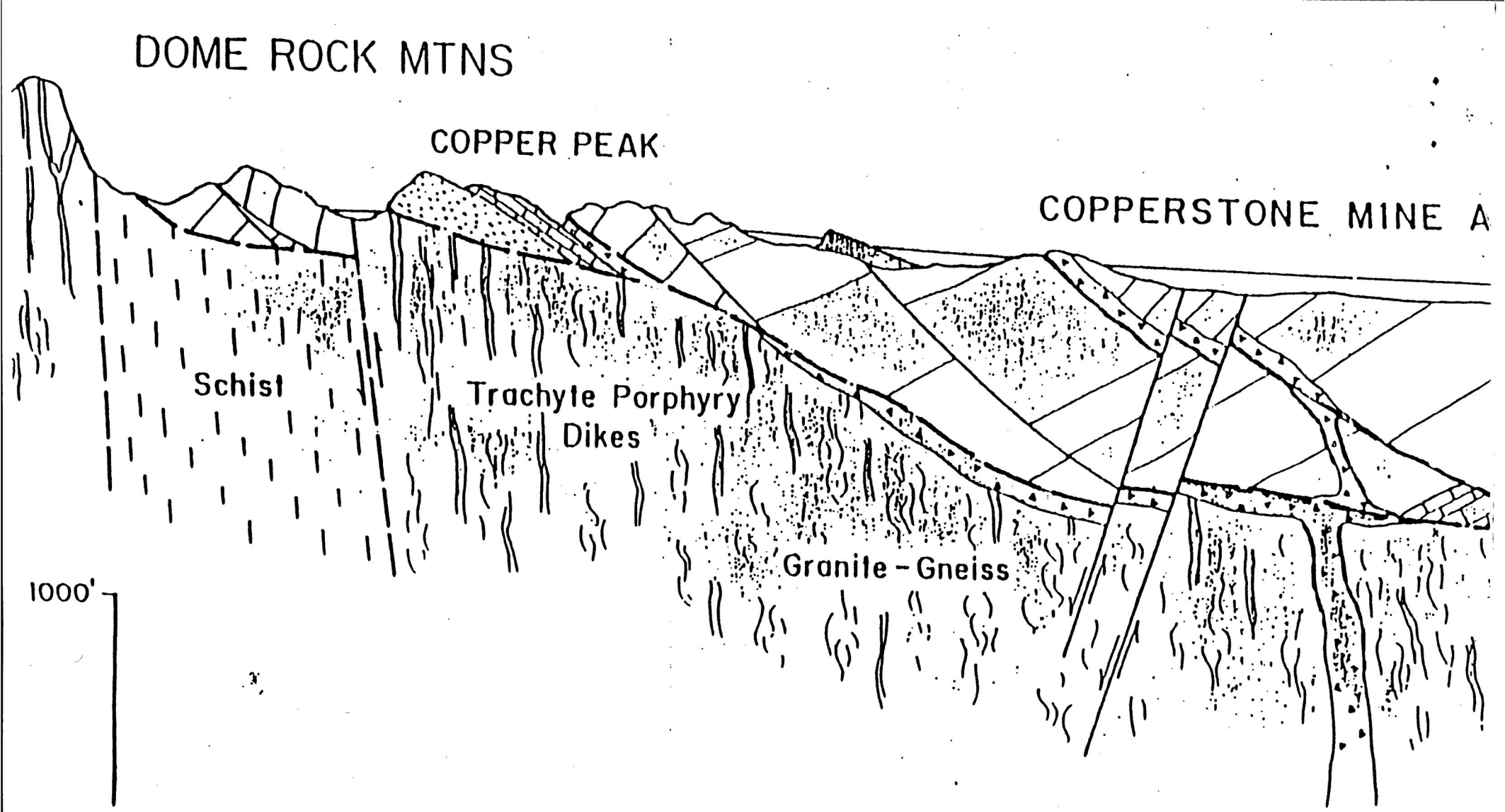
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COPPER PEAK
COPPERSTONE MINE A
Schist
Trachyte Porphyry
Dikes
Granite - Gneiss
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CAMBIOR INC.

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NOM :
NAME : Michael Gustin

COMPAGNIE :
COMPANY : CBJ - Reno

FAX :

CC :

EXPÉDITEUR (Sender)

NOM : Jean Boissonnault
NAME : Vice-président, Exploration
Vice President, Exploration

FAX : (514) 878-3324
878-4608
TÉL : (514) 878-3166

MESSAGE

Please see attached FYI.

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MBI MINING BROKERS INC.
INTERNATIONAL MINING AND MINERAL PROPERTY MARKETING

August 29,1997

Cambior Inc.
Mr. Jean Boissonnault, V.P. Exploration
Suite 850 800 Levesque Blvd.
Montreal, P.Q.
H3B 1X9

Fax: To M. Gaston Reno

Re: Royal Oak's Copperstone Gold Mine, Arizona.

Dear Jean,

As requested I have enclosed a summary report prepared by Royal Oak Mines describing their Copperstone Mine. The enclosed is provided without obligation.

Upon review of the enclosed should you wish to receive additional information and data regarding Royal Oak's Copperstone, feel free to contact the undersigned and I will make the necessary arrangements.

Yours Truly,

Bruce Young

Suite 305 - 675 West Hastings Street, Vancouver, B.C. Canada V6B 1N2 • Fax: (604) 681-6406 • Tel: (604) 681-3735

MBI MINING BROKERS INC.
INTERNATIONAL MINING AND MINERAL PROPERTY MARKETING

August 27, 1997

Attn: Jean Boissonnault,
Cambior Inc.

Ref: Copperstone Gold Deposit: Arizona

Our client, Royal Oak Mines, has requested MBI seek expressions of interest on their outright divestiture of the Copperstone gold deposit, southwestern Arizona. Open-pit to heap leach gold production occurred during 1967-92.

In 1996, Royal Oak explored the underground potential of the Copperstone property where drilling has traced the Main Zone below the floor of the open pit, 1,600 feet down dip. Examination of the ore zone and water flow rate tests have established that the deposit can be mined by underground methods and that water flow rates will be low.

Drilling has intersected several high grade gold values over substantial widths to the north of, and for up to 600 feet along strike of, the Copperstone Main Zone, including 1.55 ounces of gold per ton over 25 feet, within a relatively untested quartzitic limestone unit. The limestone unit abuts the highly altered granodiorite intrusion which hosts the Main Zone.

In early 1997, drilling established an increase in mineral inventory at the Copperstone property from 417,000 ounces of gold at year-end 1996 to approximately 509,400 ounces of gold contained in 2.7 million tons grading 0.189 ounce of gold per ton.

Both the Main Zone and the limestone unit remain open at depth and along strike and have the potential to host substantial mineralization.

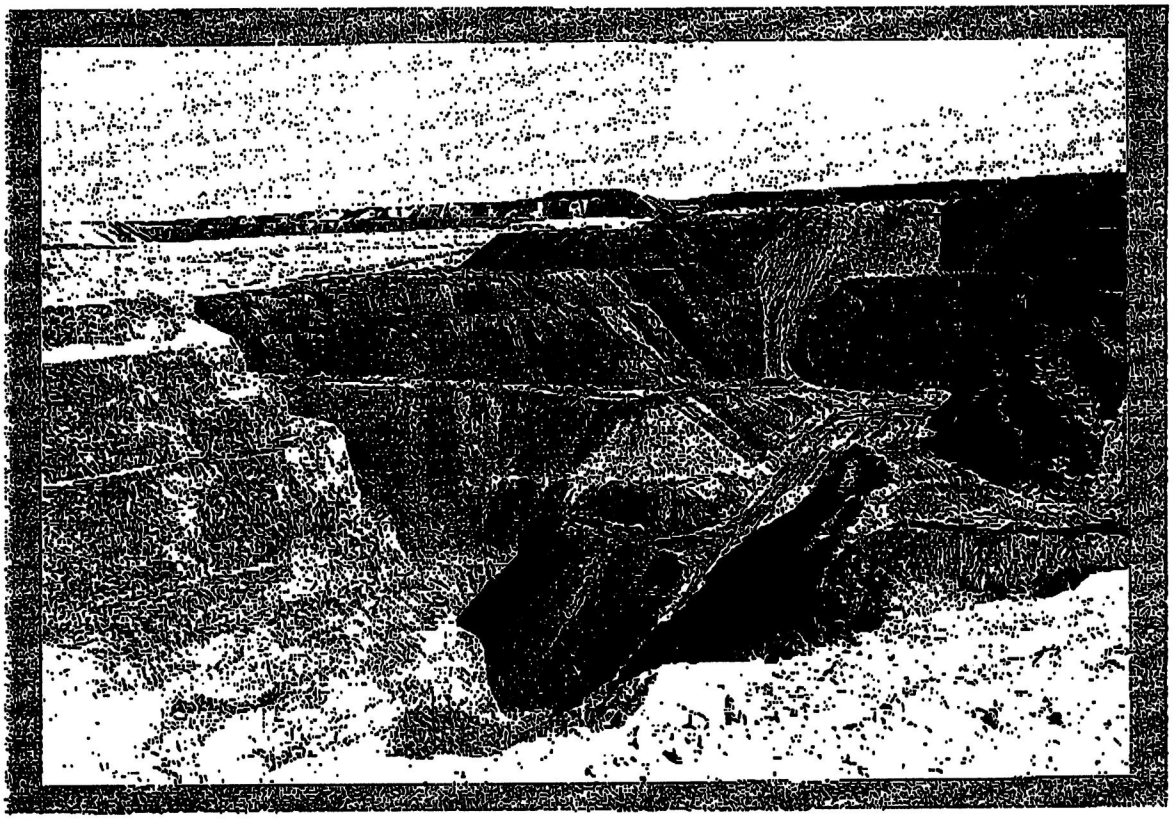
For additional information, without obligation, please contact me anytime.

Yours truly,
MBI Mining Brokers Inc.

Bruce Young
President

Suite 305 - 675 West Hastings Street, Vancouver, B.C., Canada V6B 1N2 Tel: (604)681-3735 Fax: (604)681-6406

Royal Oak Mines



Copperstone

Project Summary

June 1997

INTRODUCTION

The Copperstone mine is an exciting development project with multi-ounce gold intersections over 25 foot widths and potential for over 1 million ounces of gold mineable as an underground mine. The property was mined previously as an open pit mine and the remaining facilities simplify future development. The attached cashflow model shows that the deposit can be a profitable ongoing operation.

Copperstone is located in La Paz County, Arizona 26 km. north of Quartzite. The mine was formerly operated by Cyprus as an open pit gold mine from which 500,000 ounces of gold was produced from 6,000,000 tons of ore grading 0.1 opt. The open pit mine was closed in November 1992 and is currently in the final reclamation stage. The property, including the roads, the power system, the water system and several buildings, was returned to Mr. D. Patch upon the completion of mining and the mining lease has been terminated. Royal Oak Mines Inc. optioned the property in 1995 from Mr. Patch.

Reserves amenable to underground mining are present and are currently being drilled off by Royal Oak Mines Inc. The gold occurs in a northeasterly dipping breccia zone in volcanic rocks which contains abundant specular hematite and some traces of copper. The deposit is oxidized to the level of the current drilling where some trace sulphide mineralization occurs. A resource of 2.6 million tons at 0.23 opt containing 606,000 ounces of gold has been recently calculated from a longsection in the plane of the ore. These resources will require an underground drill program to place them in the proven-probable category, however the deposit is still open and it is expected that the reserves could exceed 1 million ounces.

A high grade zone has been discovered by recent drilling along the northwest margin of the deposit where the mineralized breccia contacts a limestone zone. Grades of over 1.0 opt are encountered in this area and have a consistent thickness of 25 feet. This mineralization occurs in a heavy hematite replacement zone that has a considerably higher specific gravity than the normal mineralized breccia. Copperstone has other exciting exploration targets including one intersection which returned 0.646 opt Au/ 15 feet that has never been followed up.

Permitting of the property, due to its having been a mine and due to low ground water flows, is likely to be quick and simple. The existing pit provides an excellent location for the collaring of a portal as it has bare rock faces close to the ore. The existing power, water, office and shop buildings will lower capital costs.

Location Map

HISTORY

Prospecting began in 1968 with bulldozer trenching by a prospector to better expose weak copper mineralization . Newmont Mining leased the property in 1975 and drilled a single 765 foot hole after running induced polarization, gravity and ground magnetic surveys. The unsuccessful hole, located at the southern end of the current Copperstone claim group, was designed to test a porphyry copper target.

The property was returned to the prospector and was subsequently submitted to Cyprus in 1980. A lease was signed after initial field evaluation and sampling indicated gold mineralization. In 1981 and 1982 conventional rotary percussion drilling on a 140 foot grid tested for the limits of the mineralization. The down dip limit for open pit mining was established and considerable drilling effort was concentrated along strike to the northwest where high grade gold-magnetite mineralization was found at depth in limestones beneath welded tuff units. To the southeast, exploration drilling found spotty mineralization extending to a large basalt subcrop. Induced polarization and ground magnetic surveys were run which outlined the gold deposit with considerable accuracy.

The entire claim block was explored in the spring of 1983 for additional Copperstone type mineralization following a detachment hosted gold exploration model. Some targets generated by this exploration were tested by shallow drill holes without success.

The proposed open pit was drilled off in 1986 by reverse circulation drilling on a 100 foot grid in the proposed pit area. A decline was started and goes from surface to approximately the bottom of the current open pit. A change of philosophy was then taken by Cyprus and it was decided to open pit the deposit.

In June 1987 stripping was started on the mine and milling commenced in mid October of 1987 at a design rate of 2,500 tons per day using a carbon-in-pulp circuit. A total of approximately 6 million tons was mined and a total of 500,000 ounces recovered from ore with an average grade of 0.11 opt for a recovery of 89%.

The operation was shut down in 1992 and the mill was removed. The mine has been reclaimed although Cypress is still treating the tailings pond discharge at the present time.

AGREEMENTS AND TENURE

The property consists of 284 lode claims and 2 state leases covering 7,018 acres and is held under a 10 year renewable lease from the Patch Living Trust. Annual advance royalty payments of $30,000 are payable to the Patch Living Trust against the following gross production sliding scale royalty.

AMOUNT	GOLD PRICE
1% GPR	<$350
2% GPR	$350 to $400.99
3% GPR	$401 to $450.99
4% GPR	$451 to $500.99
5% GPR	$501 to $550.99
6% GPR	>$551

Annual assessment fees of $28,400 are payable to the government.

Any property acquired within one mile of the property boundary will be included in the lease and Royal Oak has the first right of refusal to buy the Patch Living Trust interest in the property.

GEOLOGY

Regional Geology

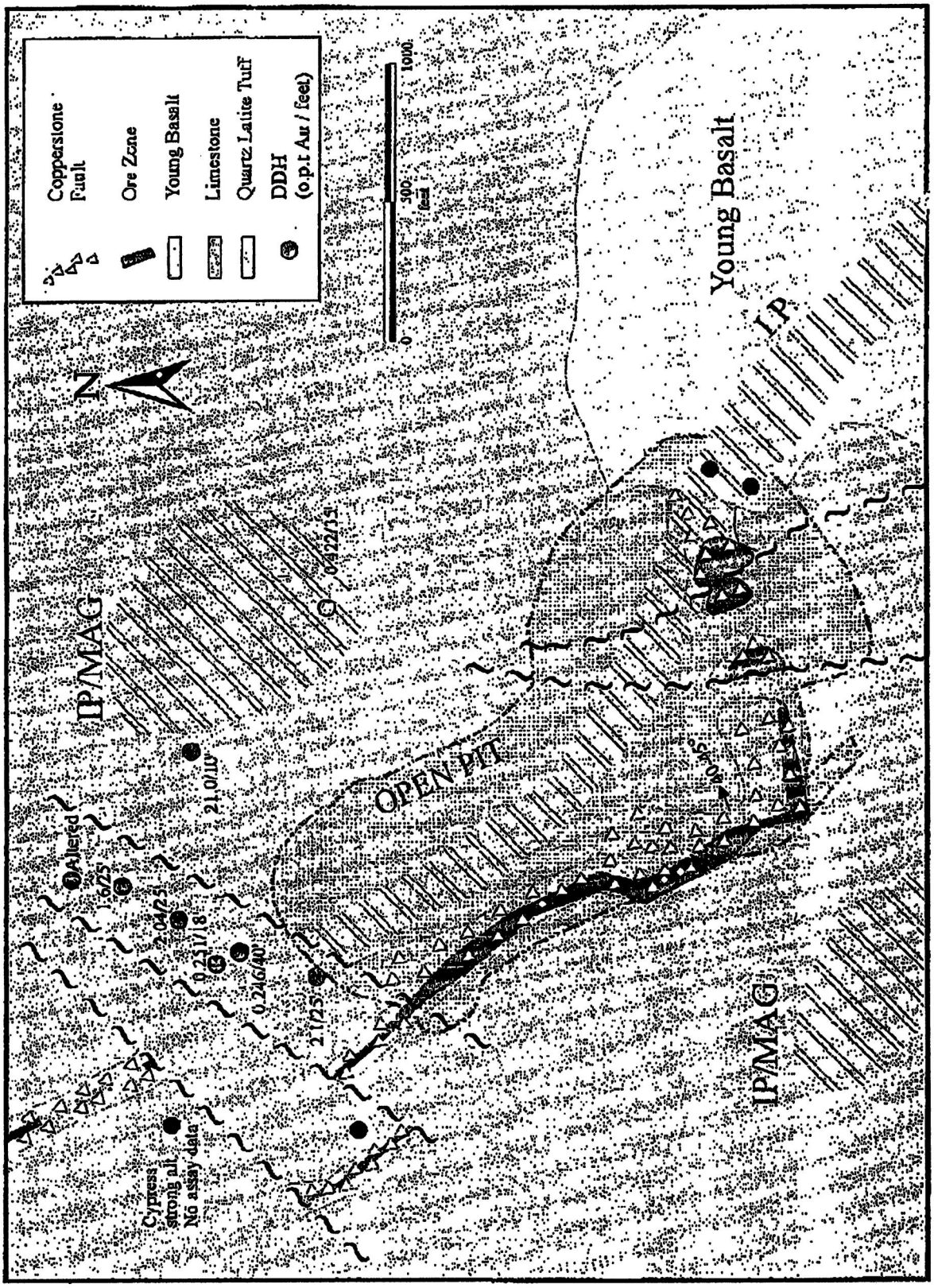
The oldest rocks in west-central Arizona are Precambrian metamorphics, approximately 1.7 billion years old. They are deformed and intruded by several generations of plutons. These rocks are unconformably overlain by a sequence of Palaeozoic carbonate and clastic strata. Mesozoic rocks include volcanic and plutonic rocks of Jurassic age and thick sections of clastic rocks which are intruded by late Cretaceous plutons. Metamorphism affected the region after deposition of the Mesozoic volcanics and sediments. Precious metal mineralization occurred before and after mid-Tertiary structural dislocation by low angle detachment faults of upper plate rocks from metamorphic core complexes. Basin and range faulting occurred in late Tertiary time.

Local Geology

The Copperstone gold deposit is located on flat, dry, sandy terrain with several small knolls up to 40 feet high and prominent longitudinal sand dunes. Outcrop is scarce and occurs on the knolls with broader areas of caliche cemented rubble around the outcrops. Unconsolidated sands and gravels thicken to several hundred feet in all directions away from the outcrop areas. The alluvium is old river channel sediment displaying cut and fill channel structures where exposed in bulldozer cuts. Igneous and metamorphic rocks including granite gneiss, schist, quartzite and amphibolite from Precambrian to Mesozoic age outcrop at the southern end of the Copperstone claim block. A low angle detachment fault separates these core complex rocks from an upper plate consisting of minor limestone and quartzite overlain by a thick sequence of Jurassic age quartz latite welded tuffs and breccias. The upper plate sequence has been affected by weak greenschist facies metamorphism in Mesozoic time The major low angle fault probably lies beneath the Copperstone gold deposit but has not been confirmed by drilling to date.

Mineralization

The deposit originally outcropped as three small exposures of mineralized breccia and subcropped beneath shallow alluvium. The ore horizon and breccia strike northwest and dips at 30 degrees to the northeast beneath a thickening alluvial cover and the hanging wall volcanic rocks. The breccia extends for 3,000 feet in strike length and is known to continue beneath the cover of a younger vesicular basalt



Royal Oak Mines

Coppersione Simplified Geology

flow. The strike of the mineralized zone is marked by an I.P. signature which continues beneath the young basalt. The deposit is open down dip where it has been intersected approximately 2000 feet from the surface outcrop. The breccia is generally 50 feet thick.

The Copperstone gold deposit is hosted by welded quartz latite tuff breccias and laminated welded tuffs. Formational breccias, which occur within the welded tuffs, appear to be formed as surface flow agglomerates with other breccia textures attributed to later hydrothermal mineralization. The northwest margin of the deposit lies at the contact of the latite tuffs and a limestone unit. The limestone is mostly replaced in this area by hematite and contains the highest grades in the deposit.

Severe faulting affects the Copperstone deposit area. Drilling has shown fault zones ranging from a few inches to 50 feet thick. The faulting is probably low angle listric faulting formed during flexing of the upper plate volcanics as movement occurred on the detachment fault. Later high angle faulting is of the Basin and Range type. North-south high angle faults cut the mineralization uplifting the down-dip sections of the deposit.

The gold mineralization occurs generally with low grade copper mineralization and abundant hematite but is not necessarily present with the copper-specularite mineralization indicating that the gold mineralizing event may have occurred at a later time or as episodic hydrothermal events . Adularia, siderite, calcite, geothite, chrysocolla, malachite, chalcopyrite, barite, pyrite, magnetite, specularite and hematite all occur within the ore zone. Mineralizing solutions also formed local zones of alteration including argillization and sericitization, chloritic veining and chalcedonic silicification. The deposit is oxidized to the depths of the current drilling and the main characteristic of the ore is the earthy red hematite.

Gold occurs as small flakes ranging between 4 and 40 microns in size with some coarse gold plates ranging from 50 to 150 microns. Most of the gold is free but a small amount is locked with quartz and iron hydroxides.

Royal Oak Mines Inc.

Copperstone
Longitudinal Section in Plane of Mineralization
1997 Drilling

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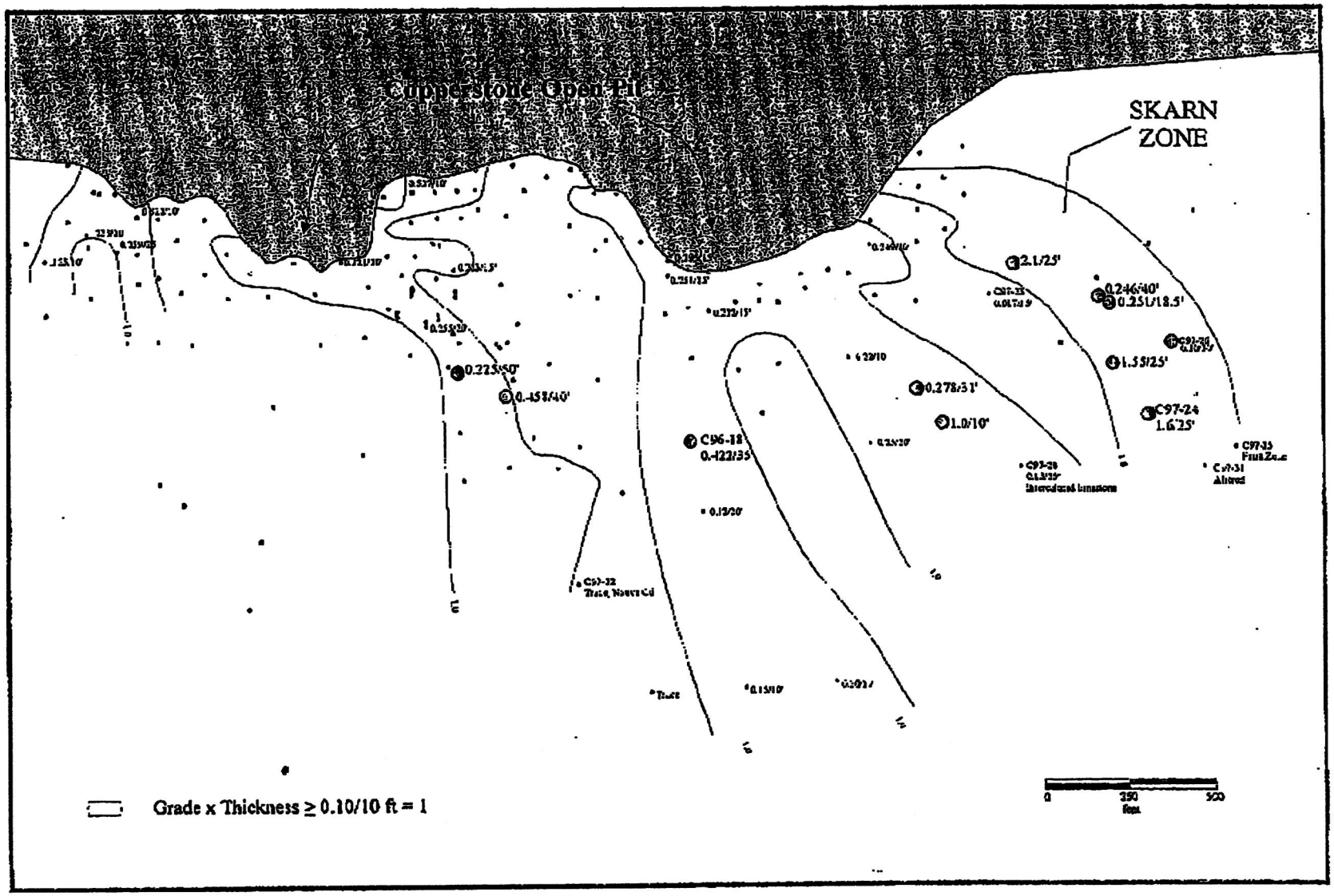


Reserves

Copperstone Main Zone: Statement of Resource

Block	Area (ft²)	Grade (opt Au)	Thickness T.W. (ft.)	Tonnage (tons)	Ounces Contained
A	197,968	0.149	12.34	222,084	33,091
B	390,625	0.168	15.6	553,977	93,068
C	951,815	0.216	13.43	1,162,080	251,009
D	401,875	0.335	17	683,188	228,868
			TOTAL	2,621,329	606,036
			GRADE	0.231	
			TRUE WIDTH (WEIGHTED)	14.70	

Criteria considered for resource calculation:
1) Tonnage Factor = 12, except Block D = 10
2) A cut-off of 0.04 opt Au over a minimum true width of 10 feet.
3) A 150 ft. Area of influence around the resource blocks.
4) Assays Uncut, except Hole C95-11- cut to 2 oz.

Exploration Possibilities

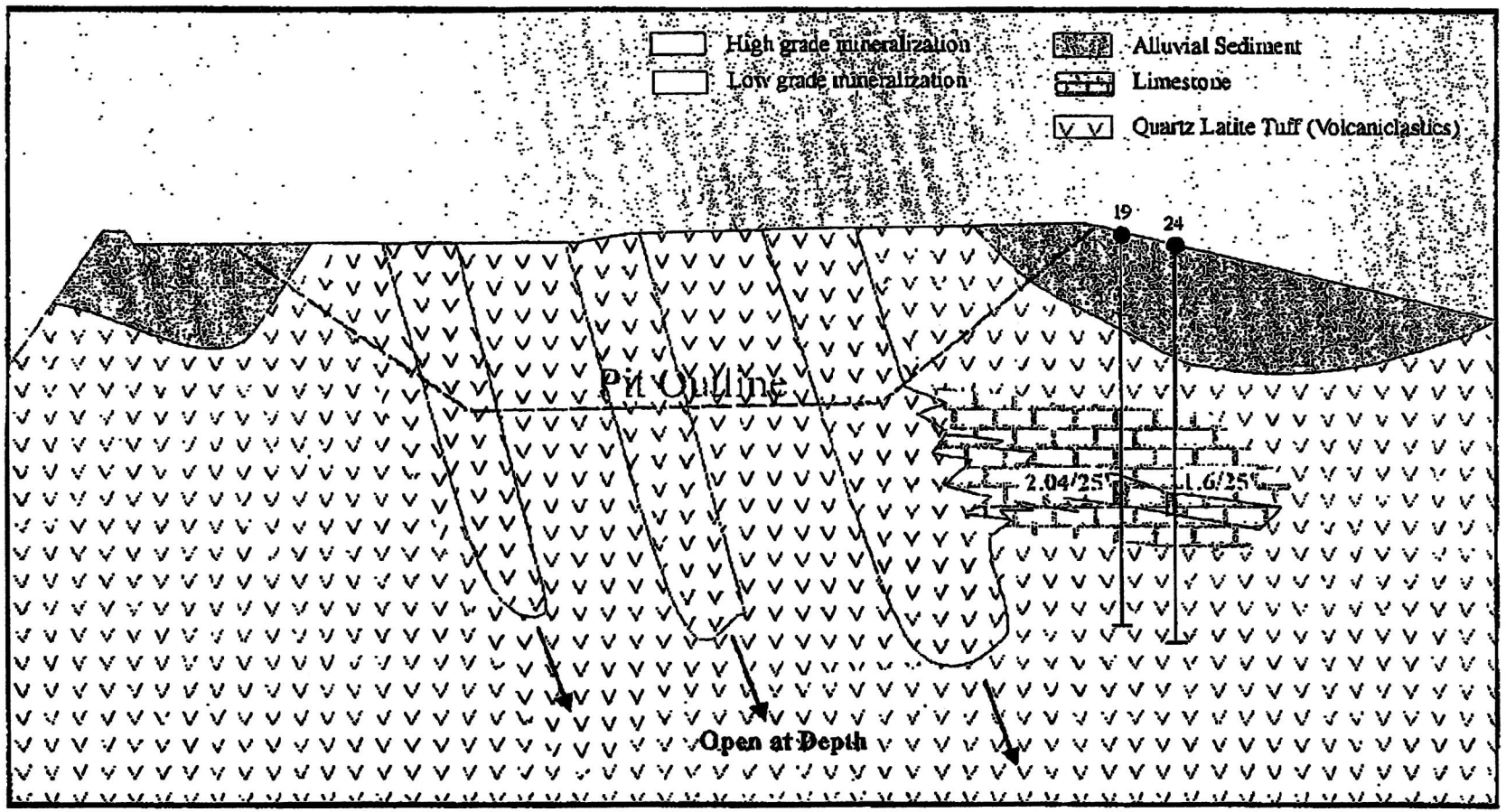
a) Property

Potential for 1 **million ounces** in the main orebody is considered excellent. Additional work should be used to evaluate the following prospective targets:

- A footwall structure below the Main Zone which has been the subject of very little exploration. Limited drilling has returned **0.646 opt Au over a core length of 15 feet, and 0.246 opt Au over a core length of 40 feet.**

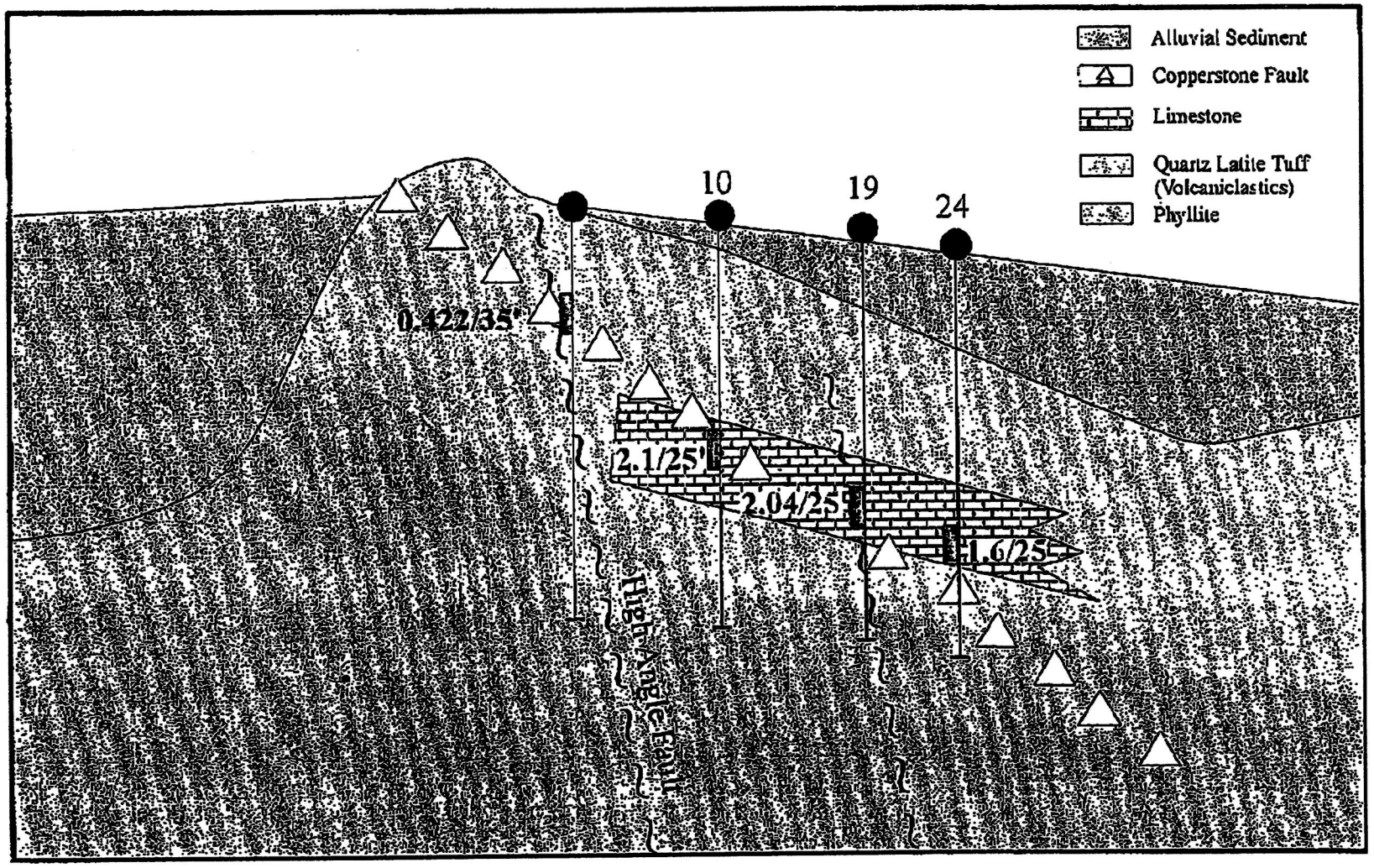
Royal Oak Mines Inc.

Copperstone
Idealized Longitudinal Section



Royal Oak Mines Inc.

Copperstone Schematic Cross Section



- Untested coincident IP chargeabilitiy and magnetic anomalies in the vicinity of the Copperstone pit, and in particular the linear IP expression trending southeast and along the strike of the deposit.

- The mineralized shoots remain open along strike and at depth and should be drill tested in order to build tonnage and expand the resource to 1 million ounces. The very prospective limestone unit remains to be drilled off and should be traced by drilling at depth and to the northwest.

- Satellite targets including a) Copper Peak and b) the high ground located 1.5 miles east of the pit should be investigated. These targets show alteration similar to Copperstone and shallow drilling has returned gold values up to 0.05 opt Au over moderate widths.

b) Regional

There are a number of interesting gold properties within trucking distance of the Copperstone property. These properties could provide satellite ore bodies that would provide additional millfeed for a mill at the property.

The region covering several placer prospects near Copperstone show strong hardrock gold potential. These include the Copper Bottom, Kellogg and Yellowdog Mines and the Goodman Bell of Arizona, Isreal and Desert Mines. As well, a single, deep drill hole on the Julian property returned 1.5 opt Au over the last 8 feet of the hole. No additional drilling has been carried out.

The Stray Elephant property, located 15 miles south of Copperstone, near Quartzite, contains 12 million tons of surface, oxide copper at a grade of 0.57% Cu. The deposit has been traced by shallow drilling over a strike length of 0.8 mile. It remains open at both ends and might provide a second operation that could be handled using the same infrastructure and administration.

MINING

Listed below are some of the key points regarding the mining potential at Copperstone. Royal Oak has completed no mine design work on the property and the following is based on a quick preliminary assessment of the project.

The open pit has a depth of 560 feet and very steep slopes on the northeast wall however there are good locations for a portal for underground access at a depth of about 200 feet from the pit rim. The ramp would use the wide turning circle of the existing ramp and would ultimately be 4,500 feet long. Prior to production an additional 2,500 feet of development would be required. An underground drill program would be needed to bring the resource to a reserve status and this would allow a good assessment of the underground mining conditions to lend confidence to the mining method selected. The cost of the development work and the drilling is estimated at $4 million. No further open pit mining is contemplated as the current pit has a 10:1 strip ratio.

The quartz latite tuff appears to be a very competent rock and the mining conditions are anticipated to be fair. Dilution of at least 10% should be anticipated however and it should be anticipated that cut and fill using waste rock and sand would be the principal mining method. All inclusive costs are expected to be in the $US 35 per ton range.

This mining method, given 5 to 6 producing headings and a similar number on fill cycles or in development should provide mined tonnages of 1,000 tons per day. Mill throughput would therefore be in the range of 750 to 1000 tons per day depending on scheduling.

Assuming a $US50 all in cost for production, a 90% recovery and a $US400 price for gold , the cut-off "mined grade" will be approximately 0.138 opt. slightly below the grade of the lowest grade ore block.

The mining resource, at 10% dilution at 0 grade and an extraction factor of 90%, would then be 2,595,114 tons at a grade of 0.21 opt. with 545,000 contained ounces.

Permitting

The mining lease was surrendered by Cyprus when the open pit mining was finished in 1992. Currently permits to allow exploration drilling on the property are in place.

Royal Oak, in anticipation of potential issues in permitting an underground operation, have done flow tests on the aquifer to determine if water flow rates would cause problems to underground mining. The tests well data indicated minimal flow rates that could be easily handled by an underground operation. The aquifer is not a major one nor does it supply water to any large city and therefore the permitting of the mine will be relatively simple.

It is estimated that the permitting of the property for underground mining could be done within 9 months as it was a previous producer and has a very low impact both on the surface and on the water resources.

MILLING AND METALLURGY

Royal Oak has not done any metallurgy on the ore however there are some facts available from the previous work. The overall recoveries achieved by Cyprus from their operation was 89% which is low for a typical CIP process however they did heap leach some low grade material and this has apparently been included in the overall recovery numbers. There is some indication from the mineralogy that there may be some encapsulation of the very fine gold within quartz or hematite however there was a lot of speculation that, due to the short retention time of the mill (said to be 16 to 24 hours) that insufficient time may have been available for complete gold dissolution. Royal Oak has not seen any metallurgical studies on the deposit.

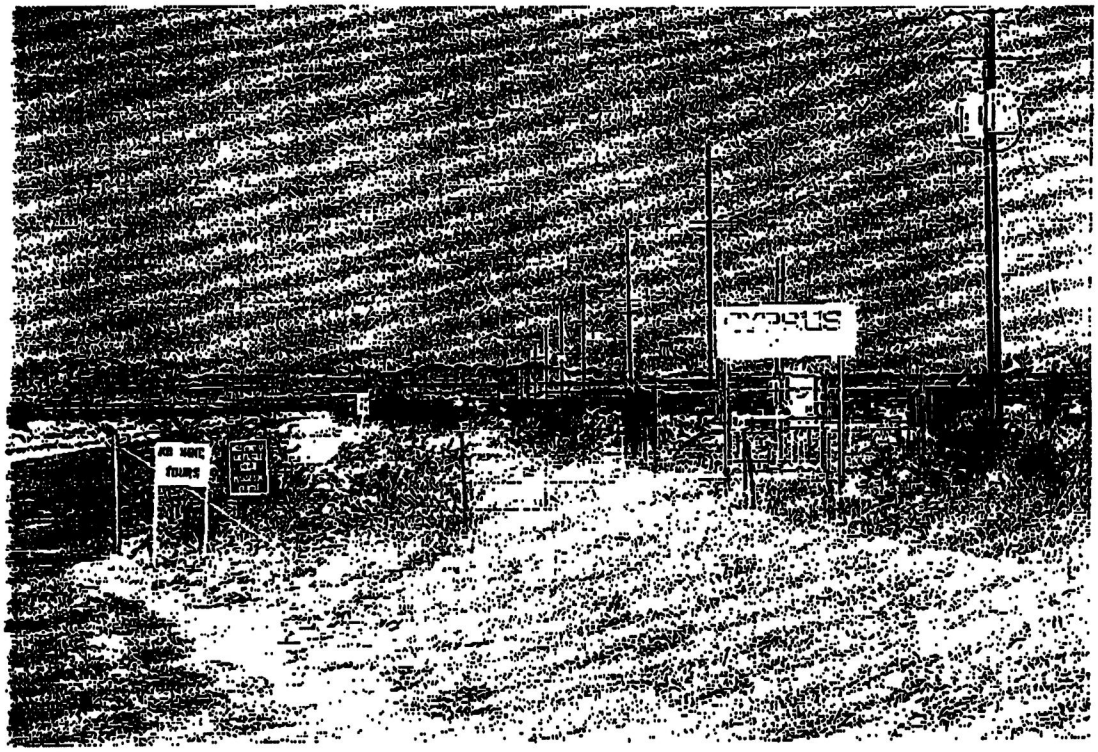
A rough estimate of the capital cost of a mill has been set at $21 million to allow the accompanying cashflow to be made. The roads, the auxiliary buildings and the power and water lines, sufficient to service the open pit operation, are still in place and active and are likely to be more than needed to service the underground operation as it will probably process a lower tonnage on a daily basis. In addition the actual mill that was at the property is apparently sitting in a bone yard and is still owned by Cyprus who might be persuaded to part with it at junk prices.

Copperstone Financial Summary

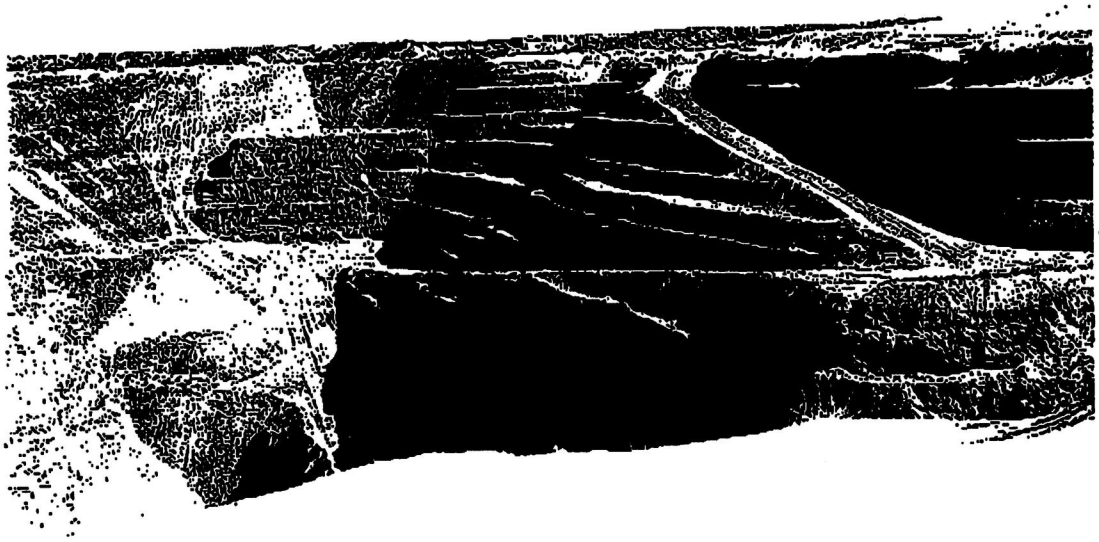
Years	0	1	2	3	4	5	6	7	8	9
Revenue Drivers										
Gold ounces sold at spot	0	37,489	74,977	74,977	74,977	74,977	74,977	54,012	47,020	31,430
Spot per ounce of gold in US$	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400
Total gold revenue	$0	$14,995,440	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$21,604,992	$18,807,840	$12,571,949
Cost Drivers										
Mining										
Mineralized material at beginning of year	2,883,460	2,883,460	2,706,960	2,353,960	2,000,960	1,647,960	1,294,960	941,960	588,960	235,960
Grade for mineralized material	0.210	0.210	0.209	0.204	0.198	0.190	0.178	0.156	0.147	0.146
Gold contained in mineralized material	604,950	604,950	563,296	479,988	396,680	313,372	230,064	146,756	86,742	34,498
Total tons mined during year	0	176,500	353,000	353,000	353,000	353,000	353,000	353,000	353,000	235,960
Total cost per ton mined	$0	$35	$35	$35	$35	$35	$35	$35	$35	$35
Total expensed tons mined	$0	$6,177,500	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$8,258,600
Processing										
Tons ore processed	0	176,500	353,000	353,000	353,000	353,000	353,000	353,000	353,000	235,960
Cost per ton processed	$0.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00
Total expensed tons processed	$0	$1,765,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$2,359,600
Gold head grade of tons processed per ounce	0.000	0.236	0.236	0.236	0.236	0.236	0.236	0.170	0.148	0.148
Gold recovery percentage	0.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%
Total gold ounces recovered	0	37,489	74,977	74,977	74,977	74,977	74,977	54,012	47,020	31,430
General and administrative costs in fixed amounts - minesite	$0	$882,500	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,179,800
Cash cost per ounce gold in US$	$0	$235	$235	$235	$235	$235	$235	$327	$375	$375
Capital additions:	$4,000,000	$21,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$0	$0	$0
Forecast Cash Flows:										
Revenues	$0	$14,995,440	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$21,604,992	$18,807,840	$12,571,949
Expenses	0	8,825,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	11,798,000
Gross profit from operations	0	6,170,440	12,340,880	12,340,880	12,340,880	12,340,880	12,340,880	3,954,992	1,157,840	773,949
(less) capital spending	(4,000,000)	(21,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	0	0	0
Net cash flow after capital spending	($4,000,000)	($14,829,560)	$11,340,880	$11,340,880	$11,340,880	$11,340,880	$11,340,880	$3,954,992	$1,157,840	$773,949

Net Asset Value	$43,761,591
NPV at 8%	$25,477,805
IRR	46.09%

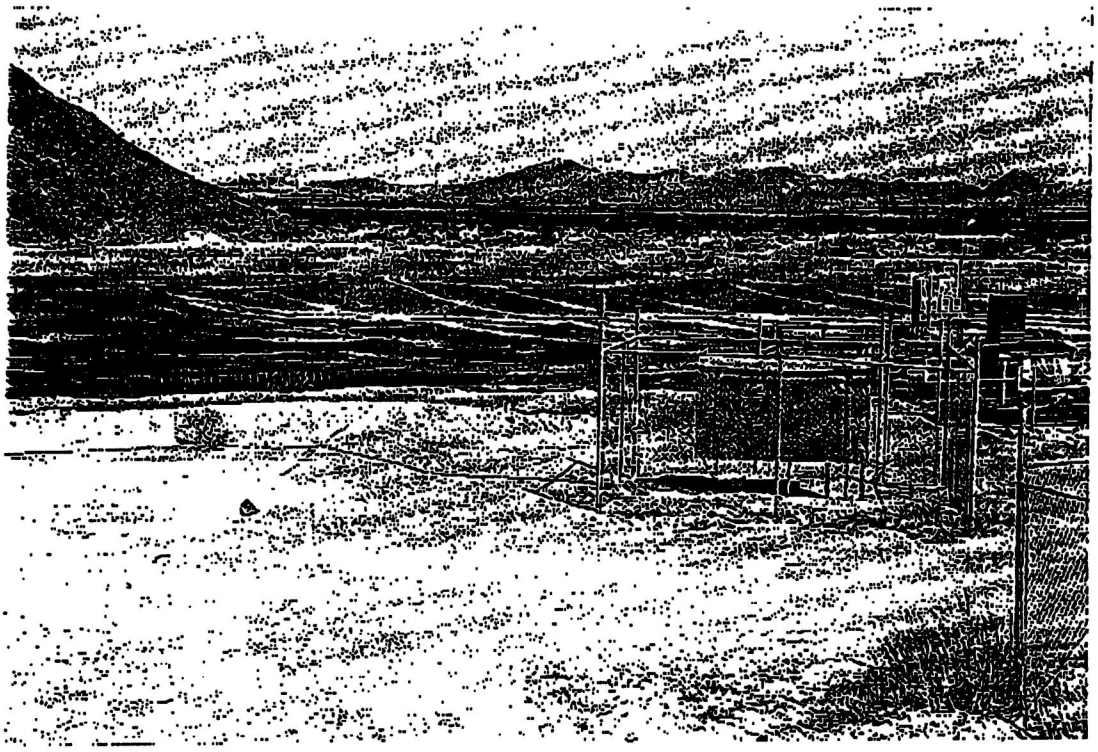
NOTE: THIS MODEL ASSUMES A BLENDED FEED OF SHOOTS C AND D FOR THE FIRST 6 YEARS (2,029,794 TONS AT 0.236 OPT.) AND A BLEND OF SHOOTS A AND B FOR THE FINAL YEARS (863,000 TONS AT 0.148 OPT)



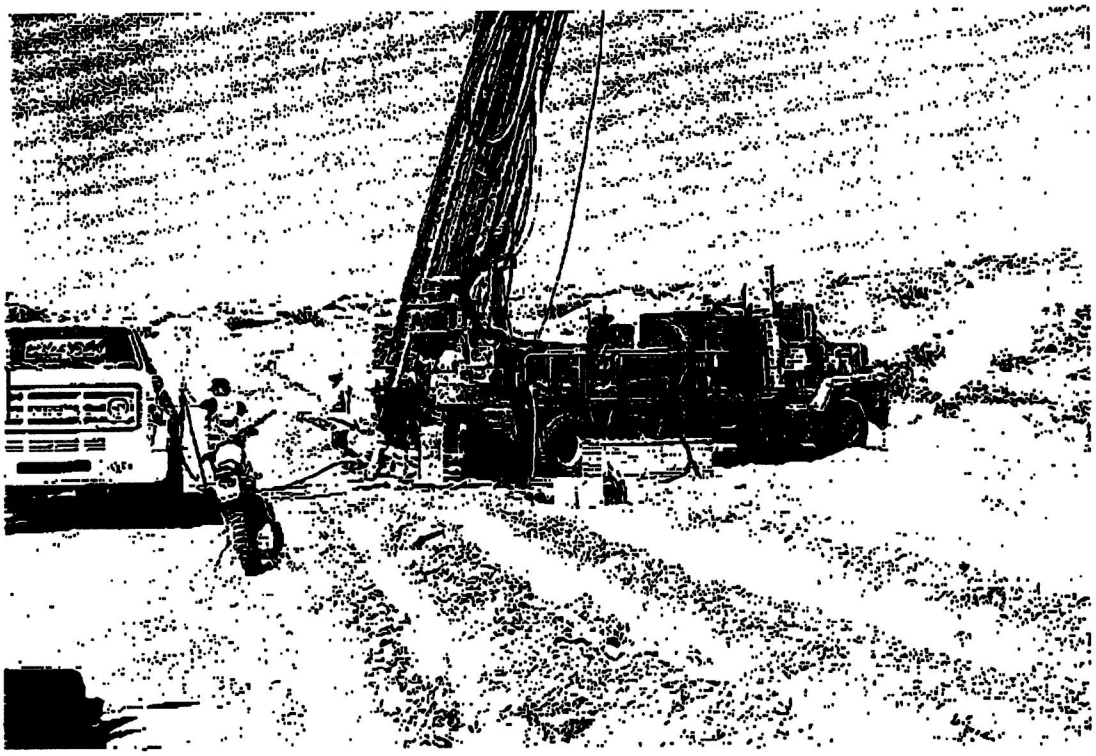
Entrance to Mine showing power-line



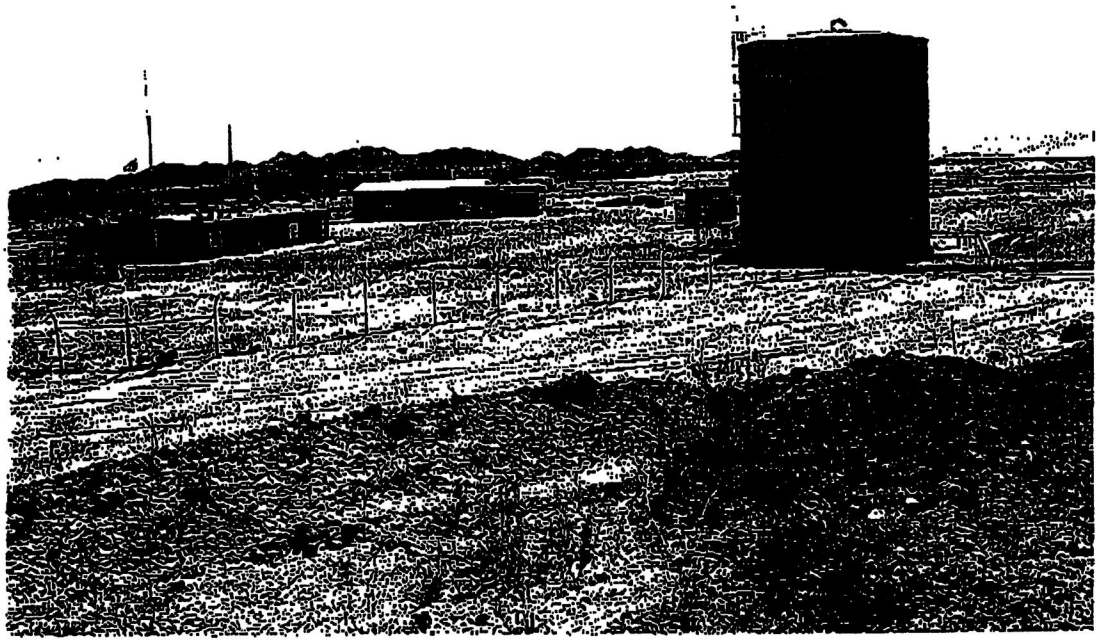
Open pit looking SSW, showing ramp access within the pit



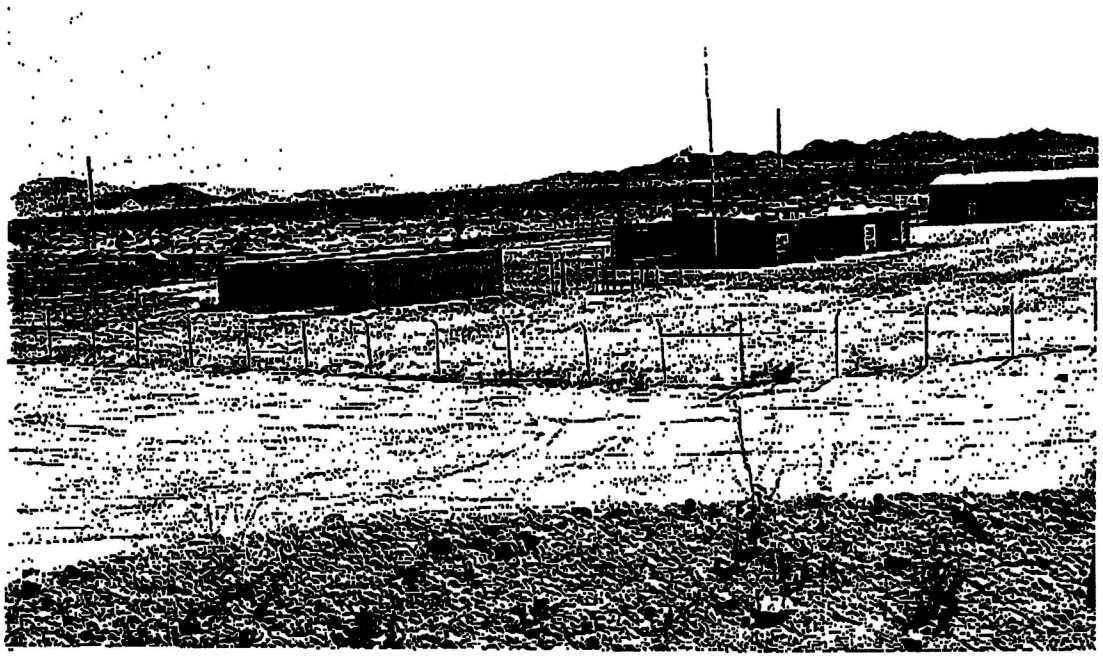
Copperstone tailings empoundment.



R.C. drill rig.

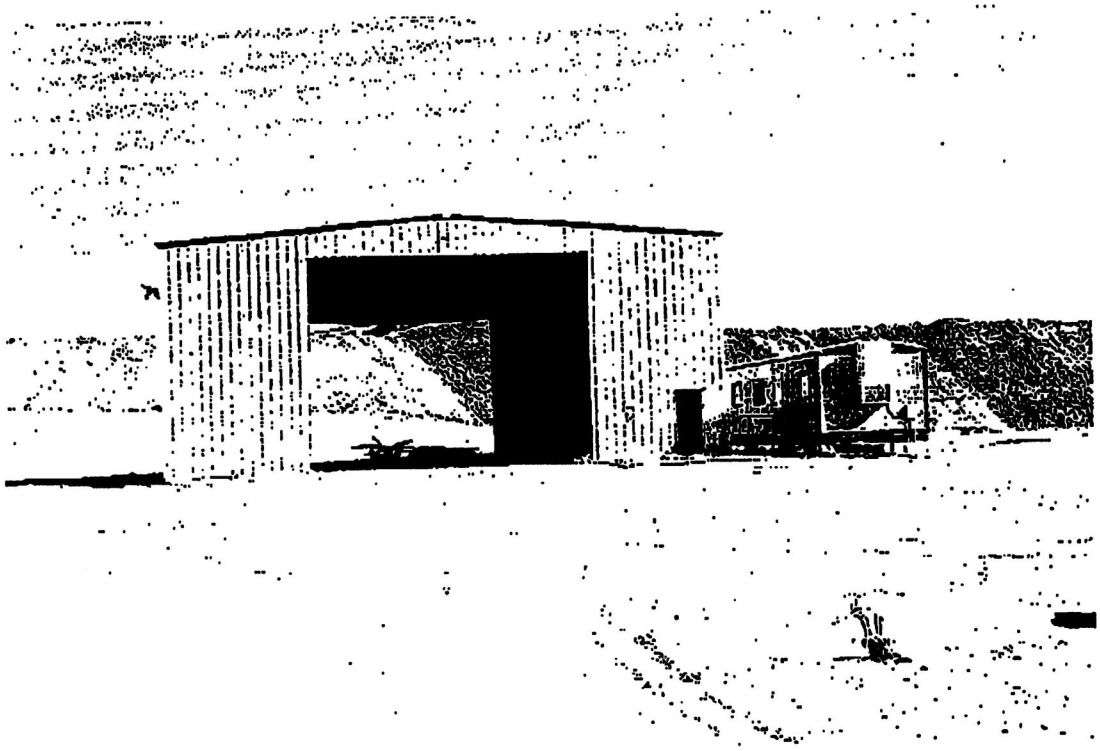


Copperstone Minesite showing office, workshop and water tower.



Copperstone Minesite showing storage containers and office.

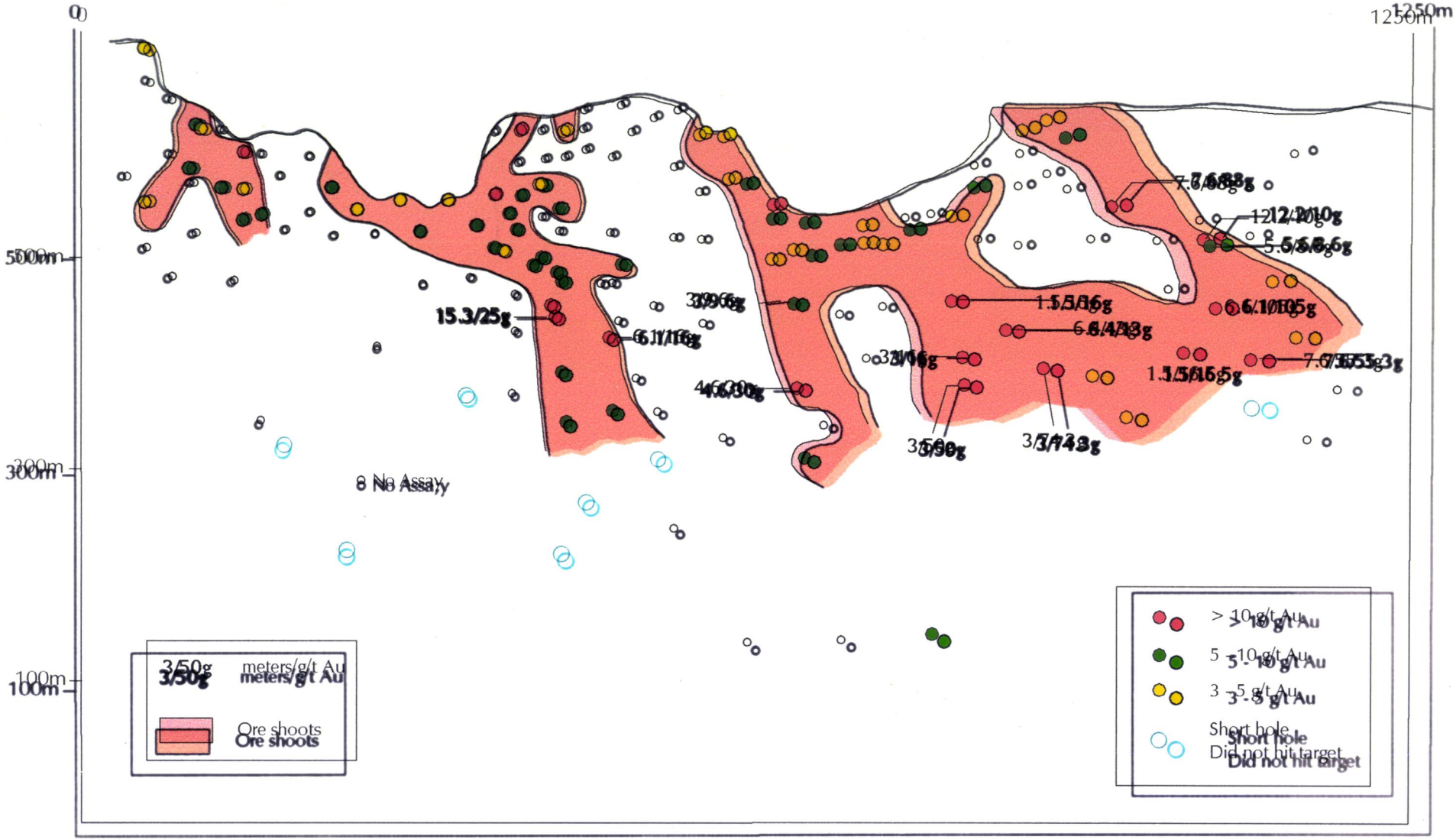
Copperstone office trailer.

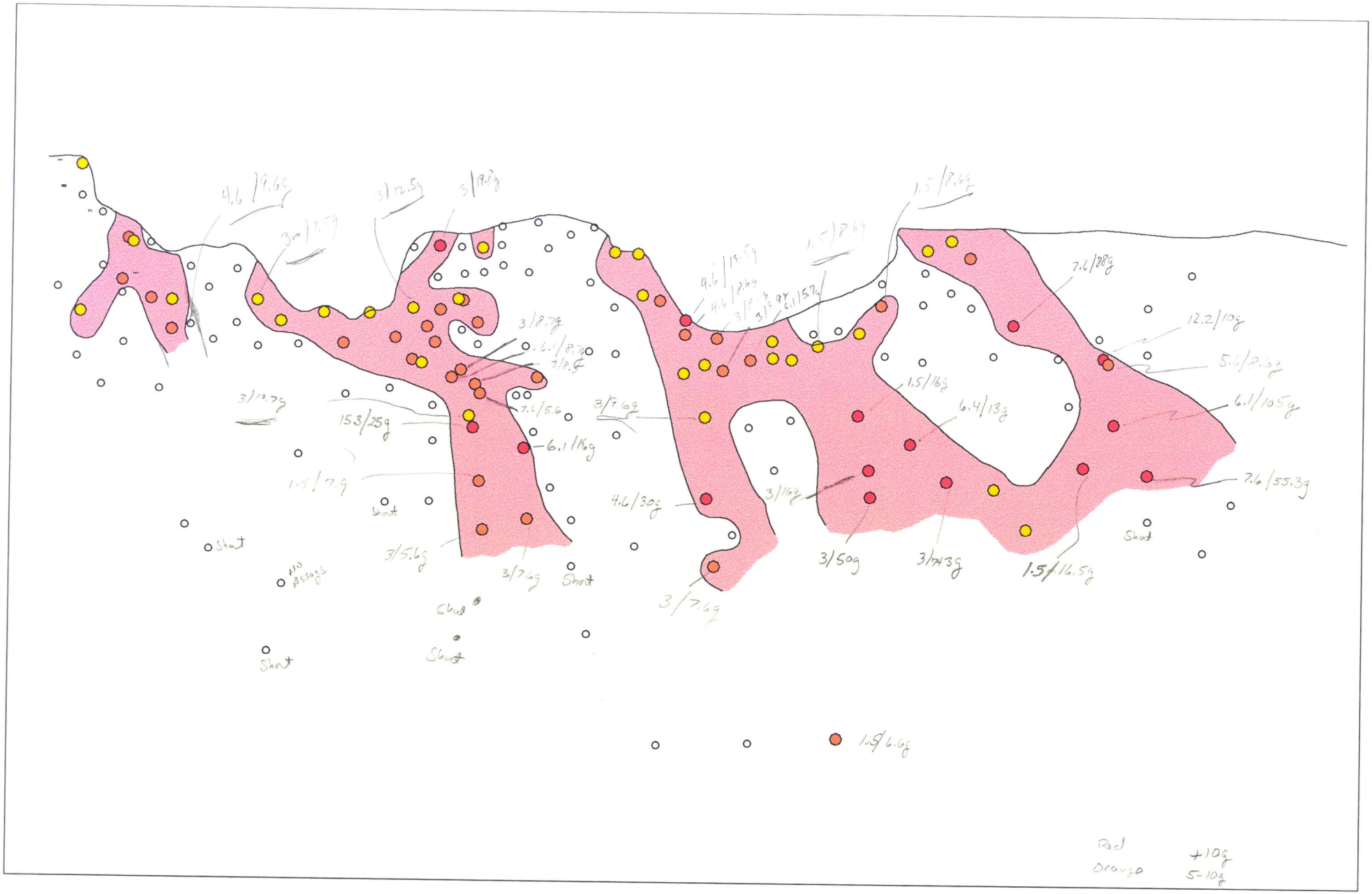


Storage shed and trailer.

Copperstone Longs Section 210

(Section in plane of structure)





Red +10g
Orange 5-10g
Yellow 3-5g
Blue O Shaft hole did not hit target.

// ore shoots.

3/50g = meters/grams

DALE G. ARMSTRONG
Consulting Geologist
1525 E. Lind Rd.
Tucson, Arizona 85719
USA
Registered Geologist Telephone: (602) 326-1577

February 14, 1995

COPPERSTONE MINE REVIEW - LA PAZ Co., ARIZONA

The Copperstone mine, Figure 1, was in production by Cyprus Mining Co. from November, 1987 through March, 1993. Total production from Copperstone yielded 6.3mm tons of ore grading 0.088 opt Au. The gold is present as coarse to fine particles of native gold mixed with various oxides of iron and copper. The host lithologies are the Moon Mtn. volcanics and sediments of Jurassic(?) age. A mild greenschist facies metamorphic overprint is present as a result of late-Tertiary extensional tectonics. Alteration of these rocks is seen as sericitization, bleaching, and minor argillization. The gold mineralization is generally confined to a zone trending N25°W that dips approximately 20°-40° northeast. The zone is defined by a 0.02opt Au envelope within which the higher grade gold occurs. Previous investigators believed that the mineralization and alteration were controlled by a "low-angle Listric fault" that is a portion of the Moon Mountain Detachment Fault thought to exist at depth.

Drilling by Cyprus during the life of the mine resulted in the completion of more than 450 reverse circulation and core holes. The majority of these were within the limits of the ultimate pit design. However there are many which were drilled along "trend" and away from the now pit limits that encountered significant gold values. This review focuses on the potential gold resource that was not exploited by Cyprus. Both underground and open pit mining methods were considered and are discussed below.

General Geology

The regional geologic setting in this part of Arizona is defined by wide-spread detachment faulting which separates the footwall Precambrian-dominated terrane from the hanging-wall Jurassic through Tertiary terrane. The hanging wall rocks are regionally metamorphosed to lower or middle greenschist facies while the footwall rocks exhibit several metamorphic facies. The structures common to the hanging wall are listric-normal faults which are over printed by basin and range systems having considerable offset.

The hanging-wall(?) stratigraphy at the Copperstone Mine is seen as Jurassic volcanic ignimbrites or quartz latites, which are overlain by mid-Tertiary(?) monolithic and polylithic breccias of both sedimentary and volcanic origin. All of these units are involved in the mineralizing system. No structural feature was observed separating these two lithologic packages during the examination of rocks in the open pit. It may be completely obscured by alteration or is not present as a single well-defined break. The majority of the alteration and mineralization is contained within one of the breccia units; probably the polylithic breccia. The genesis of this breccia is unknown. It

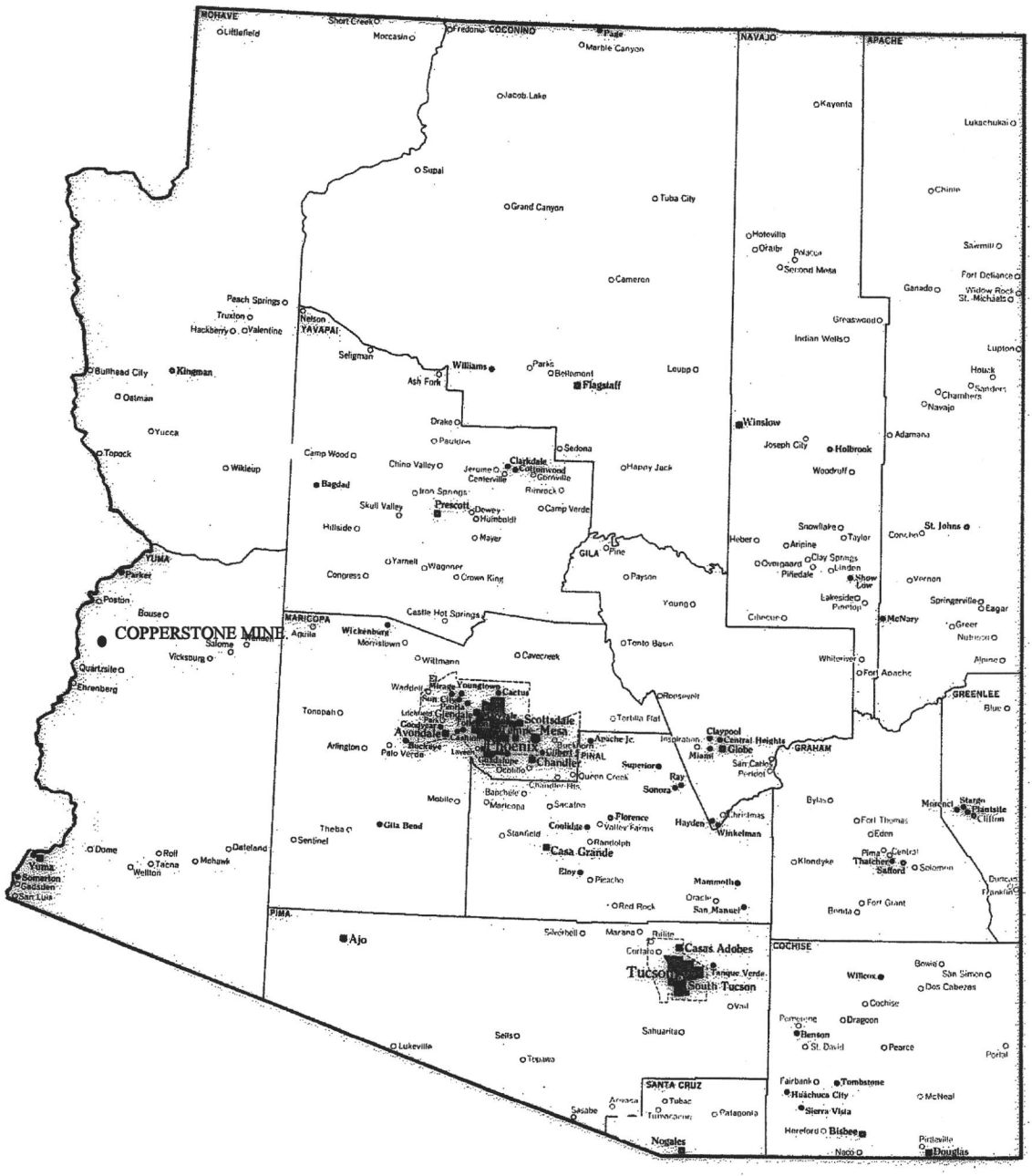


Figure 2. Location map for the Copperstone Mine.

seems to average about 50 feet thick and probably has a strike length greater than 3000 feet. This unit may be a thick fault breccia. There is an obvious east-dipping alteration envelope consisting of hematite, copper oxides, minor quartz, sericite, and chlorite which may be controlled by an older structure or the polylithic breccia. The drill data indicates that the gold mineralization is conformable with this alteration.

Numerous high-angle faults are visible within the area of mineralization. They may have helped in the localization of some or most of the high-grade gold zones. At the very least they helped with the overall ground preparation prior to mineralization. These features will be discussed further in the section on underground potential.

Open Pit Potential

The open pit potential has probably been totally eliminated because of the placement of the site facilities by Cyprus. Figure 2 is a drawing of the current site plan as drawn by Santa Fe Pacific Mining during their 12 month review and evaluation of the property. This drawing shows all of the dumps, heaps, buildings, and open pit configuration as of this report. Unfortunately the arrangement of the site layout has most of the obstructions along the mineralized trend as well as in the hanging-wall. Pit expansion in any direction would require the relocation of a majority of the site facilities. Drilling indicates that gold mineralization extends both northwest and southeast along trend. This unmined resource is not large enough or of high enough grade to pay for the relocation of the site facilities.

Underground Potential

The mineralization of most interest is that which is reflected by the drill holes in Figures 3-6. These intercepts presented are from a review of the entire data set of 450+ holes. They represent the gold zones that were not exploited by the Cyprus mining. The minimum values presented in these drawings is 5 feet of 0.15opt Au. The majority of the unmined intercepts are located in the down-dip direction of the main gold trend, i.e. northeast of the present pit and under the waste dumps.

These mineralized intercepts are intriguing in that there are a number of them greater than 10 feet of 0.25 opt Au. The obvious problem is that these intercepts are scattered throughout the "gold trend." There is no obvious control for this type of mineralization that can produce a continuous and minable block of ≥0.25 opt Au. Numerous cross sections, long sections and level plans were generated by MinTec, at my request, from the drilling database. These sections were used to review all possible scenarios for high-grade gold control. As an example, sections were constructed at oblique angles to the established trend of low-grade gold in hopes of finding a "rake trend" of high grade. The high angle fault system which intersects the shallow dipping polylithic breccia should form a rake that pitches within the breccia plane at an angle oblique to the true dip of the breccia. It was thought that this raking intersection may be responsible for some of the high-grade mineralization. These rake directions were calculated based on drill hole data in conjunction with production records for the various benches. Level plans were also used to construct high-grade projections from drill and production data. The result of these investigations shows no "secondary" oblique controls for the high grade gold intercepts with any lateral continuity. These gold-rich zones seem

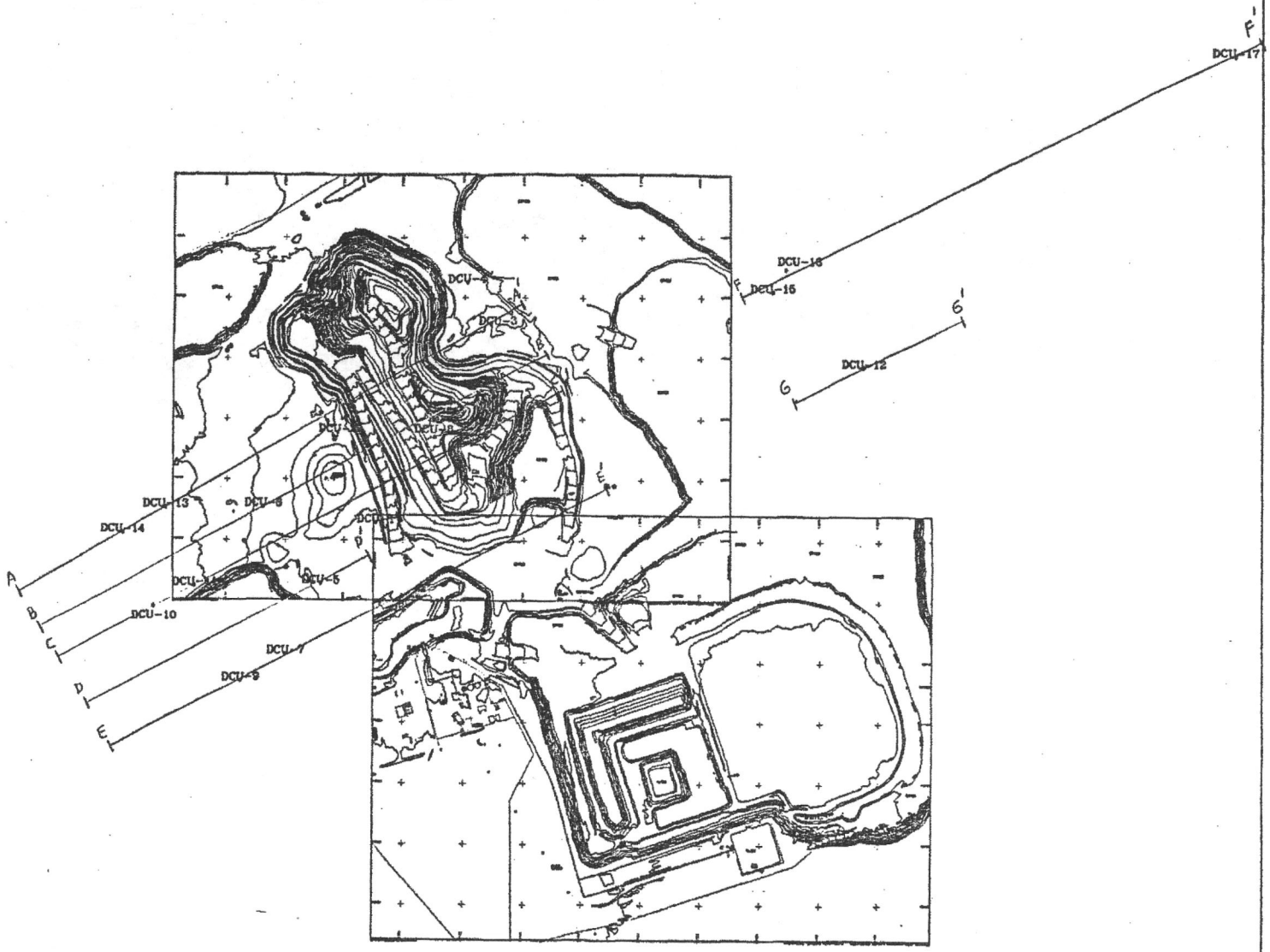
to be isolated rod shaped pods or geologic-scale "nuggets" contained within the 0.02 opt gold envelope.

This deposit-scale nugget effect is not too surprising since there is a size distribution of gold from a few microns up to a few millimeters. These nugget effects are undoubtedly responsible for part of the seemingly random distribution of the high grade zones. The degree to which the coarse gold has skewed the data set is unknown. Drilling was completed on a grid with 70 foot centers. This is probably insufficient drilling for a rigorous high grade study, however the results should be at least partially indicative of a continuous high grade gold system if one exists.

There does not seem to be sufficient potential for an underground economic resource at Copperstone. There are numerous high grade drill intercepts, however they are too discontinuous to be considered suitable for mining at current gold values. No further work is recommended for this property. It is recommended however that the property be reevaluated from time to time as gold economics change.

REGISTERED GEOLOGIST
CERTIFICATE NO.
18431
DALE G.
ARMSTRONG
Date Signed 2/14/95
ARIZONA, U.S.A.

Dale G. Armstrong
Consulting Geologist



MAP EXPLANATIONS	BASIS OF BEARING	BASIS OF ELEVATION	SPECIAL PROJECT MAP NOTES	Santa Fe Pacific Mining, Inc.
1.) ☒ = SURVEY CONTROL & CARDINAL CORNERS 2.) ☒ = SFPM DRILL HOLE LOCATION 3.) ☐ = GRID LOCATIONS---MODIFIED U.T.M. PROJECTION 4.) ☐ = 5.) ☐ = 6.) ☐ = U.T.M. GRID PROJECTION-SFPM PROPERTY 7.) ☐ = U.T.M. GRID PROJECTION-NON-SFPM LANDS 8.) ☐ = 9.) ☐ = 10.) ☐ =			1.) OLD DRILL HOLES ARE EXCLUDED!	COPPERSTONE MINE
SHT. SCALE: 1" = 1000'	COPPERSTONE MINE		U.T.M. COMBINED GRID FACTOR =	
REVISIONS: 1 1-25-94 D.J.M. SURVEY UPDATE; 2 1-26-94 M.S.H. SURVEY UPDATE; 3; 4; 5	OFFICE: RENO EXPLORATION	DEPARTMENT: PROJECT SERVICES	TOWNSHIP: T. N. RANGE: R. E. U.T.M. ZONE NUMBER	FILE: COPPER.DWG
DATE: 4-22-94 DRAWN BY: D.J.M. CHECKED: APPROVED:				

DESCRIPTIVE MODEL OF DETACHMENT-FAULT-RELATED POLYMETALLIC DEPOSITS

By Keith R. Long

BRIEF DESCRIPTION

SYNONYM: Detachment-fault-related gold, flat-fault gold.

DESCRIPTION: Massive replacements, stockworks, and veins of iron and copper oxides and locally sulfides along detachment-fault structures. These deposits sometimes contain economic concentrations of gold and silver. Distal veins of quartz-barite-fluorite-Mn oxides emplaced along high-angle faults in the upper plate of detachment-faulted terranes.

GENERAL REFERENCE: Wilkins and others (1986).

TYPICAL DEPOSITS: Bullard (Roddy and others, 1988), Copperstone (Spencer and others, 1988), Osborne (Allen, 1985), Planet (Lehman and Spencer, 1989), Harris (Roddy and others, 1988), Tiger Wash (Allen, 1985).

COMMODITIES: Cu + Au + Ag ± Pb ± Zn.

OTHER COMMODITIES: Fe-Ba-F-Mn-Mo-V.

ASSOCIATED DEPOSIT TYPES (*suspected to be genetically related): *Lacustrine Mn.

REGIONAL GEOLOGIC ATTRIBUTES

TECTONOSTRATIGRAPHIC SETTING: Extensional terranes characterized by regional detachment faulting.

REGIONAL DEPOSITIONAL ENVIRONMENT: Half-graben mountain ranges and hydrographically closed basins that formed syntectonically with extensional deformation above detachment faults.

AGE RANGE: Known deposits range from middle to late Tertiary in age.

LOCAL GEOLOGIC ATTRIBUTES

HOST ROCKS: (1) Lower-plate mylonitic rocks, chlorite breccias, and structurally emplaced slivers of upper-plate rocks. (2) Upper-plate Paleozoic to Mesozoic (meta)sedimentary and (meta)volcanic rocks, Mesozoic to early Tertiary felsic intrusive rocks, middle to late Tertiary mafic to intermediate lavas, silicic tuffs, and sedimentary rocks deposited in alluvial fan, fluvial, and saline lake environments.

ASSOCIATED ROCKS: Syn- to posttectonic alkali basalts, microdiorite dikes, and sedimentary rocks deposited in half-graben basins.

ORE MINERALOGY: Specular and earthy hematite, chrysocolla, and gold or electrum. Locally abundant chalcopyrite and other copper sulfides. Rare galena, sphalerite, and tetrahedrite. Sulfides accompany chloritic alteration in early-stage mineralization along and below detachment fault. Quartz-hematite-calcite-chrysocolla mineralization follows along and above detachment fault. Late-stage quartz-barite-fluorite-manganese oxide veins with locally abundant copper oxides, cerargyrite, argentite, gold, and hematite occur above detachment fault.

GANGUE MINERALS: Quartz (sometimes chalcedonic or amethystine), calcite (often ferrous and (or) manganiferous), barite, fluorite, and manganese oxides. Locally abundant pyrite, jasperoid, gypsum, and clays.

ZONING: Intensity of mineralization and alteration decreases away from detachment fault. Many districts zoned from polymetallic deposits outward to Ba-F-Mn veins. Mineralization tends to be base metal–rich and precious metal–poor near the detachment fault but precious metal–rich/base metal–poor away from the detachment fault.

ORE CONTROLS: Deposits commonly located above axis or flanks of synformal structures in underlying detachment surface. Orebodies are localized along high-angle fault zones below the detachment fault, along the detachment fault, and in high-angle, sometimes listric, normal faults in the upper plate. Gold is often associated with local silica flooding and amethystine quartz veins in brittle, fractured upper-plate rocks. Massive specularite replacements and chrysocolla veins occur in reactive calcareous units in both the upper and lower plates.

ISOTOPIC SIGNATURES: Quartz associated with oxide ore minerals has 6 to 8 per mill $\delta^{18}O$, and that associated with sulfide ore minerals has 10 to 12 per mill $\delta^{18}O$. Calcite associated with oxide ore minerals has 4 per mill $\delta^{18}O$ and –4 to –6 per mill $\delta^{13}C$ PDB. K-metasomatized rock has lower $\delta^{18}O$ than unaltered rock by 2 to 4 per mill.

FLUID INCLUSIONS: In quartz, calcite and barite associated with sulfide ore homogenization temperatures are higher (220 to 350 °C) than those associated with oxide ore (150 to 350 °C). Salinities, however, are similar at 10 to 23 equivalent weight percent NaCl. These fluids are thought to be saline brines derived from syntectonic, hydrographically closed, arid basins. Quartz in distal Ba-F-Mn veins have low-temperature (90 to 200 °C) and saline (6 to 20 weight percent equivalent NaCl) fluid inclusions.

STRUCTURAL SETTING: Local flexures of a regional detachment fault with strong development of upper-plate, high-angle, listric and planar normal faults.

ORE DEPOSIT GEOMETRY: (1) Narrow fracture and fault fillings that are 3 cm to 12 m in width with strike lengths of 30 to 2,000 m. (2) Irregular, pod-shaped massive replacements of reactive lithologies up to 900 m long, 100 m wide and 3 to 30 m thick. (4) Pods and anastomosing veins along low-angle faults. (5) Veinlets and breccia clasts in fault breccia.

ALTERATION: Wall rock dependent. Distinct alteration suites are observed: (1) Pre-ore to early chloritic (chlorite-epidote-hematite) alteration of lower-plate mylonites and fault breccias, sometimes with associated quartz-pyrite-chalcopyrite±galena mineralization. (2) Pre-ore to early K-metasomatism of upper-plate volcanic rocks. Mafic rocks are converted into K-feldspar-hematite-calcite-chlorite-epidote rocks, and silicic rocks are converted into K-feldspar-hematite-quartz rocks. (3) Pre-ore to early massive carbonate replacement of carbonate rocks. (4) Propylitic (chlorite-calcite-epidote-sericite-clay) alteration envelopes around veins hosted by mafic rocks. Quartz-chrysocolla veins often have clay selvages. (5) Weak sericite-silica-dolomite envelopes around Ba-F-Mn veins in calcareous rocks.

TYPICAL ALTERATION/OTHER HALO DIMENSIONS: (1) Chloritic alteration may extend from the top of the detachment fault down to 300 m below the detachment fault. (2) K-metasomatism may extend more than 2 km above the detachment fault in zones more than 10 km in extent. (3) Massive carbonate replacements range up to 900 m in length, 100 m wide, and about 30 m thick. (4) Propylitic alteration halos are narrow, up to a few centimeters around veins and fracture fillings.

EFFECT OF WEATHERING: Most ore consists of primary oxides. Locally abundant sulfides may be oxidized.

EFFECT OF METAMORPHISM: Metamorphosed deposits are not known.

GEOCHEMICAL SIGNATURES: Host rocks are enriched in Cu, Pb, Zn, Au, Ag, and Ba and depleted in Mn, Sr, Ni, and Rb. As, Sb, Hg, and Tl are also very low.

GEOPHYSICAL SIGNATURES: There may be a resistivity contrast between oxide ores along and above the detachment fault and the mylonite zone beneath the detachment fault. Silica flooded zones may have high resistivity. Massive hematite orebodies may produce a magnetic dipole anomaly. Shallow reflection seismic might detect detachment-fault structures.

OTHER EXPLORATION GUIDES: Conodont alteration of upper-plate Paleozoic sediments may serve as a guide to regional paleo-heat flow related to fluid movement along and above detachment faults.

OVERBURDEN: Variable, owing to differing degrees of uplift along half-graben structures and regional warps. Polymetallic deposits are thought to have formed at a depth of 1 to 3 km (Spencer and Welty, 1986), and Ba-F-Mn veins at a depth of 0.5 km (Allen, 1985).

Copperstone Main Zone: Statement of Mineral Inventory

Block	Area (ft)	Grade (opt Au)	Width T.W. (ft.)	Tonnage (tons)	Ounces Contained
A	112,656	0.19	12.3	115,660	21,975
B	911,094	0.18	14.1	1,071,295	192,833
C	51,563	0.115	12.1	51,993	4,620
D	431,875	0.186	12.4	444,471	82,672
E	191,406	0.194	17.4	277,539	53,842
			TOTAL	**1,960,958**	**355,942**
				Grade	**0.182**

Criteria considered for Inventory calculation:
1) Tonnage Factor = 12
2) A cut-off of 0.05 opt Au over a minimum true width of 10 ft.
3) A 150 ft. area of influence around the resource block.
4) Assays cut to 1.0 ounce
5) Includes 1996 Phase II drill results

Copperstone Main Zone: Statement of Resource

Block	Area ($ft.^2$)	Grade (opt Au)	Thickness T.W. (ft.)	Tonnage (tons)	Ounces Contained
A	197,968	0.149	12.34	222,084	33,091
B	390,625	0.168	15.6	553,977	93,068
C	951,815	0.216	13.43	1,162,080	251,009
D	401,875	0.335	17	683,188	228,868
			TOTAL	2,621,329	606,036
			GRADE	0.231	
			TRUE WIDTH (WEIGHTED)	14.70	

Criteria considered for resource calculation:

1) Tonnage Factor = 12, except Block D = 10
2) A cut-off of 0.04 opt Au over a minimum true width of 10 feet.
3) A 150 ft. area of influence around the resource blocks.
4) Assays Uncut, except Hole C95-11- cut to 2 oz.

Copperstone Main Zone: Statement of Mineral Inventory

Block	Area (ft)	Grade (opt Au)	Width T.W. (ft.)	Tonnage (tons)	Ounces Contained
A	112,656	0.19	12.3	115,660	21,975
B	911,094	0.18	14.1	1,071,295	192,833
C	51,563	0.115	12.1	51,993	4,620
D	431,875	0.186	12.4	444,471	82,672
E	191,406	0.194	17.4	277,539	53,842
			TOTAL	1,960,958	355,942
				Grade	0.182

Criteria considered for Resource calculation:
1) Tonnage Factor = 12
2) A cut-off of 0.10 opt Au over a minimum true width of 10 ft
3) A 100 ft. area of influence around the resource block.
4) Assays cut to 0.5 ounce
5) Includes 1996 Phase II drill results

Copperstone Main Zone: Statement of Mineral Inventory

Block	Area (ft^2)	Grade (opt Au)	Width (ft)	Tonnage (tons)	Ounces Contained
A	112,656	0.19	16	150,208	28,539
B	911,094	0.18	18.3	1,391,696	250,505
C	51,563	0.115	12.1	51,993	5,930
D	431,875	0.186	16.05	577,632	107,440
E	191,406	0.194	22.6	360,481	69,933
			TOTAL	2,532,010	462,347
				Grade	0.183

Criteria considered for Inventory calculation:
1) Tonnage Factor = 12
2) A cut-off of 0.05 opt Au over a minimum core length of 10
3) A 150 ft. area of influence around the resource block.
4) Assays cut to 1 ounce

MEMORANDUM

To: Kevin Leonard

From: Larry Jackson

Date: January 21, 1997

Subject: Copperstone blasthole assay reconciliation

Please find below a suggested methodology to reconcile the blast hole information with the total reported gold production at Copperstone. This method creates a "recovered grade" that includes all the various problems with reported mine grades, processing head grades, recovery, etc. This recovered grade method should also be applied to the exploration model grades.

Model blasthole assays

Digitize ore zones from bench maps

Determine total tons and grade of processed material from blasthole model

Reconcile blasthole model ounces with total recovered ounces and calculate a recovered grade factor

It may be that the blasthole model closely correlates with actual production. It is also possible that a few high grade blasthole assays will bias the data and by removing them (or top cutting) the correlation will be greatly improved. In any case a "best picture" of the deposit can be uncovered and then reconciled to the exploration data.

Since the data is already in MEDS blasthole format it should be a relatively simple process to complete.

ROYAL OAL MINES (U.S.A.) INC.
MEMORANDUM

TO: Ted Mahoney

FROM: Kevin Leonard

DATE: February 25, 1996

SUBJECT: Copperstone - Resource Estimation

The following guidelines were used in the resource estimation:

1. The resource is estimated as a "drill indicated mineral inventory". This categorization implies that the estimation should be considered as a generalization only, and that additional in-fill surface and/or U/G drilling and sampling is required to categorize the mineralization as proven/probable reserves.

2. The resource calculation was completed using:
   a. 50-scale cross sections on 70 foot line spacings constructed normal to the strike of the deposit. Starting at cross section 108 at the southeast pit boundary, sections are numbered consecutively as 70 foot step-outs to the northwest.
   b. 100-scale inclined longitudinal profile. Drill hole intersects are projected in the plane or dip of the Main Zone.

3. A 0.04 opt Au cut-off over a minimum core length of 10 ft. was used for a tonnage maximized calculation.

4. A 2.63 in-situ density factor was used.

5. Grade for a particular block was based upon the arithmetic average -*not weighted*, of drill hole intersections falling in the given block. The boundary of the resource block was arbitrarily given a 150 foot area of influence around holes satisfying criteria #3 above. Assays were cut to 1 ounce in order to reflect the overall deposit grade.

Copperstone Financial Summary

Years	0	1	2	3	4	5	6	7	8	9
Revenue Drivers										
Gold ounces sold at spot	0	37,489	74,977	74,977	74,977	74,977	74,977	54,012	47,020	31,430
Spot per ounce of gold in US$	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400
Total gold revenue	$0	$14,995,440	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$21,604,962	$18,807,840	$12,571,949
Cost Drivers										
Mining										
Mineralized material at beginning of year	2,883,460	2,883,460	2,706,960	2,353,960	2,000,960	1,647,960	1,294,960	941,960	588,960	235,960
Grade for mineralized material	0.210	0.210	0.208	0.204	0.198	0.190	0.178	0.156	0.147	0.146
Gold contained in mineralized material	604,950	604,950	563,296	479,988	396,680	313,372	230,064	146,756	86,742	34,498
Total tons mined during year	0	176,500	353,000	353,000	353,000	353,000	353,000	353,000	353,000	235,960
Total cost per ton mined	$0	$35	$35	$35	$35	$35	$35	$35	$35	$35
Total expensed tons mined	$0	$6,177,500	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$8,258,600
Processing										
Tons ore processed	0	176,500	353,000	353,000	353,000	353,000	353,000	353,000	353,000	235,960
Cost per ton processed	$0.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00
Total expensed tons processed	$0	$1,765,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$2,359,600
Gold head grade of tons processed per ounce	0.000	0.236	0.236	0.236	0.236	0.236	0.236	0.170	0.148	0.148
Gold recovery percentage	0.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%
Total gold ounces recovered	0	37,489	74,977	74,977	74,977	74,977	74,977	54,012	47,020	31,430
General and administrative costs in fixed amounts - minesite	$0	$882,500	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,179,800
Cash cost per ounce gold in US$	$0	$235	$235	$235	$235	$235	$235	$327	$375	$375
Capital additions:	$4,000,000	$21,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$0	$0	$0
Forecast Cash Flows:										
Revenues	$0	$14,995,440	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$21,604,962	$18,807,840	$12,571,949
Expenses	0	8,825,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	11,798,000
Gross profit from operations	0	6,170,440	12,340,880	12,340,880	12,340,880	12,340,880	12,340,880	3,954,962	1,157,840	773,949
(less) capital spending	(4,000,000)	(21,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	0	0	0
Net cash flow after capital spending	($4,000,000)	($14,829,560)	$11,340,880	$11,340,880	$11,340,880	$11,340,880	$11,340,880	$3,954,962	$1,157,840	$773,949
Net Asset Value	$43,761,591									
NPV at 8%	$25,477,805									
IRR	48.09%									

NOTE: THIS MODEL ASSUMES A BLENDED FEED OF SHOOTS C AND D FOR THE FIRST 6 YEARS (2,029,794 TONS AT 0.236 OPT.) AND A BLEND OF SHOOTS A AND B FOR THE FINAL YEARS (853,000 TONS AT 0.148 OPT)

Copperstone Main Zone: Statement of Mineral Inventory

Block	Area (ft)	Grade (opt Au)	Width (ft)	Tonnage (tons)	Ounces Contained
A	62,809	0.064	16	82,209	5,261
B	87,653	0.209	18.6	133,573	27,917
C	58,278	0.123	18	85,988	10,577
D	447,653	0.191	21.3	947,253	180.925
E	46,717	0.12	12.1	46,270	5,545
F	495,619	0.152	19	771,242	117,228
G	192,813	0.195	22.6	357,042	69,623
			TOTAL	**2,423,514**	**417,076**
				Grade	**0.172**

Criteria considered for Inventory calculation:
1) An in-situ density factor of 2.63
2) A cut-off of 0.05 opt Au over a minimum core length of 10
3) A 150 ft. area of influence around the resource block.
4) Assays cut to 1 ounce

ROYAL OAK MINES (USA) INC.
MEMORANDUM

TO:

FROM: Kevin Leonard

DATE: January 22nd 1997

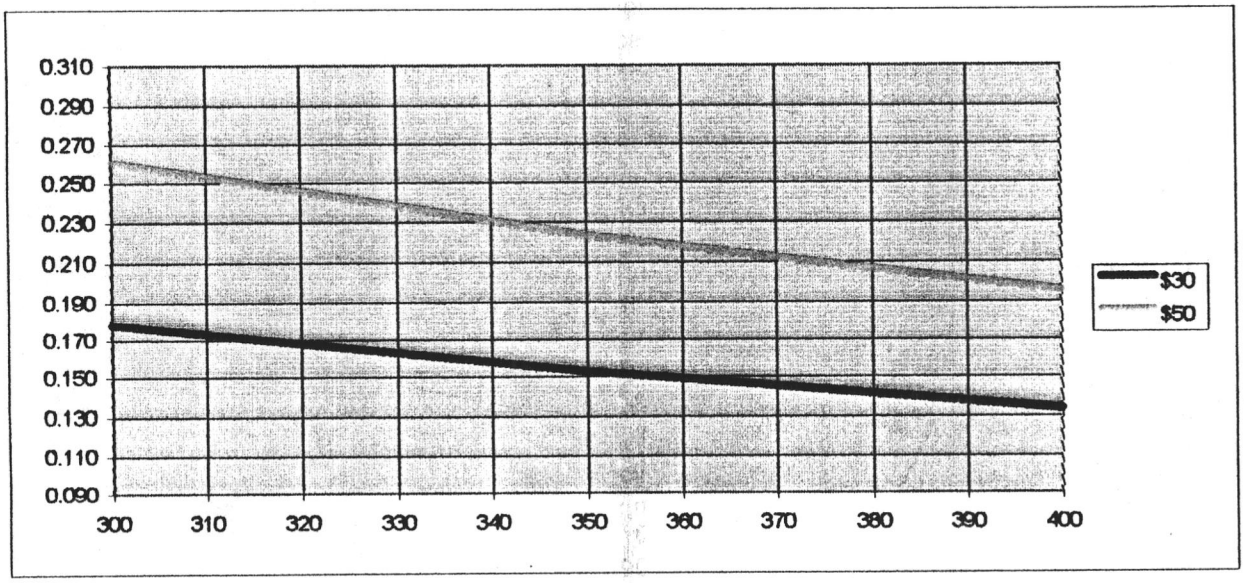
SUBJECT: Copperstone and Namosi

Explanation of Spreadsheet

1. Total Actual Tons = Minable Ore Tons - Waste Tons
2. Waste Tons = Minable Ore Tons x Waste/Ore Ratio
3. Mineable Ore Tons = Reserve Tons x Extraction Ratio (%) or
   Total Actual Tons - Waste Tons
4. Diluted Grade = Grade x Dilution (%)
5. Diluted Tons = Minable Ore Tons x Dilution (%)
6. Recovered Ounces = Diluted Grade x Diluted Tons x Recovery (%)
7. Total Cost = Diluted Tons x Mining Cost (per ton)
8. Total Revenue = Price of Gold x Recovered Ounces
9. Net Profit = Total Revenue - Total Cost

			W/O ratio	0.5
Reserve tons	2,532,000		Extraction ratio	65%
Grade	0.226		Recovery	89%
Contained Ounces	572,970		Dilution	10%
			Cost per ton of ore	$60.00
			Gold price	$400.00
			Exp. & Acquisition	$5,000,000
Total	Waste	Minable	Infrastructure	$750,000
actual tons	Tons	ore tons	Processing	$5,000,000
2,468,700	822,900	1,645,800	UG development	$2,000,000
			Operating	$3,000,000
Diluted	Diluted	Recovered	Reclamation	$2,000,000
grade	tons	ounces	Subtotal	**$17,750,000**
0.206	1,810,380	331,463	Salvage rate	10%
			Net value	**($1,775,000)**
Total cost per	Total	Net profit	Total Capital	**$15,975,000**
ore ton processed	revenue		Rate of return	50%
$108,622,800	$132,585,300	23,962,500	Total value	**$23,962,500**

	Gold Price			
Mining cost	300	350	400	
$20	0.137	0.117	0.103	Average
$30	0.178	0.153	0.134	Grade
$40	0.219	0.188	0.164	Required
$50	0.261	0.223	0.195	
$60	0.302	0.259	0.226	
Max	0.302	0.310		
Min	0.103	0.090		



QUIC1.XLS
22/1/1997

Reserve tons	1,000,000
Grade	0.278
Contained Ounces	277,602

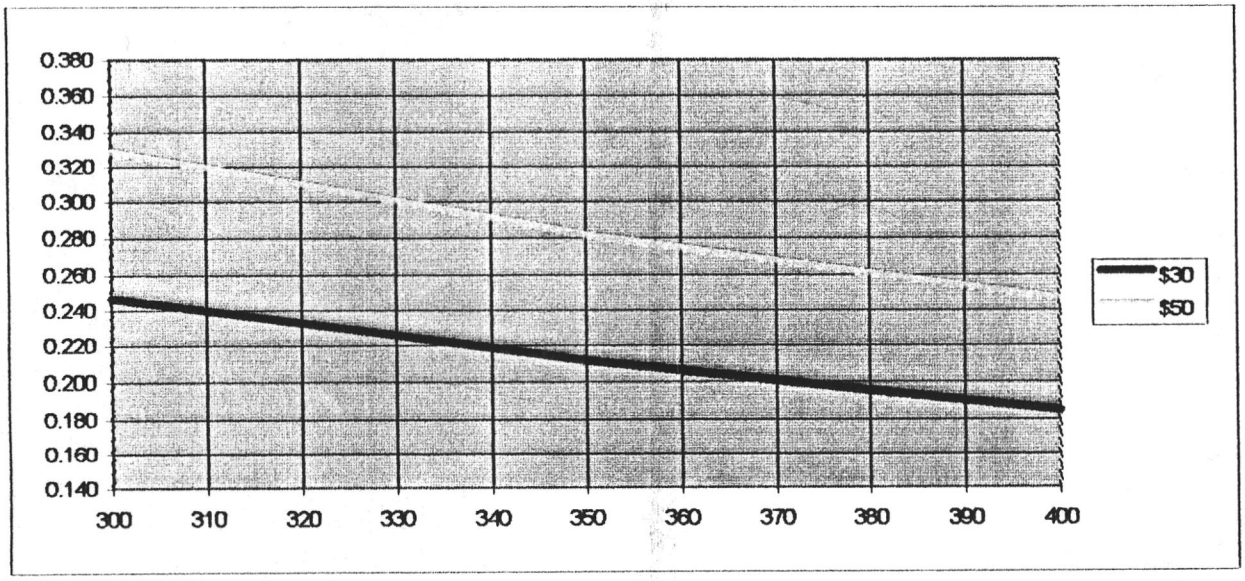
W/O ratio	0.5
Extraction ratio	65%
Recovery	85%
Dilution	5%
Mining cost	$60.00
Gold price	$400.00

Total actual tons	Waste Tons	Minable ore tons
975,000	325,000	650,000
Diluted grade	Diluted tons	Recovered ounces
0.264	682,500	153,375
Total cost	Total revenue	Net profit
$40,950,000	$61,350,000	20,400,000

Exp. & Acquisition	$5,000,000
Infrastructure	$1,000,000
Processing	$5,000,000
UG development	$2,500,000
Operating	$1,500,000
Reclamation	$2,000,000
Subtotal	$17,000,000
Salvage rate	20%
Net value	($3,400,000)
Total Capital	$13,600,000
Rate of return	50%
Total value	$20,400,000

	Gold Price		
Mining cost	300	350	400
$20	0.205	0.176	0.154
$30	0.247	0.211	0.185
$40	0.288	0.247	0.216
$50	0.329	0.282	0.247
$60	0.370	0.317	0.278
Max	0.370	0.380	
Min	0.154	0.140	

Average Grade Required



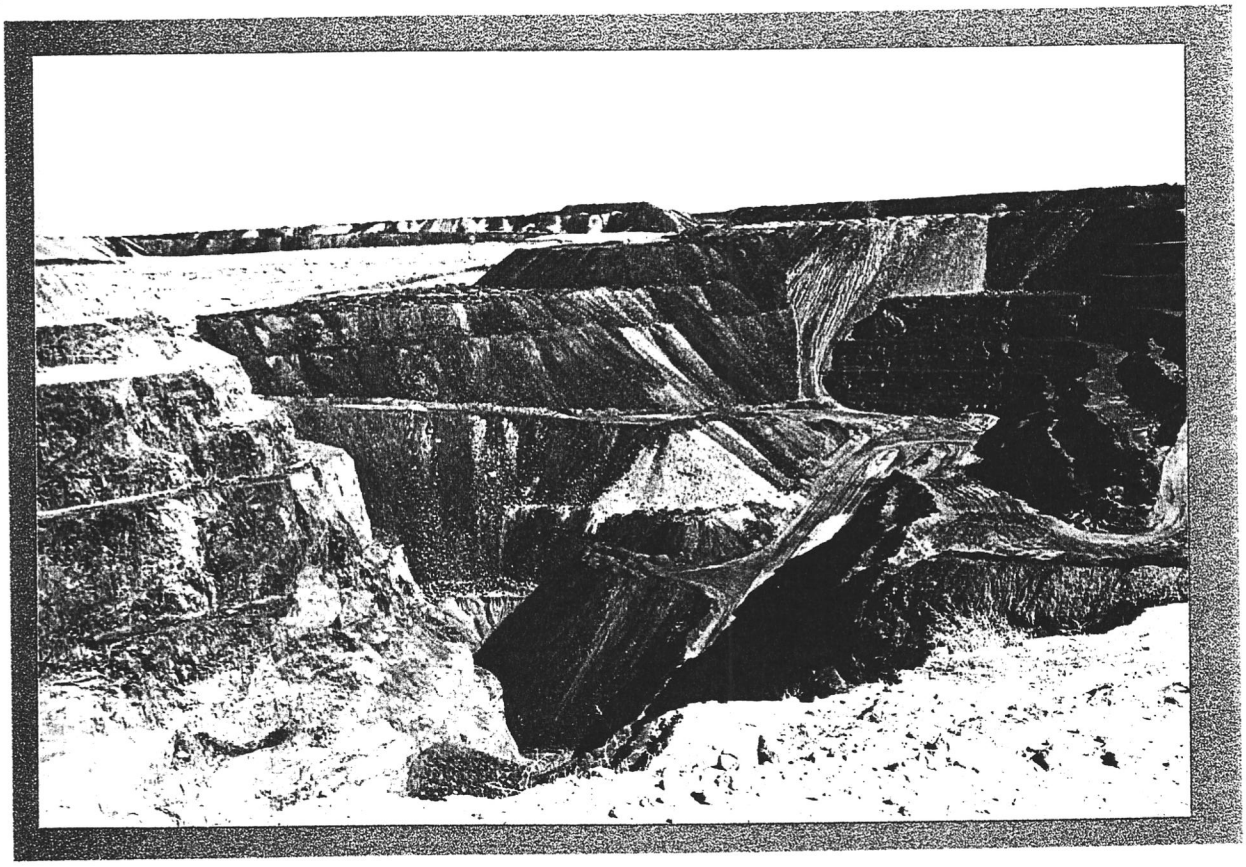
QUIC1.XLS
21/1/1997

Copperstone Main Zone: Statement of Drill Indicated Resource

Block	Area (ft^2)	Grade (opt Au)	Width T.W. (ft.)	Tonnage (tons)	Ounces Contained
A	63,750	0.208	14.3	75,969	15,802
B	266,563	0.191	15.9	353,862	67,588
C	325,000	0.166	13.2	357,771	59,390
D	117,031	0.22	16.5	160,918	35,402
			TOTAL	948,520	178,182
				Grade	0.187

Criteria considered for Resource calculation:
1) Tonnage Factor = 12
2) A cut-off of 0.10 opt Au over a minimum core length of 10
3) A 100 ft. area of influence around the resource block.
4) Assays cut to 0.5 ounce per ton
5) Excludes 1996 Phase II drill program.

Royal Oak Mines



Copperstone

Project Summary

June 1997

INTRODUCTION

The Copperstone mine is an exciting development project with multi-ounce gold intersections over 25 foot widths and potential for over 1 million ounces of gold mineable as an underground mine. The property was mined previously as an open pit mine and the remaining facilities simplify future development. The attatched cashflow model shows that the deposit can be a profitable ongoing operation.

Copperstone is located in La Paz County, Arizona 26 km. north of Quartzite. The mine was formerly operated by Cyprus as an open pit gold mine from which 500,000 ounces of gold was produced from 6,000,000 tons of ore grading 0.1 opt. The open pit mine was closed in November 1992 and is currently in the final reclamation stage. The property, including the roads, the power system, the water system and several buildings, was returned to Mr. D. Patch upon the completion of mining and the mining lease has been terminated. Royal Oak Mines Inc. optioned the property in 1995 from Mr. Patch.

Reserves amenable to underground mining are present and are currently being drilled off by Royal Oak Mines Inc. The gold occurs in a northeasterly dipping breccia zone in volcanic rocks which contains abundant specular hematite and some traces of copper. The deposit is oxidized to the level of the current drilling where some trace sulphide mineralization occurs. A resource of 2.6 million tons at 0.23 opt containing 606,000 ounces of gold has been recently calculated from a longsection in the plane of the ore. These resources will require an underground drill program to place them in the proven-probable category, however the deposit is still open and it is expected that the reserves could exceed 1 million ounces.

A high grade zone has been discovered by recent drilling along the northwest margin of the deposit where the mineralized breccia contacts a limestone zone. Grades of over 1.0 opt are encountered in this area and have a consistent thickness of 25 feet. This mineralization occurs in a heavy hematite replacement zone that has a considerably higher specific gravity than the normal mineralized breccia. Copperstone has other exciting exploration targets including one intersection which returned 0.646 opt Au/ 15 feet that has never been followed up.

Permitting of the property, due to its having been a mine and due to low ground water flows, is likely to be quick and simple. The existing pit provides an excellent location for the collaring of a portal as it has bare rock faces close to the ore. The existing power, water, office and shop buildings will lower capital costs.

HISTORY

Prospecting began in 1968 with bulldozer trenching by a prospector to better expose weak copper mineralization . Newmont Mining leased the property in 1975 and drilled a single 765 foot hole after running induced polarization, gravity and ground magnetic surveys. The unsuccessful hole, located at the southern end of the current Copperstone claim group, was designed to test a porphyry copper target.

The property was returned to the prospector and was subsequently submitted to Cyprus in 1980. A lease was signed after initial field evaluation and sampling indicated gold mineralization. In 1981 and 1982 conventional rotary percussion drilling on a 140 foot grid tested for the limits of the mineralization. The down dip limit for open pit mining was established and considerable drilling effort was concentrated along strike to the northwest where high grade gold-magnetite mineralization was found at depth in limestones beneath welded tuff units. To the southeast, exploration drilling found spotty mineralization extending to a large basalt subcrop. Induced polarization and ground magnetic surveys were run which outlined the gold deposit with considerable accuracy.

The entire claim block was explored in the spring of 1983 for additional Copperstone type mineralization following a detachment hosted gold exploration model. Some targets generated by this exploration were tested by shallow drill holes without success.

The proposed open pit was drilled off in 1986 by reverse circulation drilling on a 100 foot grid in the proposed pit area. A decline was started and goes from surface to approximately the bottom of the current open pit. A change of philosophy was then taken by Cyprus and it was decided to open pit the deposit.

In June 1987 stripping was started on the mine and milling commenced in mid October of 1987 at a design rate of 2,500 tons per day using a carbon-in-pulp circuit. A total of approximately 6 million tons was mined and a total of 500,000 ounces recovered from ore with an average grade of 0.11 opt for a recovery of 89%.

The operation was shut down in 1992 and the mill was removed. The mine has been reclaimed although Cypress is still treating the tailings pond discharge at the present time.

AGREEMENTS AND TENURE

The property consists of 284 lode claims and 2 state leases covering 7,018 acres and is held under a 10 year renewable lease from the Patch Living Trust. Annual advance royalty payments of $30,000 are payable to the Patch Living Trust against the following gross production sliding scale royalty.

AMOUNT	GOLD PRICE
1% GPR	<$350
2% GPR	$350 to $400.99
3% GPR	$401 to $450.99
4% GPR	$451 to $500.99
5% GPR	$501 to $550.99
6% GPR	>$551

Annual assessment fees of $28,400 are payable to the government.

Any property acquired within one mile of the property boundary will be included in the lease and Royal Oak has the first right of refusal to buy the Patch Living Trust interest in the property.

GEOLOGY

Regional Geology

The oldest rocks in west-central Arizona are Precambrian metamorphics, approximately 1.7 billion years old. They are deformed and intruded by several generations of plutons. These rocks are unconformably overlain by a sequence of Palaeozoic carbonate and clastic strata. Mesozoic rocks include volcanic and plutonic rocks of Jurassic age and thick sections of clastic rocks which are intruded by late Cretaceous plutons. Metamorphism affected the region after deposition of the Mesozoic volcanics and sediments. Precious metal mineralization occurred before and after mid-Tertiary structural dislocation by low angle detachment faults of upper plate rocks from metamorphic core complexes. Basin and range faulting occurred in late Tertiary time.

Local Geology

The Copperstone gold deposit is located on flat, dry, sandy terrain with several small knolls up to 40 feet high and prominent longitudinal sand dunes. Outcrop is scarce and occurs on the knolls with broader areas of caliche cemented rubble around the outcrops. Unconsolidated sands and gravels thicken to several hundred feet in all directions away from the outcrop areas. The alluvium is old river channel sediment displaying cut and fill channel structures where exposed in bulldozer cuts. Igneous and metamorphic rocks including granite gneiss, schist, quartzite and amphibolite from Precambrian to Mesozoic age outcrop at the southern end of the Copperstone claim block. A low angle detachment fault separates these core complex rocks from an upper plate consisting of minor limestone and quartzite overlain by a thick sequence of Jurassic age quartz latite welded tuffs and breccias. The upper plate sequence has been affected by weak greenschist facies metamorphism in Mesozoic time The major low angle fault probably lies beneath the Copperstone gold deposit but has not been confirmed by drilling to date.

Mineralization

The deposit originally outcropped as three small exposures of mineralized breccia and subcropped beneath shallow alluvium. The ore horizon and breccia strike northwest and dips at 30 degrees to the northeast beneath a thickening alluvial cover and the hanging wall volcanic rocks. The breccia extends for 3,000 feet in strike length and is known to continue beneath the cover of a younger vesicular basalt

flow. The strike of the mineralized zone is marked by an I.P. signature which continues beneath the young basalt. The deposit is open down dip where it has been intersected approximately 2000 feet from the surface outcrop. The breccia is generally 50 feet thick.

The Copperstone gold deposit is hosted by welded quartz latite tuff breccias and laminated welded tuffs. Formational breccias, which occur within the welded tuffs, appear to be formed as surface flow agglomerates with other breccia textures attributed to later hydrothermal mineralization. The northwest margin of the deposit lies at the contact of the latite tuffs and a limestone unit. The limestone is mostly replaced in this area by hematite and contains the highest grades in the deposit.

Severe faulting affects the Copperstone deposit area. Drilling has shown fault zones ranging from a few inches to 50 feet thick. The faulting is probably low angle listric faulting formed during flexing of the upper plate volcanics as movement occurred on the detachment fault. Later high angle faulting is of the Basin and Range type. North-south high angle faults cut the mineralization uplifting the down-dip sections of the deposit.

The gold mineralization occurs generally with low grade copper mineralization and abundant hematite but is not necessarily present with the copper-specularite mineralization indicating that the gold mineralizing event may have occurred at a later time or as episodic hydrothermal events . Adularia, siderite, calcite, geothite, chrysocolla, malachite, chalcopyrite, barite, pyrite, magnetite, specularite and hematite all occur within the ore zone. Mineralizing solutions also formed local zones of alteration including argillization and sericitization, chloritic veining and chalcedonic silicification. The deposit is oxidized to the depths of the current drilling and the main characteristic of the ore is the earthy red hematite.

Gold occurs as small flakes ranging between 4 and 40 microns in size with some coarse gold plates ranging from 50 to 150 microns. Most of the gold is free but a small amount is locked with quartz and iron hydroxides.

Reserves

Copperstone Main Zone: Statement of Resource

Block	Area (ft.)	Grade (opt Au)	Thickness T.W. (ft.)	Tonnage (tons)	Ounces Contained
A	197,968	0.149	12.34	222,084	33,091
B	390,625	0.168	15.6	553,977	93,068
C	951,815	0.216	13.43	1,162,080	251,009
D	401,875	0.335	17	683,188	228,868
			TOTAL	2,621,329	606,036
			GRADE	0.231	
			TRUE WIDTH	14.70	
			(WEIGHTED)		

Criteria considered for resource calculation:
1) Tonnage Factor = 12, except Block D = 10
2) A cut-off of 0.04 opt Au over a minimum true width of 10 feet.
3) A 150 ft. Area of influence around the resource blocks.
4) Assays Uncut, except Hole C95-11- cut to 2 oz.

Exploration Possibilities

a) Property

Potential for **1 million ounces** in the main orebody is considered excellent. Additional work should be used to evaluate the following prospective targets:

- A footwall structure below the Main Zone which has been the subject of very little exploration. Limited drilling has returned 0.646 opt Au over a core length of 15 feet, and 0.246 opt Au over a core length of 40 feet.

- Untested coincident IP chargeabilitiy and magnetic anomalies in the vicinity of the Copperstone pit, and in particular the linear IP expression trending southeast and along the strike of the deposit.

- The mineralized shoots remain open along strike and at depth and should be drill tested in order to build tonnage and expand the resource to **1 million ounces**. The very prospective limestone unit remains to be drilled off and should be traced by drilling at depth and to the northwest.

- Satellite targets including a) Copper Peak and b) the high ground located 1.5 miles east of the pit should be investigated. These targets show alteration similar to Copperstone and shallow drilling has returned gold values up to 0.05 opt Au over moderate widths.

b) Regional

There are a number of interesting gold properties within trucking distance of the Copperstone property. These properties could provide satellite ore bodies that would provide additional millfeed for a mill at the property.

The region covering several placer prospects near Copperstone show strong hardrock gold potential. These include the Copper Bottom, Kellogg and Yellowdog Mines and the Goodman Bell of Arizona, Isreal and Desert Mines. As well, a single, deep drill hole on the Julian property returned 1.5 opt Au over the last 8 feet of the hole. No additional drilling has been carried out.

The Stray Elephant property, located 15 miles south of Copperstone, near Quartzite, contains 12 million tons of surface, oxide copper at a grade of 0.57% Cu. The deposit has been traced by shallow drilling over a strike length of 0.8 mile. It remains open at both ends and might provide a second operation that could be handled using the same infrastructure and administration.

MINING

Listed below are some of the key points regarding the mining potential at Copperstone. Royal Oak has completed no mine design work on the property and the following is based on a quick preliminary assessment of the project.

The open pit has a depth of 560 feet and very steep slopes on the northeast wall however there are good locations for a portal for underground access at a depth of about 200 feet from the pit rim. The ramp would use the wide turning circle of the existing ramp and would ultimately be 4,500 feet long. Prior to production an additional 2,500 feet of development would be required. An underground drill program would be needed to bring the resource to a reserve status and this would allow a good assessment of the underground mining conditions to lend confidence to the mining method selected. The cost of the development work and the drilling is estimated at $4 million. No further open pit mining is contemplated as the current pit has a 10:1 strip ratio.

The quartz latite tuff appears to be a very competent rock and the mining conditions are anticipated to be fair. Dilution of at least 10% should be anticipated however and it should be anticipated that cut and fill using waste rock and sand would be the principal mining method. All inclusive costs are expected to be in the $US 35 per ton range.

This mining method, given 5 to 6 producing headings and a similar number on fill cycles or in development should provide mined tonnages of 1,000 tons per day. Mill throughput would therefore be in the range of 750 to 1000 tons per day depending on scheduling.

Assuming a $US50 all in cost for production, a 90% recovery and a $US400 price for gold , the cut-off "mined grade" will be approximately 0.138 opt. slightly below the grade of the lowest grade ore block.

The mining resource, at 10% dilution at 0 grade and an extraction factor of 90%, would then be 2,595,114 tons at a grade of 0.21 opt. with 545,000 contained ounces.

Permitting

The mining lease was surrendered by Cyprus when the open pit mining was finished in 1992. Currently permits to allow exploration drilling on the property are in place.

Royal Oak, in anticipation of potential issues in permitting an underground operation, have done flow tests on the aquifer to determine if water flow rates would cause problems to underground mining. The tests well data indicated minimal flow rates that could be easily handled by an underground operation. The aquifer is not a major one nor does it supply water to any large city and therefore the permitting of the mine will be relatively simple.

It is estimated that the permitting of the property for underground mining could be done within 9 months as it was a previous producer and has a very low impact both on the surface and on the water resources.

MILLING AND METALLURGY

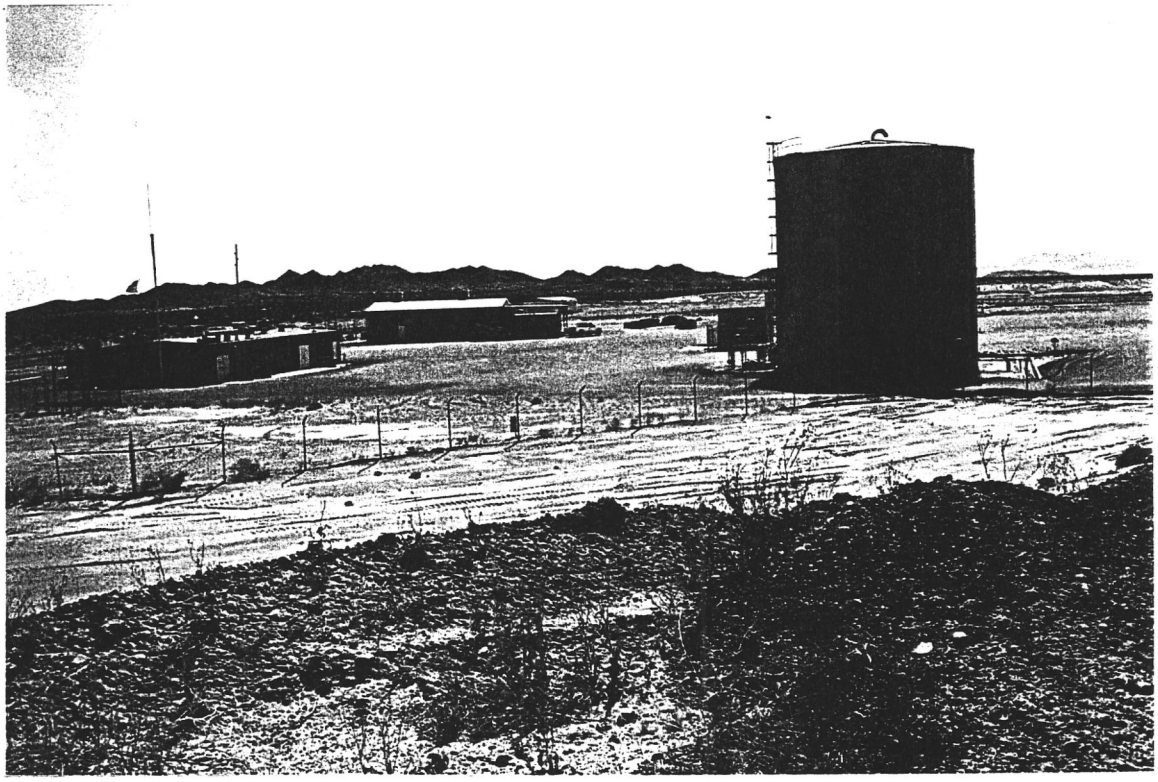
Royal Oak has not done any metallurgy on the ore however there are some facts available from the previous work. The overall recoveries achieved by Cyprus from their operation was 89% which is low for a typical CIP process however they did heap leach some low grade material and this has apparently been included in the overall recovery numbers. There is some indication from the mineralogy that there may be some encapsulation of the very fine gold within quartz or hematite however there was a lot of speculation that, due to the short retention time of the mill (said to be 16 to 24 hours) that insufficient time may have been available for complete gold dissolution. Royal Oak has not seen any metallurgical studies on the deposit.

A rough estimate of the capital cost of a mill has been set at $21 million to allow the accompanying cashflow to be made. The roads, the auxiliary buildings and the power and water lines, sufficient to service the open pit operation, are still in place and active and are likely to be more than needed to service the underground operation as it will probably process a lower tonnage on a daily basis. In addition the actual mill that was at the property is apparently sitting in a bone yard and is still owned by Cyprus who might be persuaded to part with it at junk prices.

Copperstone Financial Summary

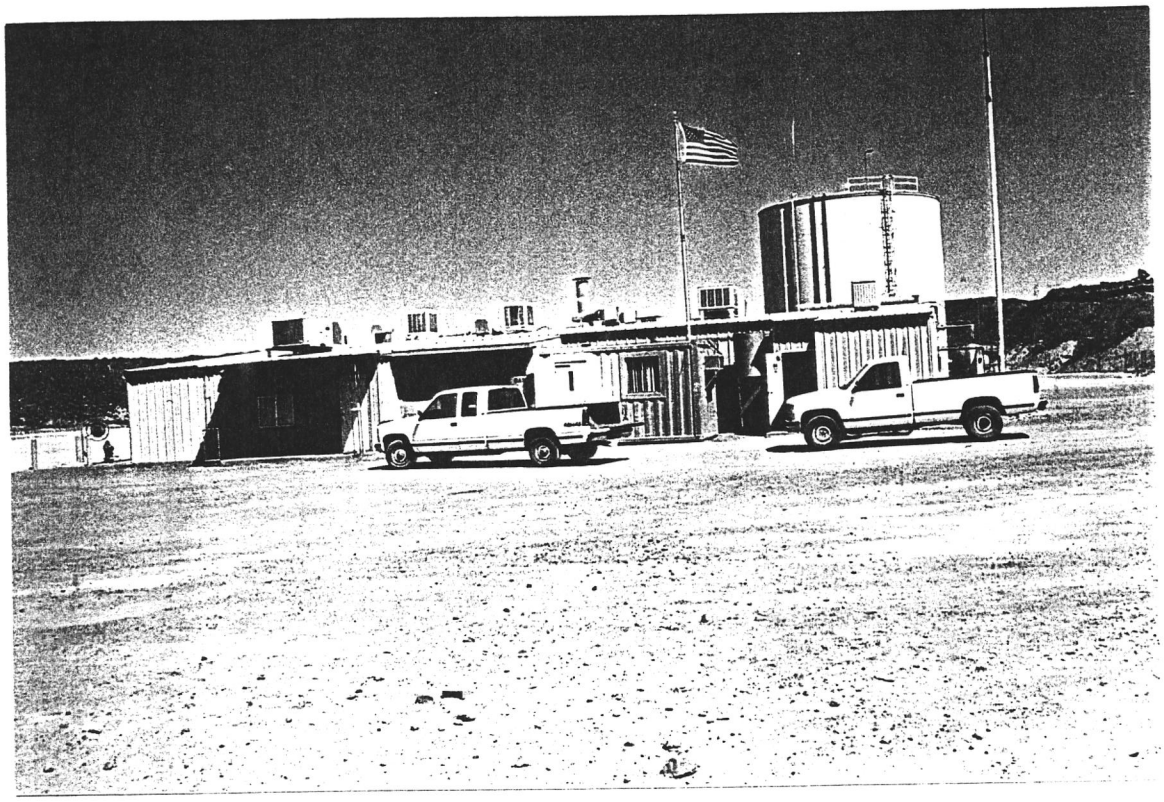
Years	0	1	2	3	4	5	6	7	8	9
Revenue Drivers										
Gold ounces sold at spot	0	37,489	74,977	74,977	74,977	74,977	74,977	54,012	47,020	31,430
Spot per ounce of gold in US$	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400
Total gold revenue	$0	$14,995,440	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$21,604,962	$18,807,840	$12,571,949
Cost Drivers										
Mining										
Mineralized material at beginning of year	2,883,460	2,883,460	2,706,960	2,353,960	2,000,960	1,647,960	1,294,960	941,960	588,960	235,960
Grade for mineralized material	0.210	0.210	0.208	0.204	0.198	0.190	0.178	0.156	0.147	0.146
Gold contained in mineralized material	604,950	604,950	563,296	479,988	396,680	313,372	230,064	146,756	86,742	34,498
Total tons mined during year	0	176,500	353,000	353,000	353,000	353,000	353,000	353,000	353,000	235,960
Total cost per ton mined	$0	$35	$35	$35	$35	$35	$35	$35	$35	$35
Total expensed tons mined	$0	$6,177,500	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$12,355,000	$8,258,600
Processing										
Tons ore processed	0	176,500	353,000	353,000	353,000	353,000	353,000	353,000	353,000	235,960
Cost per ton processed	$0.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00
Total expensed tons processed	$0	$1,765,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$3,530,000	$2,359,600
Gold head grade of tons processed per ounce	0.000	0.236	0.236	0.236	0.236	0.236	0.236	0.170	0.148	0.148
Gold recovery percentage	0.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%
Total gold ounces recovered	0	37,489	74,977	74,977	74,977	74,977	74,977	54,012	47,020	31,430
General and administrative costs in fixed amounts - minesite	$0	$882,500	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,765,000	$1,179,800
Cash cost per ounce gold in US$	$0	$235	$235	$235	$235	$235	$235	$327	$375	$375
Capital additions:	$4,000,000	$21,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$0	$0	$0
Forecast Cash Flows:										
Revenues	$0	$14,995,440	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$29,990,880	$21,604,962	$18,807,840	$12,571,949
Expenses	0	8,825,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	17,650,000	11,798,000
Gross profit from operations	0	6,170,440	12,340,880	12,340,880	12,340,880	12,340,880	12,340,880	3,954,962	1,157,840	773,949
(less) capital spending	(4,000,000)	(21,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	0	0	0
Net cash flow after capital spending	($4,000,000)	($14,829,560)	$11,340,880	$11,340,880	$11,340,880	$11,340,880	$11,340,880	$3,954,962	$1,157,840	$773,949
Net Asset Value	$43,761,591									
NPV at 8%	$25,477,805									
IRR	48.09%									

NOTE: THIS MODEL ASSUMES A BLENDED FEED OF SHOOTS C AND D FOR THE FIRST 6 YEARS (2,029,794 TONS AT 0.236 OPT.)
AND A BLEND OF SHOOTS A AND B FOR THE FINAL YEARS (853,000 TONS AT 0.148 OPT)



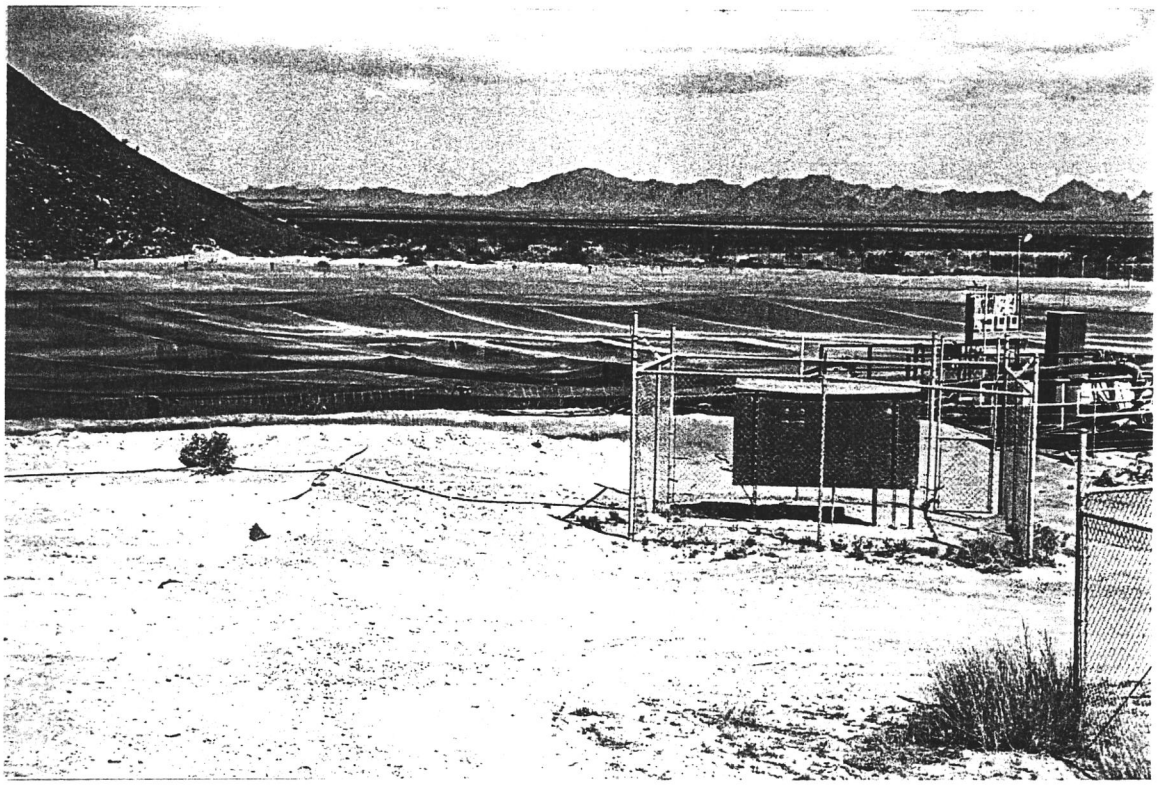
Copperstone Minesite showing office, workshop and water tower.

Copperstone Minesite showing storage containers and office.

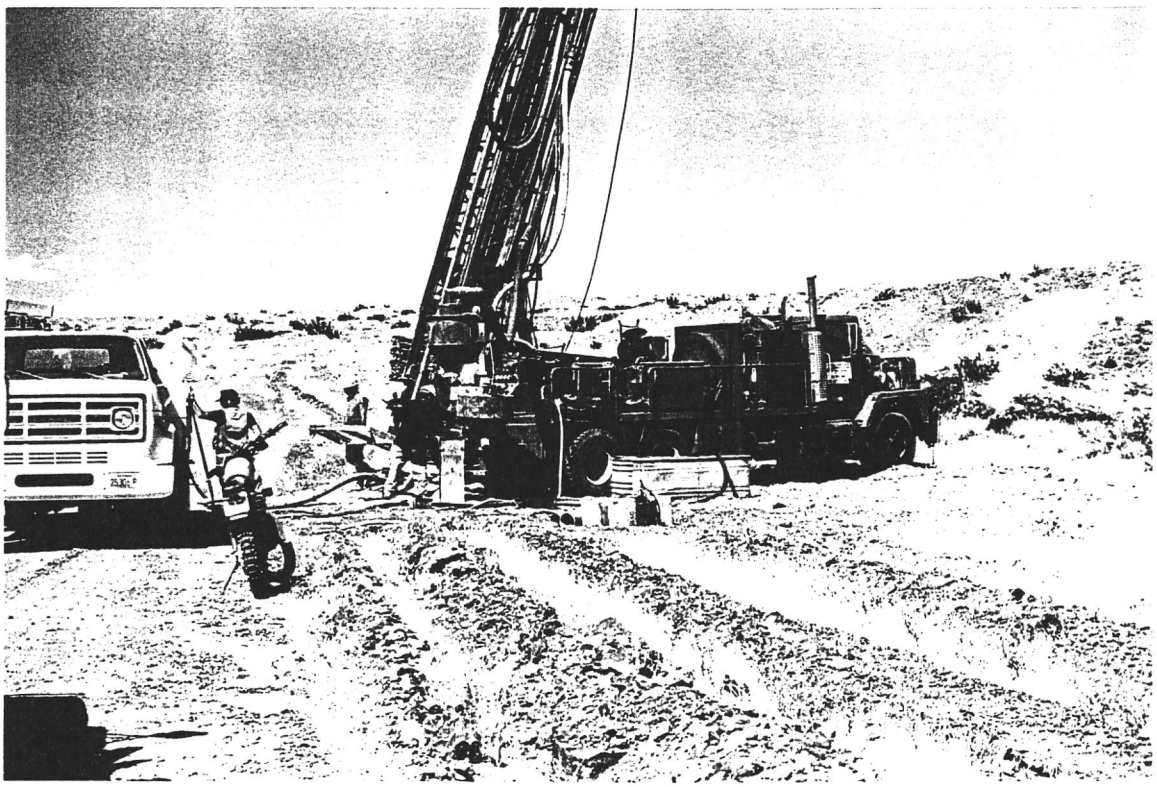


Copperstone office trailer.

Storage shed and trailer.



Copperstone tailings empoundment.



R.C. drill rig.

INTRODUCTION

The Copperstone mine is an exciting gold target with multi-ounce gold intersections over 25 feet widths and real potential for over 1 million ounces at underground grades. The property is made more attractive and economic by the information and facilities left by the previous open pit operation. The accompanying cashflow model shows that the deposit has a potential to be very profitable.

Copperstone is located in La Paz County, Arizona 26 km. north of Quartzite. The mine was formerly operated by Cyprus as an open pit gold mine from which 500,000 ounces of gold was produced from 6,000,000 tons of ore grading 0.1 opt. The mine was closed in November 1992 and is currently in the final reclamation stage. The property, including the roads, the power system, the water system and several buildings, was returned to Mr. D. Patch upon the completion of mining and the mining lease has been terminated. Royal Oak Mines Inc. optioned the property in 1995 from Mr. Patch.

Reserves amenable to underground mining are present and are currently being drilled off by Royal Oak Mines Inc. The gold occurs in a northeasterly dipping breccia zone in volcanic rocks which contains abundant specular hematite and some traces of copper. The deposit is oxidized to the level of the current drilling where some trace sulphide mineralization occurs. A resource of 2.6 million tons at 0.23 opt containing 606,000 ounces of gold has been recently calculated from a longsection in the plane of the ore. These resources will require a more detailed underground drill program to place them in the probable category.

A high grade zone has been discovered by recent drilling along the northwest margin of the deposit where the mineralized breccia contacts a limestone zone. Grades of over 1.0 opt are encountered in this area and have a consistent thickness of 25 feet. This mineralization occurs in a heavy hematite replacement zone that has a considerably higher specific gravity than the normal mineralized breccia making it even more attractive for underground mining.

Copperstone is an exciting exploration target for underground gold reserves having the known high grade down dip extension of a proven open pit mine and having the major facilities already in place. Permitting of the property, due to its having been a mine and due to low ground water flows, is likely to be quick and simple. The existing pit provides an excellent location for the collaring of a portal as it has bare rock faces close to the ore face.

Reserves

Copperstone Main Zone: Statement of Resource

Block	Area (ft.)	Grade (opt Au)	Thickness T.W. (ft.)	Tonnage (tons)	Ounces Contained
A	197,968	0.149	12.34	222,084	33,091
B	390,625	0.168	15.6	553,977	93,068
C	951,815	0.216	13.43	1,162,080	251,009
D	401,875	0.335	17	683,188	228,868
			TOTAL	2,621,329	606,036
			GRADE	0.231	
			TRUE WIDTH	14.70	
			(WEIGHTED)		

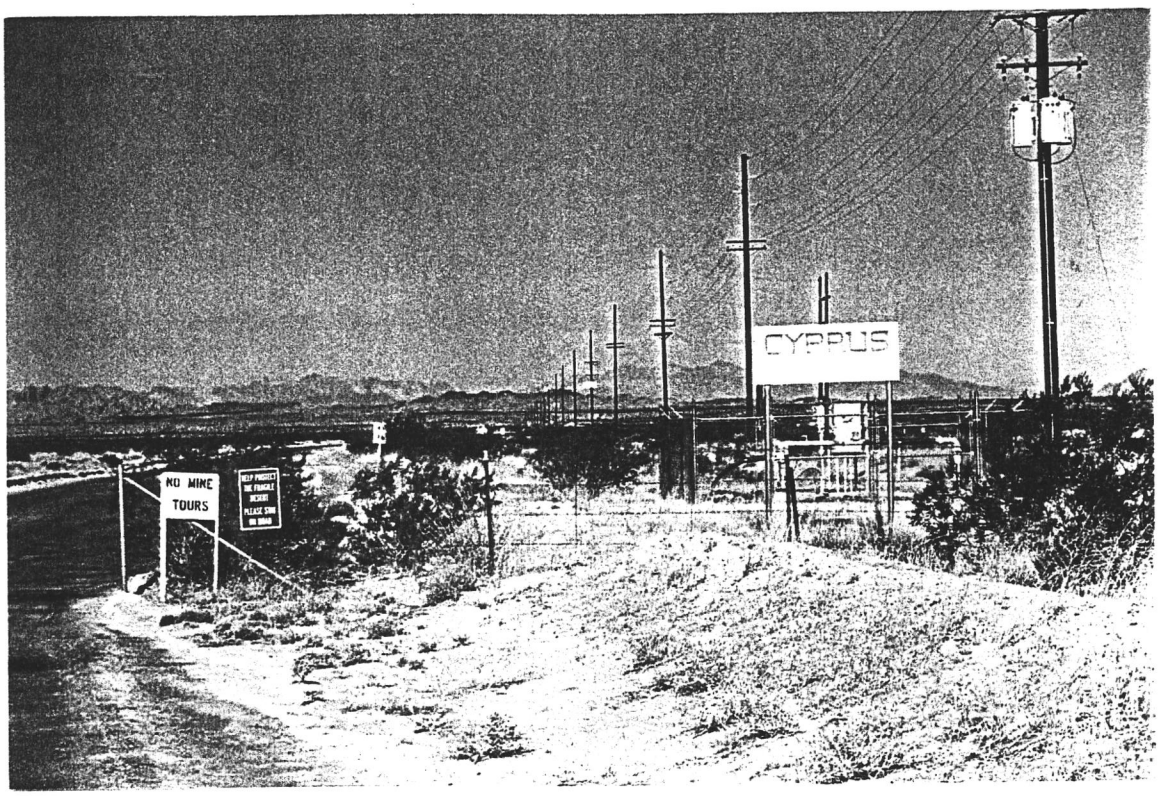
Criteria considered for resource calculation:
1) Tonnage Factor = 12, except Block D = 10
2) A cut-off of 0.04 opt Au over a minimum true width of 10 feet.
3) A 150 ft. Area of influence around the resource blocks.
4) Assays Uncut, except Hole C95-11- cut to 2 oz.

Exploration Possibilities

a) Property

Potential for **1 million ounces** in the main orebody is considered excellent. Additional work should be used to evaluate the following prospective targets:

- A footwall structure below the Main Zone which has been the subject of very little exploration. Limited drilling has returned 0.646 opt Au over a core length of 15 feet, and 0.246 opt Au over a core length of 40 feet.



Entrance to Mine showing power-line

Open pit looking SSW, showing ramp access within the pit

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Date:	Sept 5, 1997
To:	Mr. Randy Moore
Company:	Cambior Exploration USA, Inc.
Fax:	(702) 856-4549
From:	Bruce Young

We are transmitting 1 page(s), including this cover sheet. If you do not receive complete documents, please call (604) 681-3735 as soon as possible.

Re: Royal Oak Mines' Copperstone Gold Mine

Message(s): Randy, I have forwarded a copy of the CA to Ross Burns with Royal Oak Mines. He will be advising Kevin Leonard Chief Exploration Geologist, USA to contact you to make arrangements for your review of the Copperstone Gold mine data.

Yours Truly,

Bruce Young

Suite 305 - 675 West Hastings Street, Vancouver, B.C., Canada V6B 1N2 Tel: (604)681-3735 Fax: (604)681-6406

FROM PROSPECT TO PRODUCTION, MBI BROKERS ARE LOCATED ON SIX CONTINENTS TO ASSIST YOU!

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DATE: September 4, 1997

TO: Randy Moore

COMPANY: Cambior USA Inc.

Fax No: 702-856-4549

We are transmitting __4___ pages, including this cover sheet. If you do not receive complete documents, please call (604) 681-3735.

FROM: Bruce Young

RE: CA - Copperstone

MESSAGE:
Please read, sign and refax back to me at 604-681-6406.

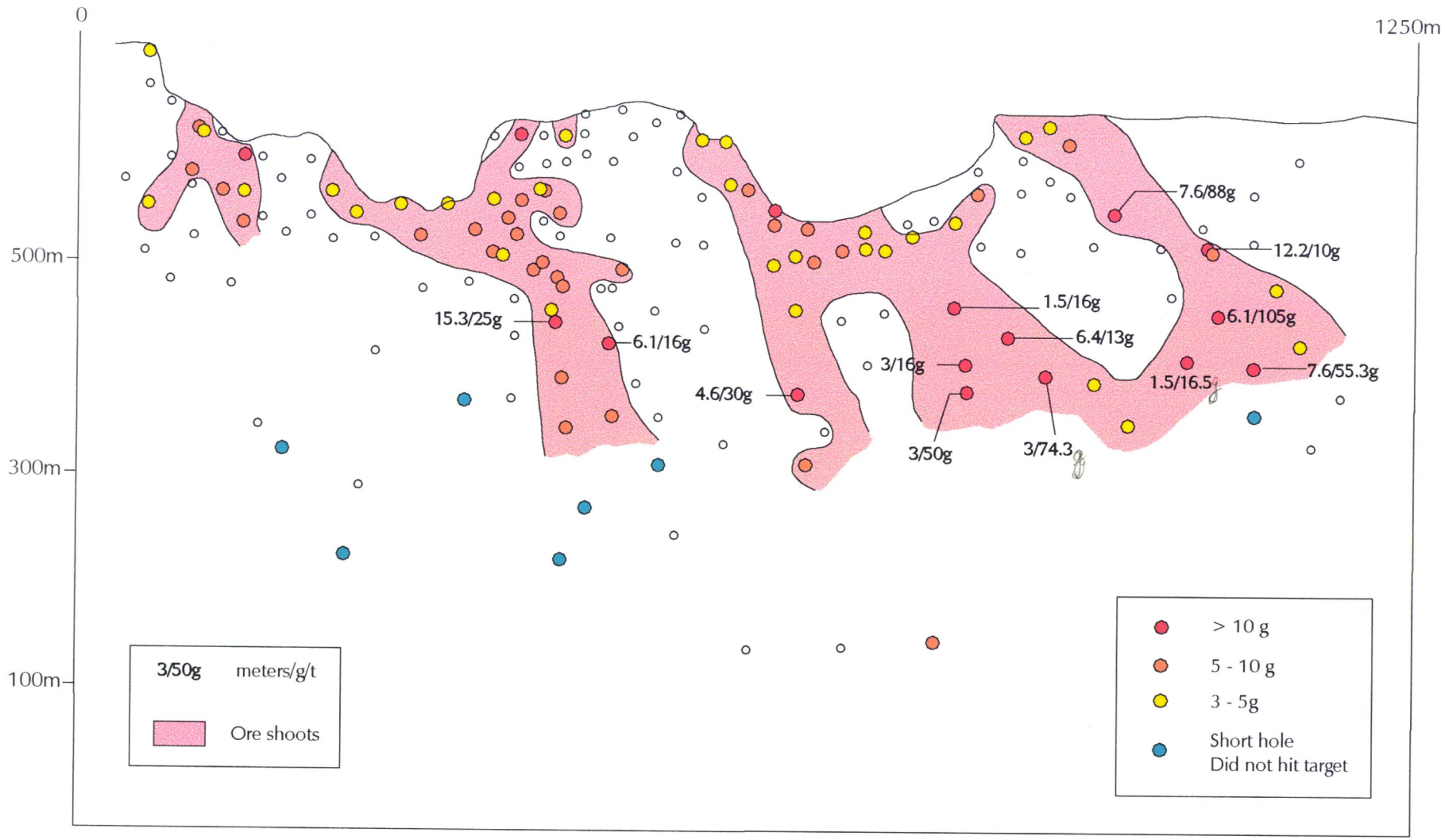
Regards,

For Bruce

Suite 305 - 675 West Hastings Street, Vancouver, B.C., Canada V6B 1N2 Tel: (604)681-3735 Fax: (604)681-6406

Copperstone Long Section 210

(Section in plane of structure)



The Phase IV Drill Program - Copperstone Property

Drill Hole	Target	Section	Grid Co-ordinates North	Grid Co-ordinates East	Dip deg.	Proposed Length (feet) RC	Proposed Length (feet) Core	Proposed Length (feet) Total	Results opt Au	Results Length (ft)
C97-24 (P1)	Down plunge from C97-19 which returned 1.55 opt Au over 25 ft.	156	1047720	332828	-90	500	200	700	1.61	25
C97-26 (P2)	Step - out to the north, down dip from Hole 264 which returned 0.08 opt Au over 30 ft.	157	1047620	332630	-90	450	200	650	0.11	5
C97-27 (P3)	Down dip of P1, deep down plunge from C97-19.	156	1047818	332928	-90	600	0	600 ABANDONED AT 600 ft.	no results	
C97-34 (P4)	Positioned between Shoots C and D. About 150 ft. from Hole 115 which intersected 0.09 opt Au over 20 ft.	153	1047572	332978	-90	500	200	700	0.167	15
P5 No drill	Shallow, step - out along strike to the north	159	1047818	332629	-90	350	200	550	not drilled	
C97-33 (P6)	Shallow, step-out from Hole 74 which returned 0.246 opt Au over 40 ft.	152	1047270	332778	-90	400	200	600	0.012	20
C97-23 (P7)	Down plunge from Hole 73 which returned 0.068 opt Au over 10 ft.	149	1047124	332928	-90	460	168	628	0.017	15
C97-25 (P8)	Down plunge from Hole 106 which returned 0.094 opt Au over 30 ft.	160	1048018	332726	-90	600	201	801	Fault Zone	
C97-28 (P9)	Down plunge from Hole 115 which returned 0.09 opt Au over 20 ft.	151	1047568	333175	-90	700	134	834	0.125	15
C97-29 (P10)	Down dip from C95-06 which returned 0.10 opt Au over 25 ft. Near abandoned Hole C97-21	144	1047220	333520	-90	650	256	906	0.974	15
C97-30 (P11)	In-fill, about 150 ft. down plunge from Hole C96-18 which returned 0.422 over 35 ft.	137	1046873	333880	-90	700	231	931	0.017	25
C97-32 (P12)	Step-out from Hole 256 which returned 0.146 opt Au over 20 ft.	124	1046225	334528	-90	600	200	800	0.004	15

SPENCER file

NOTES ON BILL BURTON'S AIME TALK, 12/7/87

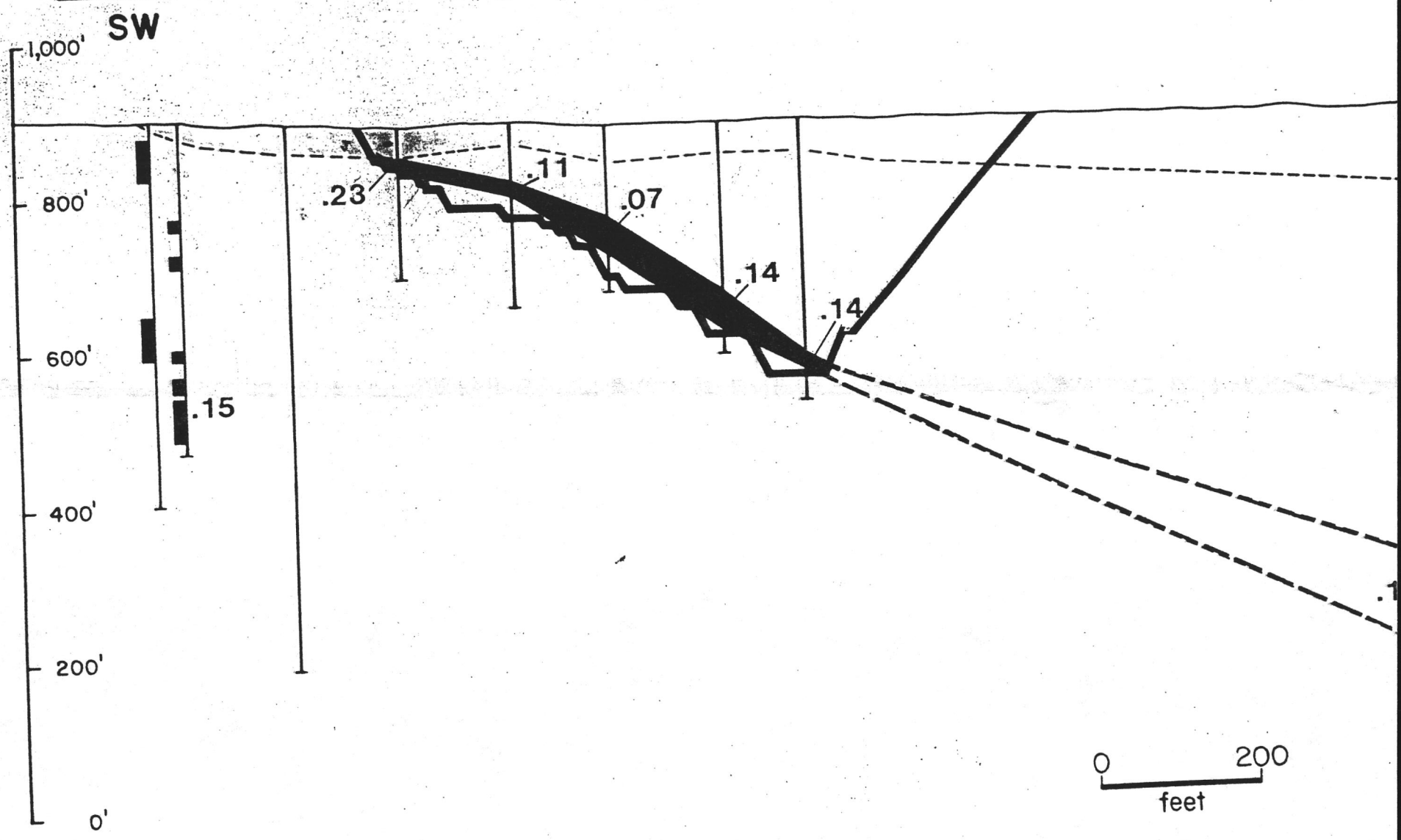
Geology of the Copperstone Gold Deposit

Ore production started in November, 1987
Open-pit has been excavated to 75 feet

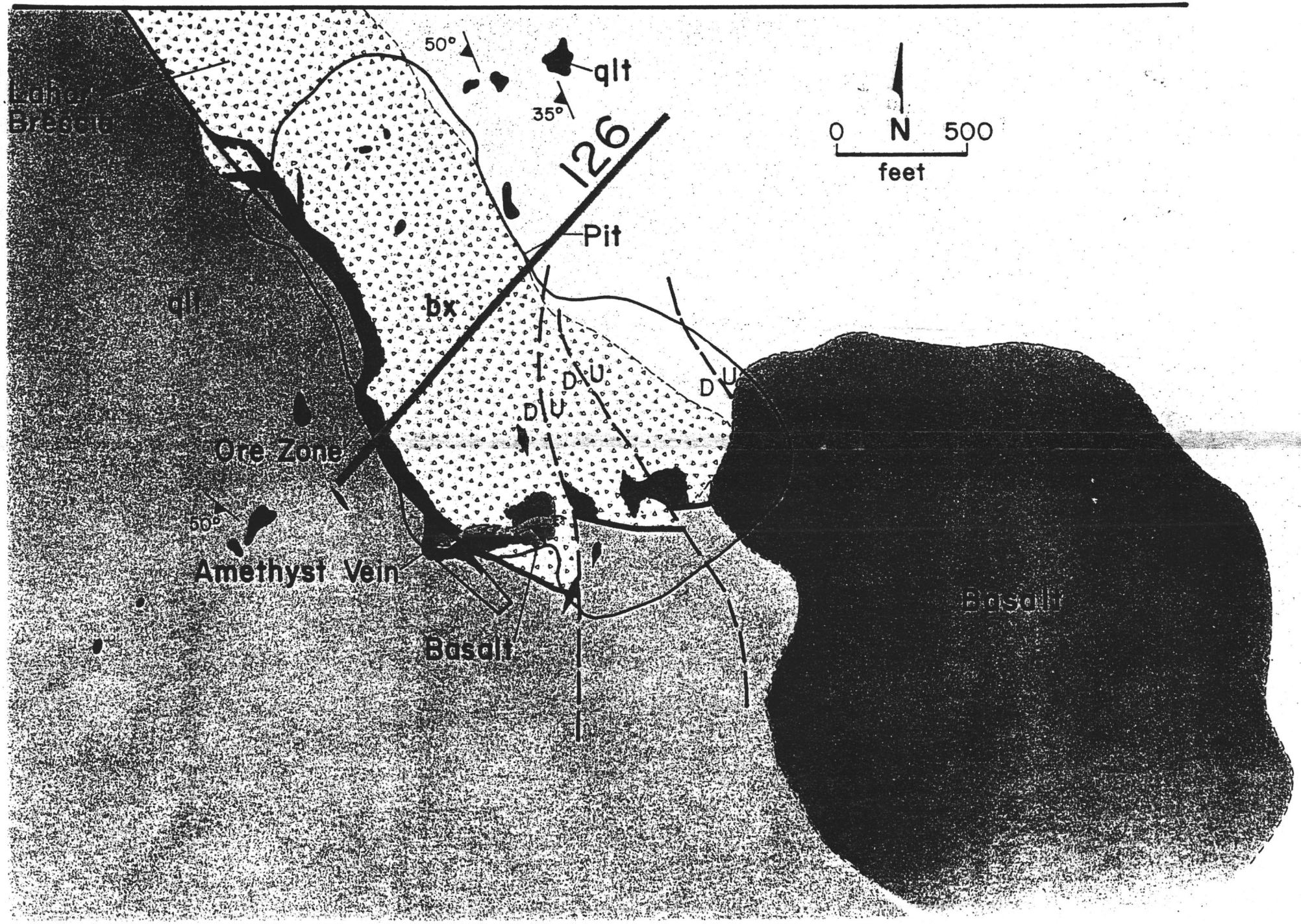
Dave Thomas - Mine Geologist
Maggie McGee - Mine Superintendent (male)

Jurassic quartz latite tuff host ore in upper-plate of low-angle fault.
Mineralized specularite breccia is 0.02 to 0.07 opT (ounces per ton).
All copper minerals in specularite breccia are after chalcopyrite, that is Burton believes the chrysacolla et al. to be SECONDARY minerals.
69 core holes, 336 rotary holes for a total of 144,000 feet of drilling.
Footwall to ore zone = quartz latite
Hangingwall to ore zone = enigmatic, perhaps a lahar at the very least some sort of volcanic conglomerate (agglomerate?).
Ore zone is controlled by a low-angle fault. Ore zone strikes NW and dips about 30 degrees to NE. Ore zone is broken by a series of N-S-trending high-angle normal faults with very little offset, probable Basin and Range deformation.
Below the water table (known from deep drilling) the Au-mineralized specularite breccias contain chalcopyrite.
Final pit depth will be 450 feet.
Qtz-amethyst veining at base of hangingwall, weakly Au mineralized, 0.02 to 0.03 opT.
"Young" that is fresh, basalt is clearly pre-mineralization, the basalt is locally mineralized.
Open-pit Reserves: 6 million tons at 0.085 opT
Underground Reserves: 0.3 million tons at 0.2 opT, UG reserves should grow in tonnage and possibly grade.
Ground magnetic studies revealed location of the basalt but nothing of economic interest. Implies amount of specularite might not be so great.
IP anomalies are crudely coincident with the pit outline. Might indicate IP response to ore, or rather that the alluvium is thinning near the pit, which it is.
Au is in the 4 to 40 micron size range.
Anomalous geochem: Fe, Ba, Cu, Pb, Zn, Bi, Cr, U, Tl, F, Au, Ag
Non-anomalous geochem: As, Sb, Hg, Tl
Mill: 2,900 TPD, ore ground to -200 mesh
Cyanide agitation circuit to carbon-in-leach recovery with 92% recovery expected. 60,000 oz/yr Au production.
Bullion is 950 fine, remainder is Ag
Full production Costs: $220/oz
Cash Costs: $180/oz

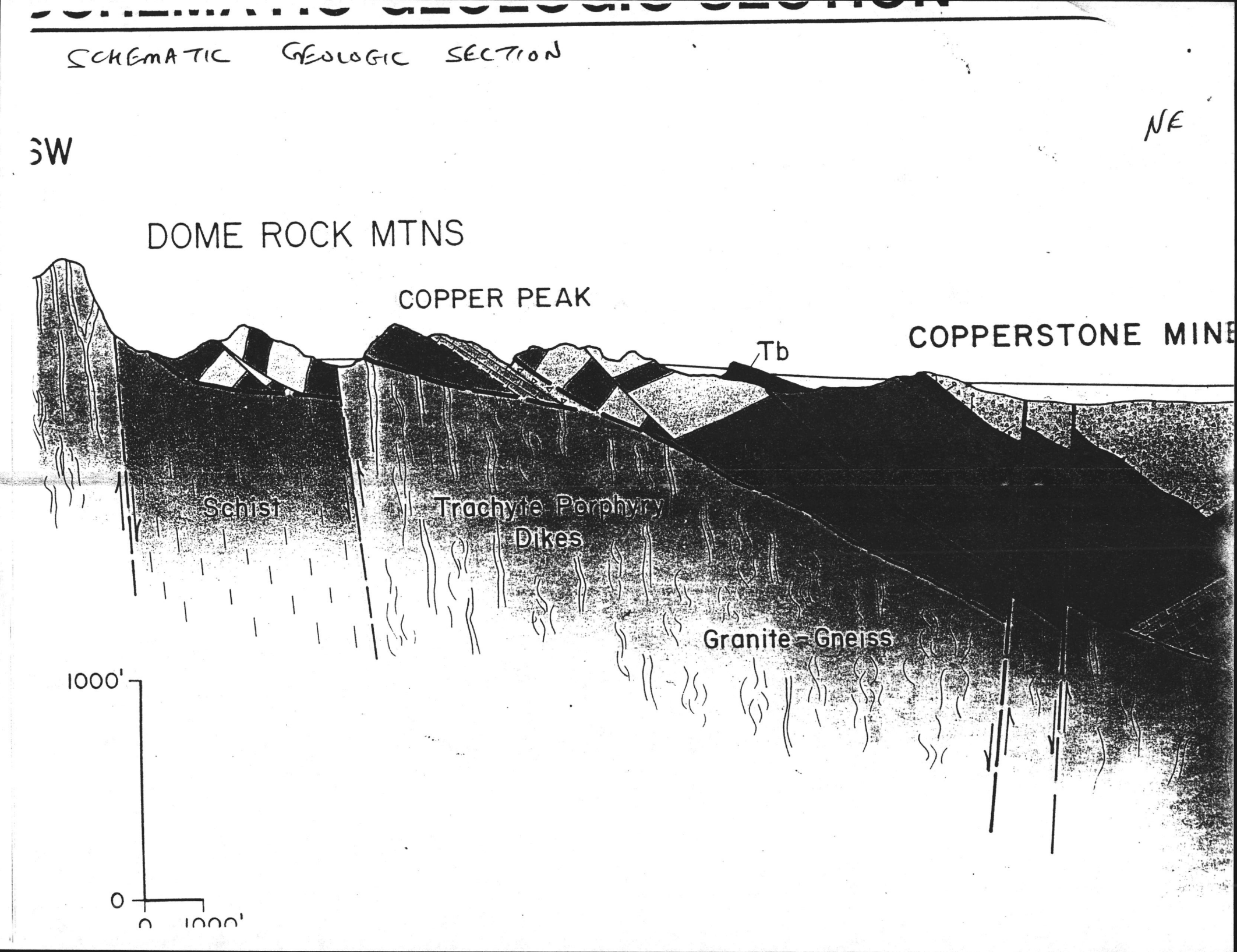
CROSS SECTION 126



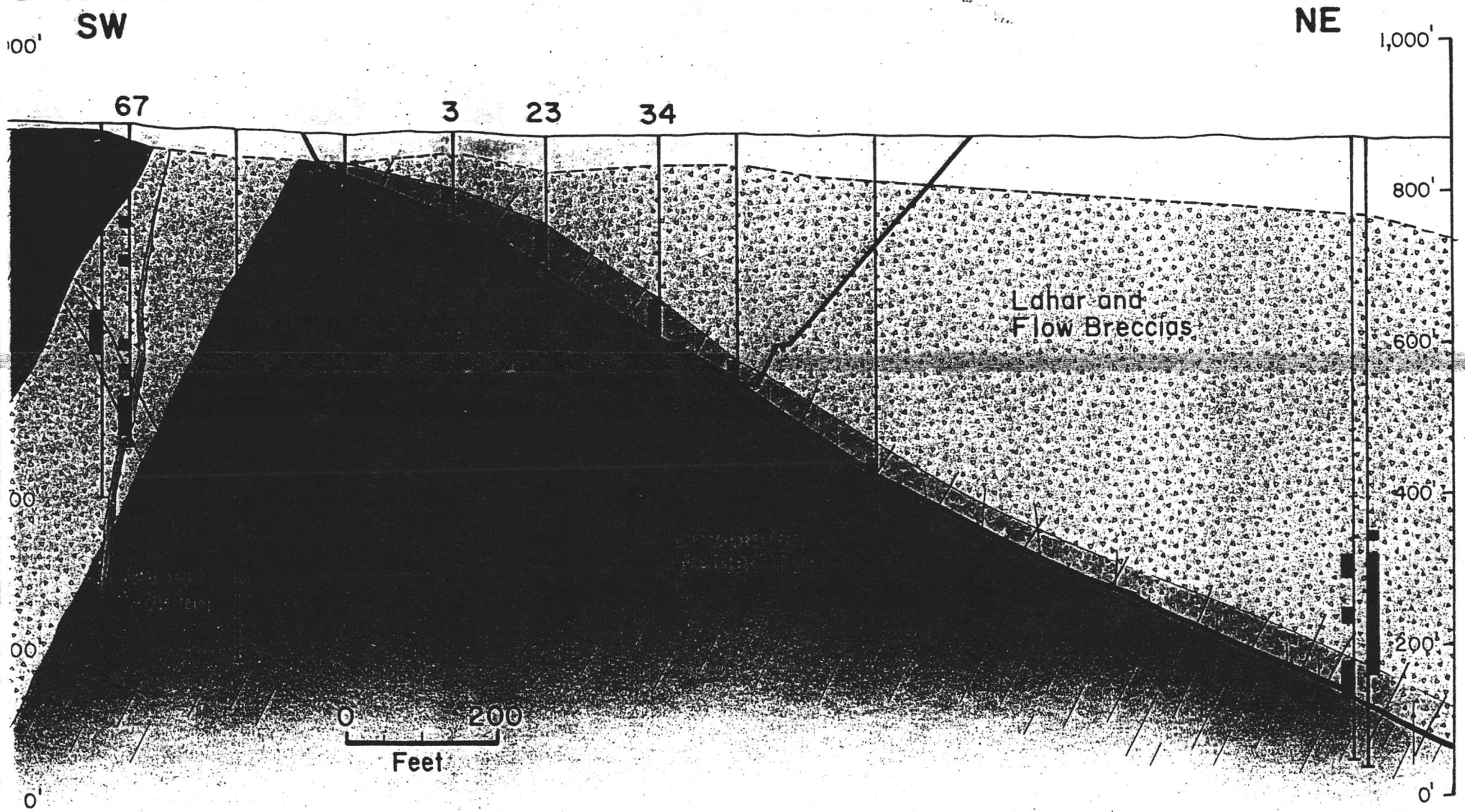
SUBSURFACE GEOLOGY



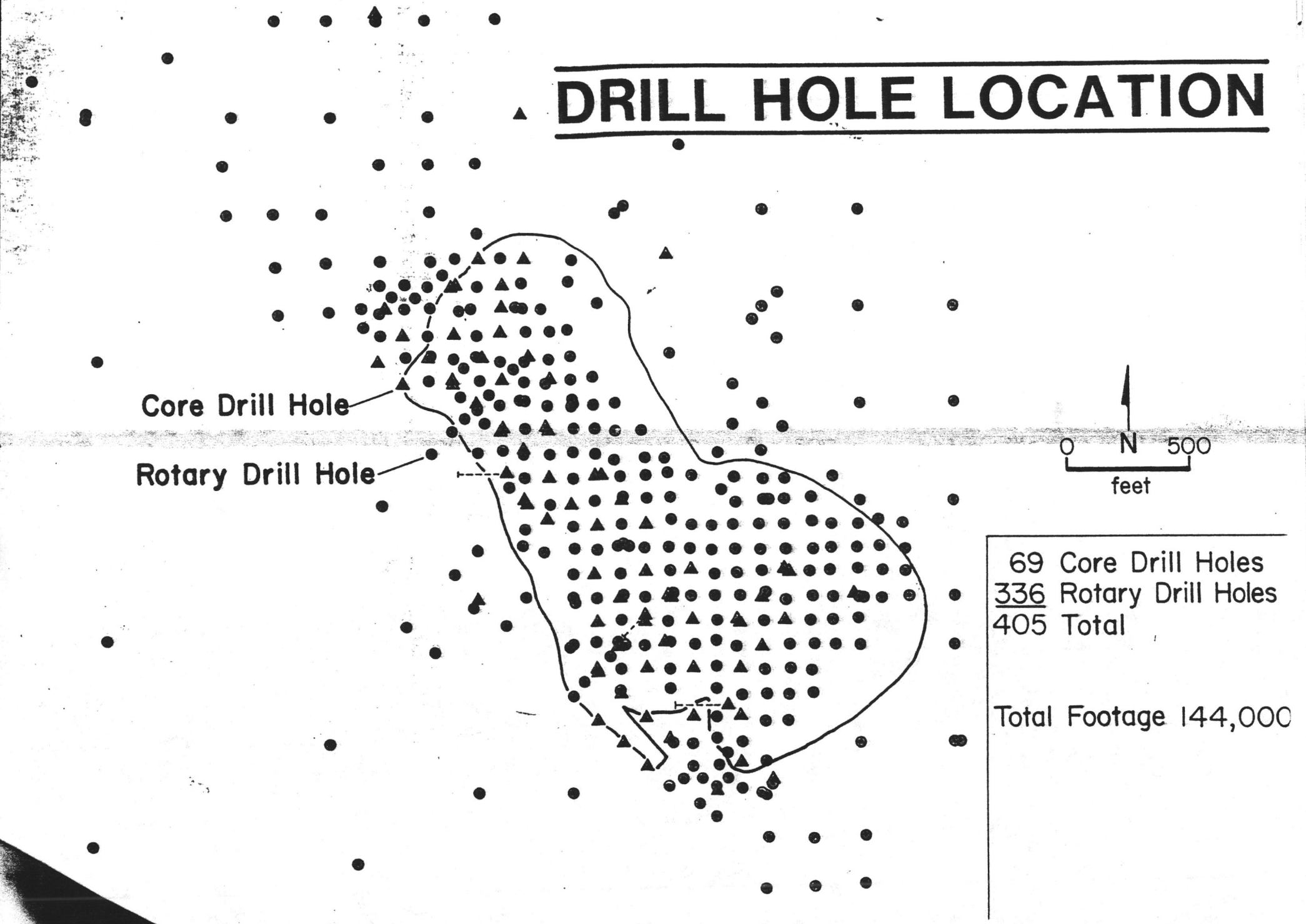
SCHEMATIC GEOLOGIC SECTION

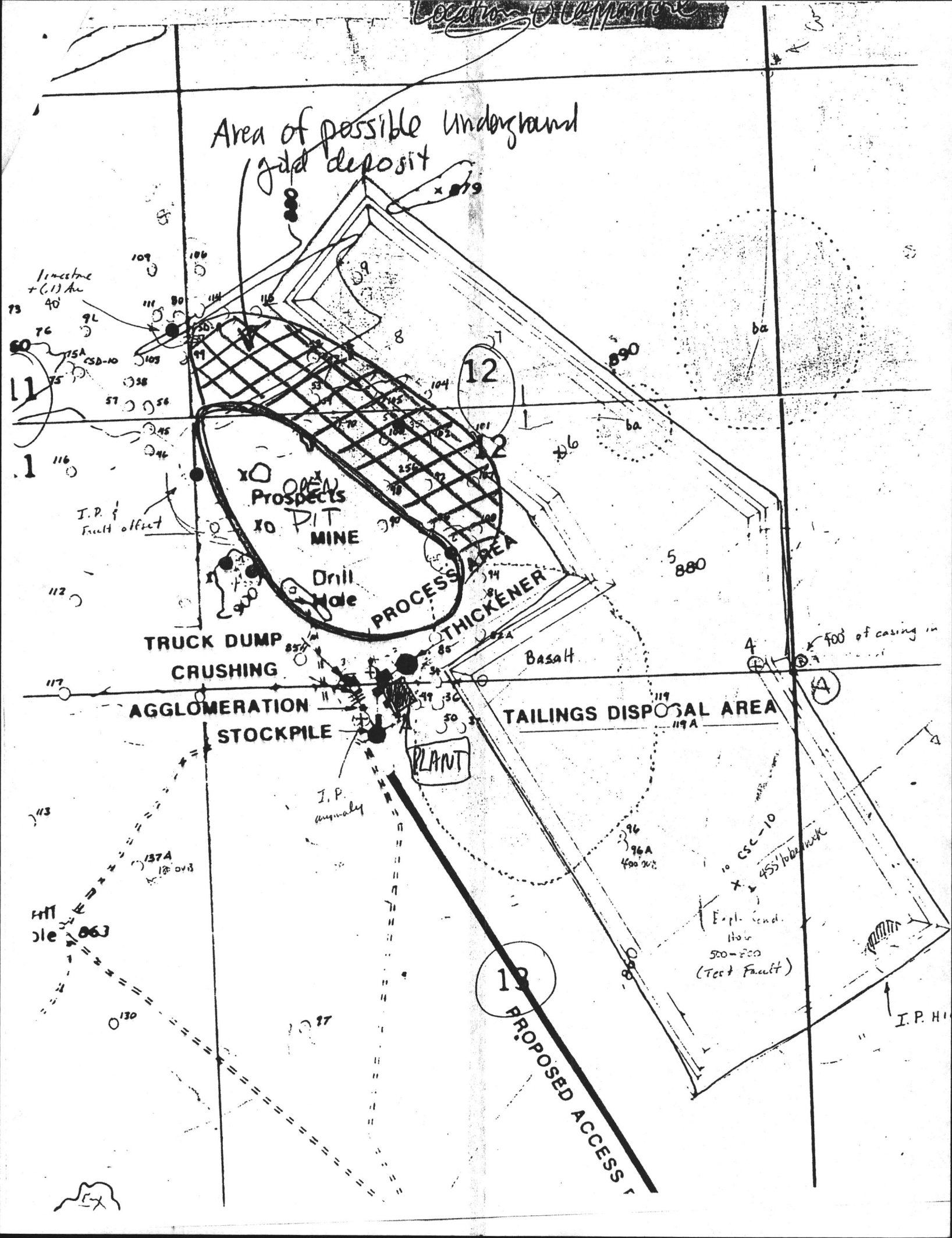


GEOLOGIC SECTION 126



DRILL HOLE LOCATION




Area of possible underground gold deposit
Limestone + (.1) Au
40'
CSD-10
OPEN PIT MINE
Prospects
Drill Hole
PROCESS AREA
THICKENER
TRUCK DUMP
CRUSHING
AGGLOMERATION
STOCKPILE
PLANT
Basalt
TAILINGS DISPOSAL AREA
I.P. anomaly
I.P. & Fault offset
400' of casing in
CSC-10
455' to bedrock
Expl. Cond. Hole 500-600 (Test Fault)
PROPOSED ACCESS
I.P. HI

WORK PROPOSAL
EXPLORATION

Property of Account Copperstone **Estimated Expenditures** $2,505,000

District or Office Kirkland **Period** Jan. 1997 To Dec. 1997 **Date** Nov. 14,1996

Statement of Proposal

A Phase I underground exploration program is recommended to validate drilling results and obtain a bulk sample. A program involving 4,000 linear feet of ramping/drifting from inside the pit and 5,000 feet of short range definition drilling is contemplated. The Phase I ramp will be driven into the existing decline and will continue below it into the footwall where drill stations can be established. In addition, 10,000 feet of surface drilling is recommended to test the interpreted down plunge extensions to known auriferous intersections and evaluate additional high priority gold targets north of the pit. Implementation of the UG program is dependant upon approval of certain permitting requirements.

Summary of Proposal

Compilation of data indicate a down dip extension of the Main Zone as well as parallel structures in the footwall that could be exploited by underground methods. A drill indicated resource totalling 2.5M tons at a grade of 0.183 opt Au containing about 462,347 ounces has been generated by Royal Oak. Reverse circulation and core drilling have traced the Main Zone an additional 1,600 feet along the dip of the structure, below the floor of the pit. High grade gold values,i.e. 0.33 opt Au over a core length of 25 feet (0.33/25) and 0.246/40 are associated with a relatively untested limestone unit. The grades were intersected 500 feet along strike of the deposit to the north. Other intersections below the Main Zone have returned 0.646/15 at a vertical depth of 870 feet. The contoured grade x thickness data suggest a periodicity of steeply north plunging mineralized shoots up to 700 feet in width. A predictable pattern of ore shoot geometry is being used to optimize results in drilling for ounces. The objectives of the 1997 exploration program are to verify the character and continuity of the mineralization, expand the existing mineral inventory of the Main Zone, and to evaluate other high priority gold targets in the footwall and north of the deposit.

Tenure

100% Royal Oak Mines (USA) Inc., subject to a gross production royalty based on the price of gold in US dollars. The royalty is 6% at a gold price greater than US$551.00.

Estimated Expenditures

1) Property Costs		
Advance Royalty	$	30,000
Fees		35,000
Facilities Maintenance		50,000
Subtotal		115,000
2) Underground Exploration Costs		
Mobilization and Demobilization		250,000
Ramping (350/ft.), Drifting/Crosscuts ($250/ft.)		1,400,000
10% Contingency on Cost Plus Materials		165,000
Detailed drilling 5,000 ft. @ $35 per ft.		175,000
Permitting		50,000
3) Surface Drilling 10,000 ft. @ $35 per ft.		350,000
	TOTAL	**2,505,000**

Previous Expenditures

$210,000

A total of US$596,000 has been expended since the inception of the project. Drilling costs contribute about US$400,000 or 67% of total expenditures.

Approved: **Proposer:** K. Leonard

[redacted] — mining, milling, recovery, reserves
SPENCER file

COPPERSTONE PROJECT PRESENTATION - DECEMBER 7, 1987

RESERVES.

INTRODUCTION

TOTAL COSTS OF PRODUCTION FROM THE PIT WILL BE ABOUT $[illegible]

THE COPPERSTONE MINE IS LOCATED IN WESTERN ARIZONA ABOUT 15 MILES NORTH OF THE TOWN OF QUARTZITE, ARIZONA.

[SLIDE OF PROJECT LOCATION] RRENTLY CONSISTS OF ABOUT 105 PEOPLE OF WHICH 40 ARE CYPRUS EMPLOYEES WORKING IN [BLANK SLIDE] N, ENGINEERING, AND THE MILL, AND 65 ARE EMPLOYEES OF MORRISON KNUDSEN, WHICH IS THE CONTRACT MINER THE PROJECT DEVELOPMENT TIME FROM APPROVAL TO POURING GOLD WAS ABOUT 13 MONTHS OF WHICH 8 MONTHS WERE REQUIRED FOR ACTUAL PLANT CONSTRUCTION. THE TOTAL PROJECT CAPITAL COST WAS APPROXIMATELY $13.9 MILLION.

[SLIDE OF ROAD CONSTRUCTION]

IN 1987 THE PROJECT SHOULD PRODUCE ABOUT 6,000 OUNCES OF GOLD AND IN 1988 THE PRODUCTION WILL REACH OVER 60,000 OUNCES PER YEAR. AT A PROCESSING RATE OF ABOUT 1 MMTPY, THE CURRENT SURFACE RESERVES WILL SUPPORT THE PROJECT FOR SIX YEARS. THE INITIAL PRODUCTION WILL BE FROM THE OPEN PIT WHICH HAS RESERVES OF 6 MILLION TONS OF ORE AVERAGING 0.085 OPT GOLD WITH A TOTAL OF 510,000 CONTAINED OUNCES. THE FINAL PIT WILL BE APPROXIMATLEY 2800 FT. LONG, 1400 FT. WIDE, AND 450 FT. DEEP. IN ADDITION TO THE SURFACE MINEABLE RESERVES, COPPERSTONE HAS EXCELLENT POTENTIAL FOR THE DEVELOPMENT OF SUBSTANTIAL UNDERGROUND RESERVES. DRILLING

IS CURRENTLY UNDERWAY FOR DEFINITION OF THE UNDERGROUND RESERVES.

THE CASH COSTS OF PRODUCTION FROM THE PIT WILL BE ABOUT $180 PER OUNCE WHILE THE FULL PRODUCTION COSTS ARE EXPECTED TO BE ABOUT $220 PER OUNCE.

THE STAFF AT COPPERSTONE CURRENTLY CONSISTS OF ABOUT 105 PEOPLE OF WHICH 40 ARE CYPRUS EMPLOYEES WORKING IN AN ADMINISTRATION, ENGINEERING, AND THE MILL, AND 65 ARE EMPLOYEES OF MORRISON KNUDSEN, WHICH IS THE CONTRACT MINER AT COPPERSTONE.

ACCESS

[SLIDE OF ROAD CONSTRUCTION]

THE PROJECT IS ACCESSED BY A 5.5 MILE DIRT ROAD OFF ARIZONA HIGHWAY 95. THE SOILS ALONG THE ROAD WERE VERY LOOSELY CONSOLIDATED ALLUVIAL SANDS WHICH REQUIRED THE USE OF A MgCl TO STABLIZE THE ROAD SURFACE AND TO CONTROL DUST.

WATER

[SLIDE OF WATER TANK]

PROJECT WATER IS SUPPLIED BY THREE WELLS LOCATED ABOUT 5 1/2 MILES EAST OF THE PLANT SITE. THE COMBINED WELL CAPACITY IS 900 GPM. THE THREE WELLS PUMP TO A 10,000 GAL. SURGE TANK (SHOWN IN SLIDE) FROM WHICH THE WATER IS PUMPED THROUGH A 10 INCH BURIED LINE TO THE PLANT. THE WELLS PUMP FROM AN AQUIFER ABOUT 600 FT. BELOW THE SURFACE.

POWER

[SLIDE OF POWER LINE CONSTRUCTION]

LINE POWER IS PROVIDED BY APS. CYPRUS CONSTRUCTED ABOUT 6 MILES OF 69 KV LINE.

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COMMUNICATIONS

BECAUSE OF THE FAIRLY REMOTE MINE LCOATION, THE NEAREST PHONE LINES ARE ABOUT 12 MILES AWAY. DUE TO THE HIGH COST ASSICIATED WITH BRINGING PHONE LINES TO THE SITE, IT WAS DECIDED TO GO WITH A MICROWAVE COMMUNICATIONS SYSTEM. IF

ANYONE IS GOING TO CONSIDER A MICROWAVE SYSTEM FOR A NEW SITE, ALLOW AT LEAST 6 MONTHS FOR THE FREQUENCY SEARCH, APPLICATION PREPARATION, AND FCC APPROVAL. IT TOOK 8 MONTHS FROM GO AHEAD TO BEING OPERATIONAL AT COPPERSTONE.

EXPLORATION & GEOLOGY

[SLIDE OF DRILL HOLES]

APPROXIMATELY 405 EXPLORATION HOLES HAVE BEEN DRILLED AT COPPERSTONE TOTALING OVER 144,000 FEET. MOST OF THE HOLES WERE DRILLED USING REVERSE CIRCULATION DRILLS BUT MANY CORE HOLES RANGING IN SIZE FROM 2½ INCH TO 6 INCHES IN DIAMETER WERE ALSO DRILLED FOR GEOLOGY AND METALLURGICAL SAMPLES. OF THIS TOTAL, ABOUT 300 HOLES ARE LOCATED WITHIN THE SURFACE MINEABLE PORTION OF THE DEPOSIT. NOTE THE GOOD DISTRIBUTION OF CORE HOLES WHICH PRODUCED REPRESENTATIVE SAMPLES FOR OUR METALLURGICAL TEST WORK.

[SLIDE OF TYPICAL X-SECTION]

THE COPPERSTONE OREBODY IS CONTAINED WITHIN A MODERATELY DIPPING (30° TO 35°) BRECCIA ZONE WITHIN QUARTZ LATITE WELDED TUFF ROCKS. THE ENTIRE MINE AREA IS COVERED BY ALLUVIUM WHICH AVERAGES ABOUT 100 FT. THICK. ALL OF THE PIT MINEABLE ORE IS COMPLETELY OXIDIZED. THE GOLD MINERALIZATION CONSITS OF MICRON SIZE FREE GOLD.

[SLIDE OF FOOTWALL CONTACT]

THE FOOTWALL CONTACT APPEARS TO BE A FAIRLY WELL DEFINED FAULT WHICH WILL AID IN ORE CONTROL AND MINIMIZING DILUTION.

ORE RESERVES

[SLIDE OF RESERVE STATISTICS]

AS MENTIONED, THE SURFACE MINEABLE RESERVES AT COPPERSTONE ARE APPROXIMATLEY 6 MM TONS WITH AN AVERAGE GRADE OF 0.085 OPT AU. THE Au:Ag RATIO AT COPPERSTONE IS ABOUT 1:1. THESE RESERVES WERE ESTIMATED USING A GEOSTATISTICAL KRIGED BLOCK MODEL. AS THE BLOCK MODEL WAS BEING DEVELOPED, IT WAS CONTINUALLY CROSS-CHECKED WITH THE GEOLOGIC CROSS-SECTIONS FOR ACCURACY.

IN ADDITION TO EXCAVATING THE ORE, APPROXIMATLEY 39 MM TONS OF WASTE MATERIAL WILL BE MINED RESULTING IN AN OVERALL STRIP RATIO OF 6.5:1. OF THE WASTE MATERIAL, ABOUT 40% IS ALLUVIUM AND 60% IS WASTE ROCK.

MINING

[BLANK]

THE COPPERSTONE PROJECT IS BEING DEVELOPED AS AN OPEN PIT MINE WITH THE MINING BEING DONE BY A CONTRACT MINER, MK, ON A UNIT PRICE BASIS. THE DECISION TO USE A CONTRACT MINER RATHER THAN DOING THE MINING OURSELVES WAS BASED ON:

1. CONSERVATION OF CAPITAL
2. QUICKER PAYBACK
3. VERY COMPETITIVE RATES
4. QUICK MOBILIZATION
5. REDUCED STAFFING REQUIREMENTS.

THE MINING IS BEING PERFORMED USING 120 TONS TRUCKS AND 13 CUBIC YARD LOADERS. OTHER MAJOR EQUIMPENT USED IN THE MINE IS:

[SLIDE OF MINING EQUIPMENT LIST]

[BLANK]

THE PIT IS DESIGNED FOR AN OVERALL INTERRAMP SLOPE ANGLE OF 50°. THE HAUL ROADS HAVE A MAXIMUM SLOPE OF 10% AND VARY IN WIDTH FROM 60 TO 80 FT. SAFETY BENCHES ARE LEFT EVERY 40 VERTICAL FEET.

THE MINE IS OPERATED TWO SHIFTS PER DAY, FIVE DAYS PER WEEK PRODUCING AN AVERAGE OF 4,000 TONS OF ORE PER DAY. ORE IS MINED IN 10 FT. LIFTS WHILE WASTE IS MINED IN 20 FT. LIFTS. THE ORE BLAST HOLES ARE DRILLED 13 FT. DEEP WITH ONLY THE TOP 10 FT. BEING SAMPLED. THE WASTE BLAST HOLES ARE DRILLED 23 FEET DEPTH WITH ASSAY SAMPLES TAKEN FOR THE FIRST 10 FT. AND THE SECOND 10 FT. FOR GRADE CONTROL. THE ORE HOLE SPACING IS 9 FT. X 9 FT. USING 3½ INCH DIAMETER HOLES WHILE THE WASTE HOLE SPACING IS GENERALLY 18 FT. X 18 FT. USING 6½ INCH DIAMETER HOLES.

SINCE THE FINAL PIT BOTTOM IS ABOUT 200 FT. ABOVE THE WATER TABLE, NO PIT WATER IS EXPECTED OTHER THAN SOME SURFACE RUNOFF FROM RAINSTORMS.

THE CURRENT MINING CONTRACT IS FOR THE FIRST 2½ YEARS OF PRODUCTION. WHEN THE CONTRACT EXPIRES, THE ECONOMICS OF CONTINUING WITH CONTRACT MINING VS. MINING OURSELVES WILL BE STUDIED.

CYPRUS IS RESPONSIBLE FOR ALL ORE CONTROL AND SURVEYING IN THE MINE. A COMPUTERIZED MINE PLANNING PACKAGE (MINTEC MEDSYSTEM) IS BEING USED AT THE MINE FOR SHORT AND LONG TERM SCHEDULING. THE SAME SYSTEM WAS USED TO DETERMINE THE FINAL PIT DESIGN AND IS ALSO BEING USED AT ALL OF THE OTHER CYPRUS METALS MINES. MINING STARTED ON JUNE 29, 1987 AND MK HAS

MOVED 2.1MM BCY OF MATERIAL TO DATE.

THE FOLLOWING SLIDES SHOW THE MINING OPERATION AT COPPERSTONE:

[MINING SLIDES]

MILLING

[BLANK]

PRELIMINARY METALLURGICAL TESTS ON THE COPPERSTONE ORE INDICATED THAT THE ORE MAY BE AMENABLE TO EITHER HEAP LEACHING OR CONVENTIONAL MILLING.

FURTHER TEST WORK SHOWED THAT EVEN THOUGH ACCEPTABLE RECOVERIES COULD BE OBTAINED FROM HEAP LEACHING, A CIL MILL WOULD YIELD SIGNIFICANTLY HIGHER RECOVERIES WHICH WOULD REPAY THE ADDITIONAL CAPITAL COSTS ASSOCIATED WITH THE MILL IN LESS THAN 1 YEAR (AT $450 GOLD.) OTHER PROCESSING ALTERNATIVES THAT WERE STUDIED INCLUDED FLOTATION AND GRAVITY CIRCUITS, AS WELL AS COMBINED MILL/HEAP LEACH PROCESSING SYSTEMS.

[SLIDE OF MILL FLOWSHEET]

THE RUN OF MINE ORE IS CRUSHED TO -5 INCHES IN A 36 X 42 JAW

CRUSHER. THE JAW PRODUCT THEN GOES TO A DOUBLE DECK SCREEN WITH THE UNDERSIZE (-5/8 INCH) GOING TO THE FINE ORE BIN AND THE OVERSIZE GOING TO A 5½ FT. CONE CRUSHER SET FOR A -5/8 INCH PRODUCT. ORE FROM THE BIN IS SENT TO THE PRIMARY BALL MILL WHICH DISCHARGES INTO THE BALL MILL SUMP. THE SUMP PRODUCT GOES TO THE CYCLONE CIRCUIT WHERE THE UNDERFLOW GOES TO THE SECONDARY BALL MILL FOR FURTHER GRINDING AND THE OVERFLOW GOES TO THE PRE-LEACH THICKENER. THE MILL CIRCUIT IS DESIGNED TO GRIND THE ORE TO 80% MINUS 200 MESH. THE THICKENED PULP GOES TO THE LEACH AND CARBON ADSORPTION CIRCUIT WHICH CONSISTS OF TWO LEACH TANKS FOLLOWED BY FIVE CIL TANKS. THE CARBON IS TRANSFERRED COUNTER-CURRENT TO THE SOLUTION FLOW AND IS REMOVED FROM THE NO.1 CIL TANK FOR STRIPPING. THE LOADED CARBON IS TRANSFERRED TO THE STRIP CIRCUIT WHERE IT IS PRESSURE STRIPPED USING A STRONG CAUSTIC/CYANIDE SOLUTION AT 10-15 PSI AND 240° F. THE STRIP SOLUTION IS PASSED THROUGH AN ELECTROLYTIC CELL WHERE THE GOLD AND SILVER IS PLATED ONTO STAINLESS STEEL WOOL. AFTER PLATING, THE WOOL CATHODES ARE THEN MOVED TO A SECOND CELL WHERE THE GOLD IS REPLATED ONTO STAINLESS STEEL PLATES AS A 990 FINE FOIL. THE GOLD FOIL IS THEN SCRAPED FROM THE SHEETS, REMELTED, AND CAST INTO DORE BARS.

THE TAILINGS FROM THE CIL CIRCUIT PASSES THROUGH A CARBON SAFETY SCREEN AND IS PUMPED TO THE TAILINGS DISPOSAL AREA. THE TAILINGS ARE DEPOSITED IN THIN LAYERS ON A SLOPED AREA TO ENHANCE DRAINIAGE AND TO MAXIMIZE WATER RECOVERY.

THE STRIPPED CARBON IS ACID WASHED AND THERMALLY REGENERATED AS REQUIRED.

[SLIDE OF MILL TAILINGS DISPOSAL AREA]

FROM PREVIOUS EXPERIENCE AT OUR ARIZONA COPPER MINES AND OUR AUSTRALIAN GOLD MINE LOCATED IN A DESERT ENVIRONMENT, IT WAS DECIDED THAT ENCLOSING THE MILL IN A BUILDING AT COPPERSTONE WAS NOT NEEDED. THE MILL CONTROL ROOM IS ENCLOSED TO KEEP OUT DUST AND MAINTAIN A REASONABLE TEMPERATURE IN BOTH SUMMER AND WINTER BUT THE REMAINDER OF THE PLANT IS UNCOVERED.

THE MILL EQUIPMENT IS SIZED FOR A 2,900 TPD OPERATING RATE. SOME OF THE MAJOR MILL COMPONENTS SUCH AS THE BALL MILLS AND MAJOR PUMPS WERE PURCHASED USED AND RECONDITIONED FOR USE AT COPPERSTONE.

THE FOLLOWING SLIDES SHOW THE CONSTRUCTION OF THE PLANT.

[SLIDES OF PLANT CONSTRUCTION]

[SLIDE OF GOLD BAR]

THIS LAST SLIDE SHOWS THE PRODUCT OF OUR EFFORTS. THE TWO GENTLEMEN IN THE SLIDE ARE MR. KEN BARR, PRESIDENT OF CYPRUS MINERALS CO. AND MR. MAGGIE McGEE - MANAGER OF THE COPPERSTONE MINE.

FROM : CHEMEX LABS LTD., VANCOUVER PHONE: 604-984-0221

TO : ROYAL OAK MINES (U.S.A.) INC.
ATTENTION : ATTN: KEVIN LEONARD
Attn: Kevin Leonard
WORKORDER : A9723426 PROJECT :

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PRELIMINARY DATA ONLY !!

*** Samples are being analyzed for: Au ppb FA+AA,Au FA oz/T

SAMPLE DESCRIPTION	983 Au ppb	996 Au FA o
C96-18 785-790	2840	-----
C96-18 790-795	850	-----
C96-18 795-800	110	-----
C96-18 800-805	890	-----
C96-18 805-810	>10000	0.367
C96-18 810-815	>10000	0.777
C96-18 815-820	>10000	1.856
C96-19 570-575	>10000	6.865
C96-19 575-580	>10000	5.578
C96-19 580-585	1340	-----
C96-19 585-590	5500	-----

END OF DATA

HEMAC Exploration Ltd.

Consulting Geologists - Geochemists

FACSIMILE TRANSMISSION

P.O. Box 4850
Vancouver, B.C.
V6B 4A4
Canada
Tel: (604) 685-0073
Fax: (604) 685-2220
e-mail: hemac@info-mine.com

To: Kevin Leonard

Date: 12 September, 1997

From: Hans E. Madeisky

Subject: Copperstone Lithogeochemisty

Further to our last telephone conversation, here are the results of my preliminary look at whole-rock geochemical data from four drill holes (CS96-17, CS96-18, CS96-19 & CS96-22) at the Copperstone mine. Chips of drill core composited over 20 ft intervals in "barren" rocks, and 10 ft intervals in "mineralized" rocks were analyzed by Chemex Labs for major oxides and trace elements by Fusion-XRF method. CO_3 and S (total) and Gold were analyzed by America Assay Labs. Gold assays (and duplicates) were for 5 ft intervals; these were later averaged to match the whole-rock sample intervals. The data are in a Quattro Pro spreadsheet file CUSTONE2.WQ1, which can be imported by several other spreadsheet programmes. Some of the graphs from the spreadsheet are attached to this memo.

For a preliminary descriptive model of detachment-fault-related mineralization, and in particular the Copperstone deposit, please refer to the attached photocopies taken from USGS Bulletin 2004 (pages 52 - 58).

The geochemical parameters of the Copperstone host rocks are:

No particular rock type seems to preferentially host the gold mineralization (as sampled in the above four drill holes). The dashed lines on the two scatterplots (Figures 1a & 1b) indicate the respective ratios of gold bearing samples (plotting near the origin of these two graphs) which have experienced significant mass gain in the form of metasomatic addition of Si, Fe, and Mn. Figures 2a, 2b, 2c, and 2d are downhole plots of the TiO_2/Zr ratio and Au grade for the four drill holes.

K-metasomatism has affected all of the feldspar bearing rocks at Copperstone. This si believed to be a consequence of K-rich (evaporite) brines circulating downward in half-grabens developed during regional extension by detachment faults. The rocks sampled in the drill holes contain up to 10.0 wt% of K_2O, with molar K/Al ratios up to 0.6 (see Figures 3a and 3b). Even though these rocks are quartz latites, their potassium content is more than twice of what would be expected for such rocks. This regional scale metasomatism appears not to be linked to gold mineralization.

Propylitic alteration of fault and fracture zones is indicated by the metasomatic addition of CO_3 and S to rocks with (K+Na)/Al molar ratios of 0.4 - 0.6 (see Figures 4a and 4b). This is a local alteration feature; it forms no appreciable alteration halo. And although propylitic alteration is present within or on the margins the some of same structures, it does not appear to be linked to gold mineralization (for the example of sulphidation, see Figures 5a, 5b, 5c, and 5d).

Alkali depletion is associated with gold mineralization. It is recognized by (K+Na)/Al molar ratios ranging from 0.01 to 0.3 in the rocks within the gold bearing structures (see Figures 6a, 6b, 6c, and 6d). There is no gold mineralization without alkali depletion, but there is no correlation between the gold grade and the degree of alkali depletion of the host rock. The same relationship exists between alkali depletion and Si, Fe, and Ba metasomatism (see Figures 7a, 7b, and 7c).

Silicification is clearly associated with gold, as is manifested by elevated Si/Al molar ratios of the mineralized rocks; the background Si/Al molar ratio is about 4, in mineralized rocks it is up to ten times that (see Figures 8a, 8b, 8c, and 8d). Again, although silicification is a necessary condition for the presence of gold mineralization, there appears to be no direct link between the degree of silicification and the gold grade.

Fe metasomatism is directly linked with gold mineralization; it is immediately obvious in the Fe_2O_3 content of the rocks, and can be measured by the molar Fe/Al ratios. Fe metasomatism does not form an appreciable halo around the gold mineralization; it is limited to the mineralized structures (see Figures 9a, 9b, 9c, and 9d).

Mn metasomatism is also linked to gold mineralization; it parallels the behaviour of Fe metasomatism and can be measured by MnO concentrations of molar Mn/Al ratios (see Figures 10a, 10b, 10c, 10d).

Ba metasomatism is similarly linked to gold mineralization, as indicated by elevated by Ba concentrations in gold mineralized rocks. Ba is also present in feldspars in unaltered rocks, which can be lost to the hydrothermal fluids due to feldspar destructive alkali depletion (see Figure 7c).

Other metals may also be involved in the alteration processes at Copperstone. In order to examine their behaviour, 32 element aqua-regia ICP analyses would be required. The Ti bearing minerals would be of particular interest because the solubility (in aqua regia) of Ti minerals (ilmenite) in unaltered rocks is several times greater than in altered rocks (rutile, brookite, anatase).

Conclusions:

Gold mineralization at Copperstone confined to structures with little or no alteration haloes. This mineralization is accompanied by metasomatic alkali depletion (K and Na loss) and Si, Fe, Mn, and Ba addition. Si and Fe metasomatism result in significant increase in rock density which may be exploitable as exploration parameters. A combination of local scale seismic and gravity surveys may be able to target the mineralized structures. Permissive host rocks can be identified geochemically (by means of whole-rock analyses) as alkali depleted rocks with accompanying Si, Fe, Mn, and Ba addition. These rocks may also be identifiable geochemically (by means of 32 element aqua-regia ICP analyses) through the presence of hydrothermally introduced metals in aqua-regia soluble alteration minerals, and by aqua-regia insoluble Ti minerals.

If you have any further questions, please contact me.

Kind Regards,

Hans E. Madeisky PhD DIC PGeo

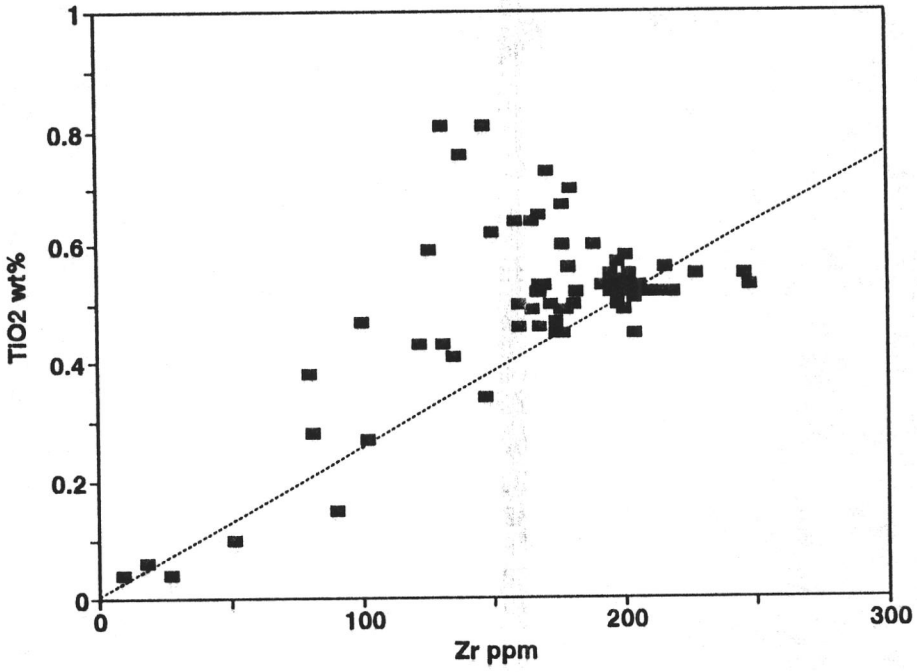
TiO2 wt%
Zr ppm
0
0.2
0.4
0.6
0.8
1
0
100
200
300

Fig. 1a

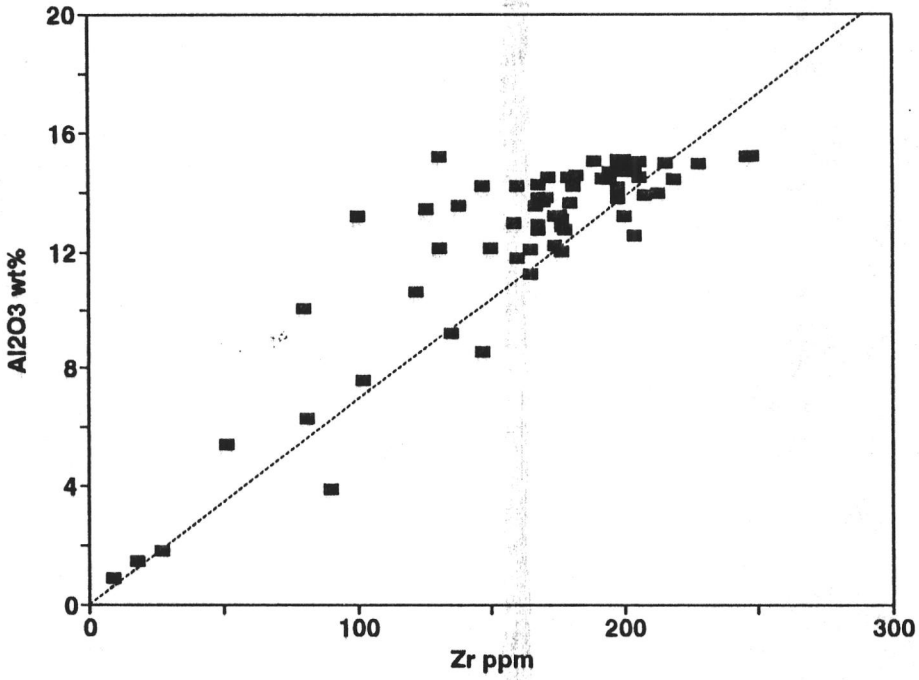
Al2O3 wt%
Zr ppm
0
4
8
12
16
20
0
100
200
300

Fig. 1b

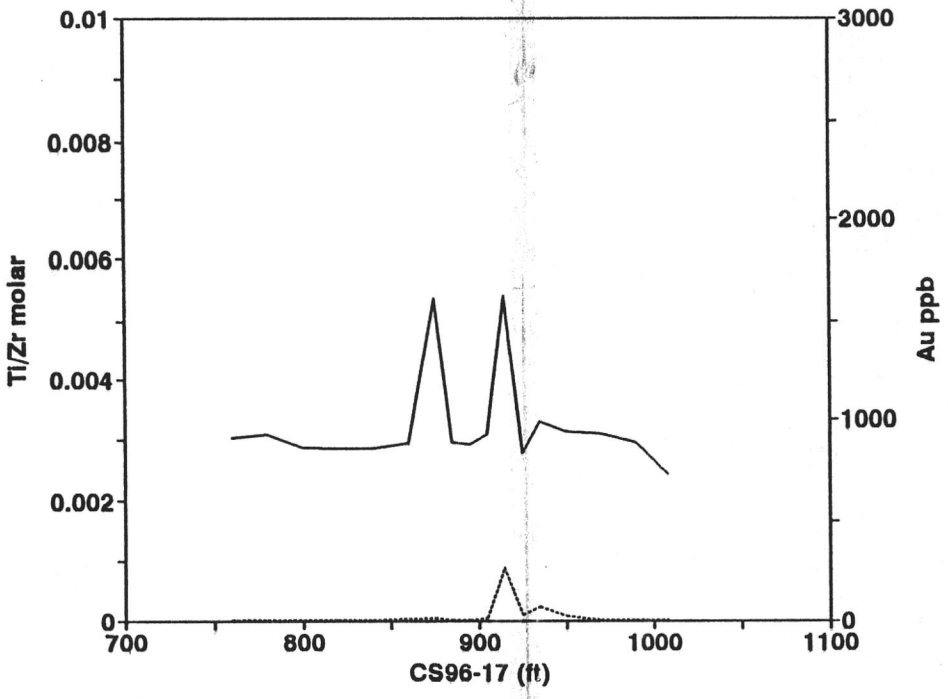
0.01
0.008
0.006
0.004
0.002
0
Ti/Zr molar
3000
2000
1000
0
Au ppb
700
800
900
1000
1100
CS96-17 (ft)

Fig. 2a

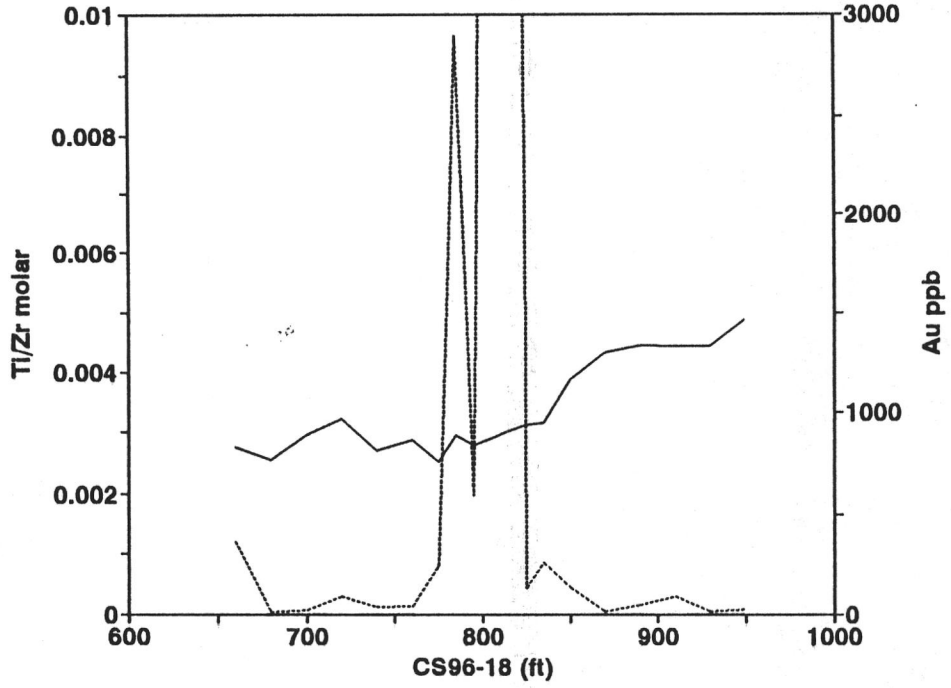
0.01
0.008
0.006
0.004
0.002
0
Ti/Zr molar
3000
2000
1000
0
Au ppb
600
700
800
900
1000
CS96-18 (ft)

Fig. 2b