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In part: Original found in 1.1.22

A.F. Budge (Mining) Limited

TO: A.F. Budge

DATE: August 16, 1989

FROM: J.W. Norby

COPIES: R.R. Short  
C.A. O'Brien  
D.H. Allen  
File

SUBJECT: EXPLORATION UPDATE

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Vulture (J.R. Bosco Project Geologist)

Core drill hole VIP89-1 has advanced to 975 ft, testing the relatively chargeable east end of the south fork of the northern Vulture induced polarization (IP) anomaly. A planned 1100 to 1200 ft total depth will completely test this anomaly. Assay results down to 695 ft indicate virtually no gold, all 0.008 oz Au/ton or less with the singular exception of a 4.7 ft core interval grading 0.025 oz Au/ton at 375 ft. Samples from the 695-902 ft interval are in the assay laboratory and results are expected by Friday, August 18.

VIP89-1 drill core indicates that the approximate local depth of oxidation (pyrite destruction) is 340 ft, which explains why the anomaly begins at this depth. The anomaly is apparently caused by 1-5% pyrite (plus trace chalcopyrite and molybdenite?) in dominantly brecciated Cretaceous (Vulture stock age) granodiorite sills layered within the Precambrian volcanic section. Some breccia sections contain rhyolite fragments which may be Tertiary (younger Vulture Peak age) indicating the brecciation and matrix pyrite may also be Tertiary and therefore less prospective if the gold originates in the Cretaceous stock (a debatable theory). Subordinate volumes of pyritic Precambrian amphibolite also contribute to the anomaly.

In addition to gold, VIP89-1 core will be analyzed for copper and molybdenum concentrations to make sure a large granodiorite hosted porphyry mineralization system is not overlooked. The Vulture stock and apophyses are of the right age and rock type to host large deposits of this type such as occur at Copper Basin near Prescott, at Bagdad, and near Kingman.

As results to date on the northern anomaly are not compelling, the current plan is to discontinue further drill testing of this anomaly. The drill will next test (VIP89-2) the middle anomaly which roughly coincides with the northwest extension of the Talmadge fault.

Detailed surface maps (1 inch = 20 ft scale) of the VIP89-1 and -2 drill targets have been completed and mapping of the north fork of the eastern end of the northern IP anomaly will be completed next. At surface, the VIP89-1 anomaly coincides with

an oxidized section of thicker medium-grained granodiorite (Cretaceous) and thinner rhyolite (Tertiary) sills/dikes both intruding Precambrian volcanic rock including subordinate amphibolite. The entire section was channel sampled returning a 20 ft section grading 0.038 oz Au/ton within the granodiorite section and insignificant gold concentration everywhere else.

VIP89-2 anomaly mapping located several northwest trending major structures and a similarly trending iron oxide enriched (oxidized pyrite?) fault-contact between amphibolite and Vulture stock granodiorite. A north trending set of galena-bearing quartz veins was also identified. Assays from this area are pending. Many of the local quartz veins have been previously drill tested. VIP89-2 is designed to test many of the local structural features in addition to testing the IP anomaly. It will be collared about 70 ft N70E from 26N on Line 7, and will be drilled about S65W (at -45 degrees) testing the middle of the IP anomaly, the altered amphibolite/granodiorite stock contact and parallel major structures, and north trending quartz veins.

A preliminary interpretation of gold mineralization on the Vulture property and in the whole Vulture District is that ore grade gold concentrations occur in vein-bearing structures of Laramide (Vulture stock) to Tertiary age. The Congress Mine north of Wickenburg is an example of such occurrence which is currently being put into production. The Vulture load is the other local significant example of a profitable vein mine. Other vein mines/prospects in the district have frustrated explorers, providing high grade but minimal tonnage over thin widths. The roughly east-west trending, continuous Vulture IP anomalies on the north end of the property and south of Vulture Mine road probably reflect pyrite-rich stratabound units (such as Cretaceous granodiorite or Precambrian amphibolite) layered in the volcanic section which do not necessarily contain gold concentrations. The middle IP anomaly provides a more structural or vein-type target.

Core drilling has been very slow mainly due to the incompetent, broken up, crumbly nature of the oxidized top 400 ft of rock. The wall rock would tighten up on the drill pipe until it would no longer turn and then the rods would be stuck in the hole. The upper part of the hole would also cave in when the pipe was pulled. A second night shift was added but drilling was still slow. This week the hole was cased to 750 ft in order to control the wall rock and subsequently the drilling rate has increased significantly. VIP89-2 will be cased from the start.

#### United Verde Extension (J.A. McKenney Mine Geologist)

An economic evaluation of United Verde Extension (UVX) reserves located above the 950 level and an exploration plan targeting mineralization above this level will be completed by about September 1. Preliminary results of the economic evaluation are

# Cimarron

South Atlantic Ventures (Lutz Klingman) and Valentine Gold (Fred Limback), both Vancouver stock companies.

All property data, including that generated by Echo Bay, was received today from Tellis. Tellis has also agreed to send us a description and cost break down of 1985 assessment by next week. We indicated that we would file the assessment ourselves.

Geologic data will be reviewed and R.R. Short and J.W. Norby will visit the claims. We plan to assess the property and decide whether or not to venture the property by mid-September.

An update on other bedrock and tailings submittals/evaluations will be written at a later date.

## Near term personal goals

Complete Korn Kob pre-drilling duties.

Visit UVX to see new orebody and check on progress of reserve assessment and exploration plan.

Visit Vulture to check progress of IP core drilling.

Evaluate Cimarron.

Open a Reno office and concentrate more on evaluating new mining opportunities. The later will be more fully realized when a project geologist (J.R. Bosco?) is available to coordinate Korn Kob evaluation.

A.F. Budge (Mining) Ltd.

To: A.F. Budge  
R.R. Short  
D.A. ALLEN  
C.A. O'Brien  
J.W. Norby

Date: 8-13-89

From: J.R. Bosco  
Subject: Vulture I.P. Drill Test  
Weekly Drill Report  
August 6-13, 1989

During the week VIP89-1 resumed mid-day Thursday (8-10-89) following a four day recess. Since that time drilling has advanced from 725 feet to 902 feet which is an improvement in daily core output resulting from casing the hole to 725 feet. The hole remains within the I.P. target zone (550-450 feet) and rocks continue to bear 1 to 5 percent sulfide (mostly pyrite with minor chalcopyrite, molybdenite and galena). VIP89-1 is planned for 1100 to 1200 feet.

Assay results have been received from 515 to 685 feet; however, gold contents are all .003 opt or less. Results from 685 to 902 feet are pending. A summary log follows:

725-733 Ft.	Dacite
733-738 Ft.	Granodiorite - Fine grained, light grey, massive.
738-746 Ft.	Amphibolite - Dark grey/black, weakly foliated.
746-802 Ft.	Diorite/Dacite Breccia - Fine grained amphibole-quartz groundmass with 20-50 percent felsic, granite and quartz fragments.
802-826 Ft.	Amphibolite
826-839 Ft.	Granodiorite
839 - (102 current)	Diorite/Dacite Breccia.

Vulture: In Part original found in 1.2.22

A.F. Budge (Mining) Limited

TO: A.F. Budge

DATE: July 17, 1989

FROM: John W. Norby with  
A.F. Budge (Mining) Limited

COPIES: file

SUBJECT: CURRENT PROJECTS - ASSESSMENT AND RECOMMENDED WORK

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### INTRODUCTION

A.F. Budge (Mining) Limited (Budge) currently has two producing precious metal properties (both in Arizona); the United Verde Extension (UVX) underground gold flux mine and the Vulture Mine mill tailings gold heap leach facility. In addition to the mined orebody at UVX, a larger lower grade gold reserve has been delineated. At the Vulture Mine property, in addition to the tailings leaching operation, an exploration program has been conducted in search of 1) disseminated mineralization around the Vulture vein, 2) Vulture vein offsets, 3) other Vulture-like veins, and 4) placer gold. The company also controls a moderate sized open pit - heap leach gold reserve on the Cimarron property in Nevada. Additionally, Budge is participating in the Gold Canyon open pit - heap leach gold deposit exploration joint venture in Montana, and in the soon-to-be-dropped Ash Peak underground silver-silica flux mine exploration joint venture in Arizona.

In planning for future development of additional economic precious metal reserves, and attendant company growth, the first order of business is to determine the potential of properties in hand. A quick summary of mineral inventory, past exploration, and expenditures is included for each property as a gauge of past performance, a partial indicator of future potential. Recommended action on each property is included.

## VULTURE MINE

Budge leased the Vulture Mine property located west of Wickenburg, Arizona in February, 1984. The combined leased and owned property package consists of a contiguous 13 square mile block of leased claims and an owned townsite surrounding and including the old Vulture Mine and present heap leach operation. Holding costs are \$4500 per month (\$54,000 per year) in advanced minimum royalty payments which count against a sliding scale royalty based at 6%.

## HEAP LEACH TAILINGS OPERATION

Vulture heap leach tailings preproduction and production costs totalled \$1,831,336 through May, 1989. Metal sales through July 7, 1989 have amounted to \$776,000 from 1993 oz gold and 6433 oz silver. Stacked tailings total 173,000 tons and the remainder of the tailings should be stacked by mid-August, totalling about 200,000 tons on the pads. Leaching of the tailings will probably be economical through about January, 1990. Approximately 4000 additional ounces of gold are projected to be recovered from the heaps. Required neutralization of the heaps will take place 6-12 months after shutdown and the cyanide has been oxidized.

According to a Don White memo (12/29/88, p. 8), there are no remaining mill tailings on the property or in the Vulture District. A 100,000 ton reserve grading 0.04-0.06 oz Au/ton has been drilled out marginal to the Vulture vein but metallurgical tests indicate only a 50% cyanide gold recovery with a required fine grind (-200 mesh). Recoveries would not justify the mining and grinding expense. There are no further identified heap leach reserves to supply the Vulture operation.

Two other as yet unevaluated possible sources of leachable ore near the Vulture are the Newsboy open pit gold deposit (Westmont Gold, Inc., Vancouver, British Columbia) located 10 miles east-northeast of the Vulture Mine and the RUS vein property (Sierra Gold, San Francisco, California) located 7 miles northeast of the Vulture operation. The Newsboy reportedly contains 1.3 million tons grading 0.044 oz Au/ton with a 1.5:1 stripping ratio and good exploration potential, but metallurgical tests indicate only 25% recoveries on 1/4 and 1 1/4 inch material. However, recoveries on -100 crush are 79-87%. Newsboy is a detachment-type deposit similar to Copperstone. RUS mineralization consists of 7 discontinuous quartz-hematite veins along a sheared trend. Sierra Gold suggests both underground and open pit potential, but mineralization may be to discontinuous to make ore of either type. No metallurgy has been performed on this property.

## BEDROCK EXPLORATION

In the early 1980s Noranda mapped the property on a large scale and Pegasus (Zortman Landusky) drilled disseminated mineralization marginal to the Vulture vein. Early work by Budge also concentrated on the Pegasus target, defining the uneconomic 100,000 tons described above. Subsequent surface exploration targeted a Vulture offset beneath the tailings and magnetic lows. More recently an Induced Polarization (IP) survey has been completed over the area east of the Vulture stock, identifying three anomalous trends. A core drill program designed to test these anomalies was initiated July 11. Vulture exploration through May, 1989 totalled \$866,000. An additional \$175,000 would be required to completely drill test all three IP anomalies with six holes but a reduced program would still be informative. There is no compilation of Vulture property exploration data.

The recent IP survey is a final exploration for buried targets not obvious at the extensively prospected surface. Drilling of the IP anomalies is warranted as it will test these deeper targets prior to the end of the heap leach operation. In general, however, bedrock exploration at Vulture has not been fruitful, producing no substantial new leads on gold mineralization. Additionally, exploration and interpretation to date suggest that the Vulture property probably does not contain the type of mineralization we want to focus on (i.e. open pit-heap leachable gold, copper oxide, more gold tails or dumps, bulk mineable shear zone gold). First impression is to discontinue bedrock exploration, but as there is no compilation or overall evaluation of Vulture exploration data, these should be completed prior to making this final decision. Some previously unrecognized gold trend could fall out of this work. Some mapping and sampling will also be required in this exercise because much of the ground has not been covered in detail.

The offset Vulture vein (lost on the Astor fault) has been a conceptual target since acquisition of the property, but an economic evaluation (R.R. Short, May, 1989) suggests difficulty turning a profit on such discovery, even though the Vulture vein was quite rich at surface. Other negative factors effecting this target are 1) the bottom of the vein was uneconomic short of the Astor fault (the very top of the vein was probably enriched due to oxidation - not expected at depth), 2) a discovered new vein segment would most likely be offset once again, and 3) the new segment would start at 1000 ft and have to be extensively core drilled from the surface. The economic analysis was completed prior to the recent sale of the Congress Mine to Malartic Hygrade (Canadian) and their subsequent announcement that they will construct a mill.

Whether or not to explore for the Vulture vein offset is a tough call but the previous recommendation that Budge should not may still be the best one. Another idea we can kick around is to go ahead with the Rehrig structural study, coming up with an offset

target. We can then use this developed target and the recommendations in the compilation report to try to joint venture the property. Suggested terms might be that the partner pay an up front fee to cover the structural study (\$10,000?), plus holding costs. The partner would have a work commitment directed towards testing the offset target and other targets generated in the compilation report. Partner expenditures would count towards a 70% earn-in (preserving a 30% piece of the action for Budge at no cost). Mylartic Hygrade would be an obvious potential partner. Other Canadian companies will become more aware of the area due to Mylartics activities and may become especially interested if Mylartic is successful at Congress and/or precious metal prices rise.

#### PLACER EXPLORATION

James Prudden, placer consultant, completed a preliminary evaluation of the gravels surrounding the Vulture vein January, 1985. He located potential south of the old workings and recommended additional evaluation. He recently completed a more detailed trench sample investigation of that area (June, 1989). Vulture placer evaluation expenditures to date have totalled \$87,500.

The recent trenching program defined the small gold-bearing channel #4 south-southwest of the old mess hall, containing an estimated 85 ounces not considering the T-50 nugget, or 1145 ounces weighting for it. Also defined was a gold enriched middle fluvial unit in channel #5 which traverses the eastern margin of the tailings. The auriferous fluvial unit only contains coarse and abundant gold on its sides where it intersects bedrock on channel margins, "severely reducing the possibilities of developing this fluvial system into a large scale mining operation." Another unsampled Western channel apparently underlies the tailings, but has not been sampled due to tailings thickness. In 1985 work, Prudden also located gold on the Vulture intrusive surface in the Southwestern placer located west of the heap leach pads, but the locally thick section of barren overlying sediments make this resource as known uneconomic. Other trenches 1/4 mile and immediately north of the Vulture vein located small volumes of placer gold.

Prudden suggests that no large placer deposits have been located to date but that there are several prospective areas still worthy of sampling. He also recommends pilot gravity plant production on the #4 channel placer to compare plant results with those found in the trenching.

Our evaluation is that a lot of money has been spent and no particularly promising resource has been identified. Placers are difficult to quantify. The overall property wide indicated potential and small gold volume of channel #4 do not justify pilot gravity production. Cyanide leach tests on channel #4

material from trenches where the entire gravel section contains gold would indicate if this small resource could be heap leached. Also limited in-house trench sampling of the Western channel after the tailings are removed would be worth a shot.

#### RECOMMENDATIONS

- 1) Drill test IP anomalies.
- 2) Complete Vulture bedrock exploration compilation and evaluation report.
- 3) Evaluate Newsboy and RUS deposits. If Newsboy looks interesting, the first thing to do would be to complete additional metallurgical tests at the Vulture lab.
- 4) Discuss Vulture vein offset study in conjunction with future plans for the property.
- 5) Learn details of Congress operation.
- 6) Do not pilot gravity plant test channel #4 placer gold, or support further Prudden evaluation of Vulture placer potential.
- 7) Complete cyanide leach tests on channel #4 samples for evaluation of heap leach potential.
- 8) Complete limited in-house trench sampling of Western channel beneath tailings once removed.

M E M O

TO: Ben F. Dickerson, Carole A. O'Brien, Joe Fernandez  
cc: R.W. Hodder

FROM: Don White

DATE: January 2, 1987

SUBJECT: Vulture gold recovery in relation to rock types and siliceousness

Initial cyanide leach amenability tests on our samples taken from 6-inch core drilling at the Vulture have confirmed that a problem exists with gold recovery from very siliceous rock. Specifically, the gold recovered from the bottle-roll test of 1-inch material from the quartz zone of hole M-1 yielded only 36% recovery (for a short period).

Metallurgical testing is continuing and finer crushing is expected to enhance recoveries considerably. However, the expectation is that crushing of the siliceous ores will be necessary. Joe Fernandez phoned Friday, Dec. 19, 1986 and requested estimates of how much quartz porphyry intrusive hanging wall and footwall rock to expect in the overall mineralized zone. Joe wanted a spur-of-the-moment estimate and a more carefully studied answer. My spot estimate was 70% qpi, 20% HW, 10% FW, if taken by tonnage, but because the HW zone is higher grade, 50% qpi, 40% HW, 10% FW if estimated by contained ounces of gold.

In order to more accurately answer the question, we agreed that I should log the drill holes for which we had only assays, no geologic logs (Hennessey-era holes H-1-14, 84-1-18). This provides the fundamental data for any study and could not be delayed given Joe's schedule for a response. The chips for those holes were logged and the written logs from Pegasus' pit-area holes were reinterpreted to graphic form compatible with our rock type designations. When the drill data was plotted on longitudinal sections through the planned pit (as provided by A.J. Fernandez, Dec. 1986) it became clear that surface data on rock types in the existing pits and underground information on the rock types down the west incline thru the 150 and 350 levels would be of much help. Thus one day was spent at the mine checking the Noranda 1" = 50' pit maps and one half day underground utilizing the Pegasus maps of workings.

I wish you will study the Noranda geologic maps of the pits for I feel they are well done and highlight some issues I have not stressed enough. Most importantly, they show the aerial extent of the qpi and massive quartz veins. The distinction between the qpi and quartz is one thing I have not made clear enough. The Laramide (?) plutonic activity likely evolved from aplite to quartz porphyry to quartz through time with corresponding increase in gold concentrations.

The bonanza grade gold all occurred in quartz veins. Old stopes are almost exclusively in quartz. The higher grades remaining are in quartz veins. The lower grades occur in the qpi and in silicified rocks. The latter is a pervasive, often intense, silica alteration of the Precambrian wall rocks in

proximity to the qpi. One has to bear in mind the differences between originally siliceous rock (such as the siltite unit and others within the varied Precambrian stratigraphy) silicified rock, quartz porphyry, and quartz as in veins. My previous drill logs, Noranda's maps, and this discussion will hopefully make this clear.

Accompanying are 1" = 50' vertical longitudinal sections, looking north. They show present topography, the planned pit, drilling to date, rock types, and mineralization. Utilizing this data I now estimate that 40% (by volume) of what is considered potential ore grade within the planned pit will be qpi and quartz, probably about equal portions (e.g., 20% qpi, 20% quartz). Another 40% will be very silicified Precambrian wall rock to the qpi and quartz (mainly qs, qsc, and w units) another 10% very siliceous rock of primary nature (e.g., the st unit) and only about 10% non-silicified and non-siliceous but quartz-veined and mineralized rock (e.g., top zone of M-2).

In summary, leachability is a function of rock type because leachability is inversely proportioned to siliceousness (whether primary or a result of silicification). The very nature of the Vulture occurrence as epigenetic, qpi-related gold means that most of the gold is in quartz, qpi or silicified wall rock. Thus the necessity of crushing is inevitable. Ongoing metallurgical studies should tell us how fine a crush is needed.

Some further observations on the Vulture longitudinal sections:

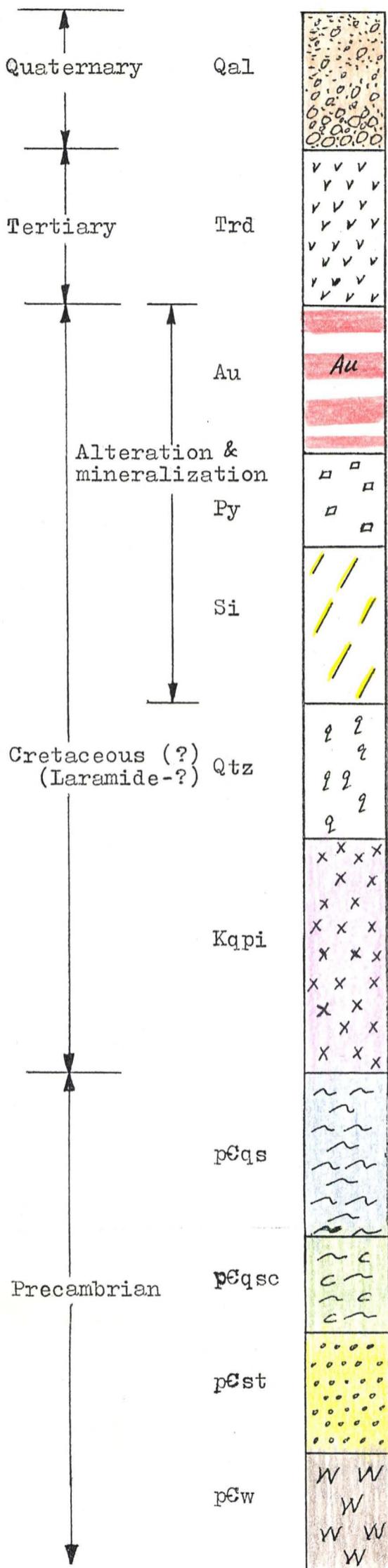
- 1) The steep east end cutoff of the planned pit is probably only an artifact of no drilling further east beneath pit 1. There is every reason to believe that M-1/H-15/H-49 grades will persist east to the Talmadge fault. Mining deeper at the east end would make the overall future pit symmetrical with the capability of having two ramps. Certain efficiencies might result from two ramps, perhaps one-way traffic on each and one to use when the other is being lowered or graded. Any future drilling should include a couple holes collared within pit 1 to confirm mineralization there.
- 2) Stripping of the Mill Wash area between pits 2 and 4 will yield much sand and gravel, some of it with placer potential. If that material must be handled anyway, it could well be washed for gold and the resulting classified material used on site and/or sold as aggregate in Wickenburg.
- 3) The "ore shoots" identified by historical workers are now recognizable in our longitudinal sections. Arthur Perry Thompson (The Mining Journal, Nov. 30, 1930, p. 11 longitudinal section attached) outlines the two main ore shoots corresponding to the west and east incline areas and merging at depth. Our sections reveal the tops of those shoots.



VULTURE MINE

GRAPHIC DRILL LOG LEGEND

Compiled from rotary-reverse circulation chips



ALLUVIUM, colluvium; derived from the same rocks as in this sequence except for granodiorite from  $\geq 2$  miles NW. Varied but generally low degree of rounding, sorting, and stratification.

RHYOLITE DIKE; white, aphanitic, cross-cutting unit up to 15 feet in drill intercept thickness. Commonly contains black Mn dendrites on joint surfaces. Only known to occur in W portion of property near pits 3 and 4.

GOLD; noted in graphic log where significant assays are reported. Thought to be cogenetic with other Laramide (?) events like qtz-pphy intrusion and associated pyritization, silicification, and quartz veining (see below).

PYRITE; generally tiny ( $\leq 0.5$ mm) disseminated cubes. Often in qtz or intensely silicified rocks.

SILICIOUS ROCK; thought to be introduced silica related to the qtz-pphy intrusive. Often obscures foliation and sometimes prevents identity of the original rock type. Intense silicification yields an amorphous quartzite.

QUARTZ; only used to designate vein or bull quartz and discrete, visible qtz as in qtz-rich siltite and qtz-pphy intrusive. May harbor sulfides (py, gal) and native gold.

QUARTZ-PORPHYRY INTRUSIVE; med. to coarse-grained, altered (sericitized, pyritized, silicified) granite to qtz-monzonite with qtz porphyroblasts (often up to 4mm dia). Quartz is typically a soft, pastel green (chloritic-?) or pale gray to milky. Emanates as an apophysis from stock to the W of pit 3. Generally semi-conformable, sill-like.

QUARTZ-SERICITE SCHIST; brown, gray, tan, or almost white, thin laminated, fine to med grained quartz and sericite. Often iron stained. Gradational to siltite or wacke (see below) and prone to silicification.

QUARTZ-SERICITE-CHLORITE SCHIST; same as above with the addition of a chlorite component (usually  $< 20\%$ ).

SILTITE; brown or tan to light gray, poorly foliated, very fine grained, meta-silt. Often a quartzite. Grades finer to quartz-sericite schist or coarser to wacke.

WACKE; brown, tan, or med to dark gray, poorly foliated, med grained, meta-wacke. Grades to siltite and qtz-ser schist. Prone to silicification.



# ELLIOT GEOPHYSICAL CO., INC.

4653 EAST PIMA STREET

TUCSON, ARIZONA 85712

TEL. (602) 323-2421

31 December, 1986

Memo

DMEA LTD.

Ref: DE01E

To: B.F. Dickerson, III

JAN 3 1987

From: C.L. Elliot

RECEIVED

Re: Airborne Magnetic Data Interpretation of the Vulture Mine Area

I am in receipt of your letter of 28 November, 1986. I am very sorry to be so late in responding to your request but recent knee surgery had to take precedence over the Vulture Mine project. However, I did have the opportunity to meet with Don White on Sunday, 7 December, prior to surgery, for several hours. I believe he got most answers that he needed to govern his thoughts and aid in his immediate needs for future Vulture Mine exploration activities.

Herein are specific answers to your questions of the 28 November letter:

1. The answers to both questions are no. See for example the last paragraph, page 2, of my 8 August, 1986 memo concerning interpretation of airborne magnetic data for Vulture Mine area. The problem is one of geometry, in that the economically important sill of qpi at the Vulture Mine is very narrow in width, in terms of tens of feet. It is therefore most unlikely that it can be recognized in airborne magnetic data flown at a mean terrain clearance of 250 feet. It therefore is necessary and has been recommended that detailed ground magnetics would be the means of recognizing such a narrow sill. However, the specific sill at the Vulture Mine is masked at least in part by surface cultural features such as pipes, buildings, etc. Other similar sills away from the culture would not be so masked.

The other aspect of recognition of this particular sill at the Vulture Mine is its fairly flat north dip. Therefore the magnetic response of the underlying footwall pre-Cambrian sequence would overshadow the zero magnetic response anticipated from the sill itself. This aspect could hurt recognition of other similar sills if flat dips are encountered.

First part of Question 1 I presume refers to the large magnetic low zone striking approximately S 75 E some 500 feet

north of the Vulture Mine. In my opinion this is not related to the sill of the Vulture Mine, the source of gold mineralization. This low magnetic zone is one of several east-west trending lows that exist both north and south of the Vulture Mine. See more discussion in #2 below.

2. No, the east-trending magnetic lows south of the Vulture Mine are not a product of the gridding routine that formed the basis of the contour presentation. It is possible that they could indicate qpi apophyses of the type that might be of economic interest. However, these broad magnetic lows do not represent narrow sills like the one at the Vulture Mine. Therefore if one can accept a wider sill as being of economic interest, then these apophyses might be of interest.

In general, these apparent east-west trending magnetic lows fit a much bigger picture. They are too wide to really represent apophyses. They fit the regional picture as portrayed in the airborne magnetic data for the area west of Fault A (See memo 8-8-86). On top of a broad pluton, probably of qpi content, are a series of pre-Cambrian remnants, roof pendants or zenoliths. Then within this area these so called magnetic apophyses are reflecting that the immediate bedrock below the alluvium is non-magnetic that could be a non-magnetic facie of the pre-Cambrian suite, could be qpi, or some other non-magnetic rock unit. Therefore, these apophyses are merely indicating non-magnetic rocks underlaying by a broad qpi pluton which goes to considerable depths. The concept that in the Vulture Mine area the pre-Cambrian goes to considerable depths in terms of miles with injected apophyses of qpi is definitely not supported by the airborne magnetic data.

The relatively straight contact drawn between the qpi and the pre-Cambrian suite to the east and south of the Vulture Mine is an attempt to show the generalized contact between the more plutonic qpi with maybe zero to up to 100 feet or so of pre-Cambrian roof pendants sitting above it against the more predominant pre-Cambrian pendants to the east. These pendants could have thousands of feet of thickness, but still overlying extensive qpi pluton at great depths. This was a means to separate sufficient thicknesses of pre-Cambrian rock units, ample to host a Vulture Mine type deposit, but yet underlain with qpi at depth. Within these roof pendants of pre-Cambrian, narrow apophyses of qpi can certainly exist and yet probably would not be directly recognizable in the airborne magnetic data. If you recall, the purpose of the survey was not to recognize such small features.

The memo of 8-8-86 recommended ground magnetics to attempt to locate these potential narrow apophyses into the pre-Cambrian east of the main plutonic mass of qpi. To that end ground magnetic survey grid parameters were presented to D. White during the meeting of 7 December. Said grid consisted of outside dimensions of approximately 1 mile north-south and 1/2 mile east-west. The general location of this 1 mile by 1/2 mile grid is in accordance with the layout previously established by D. White. It was recommended that north-south lines be magnetically surveyed with a 50 foot station interval, and with an east-west line spacing of 100 feet. This would involve 1200-1500 stations or approximately one weeks work. Baseline and key survey lines should be surveyed accurately for control, intermediate lines and stations could be done by pace and compass. Such a survey would yield at a minimum a 100 foot square grid of data with interpolation probable to a 50 foot grid. It is important to approach this problem by gridding techniques, in that this would greatly facilitate future computer processing and filtering of the data which undoubtedly would be necessary and useful.

3. Not knowing which of the magnetic lows withing the qpi that you are referencing, makes answers here difficult. In general, at the magnetic latitude of the Vulture Mine, magnetic lows in excess of background are typical and expected on the northerly side of prominent magnetic high zones and are a part of the normal magnetic response of such magnetic sources. In addition, if magnetic sources are vertically thin, then these anomalously low zones can occur on all sides of the magnetic high response of such magnetic sources. Therefore usually the magnetic lows have no further significance. A good example of this would be the small hills capped with Tertiary volcanics along the common line between 5-6-2 and 5-6-1.

I do not know what is meant by late siliceous pods, but would anticipate that likely they would be non-magnetic and quite similar therefore to the magnetic properties of qpi, aplite, and other major rock units of this area. Therefore I would not expect that such siliceous pods would be recognizable in the airborne magnetic data or ground magnetic data for that matter against the low response of the qpi.

To magnetically determine the shape of the qpi pluton beneath the Qal would not be possible in that both materials are predominately non-magnetic. The shape of the qpi pluton beneath pre-Cambrian outliers is a difficult interpretive procedure from the data distribution of the airborne magnetic

survey. A much greater density of stations would be needed and a large computer fitting project would be necessary to attempt this. I would doubt that the accuracy of these results would be sufficient for your purposes and consequently not worth the investment.

4. It is likely true that the east side of the main mass of the qpi pluton is more irregular than on the west side. However, this may not make the eastern contact more prospective in the economic sense. What one is really comparing is the magnetic response of thick pre-Cambrian roof pendant over qpi on the eastern side of the main qpi pluton with perhaps the response of much thinner pre-Cambrian roof pendants overlying aplite pluton on the west side. There is justification for the west side in that several of the Geodata drill holes intersected 100 feet or so of pre-Cambrian overlying the aplite.

The concept of the Vulture Mine lying within a pre-Cambrian roof pendant is more prospective, but definitely supported by the airborne magnetic data. Several arguments can then be proposed for the apparent irregularity on the east side of the main qpi pluton. One possibility would be that the pre-Cambrian sequence over the qpi verses over the aplite are totally different in composition, presumably thickness, and inherent magnetic properties. After all the irregularity referenced is really one of disruption of the response of the magnetics of the pre-Cambrian and has really nothing to do with the qpi or the aplite that underlie the pre-Cambrian. The association with qpi, on the other hand, does make it more prospective, based on your model for the Vulture Mine. Another argument in comparing the pre-Cambrian from the west and east side of the qpi, could be the surface of the plutons underneath. For example, and of course there is no proof of this, the top surface of the aplite could be much much smoother than the top surface of the qpi and this could give rise to the apparent difference in irregularities of magnetic response as observed in the airborne magnetic data. I proposed in the 8-8-86 memo that a possible fault exists parallel to Fault A and striking generally northwest-southeast that forms the western boundary of the qpi pluton with the aplite to the west as recognized in exposures and the Geodata drilling. Such a fault would cut off the pre-Cambrian roof pendants above the aplite and this in turn could sharpen the magnetic response and hence reduce the irregularities of the magnetic contacts.

Therein are three arguments for the east side irregularities that would make them less prospective economically than one

would hope for.

5. First addressing the question regarding the basis, bias and assumptions of the contouring program used by EDCON. First, this is a misconception in that it is not a contouring program that can have bias or give rise to problems. It is all governed by the gridding technique that can be questioned if in fact any questions can be raised. The specific basis and assumptions used in the gridding technique by EDCON are unknown to me and are likely proprietary. EDCON has been in the geophysical business for a very long time and in my opinion have excellent gridding routines that in all likelihood would be some of the best in the business. I see no evidence in inspecting the data of any problems with it. One, though, should realize that a contour presentation is a smooth artistic rendition of the actual data. The astute observer depends more on the profiles which I have done in analyzing the data. To this end, profiles in areas of particular interest to Don White have been given to him so that he too can look at the original data along with the contour presentation. If one wishes to pursue this matter, the original magnetic data is available on magnetic tape (in my possession) and can be regridded and contoured by any other organization of your choice. I sincerely doubt whether such an exercise would be worth the cost.

Also, we can go back to EDCON and get a better description of their techniques from them if they would be willing to discuss them. Most geophysical operators these days use the minimum curvature technique for first passes in gridding, followed by refinements using bicubic spline interpolation routines. This approach is a standard with the U.S.G.S. which have thoroughly researched the problem of gridding. Once data has been gridded, any modern day contouring program will produce substantially the exact same contour presentation.

Now to address the specific area of the Block 3 graben. I see absolutely no problem with the east-west striking magnetic contact that crosses the north end of the graben. Chances are this is reflecting the north boundary of the graben in Block 3. The graben itself has been crossed north-south with three flight lines and they substantially support each other and clearly suggest that the graben has a north-south length of the order of 3000 feet and an east-west general width the order of 2000 feet. The Douglas shaft is virtually in the middle of the deepest part of this graben.

6. It is not likely that the extent of the potassic volcanic rocks of the Twin Peaks and Vulture Peak area can be defined from the airborne magnetic data. Certainly one would expect overlapping magnetic properties. In order to attempt to separate them I would need more extensive detailed geology in the northeastern part of the survey area. Therefore before progressing with any further studies in attempts to understand the airborne magnetics of the northeastern part we would need a good reconnaissance geologic mapping with sample collection for physical property magnetic studies. Then and only then could we try to separate the rock units magnetically. It is very definite that the magnetic domain near the Twin Peaks and Vulture Peak is quite different than to the south and west towards the Vulture Mine. We may or may not have ample magnetic data to properly study this area in that it is near the edge of the survey and this in itself could hamper proper magnetic understanding of this region. Is there some economic reason to study this area in detail? If there is, I suggest we talk about it in a little more detail before planning an approach.
  
7. The Tertiary dikes that occur within the qpi pluton towards the north end of the known exposure of qpi are likely too thin (20-40 ft. thick) and have fairly low magnetic properties as reported in conjunction with the physical property studies. Then detection of them in existing data is definitely not possible.

In addition to the questions above addressed from your letter of 28 November, Don White and I discussed the six stratigraphic drill holes, S-1 thru S-6, that were drilled by DMEA, Ltd., in the subject area. On D. White's presentation (9-9-86) of these drill hole locations vs. qpi as interpreted from the airborne magnetics, there are serious errors in qpi contact positions. To understand the relationship better I have replotted the six holes (taken from 9-9-86 map of D. White) on to a copy of Figure 6 of my 8-8-86 memo which is the accurate positioning of geologic contacts as interpreted by me. Below are my comments in regards to these six drill tests:

- S-1 Sited 500 feet east of the contact and within the predicted pre-Cambrian over qpi. Not drilled deep enough to intercept the underlying qpi.
  
- S-2 Qpi intercepted at top of bedrock as predicted.
  
- S-3 Airborne magnetic data clearly indicates deep

non-magnetic material which is likely qpi, going to considerable depths in terms of miles. A five foot test of bedrock surface is inadequate sampling to test this concept. Thin roof pendants of pre-Cambrian are likely possible. There is absolutely no chance that the pre-Cambrian goes to depth at this locale.

- S-4 Sited west of the predicted narrow tongue of qpi and within the predicted pre-Cambrian over qpi. The pre-Cambrian section here could be quite thick.
- S-5 Qpi intercepted at top of bedrock as expected.
- S-6 Qpi intercepted at top of bedrock as expected.

I hope the above discussion and responses to your questions is adequate for your immediate purposes. Nothing in the work to date has changed the airborne magnetic data interpretation in regards to the main qpi pluton and general location of possible apophyses of interest. I take exception to the conclusion that the stratigraphic test holes have reduced the qpi extent. This is not true. The economic potential remains the same. The original recommendation of a ground magnetic survey of sufficient detail is again reaffirmed for proper search for small qpi apophyses of economic interest.

The Block 3 graben problem probably requires a different approach. So does the Twin Peak-Vulture Peak area study. I suggest a meeting to discuss these special problems before any extensive effort is expended.

cc: D. White

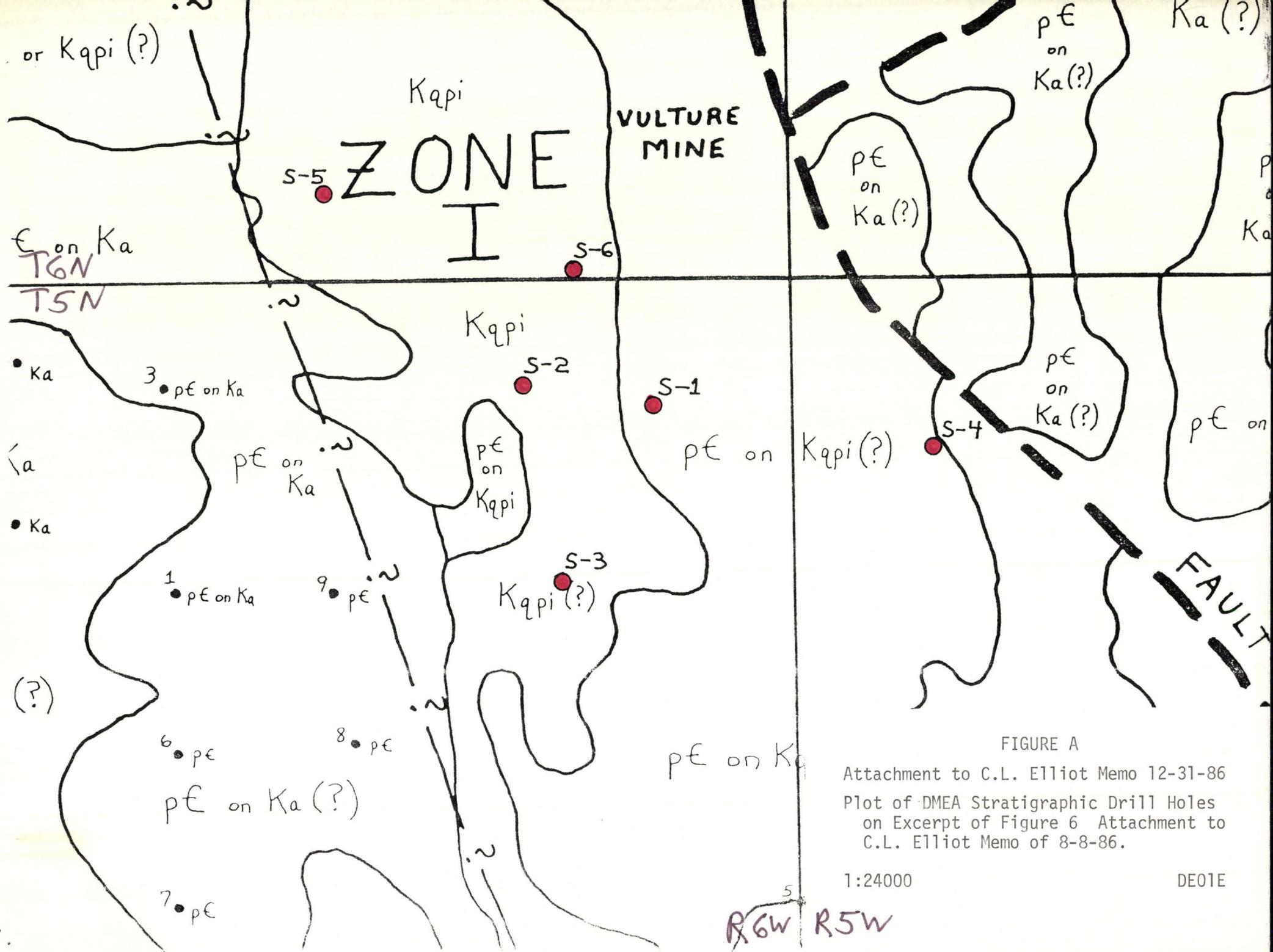


FIGURE A

Attachment to C.L. Elliot Memo 12-31-86  
 Plot of DMEA Stratigraphic Drill Holes  
 on Excerpt of Figure 6 Attachment to  
 C.L. Elliot Memo of 8-8-86.

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