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Dec 11 Mon —

Jim Funk, GLR, JEC Conference re gravity:
advised by letter (KEM file) ^{see} to proceed 3-4 days
and ahead. Network stations plus 2 lines.

Dec 14 Jim Funk at office

Beomoy has arrived. Furnished geol map for
interpretive work

Dec. 7, 1972

Mr. Kinnison,

Jim Fink telephoned and said the
ying has been completed. Work will
probably be finished next week on
Wed. or Thurs, before the Dec. 15
deadline.

What is the status of the preparymnt
check for \$2,000?

Can you meet with Mr. Fink sometime
tomorrow to discuss things?

Fran

J. E. K.

DEC 07 1972

Talked to Gordon W.

He will deliver invoice
for above tomorrow - Friday.



J. J. Durek
Oakland, California

November 24, 1972

John E. Kinnison
Tucson, Arizona

File
Blue

Vulture Mountains
Geophysical Proposal Subcontract

Jim Fink has been in touch with Parker Gay regarding the subcontract for the subject aeromag work. Inasmuch as our company is not identified to Gay, the terms of his contract with Mining Geophysical Surveys here in Tucson requires payments of \$1,000 before initiation, \$1,000 upon completion of field work, and \$1,000 upon receipt of completed maps. Mining Geophysical Surveys will meet these pre-payments, and I have advised Jim that it may be difficult to crank out payments from us prior to commencement of the airborne work.

As a convenience to the cash position of Mining Geophysical Surveys would it be possible for them to receive a payment from us in the amount of \$2,000 early in December to cover these early payments? I have indicated to him that we might be able to do this.

/fn

J. J. Durek
Oakland, California

November 24, 1972

John E. Kinnison
Tucson, Arizona

File
Blue

Vulture Mountains
Geophysical Proposal,
Supplement

In my memo to you of November 21, I did not encumber the data with a description of proposed detail. The following approach has been arrived at by mutual discussion with Jim Fink and myself regarding the airborne magnetics.

One of the difficulties normally encountered on a turn around time with airborne work is the development of photography flown for base control and preparation of a mosaic therefrom. Of the several companies contacted, those who are able to meet the deadline of December 15 offered to utilize visual observation supplemented by 35mm snapshots. We will provide as a base both the 1952 high-altitude photography of the area in question, as well as the U-2 enlargements which we have here. Thus, this photography together with existing topographic maps will provide the base, and the flight lines will be plotted on the basis of visual observation and 35mm snapshots as compared to the base. This is deemed sufficiently accurate for our purposes.

I have given to Mining Geophysical Surveys a topographic map with an area approximately six miles long and four miles wide, trending about N 60° E. For purposes of control, this "area of interest"--which largely covers an alluvial area with some outcrop on the south side--will be expanded for purposes of interpretation to an area approximately ten miles long and five miles wide. This will be flown on ½ mile spacing, the lines trending northwest across a five mile width which also crosses the probably Laramide/pre-Cambrian contact. Coverage will be complete from the southwestern edge of the alluvial basin west of Wickenburg, northeast across the Hassayampa River to the extension of Laramide-granite on that side of Wickenburg. About 200 line miles are involved utilizing ½ mile spacing.

Bids have been received from five of seven contractors contacted. Bids were received from Lockwood Kessler and Bartlett (\$4500), Geoterrics (\$2500), Applied Geophysics (\$3000), Geometrics (\$2420), and Aerial Survey Ltd. (\$1900). Geoterrics and Geometrics are not sure of delivery by the specified date. Aerial Survey Ltd. is an unknown insofar as quality is concerned. Applied Geophysics has not been utilized by Mining Geophysical Surveys before, and their airborne facility for magnetometer work is newly acquired. However, this is Parker Gay's outfit,

and his reputation to my knowledge is high. He was considered a magnetic specialist when with ASARCO, and this has been one of his major fields. Lockwood Kessler and Bartlett are known to provide excellent service, according to Jim Fink. I have elected to try Applied Geophysics on the basis of Parker Gay's reputation, combined with the lower bid compared to Lockwood Kessler and Bartlett. Mr. Fink has called Applied Geophysics to obtain a written bid and contract. The work presumably can begin on notification.

/fn

J. J. Durek
Oakland, California

November 21, 1972

John E. Kinnison
Tucson, Arizona

File
Blue

Maricopa Program,
Vulture Mountains,
Geophysical Proposal

SUMMARY AND RECOMMENDATIONS

The northern intrusive contact between Laramide granite on the south and pre-Cambrian granite on the north is concealed by alluvium in the area north and west of Wickenburg. This area of concealed contact is also the approximate site at which two demonstrable mineral "zones" intersect. One, which trends northwesterly, has been the objective of our Maricopa-Mohave program. The other, which trends northeasterly across the grain of this major zone has been defined during the course of our geologic work, and appears to be en echelon with the major zone which I discussed at the Oakland meeting last February, which appears to transverse the Colorado Plateau and to extend southwesterly from Jerome. Widespread, possibly peripherally zoned, mineralization is present in the Wickenburg area, as well as a major Laramide granite. I submit that this area offers an attractive exploration objective and that it is worth continued prospecting.

Although continued geologic work may ultimately aid in pin pointing an objective in the alluvial covered area now of interest, our results at this point are not definitive. The area of interest is situated on the edge of Wickenburg and the inhabited area surrounding, and therefore it is not desirable at this point to utilize IP reconnaissance due to:

1. the attention which would be attracted, and
2. the fact that we are not now in a position to move rapidly to a property status.

Further, the intrusive contact will predictably influence the position of a porphyry copper deposit should one be present. In other words, by comparison to other Arizona districts where such a granitic mass is present, our target will be either at the edge of the intrusive or within a few miles outside of the contact. Thus, IP work can be more effectively controlled if the granitic contact can be predicted in advance.

I feel that there is sufficient reason for believing that magnetometer survey can define this contact to justify the recommendation for such work. In the foregoing I will detail

following

the procedure recommended, with comments on the utilization of a gravimeter reconnaissance. You will find enclosed a contract from Mining Geophysical Surveys of Tucson drawn for this objective, and if you concur with the recommendations outlined in this memo, please obtain the necessary signatures and advise me by telephone when signing is complete.

GEOLOGICAL BACKGROUND

I will not attempt to review the details of the Wickenburg district in this memorandum, for you have been advised by interim reports and verbal discussion of our current state of knowledge, and of our past and proposed geological work.

Attachment A is a revised geologic map of part of the Maricopa project centering about Wickenburg. You will note that an elongate granitic intrusive (Laramide) trends northeasterly across the Vulture range and may be projected through Wickenburg to a similar northeasterly elongated granite mass. Although the length is accentuated by separation along low-angle faults, there is no doubt about the prominence of this Laramide intrusive. Although not shown on Attachment A, Laramide granite also appears further southwesterly along this same strike in the Big Horn Mountains.

Attachments C and D were not intended originally to accompany this memorandum, but I enclose them as they are now ready for transmittal. Both of these regional maps have been in preparation for considerable time for presentation and discussion. The geologic map (Attachment C) has been modified from the geologic highway maps of Arizona and New Mexico. Rock divisions are designed to accentuate the distribution of Laramide intrusive rocks, as well as post-Laramide volcanic cover rocks and alluvium. Attachment D illustrates my current working model of porphyry copper "lineaments" or mineral "belts" in Arizona and New Mexico. The importance with respect to the current topic is that the vicinity of Wickenburg is an intersection of the major "Silver Bell zone" with an enechelon segment of the major "Jerome zone".

Although we have not yet demonstrated significant mineralized porphyry to be present, the entire periphery of the granitic mass should be considered to have prospective merit. Most of the contact length is exposed and has been evaluated, but the area west and northwest of Wickenburg is covered by alluvium. This area, situated at the intersection of two major mineral zones clearly warrants attention. Eventually more work will be done along the southwestern projection of the Laramide granite, but this is not the current objective.

GEOPHYSICAL PROPOSAL

Attachment B is an overlay for Attachment A. This magnetometer map is generalized from John Sumner's residual magnetic map of Arizona which was recently published.

It will be seen that the Vulture range in part conforms to a 400-500 gamma ridge. The area north of the Laramide granite conforms generally to a magnetic low varying from 200-400 gammas. Two significant interpretations may be made:

1. The volcanics in this area have not materially affected the shape of the magnetic responses.
2. The magnetic low appears to conform to the area north of the Laramide granite intrusive body. This is in part due, perhaps, to alluvium in the area of Wickenburg and to the northeast along the Hassayampa, but it is more likely due in major part to the less magnetic character of the pre-Cambrian granite on the north contrasted to Laramide granite and pre-Cambrian schist which make up most of the area to the south.

The magnetic response of megascopically similar granites of the same ages--Laramide versus pre-Cambrian--in the Sacaton Mountains also indicates that Laramide granite is measurably more magnetic than is the pre-Cambrian.

Interpretation of the recommended magnetic data is the key to successfully outlining the shape of the granite under alluvial cover--and also possibly beneath local volcanics. For this reason I have selected Gordon Wieduwilt of Mining Geophysical Surveys for this work on the basis of his reputation with magnetics. His chief geophysicist, Mr. Jim Fink, is also well-known to me, and was formerly an employee of mine when I was with Geocomp Exploration. I remain impressed with his abilities.

I have postponed until this point a recommendation for geophysical work in the hope that last minute geological reconnaissance would help us to be more selective in the area covered. This, however, has not proved to be the case. Since at one point there seemed to be concern on the turn-around time to be provided by aerial magnetometer survey by a subcontractor, I investigated the relative speed and applicability of ground magnetics. In addition to being more expensive, the unusually stormy weather which has characterized both October and November could, if continued in December, severely impair field work. Mr. Fink advises me that he now has obtained bids from two reliable aeromag companies, and that a December 15 deadline can be met--which will allow billing to get through this year's budget. The selection of the specific subcontractor will be based in part on amount bid and in part on assurance of completion by the specified date. Whether or not all of Mining Geophysical's

interpretive work can be completed in time to be included for payment this year is questionable. In his cover letter, Mr. Fink cites his estimate of ten days for interpretation, which you will see by my letter to him of this date I protest, unless specific calculations so require.

If a field check by ground magnetometer is required, it may be possible to get most of this work charged to this year's program. Again, this is being timed very closely. I am proceeding under the belief that, as last year, bills received in Oakland by the 20th can probably be paid this year.

Two, possibly three, lines of gravity reconnaissance are also suggested in my letter to Mr. Fink, to be run concurrently with the aeromag subcontract. While technically it would be more advisable to perform this survey following the magnetic work, the relative depth of alluvial fill in the target area will remain an unknown regardless of the magnetic results. If we can determine whether this is a deep basin or merely a shallow pediment, we can better assess the utilization of induced polarization work at a later date. I do not have final estimates from two of the four potential aeromag contractors at hand yet, but the range based on the two contacted to date will be between \$3,000 and \$5,000. Thus, a preliminary estimate could be suggested for this work as follows:

1. Airborn magnetic survey	\$4,000
2. Gravity	1,200
3. Aeromag interpretation	1,000
4. Ground magnetics	900
Total	<u>\$7,100</u>

Our remaining budget will certainly accomodate this expenditure, and hopefully most of it will be chargeable to the 1972 budget. Some carry-over into 1972 (\$1000?) may be unavoidable.

If you concur in the recommendations outlined above, I urge that the contract be processed with rapidity to facilitate commencement next week. The subcontractor will initiate on verbal advice from Mining Geophysical Surveys, and Mining Geophysical is willing to initiate on verbal advice that the contract has been signed.

As a final note you will see that the cover letter is made a part of the agreement, and that it is written with considerable flexibility. Mining Geophysical was contacted late in October before the present plans had jelled, but it appears that nothing written in the cover letter or in the contract conflicts with recommendations herein proposed. Agreement to terminate on our part is specified.



* Geo ferrics \$ 2500

Not sure of delivery

esp - Applied Geoph (Parker) (Gay) 3000

Right away.

* Aero Serviced
Hemwich

Refused.

Not feasible

* Lockwood Kessler & Bonblitt \$ 4500

Right Away

unknown
quality?

? - Geometrics

2420

Think delivery can
be met but cannot

? - Aerial Surveys/Hol

1900

guarantee

Right away.

will try him

J. E. K.

NOV 22 1972

Jim Fark - Telephone

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2400 EAST GRANT ROAD - TUCSON, ARIZONA 85719

TELEPHONE - 602 326-8619

October 31, 1972

Mr. John E. Kinnison
Kaiser Exploration & Mining Company
5839 N. Oracle Road
Tucson, Arizona 85704

Dear John: RE: Wickenburg Geophysical Studies

We suggest the following approach to the titled program:

1) During our discussion with you we advocated going in on the ground and doing some quick traverses with a ground magnetometer to establish relative susceptibilities of the local rocks. Ideally, we could determine an optimum flight elevation and line spacing to obtain maximum accentuation of the target intrusive. The more we consider this step, the less essential it seems to be. We doubt very seriously that if this step were ignored and the aeromag flown first that we would lose much, if any, information.

2) MGS would subcontract the airborne work to the bidder of your (KAISER's) choice. We will accept all supervisory responsibilities for the proper performance of the survey and the data handling thereof. Location maps will be the responsibility of KAISER.

RECEIVED
NOV 1 1972

TUCSON
KAISER EXPLORATION & MINING CO.

3) MGS will interpret and analyze the aeromag data as supplied by the subcontractor. MGS will write a full report using state of the art techniques and will include recommendations as required.

4) Should the results be favorable in KAISER's opinion, then further ground work would be performed for precise location and burial depth of the target intrusive. Ground magnetics may or may not be necessary depending on the results of the aeromag. Gravity would likely be most useful for depth determinations and accurate pediment location.

Cost estimates for the ground magnetics and gravity are as follows:

1) Ground magnetics (Vertical Intensity)

3 days @ \$180.00/day	\$ 540.00
2 man crew - living cost @ \$35.00/day	105.00
1 helper - wages @ \$30.00/day	90.00
1 vehicle @ \$0.20/mi - 50 miles/day	30.00
1 day total mobilization - Wickenburg-Tucson @ \$100.00/day	<u>100.00</u>
	\$ 865.00

2) Airborne work

All work up to and including a finished
contour map to be supplied by subcontractors - - -

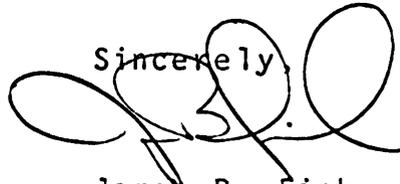
3) Aeromagnetic interpretation	
10 days @ \$120.00/day	\$ 1,200.00
4) Gravity (using topo maps for elevation control)	
4 days @ \$200.00/day	\$ 800.00
2 man crew - living cost @ \$35.00/day	140.00
1 helper - wages @ \$30.00/day	120.00
1 vehicle @ \$0.20/mi - 50 miles/day	40.00
1 day total mobilization	
Wickenburg-Tucson @ \$100.00/day	<u>100.00</u>
	\$ 1,200.00
5) IP & Resistivity	
Amount of coverage to be determined later.	
Daily production rate	\$ 275.00
4 man crew - living costs daily	60.00
Wages for 3 helpers - daily	90.00
Vehicle costs @ \$0.20/mi - 50 miles/day	<u>10.00</u>
(Estimated average daily rate	\$ 435.00)
1 day total mobilization	
Tucson-Wickenburg	\$ 100.00

All work will be performed as per agreement included herein.
Any followup IP and resistivity work shall also be performed in
accordance with the agreement, subject to the approval of KAISER.

Kaiser Exploration & Mining Company
Page 4
October 31, 1972

I hope this covers everything to your satisfaction, John.
If you have any questions or suggestions, don't hesitate to
call.

Sincerely,

A handwritten signature in black ink, appearing to read 'J.B. Fink', with a large, stylized flourish extending to the right.

James B. Fink
Chief Geophysicist

JBF/nw

Enclosure: Agreement

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November 21, 1972

Mr. James B. Fink, Chief Geophysicist
Mining Geophysical Surveys
2400 East Grant Road
Tucson, Arizona 85719

SUBJECT: Wickenburg Geophysical Program

Dear Jim:

I have prepared a memorandum describing the objective which we have discussed regarding the subject proposal, for transmittal to Oakland, together with your letter of October 31 and contract. I have the following additional comments, in line with recommendations which I have now made to Oakland.

1. As discussed on the telephone, we will not proceed with any attempt to do the job by ground mag, and will select an aeromag contractor on the basis of low bid, in consideration of contractor reputation and firmness delivery by December 15. Possibly this selection can be made tomorrow morning on the basis of bids by then received.
2. You should prepare to initiate two, or possibly three, reconnaissance gravity lines across the alluvias basin west of Wickenburg, the exact location of which will be determined by mutual discussion and agreement. Possibly 10-15 line miles may be involved.
3. Ground magnetics will be utilized only as in your professional opinion they are necessary to locate and/or verify the aeromag data.
4. I must express the hope that interpretation of the aeromagnetic data will not require ten days as estimated. If calculations requiring considerable time and utilizations of alternate models becomes necessary, then of course it must be done. However, bear in mind that all we really need from you as a final interpretation is a map with a line on it depicting the probably Laramide/pre-Cambrian contact. The report which accompanies such a map should be exceedingly brief, touching only the high points of theory utilized for the interpretation. I specifically do not wish a description of each

James B. Fink

-2-

November 21, 1972

aeromag line. Obviously, other anomalies may also be seen, and a delineation of volcanics may be in part suggested, and these could receive a brief mention.

I wish to thank you, Jim, for the considerable attention you have given this matter, and I hope to be in touch with you next week to advise that the agreement has been signed. Regarding the process of billing, I think it would be advisable to forward the subcontractor's bill directly to Oakland on receipt of their completed map and statement, with a copy to this office. As to your own work, I would hope that you can prepare a bill up to and including December 18, including field work to that date, so that it may reach the Oakland office by the 20th.

Again, thank you and Gordon for your attention to this contract, and look forward to working with you.

Very truly yours,

John E. Kinnison
Regional Geologist

JEK/fn

cc: J. J. Durek

A G R E E M E N T

THIS AGREEMENT, made and entered into this 31st day of October, 1972, by and between Kaiser Exploration & Mining Company (hereinafter referred to as KAISER) and Mining Geophysical Surveys (hereinafter referred to as MGS)

WITNESSETH:

1. At the request of KAISER, on or after November 6, 1972, MGS will commence, undertake and thereafter diligently proceed with an exploration program including airborne and ground magnetic, gravimetric, induced polarization and resistivity surveys as outlined per enclosed letter for KAISER. As stated in the aforementioned letter, the coverage may be extended or deleted at the request of KAISER or its acknowledged representatives.

2. KAISER will supply necessary maps of the area to be surveyed and will acquire all necessary access rights. Line location work as required is the responsibility of KAISER, but would be done by MGS personnel as part of the survey at the request of KAISER.

3. MGS will conduct the survey as requested by KAISER and shall provide for the purpose of such survey suitable equipment and an engineer-operator.

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4. All measurements shall be done in accordance with the accepted state of the art. MGS shall provide field notes and pencil drawings of the results. A final report and maps will be submitted within approximately one month after completion of the survey.

5. It is understood and agreed that MGS is and shall be deemed and treated as an independent contractor while engaged in the performance of the work as proposed.

6. MGS or its employees will not disclose information or show data and records gathered during this survey to unauthorized third parties or use the same except for the sole purpose of the work for KAISER contemplated hereby without prior written authorization from KAISER. All records and data shall be the sole property of KAISER and shall be delivered to KAISER at the conclusion of the data compilation.

7. MGS agrees to indemnify and save harmless KAISER against any and all loss and expense, including attorney's fees and other legal expenses, by reason of liability imposed or claimed to be imposed by the law upon KAISER directly or indirectly for personal injuries or death or damage to property sustained by any person or persons arising out of or in consequence of the performance of this contract by MGS, or by reason of any infringement or claimed infringement by MGS of any patents or applications

therefor, if such bodily injury, death, or damage to property or infringement arises in whole or in part out of the negligence or any grounds of legal liability on the part of MGS.

8. MGS will obtain and continue in force during the terms of this contract at its own expense all insurance specified below. The insurance to be obtained and continued in force by MGS is the following:

(a) Workmen's Compensation and Occupational Disease Disability Insurance to the extent required by the laws of the jurisdiction wherein the work is to be performed;

(b) Comprehensive Public Liability Insurance with bodily limits to \$300,000.00 for each person and \$500,000.00 for each accident, and property damage with limits of \$100,000.00. The limit of liability for any one occurrence is \$500,000.00.

(c) MGS agrees to furnish KAISER on request, certificates evidencing such coverage.

9. MGS will at its own expense repair any damage to all property of whatever kind or character, whether publicly or privately owned, including the property of KAISER, which may result from negligence on the part of MGS in its operations under this contract.

10. MGS will exercise reasonable care in the performance

of work proposed, and will take the special precautions necessary to avoid harm from conditions existing or created during the progress of the work containing an unreasonable or peculiar risk or harm to persons or property.

11. MGS will comply with all applicable laws, ordinances, and governmental regulations, including permits and licenses required to render professional services, but KAISER will obtain and pay for required permits and licenses related to land access rights. MGS will make all contributions with respect to employment required by such applicable laws, ordinances, and governmental regulations and will assume and pay taxes imposed, including transportation, sales, use and privilege taxes which pertain to MGS' work hereunder. MGS will pay promptly all costs and expenses assumed by it and incurred in connection with the project.

12. KAISER shall pay MGS in U.S. funds for services at the rates as per letter proposal.

13. Days lost due to weather are charged at the production rate if an abortive attempt is made to produce. If no attempt is made due to obviously hazardous or inclement conditions, One Hundred Dollars (\$100.00) per day, plus direct cost items, is to be charged. Standby costs of One Hundred Dollars (\$100.00) per day, plus direct cost items, are charged for days where

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production delays are due to client's inability to provide MGS with necessary information or access rights to proceed with survey once an MGS crew arrives on site. Equipment breakdowns are the responsibility of MGS, and KAISER shall not be charged for any time lost due to equipment failures. Days off are the responsibility of MGS and KAISER shall not be charged for these days.

14. MGS shall submit to KAISER invoices in triplicate adequately describing and supporting charges according to the terms of the agreement. KAISER shall have the right to audit the books and records relating to costs under this contract. MGS agrees to maintain such books and records for a period of two years from the date such costs were incurred and to make such books and records available to KAISER at any time or times within the two-year period. Payment is to be made in the following manner:

(a) Prepayment of one-third (1/3) of accepted subcontract bid upon receipt of invoice.

(b) Monthly billing on long-term projects.

(c) Final payment due upon receipt of reports and maps.

15. MGS will perform and execute all work and services required pursuant to this survey in a proper, careful, and workmanlike manner. It will not be liable to KAISER for delays caused by acts of God, weather, necessary equipment repairs, or other acts beyond its control.

16. KAISER has the right to terminate this contract by notice in writing after a minimum of two (2) days' production.

All amendments and modifications of this contract must be in writing. MGS will not assign this Agreement without the previous written consent of KAISER.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and date first above written.

MINING GEOPHYSICAL SURVEYS

By W. Gordon Wieduwilt
W. Gordon Wieduwilt

KAISER EXPLORATION & MINING COMPANY

By _____

Mining Geologist
Registered: Arizona
California

JOHN E. KINNISON
Rt. 1, Box 621-B
Tucson Arizona
85704

Home
(602)297-1952
Office
(602)327-1888

6 December 1973

Mr. W. E. Saegart
President
Quintana Minerals Corporation
1892 West Grant Road
Tucson, Arizona

Big Horn/Vulture Reconnaissance
Maricopa County, Arizona

Dear Sir:

This report and accompanying map are the result of a general reconnaissance of the southwest flank of the Vulture range, and most of the Big Horn mountains, in west-central Arizona. Field work consumed thirteen days in August and September of this year, and a verbal report was given in September on completion thereof. Information for your file record is presented primarily by the geologic reconnaissance map, and is supplemented briefly by the following.

BASIS FOR THE WORK

As indicated by maps which I presented during our initial conference, a Laramide granitic pluton, intrusive into pre-Cambrian terrain, extends southwesterly from a point 9 miles northeast of Wickenburg, across the Vulture range, and finally disappears beneath alluvium, for a total linear distance of 24 miles. Recurrent centers of mineralization are present along the axis of this linear feature, including the Sheep Mountain and Lane Mountain disseminated (but non-commercial) copper deposits.

I proposed that a reconnaissance be conducted to prospect the extension of this "lineament" southwest through the Big Horn range, where Laramide granite had been reported by a Kaiser geologist. Field work was started on the southwest flank of the Vulture mountains, where mapping by Kaiser Exploration had terminated, and extended into essentially unknown territory in the Big Horn range.

CONCLUSIONS

The lineament, as defined by Laramide intrusives and minor mineralization, extends southwest across the Big Horn mountains. Copper mineralization, however, becomes progressively weaker from a more intense center a few miles west and south of Wickenburg. The southwestern part of this intrusive zone is essentially "dead" from a copper standpoint, and no leads are recognized which would support further work on the western alluvial covered flank of the Big Horn range.

Although this intrusive lineament could be further prospected by continued work along its projection southwesterly into and perhaps beyond the Eagle Tail mountains, you have indicated that such a program, in your opinion, ranks low in priority compared to other Quintana efforts, and that further reconnaissance is not justified at this time. Unless new information is obtained--of a nature which might place the southwest projection of this particular mineral/intrusive lineament in a different and more favorable light--I would concur in this decision.

DISCUSSION

Pre-Cambrian Geology:

Pre-Cambrian metamorphics consist of Yavapai schist, and of a complex of gneiss and generally fine-grained, but variable-textured granites. The schist lies to the south of the granite-gneiss complex, and the contact between the two units trends southwesterly across both the Vulture and Big Horn mountains. In the Big Horn range, a narrow belt of mafic schist, gneiss, and diorite within the "complex gneiss" unit appears to form a "marker" which parallels the main schist belt to the south.

Coarse-grained pre-Cambrian granite intrudes the gneiss complex, along a northeast trending axis parallel to but north of the schist belt. A large pre-Cambrian granite stock in the Vulture range lies northeast of the reconnaissance map herein presented, but occupies a similar position north of the schist belt, and is exposed on both sides of the cross cutting Laramide granite.

Laramide intrusives:

The large mass of medium-grained, biotite granite, megoscopically identical to the Laramide granites in the Florence-Sacaton region, extends from the area of King Solomon's wash in the Constellation district, northeast of Wickenburg, a distance of 24 miles to the alluvial flank of the southwest Vulture mountains. The contacts of this elongate pluton, which ranges from 1.5-2.5 miles in width, are parallel and remarkably straight. Although Tertiary low-angle gravity faults of significant magnitude displace the granite, dip-slip movement was parallel to the axis of the pluton, and therefore noticeable offsets in the strike of the granite are not present.

In the Big Horn range, Laramide granite reappears on a simple strike projection of the Vulture mass, but here the contacts are more irregular and the intrusive is generally much narrower.

The oldest section of Tertiary volcanics in the Big Horn range appears, with some modification, to correlate to the Vulture range volcanics. As in the Vulture range, the Big Horn volcanic section is also tilted steeply to the northeast. Presumably low-angle gravity faults like those which I have mapped in the Vulture range are also present in the Big Horn mountains, and the dip-slip movement on these faults is probably also parallel to the trend of the Laramide intrusive mass.

The post-granite rotation and faulting, although not affecting the strike outline of the intrusive, presents an outcrop exposure which more closely resembles a pre-rotation cross-section through the granite. With this in mind, the irregular configuration of Laramide granite in the Big Horn range may be interpreted as in part due to nearness of the southwest terminal end of this pluton, where the uniform dimension displayed in the Vulture range have given way to irregular intrusive fingers. The structural control of both the Laramide and pre-Cambrian granitic plutons is obscure. It is noteworthy that they both occupy the same general area, and are parallel to but somewhat north of the schist belt. An apparently separate pre-Cambrian granitic mass lies within the schist belt in the southeast Big Horn mountains.

Quartz monzonite porphyry, as a narrow dike, occurs near the Power Line in the western Vulture mountains, with associated quartz stringers and copper oxides. In the eastern part of the Big Horn range, similar porphyry dikes are found on both north and south Laramide granite contacts, and there are numerous dikes in the basin which drains westward from Little Horn Peak. Although the dikes in the Big Horn range may be texturally classed as typical of the porphyry-copper-type, they are devoid of mineralization.

Tertiary Volcanics:

The oldest volcanic sequence in the Big Horn range consists of Vitrophyre, both glassy and devitrified, and of andesite flows. The base of this sequence is composed of a thin but diagnostic red conglomerate and grit and a thin, yellow, waterlaid tuff. These volcanics are steeply dipping, as is a correlative sequence in the Vulture range.

The western frontal cliffs of the Big Horn range are made of a younger sequence of acid flows and tuffs, which dip moderately west. Flat or low-dipping vesicular basalt and tuff ring the periphery of the Big Horn and Vulture ranges.

Mineralization:

Middle (?) Tertiary mineralization is represented by gold-quartz veins in Vulture-type volcanics at the U. S. mine and Tonopah-Belmont mines in the Big Horn mountains. The Vulture mine in the Vulture range, and some minor veins in the northwestern Big Horn mountains are probably of this age also. I know of only one Vulture-type gold-quartz vein (a minor unproductive vein) within Laramide granite, north of the Vulture mine and beyond the eastern limit of the attached map. The reasons for this are speculative, but perhaps the pre-Cambrian and Laramide granitic structural loci were unfavorable pathways for post-Laramide mineral solutions, which followed instead channels on the margin of the granitic zone.

Manganese mineralization is widespread in the northern part of the Big Horn range, and may be as young as the vesicular basalts.

Copper mineralization may be shown, in the Vulture range, to be unquestionably pre-volcanic and largely post-Laramide granite. The mineralization at Wickenburg Peak (and similar but weaker occurrences elsewhere near the southern margin of Laramide granite) may be pre-Cambrian, but conclusive proof is lacking. Minor quartz veins with copper oxides occur at numerous localities on the margins and within the Laramide pluton in the Vulture range, and are clearly Laramide. Small seams of copper oxides occur at many points within the Laramide granite, and are sufficiently numerous to constitute a very low grade disseminated oxide mass in two areas just west of Wickenburg. Although these seams do not have an obvious hydrothermal "plumbing system", I have interpreted them as of hydrothermal origin, originating from the oxidation of tiny seams of copper sulphide without pyrite.

The copper "showings" above described are most numerous within a few miles south and west of Wickenburg, and occur with decreasing intensity southwest along the southern margin of the Laramide granite in the Vulture range. This reconnaissance failed to show a lead under alluvial cover on the southwestern margin of the Vulture range, and no mineralized outcrops were found in the alluvial plain beyond the general edge of outcrop. The wide expanse of alluvium precludes a positive statement, but I feel it is unlikely that a major copper deposit is concealed in that area.

In the Big Horn range, copper "shows" are extremely scarce, and generally limited to small oxide seams in or near Laramide granite, on the eastern slope. As described in the foregoing, Laramide granite and porphyry continue across the range, where they disappear beneath alluvium in the basin reentrant which drains west from Little Horn Peak. Copper occurrences in this area are quite rare and certainly no leads exist to guide further exploration. Because of the presence of monzonite porphyry, this basin and surrounding areas were covered quite thoroughly.

Respectfully submitted,

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