CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

To: P. I. Eimon
From: H. David Mac Lean

Subject: REview of Geophysical Data in Essex Files for the Safford Area, Graham County, Arizona.

March 28, 1972

General Remarks;

A quantity of geophysical data taken in the vicinity of the San Juan prospect, near Safford Arizona, has been made available to ESSEX INTERNATIONAL. A review of this data has been undertaken while visiting the property March thirteenth to sixteenth, for the purpose of assembling, organizing and reinterpreting the data, and to make recommendations as to how this and simaliar work could further contribute to the geological understanding of the area. The geophysical data available consists of ground magnetics and IP-REsistivity for two properties which adjoin the ground in which Essex has an interest. Unfortunately, this data was collected at different times for very restricted purposes and does not provide district wide information. However, it does provide and indication of the type of information which could be extracted from similar surveys elsewhere in the district.

The location of the properties for which information is available is shown in Fig. 1A, which is a compilation of two of the seven and one half minute quadrangles in the Safford Area (see Fig. 1.) This figure also shows in rough outline the location of the San Juan and Winkler- Fauldkner properties for which geophysical information herein discussed is available. The property boundaries shown are diagramatic; no attempt has been made to outline the property with any degree of precision. The survey grids which are shown on the figure are also approximate.The grid locations have been scaled onto this figure from other sources, but no information was available by which grid stations could be tied to specific topographic features or reference points.

Any description of topographic or geological features, such matters as access, water supply and other factors not directly related to , or bearing on the geophyisical matters, is beyond the scope of these notes. These topics are either self evident, well known, or adequately discussed elsewhere in the Essex files.

A very preliminary examination of the available geophysical data indicates that the material is of little use for purposes of direct exploration in the classic sense of an orebody posessing certain physical properties which will permit its detection by surface measurement of these properties. Rather, the exploration problem here is one of projecting geological conditions from known to covered areas. Nevertheless, certain geological features do lend themeselves to detection by and mapping by geophysical methods and it is possible that these, or similar surveys might provide a guide to an understanding of the geology of the area, and thus indirectly to an understanding of potential ore locations.

Geophysical Data Examined.

DAta available consisted of a ground magnetic and IPs on the Winkler - Faulkner and San Juan properties. The magnetic surveys are both vertical intensity variations, measured by and Askania ground magnetometer in the case of the W.-F. ground, and presumably by a hand held fluxgate magnetometer in the case of the San Juan survey. Accordingly, the accuracy of the latter survey would be somewhat less than that of the former, but such a consideration is more or less irrelevant, since no information is available in either case which describes the method of drift recognition and removal, or the tolerances of magnetic tie points.. For the purposes of this discussion one can do nothing else but assume that all procedures were carried out in a professional manner by competant and qualified personnel.

The posted magnetic values show a high level of noise, which is probably due to the presence of magnetic boulders (of basalts). The magnetic data for the W. F. ground has been smoothed using a simple averaging technique; i.e. each point has been averaged with all neighbouring points within a radius of five hundred feet, with unit weight applied to each point. A description of the method used is not available, but this scheme appears to duplicate most of the smoothed data values. Similarly, the magnetic data from the San Juan property should be filtered either by this scheme or by a more advanced band pass filter operator before comparisons or interpretations are attempted. Magnetic data appears on Plates 1 & 1A.

The IP - REsistivity surveys in the two areas utilized quite different techniques.The survey on the W.-F. ground was run with conventional frequency domain gear, using the expanding Eltran array. All of this data is available in the Essex files (Heinrichs, 1970), and is presented on a line by line bais in pseudo- section format. The work on the San Juan property was run by the Anaconda company, using a variation of the three electrode array, with measurement of the IP effect made in terms of phase angles. The data is presented as a plan for two separate spacings, and is bound herewith as plates 2 & 2A (IP) and plates 2R & 2A(R) (Resistivity).

A few"rule of thumb" calculations will permit the conversion of data from one system to another:

$$\text{PFE} = \text{phase angle (minutes)} \cdot \frac{3.2}{60}$$

$$\text{Chargeability (milliseconds)} \approx \text{PFE} \cdot 5 \approx \text{phase angle} \cdot \tfrac{1}{4}$$

Though a report is available for the IP work done on the W. F. ground, there is not any similar technical information regarding the work which Anaconda did in the San Juan area . Again it must be assumed that in general the work was conducted in accordance with generally accepted procedures. Where discrepancies appear, they will be dealt with individually.

Discussion of Results.

IP- Resistivity. San Juan Area.

The strong IP response on Plates 2 sheets 1 & 2 is indicative of a strong mineralized zone. Reliable depths to the mineralization cannot be made since only two relatively wide spacings have been used for the measurements, but depth to source (sulfide material) is probably less than 400 feet. The strong responses are suggestive of heavy pyrite mineralization of about five to fifteen percent. The zone of mineralization has been outlined on Plate 3, which is a general interpretation map, and on Fig. 1A. The pattern is indicative of a mineralized halo which surrounds a weakly mineralized core. Since this core represents the ore of the San Juan mine, detection of this halo may be a guide to the location of ore on the hanging wall of the Butte fault,- the mineralized or anomalous zone terminates against the fault, indicating that there may be a continuation to the south west. The gap in the mineralized halo may be significant in that it may reflect a mineralization trend which should be followed during the course of exploration.

The halo could be significant in the exploration of the Essex ground. The idealized section, presented in Fig. 2 shows that the ore zone which Phelps-Dodge is now developing could extend onto the Essex ground. The halo could be traced to a depth of fifteen hundred feet, and possibly deeper by IP methods. Whether or not the delineation of this halo would constitute a material contribution to the geological understanding of the area is a question for the project geologist to answer, and the nature of this answer would dictate whether or not the survey would be justified.

It is interesting to note that the mineralized halo probably does not extend as far as the W.- F. ground to the south. The IP pseudo- sections show no evidence of mineralization except at the extreme south end. In Fig. 3 the source of the IP anomaly has been interpreted as a buried layer, at a depth of about 1,500 feet. This interpretation is reasonable, in that the resistivity interpretation indicates about 1,000 feet to bedrock. The mineralized layer should be somewhat deeper, due to weathering.

The two solutions in the figure are consistent between 1,000 and 1,500 feet. More spacings with different electrode separations would be required to obtain a more accurate interpretation. The geological significance of sulfided at 1,000 feet at the south end of the W.-F. property, and their complete absence, or at leas burial in excess of 1,500 or 2,000 feet is not immediately apparent, but is duly observed, and may have relevance to the future development of geological thinking in the area.

Elsewhere on the W.-F. ground, the resistivity data would indicate that overburden is somewhat thinner. At Line 5 there is only about three hundred feet of gravel if it is assumed that the bedrock is the higher resistivity material, and the solution of the resistivity case in Line 3 would indicate about five hundred feet or so. Clearly, any mineralization would be much deeper, since there does not appear to have been a problem in getting current into the bedrock material.. In the event that mineralization were much deeper than 1,500 feet, it could probably not be detected by this survey, since the response would likely fall within the noise level.

It may be usefull to trace the pyrite halo south west of the Butte fault. This could be accomplished by surveying the grid of five lines, spaced at 2,000 foot intervals which is shown on Plate 3, and on Fig. 1A. These lines, each of which are about three miles long, could be surveyed with dipoles of five hundred or one thousand feet in length, - depending on the depth to sulfides, or responsive material,- at a cost of about seven thousand five hundred dollars. The proposed grid has been laid out so that the material could be traced onto the W.-F. ground so that the previous survey could be used to further extend the data..

The two magnetic surveys indicate that the various rock types in the area have quite characteristic magnetic properties.. The vertical component data is amenable to various interpretation procedures, and once the data has been collected on a district basis, it should be usefull for purposes of projecting the various geological units. On plate 3 a few of the relatively obvious interpretations have been shown, and this plate illustrates what might be attempted on a district wide scale.

Provided that this information is usefull, the magnetic survey should be continued onto the Essex property, and then tied into the San Juan and W. - F. surveys. Once the data is smoothed and filtered, it should be possible to determine the position and depth of the Lone Star Granite, and other geological units. The inferred fault, which parallels the Butte fault near the North Eastern boundary of the W. F ground may also show up, as well as other structural features. The basalts will certainly interfere with the interpretation of the magnetics, but features from this source should be easily identifiable..

A complete reprocessing, filtering and re interpretation of the magnetics from the San Juan area would require about ten days using hand methods. The small amount of material would not justify processing by automatic methods. This work is being undertaken on a time available basis to demonstrate the applicability of the technique.

Even without filtering, the magnetics show a number of features. For instance the Butte fault marks the transition from high frequency to lower frequency magnetics.. A frequency analysis would enable this feature to be traced in covered areas. The broad highs,- not the isolated single point anomalies in the south east corner co-incide with the location of basalts. However, the high north of this feature is as yet unexplained, and one would be obliged to search for an intrusive rock or other magnetite bearing unit to account for this anomaly. In addition, the north west trending anomaly in the northwest corner of the property my reflect the trend of the San Juan Intrusive. Some filtering, and a much more detailed treatment of the map would be required to affix the boundaries of the feature, but even these unprocessed results may reflec some general trends..

The magnetic survey on the W.-F. ground has been employed to to trace the Lone Star granite south west from its outcrop position onto the W.-F. ground. In addition other occurences have been inferred, and a northwest trending fault has been identified. This information could be projected onto the Essex ground if the survey were continued.

Conclusions and Recommendations.

The IP data on the San Juan property indicates that the ore zone is surrounded by a halo of mineralization. Though this halo may not be everywhere visible, its presence is unmistakable. The halo has been truncated by the Butte fault but could easily be traced in the hanging wall. The proposed grid shown in Fig. 1A and in Plate 3 would permit the detection and delineation of this halo in the event that such an action would be of benefit to the development of geological information in the area.

The intrusive rock, the Lone Star granite, has an anomalously high magnetic susceptibility. The location,- position and depth,- of this unit could be approximated in many instances from the results of a magnetic survey. A ground magnetic survey which would tie into the previous work on the W.-F. and San Juan properties along the proposed grid shown in Fig. 1A and Plate 3 is recommended.

Considering the problem of access in this area the benefits which could derive from a low altitude magnetic survey should be given serious attention. The various rock types could be identified by their susceptibilities, and thus could be mapped without regard to trespass considerations. The area to be covered is shown on Fig. 1A. Cost of flying the 410 line miles,- quarter mile line spacing, would be about eight thousand dollars. This survey is not recommended at this time, but is suggested as a means of expanding the area in which geological mapping is available.

REspectfully submitted,

H. DAvid Mac Lean, P. Geoph.

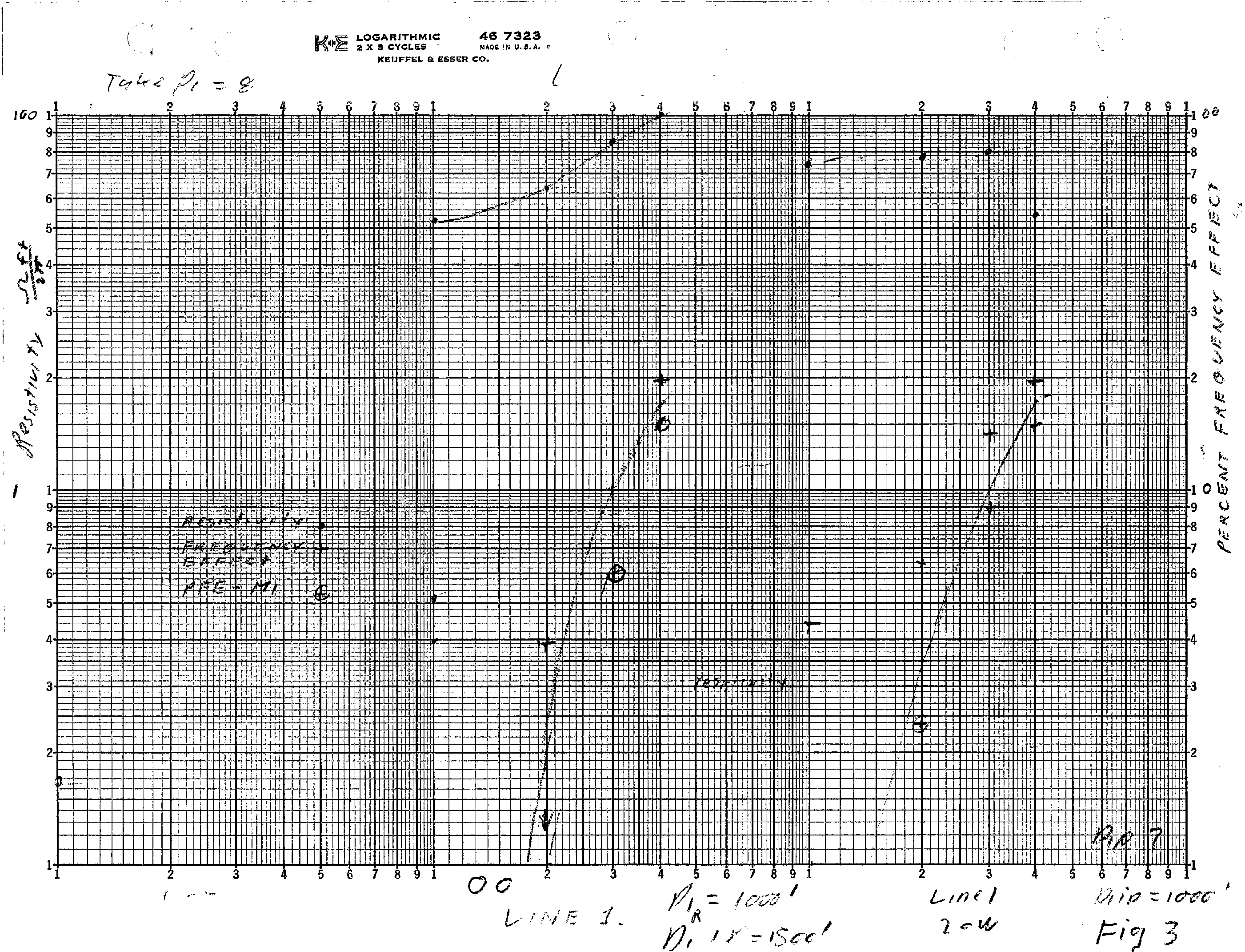
REferences;

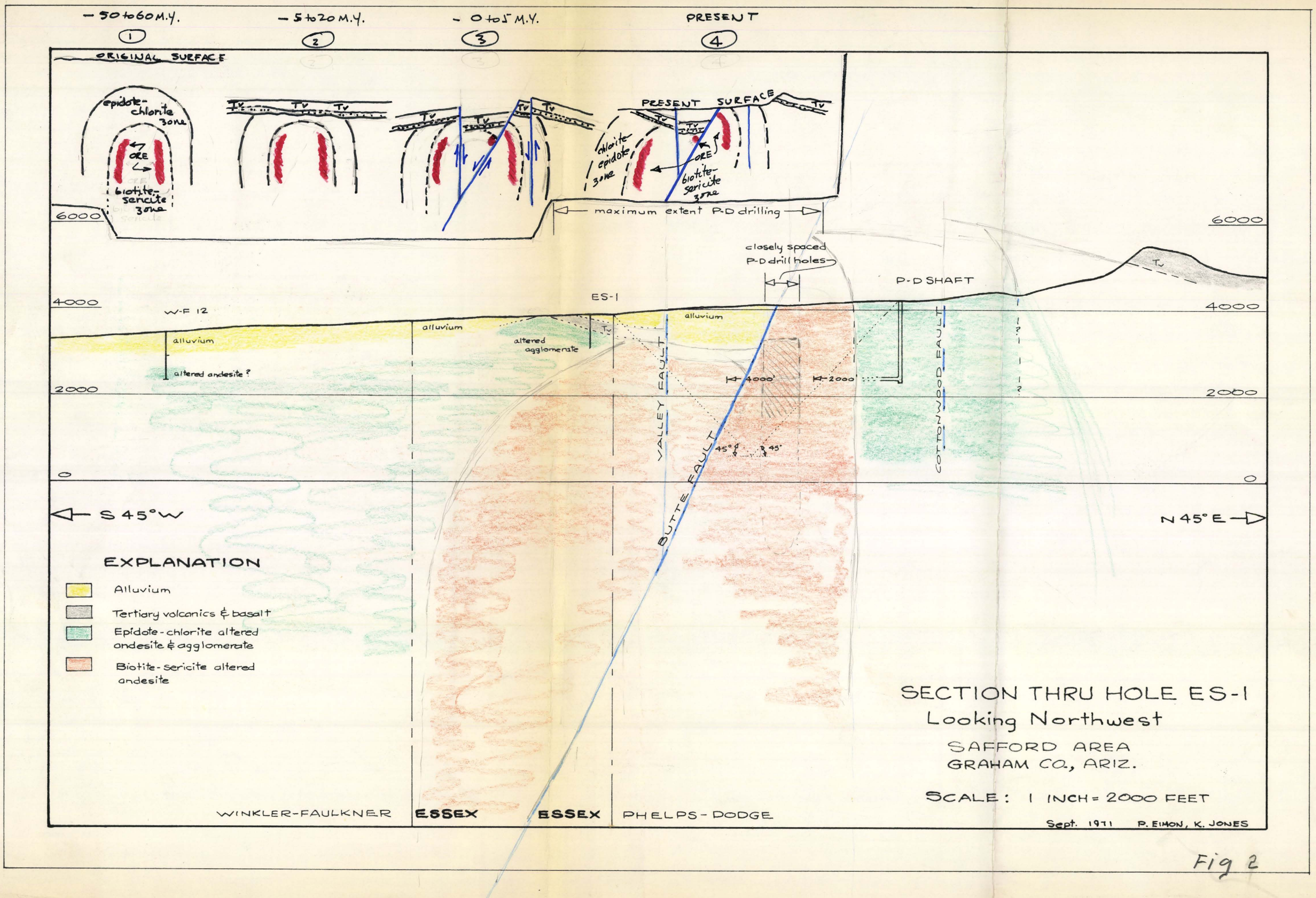
Bell, J. D. ; "Exploration summary report, Winkler-Faulkner Project, Lone Star Mining District." Graham County, Arizona.

Ludwig, C. S.; (Heinrichs GeoExploration Co.;" Letter REport, Winkler - FAulkner Project" April 3, 1965 (Essex Files)

Rodriguez, R. G.;" IP Resistivity & Magnetic Surveys, San Juan Project, Graham County, Arizona," April 1968. Maps only Essex files.

Summary of maps and figures accompanying this report.


K+E LOGARITHMIC 2 X 3 CYCLES KEUFFEL & ESSER CO.
46 7323 MADE IN U.S.A.
Take $\rho_1 = 8$
Resistivity $\frac{\Omega\,ft}{2\pi}$
PERCENT FREQUENCY EFFECT
Resistivity
Frequency Effect
PFE - MI
resistivity
OO
LINE 1.
$\rho_{1R} = 1000'$
$D_{1\,1F} = 1500'$
Line 1
2-W
Dip = 1000'
Fig 3



-50 to 60 M.Y.
-5 to 20 M.Y.
-0 to 5 M.Y.
PRESENT
1
2
3
4
ORIGINAL SURFACE
epidote-chlorite zone
ORE
biotite-sericite zone
Tv
PRESENT SURFACE
chlorite epidote zone
ORE
biotite-sericite zone
maximum extent P-D drilling
closely spaced P-D drill holes
P-D SHAFT
ES-1
W-F 12
alluvium
altered andesite ?
altered agglomerate
VALLEY FAULT
BUTTE FAULT
COTTONWOOD FAULT
4000'
2000'
45°
45°
6000
4000
2000
0
S 45°W
N 45°E
EXPLANATION
Alluvium
Tertiary volcanics & basalt
Epidote-chlorite altered andesite & agglomerate
Biotite-sericite altered andesite
WINKLER-FAULKNER
ESSEX
ESSEX
PHELPS-DODGE
SECTION THRU HOLE ES-1
Looking Northwest
SAFFORD AREA
GRAHAM CO., ARIZ.
SCALE: 1 INCH = 2000 FEET
Sept. 1971
P. EIMON, K. JONES

Fig 2

Copy to Ken Jons & L. Lickty

MINERALOGICAL REPORT

For:

Essex International, Inc.

1704 West Grant Road
Tucson, Arizona 85705

Submitted by:

Mountain States Research & Development

Post Office Box 19760
Tucson, Arizona 85710

Project No. 2008

Approved by Roshan B. Bhappu
Roshan B. Bhappu
Vice President and
General Manager

April 13, 1973

Mineralogical Report

Tucson, Arizona
March 30, 1973

To: Dr. Roshan B. Bhappu
Vice President,
Research and Development
Mountain States Mineral Enterprises
Vail, Az. 85641

From: Laszlo Dudas
Consulting Mineralogist
4737 E Adams St.
Tucson, Az. 85712

Subject: Mineralogical examination of gravity separation and flotation products of a composite sample from the San Juan deposit, Safford, Arizona. Property of Essex International, Inc. Project No.: 2008.

Purpose: To determine the mineral distribution in the samples in particular respect to their copper mineralization.

Sample: Two samples were received on Dec. 19, 1972, and Feb.25, 1973, as follows:

1. Composite ore, Dec.19, 1972; and
2. Cleaner Concentrate (3531), Feb.25, 1973.

A 100-gram fraction was split from the rolled composite. This was screened on 100 mesh sieve. The +100 mesh fraction was ground to pass the 100 mesh sieve. Then, two 20-gram fractions taken from this sample were subjected to gravity separation by Haultain Superpanner.

Two polished sections were prepared from the resulting gravity concentrate and tails. Subsequently, one polished section was made of the flotation concentrate. The polished sections were observed under reflected light, polarizing microscope. The results follow.

Mineralogy:

Transparent Gangue is the predominant mineral component in the gravity tails and concentrate, while it takes second place in the cleaner concentrate. About 85 volumetric percent of the transparent gangue is free, and 15 volumetric percent is locked with hematite (martite) in the gravity tail. The distribution of free and locked transparent gangue in the gravity concentrate is very similar (88 vol percent free, and 12 vol percent locked with hematite). Interestingly, the locking percentage also remains very similar in the cleaner concentrate, with the significant exception that 14 volumetric percent of the gangue is locked with chalcocite instead of hematite. Locking with pyrite, chalcopyrite and cuprite is present in all the observed products in trace amounts. It is very rare in the gravity tails and concentrates, but more frequent in the cleaner concentrate. The transparent gangue in the observed samples is mostly composed of quartz, feldspar and mica. Some of the micaceous gangue shows hydrous iron (and perhaps copper) oxide impregnation. The grain size of the transparent gangue varies between five and 250 microns.

Hematite is second in frequency in the gravity concentrate. It is present only in trace amounts in the gravity tails, and is almost absent in the cleaner concentrate. The hematite is almost entirely an oxidation product of magnetite (thus it is called martite). Most hematite is free; only trace amounts are locked with magnetite. Remarkably, the hematite and its predecessor, magnetite, is rarely or not at all associated with copper sulfide minerals. The grain size of the hematite ranges from four to 200 microns.

Chalcocite is the predominant component in the cleaner concentrate, but it takes only the fourth place in the gravity concentrate and is present only in trace amounts in the gravity tails. About 80 volumetric percent of the chalcocite is free. About four volumetric percent is locked with cuprite, and ten volumetric percent is locked with gangue. Most of the chalcocite occurs as the orthorhombic, supergene type. A minor amount of digenite, which, due to the close similarity of composition, is included with the chalcocite, is also present. The grain size of the chalcocite varies between one and 300 microns.

Cuprite is third in frequency among the mineral components in the cleaner concentrate. It is only sixth in the gravity concentrate, and is a very minor, trace component in the gravity tails. About 83 volumetric percent of the cuprite is free, while 17 volumetric percent is locked with gangue. The cuprite is also locked with chalcocite in trace amounts. Cuprite is present in these samples as well-crystallized, dense grains. The grain size of the cuprite ranges between five and 350 microns.

Covellite is the fifth-ranking component in the cleaner concentrate. It is present only in trace amounts in the gravity concentrate and tails. About 60 volumetric percent of the covellite is free, and 40 volumetric percent is locked, mostly with transparent gangue. Some intricate intergrowths of covellite and the chalcocite-digenite group exist, but because of the close similarity in the composition and flotation behavior of these minerals, the locking between them is not mentioned separately. The grain size of the covellite is about three to 200 microns.

Pyrite shares fifth place with covellite among the mineral components in the cleaner concentrate. It is seventh in the gravity concentrate, and is present in traces in the gravity tailings. About 60 volumetric percent of the pyrite is free, and 40 volumetric percent is tarnished with chalcocite. The term, tarnish, indicates the presence of a very thin (up to 10 microns thick) film covering the pyrite surface. Pyrite locking with chalcocite is present in trace amounts. Locking (as a term) is used to denote a coat of chalcocite or any other mineral showing more than 10 microns thickness. Pyrite is also locked with chalcopyrite and transparent gangue in trace amounts in the observed samples particularly in the cleaner concentrate. The grain size of the pyrite varies between three to 250 microns.

Chalcopyrite and bornite are sixth and seventh in abundance among the mineral components in the celaner concentrate and the gravity concentrate, respectively. Most of the chalcopyrite and bornite grains are free; only trace amounts of them are locked with pyrite, chalcocite and gangue. The grain size of the chalcopyrite and bornite is about eight to 280 microns.

Native Copper, tenorite, and malachite are frequent trace minerals in the cleaner concentrate. They are also present in the gravity concentrate in minor traces. Most of these minerals are free; only small amounts of them are locked with other minerals such as chalcocite, hydrous iron oxide, transparent gangue, etc. The grain size of these minerals ranges from one to 220 microns.

Sphalerite is a fairly frequent trace mineral in the cleaner concentrate. It also occurs in the gravity concentrate. About half of the sphalerite grains are free, while the other half carries inclusions of chalcopyrite blebs. It is also infrequently locked with chalcopyrite, covellite, galena, gangue etc. The grain size of the sphalerite is about 10 to 200 microns.

Galena, Molybdenite and Native Gold occur as trace minerals in the gravity concentrate but particularly in the cleaner concentrate.

Magnetite is a trace mineral in the gravity concentrate and tails, but it is entirely missing from the cleaner concentrate. Free magnetite is infrequent, but it is very commonly locked with hematite in both gravity products. It seems that the magnetite represented the majority of the original iron oxide minerals in the observed samples. Every other iron oxide is derived from it by oxidation, due to weathering. The grain size of the magnetite is about three to 100 microns.

Hydrous Iron Oxides are fourth and fifth-ranking components in the cleaner and gravity concentrates, respectively. The hydrous iron oxides are represented by goethite, lepidocrocite, limonite, etc., as discrete minerals. These minerals are either free or intricately intergrown with hematite, magnetite and transparent gangue.

A portion of the transparent gangue (mica, layer silicate) is impregnated by hydrous iron oxide solutions, which do not represent discrete minerals. Circulating surface waters often leach iron, manganese, and copper from their major discrete mineral species. When physical-chemical conditions in the environment permit, these solutions precipitate these elements as hydrous oxides, sulfates, carbonates, silicates, etc., in suitable environment, such as the spaces between the layers of micas, serpentine, talc, etc. Thus, impregnation is a purely physical and not chemical process; these elements do not become parts of the lattice structure of the host mineral.

The grain size of the discrete hydrous iron oxides varies between two and 350 microns.

Discussion:

1. The observed ore shows a fairly complex minaralogy, in which transparent gangue and hematite (martite), in this sequence, are the dominant components.

2. It seems that the composition of the transparent gangue is relatively simple. Quartz and feldspar are the major minerals, while the amount of micas and other accessories seems to be negligible. This means that sliming will represent only a minor problem at milling by normal car.

3. Careful observation revealed that most of the iron oxides and hydrous iron oxides present in the samples, are derived from magnetite, and only a very samll portion from pyrite. It appears that there was a considerable quantity of preexistent magnetite in the ore body which oxidized to hematite (martite), which, in turn, has altered further to hydrous iron oxides such as goethite, lepidocrocite, and limonite. No genetic connection between the magnetite (including its oxidation products, also,) and the copper sulfide mineralization could be detected in the observed samples. No replacement or intergrowth relationships were observed. This surprising independence of the major iron oxides and copper minerals cannot be explained without observing unground hand samples, in which the connections between minerals remain intact.

4. The copper mineralization of the observed samples is characterized by the presence of high grade copper minerals - chalcocite (80 % Cu); cuprite (90 % Cu); covellite (70 % Cu), malachite (65 % Cu); native copper; tenorite (70% Cu); and bornite (63 % Cu). Low grade copper minerals (chalcopyrite, 30 % Cu; and chrysocolla 1 to 35 % Cu) are present, but in relatively insignificant quantities.

5. The ore is relatively low grade (.89 wt % Cu calculated head, and the

cleaner concentrate represent only .14 volumetric percent of the samples. Inspite of this, the mineralogical characteristics of the observed samples, as discussed above, clearly explain the achieved metallurgical results. The small amount of slime forming minerals in the transparent gangue, the sharp separation between the iron oxides and the copper sulfides, and the prevalence of the high copper containing minerals in the ore is predestined the attainment of a high grade concentrate (e.g. 50 % Cu in the cleaner concentrate). The proof of this is the 63 plus columetric percent copper mineral content of the cleaner concentrate, revealed by microscopic observation.

6. Inspite of this commendable achievement, there is still room for improvement. Locking of copper minerals with foreign mineral components is fairly abundant in the cleaner concentrate. This naturally can be remedied by finer grind. To eliminate or avoid hidden copper losses due to the chalcocite tarnish of the pyrite, and the possible copper content of the hydrous iron oxide impregnations, is a more difficult task. Recovery of these hidden copper values may require a leaching step in addition to flotation. Fortunately, the pyrite content and the extent of hydrous iron impregnation seems to be minor. Of course, this cannot be stated affirmatively until the final tailing is studied.

7. The persistent occurrence of gold, galena, and molybdenite, in both the gravity and the cleaner concentrates should be mentioned. If these are not just local in occurrence, they could be recovered as valuable by-products.

<u>Conclusion:</u>

1. If the observed samples are representative of the San Juan orebody, the discussed mineralogy, combined with the results of the metallurgical tests, permits a relatively easy and successful treatment of the ore.

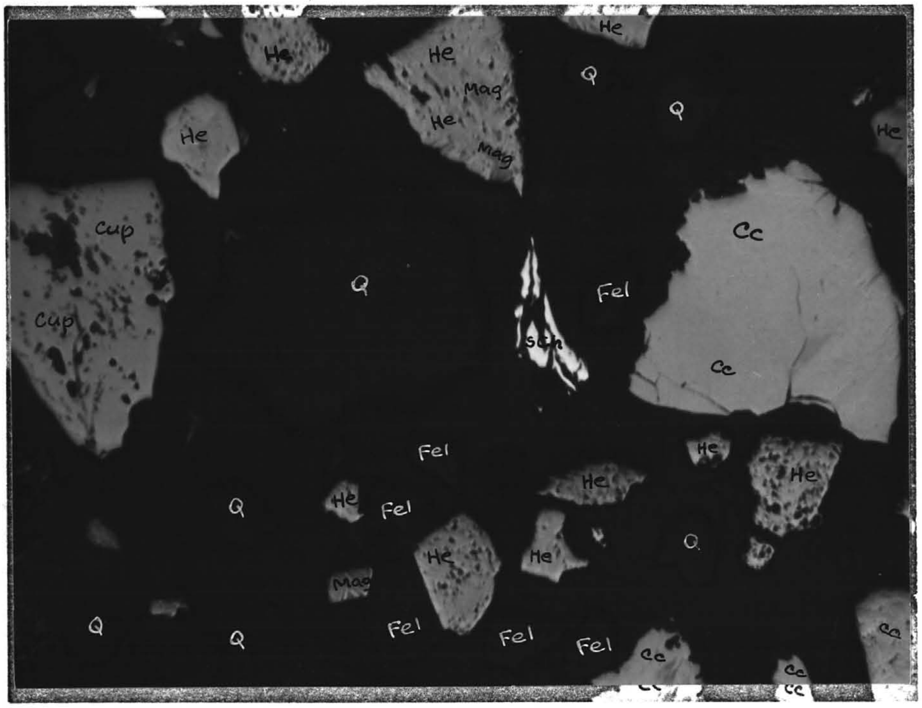
Table of volumetric percent distribution of mineral components and photomicrographs illustrating the discussed problems are appended.

Laszlo Dudas

Table.

Volumetric Percent Distribution of Mineral Components in the Gravity Separation and Flotation Products of Composite Sample from the San Juan Deposit, Safford, Arizona.

Name of Minerals	Gravity Conc.	Gravity Tails	Flotation Conc.
Wt.%	3.	97.	0.14
Chalcocite free	4.	Tr	40.
" locked w. pyrite	Tr		2.
" " " cuprite	Tr		3.
" " " sphalerite			Tr
" " " gangue	Tr		5.
Chalcopyrite free	1.	Tr	2.
" locked w. pyrite			Tr
" " " chalcocite			Tr
" " " gangue			Tr
Bornite free	Tr	Tr	2.
" locked w. pyrite			Tr
" " " gangue			Tr
Covellite free	Tr	Tr	2.
" locked w. gangue			1.
Cuprite free	2.		5.
" locked w. chalcocite			Tr
" " " gangue			1.
Pyrite free	1.	Tr	2.
" tranished w. chalcocite			1.
" locked w. chalcocite			Tr
" " " chalcopyrite			Tr
" " " gangue			Tr
Sphalerite free	Tr		Tr
" locked w. chalcopyrite	Tr		Tr
" " " gangue			Tr
Galena			Tr
Native Copper			Tr
Malachite	1.		
Tenorite	Tr		Tr
Molybdenite	Tr		Tr
Gold	Tr		Tr
Hydrous Iron Oxides	3.	2.	5.
Hematite	35.	Tr	
Magnetite free	Tr	Tr	
" locked w. hematite	5.	2.	
Transparent gangue	42.	82.	25.
" locked w. chalcocite			4.
" " " pyrite			Tr
" " " cuprite			Tr
" " " magnetite & hem.	6.	14.	Tr
Steel Chips	Tr		Tr
Total	100.	100.	100.



Reflected Light
Parallel Nicols

Magn.: 200x

Scale

Mesh	Microns
400	38
200	74
100	147
48	295

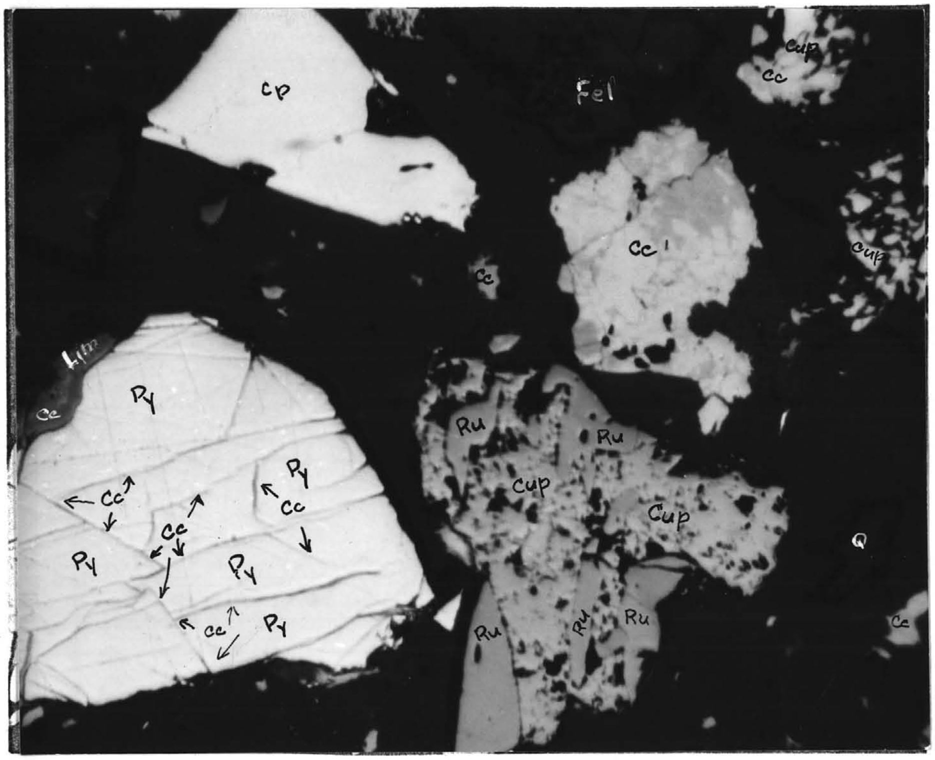
Figure 1.
Gravity Concentrate

General distribution of mineral components in the gravity concentrate. Note the preponderance of transparent gangue and hematite (martite). The two major copper minerals, chalcocite and cuprite are also showing.

Figure 2.
Gravity Concentrate

Occasionally sphalerite also occurs in the gravity concentrate. Here it is intergrown with a more common constituent, chalcopyrite. Malachite, which is a fairly frequent minor to trace component, is also showing along with hydrous iron oxide-(limonite) particles.

Code: Cc= chalcocite; Cp= chalcopyrite; Cup= cuprite; Fel= feldspar; He=hematite; Li= limonite;(hydrous iron oxide); Mag= magnetite; Mal= malachite; Mic= mica; Q= quartz; SCh= steel chips.



Reflected Light
Parallel Nicols

Magn.: 200x

Scale

Mesh	Microns
400	38
200	74
100	147
48	295

Figures 3 and 4.

Cleaner Concentrate.

These photomicrographs show the general distribution of mineral components in the final flotation concentrate. The dominance of copper sulfides and oxide and the absence of hematite is evident. Moderate amounts of transparent gangue is present. Note the fractures of the pyrite, which are filled by copper sulfides, bornite and chalcocite. The pyrite grains also show coatings and tarnish of chalcocit

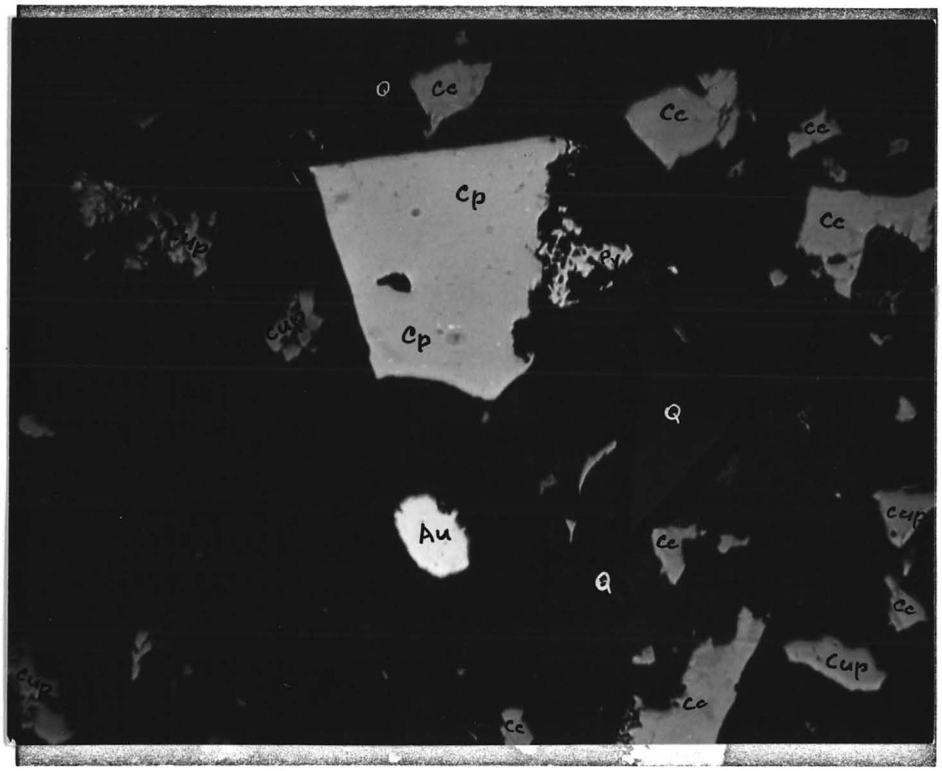
Code: Br= bornite; Cc= chalcocite; Cp= chalcopyrite; Cup= cuprite; Fel= feldspar; Mic= mica; Q= quartz; Ru= rutile.

Reflected Light
Parallel Nicols

Magn.: 200x

Scale

Mesh	Microns
400	38
200	74
100	147
48	295

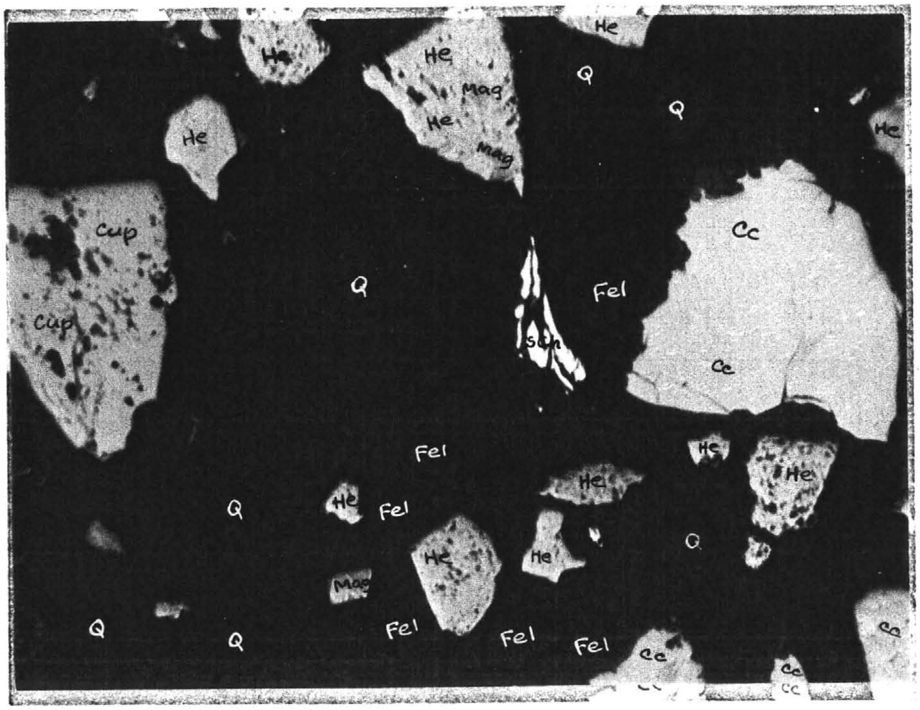


Figures 5 and 6.

Gravity and Cleaner Concentrates.

Gold occurs in both concentrates as a fairly frequent component. If these free grains are truly present in the ore their recovery could mean a very valuable by-product.

Code: Au= gold; Cc= chalcocite; Cp= chalcopyrite; Cup= cuprite; Fel= feldspar; Go= goethite; He= hematite; Q= quartz.



Reflected Light
Parallel Nicols

Magn.: 200x

Scale

Mesh	Microns
400	38
200	74
100	147
48	295

Figure 1.
Gravity Concentrate

General distribution of mineral components in the gravity concentrate. Note the preponderance of transparent gangue and hematite (martite). The two major copper minerals, chalcocite and cuprite are also showing.

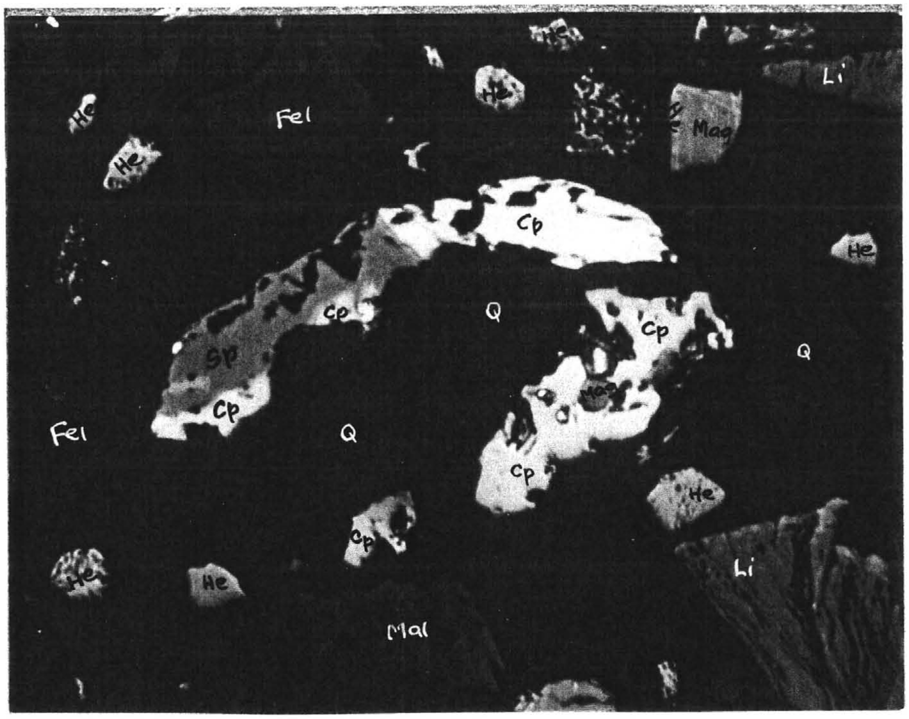
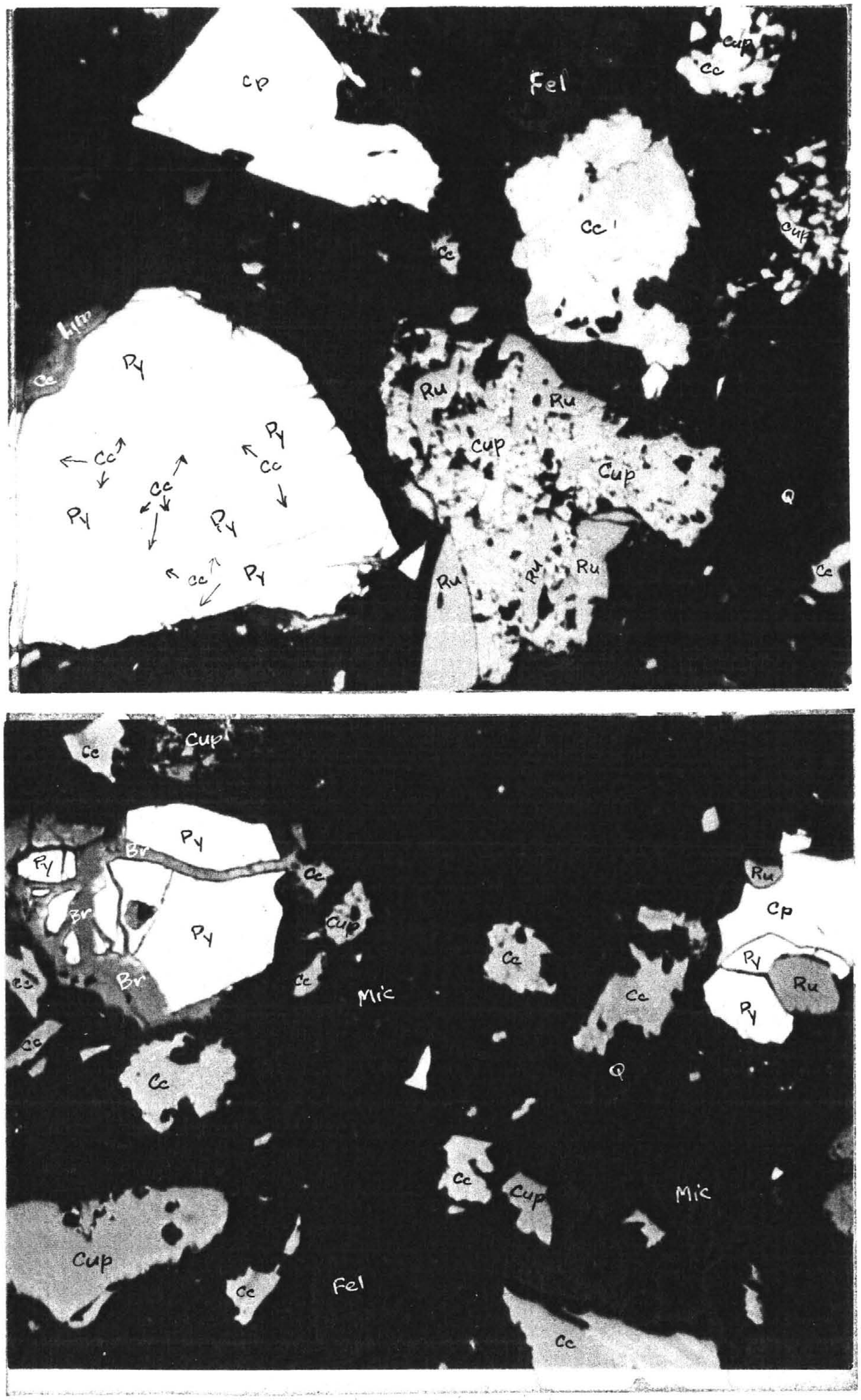


Figure 2.
Gravity Concentrate

Occasionally sphalerite also occurs in the gravity concentrate. Here it is intergrown with a more common constituent, chalcopyrite. Malachite, which is a fairly frequent minor to trace component, is also showing along with hydrous iron oxide-(limonite) particles.

Code: Cc= chalcocite; Cp= chalcopyrite; Cup= cuprite; Fel= feldspar; He=hematite; Li= limonite;(hydrous iron oxide); Mag= magnetite; Mal= malachite; Mic= mica; Q= quartz; SCh= steel chips.



Reflected Light
Parallel Nicols

Magn.: 200x

Scale

Mesh	Microns
400	38
200	74
100	147
48	295

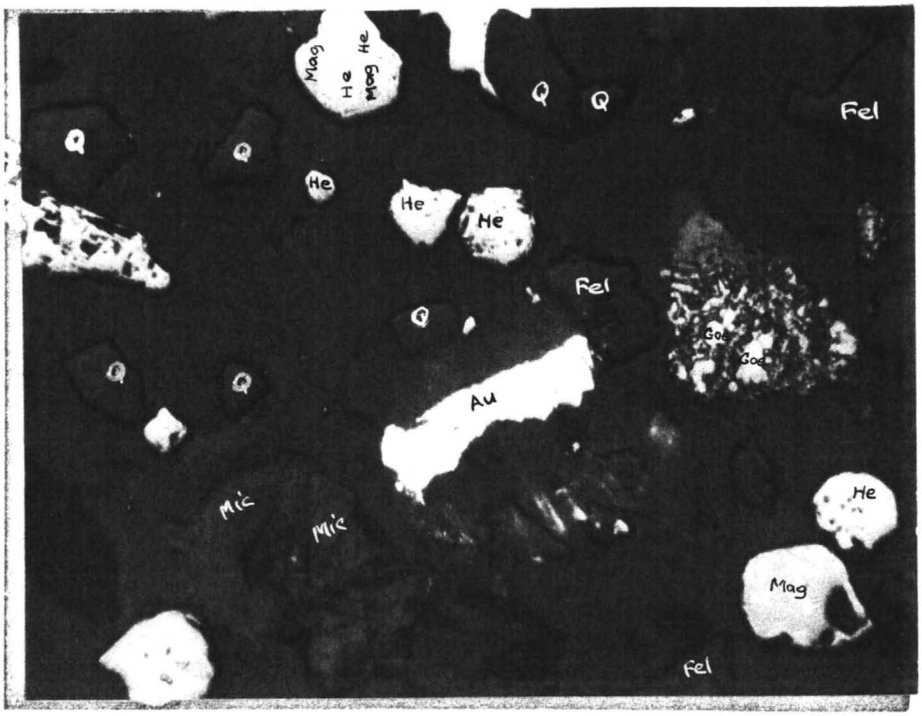
Figures 3 and 4.

Cleaner Concentrate.

These photomicrographs show the general distribution of mineral components in the final flotation concentrate. The dominance of copper sulfides and oxide and the absence of hematite is evident. Moderate amounts of transparent gangue is present. Note the fractures of the pyrite, which are filled by copper sulfides, bornite and chalcocite. The pyrite grains also show coatings and tarnish of chalcoci

Code: Br= bornite; Cc= chalcocite; Cp= chalcopyrite; Cup= cuprite; Fel= feldspar; Mic= mica; Q= quartz; Ru= rutile.

San Juan Deposit, Arizona

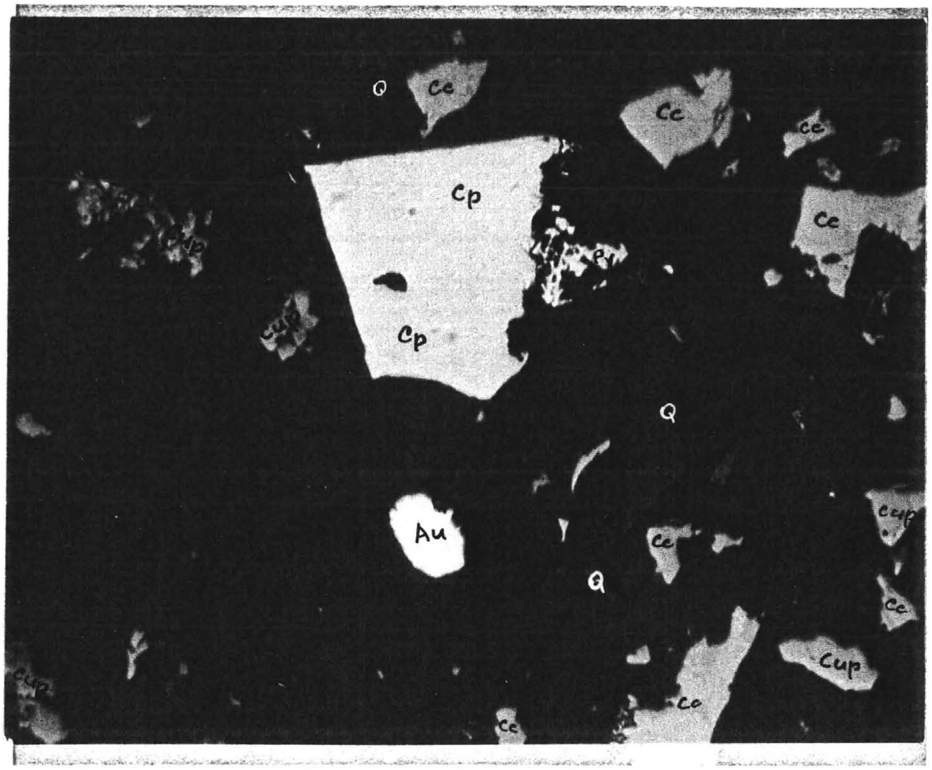


Reflected Light
Parallel Nicols

Magn.: 200x

Scale

Mesh	Microns
400	38
200	74
100	147
48	295



Figures 5 and 6.
Gravity and Cleaner Concentrates.

Gold occurs in both concentrates as a fairly frequent component. If these free grains are truly present in the ore their recovery could mean a very valuable by-product.

Code: Au= gold; Cc= chalcocite; Cp= chalcopyrite; Cup= cuprite; Fel= feldspar; Go= goethite; He= hematite; Q= quartz.