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G. WARNOCK
MINING & GEOLOGICAL CONSULTANT

October 4, 1971

Mr. Paul I. Eimon
Manager of Exploration
Essex International, Inc.
1704 West Grant Road
Tucson, Arizona 85705

Dear Paul:

Enclosed are the long awaited reports on the geographical mapping done for you at Safford.

My apologies for the delay, but it seems that the business picked up noticeably just after my return from Safford, and I was delayed getting started on the reports.

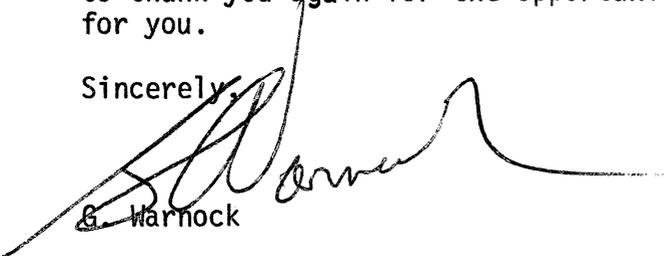
There are an original and three copies of each, and they are as follows:

1. Big Ben Group
2. Bardwell Group
3. Big Ben Group & Lead Hill Claims
4. Key & Keystone Group
5. Soto State Lease
6. Boehiema 21 Claim

Additionally, I am returning the Robinson alteration map as Ken Cook specifically requested the return of it. I am also enclosing the excess 1,000 foot scale air photos. I have kept #6-4 through 6-9 for my reference in case you have any questions concerning the geology. These, of course, can be returned to you later if you so desire.

I am also enclosing my statement for the contracted price and wish to thank you again for the opportunity of doing this assignment for you.

Sincerely,



G. Warnock

GW/11m

Encls.

P. I. E. Copy

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File No. 103-001-011

Report No. 71-5

Contract No.

Date October 1, 1971

KEY & KEYSTONE GROUP

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Key & Keystone group of claims are occupied by a Cretaceous andesite which has been separated into an upper agglomeritic unit and a lower unit. The lower unit is the host to known copper mineralizations in this district.

The lower unit crops out through the southwest portion of the claims but is relatively unaltered and thus does not indicate porphyry copper type mineralization near surface in this area.

The overlying upper agglomeritic unit varies in thickness from 0 to 400 feet within the claim boundaries and obtains a thickness of 1,000 feet some 2,000 feet east of the claim block. It also is generally unaltered with the exception of a pervasive epidotization which is thought to be deuteritic and one zone of intrusive volcanic pipes some 2,000 feet east of the property line that shows an intensely altered and somewhat mineralized area approximately 800 to 900 feet in diameter.

These pipe-like volcanic intrusives occur at the intersection of two different northeast trending structural zones which contain the Roper adit and Ben Hur mine mineralization. The area is considered favorable for a small porphyry copper type target to exist in depth in the lower andesite some 1,000 to 2,000 feet below outcrop.

It is recommended that detailed mapping of the area, particularly the east slope of the north-south ridge in this area--down to the Ben Hur mine, be continued. If alteration and mineralization continue as far as the Ben Hur property, the prospect would be judged worthy of follow up work, resulting ultimately in drilling of 2,000 foot holes if justified by the step by step work.

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The Ben Hur claims should be optioned with free time prior to the mapping as Kennecott and others appear to be watching Essex's actions closely. However, if free time cannot be had, I would map the Ben Hur area in detail prior to putting out front money.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, 1.5 days were spent geologically mapping the Key & Keystone claim group from August 24 to 25, 1971. Additionally, three days were spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately eleven miles northeast of Safford, Arizona. This is in Graham County in Township 5 south, Range 26 east, sections 35 and 36. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International,



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KEY & KEYSTONE GROUP

Inc. and these also were not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are ten claims comprising the group. These are the

1. Key No. 1
2. Key No. 2
3. Key No. 3
4. Key No. 4
5. Key No. 5
6. Key No. 6
7. Key No. 7
8. Key No. 8
9. Keystone No. 1
10. Keystone No. 2

all of which are contiguous.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located one mile southwest of the Key & Keystone claim group has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton orebodies. The Kennecott Deposit is two miles southeast of the claim group and the Phelps Dodge orebody is two miles west of the claim block.

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PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains well above the pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography with major elevation differences in this local area.

The elevation on the claim group varies from 4,260 to 4,750 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniordiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes along with mineralization and alteration. Strong shear zones conform to this direction as do a number of

B

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offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the



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rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Key & Keystone group is located on and near the contact of an upper agglomeritic andesite and a lower non-agglomeritic andesite.

The upper unit is distinguished by its agglomeritic fabric. It crops out in the main portion of the claim group area. The upper unconformable contact is approximately 2,000 feet east of the claim group. It is approximately 1,000 feet thick in the claim area. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz monzonite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric

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developed by alteration near intrusives is strictly a question of field relationship.

An older, apparently premineral, set of andesitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz monzonite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).

Quartz monzonite intrudes both andesite units as dikes and one small plug like occurrence approximately 2,000 feet east of the claim group.

This quartz monzonite contains decidedly less mafic minerals and tends to be coarser grained than the Lone Star quartz diorite stock some 5,000 feet south of the claims. The mineralized quartz monzonite dike cutting the east property line is even pegmatitic in places.

The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and a white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter also occurs.

The Tertiary acid dikes in two occasions form small pipes several hundred feet in diameter. These are both located some 2,000 feet east of the property and appear to be at the intersection of a N70-75°E and N45°E set of shears and subsequent dikes.



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Intense alteration of these pipes and the dikes around them make megascopic identification of the rock type tenuous, but they are probably white quartz latite.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties.

Structurally, the claim area is on the strike of the northeast trending San Juan shear zone in which the San Juan orebody is located some 5,000 feet southwest of the property.

This shear zone has two predominant trends, N70-75°E and N45°E. Dikes occupying both directions can be seen to intersect in some instances. Strong shearing in the upper agglomeritic andesite seems to favor the N70-75°E direction and may be so intense that individual shears will occur within inches of each other.

ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It crops out only in the southwest portion of the claim block but no doubt underlies the whole area below the upper andesite.

In this area the lower andesite is thoroughly altered only where intruded by quartz monzonite and volcanic dikes. A few shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible.

Away from dikes or mineralization such as along the western border of the property, the andesite is only mildly altered. It contains the pervasive epidote



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development, although not to the degree of the upper andesite. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

Some very minor fine grain distinctly black biotite is apparent in the lower andesite near mineralized dikes. However, not even these areas approach the degree of biotization described by Kennecott (10 to 50% of the rock). This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the lower andesite where cropping out is relatively unaltered as compared with the reported alteration at the Kennecott and San Juan orebodies.

The quartz monzonite is only mildly altered by kaolinization, orthoclazation, and chloritization. The later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the country rock 20-30 feet on either side of the dike. At the previously mentioned two quartz latite pipes some 2,000 feet east of the property, sericitization and silicification of the quartz latite has all but obscured the rock. This alteration and mineralization has formed a zone some 800 to 900 feet wide of quite intense alteration and mineralized shears. However, the upper agglomeritic andesite host in this area is strongly chlorized and propylized with no evident development of secondary biotite.

With the exception of the above mentioned occurrence, the upper agglomeritic andesite is only mildly altered by chloritization and propylization. It does, however, display a pervasive content of epidote, relatively much more than any other rock type in the area, including the lower andesite. The epidote is found

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both on fractures and disseminated through the rock as both fine and coarse grained blebs. The preponderance of epidote in the upper agglomeritic andesite with apparently little control by later alteration or mineralization leads me to believe that it is probably deuteric. If so, it has been remobilized and redeposited on later fractures.

It is interesting to note that while the acid Tertiary dikes altered the upper andesite extensively, the quartz monzonite plug approximately 1,000 feet south of the volcanic plugs has only slightly altered the andesite within a few feet of the contact and is itself only mildly kaolinized and chloritized.

Two zones of mineralization are known east of the claim block, these are the Roper adit where a tunnel has been driven on a mineralized quartz latite dike and the Ben Hur property to the east which was not mapped.

EXPLORATION & DEVELOPMENT RECOMMENDED

The only serious alteration and mineralization in this area is at the two volcanic pipes some 2,000 feet east of the property line.

Away from this area, alteration is so mild or non-existent in the upper agglomeritic andesite as to indicate that the favorable lower andesite horizon, from 0 to 1,000 feet below outcrop, is also likely to be only mildly altered. At the eastern claim boundary, the upper andesite is only approximately 400 feet thick--this certainly is too thin a section to hide pervasive alteration at the top of the underlying lower andesite unit.

Of course, a yet deeper alteration and mineralization could exist under the claim area but based on the known orebody geology, it would have to be 4,000 to 6,000 feet deep not to show serious alteration at the surface.



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The area of the two volcanic pipes east of the claim block is considered worthy of further detailed work. This small intensely altered area of volcanic pipes and shear type mineralization occurs at the intersection of two northeast trending structural zones which contain known copper mineralization at the Roper adit (700 feet east of the eastern property line) and at the Ben Hur property some 2,500 feet east of the property line.

The volcanic pipes are clearly the center of a small mineralized altered area, and in fact, are on strike along the northeast trending San Juan shear zone. It is possible that this mineralized zone may be more extensive in the lower andesite which would be at least 1,000 feet deep at this locality.

Negative features are restricted size of the alteration zone, and its being restricted closely to the actual volcanic pipes and dikes.

It is recommended that the Ben Hur group be acquired on a free time option basis to give a contiguous block of claims with the Key and Keystone and Soto State lease. This should be followed by additional detailed mapping, particularly on the east slope of the ridge held up by the pipes toward the Ben Hur property, an area that was not covered in this project. If the mineralization and alteration can be shown to extend as far as the Ben Hur property, the area would be a serious target for a small porphyry type deposit at a depth of 1,000 to 2,000 feet, perhaps similar to the San Juan.

If the Ben Hur group cannot be obtained with free time, I would recommend the detailed mapping in any case--this to form a base for the decision to lay out front money for the group.



EXPLANATION

Quaternary	Qal, alluvium	Tertiary	Tbb	Ti, Td	Tb
	(Tqd. fl.) predominantly Tertiary quartz diorite float.		Tqm, Tqd		
	(Ka. fl.) predominantly lower Cretaceous andesite float.				
	(Kaa. fl.) predominantly upper Cretaceous andesite float.				
Cretaceous			Kaa	Ka, Kpa	

Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics.

Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.

Td, andesite and dacite.

Tqm, quartz monzonite.

Tqd, quartz diorite.

Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.

Kaa, upper andesite predominantly agglomerate.

Ka, lower andesite.

Kpa, lower porphyritic.

Contact, dashed where indefinite or inferred

Fault, dashed where indefinite or inferred

T10
Strike & dip of beds

Strike & dip of flow layers

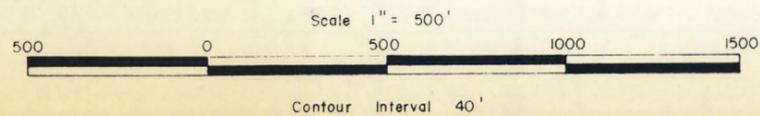
Strike & dip of joint & shear zones

Cu
Veins mineralized with limonite after sulfides (predominantly pyrite) and hematite. Cu denotes some minor chrysocolla

Outcrop boundary

Topographical base, USGS advance sheet, Safford NW, Graham County, Arizona, 1:24,000

Claim group boundary



G. WARNOCK
 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
KEY & KEYSTONE GROUP CLAIM
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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File No. 103-001-011

Report No. 71-6

Contract No.

Date October 1, 1971

SOTO STATE LEASE

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Soto State lease is occupied by a Cretaceous andesite which has been separated into an upper agglomeritic unit and a lower unit. The lower unit is the host to known copper mineralizations in this district.

The lower unit crops out only on the southwest corner of the lease and is relatively unaltered; thus, it does not indicate prophyry copper type mineralization near surface in this area.

The overlying upper agglomeritic unit varies in thickness from 0 to 250 feet within the lease boundaries and obtains a thickness of 1,000 feet some 1,200 feet east of the lease. It also is unaltered with the exception of a pervasive epidotization which is thought to be deuteric; and one zone of intrusive volcanic pipes some 1,200 feet northeast of the northeast corner that shows an intensely altered and somewhat mineralized area approximately 800 to 900 feet in diameter.

These pipe-like volcanic intrusives occur at the intersection of two different northeast trending structural zones which contain the Roper adit and Ben Hur mine mineralization. The area is considered favorable for a small porphyry copper type target to exist in depth in the lower andesite some 1,000 to 2,000 feet below outcrop.

It is recommended that detailed mapping of the area, particularly the east slope of the north-south ridge in this area--down to the Ben Hur mine be continued. If alteration and mineralization continue as far as the Ben Hur property, the prospect would be judged worthy of follow up work, resulting ultimately in drilling of 2,000 foot holes if justified by the step by step work.

B

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The Ben Hur claims should be optioned with free time prior to the mapping as Kennecott and others appear to be watching Essex's actions closely. However, if free time cannot be had, I would map the Ben Hur area in detail prior to putting out front money.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, one half day was spent geologically mapping the Soto State lease on August 25, 1971. Additionally, one day was spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The lease is located in the Lone Star Mining District approximately eleven miles northeast of Safford, Arizona. This is in Graham County in Township 5 south, Range 26 east, section 36. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the lease proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the lease was made. The location and configuration of the lease was supplied by Essex International,

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Inc. and this also was not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located one mile southwest of the Soto State lease has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton orebodies. The Kennecott Deposit is two miles southeast of the lease and the Phelps Dodge orebody is two miles west of the lease.

PHYSICAL FEATURES

The lease area is on the southwest flank of the northwest trending Gila Mountains well above the pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography with major elevation differences in this local area.

The elevation on the lease varies from 4,550 to 4,800 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous



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andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniordiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend, is predominant in the area. It controls most intrusives, both stock like and dikes along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are

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reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast- southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Soto State lease is located on the contact of an upper agglomeritic andesite and a lower non-agglomeritic andesite.

The upper unit is distinguished by its agglomeritic fabric. It crops out in the main portion of the lease area. The upper unconformable contact is approximately 1,200 feet east of the lease. It is approximately 1,000 feet thick. Kenecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground



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mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz monzonite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric developed by alteration near intrusives is strictly a question of field relationship.

An older, apparently premineral, set of andesitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz monzonite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).

Quartz monzonite intrudes both andesite units as dikes and one small plug like occurrence approximately 1,000 feet east of the lease.

This quartz monzonite contains decidedly less mafic minerals and tends to be coarser grained than the Lone Star quartz diorite stock some 5,000 feet south of the lease. The mineralized quartz monzonite dike at the northwest corner of the property is even pegmatitic.



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The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter also occurs.

The Tertiary acid dikes in two occasions form small pipes several hundred feet in diameter. These are both located some 1,200 feet northeast of the property and appear to be at the intersection of a N70-75°E and N45°E set of shears and subsequent dikes.

Intense alteration of these pipes and the dikes around them make megascopic identification of the rock type tenuous but they are probably white quartz latite.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties.

Structurally, the lease area is on the strike of the northeast trending San Juan shear zone in which the San Juan orebody is located some 5,000 feet southwest of the property.

This shear zone has two predominant trends, N70-75°E and N45°E. Dikes occupying both directions can be seen to intersect in some instances. Strong shearing in the upper agglomeritic andesite seems to favor the N70-75°E direction and is so intense that individual shears will occur within inches of each other.



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ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It crops out only in the southwest corner of the lease but no doubt underlies the whole area below the upper andesite.

In this area the lower andesite is thoroughly altered only where intruded by quartz monzonite and volcanic dikes. A few shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible.

Away from dikes or mineralization such as at the southwest corner of the property, the andesite is only mildly altered. It contains the pervasive epidote development, although not to the degree of the upper andesite. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

Some very minor fine grain distinctly black biotite is apparent in the lower andesite near mineralized dikes. However, not even these areas approach the degree of biotization described by Kennecott (10 to 50% of the rock). This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the lower andesite where cropping out is relatively unaltered as compared with the reported alteration at the Kennecott and San Juan orebodies.

The quartz monzonite is only mildly altered by kaolinization, orthoclazation and chloritization. The later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and

B

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sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the country rock 20-30 feet on either side of the dike. At the previously mentioned two quartz latite pipes some 1,200 feet east of the property; sericitization and silicification of the quartz latite has all but obscured the rock. This alteration and mineralization has formed a zone some 800 to 900 feet wide of quite intense alteration and mineralized shears. However, the upper agglomeritic andesite host in this area is strongly chlorized and propylized with no evident development of secondary biotite.

With the exception of the above mentioned occurrence, the upper agglomeritic andesite is only mildly altered by chloritization and propylization. It does, however, display a pervasive content of epidote, relatively much more than any other rock type in the area, including the lower andesite. The epidote is found both on fractures and disseminated through the rock as both fine and coarse grained blebs. The preponderance of epidote in the upper agglomeritic andesite with apparently little control by later alteration or mineralization leads me to believe that it is probably deuteric. If so, it has been remobilized and redeposited on later fractures.

It is interesting to note that while the acid Tertiary dikes altered the upper andesite extensively, the quartz monzonite plug approximately 1,000 feet south of the volcanic plugs has only slightly altered the andesite within a few feet of the contact and is itself only mildly kaolinized and chloritized.

Two zones of mineralization are known east of the lease, these are the Roper adit where a tunnel has been driven on a mineralized quartz latite dike just at the east boundary line and the Ben Hur property to the northeast which was not mapped.

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EXPLORATION & DEVELOPMENT RECOMMENDED

The only serious alteration and mineralization in this area is at the two volcanic pipes some 1,200 feet east of the property.

Away from this area, alteration is so mild or non-existent in the upper agglomeritic andesite as to indicate that the favorable lower andesite horizon, from 0 to 1,000 feet below outcrop, is also likely to be only mildly altered. At the eastern lease boundary, the upper andesite is only approximately 250 feet thick--this certainly is too thin a section to hide pervasive alteration at the top of the underlying lower andesite unit.

Of course, a yet deeper alteration and mineralization could exist under the lease area but based on the known orebody geology, it would have to be 4,000 to 6,000 feet deep not to show serious alteration at the surface.

The area of the two volcanic pipes northeast of the lease is considered worthy of further detailed work. This small intensely altered area of volcanic pipes and shear type mineralization occurs at the intersection of two northeast trending structural zones which contain known copper mineralization at the Roper adit (along the eastern property line) and at the Ben Hur property some 2,000 feet northeast of the property.

The volcanic pipes are clearly the center of a small mineralized altered area, and in fact, are on strike along the northeast trending San Juan shear zone. It is possible that this mineralized zone may be more extensive in the lower andesite which would be at least 1,000 feet deep at this locality.

Negative features are restricted size of the alteration zone, and its being restricted closely to the actual volcanic pipes and dikes.

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It is recommended that the Ben Hur group be acquired on a free time option basis to give a contiguous block of claims with the Soto State lease and the Key and Keystone claims. This should be followed by additional detailed mapping, particularly on the east slope of the ridge held up by the pipes toward the Ben Hur property, an area which was not covered in this project. If the mineralization and alteration can be shown to extend as far as the Ben Hur property, the area would be a serious target for a small porphyry type deposit at a depth of 1,000 to 2,000feet, perhaps similar to the San Juan.

If the Ben Hur group cannot be obtained with free time, I would recommend the detailed mapping in any case--this to form a base for the decision to lay out front money for the Ben Hur group.



EXPLANATION

Quaternary

Qal (Tqd. fl.) (Ka. fl.) (Kaa. fl.)

Qal, alluvium

(Tqd. fl.) predominantly Tertiary quartz diorite float.

(Ka. fl.) predominantly lower Cretaceous andesite float.

(Kaa. fl.) predominantly upper Cretaceous andesite float.

Tertiary

Tbb

Ti Td

Tb

Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics.

Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.

Td, andesite and dacite.

Tqm Tqd

Kad

Tqm, quartz monzonite.

Tqd, quartz diorite.

Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.

Cretaceous

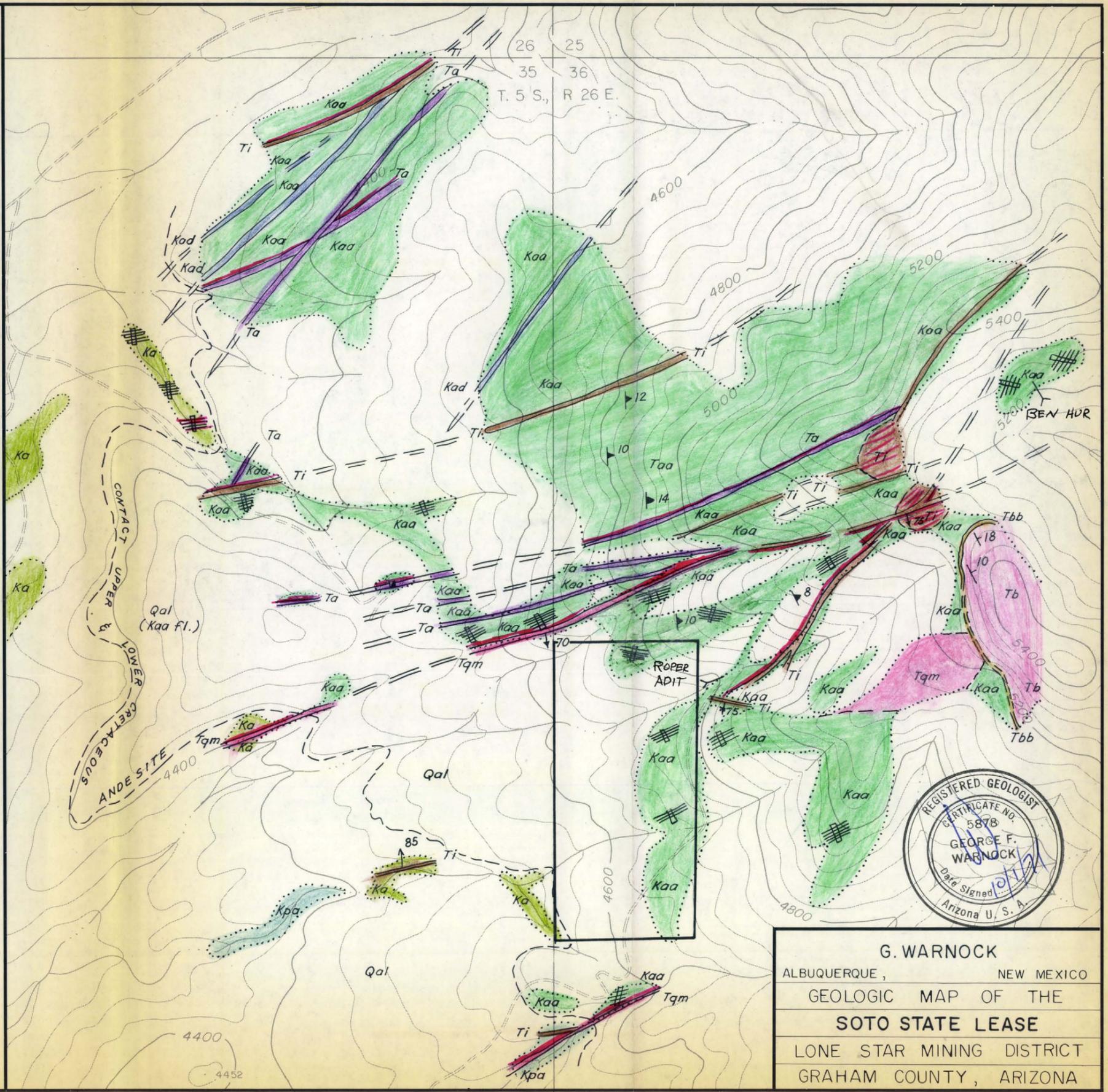
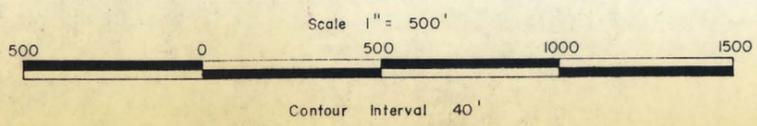
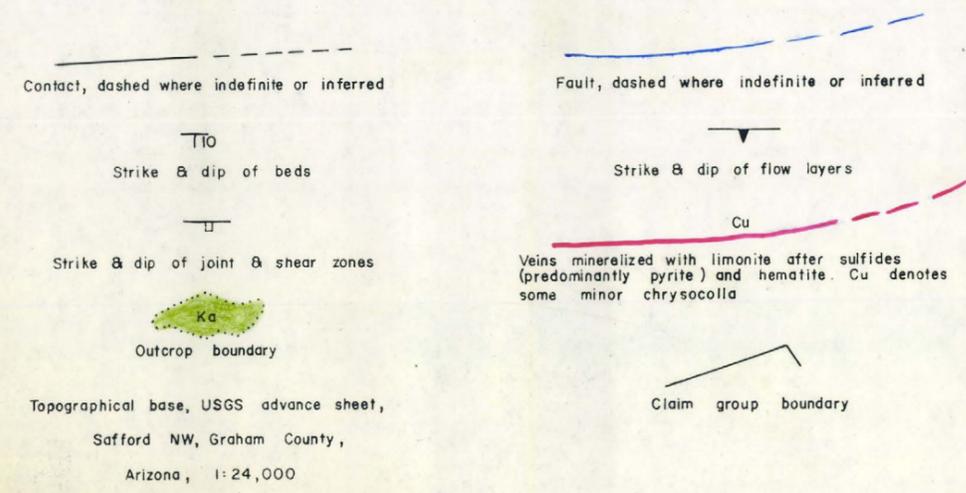
Kaa

Ka Kpa

Kaa, upper andesite predominantly agglomerate.

Ka, lower andesite.

Kpa, lower porphyritic.



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 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
SOTO STATE LEASE
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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File No. 103-001-011
Report No. 71-7
Contract No.
Date October 1, 1971

BOEHIEMA 21 CLAIM

SUMMARY, CONCLUSIONS, & RECOMMENDATIONS

The Boehiema 21 claim does not display outcrop anywhere on or near the claim. However, it is only 2,000 feet north of the structurally interpreted projection of the Phelps Dodge orebody and related northeast trending shear zone west of the Butte fault. It also is only 6,000 to 7,000 feet north of the same projection of The San Juan shear zone.

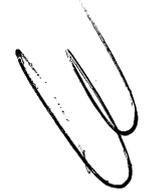
The Phelps Dodge zone is projected into the south 1/2 of section 4 and the north 1/2 of section 3, T5S, R26E and the San Juan zone is projected into the south 1/2 of section 9, the north 1/2 of section 10, and the southwest 1/4 of section 2, T5S, R26E. Please refer to R. Robinson 1" = 2,000' map accompanying his report of March, 1971. Both of these zones are valid covered targets for a major porphyry copper deposit similar to the Phelps Dodge or Kennecott orebodies in this district.

A standard, covered area porphyry copper exploration program for a deep target is recommended for these two areas.

Boehiema 21's proximity to these areas indicates that it should be held as long as interest continues in the area.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, three hours were spent investigating the Boehiema 21 claim on August 29, 1971. Additionally, one day was spent in office compilation and drafting of the map and report.



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Emphasis was to be on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. However, no outcrop was found on or near the claim, and the investigation was restricted to theoretical consideration of the claim's location relative to known district geology.

LOCATION & ACCESSIBILITY

The claim is located in the Lone Star Mining District approximately seven miles north of Safford, Arizona. This is in Graham County in Township 6 south, Range 26 east, sections 4 and 5. Access is via Safford to the Phelps Dodge road to jeep trails onto the claim proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claim was made. The location and configuration of the claim was supplied by Essex International, Inc. and these also were not checked.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located 2.5 miles due east of the Boehiema 21 claim has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton copper orebodies.

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The Kennecott Deposit is 5.5 miles due east of the claim and the Phelps Dodge orebody is 1.5 miles northeast of the claim.

PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is on the upper pediment of this range at an elevation of 3,650 feet. Climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniodiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to

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the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strongly altered andesite is reportedly principally biotitized. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous



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andesite and may in fact be principally deuteritic, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

No outcrops are on or near the Boehiema 21 claim. However, it is known to be southwest of or in the hanging wall of the Butte fault. Approximately a mile to the east, near where Essex is drilling, unaltered Cretaceous upper agglomeritic andesite crops out close to post mineral Tertiary basalt. This, plus mapping in the hanging wall of the fault to the east of the claim by Ray Robinson, indicates that the hanging wall of the Butte fault in this area is upper agglomeritic andesite directly overlain by Tertiary basalt with the basal basalt unit known further to the east.

Mapping to the south along the Butte fault has shown the possibility that in addition to the 2,000 foot vertical component of displacement, there is probably at least a 1,000 foot left hand horizontal offset that could be considerably larger. As the Butte fault is reported to cut the Phelps Dodge orebody and the San Juan biotite alteration zone, these units should be offset relatively down and to the southeast (see R. Robinson's 1" = 2,000' alteration map).

With agglomeritic andesite cropping out southwest of the fault and thickness of this unit being 1,000 feet, three miles to the northeast the favorable lower andesite should be within 2,000 feet of the surface throughout this area.

A number of drill holes have been drilled in the area of the Boehiema 21 claim. As the ground was subsequently abandoned, it must be assumed that they did not show signs of mineralization or strong alteration. Subsequently, the Essex hole

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has been drilled approximately one mile east of Boehiema 21 which results are not known.

The abandoned drill holes plus fresh upper agglomeritic andesite would indicate that no pervasive alteration is present in sections 32 & 33, T5S, R26E or in sections 3, 4 & 5, T6S, R26E; the latter including Boehiema 21. If the offset portion of the Phelps Dodge orebody is in the southwest 1/4 of section 34, T5S, R26E and only 2,000 feet below surface strong alteration should be evident in drill holes anywhere in the east half of section 33, SW 1/2 34, NE 1/4 3, and NW 1/2 of 2. In fact, Robinson does map biotization in section 2 in three different drill holes. This is probably the offset portion of the Phelps Dodge, San Juan biotized zone. Its occurrence southeast of its relative position on the east side of the fault tends to support the left hand horizontal offset along the Butte fault.

The covered area in Cottonwood wash should contain the offset portion of the northeast-southwest structural zone containing the offset portion of the Phelps Dodge orebody. This would project the zone some 2,000 feet south of Boehiema 21 in section 4.

The San Juan shear zone, west of the Butte fault, should strike southwestwardly through the flat top mesa capped by Tertiary basalt in the northern portion of section 10. The presence of the intrusive quartz diorite mapped in section 10 would seem to support this area as the San Juan shear zone on the west side of the fault.

EXPLORATION & DEVELOPMENT RECOMMENDED

This whole area, from Boehiema 21 southeastward to the San Juan road in section 11, should be carefully scanned for all possible outcrop and these mapped



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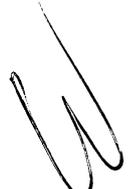
carefully for alteration as a guide to the best location for deep probing in this general area.

The Boehiema 21 claim is on the northwest fringe of a very interesting covered area. This general area west of the Butte fault certainly deserves a serious exploration effort. Recent cover does not appear to be deep as some outcrop is present. However, the favorable lower andesite horizon will be from 1,000 to 2,000 feet below surface so that all geophysics will have to be interpreted carefully.

Based on the sketchy structural interpretation of the Butte fault, two zones west of the fault would appear to be best. These are 1) the south 1/2 of section 4 and the north 1/2 of section 3 along Cottonwood wash; and 2) the south 1/2 of section 9, the north 1/2 of section 10 and the southwest 1/4 of section 2.

The first area is apparently one of no outcrop but it should be searched carefully for outcrop. Subsequent ground magnetics should be run to attempt to define zones of intrusive rocks. This followed by IP, spread for the greatest possible depth penetration, and subsequent deep drilling if a target is delineated. I feel that neither S.P. or Geochem is likely to be definitive in this area due to the expected depth of the target and possible contamination from both the Phelps Dodge and San Juan orebodies.

The second area has known[^] outcrops of Tertiary quartz diorite and upper agglomeritic andesite. It also has at least some biotization, a highly favorable indication. This zone west of fault also should be explored with the same basic procedure as for the first area. Concurrent rotary drill probing in shallow holes in the upper agglomeritic andesite could aid material[^] by revealing alteration patterns in this unit.



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The Boehiema 21 is only approximately 2,000 feet north of the interesting area and it definitely should be held as long as an interest in this general area continues.



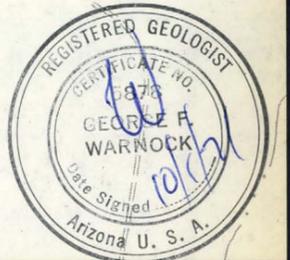
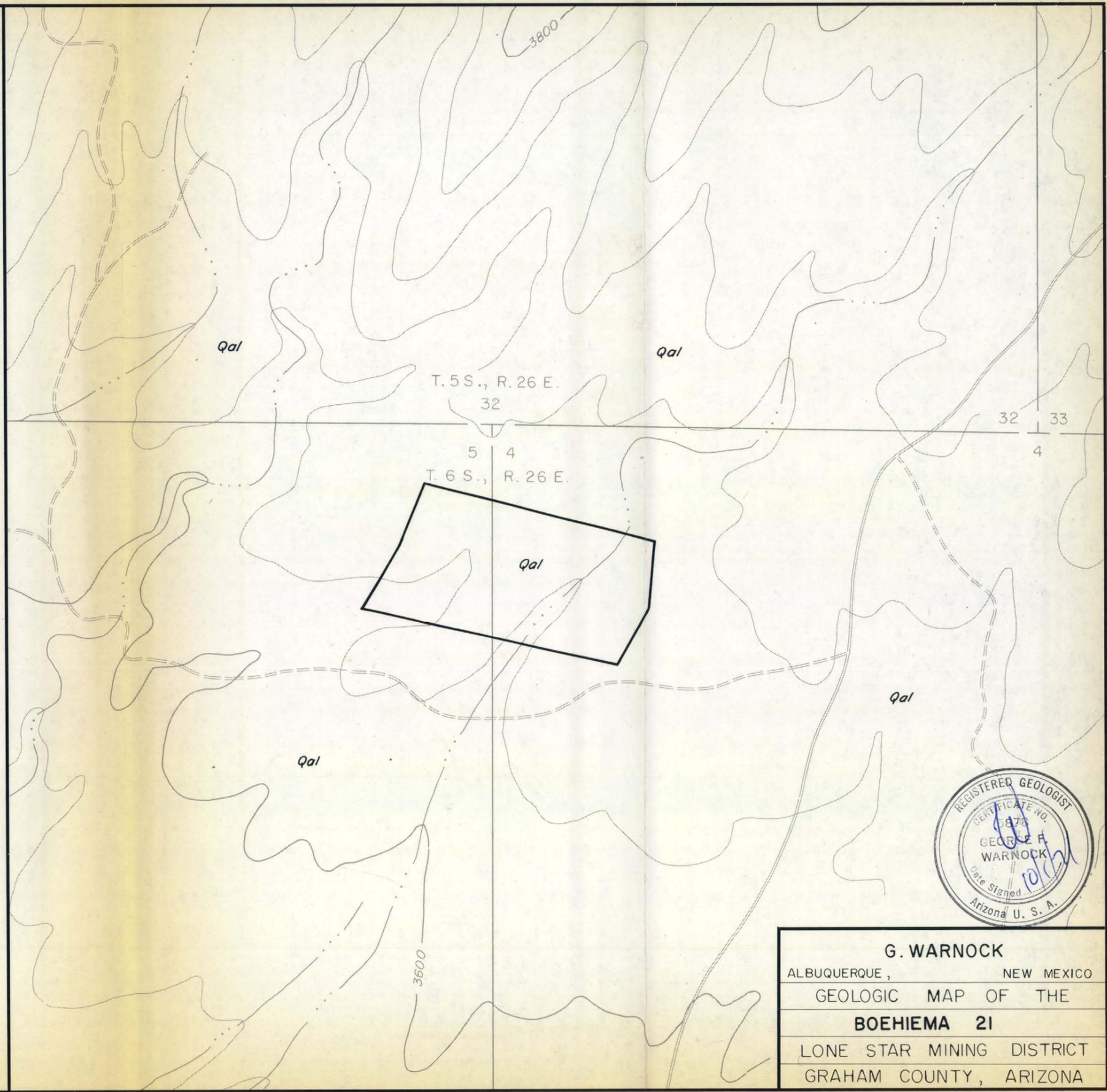
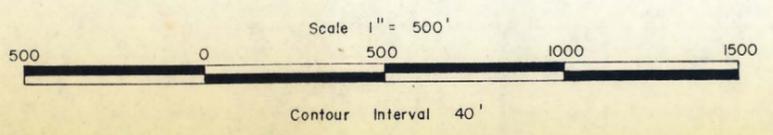
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EXPLANATION

Quaternary	Qal (Tqd. fl.) (Ka. fl.) (Kaa. fl.)	
	Qal, alluvium	
	(Tqd. fl.) predominantly Tertiary quartz diorite float.	
(Ka. fl.) predominantly lower Cretaceous andesite float.		
(Kaa. fl.) predominantly upper Cretaceous andesite float.		
Tertiary	Tbb	Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.
	Tt Td	Td, andesite and dacite.
	Tb	
	Tqm Tqd	Tqm, quartz monzonite.
	Tqd	Tqd, quartz diorite.
Cretaceous	Kad	Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.
	Kaa	Kaa, upper andesite predominantly agglomerate.
	Ka Kpa	Ka, lower andesite.
	Kpa	Kpa, lower porphyritic.

	Contact, dashed where indefinite or inferred
	Fault, dashed where indefinite or inferred
	Strike & dip of beds
	Strike & dip of flow layers
	Strike & dip of joint & shear zones
	Outcrop boundary
	Topographical base, USGS advance sheet, Safford NW, Graham County, Arizona, 1:24,000
	Claim group boundary

	Veins mineralized with limonite after sulfides (predominantly pyrite) and hematite. Cu denotes some minor chrysocolla
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 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
BOEHIEMA 21
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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File No. 103-001-011

Report No. 71-4

Contract No.

Date September 30, 1971

BIG BEN GROUP & LEAD HILL CLAIMS

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Big Ben Group and Lead Hill claims straddle the Butte fault, the major northwest trending normal fault of this area. The Butte fault has approximately 2,000 feet vertical offset and probably a minimum of 1,000 feet left handed horizontal offset. It is in turn offset some 800 feet by a northeast trending structure northeast of the claim group.

Tertiary quartz diorite on both sides of the Butte fault is relatively unaltered as is also Cretaceous lower andesite in the hanging wall of the fault. The lower andesite is host for known mineralization in this district and its lack of alteration foregoes a reasonable possibility for a porphyry type copper orebody in the footwall of the Butte fault in the claim area.

The favorable lower andesite to quartz diorite contact is buried in the hanging wall of the fault but the structural interpretation of the area indicates that the favorable contact should be off of the claim block to the south.

Based on the above interpretation, no further work can be recommended on the claims. They should, however, be maintained in good standing as long as Essex continues to hold a major land position in the district.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, one day was spent geologically mapping the Big Ben Group & Lead Hill claims on August 29, 1971. Additionally, two days were spent in office compilation and drafting of the geological map and report.

W

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Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately nine miles northeast of Safford, Arizona. This is in Graham County in Township 6 south, Range 26 east, section 12. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International, Inc. and these also were not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are four claims comprising the group. These are the

- 1. Big Ben Group No. 1
- 2. Big Ben Group No. 2
- 3. Lead Hill No. 1
- 4. Lead Hill No. 2

all of which are contiguous.

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BIG BEN GROUP & LEAD HILL CLAIMS

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located two miles northwest of the claim group has had production to date. This was negligible up to recent development by Producer Minerals company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton copper orebodies. The Kennecott Deposit is two miles northeast of the claim group and the Phelps Dodge orebody is three miles northwest of the claim block.

PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is principally on the upper pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography, although without major elevation differences.

The elevation on the claim group varies from 3,500 to 3,950 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite,



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BIG BEN GROUP & LEAD HILL CLAIMS

graniodiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes, along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are

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reported to decrease laterally along the shear zone from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Big Ben Group & Lead Hill claims are located on the southern margin of a quartz diorite stock or plug called the Lone Star stock by Kennecott geologists and dated as early Tertiary. It is mapped as Tqd (see attached map).

This stock is clearly controlled along a strong zone of shearing that strikes northeast directly into the Kennecott orebody approximately 10,000 feet northeast of the northeast corner of the claim group. All margins of the stock, with the exception of the southwest which is faulted, become dike zones striking N50E to

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N80E through the sheared andesite country rock. In fact, the northwest margin is approximately equal parts quartz diorite dikes and andesite. The first of these sheared remnants of andesite show up in the northwest corner of the claim group; however, numerous wide dikes and zones of quartz diorite continue to occur in an area 1,500 to 2,000 feet northwest of the northwest corner of the claim group.

To the northeast, along strike of the shear zone, the quartz diorite stock is uninterrupted for approximately 7,000 feet northeast of the claim group where elongated remnants of andesite again appear within the quartz diorite.

The quartz diorite stock in the Big Ben Group & Lead Hill area intrudes an andesite dated by Kennecott as Cretaceous and separated into upper and lower units.

The upper unit is distinguished by its agglomeritic fabric. It does not crop out in the claim group area and the closest outcrop being approximately 10,000 feet to the northwest. At that point, it is approximately 1,000 feet thick. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz diorite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the

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detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. As a matter of fact, the distinction between it and the porphyritic fabric developed by alteration near the intrusive is strictly a question of field relationship. This unit also does not crop out in the claim area but is known to both the north and northeast of the map borders.

An older, apparently premineral, set of andesitic and dacitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz diorite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad). No Cretaceous andesite dikes are known in the immediate vicinity of the claim group.

The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and a white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter is also present.

The dikes in several instances grade imperceptible into pipe-like zones of

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essentially pure granular quartz. One of these is located approximately 1,500 feet north of the northwestern claim corner intruding quartz diorite.

Kennecott has mapped these occurrences as xenoliths of Cambrian quartzite, probably the Coronado Quartzite known in the Morenci district approximately 19 miles to the northeast. However, the grading of the pipe-like granular quartz occurrence into distinctly intrusive quartz rich dikes plus an identical megascopic appearance to a number of similar occurrences of essentially pure quartz pipes known in the Andes of South America leads me to believe that the granular quartz is intrusive. However, if petrographic study shows welded fringes between rounded or semi-rounded grains, these may well be remnants of quartzite that have been intruded and partially assimilated furnishing the quartz to the quartz rich dikes. The question is academic as no significant change in alteration or mineralization appear to be associated with the granular quartz pipes.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties.

The Big Ben Group and Lead Hill claims are straddled by the northwest trending, normal Butte fault. This fault has dropped the Tertiary basalt (Tb) to Cretaceous andesite and Tertiary quartz diorite unconformity from an elevation of 5,300 feet some three miles north of the property to an elevation of 3,800 feet in the claim area. Considering a northerly dip of 10 degrees for the unconformity as displayed to the northwest, an offset of 2,000 feet is indicated. This may not all be on the Butte fault as there could be a number of parallel offsetting normal faults between the two control points on the unconformity. However,



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detailed air photo interpretation indicates no other single northwest structure as strong as the Butte fault, and it appears the major amount of the 2,000 foot offset is on the Butte fault.

The Butte fault is offset with a right hand throw of 800 feet just northwest of the claim group corner. The down thrown block west of the Butte fault both northwest and southeast of the offset has Tertiary basalt resting directly upon quartz diorite. The actual unconformity is visible only on the western slope of Corn Cob Mountain some 1,000 feet west of the western boundary of the claims.

To the northwest, just off of the map, Tertiary basalt in the hanging wall of the Butte fault is found within 50 feet of Cretaceous lower andesite in two different washes. The actual Butte fault is nowhere observable in the map area. Its trace, however, is very clear on the air photos and the aforementioned 800 foot right hand offset is based on air photo interpretation.

Outcrop and predominant float indicate that Cretaceous lower andesite is present on the foot wall of the Butte fault from the northwest corner of the claim all along the northern boundary. The hanging wall in this same area is Tertiary quartz diorite. The extreme interfingering of quartz diorite and lower andesite on the margins of the stock does not allow one to assume a horizontal element of offset even though different rock types apparently abutt each other across the fault. However, this could represent an offset and if so, it would be a minimum of 1,000 feet horizontal throw with left hand movement.

At least in the area of the Lone Star quartz diorite stock there appears to be no material change in the quartz diorite on either side of the fault. It continues to be only mildly kaolinized and chloritized with minor mineralization on dikes west of the fault as it is to the east.



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ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It occurs only on the northern and eastern fringes of the claim block where the southwest margin of the Lone Star stock is approached north of the Butte fault.

In this area the lower andesite is altered by intruding quartz diorite and volcanic dikes. Many shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible. The only copper mineralization known in this area is approximately 2,600 feet north of the claim group off of the map.

Away from dikes or mineralization such as in the far southeast corner of the property, the andesite is only mildly altered. It contains the pervasive epidote development, although not to the degree of the upper andesite to the northwest of the claim block. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

No biotization of the degree described by Kennecott (10 to 50% of the rock) of the andesite was found in the area. This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the andesite is relatively unaltered as compared with the reported alteration at the Kennecott orebody.

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The quartz diorite is only mildly altered by kaolinization and chloritization. The many later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the quartz diorite, 20-30 feet on either side of the dike, but these are restricted in occurrence on both sides of the Butte fault in the claim area.

EXPLORATION & DEVELOPMENT RECOMMENDED

The Big Ben Group and Lead Hill claims straddle the Butte fault resulting in a markedly different geological situation on either side of the fault. To the northeast of the fault outcropping Tertiary quartz diorite and Lower Cretaceous andesite are only mildly altered except along Tertiary dikes. This indicates that this area is well out from any source of a Kennecott type orebody. The depth factor is unknown but if an orebody did exist in depth in this general area, it would have to be predicted to occur to the north of the claims and map area where slightly more intense alteration and mineralization are present.

No further work is recommended for the footwall zone of the Butte fault on the Big Ben Group and Lead Hill claims.

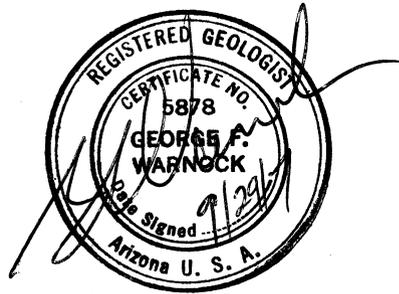
The hanging wall zone is occupied by relatively unaltered Tertiary quartz diorite and post mineral Tertiary basalt. The contact of favorable lower andesite to quartz diorite is buried south of the fault but might occur somewhere near the southern border of the claims. However, assuming some horizontal throw with left hand movement across the fault, the andesite contact could only be from about the southern border of the claim and further south. While this ground south of the claims area cannot be eliminated without deep probing, the claim group itself is

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located north of the most favorable area on the hanging wall of the Butte fault.
Therefore, no further work is recommended on the hanging wall portion.

In summary, the claims should be held as long as Essex has a major land holding in the district, at the minimum necessary cost.



EXPLANATION

Quaternary

Qal (Tqd. fl.) (Ka. fl.) (Kaa. fl.)

Qal, alluvium

(Tqd. fl.) predominantly Tertiary quartz diorite float.

(Ka. fl.) predominantly lower Cretaceous andesite float.

(Kaa. fl.) predominantly upper Cretaceous andesite float.

Tertiary

Tbb

Ti Td

Tb

Tqm Tqd

Kad

Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics.

Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.

Td, andesite and dacite.

Tqm, quartz monzonite.

Tqd, quartz diorite.

Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.

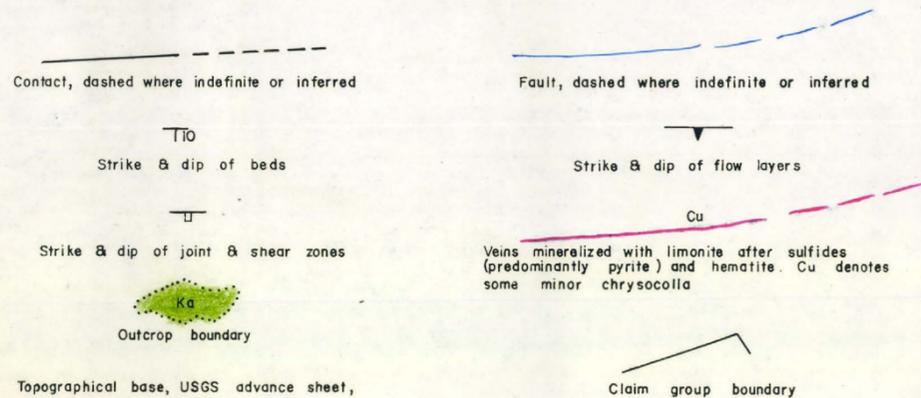
Kaa

Ka Kpa

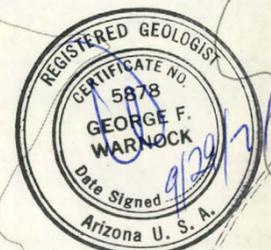
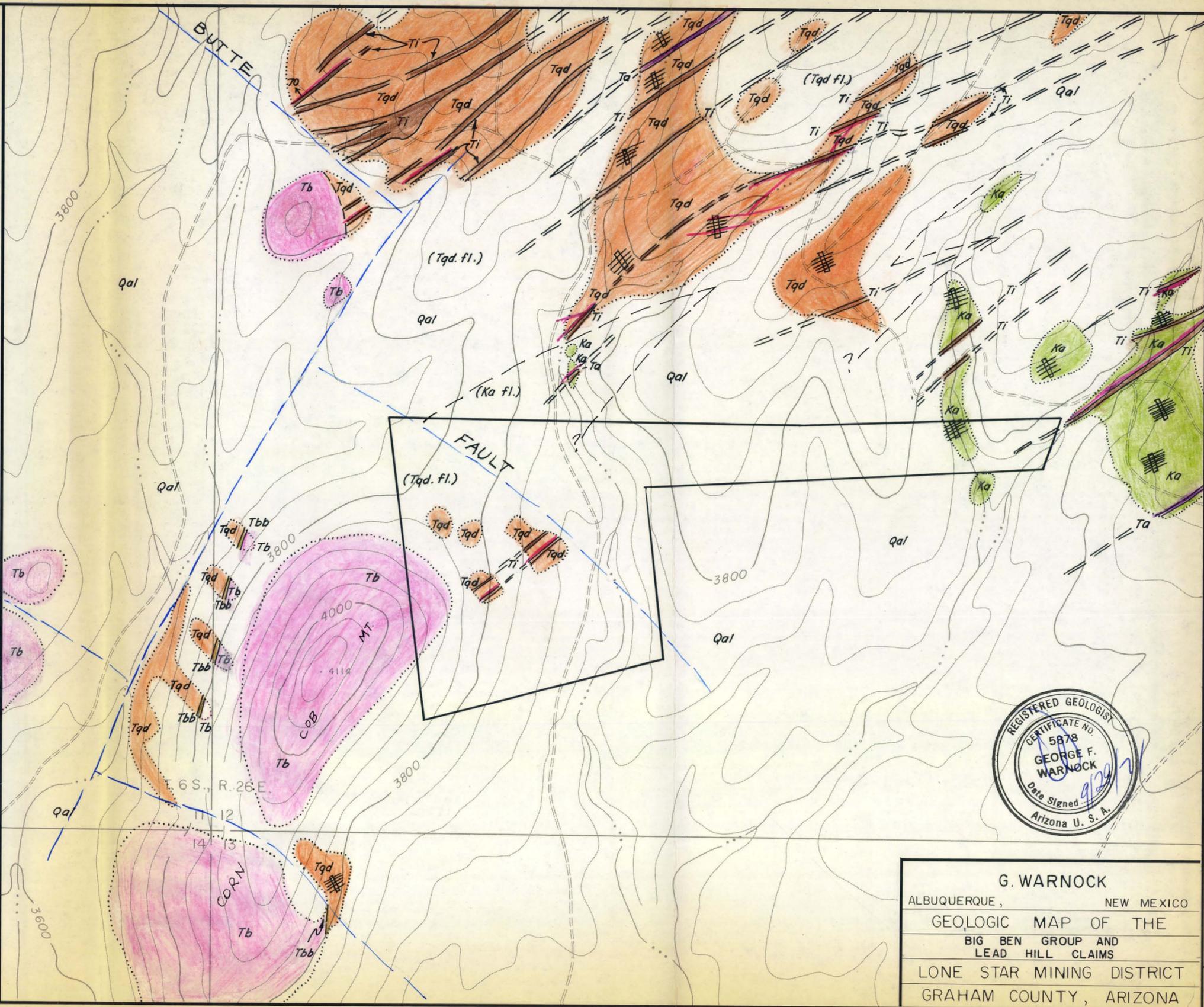
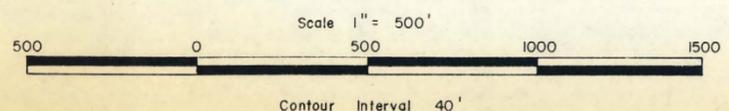
Kaa, upper andesite predominantly agglomerate.

Ka, lower andesite.

Kpa, lower porphyritic.



Topographical base, USGS advance sheet,
Safford NW, Graham County,
Arizona, 1:24,000



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ALBUQUERQUE, NEW MEXICO
GEOLOGIC MAP OF THE
BIG BEN GROUP AND
LEAD HILL CLAIMS
LONE STAR MINING DISTRICT
GRAHAM COUNTY, ARIZONA

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File No. 103-001-011

Report No. 71-2

Contract No.

Date. September 29, 1971

BIG BEN GROUP

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Big Ben Group of claims is situated centrally in the Lone Star quartz diorite stock. This Tertiary intrusive is controlled on a northeast trending shear zone through Cretaceous andesite. The andesite is reported to host porphyry type copper mineralizations at the San Juan, Phelps Dodge and Kennecott orebodies. However, lack of pervasive alteration in outcrop and the location centrally in the stock rather than on the contact zone, does not speak well for the economic possibilities of the group.

It is possible that strong silicification and sericitization of the quartz diorite and chloritization with mild biotization of the andesite in the northwest corner of the claims associated with Tertiary dikes has its center of intensity in depth rather than at the Kennecott orebody to the northeast along the strike of the northeast trending shear zone. However, relatively fresh andesite to the west and fresh quartz diorite to the east away from the dike swarm demonstrates fairly conclusive that any such target would be very deep. Based on halo alteration as reported at the Kennecott orebody, the depth factor in this area would be 4,000 to 6,000 feet.

The most persuasive geological picture by far is the Kennecott orebody as the center of mineralization and alteration which decreases southwestward along the shear zone to the Lone Star quartz diorite stock. Therefore, the expensive deep drilling required to probe this area cannot be recommended. However, these claims are centrally located in the district and they certainly should be held as long as Essex has a major land holding in the area.



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SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, two days were spent geologically mapping the Big Ben Group claims from August 27 to 28, 1971. Additionally, three days were spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately nine miles northeast of Safford, Arizona. This is in Graham County, in Township 6 south, Range 26 and 27 east sections 1, 6, 12, 7. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International, Inc. and these also were not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are 12 claims



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comprising the group. These are the

1. Big Ben Group No. 9
2. Big Ben Group No. 10
3. Big Ben Group No. 11
4. Big Ben Group No. 12
5. Big Ben Group No. 13
6. Big Ben Group No. 14
7. Big Ben Group No. 21
8. Big Ben Group No. 22
9. Big Ben Group No. 23
10. Big Ben Group No. 24
11. Big Ben Group No. 25
12. Big Ben Group No. 26

all of which are contiguous.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located 1.5 miles northwest of the Big Ben Group claims has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton copper orebodies. The Kennecott Deposit is one mile northeast of the claim group and the Phelps Dodge orebody is three miles northwest of the claim block.



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PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is principally on the upper pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography.

The elevation on the claim group varies from 3,900 to 4,500 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniodiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes, along with mineralization and alteration. Strong shear zones conform to this direction as do a number of

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offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization

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appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Big Ben Group claims are located centrally on a quartz diorite stock or plug called the Lone Star stock by Kennecott geologists and dated as early Tertiary (Tgd) (see attached map).

This stock is clearly controlled along a strong zone of shearing that strikes northeast directly into the Kennecott orebody approximately 6,000 feet northeast of the northeast corner of the claim group. All margins of the stock, with the exception of the southwest which is faulted, become dike zones striking N50E to N80E through the sheared andesite country rock. In fact, the northwest margin is approximately equal parts quartz diorite dikes and andesite. The first of these sheared remnants of andesite show up in the northwest corner of the claim group; however, numerous wide dikes and zones of quartz diorite continue to occur in an area 1,500 to 2,000 feet northwest of the northwest corner of the claim group.

To the northeast, along strike of the shear zone, the quartz diorite stock is uninterrupted for approximately 1,000 feet northeast of the claim group corner where elongated remnants of andesite again appear within the quartz diorite.

The quartz diorite stock in the Big Ben Group area intrudes an andesite dated by Kennecott as Cretaceous and separated into upper and lower units.

The upper unit is distinguished by its agglomeritic fabric. It does not crop out in the claim group area, the closest outcrop being approximately 5,000

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feet to the northwest. At that point, it is approximately 1,000 feet thick. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain, dense, ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz diorite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric developed by alteration near the intrusives is strictly a question of field relationship.

An older set of andesitic and dacitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz diorite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).



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The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter is also present.

The dikes in several instances grade imperceptible into pipe-like zones of essentially pure granular quartz. One of these is located approximately 500 feet west of the southwestern claim boundary and forms a mineralized contact between quartz diorite and lower andesite.

Kennecott has mapped these occurrences as xenoliths of Cambrian quartzite, probably the Coronado Quartzite known in the Morenci district approximately 19 miles to the northeast. However, the grading of the pipe-like granular quartz occurrence into distinctly intrusive quartz rich dikes plus an identical megascopic appearance to a number of similar occurrences of essentially pure quartz pipes known in the Andes of South America leads me to believe that the granular quartz is intrusive. However, if petrographic study shows welded fringes between rounded or semi-rounded grains, these may well be remnants of quartzite that have been intruded and partially assimilated furnishing the quartz to the quartz rich dikes. The question is probably academic as no significant change in alteration or mineralization appear to be associated with the granular quartz pipes.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties of Tertiary dikes.



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ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It occurs only in the northwest corner of the claim block where the northwest margin of the Lone Star stock is approached.

In this area the lower andesite is thoroughly altered by swarms of intruding quartz diorite and acid volcanic dikes. Many shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible. One strong shear forming a quartz diorite to lower andesite contact just on the north claim boundary approximately 600 feet east of the northwest corner displays minor copper oxides, principally as chrysocolla. A small 30 foot adit has prospected the mineralized shear. The only other copper mineralization known in this area is approximately 1,000 feet north of the northeast corner of the claim group. At this locality strong Tertiary acid dikes have intruded a quartz diorite and lower porphyritic andesite contact zone with relatively strong mineralization of both the highly sericitized and silicified quartz diorite and chloritized and slightly biotized porphyritic andesite. Several trenches, tunnels, pits and shafts have prospected this area which appears to be a zone of relatively stronger intrusive acid dikes and accompanying mineralization including copper, along the general northeast trending shear zone. This area is approximately 5,000 feet from the Kennecott orebody and no doubt is fringe mineralization to it leaking out along the shear zone.

Away from dikes or mineralization such as in the far southeast corner of the property, the andesite is only mildly altered. It contains the pervasive



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epidote development, although not to the degree of the upper andesite to the northwest of the claim block. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined, it is classed as chlorite rather than biotite alteration.

Some fine grain distinctly black biotite is apparent in the porphyritic andesite near the copper oxides mentioned some 1,000 feet north of the northeast corner of the claim. Other than this, no biotization of the degree described by Kennecott (10 to 50% of the rock) of the andesite was found in the area. This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the andesite is relatively unaltered as compared with the reported alteration at the Kennecott orebody.

The quartz diorite is only mildly altered by kaolinization and chloritization. The many later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the quartz diorite, 20-30 feet on either side of the dike. Just off of the claim group to both the northeast and northwest, the mineralized zones mentioned above created strongly altered zones up to 500 feet wide in the quartz diorite and quartz diorite to lower andesite contact.

EXPLORATION & DEVELOPMENT RECOMMENDED

The Big Ben Group covers the central portion of the Lone Star quartz diorite stock eroded vertically, well down into the favorable lower andesite (some 1,000 feet below its upper contact with the upper agglomeritic andesite). While



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faulting in between the known contact to the northwest and the Big Ben Group may change that stratigraphic relationship, lack of intense alteration in the quartz diorite and andesite away from dikes and shears does not indicate a strong possibility for a porphyry type deposit to be located in this area.

The conditions of the quartz diorite to lower andesite contact at depths great enough for the near mineralization type alteration not to crop out is, of course, not known. One might argue that the swarms of mineralized dikes with strong alteration and some mineralization could well have their center of intensity at depth rather than at the Kennecott orebody. A deep hole in the area might show increasing alteration and disseminated pyrite mineralization but with only chloritization at the surface, any such mineralization should be 4,000 to 6,000 feet deep.

I would judge the probability of success of such deep holes is not worth the cost, but if this high risk type probing for geological information is desired, I would place those holes relative to the strongest dike swarms and the quartz diorite to lower andesite contact, namely the northwest and west side of the claims.

I would not recommend this drilling but the claims are central enough to the general district that they should be held as long as Essex maintains its other major land holding in the district.



EXPLANATION

Quaternary

Qal (Tqd. fl.) (Ka. fl.) (Kaa. fl.)
 Qal, alluvium
 (Tqd. fl.) predominantly Tertiary quartz diorite float.
 (Ka. fl.) predominantly lower Cretaceous andesite float.
 (Kaa. fl.) predominantly upper Cretaceous andesite float.

Tertiary

Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics.

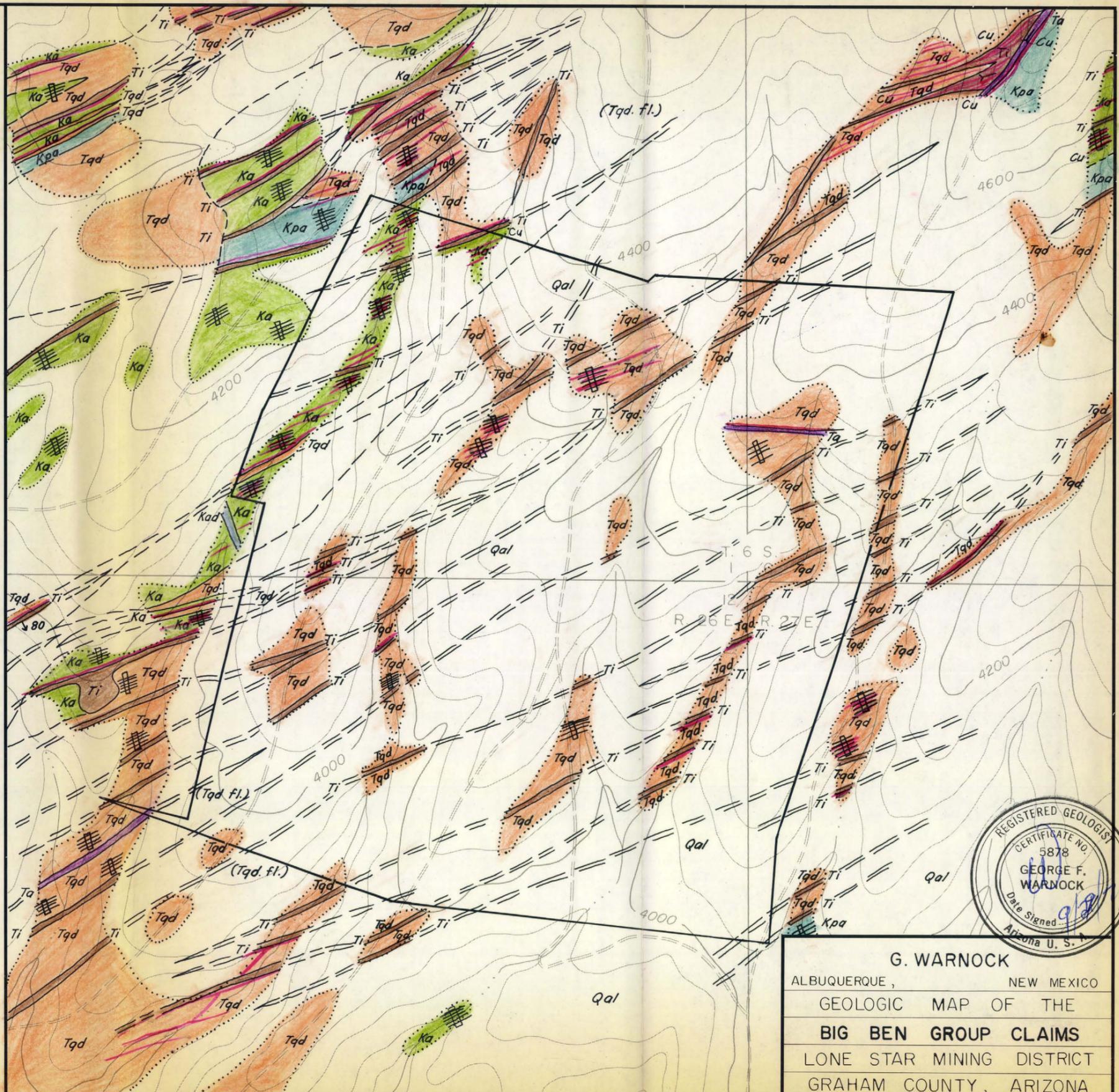
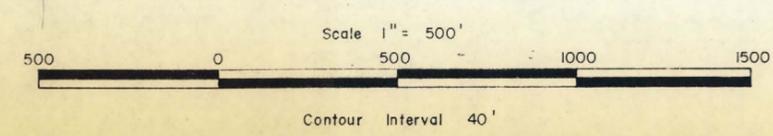
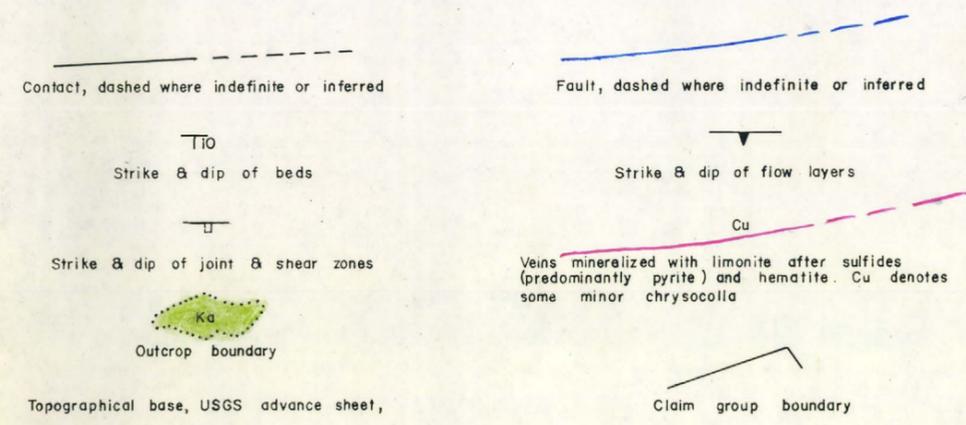
Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.
 Td, andesite and dacite.

Tqm, quartz monzonite.
 Tqd, quartz diorite.

Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.

Cretaceous

Kaa, upper andesite predominantly agglomerate.
 Ka, lower andesite.
 Kpa, lower porphyritic.



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 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
BIG BEN GROUP CLAIMS
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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File No. 103-001-011

Report No. 71-3

Contract No. _____

Date September 29, 1971

BARDWELL GROUP

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Bardwell group of claims is situated on the northwest margin of the Lone Star quartz diorite stock where it intrudes Cretaceous andesite. This andesite reportedly hosts porphyry copper type mineralization at the San Juan, Phelps Dodge and Kennecott orebodies. However, lack of pervasive alteration in out crop and any sign of copper mineralization other than as veins on shears in the otherwise favorable contact zone would appear to rule out the probability of an economic deposit in the general area of the claim group.

The only exception to this negative outlook would be at extreme depths where the zone of intense alteration has not reached the surface. For a Kennecott type orebody that would have to be some 4,000 to 6,000 feet below surface.

A more geologically sound conclusion is that the mild alteration and minor mineralization found in the vicinity of the claim is fringing mineralization southwestward along the shear zone from the Kennecott orebody.

Based on this interpretation, I would recommend that only the minimum of work necessary be performed on the claims to hold them and this only as long as Essex maintains a major land position in the district.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, one day was spent geologically mapping the Bardwell claim group on August 26, 1971. Additionally, two days were spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a

①

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scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' feet to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately nine miles northeast of Safford, Arizona. This is in Graham County in Township 6 south, Range 26 east, sections 1 and 12. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International, Inc. and these also were not checked. Several claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are three claims comprising the group. These are the

1. Bardwell No. 1
2. Bardwell No. 2
3. Bardwell No. 3

all of which are contiguous.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan

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mine, located one mile northwest of the Bardwell claim group has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton copper orebodies. The Kennecott Deposit is two miles northeast of the claim group and the Phelps Dodge orebody is 2.5 miles northwest of the claim block.

PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is principally on the upper pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography, although without major elevation differences.

The elevation on the claim group varies from 3,900 to 4,200 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniordiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

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This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes, along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.

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Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strongly altered andesite is reportedly biotitized. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone and so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Bardwell group is located on the northwest contact zone of quartz diorite stock or plug called the Lone Star stock by Kennecott geologists and dated as early Tertiary. It is mapped as Tqd. (see attached map)

This stock intrudes Cretaceous andesite and is clearly controlled along a strong zone of shearing that strikes northeast directly into the Kennecott orebody which is approximately 8,000 feet northeast of the northeast corner of the claim group. All margins of the stock, with the exception of the southwest which is faulted, become dike zones striking N50E to N80E through the sheared andesite country rock. In fact, the northwest margin covered by the claim is approximately

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equal parts quartz diorite dikes and andesite. The first of these sheared remnants of andesite show up to the east of the claim group; however, numerous wide dikes and zones of quartz diorite continue to occur in an area 1,500 to 2,000 feet in the northwest portion of the claim group.

The southern boundary of the claims is well into the quartz diorite stock. The stock continues uninterrupted from the southern boundary of the claim for approximately 5,000 feet to the northeast where elongated remnants of andesite again appear within the quartz diorite.

The quartz diorite stock in the Bardwell group area intrudes an andesite dated by Kennecott as Cretaceous and separated into upper and lower units.

The upper unit is distinguished by its agglomeritic fabric. It does not crop out in the claim group area, the closest outcrop being approximately 4,000 feet to the northwest. At that point, it is approximately 1,000 feet thick. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz diorite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to

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be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric developed by alteration near the intrusives is strictly a question of field relationship.

An older set of andesitic and dacitic dikes and one small plug cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz diorite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).

A small plug intrusion of this Cretaceous andesite occurs near the western boundary of the property. The plug clearly intrudes the lower Cretaceous andesite flows and in turn is intruded by the Tertiary quartz diorite.

The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and a white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter is also present.

The dikes in several instances grade imperceptible into pipe-like zones of essentially pure granular quartz. One of these is located approximately 500 feet



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north of the southeastern claim corner and forms a mineralized contact between quartz diorite and lower andesite. A second occurs approximately 1,000 feet southwest of the southwestern corner.

Kennecott has mapped these occurrences as xenoliths of Cambrian quartzite, probably the Coronado Quartzite known in the Morenci district approximately 19 miles to the northeast. However, the grading of the pipe-like granular quartz occurrence into distinctly intrusive quartz rich dikes plus an identical megascopic appearance to a number of similar occurrences of essentially pure quartz pipes known in the Andes of South America leads me to believe that the granular quartz is intrusive. However, if petrographic study shows welded fringes between rounded or semi-rounded grains, these may well be remnants of quartzite that have been intruded and partially assimilated furnishing the quartz to the quartz rich dikes. The question is academic as no significant change in alteration or mineralization appear to be associated with the granular quartz pipes.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties of Tertiary dikes.

Structurally, the northwest trending normal Butte fault passes approximately 1,500 feet southwest of the southwestern corner of the claim block.

This fault has dropped the Tertiary basalt (Tb) to Cretaceous andesite and Tertiary quartz diorite unconformity from an elevation of 5,300 feet some two miles north of the property to an elevation of 3,800 feet, 1,500 feet southwest of the claim group. Considering a northerly dip of 10 degrees for the unconformity as displayed to the northwest, an offset of 2,000 feet is indicated. This may



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not all be on the Butte fault as there could be a number of parallel offsetting normal faults between the two control points on the unconformity. However, detailed air photo interpretation indicates no other single northwest structure as strong as the Butte fault, and it appears the major amount of the 2,000 foot offset is on the Butte fault.

The Butte fault is offset with a right hand throw of 800 feet just at the southern border of the map. The down thrown block west of the Butte fault both northwest and southeast (off of the map to the south) of the offset has Tertiary basalt resting directly upon quartz diorite. The actual unconformity is not visible so that it is not known if the basal sandstone and conglomerate unit (Tbb) is present.

To the northwest, along the western boundary of the map, Tertiary basalt in the hanging wall of the Butte fault is found within 50 feet of Cretaceous lower andesite in two different washes. The actual Butte fault is nowhere observable in the map area. Its trace, however, is very clear on the air photos and the aforementioned 800 foot right hand offset is based on air photo interpretation.

At least in the area of the Lone Star quartz diorite stock there appears to be no material change in the quartz diorite on either side of the fault. It continues to be only mildly kaolinized and chloritized with minor mineralization on dikes west of the fault as it is to the east.

ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It occurs through most of the northwestern portion of the claim block.



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Approximately 1,000 feet east of the northeast corner of the claims, the andesite is thoroughly altered by swarms of intruding quartz diorite and acid volcanic dikes. Many shears within this area of andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible. One strong shear forming a quartz diorite to lower andesite contact 1,300 feet east of the northeast corner of the claim group displays minor copper oxides, principally as chrysocolla. A small 30 foot adit has prospected the mineralized shear. A second occurrence of copper oxides is approximately 250 feet west of the southwest corner of the claims. Host here is a Tertiary quartz latite dike intruding Tertiary quartz diorite. Intense silicification and sericitization is restricted to within a few feet of the dike. The zone is explored by a shaft some 100 or more feet deep and an adit just at the western claim boundary follows the dike to the southwest.

Both of these occurrences are in all probability fringing mineralization out from the Kennecott orebody; some 7,000 to 12,000 feet to the northeast.

Away from dikes or mineralization such as along the western claim boundary and the central portion of the claims, the andesite is only mildly altered. It contains the pervasive epidote development, although not to the degree of the upper andesite to the northwest of the claim block. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

Some fine grain distinctly black biotite is apparent in porphyritic andesite near the copper oxides some 3,500 feet north of the northeast corner of the

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claim and off of the map. Other than this, no biotization of the degree described by Kennecott (10 to 50% of the rock) of the andesite was found in the area. This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the andesite is relatively unaltered as compared with the reported alteration at the Kennecott orebody.

The quartz diorite is only mildly altered by kaolinization and chloritization. The many later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the quartz diorite, 20-30 feet on either side of the dike. The mineralized contact zone northeast of the claim group with swarms of these dikes has created strongly a altered zone up to 500 feet wide in the quartz diorite and quartz diorite to lower andesite contact.

EXPLORATION & DEVELOPMENT RECOMMENDED

Lack of intense alteration of the type known to be associated with mineralization at the Kennecott orebody and thought to be duplicated at both the San Juan and Phelps Dodge properties, indicates that the Bardwell group claims are well away from a center of mineralization. In all probability the mild alteration and mineralization controlled on Tertiary dikes in the northeast shear zone are fringing mineralization along strike to the southwest from the Kennecott orebody, some 7,000 to 12,000 feet east of the two known shows of copper oxide in the Bardwell claim area.

The possibility exists that the source of the mild alteration and mineralization



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found in the Bardwell area is at depth. If so, a Kennecott type orebody would have to be some 4,000 to 6,000 feet in depth not to display more alteration on the surface.

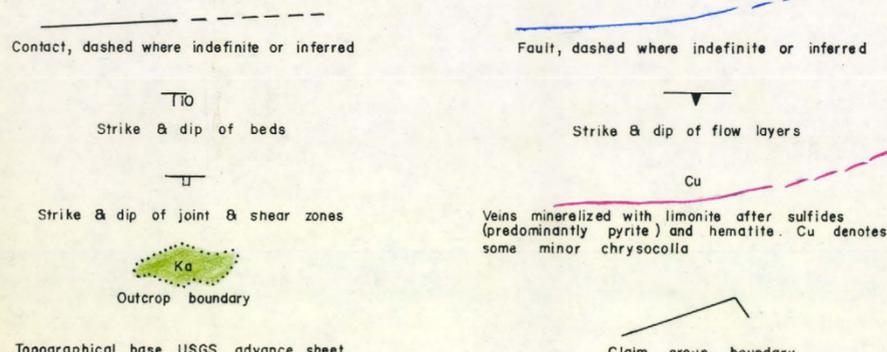
The probability of this hypothesis over that of the Kennecott orebody being the source of mineralization is thought highly unlikely; to the degree that no deep drilling can be recommended.

The claims are, however, centrally located in the district and should be maintained as long as a serious land position is held by Essex.

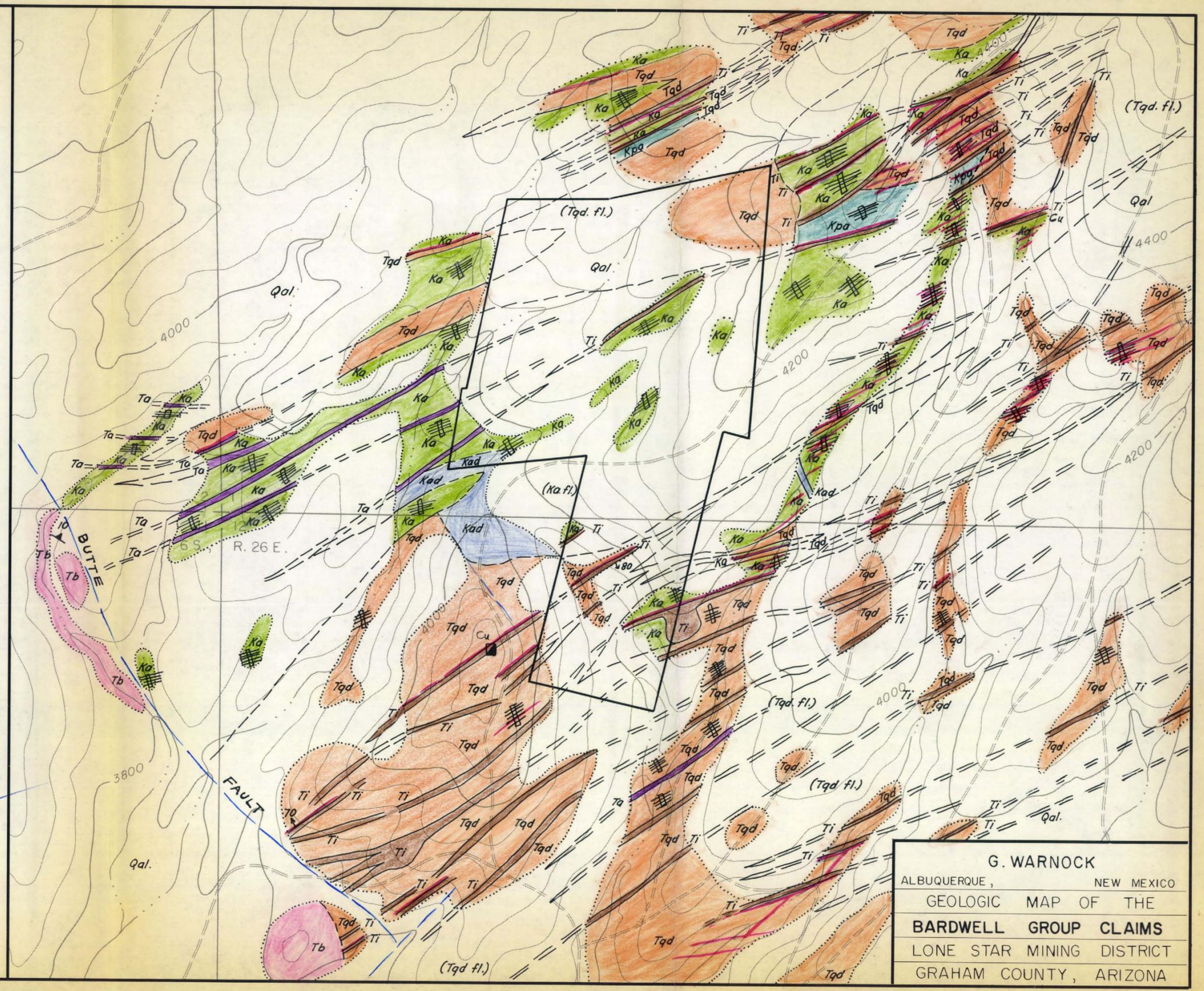
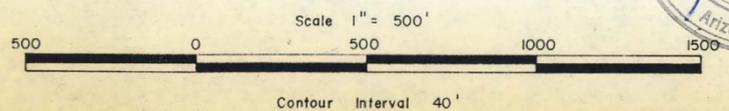


EXPLANATION

- Quaternary**
- Qal, alluvium
 - (Tqd. fl.) predominantly Tertiary quartz diorite float.
 - (Ka. fl.) predominantly lower Cretaceous andesite float.
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- Tertiary**
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- Kaa, upper andesite predominantly agglomerate.
 - Ka, lower andesite.
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Topographical base, USGS advance sheet,
Safford NW, Graham County,
Arizona, 1:24,000



G. WARNOCK
ALBUQUERQUE, NEW MEXICO
GEOLOGIC MAP OF THE
BARDWELL GROUP CLAIMS
LONE STAR MINING DISTRICT
GRAHAM COUNTY, ARIZONA

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Essex Subtotal Copy

File No. 103-001-011

Report No. 71-2

Contract No.

Date. September 29, 1971

BIG BEN GROUP

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Big Ben Group of claims is situated centrally in the Lone Star quartz diorite stock. This Tertiary intrusive is controlled on a northeast trending shear zone through Cretaceous andesite. The andesite is reported to host porphyry type copper mineralizations at the San Juan, Phelps Dodge and Kennecott orebodies. However, lack of pervasive alteration in outcrop and the location centrally in the stock rather than on the contact zone, does not speak well for the economic possibilities of the group.

It is possible that strong silicification and sericitization of the quartz diorite and chloritization with mild biotization of the andesite in the northwest corner of the claims associated with Tertiary dikes has its center of intensity in depth rather than at the Kennecott orebody to the northeast along the strike of the northeast trending shear zone. However, relatively fresh andesite to the west and fresh quartz diorite to the east away from the dike swarm demonstrates fairly conclusive that any such target would be very deep. Based on halo alteration as reported at the Kennecott orebody, the depth factor in this area would be 4,000 to 6,000 feet.

The most persuasive geological picture by far is the Kennecott orebody as the center of mineralization and alteration which decreases southwestward along the shear zone to the Lone Star quartz diorite stock. Therefore, the expensive deep drilling required to probe this area cannot be recommended. However, these claims are centrally located in the district and they certainly should be held as long as Essex has a major land holding in the area.



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SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, two days were spent geologically mapping the Big Ben Group claims from August 27 to 28, 1971. Additionally, three days were spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately nine miles northeast of Safford, Arizona. This is in Graham County, in Township 6 south, Range 26 and 27 east sections 1, 6, 12, 7. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International, Inc. and these also were not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are 12 claims

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comprising the group. These are the

1. Big Ben Group No. 9
2. Big Ben Group No. 10
3. Big Ben Group No. 11
4. Big Ben Group No. 12
5. Big Ben Group No. 13
6. Big Ben Group No. 14
7. Big Ben Group No. 21
8. Big Ben Group No. 22
9. Big Ben Group No. 23
10. Big Ben Group No. 24
11. Big Ben Group No. 25
12. Big Ben Group No. 26

all of which are contiguous.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located 1.5 miles northwest of the Big Ben Group claims has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton copper orebodies. The Kennecott Deposit is one mile northeast of the claim group and the Phelps Dodge orebody is three miles northwest of the claim block.



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PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is principally on the upper pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography.

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offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization



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appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteritic, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Big Ben Group claims are located centrally on a quartz diorite stock or plug called the Lone Star stock by Kennecott geologists and dated as early Tertiary (Tgd) (see attached map).

This stock is clearly controlled along a strong zone of shearing that strikes northeast directly into the Kennecott orebody approximately 6,000 feet northeast of the northeast corner of the claim group. All margins of the stock, with the exception of the southwest which is faulted, become dike zones striking N50E to N80E through the sheared andesite country rock. In fact, the northwest margin is approximately equal parts quartz diorite dikes and andesite. The first of these sheared remnants of andesite show up in the northwest corner of the claim group; however, numerous wide dikes and zones of quartz diorite continue to occur in an area 1,500 to 2,000 feet northwest of the northwest corner of the claim group.

To the northeast, along strike of the shear zone, the quartz diorite stock is uninterrupted for approximately 1,000 feet northeast of the claim group corner where elongated remnants of andesite again appear within the quartz diorite.

The quartz diorite stock in the Big Ben Group area intrudes an andesite dated by Kennecott as Cretaceous and separated into upper and lower units.

The upper unit is distinguished by its agglomeritic fabric. It does not crop out in the claim group area, the closest outcrop being approximately 5,000

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feet to the northwest. At that point, it is approximately 1,000 feet thick. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain, dense, ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz diorite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric developed by alteration near the intrusives is strictly a question of field relationship.

An older set of andesitic and dacitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz diorite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).



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The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter is also present.

The dikes in several instances grade imperceptible into pipe-like zones of essentially pure granular quartz. One of these is located approximately 500 feet west of the southwestern claim boundary and forms a mineralized contact between quartz diorite and lower andesite.

Kennecott has mapped these occurrences as xenoliths of Cambrian quartzite, probably the Coronado Quartzite known in the Morenci district approximately 19 miles to the northeast. However, the grading of the pipe-like granular quartz occurrence into distinctly intrusive quartz rich dikes plus an identical megascopic appearance to a number of similar occurrences of essentially pure quartz pipes known in the Andes of South America leads me to believe that the granular quartz is intrusive. However, if petrographic study shows welded fringes between rounded or semi-rounded grains, these may well be remnants of quartzite that have been intruded and partially assimilated furnishing the quartz to the quartz rich dikes. The question is probably academic as no significant change in alteration or mineralization appear to be associated with the granular quartz pipes.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties of Tertiary dikes.



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ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It occurs only in the northwest corner of the claim block where the northwest margin of the Lone Star stock is approached.

In this area the lower andesite is thoroughly altered by swarms of intruding quartz diorite and acid volcanic dikes. Many shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible. One strong shear forming a quartz diorite to lower andesite contact just on the north claim boundary approximately 600 feet east of the northwest corner displays minor copper oxides, principally as chrysocolla. A small 30 foot adit has prospected the mineralized shear. The only other copper mineralization known in this area is approximately 1,000 feet north of the northeast corner of the claim group. At this locality strong Tertiary acid dikes have intruded a quartz diorite and lower porphyritic andesite contact zone with relatively strong mineralization of both the highly sericitized and silicified quartz diorite and chloritized and slightly biotized porphyritic andesite. Several trenches, tunnels, pits and shafts have prospected this area which appears to be a zone of relatively stronger intrusive acid dikes and accompanying mineralization including copper, along the general northeast trending shear zone. This area is approximately 5,000 feet from the Kennecott orebody and no doubt is fringe mineralization to it leaking out along the shear zone.

Away from dikes or mineralization such as in the far southeast corner of the property, the andesite is only mildly altered. It contains the pervasive



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epidote development, although not to the degree of the upper andesite to the northwest of the claim block. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined, it is classed as chlorite rather than biotite alteration.

Some fine grain distinctly black biotite is apparent in the porphyritic andesite near the copper oxides mentioned some 1,000 feet north of the northeast corner of the claim. Other than this, no biotization of the degree described by Kennecott (10 to 50% of the rock) of the andesite was found in the area. This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the andesite is relatively unaltered as compared with the reported alteration at the Kennecott orebody.

The quartz diorite is only mildly altered by kaolinization and chloritization. The many later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the quartz diorite, 20-30 feet on either side of the dike. Just off of the claim group to both the northeast and northwest, the mineralized zones mentioned above created strongly altered zones up to 500 feet wide in the quartz diorite and quartz diorite to lower andesite contact.

EXPLORATION & DEVELOPMENT RECOMMENDED

The Big Ben Group covers the central portion of the Lone Star quartz diorite stock eroded vertically, well down into the favorable lower andesite (some 1,000 feet below its upper contact with the upper agglomeritic andesite). While



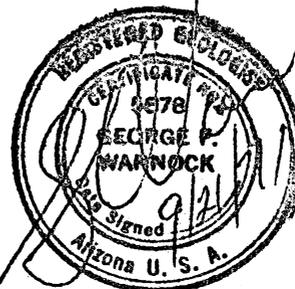
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faulting in between the known contact to the northwest and the Big Ben Group may change that stratigraphic relationship, lack of intense alteration in the quartz diorite and andesite away from dikes and shears does not indicate a strong possibility for a porphyry type deposit to be located in this area.

The conditions of the quartz diorite to lower andesite contact at depths great enough for the near mineralization type alteration not to crop out is, of course, not known. One might argue that the swarms of mineralized dikes with strong alteration and some mineralization could well have their center of intensity at depth rather than at the Kennecott orebody. A deep hole in the area might show increasing alteration and disseminated pyrite mineralization but with only chloritization at the surface, any such mineralization should be 4,000 to 6,000 feet deep.

I would judge the probability of success of such deep holes is not worth the cost, but if this high risk type probing for geological information is desired, I would place those holes relative to the strongest dike swarms and the quartz diorite to lower andesite contact, namely the northwest and west side of the claims.

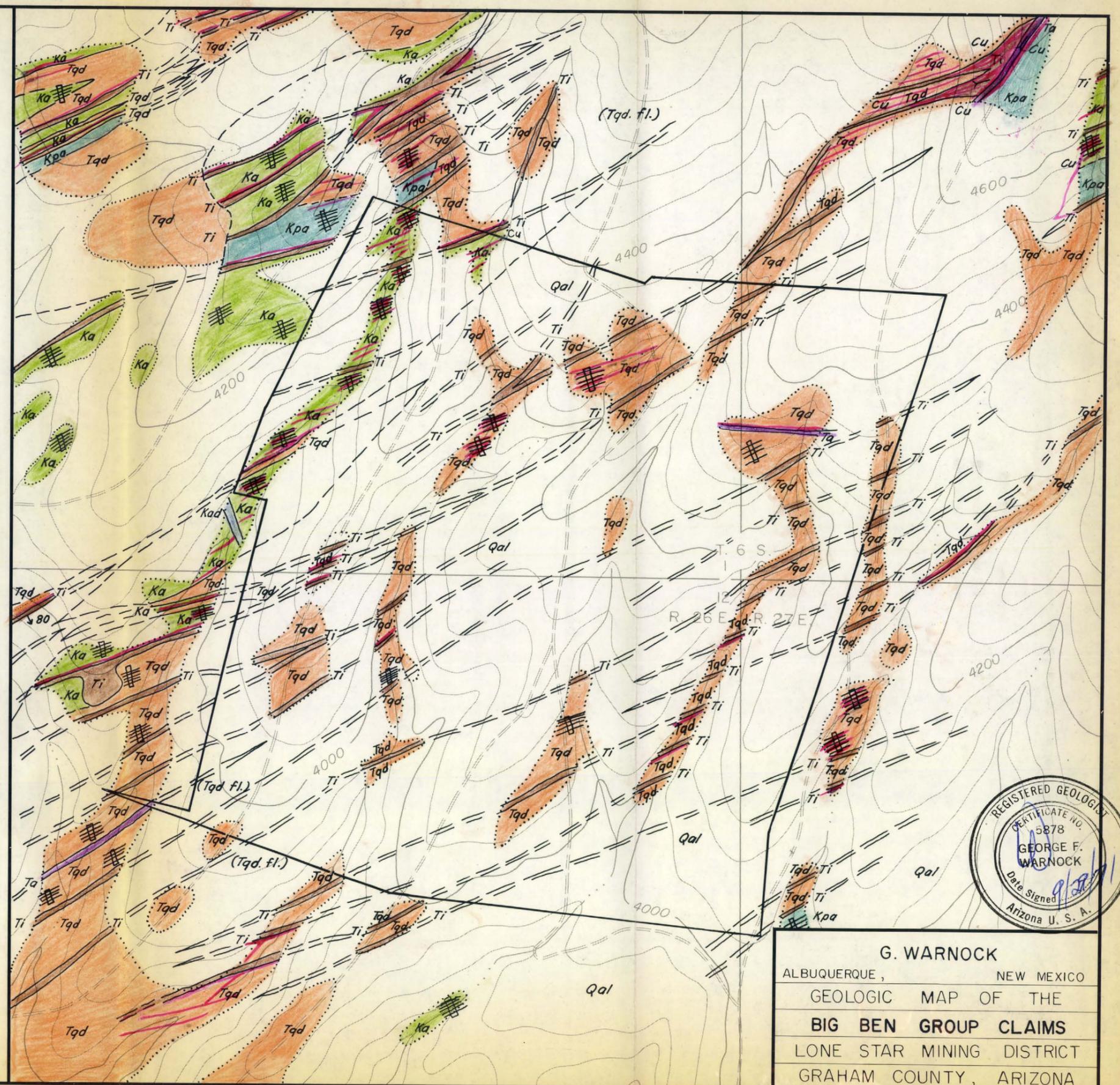
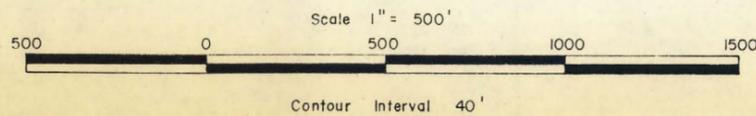
I would not recommend this drilling but the claims are central enough to the general district that they should be held as long as Essex maintains its other major land holding in the district.



EXPLANATION

- | | | | |
|------------|---|--|--------------------------|
| Quaternary | Qal (Tqd. fl.) (Ka. fl.) (Kaa. fl.) | | |
| | Qal, alluvium | | |
| | (Tqd. fl.) predominantly Tertiary quartz diorite float. | | |
| | (Ka. fl.) predominantly lower Cretaceous andesite float. | | |
| | (Kaa. fl.) predominantly upper Cretaceous andesite float. | | |
| Tertiary | Tbb | Ti, Td | Tb |
| | Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics. | Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff. | Td, andesite and dacite. |
| | Tqm, Tqd | | |
| | Tqm, quartz monzonite. | | Tqd, quartz diorite. |
| Cretaceous | Kad | | |
| | Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary. | | |
| | Kaa | | |
| | Kaa, upper andesite predominantly agglomerate. | | |
| | Ka, Kpa | | |
| | Ka, lower andesite. | | Kpa, lower porphyritic. |

- Contact, dashed where indefinite or inferred
- Fault, dashed where indefinite or inferred
- Ti0
Strike & dip of beds
- Strike & dip of joint & shear zones
- Outcrop boundary
- Topographical base, USGS advance sheet, Safford NW, Graham County, Arizona, 1:24,000
- Claim group boundary
- Veins mineralized with limonite after sulfides (predominantly pyrite) and hematite. Cu denotes some minor chrysocolla



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 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
BIG BEN GROUP CLAIMS
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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Essex Surface Corp
File No. 103-001-011

Report No. 71-3

Contract No.

Date September 29, 1971

BARDWELL GROUP

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Bardwell group of claims is situated on the northwest margin of the Lone Star quartz diorite stock where it intrudes Cretaceous andesite. This andesite reportedly hosts porphyry copper type mineralization at the San Juan, Phelps Dodge and Kennecott orebodies. However, lack of pervasive alteration in out crop and any sign of copper mineralization other than as veins on shears in the otherwise favorable contact zone would appear to rule out the probability of an economic deposit in the general area of the claim group.

The only exception to this negative outlook would be at extreme depths where the zone of intense alteration has not reached the surface. For a Kennecott type orebody that would have to be some 4,000 to 6,000 feet below surface.

A more geologically sound conclusion is that the mild alteration and minor mineralization found in the vicinity of the claim is fringing mineralization southwestward along the shear zone from the Kennecott orebody.

Based on this interpretation, I would recommend that only the minimum of work necessary be performed on the claims to hold them and this only as long as Essex maintains a major land position in the district.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, one day was spent geologically mapping the Bardwell claim group on August 26, 1971. Additionally, two days were spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a

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scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' feet to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately nine miles northeast of Safford, Arizona. This is in Graham County in Township 6 south, Range 26 east, sections 1 and 12. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International, Inc. and these also were not checked. Several claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are three claims comprising the group. These are the

1. Bardwell No. 1
2. Bardwell No. 2
3. Bardwell No. 3

all of which are contiguous.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan

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mine, located one mile northwest of the Bardwell claim group has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton copper orebodies. The Kennecott Deposit is two miles northeast of the claim group and the Phelps Dodge orebody is 2.5 miles northwest of the claim block.

PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is principally on the upper pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography, although without major elevation differences.

The elevation on the claim group varies from 3,900 to 4,200 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniodiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.



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This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes, along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.



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Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strongly altered andesite is reportedly biotitized. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone and so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Bardwell group is located on the northwest contact zone of quartz diorite stock or plug called the Lone Star stock by Kennecott geologists and dated as early Tertiary. It is mapped as Tqd. (see attached map)

This stock intrudes Cretaceous andesite and is clearly controlled along a strong zone of shearing that strikes northeast directly into the Kennecott orebody which is approximately 8,000 feet northeast of the northeast corner of the claim group. All margins of the stock, with the exception of the southwest which is faulted, become dike zones striking N50E to N80E through the sheared andesite country rock. In fact, the northwest margin covered by the claim is approximately

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equal parts quartz diorite dikes and andesite. The first of these sheared remnants of andesite show up to the east of the claim group; however, numerous wide dikes and zones of quartz diorite continue to occur in an area 1,500 to 2,000 feet in the northwest portion of the claim group.

The southern boundary of the claims is well into the quartz diorite stock. The stock continues uninterrupted from the southern boundary of the claim for approximately 5,000 feet to the northeast where elongated remnants of andesite again appear within the quartz diorite.

The quartz diorite stock in the Bardwell group area intrudes an andesite dated by Kennecott as Cretaceous and separated into upper and lower units.

The upper unit is distinguished by its agglomeritic fabric. It does not crop out in the claim group area, the closest outcrop being approximately 4,000 feet to the northwest. At that point, it is approximately 1,000 feet thick. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz diorite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to

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be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric developed by alteration near the intrusives is strictly a question of field relationship.

An older set of andesitic and dacitic dikes and one small plug cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz diorite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).

A small plug intrusion of this Cretaceous andesite occurs near the western boundary of the property. The plug clearly intrudes the lower Cretaceous andesite flows and in turn is intruded by the Tertiary quartz diorite.

The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and a white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter is also present.

The dikes in several instances grade imperceptible into pipe-like zones of essentially pure granular quartz. One of these is located approximately 500 feet



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north of the southeastern claim corner and forms a mineralized contact between quartz diorite and lower andesite. A second occurs approximately 1,000 feet southwest of the southwestern corner.

Kennecott has mapped these occurrences as xenoliths of Cambrian quartzite, probably the Coronado Quartzite known in the Morenci district approximately 19 miles to the northeast. However, the grading of the pipe-like granular quartz occurrence into distinctly intrusive quartz rich dikes plus an identical megascopic appearance to a number of similar occurrences of essentially pure quartz pipes known in the Andes of South America leads me to believe that the granular quartz is intrusive. However, if petrographic study shows welded fringes between rounded or semi-rounded grains, these may well be remnants of quartzite that have been intruded and partially assimilated furnishing the quartz to the quartz rich dikes. The question is academic as no significant change in alteration or mineralization appear to be associated with the granular quartz pipes.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties of Tertiary dikes.

Structurally, the northwest trending normal Butte fault passes approximately 1,500 feet southwest of the southwestern corner of the claim block.

This fault has dropped the Tertiary basalt (Tb) to Cretaceous andesite and Tertiary quartz diorite unconformity from an elevation of 5,300 feet some two miles north of the property to an elevation of 3,800 feet, 1,500 feet southwest of the claim group. Considering a northerly dip of 10 degrees for the unconformity as displayed to the northwest, an offset of 2,000 feet is indicated. This may



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not all be on the Butte fault as there could be a number of parallel offsetting normal faults between the two control points on the unconformity. However, detailed air photo interpretation indicates no other single northwest structure as strong as the Butte fault, and it appears the major amount of the 2,000 foot offset is on the Butte fault.

The Butte fault is offset with a right hand throw of 800 feet just at the southern border of the map. The down thrown block west of the Butte fault both northwest and southeast (off of the map to the south) of the offset has Tertiary basalt resting directly upon quartz diorite. The actual unconformity is not visible so that it is not known if the basal sandstone and conglomerate unit (Tbb) is present.

To the northwest, along the western boundary of the map, Tertiary basalt in the hanging wall of the Butte fault is found within 50 feet of Cretaceous lower andesite in two different washes. The actual Butte fault is nowhere observable in the map area. Its trace, however, is very clear on the air photos and the aforementioned 800 foot right hand offset is based on air photo interpretation.

At least in the area of the Lone Star quartz diorite stock there appears to be no material change in the quartz diorite on either side of the fault. It continues to be only mildly kaolinized and chloritized with minor mineralization on dikes west of the fault as it is to the east.

ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It occurs through most of the northwestern portion of the claim block.



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Approximately 1,000 feet east of the northeast corner of the claims, the andesite is thoroughly altered by swarms of intruding quartz diorite and acid volcanic dikes. Many shears within this area of andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible. One strong shear forming a quartz diorite to lower andesite contact 1,300 feet east of the northeast corner of the claim group displays minor copper oxides, principally as chrysocolla. A small 30 foot adit has prospected the mineralized shear. A second occurrence of copper oxides is approximately 250 feet west of the southwest corner of the claims. Host here is a Tertiary quartz latite dike intruding Tertiary quartz diorite. Intense silicification and sericitization is restricted to within a few feet of the dike. The zone is explored by a shaft some 100 or more feet deep and an adit just at the western claim boundary follows the dike to the southwest.

Both of these occurrences are in all probability fringing mineralization out from the Kennecott orebody; some 7,000 to 12,000 feet to the northeast.

Away from dikes or mineralization such as along the western claim boundary and the central portion of the claims, the andesite is only mildly altered. It contains the pervasive epidote development, although not to the degree of the upper andesite to the northwest of the claim block. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

Some fine grain distinctly black biotite is apparent in porphyritic andesite near the copper oxides some 3,500 feet north of the northeast corner of the

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claim and off of the map. Other than this, no biotization of the degree described by Kennecott (10 to 50% of the rock) of the andesite was found in the area. This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the andesite is relatively unaltered as compared with the reported alteration at the Kennecott orebody.

The quartz diorite is only mildly altered by kaolinization and chloritization. The many later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the quartz diorite, 20-30 feet on either side of the dike. The mineralized contact zone northeast of the claim group with swarms of these dikes has created strongly a altered zone up to 500 feet wide in the quartz diorite and quartz diorite to lower andesite contact.

EXPLORATION & DEVELOPMENT RECOMMENDED

Lack of intense alteration of the type known to be associated with mineralization at the Kennecott orebody and thought to be duplicated at both the San Juan and Phelps Dodge properties, indicates that the Bardwell group claims are well away from a center of mineralization. In all probability the mild alteration and mineralization controlled on Tertiary dikes in the northeast shear zone are fringing mineralization along strike to the southwest from the Kennecott orebody, some 7,000 to 12,000 feet east of the two known shows of copper oxide in the Bardwell claim area.

The possibility exists that the source of the mild alteration and mineralization

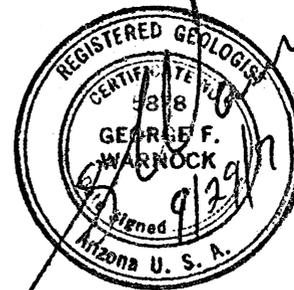


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found in the Bardwell area is at depth. If so, a Kennecott type orebody would have to be some 4,000 to 6,000 feet in depth not to display more alteration on the surface.

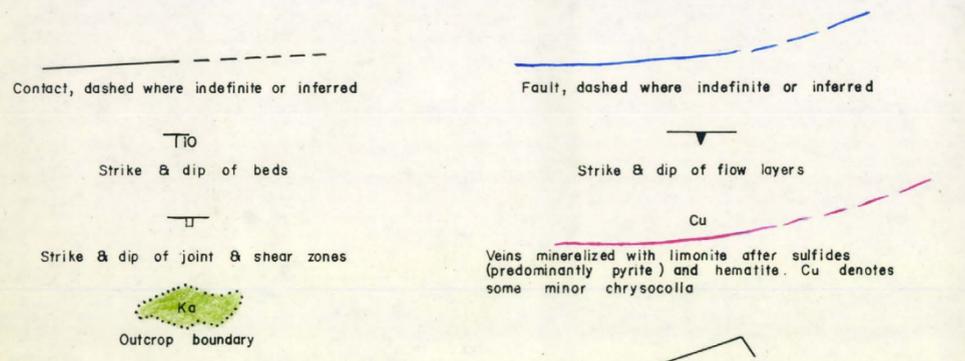
The probability of this hypothesis over that of the Kennecott orebody being the source of mineralization is thought highly unlikely; to the degree that no deep drilling can be recommended.

The claims are, however, centrally located in the district and should be maintained as long as a serious land position is held by Essex.



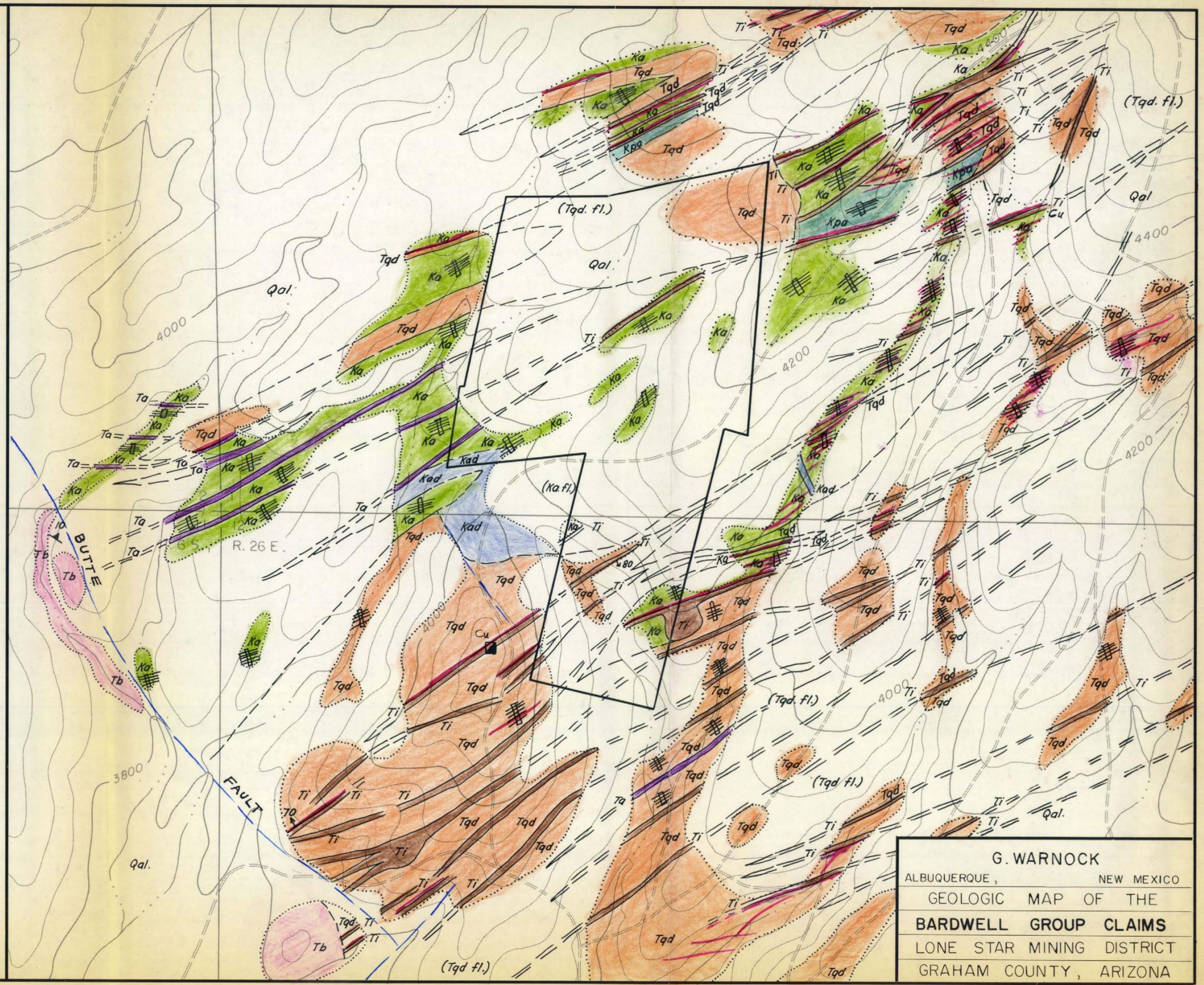
EXPLANATION

- | | | | |
|------------|---|--|----|
| Quaternary | Qal (Tqd. fl.) (Ka. fl.) (Kaa. fl.) | | |
| | Qal, alluvium | | |
| | (Tqd. fl.) predominantly Tertiary quartz diorite float. | | |
| | (Ka. fl.) predominantly lower Cretaceous andesite float. | | |
| | (Kaa. fl.) predominantly upper Cretaceous andesite float. | | |
| Tertiary | Tbb | Ti Td | Tb |
| | Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics. | Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff. | |
| | | Tqm Tqd | |
| | Tqm, quartz monzonite. | Tqd, quartz diorite. | |
| Cretaceous | Kad | | |
| | Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary. | | |
| | Kaa | | |
| | Kaa, upper andesite predominantly agglomerate. | | |
| | Ka Kpa | | |
| | Ka, lower andesite. | | |
| | Kpa, lower porphyritic. | | |



Topographical base, USGS advance sheet,
Safford NW, Graham County,
Arizona, 1:24,000

Scale 1" = 500'
Contour Interval 40'



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 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
BARDWELL GROUP CLAIMS
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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File No. 103-001-011

Report No. 71-4

Contract No.

Date September 30, 1971

BIG BEN GROUP & LEAD HILL CLAIMS

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Big Ben Group and Lead Hill claims straddle the Butte fault, the major northwest trending normal fault of this area. The Butte fault has approximately 2,000 feet vertical offset and probably a minimum of 1,000 feet left handed horizontal offset. It is in turn offset some 800 feet by a northeast trending structure northeast of the claim group.

Tertiary quartz diorite on both sides of the Butte fault is relatively unaltered as is also Cretaceous lower andesite in the hanging wall of the fault. The lower andesite is host for known mineralization in this district and its lack of alteration foregoes a reasonable possibility for a porphyry type copper orebody in the footwall of the Butte fault in the claim area.

The favorable lower andesite to quartz diorite contact is buried in the hanging wall of the fault but the structural interpretation of the area indicates that the favorable contact should be off of the claim block to the south.

Based on the above interpretation, no further work can be recommended on the claims. They should, however, be maintained in good standing as long as Essex continues to hold a major land position in the district.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, one day was spent geologically mapping the Big Ben Group & Lead Hill claims on August 29, 1971. Additionally, two days were spent in office compilation and drafting of the geological map and report.



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Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately nine miles northeast of Safford, Arizona. This is in Graham County in Township 6 south, Range 26 east, section 12. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International, Inc. and these also were not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are four claims comprising the group. These are the

1. Big Ben Group No. 1
2. Big Ben Group No. 2
3. Lead Hill No. 1
4. Lead Hill No. 2

all of which are contiguous.

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BIG BEN GROUP & LEAD HILL CLAIMS

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located two miles northwest of the claim group has had production to date. This was negligible up to recent development by Producer Minerals company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton copper orebodies. The Kennecott Deposit is two miles northeast of the claim group and the Phelps Dodge orebody is three miles northwest of the claim block.

PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is principally on the upper pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography, although without major elevation differences.

The elevation on the claim group varies from 3,500 to 3,950 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite,

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BIG BEN GROUP & LEAD HILL CLAIMS

graniodiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes, along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are

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BIG BEN GROUP & LEAD HILL CLAIMS

CL

reported to decrease laterally along the shear zone from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Big Ben Group & Lead Hill claims are located on the southern margin of a quartz diorite stock or plug called the Lone Star stock by Kennecott geologists and dated as early Tertiary. It is mapped as Tqd (see attached map).

This stock is clearly controlled along a strong zone of shearing that strikes northeast directly into the Kennecott orebody approximately 10,000 feet northeast of the northeast corner of the claim group. All margins of the stock, with the exception of the southwest which is faulted, become dike zones striking N50E to

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BIG BEN GROUP & LEAD HILL CLAIMS

N80E through the sheared andesite country rock. In fact, the northwest margin is approximately equal parts quartz diorite dikes and andesite. The first of these sheared remnants of andesite show up in the northwest corner of the claim group; however, numerous wide dikes and zones of quartz diorite continue to occur in an area 1,500 to 2,000 feet northwest of the northwest corner of the claim group.

To the northeast, along strike of the shear zone, the quartz diorite stock is uninterrupted for approximately 7,000 feet northeast of the claim group where elongated remnants of andesite again appear within the quartz diorite.

The quartz diorite stock in the Big Ben Group & Lead Hill area intrudes an andesite dated by Kennecott as Cretaceous and separated into upper and lower units.

The upper unit is distinguished by its agglomeritic fabric. It does not crop out in the claim group area and the closest outcrop being approximately 10,000 feet to the northwest. At that point, it is approximately 1,000 feet thick. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz diorite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the

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BIG BEN GROUP & LEAD HILL CLAIMS

detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. As a matter of fact, the distinction between it and the porphyritic fabric developed by alteration near the intrusive is strictly a question of field relationship. This unit also does not crop out in the claim area but is known to both the north and northeast of the map borders.

An older, apparently premineral, set of andesitic and dacitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz diorite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad). No Cretaceous andesite dikes are known in the immediate vicinity of the claim group.

The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and a white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter is also present.

The dikes in several instances grade imperceptible into pipe-like zones of

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BIG BEN GROUP & LEAD HILL CLAIMS

essentially pure granular quartz. One of these is located approximately 1,500 feet north of the northwestern claim corner intruding quartz diorite.

Kennecott has mapped these occurrences as xenoliths of Cambrian quartzite, probably the Coronado Quartzite known in the Morenci district approximately 19 miles to the northeast. However, the grading of the pipe-like granular quartz occurrence into distinctly intrusive quartz rich dikes plus an identical megascopic appearance to a number of similar occurrences of essentially pure quartz pipes known in the Andes of South America leads me to believe that the granular quartz is intrusive. However, if petrographic study shows welded fringes between rounded or semi-rounded grains, these may well be remnants of quartzite that have been intruded and partially assimilated furnishing the quartz to the quartz rich dikes. The question is academic as no significant change in alteration or mineralization appear to be associated with the granular quartz pipes.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties.

The Big Ben Group and Lead Hill claims are straddled by the northwest trending, normal Butte fault. This fault has dropped the Tertiary basalt (Tb) to Cretaceous andesite and Tertiary quartz diorite unconformity from an elevation of 5,300 feet some three miles north of the property to an elevation of 3,800 feet in the claim area. Considering a northerly dip of 10 degrees for the unconformity as displayed to the northwest, an offset of 2,000 feet is indicated. This may not all be on the Butte fault as there could be a number of parallel offsetting normal faults between the two control points on the unconformity. However,

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BIG BEN GROUP & LEAD HILL CLAIMS

detailed air photo interpretation indicates no other single northwest structure as strong as the Butte fault, and it appears the major amount of the 2,000 foot offset is on the Butte fault.

The Butte fault is offset with a right hand throw of 800 feet just northwest of the claim group corner. The down thrown block west of the Butte fault both northwest and southeast of the offset has Tertiary basalt resting directly upon quartz diorite. The actual unconformity is visible only on the western slope of Corn Cob Mountain some 1,000 feet west of the western boundary of the claims.

To the northwest, just off of the map, Tertiary basalt in the hanging wall of the Butte fault is found within 50 feet of Cretaceous lower andesite in two different washes. The actual Butte fault is nowhere observable in the map area. Its trace, however, is very clear on the air photos and the aforementioned 800 foot right hand offset is based on air photo interpretation.

Outcrop and predominant float indicate that Cretaceous lower andesite is present on the foot wall of the Butte fault from the northwest corner of the claim all along the northern boundary. The hanging wall in this same area is Tertiary quartz diorite. The extreme interfingering of quartz diorite and lower andesite on the margins of the stock does not allow one to assume a horizontal element of offset even though different rock types apparently abutt each other across the fault. However, this could represent an offset and if so, it would be a minimum of 1,000 feet horizontal throw with left hand movement.

At least in the area of the Lone Star quartz diorite stock there appears to be no material change in the quartz diorite on either side of the fault. It continues to be only mildly kaolinized and chloritized with minor mineralization on dikes west of the fault as it is to the east.

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BIG BEN GROUP & LEAD HILL CLAIMS

ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It occurs only on the northern and eastern fringes of the claim block where the southwest margin of the Lone Star stock is approached north of the Butte fault.

In this area the lower andesite is altered by intruding quartz diorite and volcanic dikes. Many shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible. The only copper mineralization known in this area is approximately 2,600 feet north of the claim group off of the map.

Away from dikes or mineralization such as in the far southeast corner of the property, the andesite is only mildly altered. It contains the pervasive epidote development, although not to the degree of the upper andesite to the northwest of the claim block. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

No biotization of the degree described by Kennecott (10 to 50% of the rock) of the andesite was found in the area. This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the andesite is relatively unaltered as compared with the reported alteration at the Kennecott orebody.

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BIG BEN GROUP & LEAD HILL CLAIMS

The quartz diorite is only mildly altered by kaolinization and chloritization. The many later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the quartz diorite, 20-30 feet on either side of the dike, but these are restricted in occurrence on both sides of the Butte fault in the claim area.

EXPLORATION & DEVELOPMENT RECOMMENDED

The Big Ben Group and Lead Hill claims straddle the Butte fault resulting in a markedly different geological situation on either side of the fault. To the northeast of the fault outcropping Tertiary quartz diorite and Lower Cretaceous andesite are only mildly altered except along Tertiary dikes. This indicates that this area is well out from any source of a Kennecott type orebody. The depth factor is unknown but if an orebody did exist in depth in this general area, it would have to be predicted to occur to the north of the claims and map area where slightly more intense alteration and mineralization are present.

No further work is recommended for the footwall zone of the Butte fault on the Big Ben Group and Lead Hill claims.

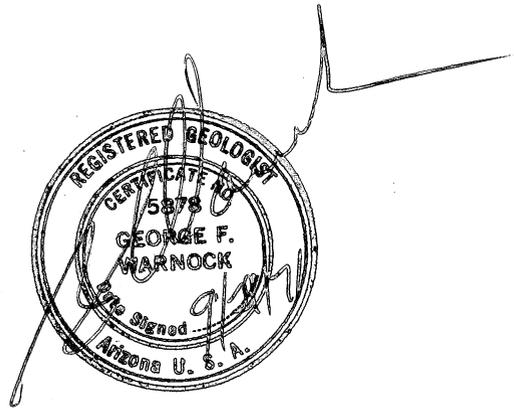
The hanging wall zone is occupied by relatively unaltered Tertiary quartz diorite and post mineral Tertiary basalt. The contact of favorable lower andesite to quartz diorite is buried south of the fault but might occur somewhere near the southern border of the claims. However, assuming some horizontal throw with left hand movement across the fault, the andesite contact could only be from about the southern border of the claim and further south. While this ground south of the claims area cannot be eliminated without deep probing, the claim group itself is

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BIG BEN GROUP & LEAD HILL CLAIMS

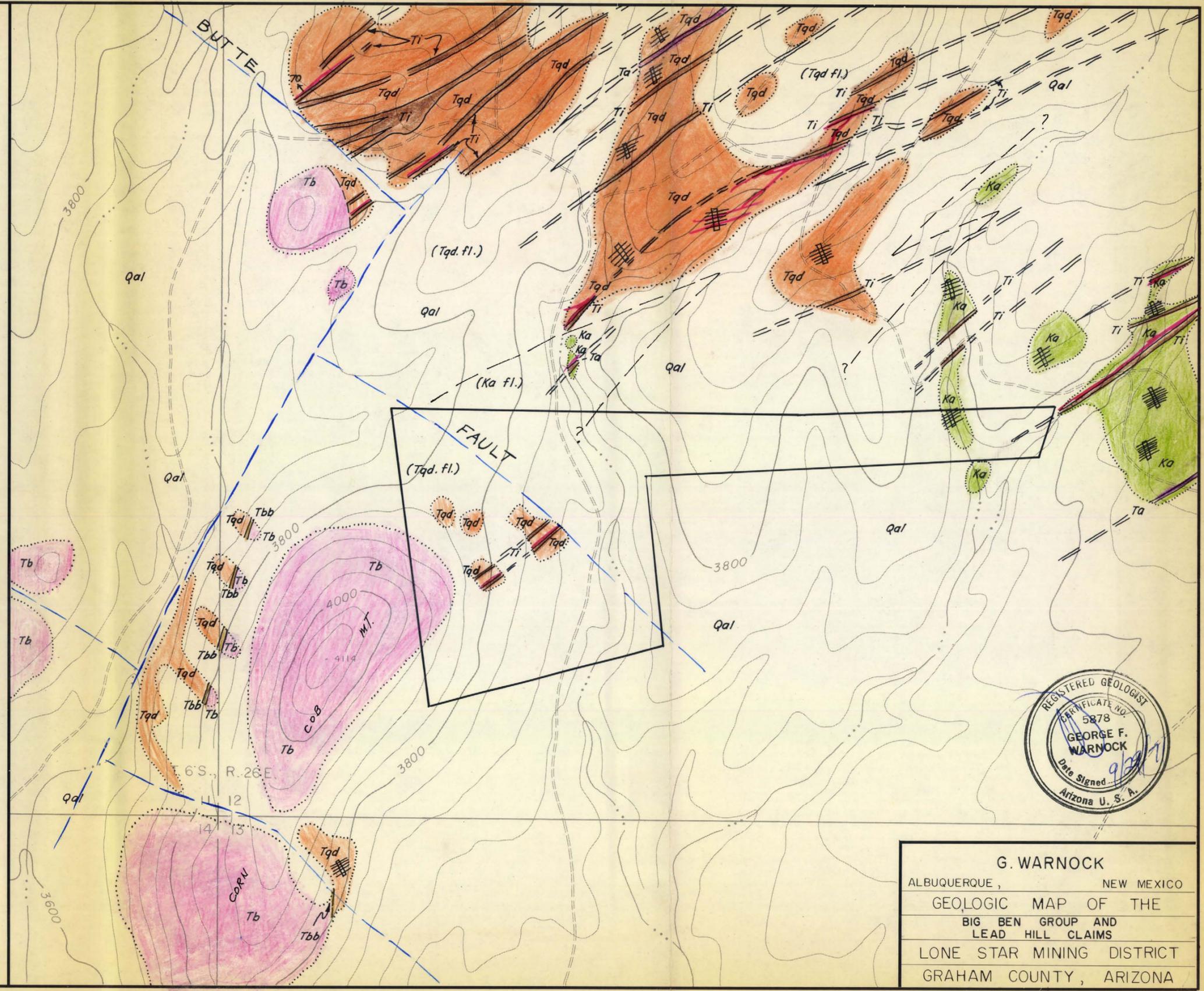
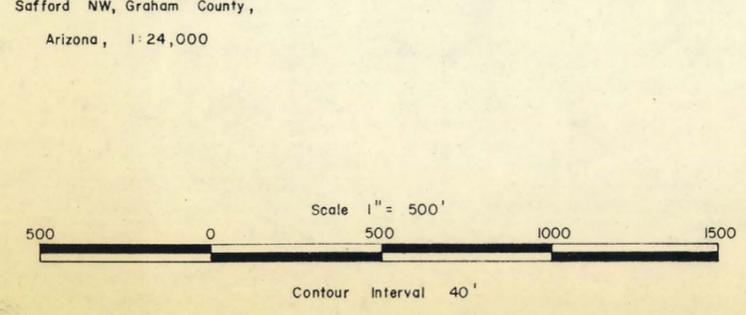
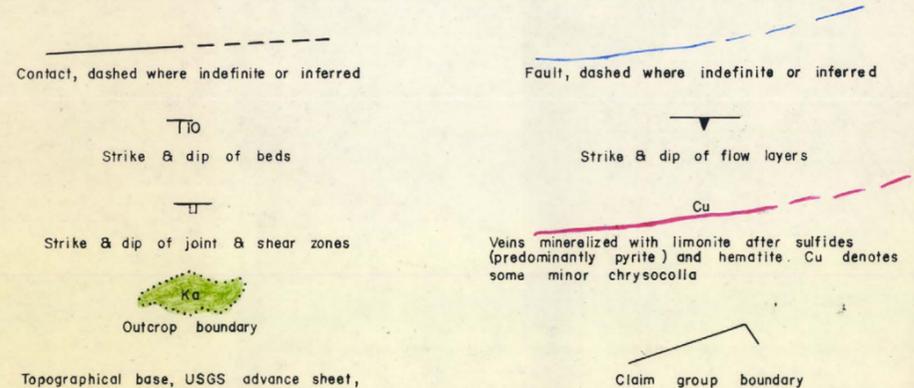
located north of the most favorable area on the hanging wall of the Butte fault.
Therefore, no further work is recommended on the hanging wall portion.

In summary, the claims should be held as long as Essex has a major land holding in the district, at the minimum necessary cost.



EXPLANATION

- | | | | | |
|------------|---------------|--|--|---|
| Quaternary | Qal, alluvium | (Tqd. fl.) predominantly Tertiary quartz diorite float. | (Ka. fl.) predominantly lower Cretaceous andesite float. | (Kaa. fl.) predominantly upper Cretaceous andesite float. |
| | Tbb | Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff. | Td, andesite and dacite. | |
| | Tqm, Tqd | Tqm, quartz monzonite. | Tqd, quartz diorite. | |
| | Kad | Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary. | | |
| Tertiary | | | | |
| | | | | |
| Cretaceous | | | | |
| | | | | |



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 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
 BIG BEN GROUP AND
 LEAD HILL CLAIMS
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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File No. 103-001-011

Report No. 71-5

Contract No.

Date October 1, 1971

KEY & KEYSTONE GROUP

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Key & Keystone group of claims are occupied by a Cretaceous andesite which has been separated into an upper agglomeritic unit and a lower unit. The lower unit is the host to known copper mineralizations in this district.

The lower unit crops out through the southwest portion of the claims but is relatively unaltered and thus does not indicate porphyry copper type mineralization near surface in this area.

The overlying upper agglomeritic unit varies in thickness from 0 to 400 feet within the claim boundaries and obtains a thickness of 1,000 feet some 2,000 feet east of the claim block. It also is generally unaltered with the exception of a pervasive epidotization which is thought to be deuteric and one zone of intrusive volcanic pipes some 2,000 feet east of the property line that shows an intensely altered and somewhat mineralized area approximately 800 to 900 feet in diameter.

These pipe-like volcanic intrusives occur at the intersection of two different northeast trending structural zones which contain the Roper adit and Ben Hur mine mineralization. The area is considered favorable for a small porphyry copper type target to exist in depth in the lower andesite some 1,000 to 2,000 feet below outcrop.

It is recommended that detailed mapping of the area, particularly the east slope of the north-south ridge in this area--down to the Ben Hur mine, be continued. If alteration and mineralization continue as far as the Ben Hur property, the prospect would be judged worthy of follow up work, resulting ultimately in drilling of 2,000 foot holes if justified by the step by step work.



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KEY & KEYSTONE GROUP

The Ben Hur claims should be optioned with free time prior to the mapping as Kennecott and others appear to be watching Essex's actions closely. However, if free time cannot be had, I would map the Ben Hur area in detail prior to putting out front money.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, 1.5 days were spent geologically mapping the Key & Keystone claim group from August 24 to 25, 1971. Additionally, three days were spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The claims are located in the Lone Star Mining District approximately eleven miles northeast of Safford, Arizona. This is in Graham County in Township 5 south, Range 26 east, sections 35 and 36. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the claim block proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claims was made. The location and configuration of the claims was supplied by Essex International,

B

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KEY & KEYSTONE GROUP

Inc. and these also were not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

Based on Essex International, Inc's. property maps, there are ten claims comprising the group. These are the

1. Key No. 1
2. Key No. 2
3. Key No. 3
4. Key No. 4
5. Key No. 5
6. Key No. 6
7. Key No. 7
8. Key No. 8
9. Keystone No. 1
10. Keystone No. 2

all of which are contiguous.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located one mile southwest of the Key & Keystone claim group has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton orebodies. The Kennecott Deposit is two miles southeast of the claim group and the Phelps Dodge orebody is two miles west of the claim block.

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KEY & KEYSTONE GROUP

PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains well above the pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography with major elevation differences in this local area.

The elevation on the claim group varies from 4,260 to 4,750 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, granodiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes along with mineralization and alteration. Strong shear zones conform to this direction as do a number of



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offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the



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rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Key & Keystone group is located on and near the contact of an upper agglomeritic andesite and a lower non-agglomeritic andesite.

The upper unit is distinguished by its agglomeritic fabric. It crops out in the main portion of the claim group area. The upper unconformable contact is approximately 2,000 feet east of the claim group. It is approximately 1,000 feet thick in the claim area. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz monzonite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric

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developed by alteration near intrusives is strictly a question of field relationship.

An older, apparently premineral, set of andesitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz monzonite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).

Quartz monzonite intrudes both andesite units as dikes and one small plug like occurrence approximately 2,000 feet east of the claim group.

This quartz monzonite contains decidedly less mafic minerals and tends to be coarser grained than the Lone Star quartz diorite stock some 5,000 feet south of the claims. The mineralized quartz monzonite dike cutting the east property line is even pegmatitic in places.

The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and a white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter also occurs.

The Tertiary acid dikes in two occasions form small pipes several hundred feet in diameter. These are both located some 2,000 feet east of the property and appear to be at the intersection of a N70-75°E and N45°E set of shears and subsequent dikes.



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Intense alteration of these pipes and the dikes around them make megascopic identification of the rock type tenuous, but they are probably white quartz latite.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties.

Structurally, the claim area is on the strike of the northeast trending San Juan shear zone in which the San Juan orebody is located some 5,000 feet southwest of the property.

This shear zone has two predominant trends, N70-75°E and N45°E. Dikes occupying both directions can be seen to intersect in some instances. Strong shearing in the upper agglomeritic andesite seems to favor the N70-75°E direction and may be so intense that individual shears will occur within inches of each other.

ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It crops out only in the southwest portion of the claim block but no doubt underlies the whole area below the upper andesite.

In this area the lower andesite is thoroughly altered only where intruded by quartz monzonite and volcanic dikes. A few shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible.

Away from dikes or mineralization such as along the western border of the property, the andesite is only mildly altered. It contains the pervasive epidote

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development, although not to the degree of the upper andesite. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

Some very minor fine grain distinctly black biotite is apparent in the lower andesite near mineralized dikes. However, not even these areas approach the degree of biotization described by Kennecott (10 to 50% of the rock). This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the lower andesite where cropping out is relatively unaltered as compared with the reported alteration at the Kennecott and San Juan orebodies.

The quartz monzonite is only mildly altered by kaolinization, orthoclazation, and chloritization. The later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the country rock 20-30 feet on either side of the dike. At the previously mentioned two quartz latite pipes some 2,000 feet east of the property, sericitization and silicification of the quartz latite has all but obscured the rock. This alteration and mineralization has formed a zone some 800 to 900 feet wide of quite intense alteration and mineralized shears. However, the upper agglomeritic andesite host in this area is strongly chlorized and propylized with no evident development of secondary biotite.

With the exception of the above mentioned occurrence, the upper agglomeritic andesite is only mildly altered by chloritization and propylization. It does, however, display a pervasive content of epidote, relatively much more than any other rock type in the area, including the lower andesite. The epidote is found

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both on fractures and disseminated through the rock as both fine and coarse grained blebs. The preponderance of epidote in the upper agglomeritic andesite with apparently little control by later alteration or mineralization leads me to believe that it is probably deuteric. If so, it has been remobilized and redeposited on later fractures.

It is interesting to note that while the acid Tertiary dikes altered the upper andesite extensively, the quartz monzonite plug approximately 1,000 feet south of the volcanic plugs has only slightly altered the andesite within a few feet of the contact and is itself only mildly kaolinized and chloritized.

Two zones of mineralization are known east of the claim block, these are the Roper adit where a tunnel has been driven on a mineralized quartz latite dike and the Ben Hur property to the east which was not mapped.

EXPLORATION & DEVELOPMENT RECOMMENDED

The only serious alteration and mineralization in this area is at the two volcanic pipes some 2,000 feet east of the property line.

Away from this area, alteration is so mild or non-existent in the upper agglomeritic andesite as to indicate that the favorable lower andesite horizon, from 0 to 1,000 feet below outcrop, is also likely to be only mildly altered. At the eastern claim boundary, the upper andesite is only approximately 400 feet thick--this certainly is too thin a section to hide pervasive alteration at the top of the underlying lower andesite unit.

Of course, a yet deeper alteration and mineralization could exist under the claim area but based on the known orebody geology, it would have to be 4,000 to 6,000 feet deep not to show serious alteration at the surface.

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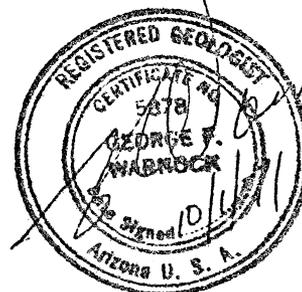
The area of the two volcanic pipes east of the claim block is considered worthy of further detailed work. This small intensely altered area of volcanic pipes and shear type mineralization occurs at the intersection of two northeast trending structural zones which contain known copper mineralization at the Roper adit (700 feet east of the eastern property line) and at the Ben Hur property some 2,500 feet east of the property line.

The volcanic pipes are clearly the center of a small mineralized altered area, and in fact, are on strike along the northeast trending San Juan shear zone. It is possible that this mineralized zone may be more extensive in the lower andesite which would be at least 1,000 feet deep at this locality.

Negative features are restricted size of the alteration zone, and its being restricted closely to the actual volcanic pipes and dikes.

It is recommended that the Ben Hur group be acquired on a free time option basis to give a contiguous block of claims with the Key and Keystone and Soto State lease. This should be followed by additional detailed mapping, particularly on the east slope of the ridge held up by the pipes toward the Ben Hur property, an area that was not covered in this project. If the mineralization and alteration can be shown to extend as far as the Ben Hur property, the area would be a serious target for a small porphyry type deposit at a depth of 1,000 to 2,000 feet, perhaps similar to the San Juan.

If the Ben Hur group cannot be obtained with free time, I would recommend the detailed mapping in any case--this to form a base for the decision to lay out front money for the group.



Essex Cultural Copy

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File No. 103-001-011

Report No. 71-6

Contract No.

Date October 1, 1971

SOTO STATE LEASE

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

The Soto State lease is occupied by a Cretaceous andesite which has been separated into an upper agglomeritic unit and a lower unit. The lower unit is the host to known copper mineralizations in this district.

The lower unit crops out only on the southwest corner of the lease and is relatively unaltered; thus, it does not indicate porphyry copper type mineralization near surface in this area.

The overlying upper agglomeritic unit varies in thickness from 0 to 250 feet within the lease boundaries and obtains a thickness of 1,000 feet some 1,200 feet east of the lease. It also is unaltered with the exception of a pervasive epidotization which is thought to be deuteric; and one zone of intrusive volcanic pipes some 1,200 feet northeast of the northeast corner that shows an intensely altered and somewhat mineralized area approximately 800 to 900 feet in diameter.

These pipe-like volcanic intrusives occur at the intersection of two different northeast trending structural zones which contain the Roper adit and Ben Hur mine mineralization. The area is considered favorable for a small porphyry copper type target to exist in depth in the lower andesite some 1,000 to 2,000 feet below outcrop.

It is recommended that detailed mapping of the area, particularly the east slope of the north-south ridge in this area--down to the Ben Hur mine be continued. If alteration and mineralization continue as far as the Ben Hur property, the prospect would be judged worthy of follow up work, resulting ultimately in drilling of 2,000 foot holes if justified by the step by step work.

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The Ben Hur claims should be optioned with free time prior to the mapping as Kennecott and others appear to be watching Essex's actions closely. However, if free time cannot be had, I would map the Ben Hur area in detail prior to putting out front money.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, one half day was spent geologically mapping the Soto State lease on August 25, 1971. Additionally, one day was spent in office compilation and drafting of the geological map and report.

Emphasis was predominantly on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. The geology was subsequently plotted at 1" = 500' to increase readability and presentation.

LOCATION & ACCESSIBILITY

The lease is located in the Lone Star Mining District approximately eleven miles northeast of Safford, Arizona. This is in Graham County in Township 5 south, Range 26 east, section 36. Access is via the Safford Municipal Airport road to the San Juan road to jeep trails onto the lease proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the lease was made. The location and configuration of the lease was supplied by Essex International,

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Inc. and this also was not checked. Numerous claim posts were found in the field but no attempt was made to correlate these with legal description.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located one mile southwest of the Soto State lease has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimillion ton orebodies. The Kennecott Deposit is two miles southeast of the lease and the Phelps Dodge orebody is two miles west of the lease.

PHYSICAL FEATURES

The lease area is on the southwest flank of the northwest trending Gila Mountains well above the pediment of this range which is deeply dissected by washes, commonly down to bed rock, creating rugged, local topography with major elevation differences in this local area.

The elevation on the lease varies from 4,550 to 4,800 feet and climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous



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andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniordiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are

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reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strong alteration of andesite is reportedly biotitization. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous andesite and may in fact be principally deuteric, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

The Soto State lease is located on the contact of an upper agglomeritic andesite and a lower non-agglomeritic andesite.

The upper unit is distinguished by its agglomeritic fabric. It crops out in the main portion of the lease area. The upper unconformable contact is approximately 1,200 feet east of the lease. It is approximately 1,000 feet thick. Kennecott, however, has reported thickness of 2,700 feet for the unit. In the detailed mapping, the unit is designated as Cretaceous agglomeritic andesite (Kaa). Its only distinguishing feature megascopically from the lower unit is its agglomeritic fabric. Otherwise, they appear identical with a fine grain dense ground



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mass varying from green to dark blackish green depending on relative distribution of mafic minerals.

Either the upper or lower unit may be porphyritic, particularly near dikes and mineralized shears, where the andesite on occasion grades from porphyritic andesite to quartz monzonite of a fairly coarse grain fabric.

Additionally, the lower unit designated as Cretaceous andesite (Ka) in the detailed mapping has a porphyritic zone near its upper boundary that appears to be an original feature of the rock. This unit is designated Cretaceous porphyritic andesite (Kpa) in the mapping. However, the validity of this as a distinct flow is open to question. The distinction between it and the porphyritic fabric developed by alteration near intrusives is strictly a question of field relationship.

An older, apparently premineral, set of andesitic dikes cut both the upper and lower andesites. They are in turn cut by the Tertiary quartz monzonite and all subsequent intrusive dikes. They are mapped as Cretaceous andesitic dikes (Kad) and are generally a denser, darker rock megascopically than the andesitic flows. They are very similar in the field to the basic Tertiary dikes (Ta), and unless field relationships indicate that the dike in question is pre-Tertiary (by being cut by Tertiary intrusives), it is mapped as a basic Tertiary intrusive (Ta) rather than the Cretaceous andesitic dike (Kad).

Quartz monzonite intrudes both andesite units as dikes and one small plug like occurrence approximately 1,000 feet east of the lease.

This quartz monzonite contains decidedly less mafic minerals and tends to be coarser grained than the Lone Star quartz diorite stock some 5,000 feet south of the lease. The mineralized quartz monzonite dike at the northwest corner of the property is even pegmatitic.



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The later Tertiary dikes have been separated into two groups, acid to intermediary and basic.

The acid to intermediate group (Ti) consists of most of the common variations in this general category with a predominance for the acid end. Thus rhyolite and white quartz latite predominate. Bull quartz dikes occur within the acid dikes and appear to be intruded rather than vein quartz although the latter also occurs.

The Tertiary acid dikes in two occasions form small pipes several hundred feet in diameter. These are both located some 1,200 feet northeast of the property and appear to be at the intersection of a N70-75°E and N45°E set of shears and subsequent dikes.

Intense alteration of these pipes and the dikes around them make megascopic identification of the rock type tenuous but they are probably white quartz latite.

The other type of Tertiary dike is basic andesite or dacite (Ta), the latter commonly with a few rounded, glassy quartz phenocrysts. No distinction has been made in age between the acid and basic varieties.

Structurally, the lease area is on the strike of the northeast trending San Juan shear zone in which the San Juan orebody is located some 5,000 feet southwest of the property.

This shear zone has two predominant trends, N70-75°E and N45°E. Dikes occupying both directions can be seen to intersect in some instances. Strong shearing in the upper agglomeritic andesite seems to favor the N70-75°E direction and is so intense that individual shears will occur within inches of each other.

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ALTERATION & MINERALIZATION

According to Kennecott, their orebody is contained in the lower Cretaceous andesite where intruded by swarms of Tertiary dikes. The lower andesite is thus a prime target in this area. It crops out only in the southwest corner of the lease but no doubt underlies the whole area below the upper andesite.

In this area the lower andesite is thoroughly altered only where intruded by quartz monzonite and volcanic dikes. A few shears within the andesite are also mineralized with limonite, hematite and gouge. Relic pyrite casts are sometimes discernible.

Away from dikes or mineralization such as at the southwest corner of the property, the andesite is only mildly altered. It contains the pervasive epidote development, although not to the degree of the upper andesite. It generally displays fine grained green to greenish black secondary chlorite. Much of this chlorite tinges on black but if any discernible green tint can be megascopically determined it is classed as chlorite rather than biotite alteration.

Some very minor fine grain distinctly black biotite is apparent in the lower andesite near mineralized dikes. However, not even these areas approach the degree of biotization described by Kennecott (10 to 50% of the rock). This leads to the inescapable conclusion that apart from the previously described dike and shear zones, the lower andesite where cropping out is relatively unaltered as compared with the reported alteration at the Kennecott and San Juan orebodies.

The quartz monzonite is only mildly altered by kaolinization, orthoclazation and chloritization. The later intrusive dikes and mineralized shears commonly display thin (sometimes only a few inches) strong zones of silicification and

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sericitization along the margin of the dikes or shears. Stronger acid volcanic dikes severely alter the country rock 20-30 feet on either side of the dike. At the previously mentioned two quartz latite pipes some 1,200 feet east of the property; sericitization and silicification of the quartz latite has all but obscured the rock. This alteration and mineralization has formed a zone some 800 to 900 feet wide of quite intense alteration and mineralized shears. However, the upper agglomeritic andesite host in this area is strongly chloritized and propylized with no evident development of secondary biotite.

With the exception of the above mentioned occurrence, the upper agglomeritic andesite is only mildly altered by chloritization and propylization. It does, however, display a pervasive content of epidote, relatively much more than any other rock type in the area, including the lower andesite. The epidote is found both on fractures and disseminated through the rock as both fine and coarse grained blebs. The preponderance of epidote in the upper agglomeritic andesite with apparently little control by later alteration or mineralization leads me to believe that it is probably deuteric. If so, it has been remobilized and redeposited on later fractures.

It is interesting to note that while the acid Tertiary dikes altered the upper andesite extensively, the quartz monzonite plug approximately 1,000 feet south of the volcanic plugs has only slightly altered the andesite within a few feet of the contact and is itself only mildly kaolinized and chloritized.

Two zones of mineralization are known east of the lease, these are the Roper adit where a tunnel has been driven on a mineralized quartz latite dike just at the east boundary line and the Ben Hur property to the northeast which was not mapped.

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EXPLORATION & DEVELOPMENT RECOMMENDED

The only serious alteration and mineralization in this area is at the two volcanic pipes some 1,200 feet east of the property.

Away from this area, alteration is so mild or non-existent in the upper agglomeritic andesite as to indicate that the favorable lower andesite horizon, from 0 to 1,000 feet below outcrop, is also likely to be only mildly altered. At the eastern lease boundary, the upper andesite is only approximately 250 feet thick--this certainly is too thin a section to hide pervasive alteration at the top of the underlying lower andesite unit.

Of course, a yet deeper alteration and mineralization could exist under the lease area but based on the known orebody geology, it would have to be 4,000 to 6,000 feet deep not to show serious alteration at the surface.

The area of the two volcanic pipes northeast of the lease is considered worthy of further detailed work. This small intensely altered area of volcanic pipes and shear type mineralization occurs at the intersection of two northeast trending structural zones which contain known copper mineralization at the Roper adit (along the eastern property line) and at the Ben Hur property some 2,000 feet northeast of the property.

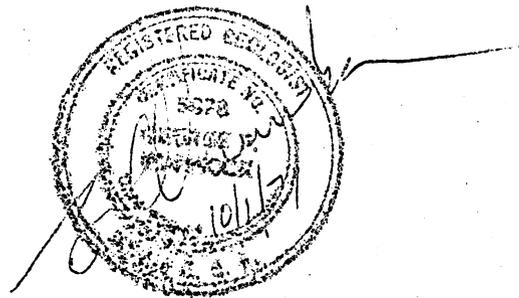
The volcanic pipes are clearly the center of a small mineralized altered area, and in fact, are on strike along the northeast trending San Juan shear zone. It is possible that this mineralized zone may be more extensive in the lower andesite which would be at least 1,000 feet deep at this locality.

Negative features are restricted size of the alteration zone, and its being restricted closely to the actual volcanic pipes and dikes.

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It is recommended that the Ben Hur group be acquired on a free time option basis to give a contiguous block of claims with the Soto State lease and the Key and Keystone claims. This should be followed by additional detailed mapping, particularly on the east slope of the ridge held up by the pipes toward the Ben Hur property, an area which was not covered in this project. If the mineralization and alteration can be shown to extend as far as the Ben Hur property, the area would be a serious target for a small porphyry type deposit at a depth of 1,000 to 2,000 feet, perhaps similar to the San Juan.

If the Ben Hur group cannot be obtained with free time, I would recommend the detailed mapping in any case--this to form a base for the decision to lay out front money for the Ben Hur group.



EXPLANATION

Quaternary

Qal (Tqd. fl.) (Ka. fl.) (Kaa. fl.)

Qal, alluvium

(Tqd. fl.) predominantly Tertiary quartz diorite float.

(Ka. fl.) predominantly lower Cretaceous andesite float.

(Kaa. fl.) predominantly upper Cretaceous andesite float.

Tertiary

Tbb

Tb

Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.

Td, andesite and dacite.

Tqm Tqd

Tqm, quartz monzonite.

Tqd, quartz diorite.

Kad

Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.

Kaa

Kaa, upper andesite predominantly agglomerate.

Ka Kpa

Ka, lower andesite.

Kpa, lower porphyritic.

Contact, dashed where indefinite or inferred

Fault, dashed where indefinite or inferred

T10

Strike & dip of beds

Strike & dip of flow layers

Strike & dip of joint & shear zones

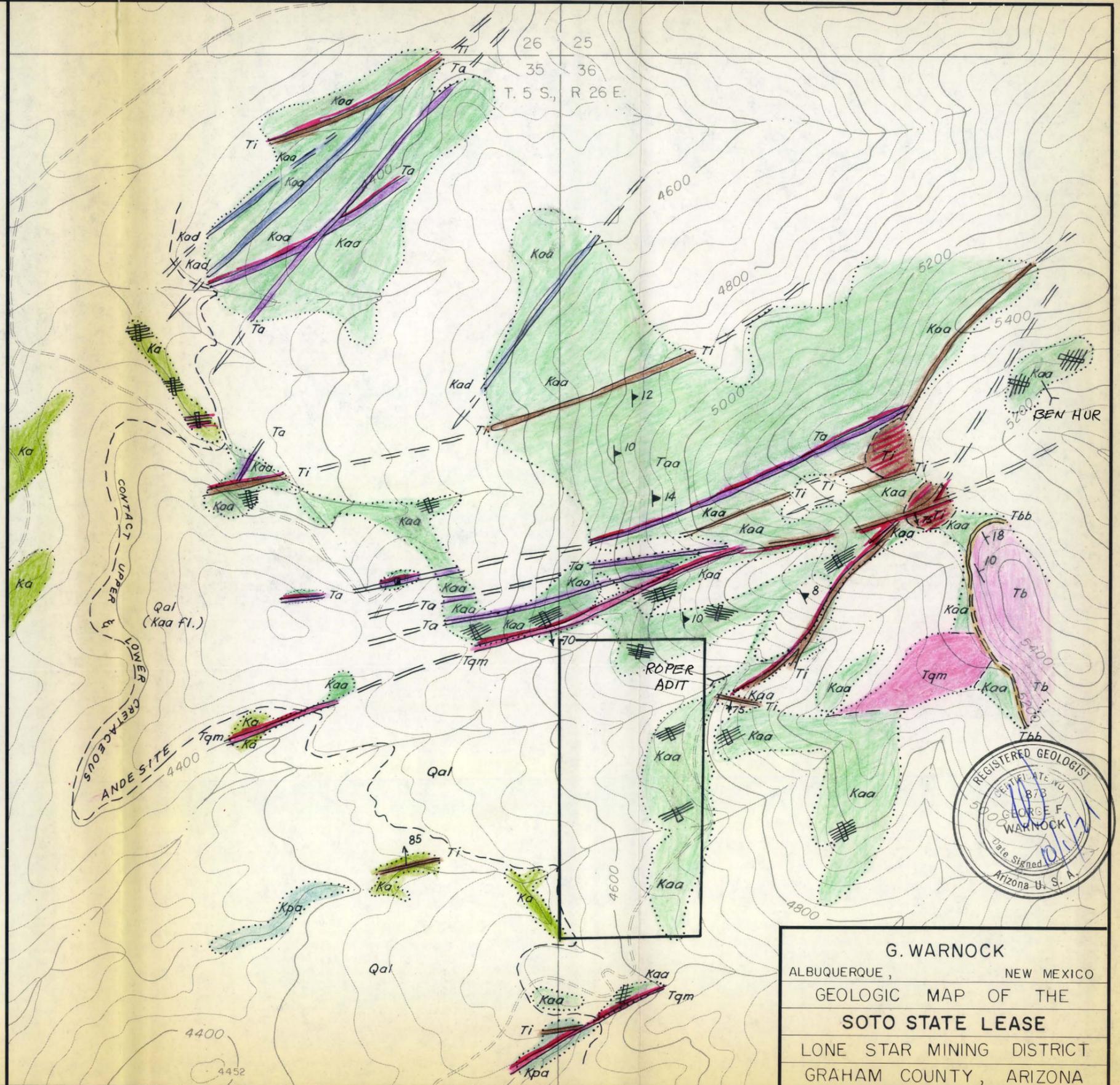
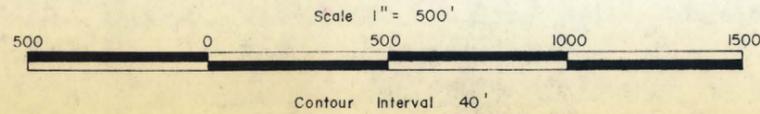
Cu

Veins mineralized with limonite after sulfides (predominantly pyrite) and hematite. Cu denotes some minor chrysocolla

Outcrop boundary

Topographical base, USGS advance sheet, Safford NW, Graham County, Arizona, 1:24,000

Claim group boundary



G. WARNOCK
 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
SOTO STATE LEASE
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA

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Report No. 71-7
Contract No.
Date October 1, 1971

BOEHIEMA 21 CLAIM

SUMMARY, CONCLUSIONS, & RECOMMENDATIONS

The Boehiema 21 claim does not display outcrop anywhere on or near the claim. However, it is only 2,000 feet north of the structurally interpreted projection of the Phelps Dodge orebody and related northeast trending shear zone west of the Butte fault. It also is only 6,000 to 7,000 feet north of the same projection of The San Juan shear zone.

The Phelps Dodge zone is projected into the south 1/2 of section 4 and the north 1/2 of section 3, T5S, R26E and the San Juan zone is projected into the south 1/2 of section 9, the north 1/2 of section 10, and the southwest 1/4 of section 2, T5S, R26E. Please refer to R. Robinson 1" = 2,000' map accompanying his report of March, 1971. Both of these zones are valid covered targets for a major porphyry copper deposit similar to the Phelps Dodge or Kennecott orebodies in this district.

A standard, covered area porphyry copper exploration program for a deep target is recommended for these two areas.

Boehiema 21's proximity to these areas indicates that it should be held as long as interest continues in the area.

SCOPE

Upon verbal agreement with Mr. Paul I. Eimon, Manager of Exploration, Essex International, Inc., Tucson, Arizona, three hours were spent investigating the Boehiema 21 claim on August 29, 1971. Additionally, one day was spent in office compilation and drafting of the map and report.



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Emphasis was to be on detailed mapping of outcropping geology at a scale of 1" = 1,000' on air photos flown specifically for this job by Coopers Aerial Surveys of Tucson, Arizona. However, no outcrop was found on or near the claim, and the investigation was restricted to theoretical consideration of the claim's location relative to known district geology.

LOCATION & ACCESSIBILITY

The claim is located in the Lone Star Mining District approximately seven miles north of Safford, Arizona. This is in Graham County in Township 6 south, Range 26 east, sections 4 and 5. Access is via Safford to the Phelps Dodge road to jeep trails onto the claim proper.

PROPERTY & OWNERSHIP

To allow the greatest possible distribution of the contracted time to be spent in geological mapping, no investigation of title to the claim was made. The location and configuration of the claim was supplied by Essex International, Inc. and these also were not checked.

HISTORY

Published data on the Lone Star Mining district indicates only the San Juan mine, located 2.5 miles due east of the Boehiema 21 claim has had production to date. This was negligible up to recent development by Producer Minerals Company, Inc. who are currently producing cement copper from oxide ore.

Since 1956, both Kennecott Copper Corporation and Phelps Dodge Corporation have reportedly drilled out and developed low grade multimilion ton copper orebodies.



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The Kennecott Deposit is 5.5 miles due east of the claim and the Phelps Dodge orebody is 1.5 miles northeast of the claim.

PHYSICAL FEATURES

The claim area is on the southwest flank of the northwest trending Gila Mountains. It is on the upper pediment of this range at an elevation of 3,650 feet. Climate and vegetation are typical Sonoran desert for these altitudes.

GENERAL GEOLOGY

The geology of the Lone Star District is based on published information by R. F. Robinson and Annan Cook compiled from mapping and research done for Kennecott Copper Corporation.

The Lone Star District is comprised of a thick sequence of Cretaceous andesitic volcanics intruded by small irregular masses and dikes of quartz diorite, graniordiorite, quartz monzonite, dacite, andesite, quartz latite, latite and rhyolite with many variations of mineralogical content, fabric and texture.

This sequence is overlain unconformably by Tertiary volcanic flows consisting principally of basalt, dacite and andesite. A basal tuffaceous sandstone and conglomerate with distinct water worn grains and pebbles marks this unconformity throughout the district. The volcanic flows above the unconformity are all considered to be post mineral while those below are premineral.

Structurally, the northeast, Precambrian trend is predominant in the area. It controls most intrusives, both stock like and dikes along with mineralization and alteration. Strong shear zones conform to this direction as do a number of offsetting faults. Generally, the northeast trending shear zones are confined to

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the lower Tertiary and older rocks below the premineral unconformity. However, a number of the northeast offsetting faults also offset both younger post mineral volcanics and northwest trending block faulting which in turn has offset the post mineral volcanics.

The second major structural trend is the northwest striking block faulting related to the development of the Basin & Range province in Southern Arizona. These faults offset all rocks in the area and in some cases have probably faulted only slightly consolidated gravels against premineral andesite. Most notable of the northwest trending faults is the Butte fault which generally separates the Gila Mountain Range from its pediment in this area.

Reportedly, mineralization in all known orebodies is found in the contact zones of intrusive rocks to andesite which are in turn controlled by the stronger northeast structural trend. Both pyrite and chalcopyrite mineralization are reported to decrease laterally along the shear zones from the centers of mineralization.

Halo alteration appears to also conform in intensity to the northeast trend, but varies in type with the rock type involved. Strong silicification and sericitization conform to acid and intermediary intrusive rocks in the zone of mineralization while the strongly altered andesite is reportedly principally biotitized. These zones are followed along trend (northeast-southwest) by chloritized and propylized zones.

Most of the later intrusive dikes have narrow sericitized or chloritized zones accompanying them.

Epidote is the predominant mineral in the propylitic zone, so much so that the rock commonly is simple epidotized rather than propylized. This epidotization appears to predominate in the upper agglomeritic flows of the Cretaceous



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andesite and may in fact be principally deuteritic, only being redistributed where found on fractures.

CLAIM AREA GEOLOGY

No outcrops are on or near the Boehiema 21 claim. However, it is known to be southwest of or in the hanging wall of the Butte fault. Approximately a mile to the east, near where Essex is drilling, unaltered Cretaceous upper agglomeritic andesite crops out close to post mineral Tertiary basalt. This, plus mapping in the hanging wall of the fault to the east of the claim by Ray Robinson, indicates that the hanging wall of the Butte fault in this area is upper agglomeritic andesite directly overlain by Tertiary basalt with the basal basalt unit known further to the east.

Mapping to the south along the Butte fault has shown the possibility that in addition to the 2,000 foot vertical component of displacement, there is probably at least a 1,000 foot left hand horizontal offset that could be considerably larger. As the Butte fault is reported to cut the Phelps Dodge orebody and the San Juan biotite alteration zone, these units should be offset relatively down and to the southeast (see R. Robinson's 1" = 2,000' alteration map).

With agglomeritic andesite cropping out southwest of the fault and thickness of this unit being 1,000 feet, three miles to the northeast the favorable lower andesite should be within 2,000 feet of the surface throughout this area.

A number of drill holes have been drilled in the area of the Boehiema 21 claim. As the ground was subsequently abandoned, it must be assumed that they did not show signs of mineralization or strong alteration. Subsequently, the Essex hole

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has been drilled approximately one mile east of Boehiema 21 which results are not known.

The abandoned drill holes plus fresh upper agglomeritic andesite would indicate that no pervasive alteration is present in sections 32 & 33, T5S, R26E or in sections 3, 4 & 5, T6S, R26E; the latter including Boehiema 21. If the offset portion of the Phelps Dodge orebody is in the southwest 1/4 of section 34, T5S, R26E and only 2,000 feet below surface strong alteration should be evident in drill holes anywhere in the east half of section 33, SW 1/2 34, NE 1/4 3, and NW 1/2 of 2. In fact, Robinson does map biotization in section 2 in three different drill holes. This is probably the offset portion of the Phelps Dodge, San Juan biotized zone. Its occurrence southeast of its relative position on the east side of the fault tends to support the left hand horizontal offset along the Butte fault.

The covered area in Cottonwood wash should contain the offset portion of the northeast-southwest structural zone containing the offset portion of the Phelps Dodge orebody. This would project the zone some 2,000 feet south of Boehiema 21 in section 4.

The San Juan shear zone, west of the Butte fault, should strike southwestwardly through the flat top mesa capped by Tertiary basalt in the northern portion of section 10. The presence of the intrusive quartz diorite mapped in section 10 would seem to support this area as the San Juan shear zone on the west side of the fault.

EXPLORATION & DEVELOPMENT RECOMMENDED

This whole area, from Boehiema 21 southeastward to the San Juan road in section 11, should be carefully scanned for all possible outcrop and these mapped

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carefully for alteration as a guide to the best location for deep probing in this general area.

The Boehiema 21 claim is on the northwest fringe of a very interesting covered area. This general area west of the Butte fault certainly deserves a serious exploration effort. Recent cover does not appear to be deep as some outcrop is present. However, the favorable lower andesite horizon will be from 1,000 to 2,000 feet below surface so that all geophysics will have to be interpreted carefully.

Based on the sketchy structural interpretation of the Butte fault, two zones west of the fault would appear to be best. These are 1) the south 1/2 of section 4 and the north 1/2 of section 3 along Cottonwood wash; and 2) the south 1/2 of section 9, the north 1/2 of section 10 and the southwest 1/4 of section 2.

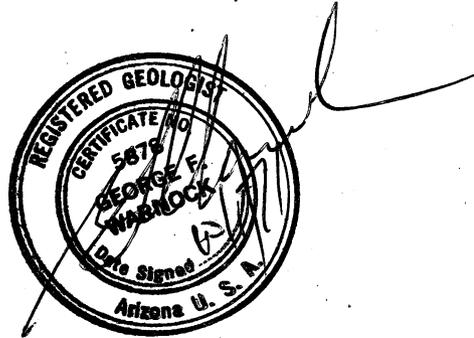
The first area is apparently one of no outcrop but it should be searched carefully for outcrop. Subsequent ground magnetics should be run to attempt to define zones of intrusive rocks. This followed by IP, spread for the greatest possible depth penetration, and subsequent deep drilling if a target is delineated. I feel that neither S.P. or Geochem is likely to be definitive in this area due to the expected depth of the target and possible contamination from both the Phelps Dodge and San Juan orebodies.

The second area has known^{HA} outcrops of Tertiary quartz diorite and upper agglomeritic andesite. It also has at least some biotization, a highly favorable indication. This zone west of fault also should be explored with the same basic procedure as for the first area. Concurrent rotary drill probing in shallow holes in the upper agglomeritic andesite could aid material^{HA} by revealing alteration patterns in this unit.



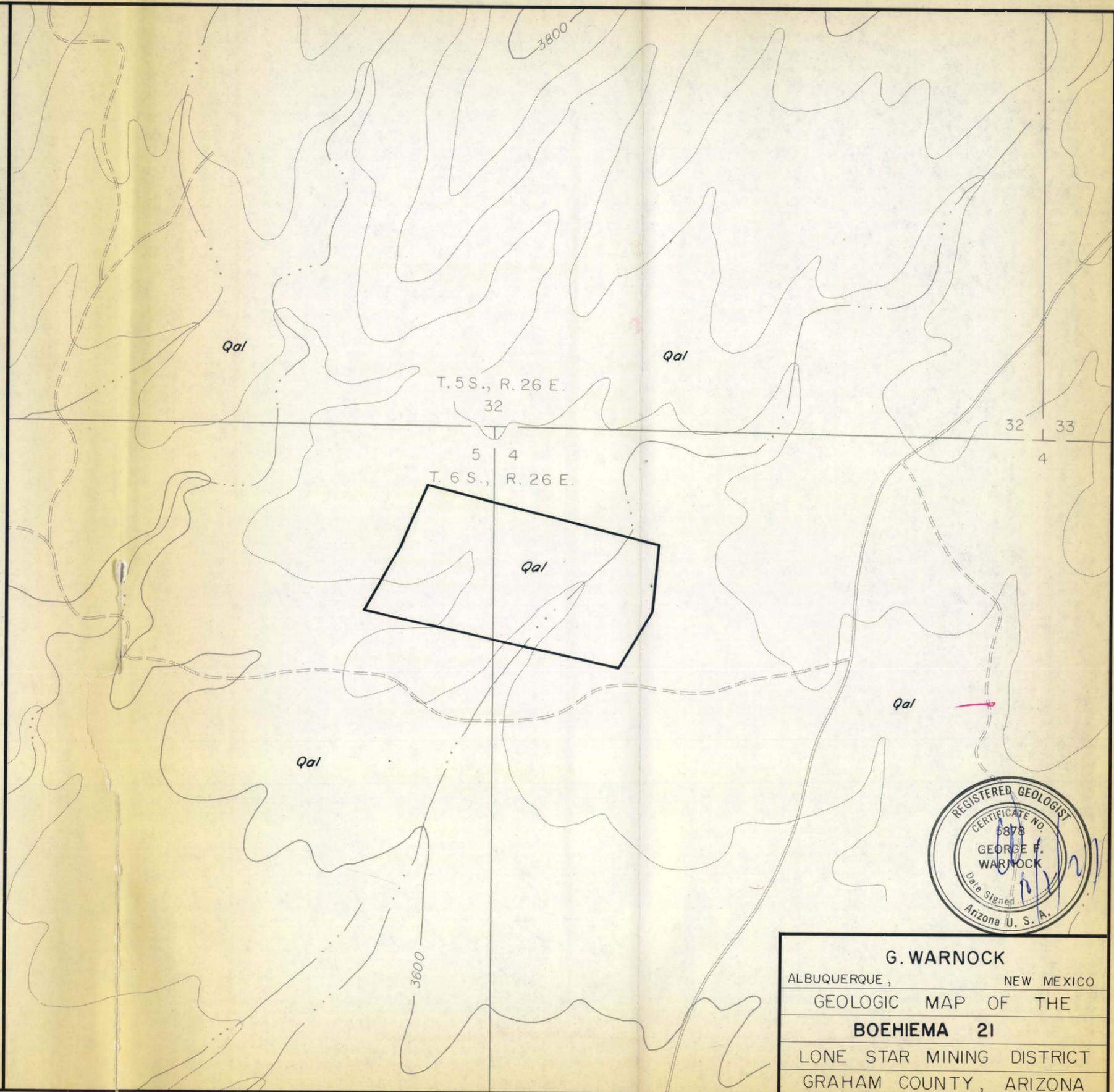
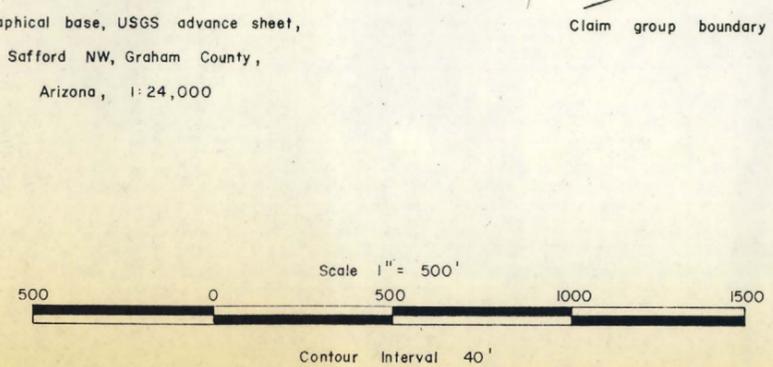
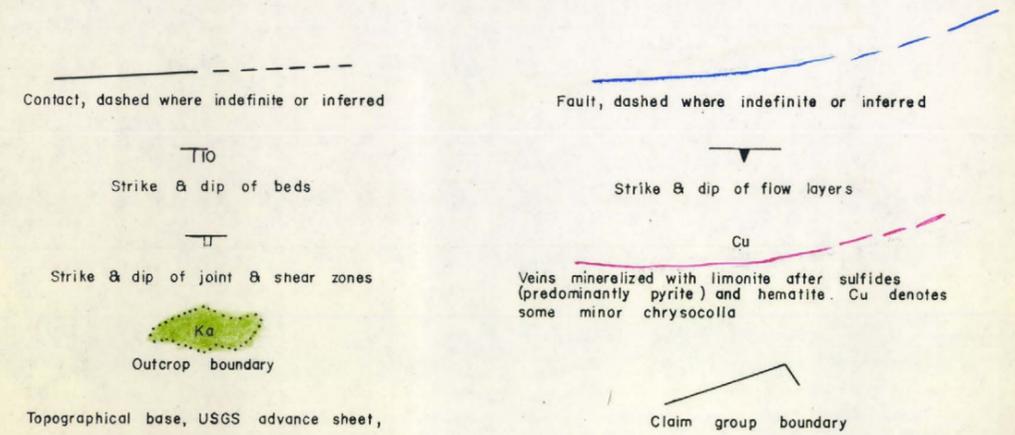
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The Boehiema 21 is only approximately 2,000 feet north of the interesting area and it definitely should be held as long as an interest in this general area continues.



EXPLANATION

- Quaternary**
- Qal, alluvium
 - (Tqd. fl.) predominantly Tertiary quartz diorite float.
 - (Ka. fl.) predominantly lower Cretaceous andesite float.
 - (Kaa. fl.) predominantly upper Cretaceous andesite float.
- Tertiary**
- Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics.
 - Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.
 - Td, andesite and dacite.
 - Tqm, quartz monzonite.
 - Tqd, quartz diorite.
 - Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.
- Cretaceous**
- Kaa, upper andesite predominantly agglomerate.
 - Ka, lower andesite.
 - Kpa, lower porphyritic.



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ALBUQUERQUE, NEW MEXICO
GEOLOGIC MAP OF THE
BOHEIMA 21
LONE STAR MINING DISTRICT
GRAHAM COUNTY, ARIZONA

EXPLANATION

Qal (Tqd. fl.) (Ka. fl.) (Kaa fl.)
 Quaternary
 Qal, alluvium
 (Tqd. fl.) predominantly Tertiary quartz diorite float
 (Ka. fl.) predominantly lower Cretaceous andesite float.
 (Kaa fl.) predominantly upper Cretaceous andesite float.

Tbb

Tbb, basal tuffaceous sandstone and conglomerate. Forms marker bed at unconformity on older Cretaceous volcanics.

Ti Td

Ti, rhyolite, latite and quartz latite dikes. Tb, basalt flow with some andesite, dacite and tuff.

Tb

Td, andesite and dacite.

Tqm Tqd

Tqm, quartz monzonite

Tqd, quartz diorite.

Kad

Kad, andesite dikes intruding the Cretaceous section but intruded by Tertiary.

Kaa

Kaa, upper andesite predominantly agglomerate.

Ka Kpa

Ka, lower andesite

Kpa, lower porphyritic.

Contact, dashed where indefinite or inferred

Fault, dashed where indefinite or inferred

T10

Strike & dip of beds

Strike & dip of flow layers

T

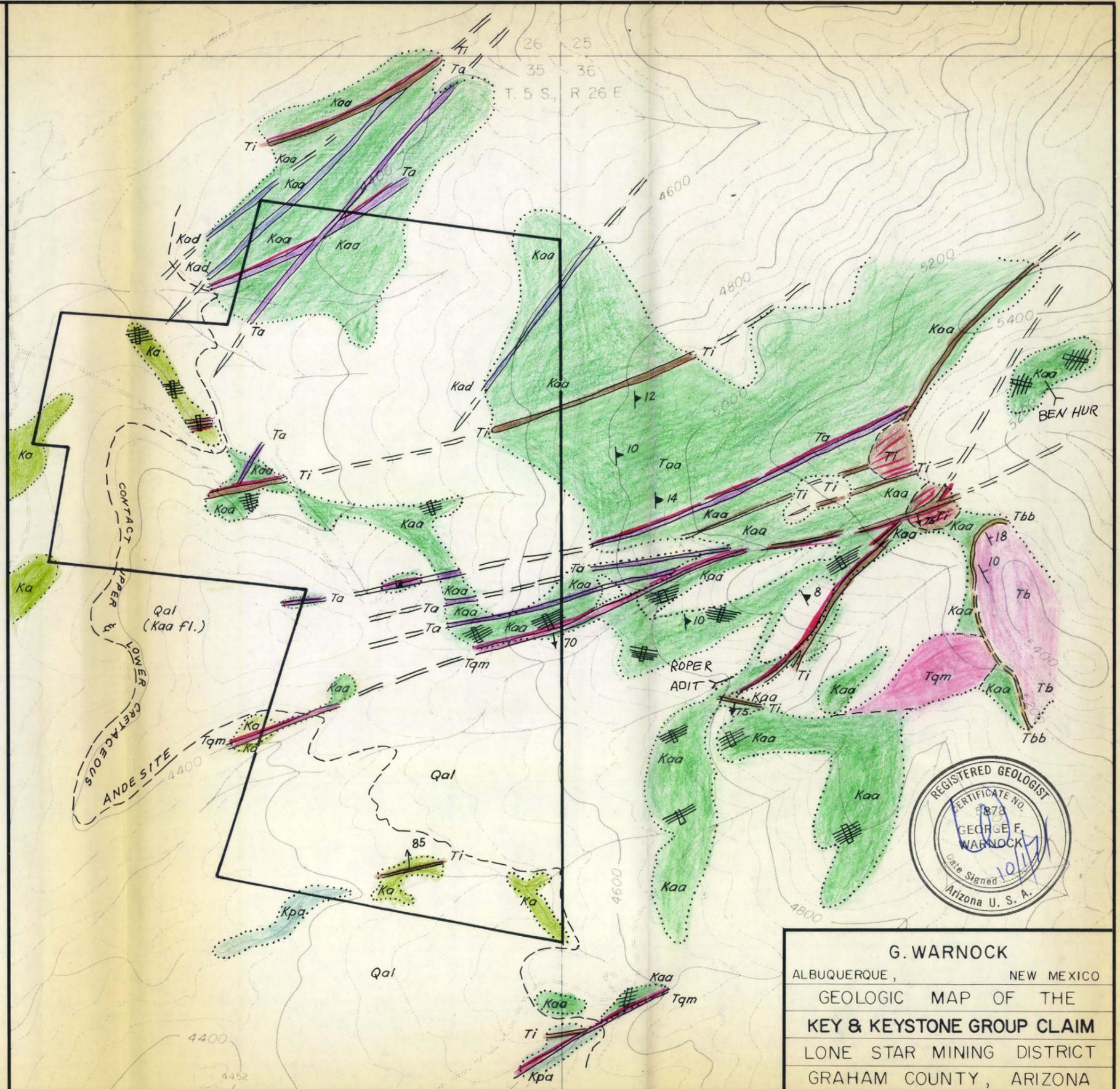
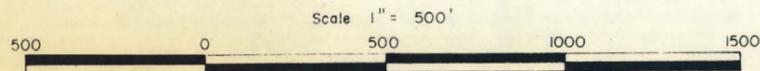
Strike & dip of joint & shear zones

Cu
 Veins mineralized with limonite after sulfides (predominantly pyrite) and hematite. Cu denotes some minor chrysocolla

Ka
 Outcrop boundary

Topographical base, USGS advance sheet, Safford NW, Graham County, Arizona, 1:24,000

Claim group boundary



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 ALBUQUERQUE, NEW MEXICO
 GEOLOGIC MAP OF THE
 KEY & KEYSTONE GROUP CLAIM
 LONE STAR MINING DISTRICT
 GRAHAM COUNTY, ARIZONA