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BLACKWATER & POSTEN BUTTE PROSPECTS
Blackwater Mining District
Pinal County, Arizona

June 1960

A. G. Blucher

3-11-2.2 Blackwater - Poston Butte
(A.G. Blucher Report)
Pinal County
Arizona

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 7, 1960

Kenyon E. Richard, Chief Geologist
American Smelting and Refining Company
Tucson, Arizona

BLACKWATER & POSTEN BUTTE PROSPECTS
Blackwater Mining District
Pinal County, Arizona

Dear Sir:

Following is my report on the subject area:

INTRODUCTION

The Blackwater Prospect and Posten Butte Prospect are in the Blackwater Mining District approximately 75 miles northwest of Tucson and 40 miles southeast of Phoenix. They are in the southeastern end of the low range of mountains between Florence, Coolidge, and Chandler, Arizona. These mountains are entirely surrounded by the flat land of the Gila and Salt River Valleys, much of which is under cultivation.

The Blackwater Prospect was first examined for the Company by O. D. Evans in 1954. He concluded that the exposed mineralization did not warrant exploration and that the possibility of an extension beneath cover was slight.

Because of refinements in geophysical techniques since 1954, and because later bulldozer work had exposed better mineralized ground along the edge of cover, a second reconnaissance was conducted in November of 1959 by Kenyon Richard, J. H. Courtright, and J. E. Kinnison. It was decided at that time that an Induced Polarization geophysical survey, coupled with detailed mapping of the better outcrops, might determine a drilling target.

Between December 9th and December 14th, eighty-two claims were staked on Federal and State land, and negotiations were opened to acquire the privately owned land in the area of interest. An Induced Polarization survey was conducted by Mr. W. E. Saegart over an area of about two and two-thirds square miles.

Geologic mapping was started in the last week of December by A. G. Blucher and J. E. Kinnison and was completed in the first week of March, 1960. In addition to the outcrop map of the Blackwater Prospect, a reconnaissance geologic map was prepared of an area of about seven miles by twenty miles surrounding the Blackwater Prospect.

During this reconnaissance the possibility of a second, more southerly, zone of mineralization became apparent with the finding of small outcrops of favorable alteration beneath the post-mineral basalt which

caps Posten Butte just west of Florence. Other outcrops of less favorable, but typical, alteration were found near Cholla Mountain and Walker Butte just north of Coolidge. These three altered outcrops are separated by about six miles of terrace and valley fill, in which there are no outcrops of pre-mineral rocks. This potentially mineralized covered area is termed the Posten Butte Prospect.

In preparing the outcrop map of the Blackwater Prospect the mineralization on Mineral Butte and its eastward extension was mapped by J. E. Kinnison, and that on East Butte and the outlying areas by A. G. Blucher. Kinnison also assisted in mapping a part of Gray Hill. Reconnaissance work was done together. The interpretations and conclusions in this report, to which Kinnison expresses general agreement, result from mutual study and discussion.

SUMMARY AND CONCLUSIONS

Both Blackwater and Posten Butte are worthy of further Company interest as porphyry copper prospects.

In each case recurrent Laramide intrusive activity has resulted in pervasive alteration and mineralization associated with monzonite porphyries.

The post-mineral history is favorable to enrichment, and well mineralized outcrops are adjacent to and may extend beneath wide areas in which post-mineral formations are probably not of great thickness.

These recommending factors are partially counterbalanced by a difficult property situation, and the following recommendations are made as though the property were available on reasonable terms.

Blackwater Prospect

The detailed mapping at Blackwater outlined two N 70 E trending zones, one on East Butte and one on Mineral Butte, in which the limonites in the capping indicate secondary copper sulphides in amounts approaching ore grade.

Neither of these exposed zones is sufficiently large to warrant drilling. However, near the covered fringe the weak but pervasive alteration surrounding these seperate zones merges, and some of the limonites along this fringe indicate copper mineralization extending beneath cover.

As can be seen on Attachment D this zone of limonite-after-chalcocite coincides closely with the anomaly defined by Induced Polarization methods.

The 6 mv/v contour recommended by Mr. Saegart as the limit of the anomaly encompasses an area of about 2500' by 1000'. Much of the western half of this area is exposed bedrock in which the leached capping indicates secondary copper sulphides in quantities less than ore grade.

Exposures of weakly mineralized rock clearly limit this zone on the south and on the west, and several fresh or weakly altered outcrops

along its northern edge suggest that the only probable extension is to the east or northeast.

The covered portion of the target thus presented has a width of 1000' or less, and extends 1200' or more into the alluvium.

As geophysical indications limit this target to a relatively small area of doubtful grade, the worth of this prospect must depend on the margin of interpretation of these indications.

If an option can be acquired on the necessary property with liberal time limits and little or no initial payment, the prospect deserves active interest. Five holes drilled on a triangular grid of 500' to the side and progressing eastward from the center of the anomaly would be an adequate preliminary test of this prospect.

Posten Butte Prospect

If a line were drawn from the easternmost bedrock outcrops at the Blackwater Prospect due south six miles to the Gila River, it would very roughly conform to the eastern edge of the pre-mineral outcrops of the district. At the start of this examination it was believed, and it is so shown on the state geologic maps, that east of this line there were no outcrops of pre-mineral rocks for a distance of perhaps 15 miles.

The finding of mineralized porphyry intrusives on the extreme southeastern edge of this limit of outcrops led to a careful reconnaissance for outlying outcrops in the covered area to the east.

Several such outcrops were found. One of these, that at Posten Butte, is pervasively altered and contains weak to moderate amounts of limonite-after-chalcocite.

If this outcrop were adjacent to Federal or State land where mining claims might be filed, it would, in itself, deserve immediate active interest. However, the property situation here is complex.

The entire area around Posten Butte and between it and Cholla Mountain must be considered as potentially mineralized ground. This includes large areas of cultivated land in which mineral rights may be held by the owners. Further complicating the property situation are several miles of railroad right of way, a natural gas pipeline, and the Gila River.

Because surface geologic methods cannot further localize this target, and because prior acquisition of the entire strip is not feasible, further exploration activity in the area must depend on information gained by geophysical methods.

Initially, a study should be made of the surface and mineral ownership of the entire potential area. Following this, an Induced Polarization survey and a mobile magnetometer survey should be made of the area around Posten Butte and between it and Cholla Mountain (see Attachment B).

HISTORY

Most of the prospecting in the Blackwater District has been directed at copper oxides along basic dikes and in fresh granite. Northwest of Mineral Butte and at Cholla Mountain there has been a little work done on quartz veins carrying some gold, silver, and copper. Several small mining ventures in the Mineral Butte area have resulted in a reported production of about 2000 tons averaging less than 5% copper.

In 1922 Saeaton Copper Company of Magma, Arizona drilled the Blackwater alteration zone as a porphyry copper prospect. Five churn drill holes totalling about 1266' were drilled on and between Mineral Butte and East Butte. The highest single assay was 0.37% Cu, and average assays in the sulphide zone did not exceed 0.18% Cu. One and possibly both of the holes on East Butte failed to reach sulphides although they were drilled to depths in excess of 1300'.

It is reported that in 1958 Vanadium Corporation of America drilled the same area as a uranium prospect. According to R. D. Rodney they encountered some copper mineralization but did not assay the core for copper. Neither core nor sludge from these seven holes is presently available.

It is rumored that in 1959 Bear Creek was active in the Mineral Butte area. Miami Copper Company also recently examined the property.

PROPERTY

Because no property study has yet been made of the Eastern Butte area only the ownership of property at Blackwater will be discussed here.

At the Blackwater Prospect property ownership can be divided into four classes: State land; Federal land; Indian Reservation; and private land on which mineral rights are held by the owner. The areal distribution of these is shown on Attachment C.

The property of the company is almost wholly within the SW quarter of Section 31. This is patented land owned by Virgil J. Vance, and the mineral rights are conveyed with the patent.

A possible continual extension beyond the property would be within the east half of Section 31, which has the same status and is held by Leo Hilsworth.

The mineralized zone on Mineral Butte is on federal land and is covered by mining claims held by R. D. Rodney, on behalf of Virgil Vance.

The mineralized zone on East Butte is within the Gila Indian Reservation. It is also controlled by R. D. Rodney, according to him, through a lease from the Indians on six sections of land along the northern boundary of the Reservation.

The claims filed by the Company to the north and east of the property were allowed to lapse after it became apparent that Vance's terms -- a 90 day option period and a price of $100 per acre -- were exorbitant.

MAPS AND MAPPING METHODS

Mapping of the outcrops and mineralization at the Blackwater Prospect was done directly on aerial photographs on a scale of 200' to the inch. The area surrounding the anomaly appears with very little distortion on the photographs, but in other areas distortion may be as great as 10%. This was partly compensated for on the final map.

Precision of mapping was varied, depending on the degree of mineralization and proximity to the area of principal interest; i.e., the mineralization and outcrops within the geophysical anomaly and westward on Mineral Butte were mapped in close detail, whereas those on East Butte and elsewhere in the altered zone were somewhat generalized.

Reconnaissance mapping was done on soil conservation photographs (2" equals 1 mile) and transferred to the San Tan and Florence quadrangles. Errors in drainage and contours which limited the usefulness of the topographic sheets in detailed geologic mapping were not so great as to affect the accuracy of the reconnaissance map (see Att. B).

In most of the area mapped during this reconnaissance there are numerous roads, and much of the terrain between these roads can be traversed by a four wheel drive vehicle. This greatly facilitated the work and allowed close coverage of wide areas.

REGIONAL GEOLOGY

Roughly paralleling the San Pedro Valley and extending from San Manuel, Arizona, nearly 50 miles northwest to Superior, Arizona, is an axis of change separating regions of somewhat different physiographic and geologic characteristics.

Northeast of this axis are almost continuous ranges of mountains of considerable relief separated in places by narrow northeast trending gravel-filled basins. The sequence of sedimentary rocks from late Precambrian through Paleozoic is well represented, and Precambrian granite and schist is exposed in only relatively small areas.

Southwest of the axis sedimentary rocks of Paleozoic age are as a general rule absent. Where rocks of Tertiary age are present they rest directly on Precambrian schist or granite. Topography is generally more moderate, and to the west wide expanses of valley fill separate and surround small ranges of mountains.

The Blackwater Mining District is in this second described area, and its low granite or schist hills, rugged only where they are capped by Tertiary volcanics, are typical of the region.

The apparent geometric arrangement of the porphyry copper districts of southern Arizona along definite alignments has led to much speculation as to probable causes of these alignments and their possible uses in exploration. It is interesting to note that these prospects lie N 70 E along strike from the copper districts of Globe-Superior and Ray.

LOCAL GEOLOGY

Physiography

From the San Tan Mountains in the northwest corner of the Blackwater area a crescent-shaped ridge of low hills curves east and then south to the Gila River at Cholla Mountain dividing the area into two broad pediments (see Att. B). The two highest points along this ridge are Mineral Butte and East Butte, which rise abruptly from the pediments to heights of nearly 700'. Present day drainage is not governed by this ridge but instead transects it in a parallel stream pattern through gaps in the ridge.

North and east of this ridge is a flat agricultural plain except for a few low hills and an irregular belt along its southern edge where erosion is dissecting this plain.

At the Blackwater Prospect drainage from this higher plain flows southwest between Mineral and East Buttes and then south across a gently sloping pediment to the Gila River.

Pre-mineral Rocks

The oldest rock formation in the area, the Pinal Schist of Precambrian age, has been intruded by a coarse-grained granitic rock, here referred to as Mineral Butte granite. Clear-cut age relationships with rocks of post-Cambrian age were not found, but in lithology and habit it closely resembles other granites of known Precambrian age.

The contact between the schist and the Mineral Butte granite is very irregular. It follows generally the ridge between the two pediment areas. Most of the schist lies to the north and east of this ridge, and most of the granite is to the south. Scattered outcrops in the eastern pediment suggest that this granite-schist contact continues eastward beneath the alluvium on about the same line.

On the south and west these older rocks are intruded by a younger granite, referred to here as Coolidge granite. This younger intrusive varies greatly in texture from a coarse-grained rock, much like Mineral Butte granite, to an aplite or microgranite. It is generally lighter colored and displays an unevenness of grain-size not found in the Mineral Butte granite.

On Mineral and East Buttes are irregular bodies of intermixed granite and aplite. On the outcrop map (Att. D) these are shown as granite-aplite complex. On the south slope of East Butte some of these zones grade into N 20 W trending dikes of aplite or microgranite, much resembling some facies of the Coolidge granite. A similar dike system occurs near the patch of alteration just north of the granite-schist contact 1.5 miles west of Mineral Butte. Wholly within the schist, but near the contact at Mineral Butte, are small bodies of aplite, which may be the same rock.

The intrusives most closely associated with copper mineralization in this area, the rocks grouped under the term monzonite porphyry, occur

as dikes and small stocks in three distinct localities -- at Cholla Mountain, between Mineral Butte and East Butte, and in the western end of the area about one mile north of Granite Knob. In each case there is attendant alteration and mineralization, although at Mineral Butte the monzonite stock is very much less altered than is the intruded granite.

Near the monzonite intrusives north of Granite Knob is an outcrop of arkosic quartzite and shale, which much resembles rocks of the late Precambrian Apache Group. These are intruded by Coolidge granite and by monzonite porphyry and are partly altered and mineralized. It is possible that some of the rock on East Butte mapped as altered granite and granite-aplite complex is of this formation, but intense alteration and brecciation render a separation difficult.

Minor Intrusives

South and west of the altered area at Blackwater there are abundant narrow dikes of basic or intermediate composition which commonly strike N 70 E and are persistent or recurrent for a considerable distance along strike. These dikes cut the aplite dikes. They show little evidence of alteration other than occasional bleaching and iron-staining, which may be the result of supergene solutions. They show only a broad spatial relationship with the altered zones. Five miles south of Blackwater are several felsite dikes which show much the same habit of occurrence.

At Blackwater and in the altered zone east of Walker Butte are several basic dikes of less regular outline and with occasional diabasic textures. Most of them strike N 20 W and are distributed along faults of the same strike. These dikes show no evidence of alteration or mineralization other than copper oxides on fractures. However, a sample taken from a prospect dump assayed 1.46% Cu, of which only 0.93% was non-sulphide copper. No sulphides and little copper staining could be seen on this dump. Panning the pulp of this sample showed a few very fine grains of sulphides.

In the exposures at the base of Foster Butte there appear to be basic dikes of three ages. The oldest is pre-mineral and possibly should be classed with the monzonite porphyries. A second is post-mineral but pre- Yellow Peak Conglomerate. The youngest is post-mineral and clearly intrudes the Yellow Peak Conglomerate.

Pre-mineral Faulting

At Blackwater the distribution of the intrusive rocks probably outlines the trace of the major pre-mineral structures. As was noted in the Globe-Superior Area (Report May 15, 1959) the contact between Precambrian Pinal schist and Precambrian granite strikes approximately E-W and roughly coincides with the major trends of mineralization and alteration. It seems likely that this contact represents an ancient and profound structure along which there has been recurrent intrusive activity. Subsequent disturbance along this structure resulted in the intrusion of monzonite stocks and dikes followed by the intrusion of the narrow N 70 E trending dikes. At some time prior to the intrusion of these later

dikes there developed a second fault system with a trend of about N 20 W. This second set of structures appears to have exerted a fairly direct control of the mineralization and alteration within the broader control of the E-W system. Although most of the mineralized veinlets strike between N 70 E and N 70 W their grouping is aligned along the N 20 W faults in many cases.

Because of the limited exposures the record of pre-mineral faulting is less clearly seen at the Posten Butte Prospect. However, nearly all of the mineralized fissures at Posten Butte, Cholla Mountain, and Walker Butte are within 10 degrees of an E-W strike.

Alteration and Mineralization at Blackwater

Alteration

The exposed altered area at Blackwater trends N 70 E and is more than two miles long. It is nearly a mile wide near the alluvium on its eastern end. It tapers slightly to the southwest. Beyond its main southwestern limit there is occasional alteration for nearly three miles. (See Att. B)

Most of the alteration in this zone is of a low degree, and there are no wide areas of intense argillic or sericitic alteration. Both the intensely sericitized rock on Mineral Butte and the intense silicification on East Butte are relatively small, distinctly defined patches. At a few other places in the area there are quartz veinlets bordered by thin bands of sericite, but the rock between the veinlets is weakly altered.

In the schist the degree of alteration is difficult to determine, as both quartz and sericite were pre-mineral components of the rock. The most easily observed effect of alteration is occasional bleaching; fresh schist is sometimes greenish and chloritic -- alteration produces all sericite. There is little evidence of the intense bleaching or of the lattice-work of quartz veinlets, as at Ray and Miami for example.

Although the alteration in this main zone is shown as pervasive on the reconnaissance map, it contains fairly numerous small areas in which the rocks are nearly fresh. Most of these are in or near the central monzonite stock, and their alignment tends to separate the more intense alteration on Mineral Butte from that on East Butte. (see Att. D)

Mineralization

In most of the Blackwater altered area, the mineralization consists of disseminated and veinlet pyrite in Mineral Butte granite. The degree of mineralization is generally low and in most places probably does not exceed 1% total sulphides. Although there is limonite-after-chalcocite in some of the capping and exotic copper staining in some of the fresher rock, evidence of primary copper sulphides is generally lacking.

On the western peak of East Butte there are zones in which intimately fractured granite has been silicified and weakly mineralized. To

the east these zones border on mineralized breccia and granite-aplite complex. In some of the breccia there is limonite-after-chalcocite, but for the most part the breccia appears to have been only weakly mineralized. There is very little mineralization in veinlets or on fractures. The areas of more favorable appearing limonites usually coincide with the areas of stronger alteration and are sharply limited by weakly mineralized rocks. On the lower slopes of the western end of East Butte there are two small areas of parallel veinlet mineralization. These veinlets strike between N 70 W and N 70 E and are partly filled with brick red or purplish-red earthy limonite.

On Mineral Butte intense sericitic alteration with limonite-after-chalcocite on veinlets and disseminated is much more common than elsewhere in the area. There is occasional boxwork after primary copper sulphides. Some of the limonite-filled vugs in apparently unbrecciated rocks are angular in shape like small breccia vugs. As on East Butte these intensely altered zones have very abrupt boundaries against weakly mineralized rock; however, they are more abundant and more heavily mineralized than on East Butte. One old churn drill hole, No. 4, was collared in some of the better outcrops on the southeastern edge of this zone. Although it encountered only 115' of 0.17% Cu, this is possibly due to the fact that at less than 100' it penetrated a fault on which there has been post-mineral movement and the footwall side of which is weakly mineralized rock.

Because of the more abundant mineralization in this zone it received very close scrutiny by Mr. Kinnison -- particularly the weakly mineralized interior of the U-shape, and the breccia on the north side of the zone. Although it is not large enough to be considered an initial exploration target, it would deserve attention in the event of favorable drilling results elsewhere.

The best mineralization in the Final schist is on Gray Hill. The limonite in the capping on and near this hill indicates narrow zones in which chalcocite is fairly abundant separated by zones of weakly mineralized rock. As a rule these zones, and the limonite-filled fractures, parallel the plane of schistocity. The size of these zones and the degree of mineralization appears to be greater along the northeasterly edge of cover.

Leached Capping at Blackwater

Although much of the capping at Blackwater is typical of that over known copper deposits, there are three anomalous aspects which require special consideration.

Possibly the most important of these is the fact that in many cases the rock exposed in the bulldozer cuts along the edge of cover contains appreciable amounts of limonite-after-chalcocite, even though it is only a few feet below surface rocks with very little favorable limonite. This is not the usual situation in capping of this sort, and it is not understood. Where bulldozer cuts show that this situation exists, some allowance was made for it in mapping the surrounding leached outcrops.

A second feature is the occurrence of earthy purplish-red limonites which do not quite resemble either typical limonite-after-pyrite or limonite-after-copper sulphides. On the northwest slope of East Butte is a zone of parallel veinlets filled with this "questionable" limonite. In the adjoining aplite there are abundant vugs of this limonite, in which there are also large flakes of specularite. Elsewhere in the area, particularly on East Butte but also within the geophysical anomaly, specularite can be found.

The role of specularite in leached capping is not thoroughly understood. Finely divided hematite is a major constituent of limonite-after-chalcocite and differs from specularite only in form -- the latter being micaceous or foliated. Primary specularite is known to occur in some porphyry copper deposits. It is also known that under certain conditions specularite can be a direct oxidation product of pyrite. It may be true that specularite can result from the re-grouping of the hematite present in limonite-after-chalcocite.

Although this "questionable" limonite is fairly common in the capping it is not so abundant as to constitute the difference between economic and uneconomic size and grade. In preparing the outcrop map this limonite was classed with limonite-after-pyrite.

Even less well understood is the discrepancy between the great thickness (1300') of leached capping reported in the old churn drill holes, Nos. 2 and 3, and the very shallow sulphides (75' to 90') indicated by geophysical determinations a short distance to the north (memorandum by Mr. Saegart, 1-4-60). If the geophysical interpretation is correct, then this discrepancy can be explained by an error in the old drill logs or by a very irregular depth of oxidation.

To check the reliability of the logs of the old drill holes, samples were taken from the old sludge piles, washed, and examined for sulphides. In the sludge from Hole No. 2, which reportedly was drilled to a depth of 1315' in oxidized material, no sulphides were found. In the sludge from Hole No. 3, which reportedly encountered sulphides at 1180', a few grains of pyrite were found. Experience with other old sludge piles in southern Arizona has shown that even after thirty or forty years some of the original sulphides remain.

Prior to a penetration of the sulphide zone by drilling there is no definite evidence with which to correlate and adjust the depth to sulphides predicted from geophysical data. However, about 300' south of the southern edge of the geophysical anomaly is an old inclined shaft to a depth of about 80'. According to R. B. Rodney, a drift off the bottom of this shaft bears northwest for more than 2000'. The very small amount of material on the dump casts some doubt on the reliability of the report, but an examination of the shaft showed that there was a drift which ran for at least 150', and possibly much farther, to the northwest. Untimbered loose ground prohibited examination of rock closer to the anomaly, but none of the rock in the drift appears to be in or near the sulphide zone. Although the open part of this drift does not reach the anomaly or the granite-schist contact, it suggests that the sulphide zone may be somewhat deeper than is indicated by geophysical results.

Great irregularities in the depth of oxidation are not unusual in porphyry copper deposits. At San Manuel tongues of oxidized material extend as deep as the 1475 level. In the Ex Pipe which the Company drilled in the Sunnyside area south of Patagonia, Arizona, the depth of oxidation in the pipe was as much as 400' below unoxidized ground adjacent to the pipe.

According to Mr. Saegart, the only materials other than sulphides which will react to Induced Polarization methods are graphite and specularite. A rock contact, fault, or other structure would not affect the interpretation of depth to sulphides. The occurrence of specularite in the capping forces the consideration of its having had a slight effect on geophysical results. However, its abundance is probably not such as to affect more than a general amplification of the anomaly.

It appears most likely that the geophysical results, although possibly having some slight discrepancy in depth to sulphides, truly reflect a great irregularity in the depth of oxidation. In the long history of exposure and oxidation, the very permeable breccias in the East Butte area may have been leached to great depths, but were separated from a higher water table in the schist by a rib of altered but relatively impermeable granite.

Alteration and Mineralization at Posten Butte

Walker Butte

A little more than a half mile northeast of Walker Butte (see Art. 3) is a N 70 E trending ridge forming an embayment in the eastern covered area. The contact between Mineral Butte granite and Coolidge granite follows the southern flank of this ridge. Along this contact are narrow lenses of moderate to intense alteration closely bounded by rocks of weak to moderate alteration. Basic dikes like those on East Butte occur along this contact and have been prospected for copper. There is no pervasive alteration, but the zone of alteration lenses appears to widen slightly, and the alteration becomes more intense near cover.

Cholla Mountain

Two and one-half miles south of Walker Butte is a group of low hills bounded on the east and south by alluvium and valley gravels. On the southern tip of these hills and just north of the Gila River are two large and several smaller dikes of monzonite and monzonite porphyry. These dikes trend N 70 E and locally are weakly mineralized by veinlet and disseminated pyrite and chalcopyrite. There are no areas in which mineralization is moderate or strong, and there is no intense sericitization or silicification except along widely spaced veins and veinlets. The alteration does not appear to become stronger near cover.

Posten Butte

Posten Butte is a low basalt hill about two miles northwest of Florence, Arizona, and about two hundred yards north of the dirt road which parallels the Gila River on the north side. Along its western base

are several old prospect dumps easily observable from the road. The hill is capped by Walker Butte basalt underlain by Blue Basalt and eastward dipping Yellow Peak Conglomerate. Alluvium and caliche conglomerate laps the base of the hill, but the prospect workings have penetrated and exposed a narrow strip of granite below the conglomerate and basalts.

There are five prospect pits aligned along the western base of the hill over a distance of about 500'. The total of the exposed bedrock in that distance is about 50'. The deepest pit, that on the northern end, consists of about 20' of vertical shaft from which a 30 degree incline follows the base of the Yellow Peak Conglomerate down dip for about 80'. The other pits are also located on the base of the conglomerate, but they are much smaller.

The granite exposed in these workings is pervasively altered throughout. There is no fresh or unmineralized rock exposed, nor does the mineralization diminish noticeably in any direction. Although quartz veinlets, and limonites-after-chalcocite are sparse, their occurrence is widespread and evenly distributed. Most of the rock is sericitized.

Post-mineral Rocks

Post-mineral formations in the Blackwater District consist of a conglomerate, a basalt flow, a younger conglomerate, a series of dacitic volcanic rocks, a younger basalt flow, valley gravels, terrace deposits, and alluvium.

The best exposures of these formations are in the canyons and cliffs north of Olberg in the western end of the area, and it was here that most of the sequence was worked out. From these hills westward to Florence are wide areas in which most of these rocks have been removed by erosion or covered by alluvium. Consequently, correlation of formations between the western end and the eastern end is based largely on similarity of lithology and sequence.

These formations are briefly described below under the names assigned them during this investigation.

Yellow Peak Conglomerate: This is the oldest recognized post-mineral formation and is a poorly sorted, poorly bedded, fluvial deposit. At Yellow Peak it is composed principally of pebbles, cobbles, and boulders of Coolidge granite in a silty matrix. Most of the fragments are altered and mineralized; however, their distribution suggests that they were derived from presently known altered areas. There are a few thin beds of silt and sand. Although it may be as much as 800' thick at Yellow Peak, it loses out rapidly to the west.

Blue Basalt: Directly overlying this conglomerate at Yellow Peak is a basalt flow about 50' thick. It is seldom amygdaloidal or vesicular and weathers to a soft bluish-gray surface. In some places there are beds up to 20' thick of red-brown clinker and rubble at the base. East of Yellow Peak its thickness varies from 0' to 200'.

Rock Peak Conglomerate: On Rock Peak about two miles north of Yellow Peak there is exposed about 300' of tuffaceous sandstone, siltstone, and conglomerate which weathers to a light tan pock-marked surface. Good exposures in the cliffs to the southwest show these beds thinning rapidly to a point 2.5 miles southwest of Rock Peak beyond which they are absent.

Dacite Series: Capping Rock Peak and Yellow Peak and most of the cliffs to the west is a thick sequence of volcanic rocks closely resembling the dacite series of the Globe-Ray-Superior area. In part it may be a welded tuff or tuff agglomerate. In some places there is a brown or black vitrophyre at the base of the series. The existing remnant has a maximum thickness of about 600'.

Walker Butte Basalt: Good outcrops of the Walker Butte Basalt were not seen in the western part of the area. Possibly it overlies the Blue Basalt at Olberg or in the Malpais Hills to the northwest. Its best exposures are on Walker Butte, Posten Butte, and on the low hills north and northwest of Florence. It is a very hard aphanitic to fine-grained basalt. It is commonly vesicular or scoriaceous, and weathers to a hard vitreous surface. Its thickness probably does not exceed 100'.

Valley Gravels: The soil, silt, and caliche conglomerate north and east of the Blackwater Prospect is probably quite thin for a considerable distance out from the edge of bedrock. This edge is very irregular, and where the base of the caliche and soil can be seen, it has a very gentle northeasterly dip. Caliche float on the tops of hills along this contact suggests that dissection during the present erosion cycle has reduced the thickness of this cover by at least 50'. The level of the soil and silt along the Gila River between Cholla Mountain and Posten Butte may be rising due to the deposition of silt from the higher dissected plain. Along the river these gravels may be quite thick. A well just north of Florence penetrated 415' of gravel without reaching bedrock.

Terrace Deposits: The dissected terrace deposits, shown on the reconnaissance map on each side of the Gila River, are not far different in appearance from the other gravels except for the abundance of flat, very well rounded pebbles and cobbles. Their thickness does not exceed 50', and they appear to rest on an older level of silts and gravels.

Erosion Surfaces and Enrichment History

A study of the character and distribution of post-mineral layered rocks in the Blackwater area shows that there have been at least two, possibly four, periods in which deep oxidation must have resulted in deep leaching, and, possibly, secondary enrichment.

Opinion as to the precise environment required to precipitate the copper from these solutions as an orebody -- rather than disperse it over wide horizontal or vertical distances -- differs considerably. It is generally agreed that precipitation occurs at or below the depth at which sub-surface water produces a reducing environment. Probably this water is relatively stagnant -- possibly fluctuating vertically, but with little lateral movement. Other than a general correlation with the enrichment

history of the nearest tested porphyry copper deposits and the record displayed in the leached capping, there are few clues to the sub-surface environment at Blackwater during the various periods of oxidation.

Probably, the mineralized zones at Blackwater and Posten Butte were first exposed to oxidation during the period which culminated in the deposition of the Yellow Peak conglomerate. At this time the long period of erosion which removed the entire Paleozoic sequence and most or all of the Late Precambrian Apache sediments had produced a surface of low relief on the basement rocks of Precambrian granite and schist. In the channels and basins of this surface were deposited detrital materials from adjacent granitic highlands, and from the more resistant altered rocks around Mineral and East Buttes.

The character of the Yellow Peak conglomerate -- that is, coarse, angular fragments laid down with a minimum of sorting -- indicates rapid deposition in local basins under arid climatic conditions similar to those of the present. Because of the scarcity of outcrops the distribution and extent of these older basins is not known. The predominantly granitic fragments probably came from a highland area lying to the south and west.

The occurrence of mineralized fragments in this conglomerate at both Yellow Peak and Posten Butte is good evidence that at least some of the alteration and mineralization of the area was exposed to erosion. That these areas were exposed throughout this erosion period is suggested by the fact that there are some of these fragments in the uppermost horizons on Yellow Peak.

Upon this surface was extruded the Blue Basalt. The close similarity of its widespread existing outcrops suggests that it covered the entire area. If this was the case, it was removed from much of the area during the period which produced the younger Rock Peak conglomerate and prior to the deposition of the dacite tuff.

In the Rock Peak conglomerate the fragments are mainly of granitic origin. A very few fragments are mineralized. The altered areas were probably exposed for only a short time during the erosion period which produced this conglomerate.

Although outcrops of dacite or dacite tuff east of Yellow Peak are small and infrequent, they are so situated that it seems probable that this formation covered the entire area. The abundance of dacite float on some of the hills north and south of Mineral Butte lends support to this thesis.

Subsequent to the deposition of the dacite the area was probably completely covered by the Walker Butte Basalt flow. Erosion has removed this basalt from the vicinity of Mineral Butte, but fairly large outcrops still cover part of the area north of Florence.

Thus, there is displayed a post-mineral history involving the original long exposure and erosion of the mineralized zones followed by three successive periods in which these zones were lightly covered by volcanic rocks, then re-exposed for short periods during which little erosion took place.

This sequence is quite similar to that of the Globe-Superior Area 30 miles to the east, which I reported on in December of 1958. Although only the three definitely known erosion periods were considered in that report, it was noted that: "The existence of volcanic rocks in the western part of the area, distinctly different from and definitely older than the dacite series, suggests the possibility of an unrecognized erosion cycle." The "older volcanics" are identical in appearance and stratigraphic position with the Blue Basalt, and they complete the similarity of the post-mineral sequence in the two areas. Because of this it is felt that a broad correlation of erosion surfaces and periods of enrichment is possible.

At Miami and at Ray, Ransome concluded that the greater part of the secondary enrichment took place prior to the period of dacitic volcanic activity and that the ore zones probably remained covered until exposure during the present erosion cycle.

In studying the Castle Dome and Copper Cities orebodies in the same district, Peterson concluded that these deposits were not exposed during the pre-dacite erosion cycle but were enriched only during the present erosion cycle. Both the thickness of the secondary zone and the degree of replacement of pyrite by chalcocite are less in these deposits than at Miami.

From this it may be concluded that on a regional scale the pre-dacite erosion cycle was the longest and most favorable to secondary enrichment, but that enrichment did take place during later cycles.

If during these periods of erosion the water table at Blackwater was deep and stagnant, then the post-mineral history at Blackwater would constitute a very favorable environment for secondary enrichment.

Post-mineral Faulting

Detailed mapping at Blackwater found no structures along which movement was wholly post-mineral. Several large, steeply dipping faults which strike N-S to N 20 W across the area show definite evidence of post-mineral movement, but the localization of more intense alteration and mineralization along some of these indicates pre-mineral origin.

Reconnaissance mapping found no definite evidence of post-mineral faults of large displacement of the sort which are common in many parts of southern Arizona. A possible exception to this is the distinct alignment of the granite outcrops between Olberg and Cholla Mountain, which is suggestive of a N 70 W trending structure north of the Gila River along this line.

Although widely separated, the outcrops of the base of the post-mineral formations are on about the same elevation throughout the area. The only structure that appears to have much affected this level is a N 65 E striking fault about 1.5 miles southeast of East Butte.

In the Posten Butte area there are no definite signs of post-mineral faulting, but there are features which suggest a northwest trending structure just west of Posten Butte. These are (1) the northwest alignment of bedrock outcrops northwest of Posten Butte, and (2) the eastward

dip of the Yellow Peak conglomerate beneath the relatively horizontal Walker Butte basalt on Posten Butte. Movement along this fault would have resulted in the downdropping of bedrock west of Posten Butte and correspondingly thicker cover. In addition to this possible structure there could be a major post-mineral fault paralleling the Gila River along a line south of Cholla Mountain and Posten Butte. No evidence of such a fault was found, but the possibility should be considered in evaluating geophysical results.

EXPLORATION POSSIBILITIES

Blackwater Prospect

At Blackwater the indicated maximum potential is small -- about 1,800,000 sq. ft. or 150,000 tons per vertical foot. For this deposit to be of economic tonnage and grade requires a thick zone of secondary enrichment in which the replacement of pyrite by chalcocite is nearly complete.

Although the capping at this prospect indicates with certainty that some secondary enrichment has taken place, it is not a "rich" capping. Limonite-after-chalcocite is not abundant in the exposed western half of the anomaly and it would appear from the even gradient of the geophysical contours that the mineralization in the lightly covered eastern half may not be much more intense.

These features -- the small potential area indicated by geophysics, and the relatively low grade indicated by the exposed part of the capping -- suggest a commercially marginal, or sub-marginal deposit. However, as an untested porphyry copper deposit, the Blackwater Prospect has a chance of being an economic ore deposit, and deserves a limited amount of exploration by drilling.

Posten Butte Prospect

The focal point of the Posten Butte Prospect is the intensely altered rock which outcrops at the base of Posten Butte itself. From this point the surrounding areas are limited as an exploration prospect by bedrock outcrops about 1/2 mile to the north and 6 miles to the west, and, probably, by rapidly deepening cover to the east and south. Within these limits is a rectangular area about 4 miles wide by 6 miles long and trending N 70 E (see Att. B). The abundance of altered and mineralized outcrops on the fringes of this area, and its situation directly on the continuing mineralized belt from the Ray district 30 miles to the east, makes this area an excellent prospect for the existence of a buried ore zone.

The effective use of geophysical methods at Posten Butte will depend to a large extent on the thickness and character of the post-mineral formations and the character of the underlying pre-mineral bedrock.

Covering Formations

The simplest possible picture to be drawn from existing outcrops

would be a bedrock surface of slight relief under a thin cover of valley gravels and a few remnants of Walker Butte Basalt. The thickness of this cover would vary from 100' or so in the north to more than 400' along the Gila River in the south. Two structural conditions -- pre-Walker Butte faulting, or pre-Walker Butte basins and channels --might exist which would result in much thicker cover.

As is described under Post-mineral Faulting, there is some slight evidence that pre-Walker Butte faulting may have resulted in a thickening of covering formations in the eastern and southern parts of the area.

In the absence of outcrops there is no way of determining the location and extent of basins or channels which might contain a considerable thickness of Yellow Peak or Rock Peak conglomerates. The only conglomerate outcrop in the area is that beneath the baselt at Posten Butte. Although it is less than 100' thick in that outcrop, it may indicate a rapidly deepening basin to the east. It is probable that remnants of post-mineral conglomerates, and possibly basalts, underly other parts of the area.

Both the Blue basalt and Walker Butte basalt contain significant amounts of magnetite. There may be local concentrations of magnetite sands in the conglomerates. A survey by magnetometer should show buried remnants of these formations as a magnetic high.

Underlying Bedrock

Most of the covered, pre-mineral bedrock between Cholla Mountain and Posten Butte is probably Coolidge granite or Mineral Butte granite. In the northern part of the covered area Pinal schist underlies the covering formations. An Induced Polarization geophysical survey should show a clear anomaly over a covered mineralized zone in these rocks.

Both the granite and the schist contain small amounts of magnetite, probably less than 1% in the granites and slightly more in the schist. Under fairly shallow cover an altered zone in these rocks should produce a magnetic low anomaly.

RECOMMENDATIONS

Posten Butte Prospect

(1) An investigation should be made of the surface and mineral ownership of the property within the area shown on Att. E.

(2) A magnetometer survey should be made on the covered ground surrounding Posten Butte and progress westward to Cholla Mountain and eastward toward Florence. Suggested traverses for correlating data over known occurrences of post-mineral basalts and over known altered zones are shown on Att. E.

(3) An Induced Polarization survey should be made on the covered ground surrounding Posten Butte and should progress westward to Cholla

Mountain and eastward to the Florence highway. Data from the recent survey of the Blackwater Prospect should be of use in correlating results. An initial traverse running N-S through the Posten Butte outcrops would span the difference between intensely altered rocks at Posten Butte and fresh rocks in the outcrops to the north.

(4) If the information gained by these surveys is inconclusive, then consideration should be given to the Posten Butte outcrops as an individual prospect which should be explored with a few drill holes in the covered area around Posten Butte.

Blackwater Prospect

Geophysical and geologic studies at Blackwater have reduced the target to a very modest potential. On Att. D five proposed drill hole locations are shown which will test this potential. Two of these holes are located on exposed bedrock and three are on the covering alluvium.

If the results of this drilling are favorable, exploration of Mineral and East Buttes should be considered, and a geophysical survey might be run over the covered extension of mineralization north of Granite Knob.

Yours very truly,

ARTHUR G. BLUCHER, JR.

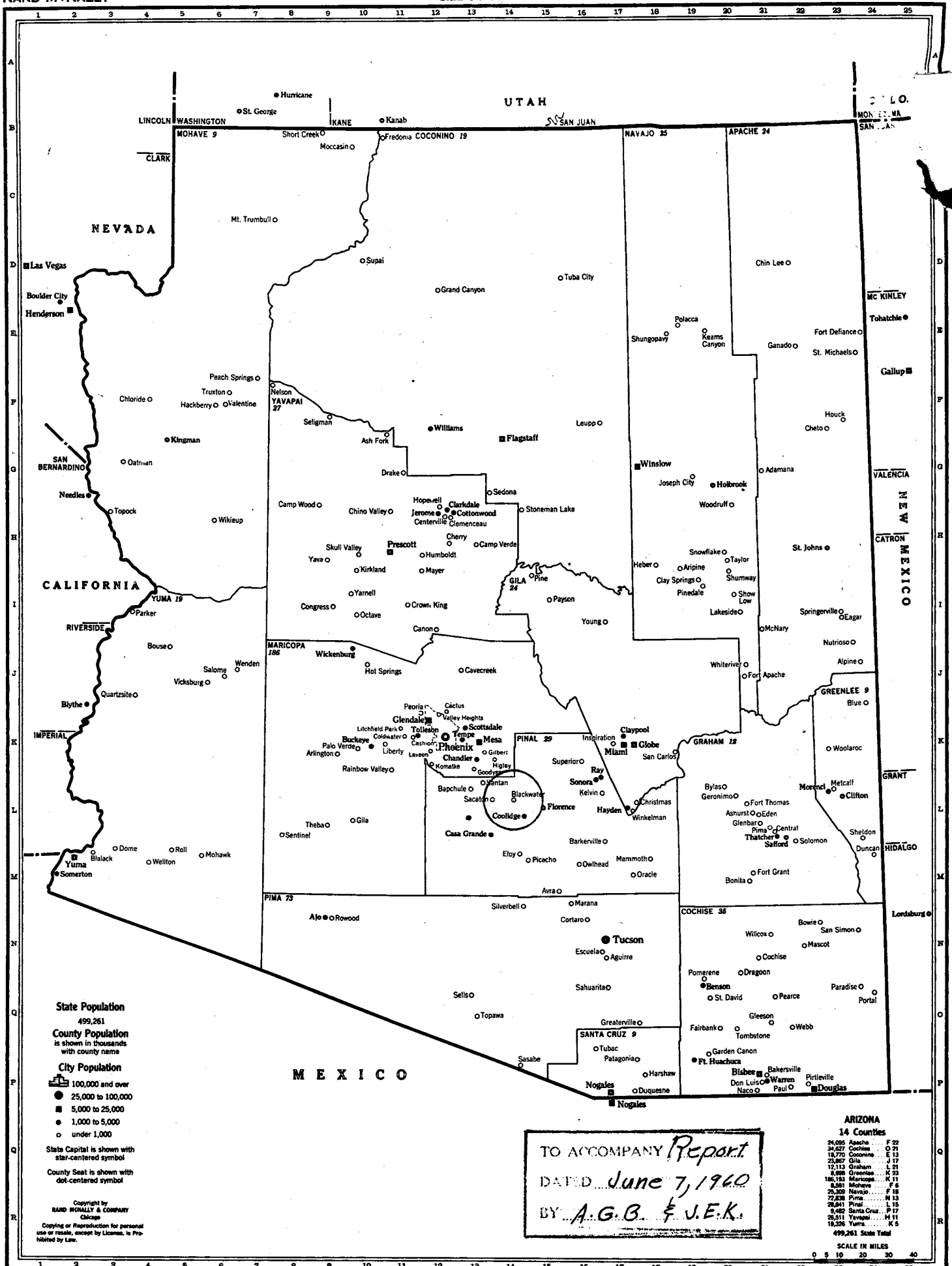
AGB/ds

RAND McNALLY

CITY-COUNTY STATE MAP
SIZE 8½ X 11

ATTACHMENT A

ARIZONA



State Population
499,261

County Population
is shown in thousands with county name

City Population
- 100,000 and over
- 25,000 to 100,000
- 5,000 to 25,000
- 1,000 to 5,000
- under 1,000

State Capital is shown with star-centered symbol

County Seat is shown with dot-centered symbol

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TO ACCOMPANY Report
DATED June 7, 1960
BY A.G.B. & J.E.K.

ARIZONA
14 Counties

24,095	Apache	F 22
34,627	Cochise	O 21
18,770	Coconino	E 13
23,867	Gila	J 17
12,113	Graham	L 21
8,988	Greenlee	K 23
186,193	Maricopa	K 11
8,561	Mohave	F 6
25,309	Navajo	F 18
72,838	Pima	N 13
28,841	Pinal	L 15
9,482	Santa Cruz	P 17
26,511	Yavapai	H 11
19,326	Yuma	K 5
499,261	State Total	

SCALE IN MILES
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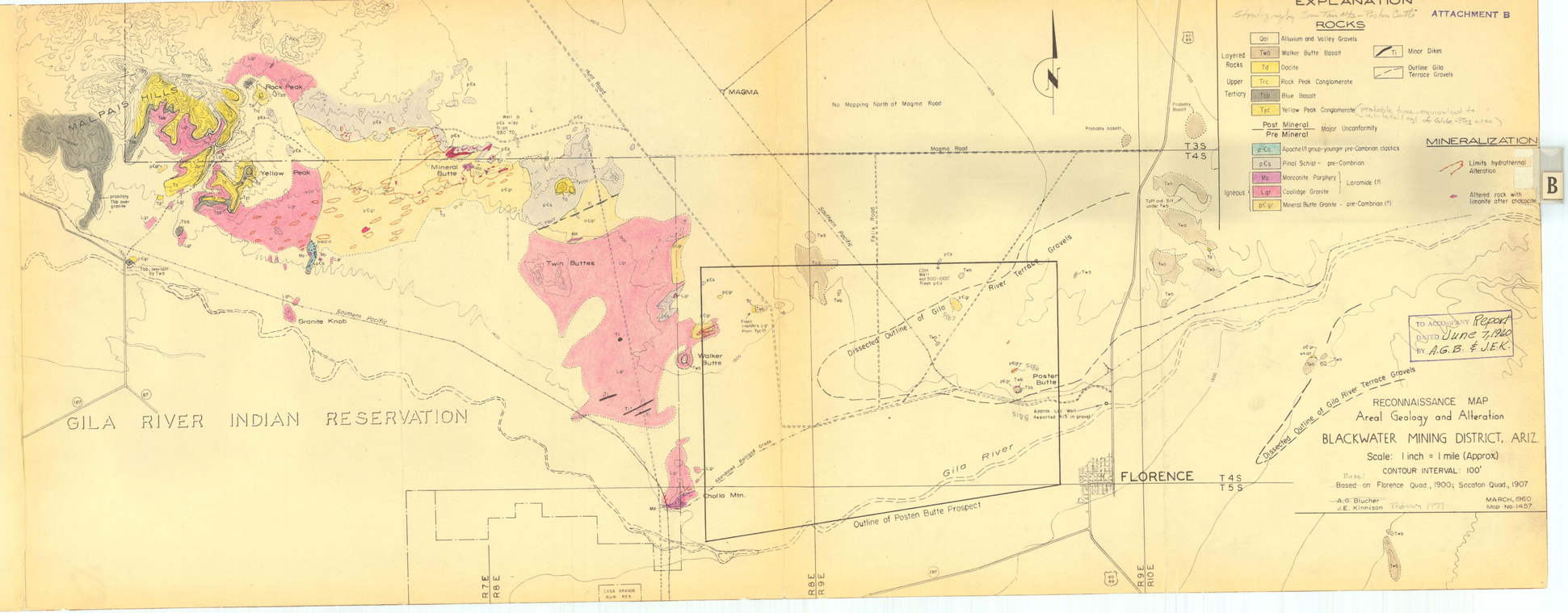
A



EXPLANATION
Stratigraphy San Tan Mts - Poston Butte
ATTACHMENT B
ROCKS
Qal Alluvium and Valley Gravels
Layered Rocks
Twb Walker Butte Basalt
Td Dacite
Upper Tertiary
Trc Rock Peak Conglomerate
Tbb Blue Basalt
Tyc Yellow Peak Conglomerate (probable time - equivalent to white tail cgl of Globe - Pay area)
Post Mineral
Pre Mineral
Major Unconformity
p€a Apache (?) group - younger pre-Cambrian clastics
p€s Pinal Schist - pre-Cambrian
Igneous
Mp Monzonite Porphyry
Lgr Coolidge Granite
Laramide (?)
p€gr Mineral Butte Granite - pre-Cambrian (?)
Ti Minor Dikes
Outline Gila Terrace Gravels
MINERALIZATION
Limits hydrothermal Alteration
Altered rock with limonite after chalcocite
B
TO ACCOMPANY Report
DATED June 7, 1960
BY A.G.B. & J.E.K.
RECONNAISSANCE MAP
Areal Geology and Alteration
BLACKWATER MINING DISTRICT, ARIZ.
Scale: 1 inch = 1 mile (Approx)
CONTOUR INTERVAL: 100'
Base: Based on Florence Quad., 1900; Sacaton Quad., 1907
A.G. Blucher
J.E. Kinnison
MARCH, 1960
Map No. 1457
MALPAIS HILLS
Rock Peak
Yellow Peak
Mineral Butte
Twin Buttes
Walker Butte
Granite Knob
Cholla Mtn.
Poster Butte
MAGMA
No Mapping North of Magma Road
Magma Road
Hunt Road
Southern Pacific
Felix Road
Dissected Outline of Gila River Terrace Gravels
Gila River
Outline of Posten Butte Prospect
GILA RIVER INDIAN RESERVATION
FLORENCE
T3S
T4S
T5S
R7E
R8E
R9E
R10E

ATTACHMENT C

C

25

30

29

36

31

32

Leo Ellsworth

Virgil J. Vance

GRAY HILL

MINERAL BUTTE

6MV/V

2MV/V

Approx.

INDIAN RESERVATION BOUNDARY LINE

T3S
T4S

Monzonite

EAST BUTTE

Pinal Schist

Granite

1

6

5

R7E
R8E

EXPLANATION

- Zone of Alteration & Mineralization
- Intense Alteration & Mineralization
- Fresh Rock
- Geophysical Contours
- Federal Ownership of Mineral Rights
- State Ownership of Mineral Rights
- Private Ownership of Surface & Mineral Rights
- Gila Indian Reservation
- Approx. Outline of Federal Mining Claims Held by R. B. Rodney
- Outline of Company Claims as of December, 1959.

TO ACCOMPANY Report
DATED June 7, 1960
BY A.G.B. & J.E.K.

PROPERTY MAP OF BLACKWATER PROSPECT

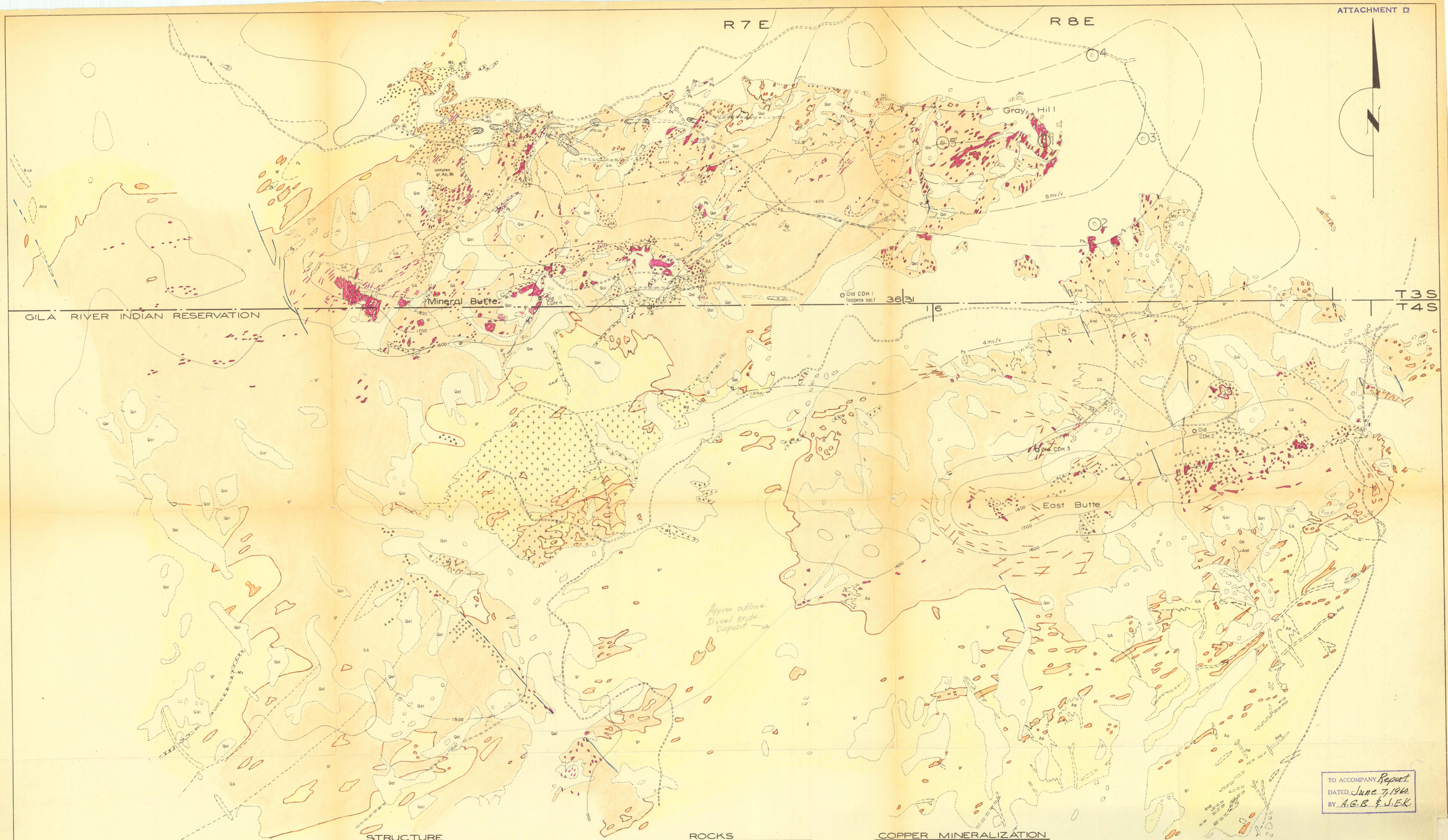
Blackwater Mining District
Pinal County, Arizona
Scale 1" = 1000'

A.G.B.
J.E.K.

June 18, 1960

1464

ATTACHMENT D



TO ACCOMPANY Report
DATED June 7, 1960
BY A.G.B. & J.E.K.

STRUCTURE

- Breccia. Includes breccia pipes( ), crushed zones, and other breccia-like bodies.
- Faults
- Mineralized veins
- Rock contact
- Alluvial contact

ROCKS

Post-Mineral

	Qal	Alluvium
	And	Andesite

Pre-Mineral

Laramide	Mz	Monzonite
Laramide or pre-Cambrian	Ap	Aplite
	GA	Granite and aplite complex zones
	gr	Granite
pre-Cambrian	Ps	Pinal schist, includes small bodies of metamorphic aplite

COPPER MINERALIZATION

Leached Capping

- Moderate to strong alteration with common to abundant limonite-after-chalcocite.
- Weak to strong alteration with limonite-after-pyrite predominating; limonite-after-chalcocite absent or sparse.
- Rock essentially fresh; no evidence of hypogene mineralization.

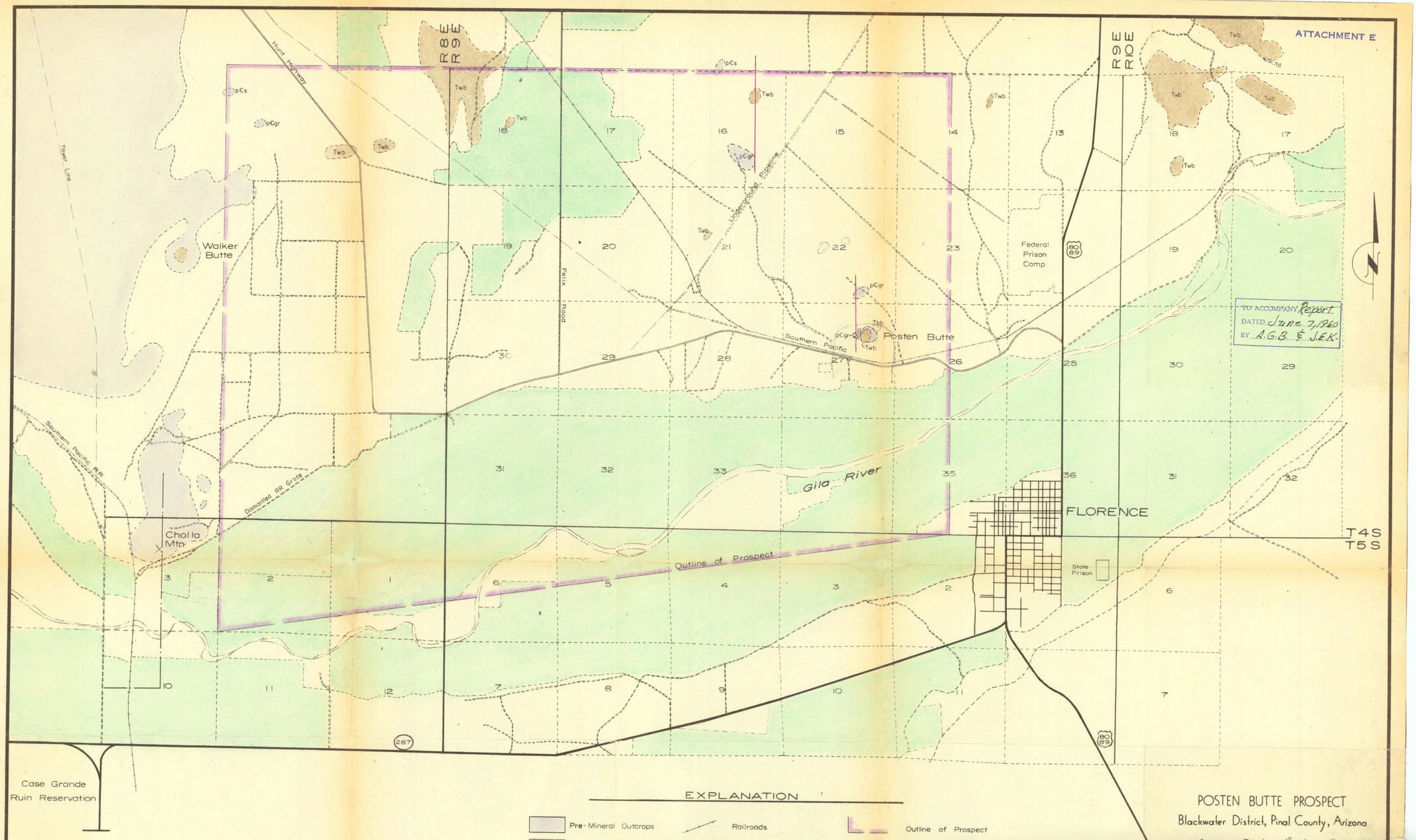
(o)2 Proposed Diamond Drill Hole

OUTCROP MAP
MINERAL BUTTE PROSPECT
BLACKWATER MINING DISTRICT ARIZONA

Base: Areal Photographs, Blanton & Cole
Approximate Scale: 1" = 300'
Contour Interval: 100'

GEOLOGY BY: A.G. BLUCHER
J.E. KINNISON

March, 1960

1460

ATTACHMENT E