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9 OF 11 SUBPART 13
JW GIESE REPORT

PRINTED: 06-20-2006

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: BULLARD

ALTERNATE NAMES:
LITTLE GIANT

YAVAPAI COUNTY MILS NUMBER: 109

LOCATION: TOWNSHIP 8 N RANGE 10 W SECTION 11 QUARTER N2
LATITUDE: N 34DEG 03MIN 57SEC LONGITUDE: W 113DEG 16MIN 23SEC
TOPO MAP NAME: SMITH PEAK - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:
COPPER OXIDE
COPPER SULFIDE
SILVER
GOLD
SILICON
CALCIUM CALCITE

BIBLIOGRAPHY:
MAPS - FLAT STORAGE, 2ND DRAWER
ADMMR BULLARD MINE FILE & COLVO FILE
ADMMR INDEPENDENCE FILE
BLM MINING DISTRICT SHEET 341
USBM WAR MINERAL REPORT 1945 REPORT 453
CLAIMS ALSO IN SEC 1, 2, 3, 10 & 12
FOWLER, GEORGE M (EAGLE PITCHER) GEO FILE
TOVOTE, W. 1918 "CUNNINGHAM PASS", GEO FILE
AGSU OFR 92-1, MINERAL DEP. BULLARD MINERAL DIST. . . ., 1992, SPENCER, J. AND REYNOLDS

"A GEOLOGICAL INVESTIGATION OF THE

BULLARD MINE, AGUILA, ARIZONA"

Jeffery W. Giese

April, 1984

ABSTRACT

The Paleozoic stratigraphy of the Bullard area claims has been obscured by the shallow intrusion of a Laramide Andesite porphyry. In the Mid-Tertiary, the area was effected by the metamorphic core development in the Harcuvar Mountains with subsequent listric normal faults. The area also has mid to late Tertiary sediments and volcanics. The ore forming event(s) are post Andesite intrusion.

Mapping and sampling in the Bullard claims indicate six veins with an estimated total of 673,000 tons and value of 90, million dollars. The possibility of a bulk, low-grade porphyry gold deposit may be considered as drilling proceeds to prove vein targets. Geophysics should be the next step at the Bullard property but only after the acquisition of the patented property.

INTRODUCTION:

The town of Aguila, Arizona, is located twenty five miles west of Wickenburg, Arizona, on US 60. The field area for this investigation is the Bullard Claims located eleven miles to the north-west of Aguila. The area is accessible by seven miles of county maintained road and four miles of road which is passable by two-wheel drive vehicle. Present road conditions are good. Vegetation is typical of the upper Sonoran Desert. Water does exist in the mine workings and local wells.

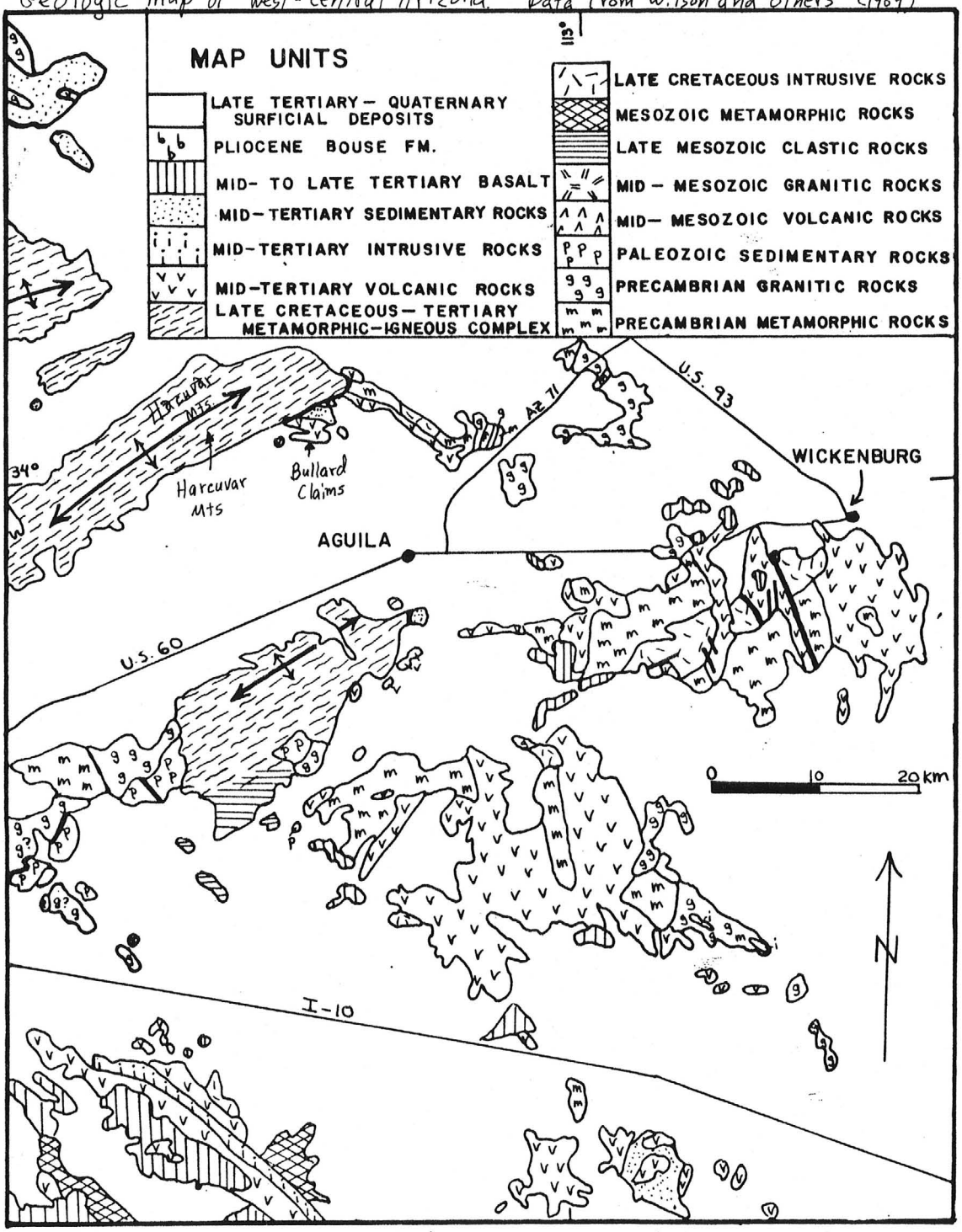
The area has been mined intermittently since the late 1800's. Early records are sparse to non-existent. In the 1940's, records indicate 5,500 tons of ore removed averaging 0.32 oz/ton of gold, 0.24 oz/ton of silver and 2% copper. In the 1950's, ASARCO took 43 samples which averaged 0.25 oz Au/ton, 0.5 oz Ag/ton and 2.67% copper. The area has been mined as recently as 1980. There are 152 claims in the Bullard group of claims held by Michael C. Sansome. These claims surround a block of patented claims of record.

REGIONAL GEOLOGY:

The Bullard claims occupy hills of low to moderate relief situated on the south-east flank of the Harcuvar Mountains. These mountains were formed twenty to thirty million years ago by a metamorphic/tectonic event. There are several of these "metamorphic core complexes" in the Basin and Range province of both Arizona and California; the Harcuvars seem to be typical of them. These complexes appear as broad up-arches of Pre-Cambrian basement. As the up-arching proceeds, the Pre-Cambrian develops sub-horizontal joints and foliations while the Phanerozoic rocks above the basement are typically faulted by low-angle, listric, normal faults. These faults result in highly deformed, near vertical dipping Phanerozoic strata on the flanks of the metamorphic core complex.

The Laramide orogeny has effected many areas of the Basin and Range. The area of the Bullard claims are now largely occupied by an intrusion of this age. These rocks intrude the Phanerozoic strata from 100 plus to 30 million years ago and subsequently rotated through 90 degrees by the listric faults. Mineralization in the area is post-intrusive. Mineralization is cut by late Tertiary faults.

Geologic map of West-central Arizona. Data from Wilson and others (1969)



modified using maps of Ciancanelli (1965), Jemmett (1966), Miller (1966, 1970), Shackelford (1975), Rehrig and Reynolds (in press), Rehrig and others (this volume), Marshak (1979), Arizona Public Service (1975), and regional and detailed mapping by S. Reynolds.

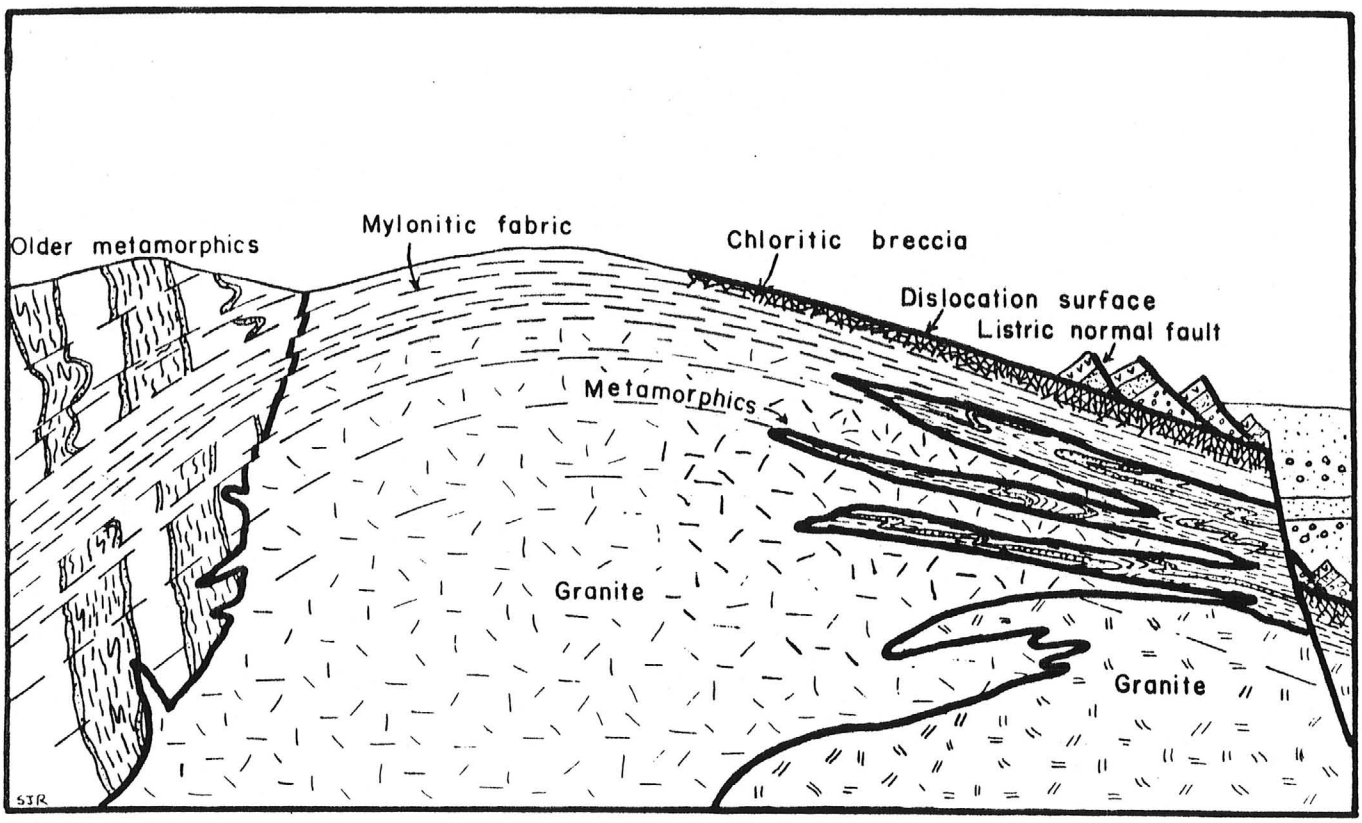


Fig. 4. Schematic cross section across a "typical metamorphic core complex"

GEOLOGY OF THE BULLARD CLAIMS:

The story of the Bullard claims is basically one of Phanerozoic sedimentation and volcanism which are intruded by a Laramide porphyry. All of these rocks are faulted and locally overturned by listric faults as the metamorphic core complex develops to the north-west. Mineralization is post-porphyry but before some late-Tertiary faulting.

The Pre-Cambrian in the claim's area is now represented by the granites and gneisses in the metamorphic core complex of the Harcuvar Mountains. These rocks are separated from the rocks of the Bullard claims by a major east-north-east fault that is covered but probably listric and normal.

The sediments of the area are conglomerates, sandstones, shales and limestones of probable Paleozoic age. These rocks have been intruded by a Laramide Andesite Porphyry. Later deformation has resulted in the sediments generally striking east-west and dipping near vertical. Some sediments and volcanics are not involved in the intrusion and possessing different bedding attitudes are mapped as Tertiary in age.

ANDESITE PORPHYRY

From Cretaceous to mid-Tertiary, this Laramide pluton intruded into a shallow level of the crust. Its intrusion, as dikes and sills, disrupted and assimilated all previously existing strata. In a few outcrops the porphyry weathers to mimic an extrusive texture. Although some portions of the unit may have been extrusive volcanics, the larger majority of field relations indicate an intrusive origin for this rock.

The Andesite porphyry of this report is equivalent to the "Diabase" of the DeLise (April, 1980) report. Although locally the rock may be diabasically textured, more generally the rock has a porphyritic texture. The Andesite porphyry is the host for at least one wall, and usually both walls, of all mineralized veins in the area, with the notable exception of the "Broken Ladder" mine.

A subject beyond the scope of both this paper and existing samples, but a subject that does deserve further investigation, is that the Andesite porphyry could be the host of a bulk, low-grade, disseminated gold porphyry-type deposit. The Andesite porphyry makes up the vast majority of the outcrops of the area and is under a thin alluvial cover in the Aguila Extension claim block. This rock may extend another 2 miles to the west and several miles to the north and east of the Bullard Claim area.

ROCK DESCRIPTIONS:

Andesite Porphyry to Porphyritic Diorite

Rock weathers black, green and red; grey on fresh surface, usually high fractured; slope former.

Plagioclase: 20-50% white to grey, euhedral, rarely corroded, flow oriented (?), porphyritic, argillic altered.

Augite: less than 10% euhedral, black, chlorite altered.

Aphanitic: 20-70% fine granular, grey.

Accessory: Hornblende, magnetite and olivine.

Secondary: Quartz and calcite.

Sedimentary

Clastics are usually red and cliff formers. Sandstone is rarely well rounded and sorted. Most commonly the rock is conglomerate. Pebbles to cobbles are usually granitic, rarely basaltic and occasionally lithic. Rare cut and fill. Shales are fissile to blocky, aphanitic. All rocks have suffered at least low grade metamorphosis.

The freshest rock in the area are the limestones. Breciated in the hanging wall of the Bullard Mine, they appear very well preserved in the flats of the Extension Group of 48 claims. They are composed of 80% micrite with 20% chert nodules. Echinoderm spines have been replaced by silica and well preserved. Other fossils may be fusulinid and rugose coral could assign an upper Paleozoic age.

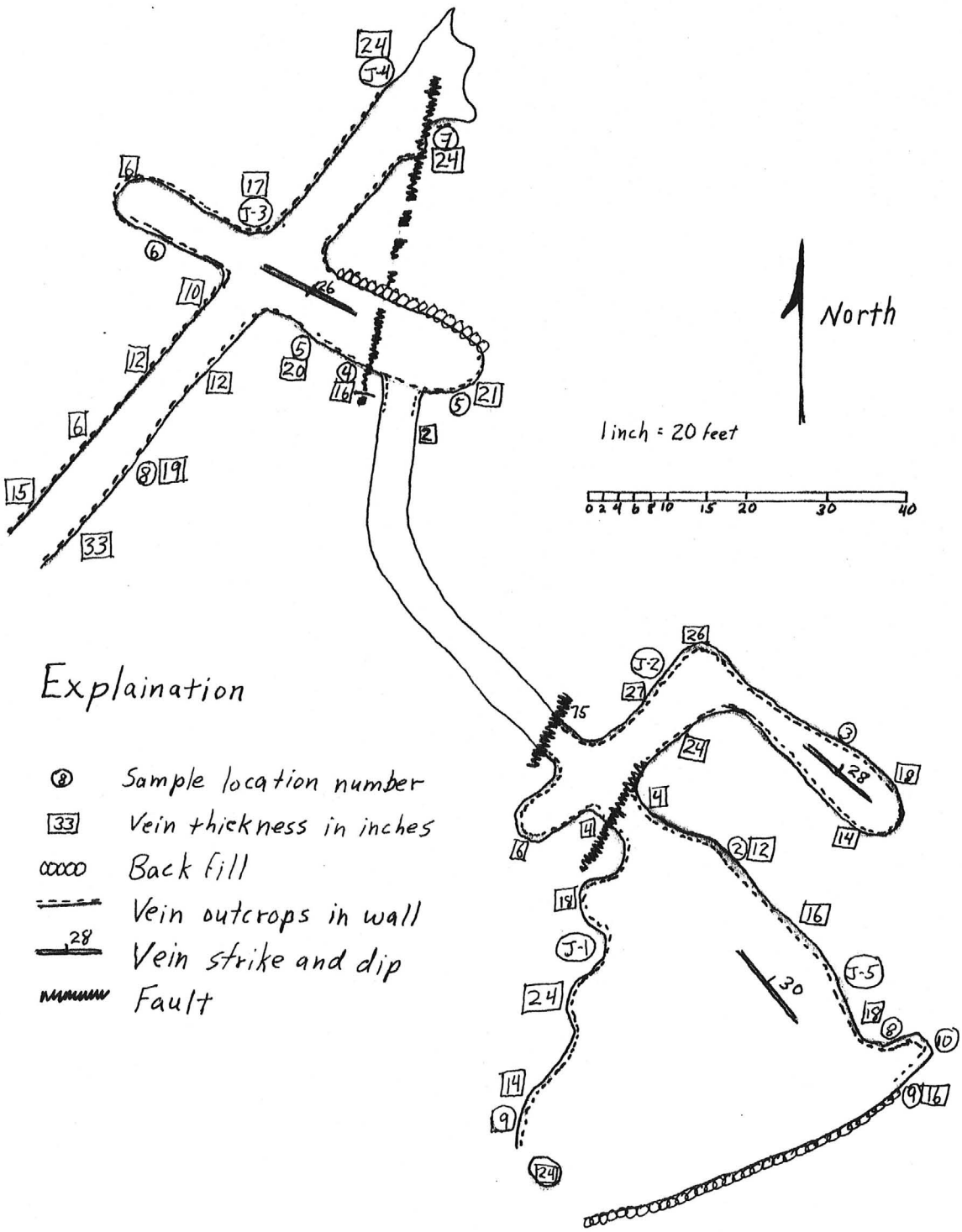
ECONOMIC GEOLOGY:

The mineralization in the Bullard claims occurs as veins in fault and shear zones. The possibility of a bulk, low-grade, disseminated gold porphyry warrants further investigation. The veins must be the present target, however, since a porphyry could not be considered porperly until a large amount of subsurface data has been obtained. This data may be generated as a by-product of drilling for vein targets.

The age of mineralization is younger than the andesite porphyry and older than late-Tertiary faulting. The occurrence of good mineralization at the "Broken Ladder" hosted in the Pre-Cambrian gneiss may indicate that veins will extend into basement and could be younger than metamorphic core complex development. All other veins are hosted in the andesite porphyry. Indirect evidence suggests that mineralization may extend to greater than 900 feet; this distance is unusually large for this type of deposit, but believable. Another geologist working in the area suggests that, "samples indicate that lower in the section higher average values may exist." This, again, would be unusual for this type of deposit, but could make development attractive. In some cases, notably Red Hill and possibly John Moore and Unity Group, veins are still only a few feet wide, but several, parallel veins occur in a shear zone 10's of feet thick.

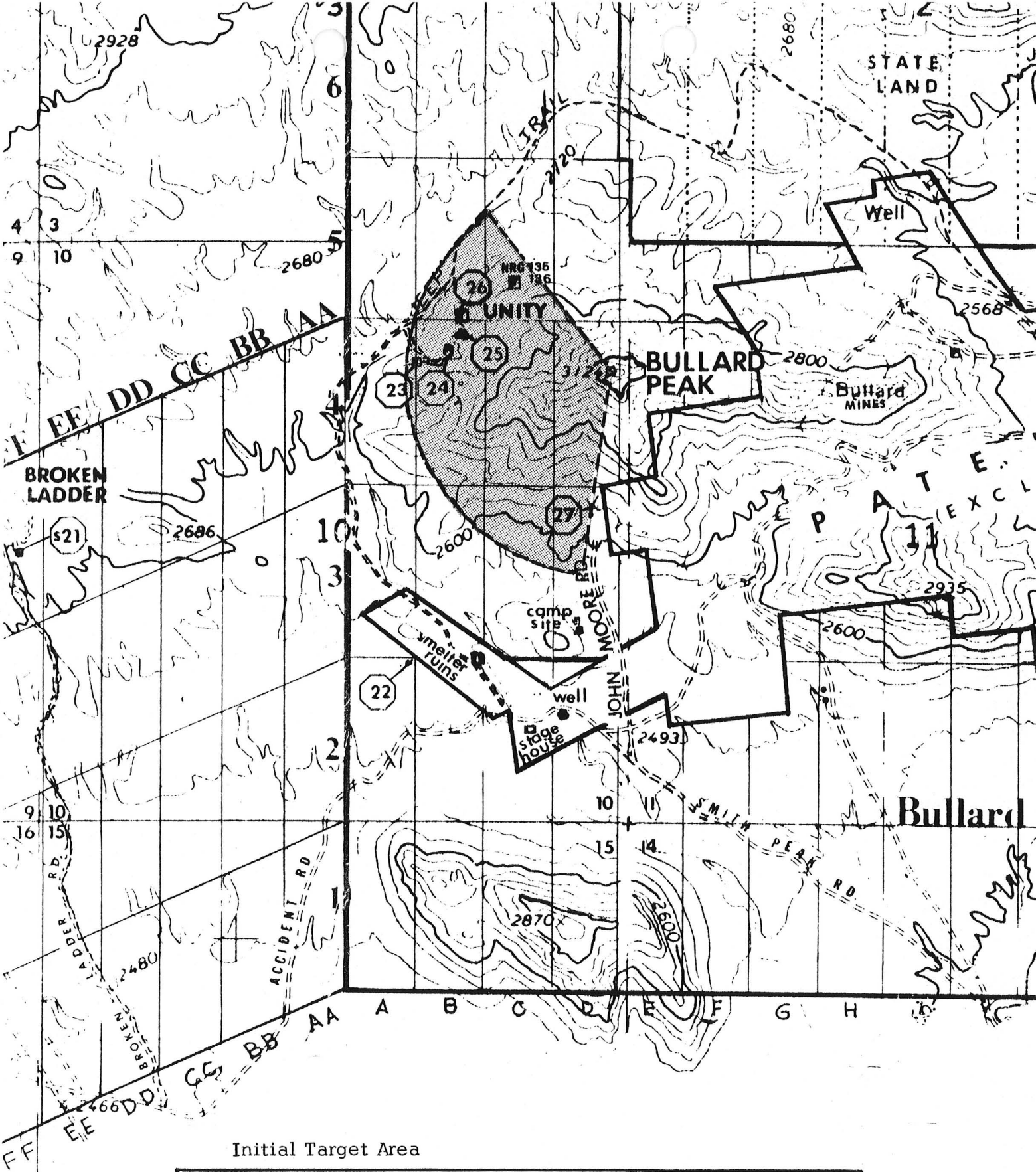
Veins exposed to date generally strike north-west and dip

Plan Projection of the John Moore Mine



north-east but a few strike north-east and dip south-east. Cutting faults generally strike north. Mineralized veins occur as silicates, carbonates, oxides, and sulfides. The most prominent minerals are chrysocolla, malachite, azurite, cuprite, chalcopyrite, hematite and pyrite. The majority of the vein material is quartz and calcite gangue. Gold and silver occur as electrum and as native elements. The wall rock adjacent to veins have been bleached (sericite or argilic alteration) and occasionally chloritized.

Economic veins form in dilational portions of faults. Veins of considerable thickness can pinch to non-existent in a matter to tens of feet; veins can be displaced by later faulting. Subsurface drilling can pass through uneconomical portions of an otherwise rich vein; you really don't know what's there until it's dug up. However, by linear measurements and estimates, and through sampling establish average grades, we can generate estimates of tons and value.



Initial Target Area

Striking a 135 degree arc with a radius of 1800 feet from Bullard Peak to encompass the sampled locations results in an initial target area of approximately 80 acres.

JOHN MOORE VEIN

A portion of this vein is on the patented property.

1500 x 600 x 2	=	1,800,000 cu.ft.
1,800,000/ 13	=	140,000 tons.

12 samples within this structure, processed in 3 laboratories, yielded an overall average of .411 oz/ton Au.

JOHN WEST VEINS

To the west of John Moore I found two different veins with attractive widths.

JW1	500 x 500 x 3	=	750,000 cu.ft.
	750,000/ 13	=	57,000 tons
JW2	700 x 500 x 4	=	1,400,000 cu. ft.
	1,400,000/ 13	=	107,000 tons

One sampling from this area yielded .334 oz/ton Au.

UNITY

This could prove to be the richest vein on the property.

2000 x 600 x 2	=	2,400,000 cu. ft.
2,400,000/ 13	=	185,000 tons

An average of 19 samples, processed in 3 laboratories yielded .498 oz/ton Au; .48 oz/ton Ag.; and 2.3% Cu.

These three groups lie within an arc of 135 degrees, having a radius of 1800 feet from Bullard Peak, and comprising approximately 80 acres. Collectively, this area should be designated as a "target area".

Average values of $390/oz Au., $10/oz Ag. and 66¢/lb. Cu. are used herein.

This "target area", totalling 498,000 tons, would yield $96,491,940.00.

BROKEN LADDER

In the Aguila Extension claims is the Broken Ladder. This is a good looking vein with inclined shaft whose extension is under the Tertiary gravels. For this, we must estimate not only depth, but also length.

1000 x 600 x 2	=	1.200,000 cu.ft.
1,200,000/ 13	=	92,000 tons

Four samples, processed in three laboratories, yielded .557 oz/ton Au. This yield, coupled with the district average of .23 oz/ton Ag and 2.3% Cu. and 92,000 tons would result in $22,894,720.00.

The combined total of yields is:

"Target Area"....	$ 96,491,940.00
Broken Ladder ..	$ 22,894,720.00
Total Value	$119,386,660.00

The above sites on which these estimates have been made comprise only a small portion of the total number of known sites within the boundaries of the 152 lode claims owned by Sansone.

GEOLOGIC RECOMMENDATIONS:

The two veins west of John Moore have not been sampled; each has an audit which needs mapping and sampling. More samples could be taken between existing sample locations to get a better idea of the mineralization which is in outcrop and in the shallow, existing mine workings.

The most emphatic recommendation is a geophysic program. The method to use would probably be induced polarization. The first uses would be on the "Owl" and "22" to determine their strike length and depth. By these small scale surveys we may determine how effective this method is in the detection of ore at the property. It should prove successful and the next place for a survey would be on a larger scale in the areas south of the Unity Group and west of John Moore. If this is still giving good results, then a still larger scale survey should be undertaken in the Aguila Extension.

The better anomalies of the geophysical survey should be drilled into. Drilling may produce favorable results on the dip side of veins. The first intercepts of the veins should be approximately 200 feet below surface. Deeper holes will probably not be used unless favorable intercepts occur. It bears repeating that drilling can pass between the rich portions to show poor results on a good vein. The most enlightening program could well be a geophysical survey.

Jeffery W. Giese

Wickenburg, Arizona
April 30, 1984

Jeffery W. Giese

The following Geological report was prepared for NRG Resources by KNOXIE DE LISE on patented claims which adjoin the 152 claims owned by MICHAEL SANSONE.

This report and test samples extend into the claims controlled by Sansone.

Plate One, at the end of the report, shows that the highest reported gold content was assayed from samples #135 and #136. These two samples came from Sansone claims.

"A GEOLOGIC INVESTIGATION OF THE

BULLARD MINE, AGUILA, ARIZONA"

Knoxie C. DeLise

October, 1981

PROFESSIONAL STATEMENT

I, Knoxie C. DeLise, do hereby certify in the County of San Diego, California, that:

1. This report was prepared for NRG Resources, Ltd., and that I have no interest in NRG Resources, Contract Mining Corporation or Brunyan Resources, Ltd. I also certify that I will not in the future receive any interest in these companies.
2. This report is based on my personal examination of the Bullard Mine patented mineral claims.
3. I hereby certify that I hold neither direct nor contingent interest in NRG Resources Ltd., Contract Mining Corp. or Brunyan Resources Ltd.
4. I am a consulting geologist with a business address at 9043 Harmony Grove Road, Escondido, California 92025.
5. I am a graduate of the University of California, Berkeley, with advanced degrees in the geological sciences in 1955 and 1957.
6. I am a duly registered and licensed professional geologist and a member in good standing of the Society of Mining Engineers, the American Association of Petroleum Geologists, The Society of Economic Paleontologists and Mineralogists and other professional associations.

PROFESSIONAL STATEMENT (continued)

7. I have practiced my profession for more than 20 years.

8. Consent is hereby granted to NRG Resources Ltd., to reproduce all of this report with or without plates, figures or appendices.

Dated in the City of Escondido, County of San Diego, California this 24th day of October, 1981

Knoxin C. DeLisle

Reg. Geol. No. 2118

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ABSTRACT

The Bullard Mine consists of 26 lode claims in southwest Yavapai County, Arizona. The outcrop exposures are visible in the foothills adjacent to, and southeast of the Harcuvar Mountain Range.

Economic conditions have controlled mining at the Bullard since the late 1800's. Subsequently, such mining has been intermittent with probably 10,000 to 20,000 tons having been extracted up to 1970.

The area consists of Paleozoic clastic strata and limestones, possibly of Devonian or Mississippian age, intruded by thick diabase sills, all of which have been rotated to vertical. The diabase appears to be Late Cretaceous or Early Tertiary and is related to the Laramide orogeny. Mineralization is expressed as silicates, carbonates, oxides and phosphates of copper with small quantities of associated gold and silver, as well as sulphides. This mineralization appears in faults, shear zones, fissures and some bedding planes and pre-dates the major, Late Cretaceous orogenic movements. Bullard mineralization occurrence is seen as intrinsically related to the diabase intrusive. Tertiary faulting has subsequently superimposed a complex structrual pattern upon these beds.

Mineralized zone reserves are calculated as: 40,000 tons (measured), 72,693 tons (indicated) and 612,643 tons (inferred). Average assays show .22 oz/ton gold, 0.23 oz/ton silver and

about $144.00 per ton gross (using $450.00 per ounce gold, $10.00 per ounce silver and $.70 per pound copper.

The implied gross value of the mineralized zones is calculated on a total of 725,336 tons with the resulting figure being $104,450,000.00.

Treatment procedures of Bullard potential ore are still being studied but early test results indicate crushing to minus 40 mesh with gravity separation to reach 95 to 97% recovery of all sulphides. This would be followed by acid copper leach processes.

2. INTRODUCTION

A. Location

The Bullard mining claims are situated in the Pierce Mining District of southwest Yavapai County, Arizona, 11 miles north of Aguila. The town of Aguila, with a population of around 1000, is on the Santa Fe Railroad, 25 miles west of Wickenburg and 80 miles west-northwest of Phoenix (see figure A).

All-year highways (U.S. 60 and Ariz. 71) reach Aguila with most services available there or in Wickenburg. Roads from Aguila to the claim area are good but can be impassible for a few days after seasonal rains. Adequate water is available for mining purposes from several wells on and near the property and in abandoned shafts.

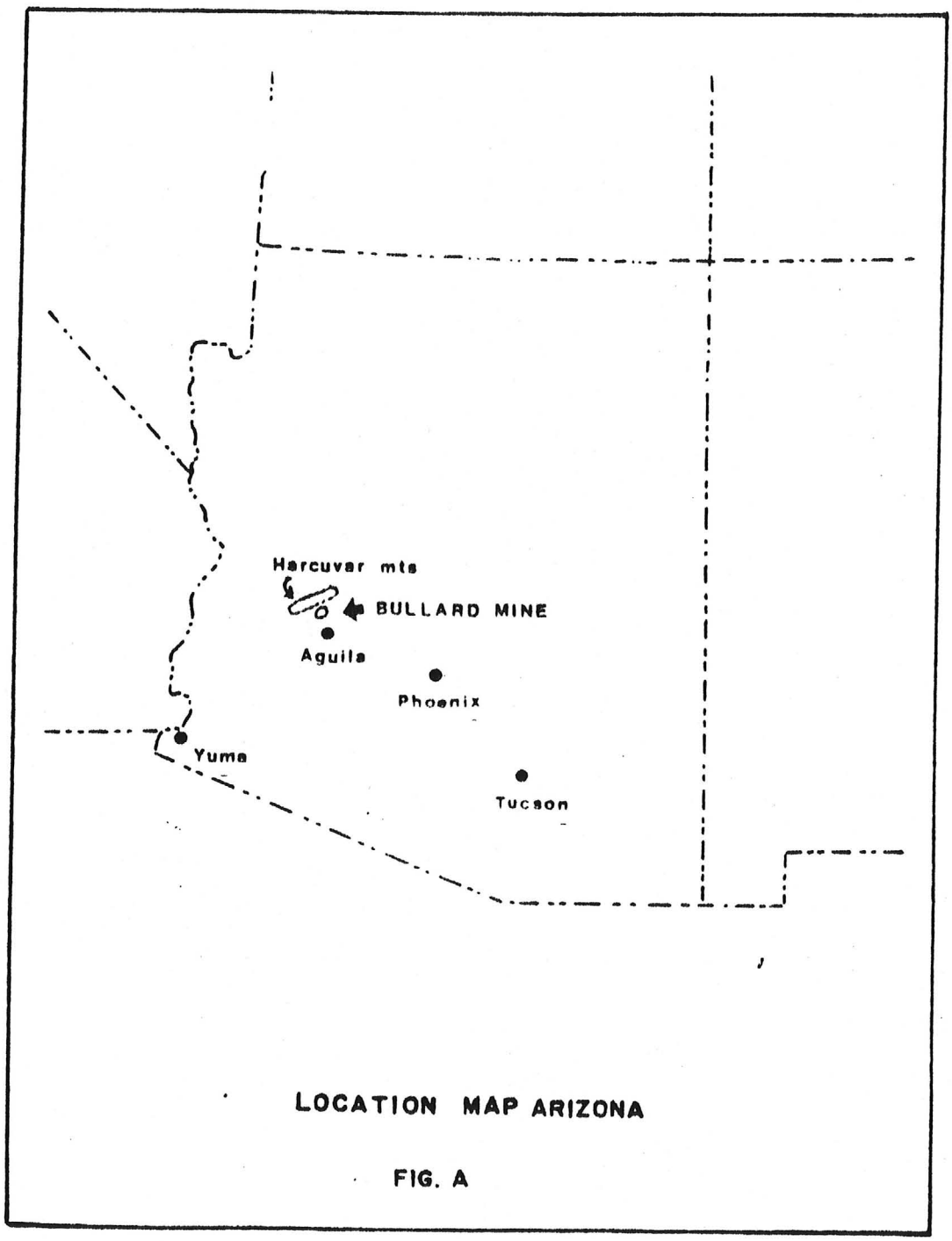
B. Area of Interest

The Bullard Mine is at an altitude of about 3000 feet. There are 26 lode claims which occupy a total area of 537 acres (0.84 square miles or 2.17 square kilometers).

A reconnaissance geologic map was completed in January of 1981 overlaying the claim area in particular and although time limited the detail of mapping, contiguous surrounding features were also investigated and mapped. The total resultant map area covers 3.3 square miles or 8.5 square kilometers (see Plate 1,2).

C. The Claims

The claim boundaries are outlined on Plates 1 and 2 and are identified as follows:



LOCATION MAP ARIZONA

FIG. A

CLAIMS

1. North Extention
2. Augustus
3. South Wing
4. Sulla
5. Chancellor
6. Amazon
7. Newborn
8. Napoleon
9. Venice
10. Jay Bird
11. Nevada
12. Producer
13. Butte
14. Rattler
15. Emily
16. Steller
17. North Star
18. Homestake
19. Washington
20. International
21. Sweep Stake
22. Avalanche
23. Last Bean
24. Democrat
25. Arizona
26. State

3. PAST WORK

The Bullard property has been optioned to various groups and individuals through the years and a complete chronology is beyond the scope of this report. However, the reader is referred to the appendix where some of the documents have been reproduced. At least one company, Powdered Metals Corporation (PMC), churn-drilled several holes on the claims from 1969 to 1970. Some of the holes are shown on plate 1. Unfortunately, the information and data from the PMC drilling is, so far, not available. Powdered Metals Corporation went into bankruptcy in 1973 or 1974.

The Bullard Mine has a long history of intermittent operation since the late 1800's. It is known that a smelter was built around 1887 and according to Durfee (report undated; p. 1) worked for a short period. The ruins of the smelter are visible today and are noted on the map (see plate 1,2). Durfee also mentions that the coke needed for this smelter was hauled by horse and wagon from the nearest railhead at Maricopa, 100 miles distant. The Bullard family patented the property in 1907.

Later operators and promoters of the Bullard property have reported copper concentrations at around two to three percent with small amounts of gold and silver. In 1950, ASARCO mapped and evaluated the main mineralized horizon, assaying 43 samples for an average concentration of 0.25 oz/ ton Au, 0.50 oz/ton Ag and 2.67% copper.

Shipping records are sparse but workings suggest that probably no more than 10 to 20 thousand tons were shipped before Contract Mining Corporation took over in November of 1979. CMC began mining the property in 1980 and has shipped some 4,000 tons to date. Development is now continuing with NRG Resources Ltd. of Canada and Contract Mining Corporation of Yuma, Arizona.

4. GENERAL GEOLOGY

A. Introduction

The Bullard area is adjacent to the Harcuvar Mountains, the latter of which is a Late Cretaceous or Early Tertiary metamorphic-igneous complex (Reynolds, 1980). The Harcuvar Range is

about 35 miles long, trending northeast-southwest. The area of investigation in this report is an east-west trending series of vertical or near vertical sedimentary strata intercalated with thick sills of olivine diabase and possibly some extrusive volcanic beds.

The sedimentary strata are siliceous limestones, metashales and sandstones, probably Devonian or Mississippian in age. The limestones and sandstones are very well indurated, altered by low rank metamorphism and forming high ridges due to their resistance to erosion. Not all the high resistant ridges here are siliceous limestones or sandstones; some of these features are diabase.

Diabase commonly and frequently weathers to low profiles rather readily as seen in other areas such as the Globe-Miami district of central Arizona. Such weathering to subdued topography is seen in the Bullard area. Bullard Peak itself, the highest resistant diabase is probably the consequence of juxtapositioning by faulting or by variable mineralogy or both.

B. Lithology

a. The Diabase

Mapping in the area has revealed the pervasive relationship of a Late Cretaceous or Early Tertiary mafic olvine diabase intrusion as sills into a series of Paleozoic clastic sedimentary strata.

The diabase is gray to dark gray, often with a greenish hue. It ranges from very coarse grained to aphanitic. As is common in diabase texture, the plagioclase laths are as much as 20 millimeters in length. Poikilitic augite (and hornblende?) in spheroidal to very irregular masses up to several inches long occur as rounded inclusions and curious, unusual shapes (not unlike a coarse porphyritic texture). These often weather out intact and appear as spheroidal "kernels" and rounded, marble-like shapes. Similar diabase texture occurs near the Globe-Miami and Superior areas (Peterson, 1962).

Dark brown augite is abundant in the groundmass and is frequently poikilitically arranged with secondary quartz rim. Euhedral calcite is also noted as "poikiliths". It is not clear whether these calcite crystals are deuteric or metasomatic in origin. Their presence within the mineralized zones suggests that they are probably metasomatic in orgin. Poikilitic and trace olivine is also common as light, bottle green, divergent, acicular crystals, comprising up to 5% of the rock or more. Differentiation of olivine crystals is more concentrated in the lower portions or floors of the thicker sills in the Bullard area. This is a classic example of elutriation or magmatic differentiation of olivine in a theoleiitic diabase sill such as manifest in the Palisades of New York.

b. The Siliceous Sandstones

The sandstones are buff to reddish, thin-bedded to massive from 10 to 100 feet in thickness. These strata are fine to medium

grained, argillaceous, very siliceous, often calcareous, locally with stringers of pebble conglomerate and poorly sorted grits. They are very hard, dense and have been subjected to low to moderate metamorphosis and much secondary crystallization. Quartz and feldspar grains are often subrounded, angular to subangular in coarser grained beds.

c. The Meta-shales

The denser, aphanitic texture of the meta-shales are noted in what appears to be an easterly facies change of the coarser sediments found to the west. These meta-shales are often calcareous, very siliceous and have undergone considerable metasomatic change along with low-rank metamorphism. The shales are gray to dark gray, hard and are fissile to blocky. The rock becomes more abundant and more pronounced from west to east as well as higher in the sections, possibly indicating a deepening (facies) of the offshore basin and also a deepening of the basin with time.

These so-called meta-shales are so fine grained and aphanitic that it is impossible to know the mineralogy in the hand specimen. There certainly exists the possibility that some of the rock types referred to as meta-shales may be in fact, extrusive igneous or welded tuffs. Thin-section examination should identify these in a more positive way.

d. The Conglomerate

Conglomerates were noted in the eastern portion of the mapped area. In general they are gray to dark gray, calcareous, argill-

aceous to arenaceous, often siliceous with angular to subangular pebbles and cobbles to 6 inches. Some pebbly conglomeratic seams are noted in the more arenaceous members (sandstones). The beds are highly altered, fractured and faulted with calcareous seams throughout. The rock is so changed in many places that much of its original structure is lost. The angular to subangular inclusions are suggestive of a breccia. However, the beds are often wide and regular so that brecciation cannot be confirmed.

C. Structure and Stratigraphy

During the Paleozoic a very shallow basin of deposition existed in the Bullard Peak area. Sedimentation was intermittent and beds were probably deposited upon truncated Pre-Cambrian metamorphic strata which is common in adjacent areas and those of southwest and central Arizona. Sedimentation was interrupted from time to time in this shallow basin causing disconformities at several horizons. This phenomenon has not been investigated in the course of preparation of this report.

During Cambrian to Pennsylvanian time to the northwest of the State of Arizona, northward from southern Nevada, there existed the southeastern limits of the Cordilleran Geosyncline and in southeastern Arizona and southwestern New Mexico we note the northwestern limits of the Sonoran Geosyncline. The area between these two basins of deposition is referred to as Mazatzal Land which was a shelf inundated periodically by marine waters from Cambrian to Mississippian time (see figures 1, 2).

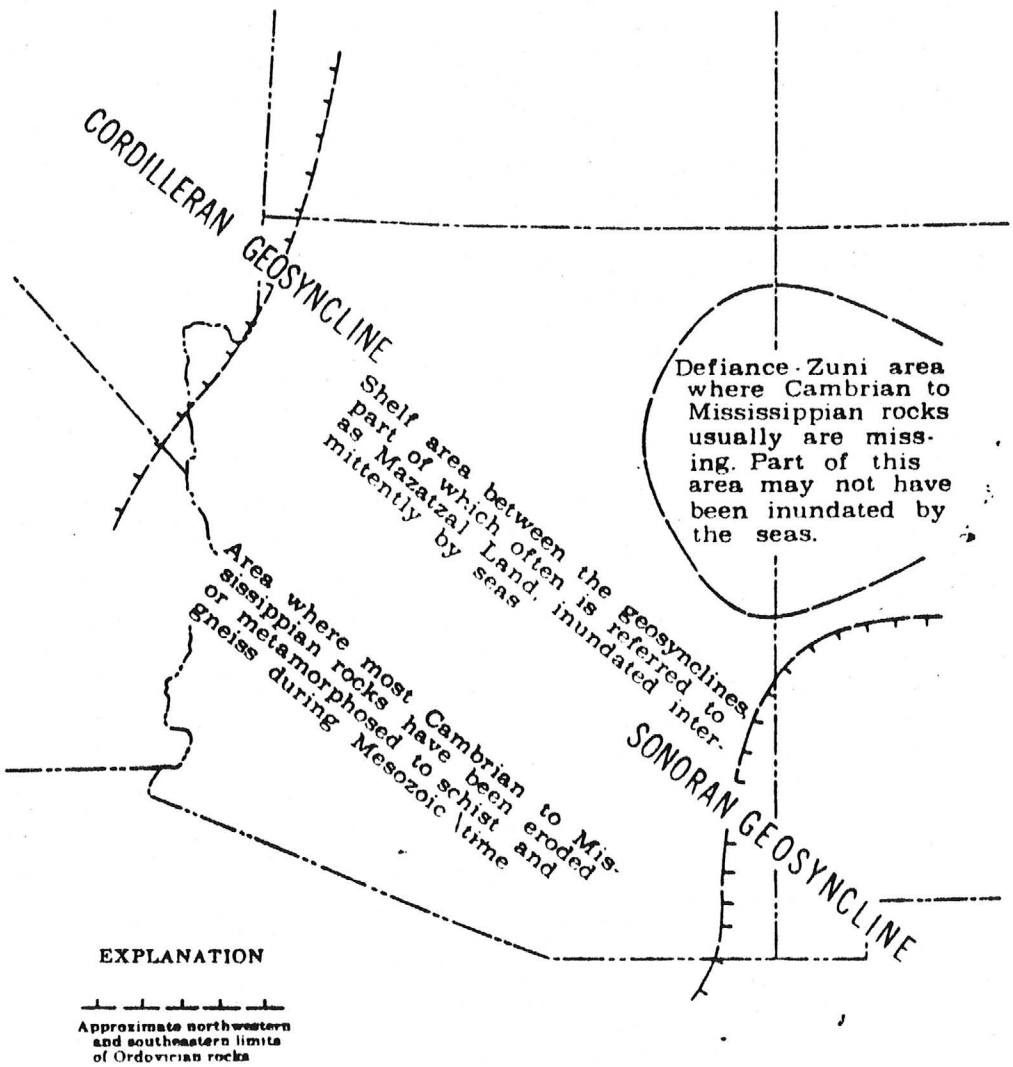


Figure 1. Cambrian to Mississippian time

Early development of the Paleozoic Cordilleran and Sonoran geosynclines.

Arizona Geol. Soc.
1967

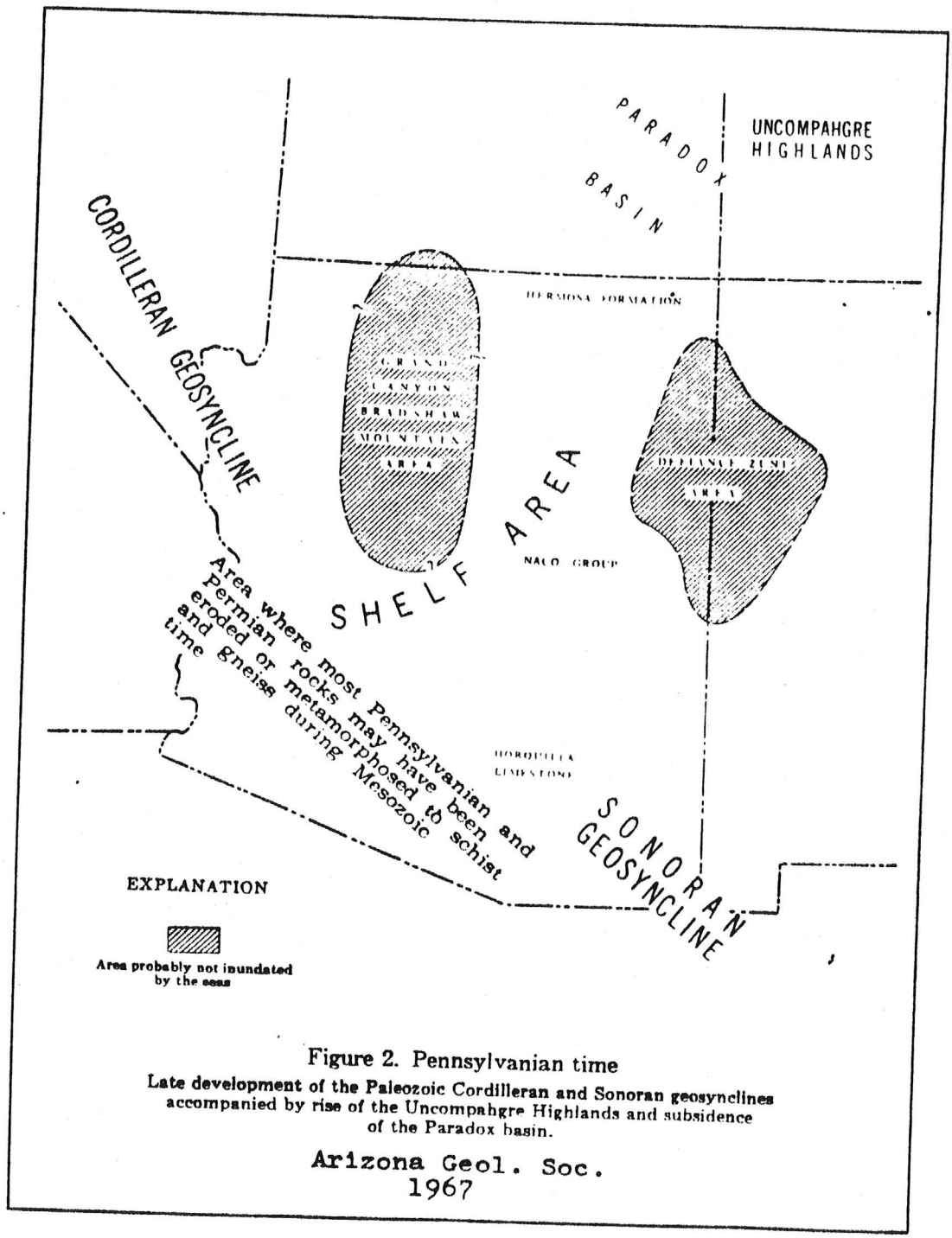


Figure 2. Pennsylvanian time

Late development of the Paleozoic Cordilleran and Sonoran geosynclines accompanied by rise of the Uncompahgre Highlands and subsidence of the Paradox basin.

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It is believed little tectonic activity occurred during the early Paleozoic in this area except for limited hiatus and subsequent disconformities due to broad upwarping. Regional uplift continued to affect the shallow seas during the Pennsylvanian period and ultimately caused complete regression. Instability continued into the Late Triassic with volcanism and igneous intrusions establishing the primordial Mogollon Highlands in southwest Arizona (see figures 3, 4). During this time, Pennsylvanian and Permian rocks, if they ever were deposited, may have been eroded or metamorphosed or both. The Larimide orogeny began to severely disturb existing Bullard Paleozoic strata in Late Cretaceous and/or Early Tertiary time (see figures 5, 6). So large a phenomenon, this major orogeny affected the entire western North American scene. Intense orogenic activity began with the relatively shallow emplacement of large quantities of mafic, diabase intrusives between strata. This interjection of igneous rock must have induced considerably normal faulting and shear zones across the still relatively flat-lying sedimentary beds of the Bullard section. It is very probable that mineralization at the Bullard Mine was coupled with this intrusion, as it is with porphyritic intrusive rocks noted at large Arizona Copper deposits elsewhere. Deuteric solutions must have played a role, as they and their potent vapors breeched the integrity of the sedimentary beds in shear zones, faults and other zones of weakness. It

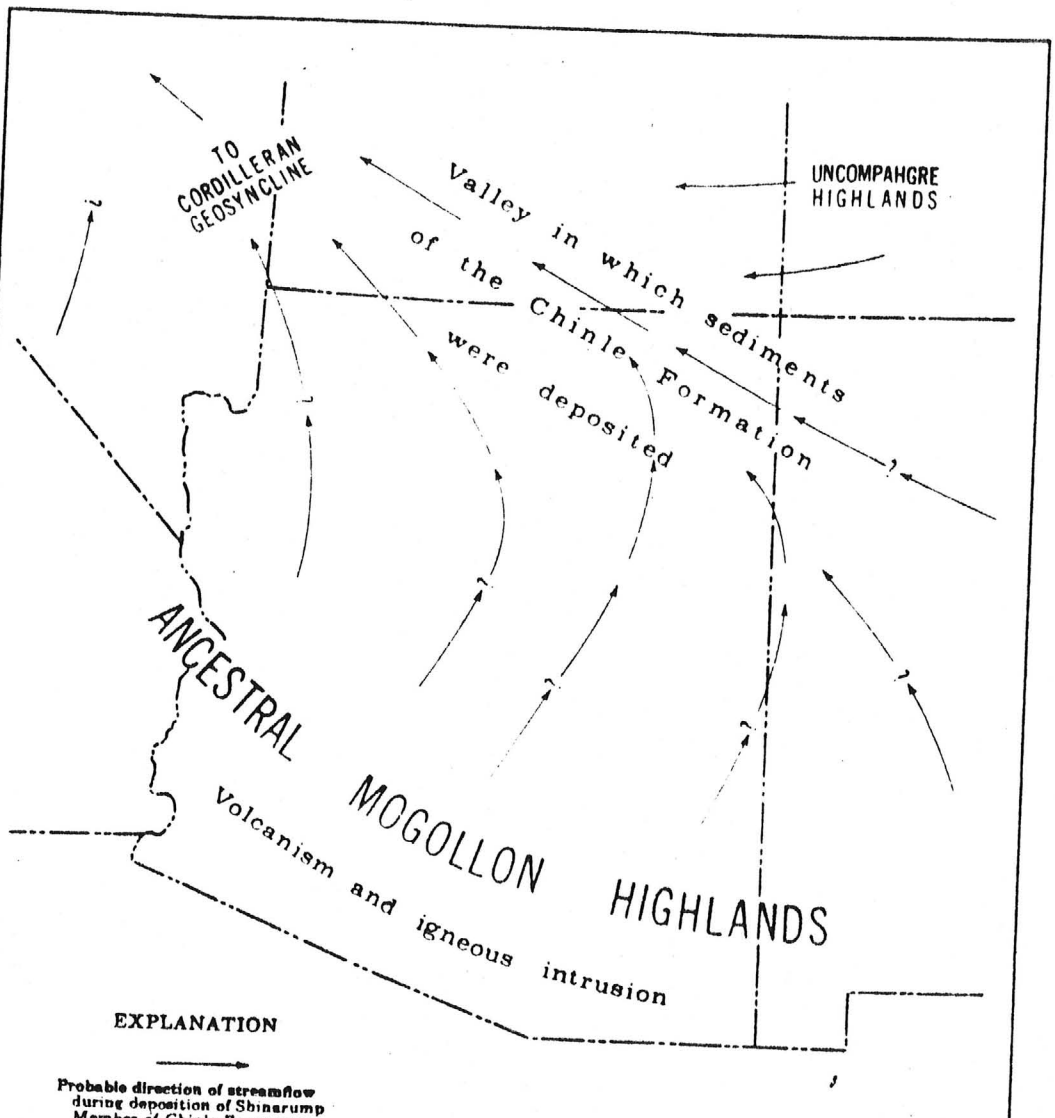

Figure 3. Late Triassic time

Waning stage of the Cordilleran geosyncline and uplift of the Uncompahgre and ancestral Mogollon Highlands.

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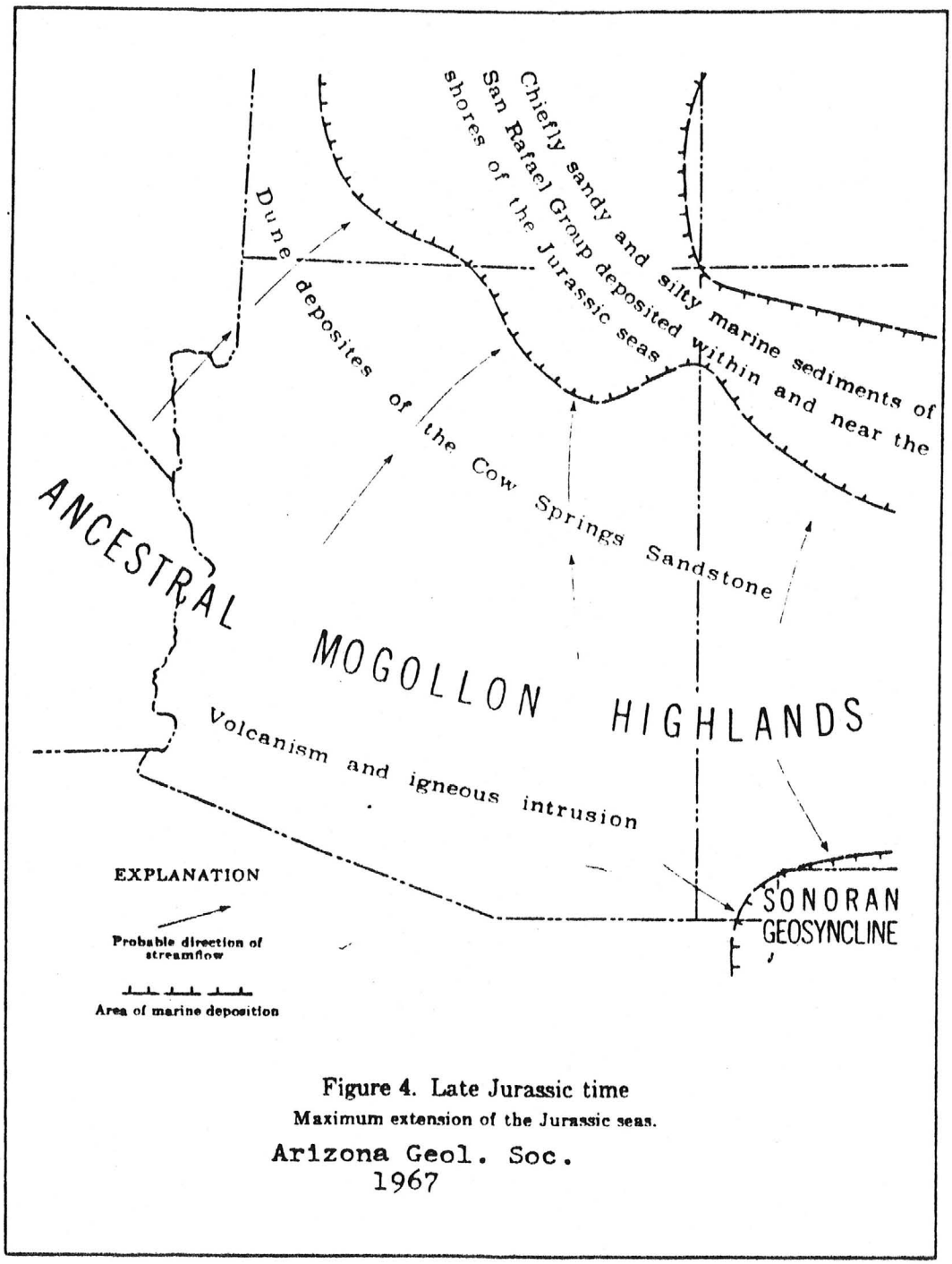

Figure 4. Late Jurassic time
Maximum extension of the Jurassic seas.

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1967

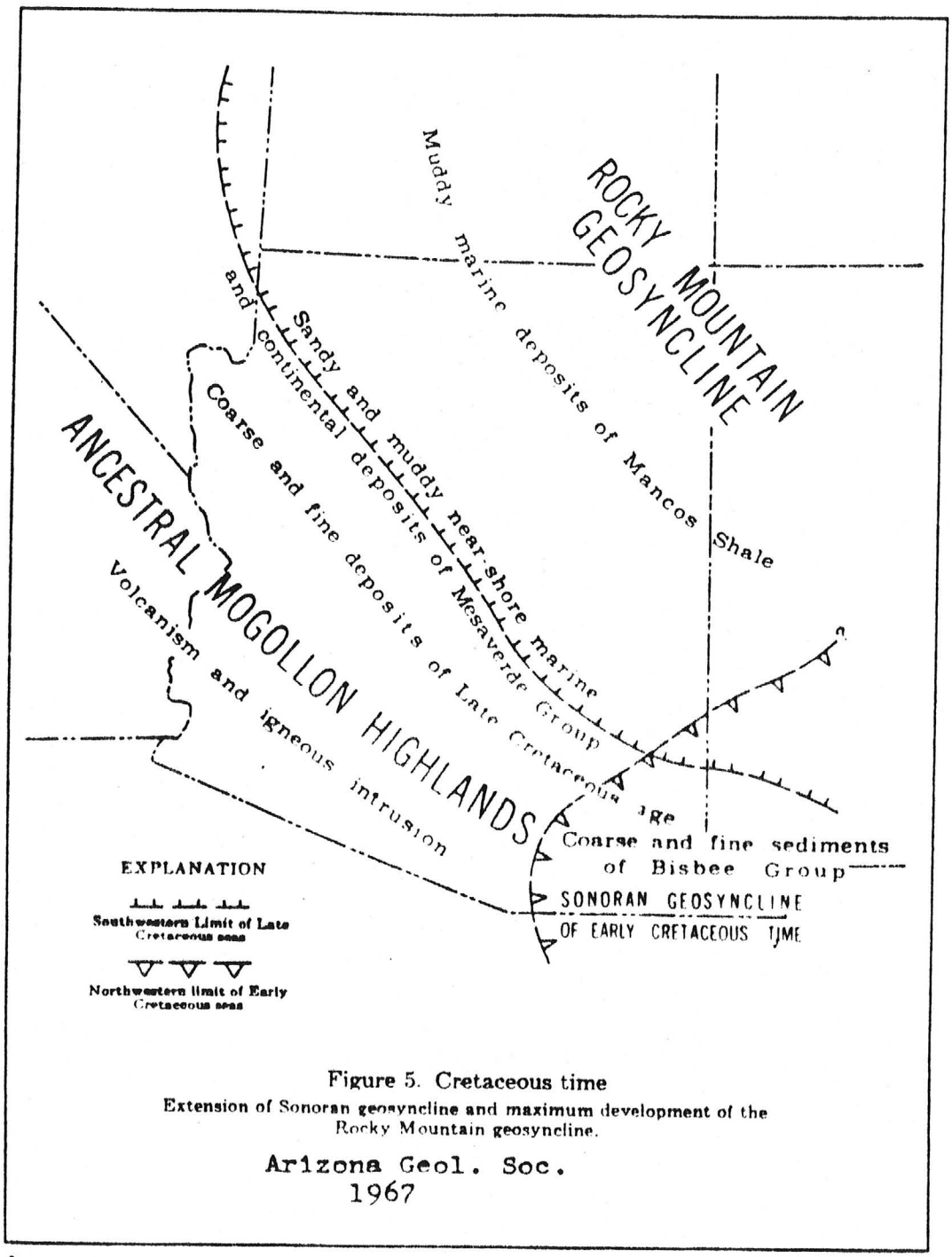

Figure 5. Cretaceous time

Extension of Sonoran geosyncline and maximum development of the Rocky Mountain geosyncline.

Arizona Geol. Soc.
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is suspected that it is within this environment that deposition of hypogene copper, gold, silver sulphides and other mineral species and compounds occurred. The lowering of temperature and pressure in such an environment could have triggered the deposition and mineralization of such zones.

As the Laramide orogeny developed, the Bullard Peak Paleozoic strata, solidified diabase sills and mineralized zones and veins began their listric rotation to vertical from relatively low-dipping attitudes (see figure 6).

Volcanism and igneous intrusions continued throughout the Late Cretaceous and Early Tertiary but by middle Tertiary time the major uplift had already been completed and formation of the Basin and Range province had begun. (see figures 7, 8).

Teriary faulting then further dissected the steeply dipping sedimentary series with its contained diabase sills. Major offsets of mineralized fissure zones also occurred during the Tertiary. However, primary mineralization is neither found along nor within these Tertiary structural features.

5. ECONOMIC GEOLOGY

A. The Mineralized Zones

Mineralization in the Bullard area is confined mainly to faults, fissures and shear zones. There appears to be no primary mineralization of any consequence in structural features younger than Late

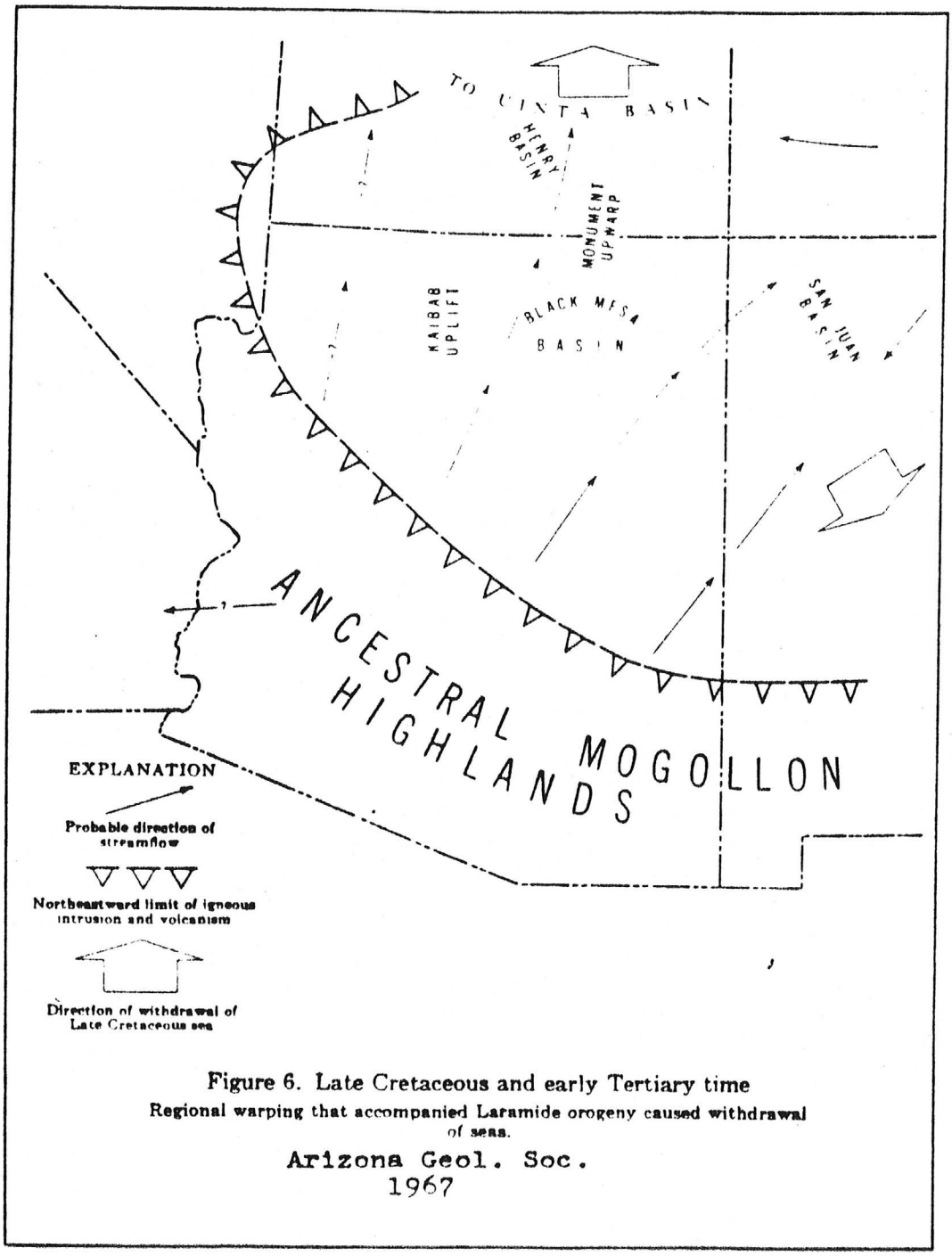

Figure 6. Late Cretaceous and early Tertiary time

Regional warping that accompanied Laramide orogeny caused withdrawal of seas.

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1967

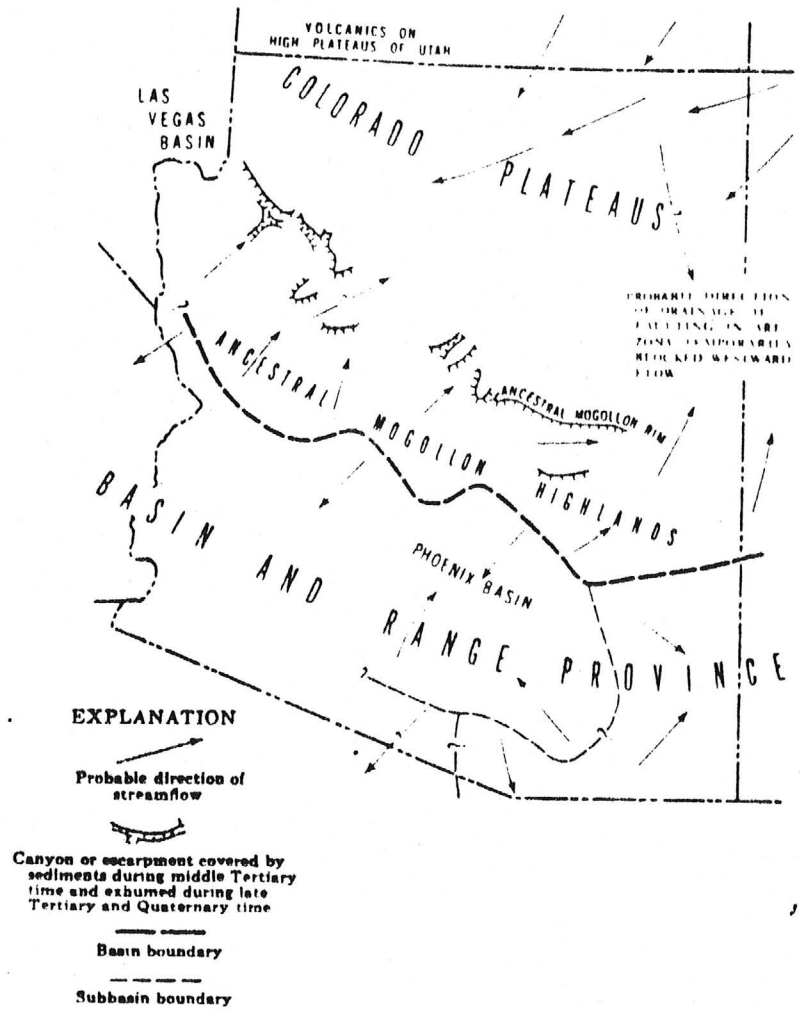

Figure 7. Middle Tertiary time

Beginning development of the Basin and Range and Colorado Plateaus physiographic provinces and the Colorado River system on the Colorado Plateaus.

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1967

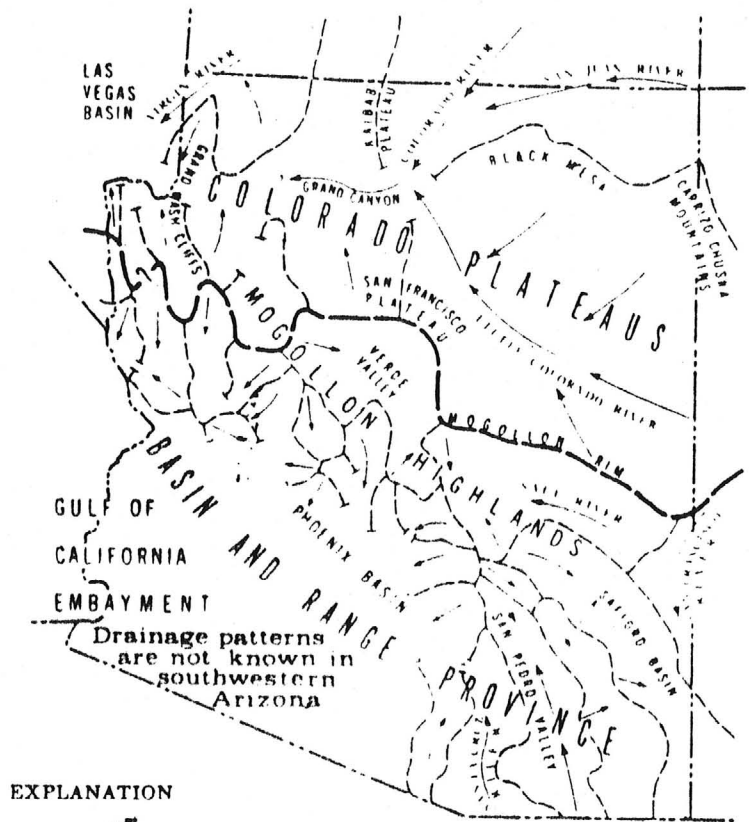


Figure 8. Late Tertiary time

Cutting of Grand Canyon by the Colorado River and maximum development of internally drained basins in Basin and Range provence.

Arizona Geol. Society

1967

Cretaceous or Early Tertiary. Later Tertiary faulting has been observed to have cut off mineral veins in several places. However, there may be secondary deposits or supergene enrichment as yet not located.

The mineralized zones are mainly silicates, carbonates, oxides and phosphates of copper with some sulphides and other metals. Small amounts of gold and silver are associated with the copper. Gold and silver are, in some samples, bonded as electrum or near electrum. Some free gold and silver are no doubt contained within these mineralized veins as well.

Chrysocolla, a silicate of copper, $CuSiO_2$, $2H_2O$, is the predominent copper ore mineral with malachite, a carbonate of copper, $Cu_2(OH)_2CO_3$, and cuprite, an oxide of copper, Cu_2O, as secondary minerals. Also associated in gangue is crystalline and amorphous quartz (silica comprising about 73% of the ore), euhedral calcite, dioptase (H_2CuSiO_4), and hydrated copper sulphate. The zones of mineralization are also the locus of secondary oxidation minerals such as limonite, jarosite, possibly alunite, magnetite, siderite and barite.

Sulphides are present but not obvious in hand specimens and except for the surficial occurrence of the metallic oxide psilomelane (MnO), no other sulphides were noted. Petrographic examination of samples is continuing. A comprehensive paragenetic study of the Bullard area mineralization has not yet been completed,

so many petrographic and mineralogic questions will be answered as work continues.

B. Assays and Values

A detailed sample map was made by ASARCO, presumably in 1950. This map covered the main Bullard vein and indicated the location of 43 samples. The computed average of these samples was given as 0.25 oz/ton Au, 0.50 oz/ton Ag and 2.67% copper. This relates to an estimated value for this ore body to be around $150.00 per ton using values of $450.00 per oz. for gold, $10.00 per oz. for silver, and $.70 oz. per pound for copper. This metalliferous zone has been mined at a profit in years past and recently by Contract Mining Corporation.

Five samples were analyzed from a mineralized vein workings west of Bullard Peak. This area is off the Bullard claims and thought to be stratigraphically lower in the section. Subsequently, these samples are important as they indicate that lower in the section higher average values may exist. These five samples assayed at; 0.56 oz/ton Au, 0.40 oz/ton Ag and 3.83% Cu.

West of Bullard Peak on Sansone claims

International Claim: A mineralized zone occurs within the International Claim which assayed at 0.02 oz/ton Au, 0.10 oz/ton Ag and 2.58% Cu. This vein appears to have good potential because the mineralized area lies within a large shear zone. There is a deep shaft at this point but little is known at the present time as to its depth or the minerals removed from it. Some super-

ficial shallow precussion drilling has been done on the International Claim but little else is known about it.

Last Bean and Democrat Claims: Just west of the stone cabin, five samples were taken from the prospect holes, mineralized zones and tops of the incline shafts. The results of these assays were: 0.11 oz/ton Au, 0.33 oz/ton Ag and 1.74% Cu.

Sulla Claim: A very substantial vein of mineralization exists on the Sulla claim in the northeast area of the map (see plate 2). Sampling there indicated an average of; 0.15 oz/ton Au, 0.10 oz/ton Ag and 1.59% Cu. It should be noted here that of the three samples taken from this vein, two of them gave an average of; 0.36 oz/ton Au, 0.25 oz/ton Ag and 2.0% Cu for an estimated $192.00 per ton value. This zone appears to be stratigraphically lower in the section than the Bullard vein. This further indicates that values may be higher at points lower in the section.

The average computed values of all samples in the Bullard area taken in the course of mapping was as follows: 0.22 oz/ton Au, 0.23 oz/ton Ag and 2.3% Cu for a gross value per ton of around $133.00.

C. Potential and Observed Ore Areas

There are five potentially favorable areas for investigation and possible production. These are both observed and inferred. One through four have been observed, while number five is inferred.

1. The Bullard Vein proper (homestake, Sweepstake, and Washington claims.

2. Area west of Stone Cabin (State, Last Bean, and Democrat claims.)

3. The fault areas of the Sulla claim.

4. The fault zones of International and Producer claims.

5. Bullard Extension (all areas south of Bullard Ridge).

This list, with the exception of number 5, contains only those reserves with production history, surface expression, and/or favorable sampling. Based on geologic interpretation and observation to date, it is certain that there are still to be located other favorable zones in the subsurface.

6. DEFINITION OF MINERALIZED RESERVES

The U. S. Bureau of Land Management and the U. S. Geological Survey in a recent estimate of mineral reserves have agreed upon and defined the following terms to signify relative dependability of information.

A. Measured Mineralized Reserves

Measured reserve tonnage is computed from dimensions revealed in outcrop trenches, workings and drill holes for which the grade is computed from the results of detailed sampling. The sites for inspection, sampling and measurement are so closely spaced and the geologic character is so well defined that the size, shape and mineral content are well established.

The computed tonnage and grade are judged to be accurate within limits which are stated and no such limits are judged to differ

from the computed tonnage or grade by more than 20%.

B. Indicated Mineralized Reserves

These are reserves for which the tonnage and grade are computed from projections for a reasonable distance on geologic evidence. The sites available for inspection, measurement and sampling are too widely or otherwise inappropriately spaced to outline the mineralized zone completely or establish its grade throughout.

C. Inferred Mineralized Reserves

Inferred reserves are quantitative estimates which are based largely on broad knowledge of the geologic character of the deposits and for which there are few if any samples or measurements. The estimates are based on an assured continuity or repetition for which there is geologic evidence. The evidence may include comparison with deposits of similar types. Bodies that are completely concealed may be included if there is specific geologic evidence of their presence. Estimates of inferred reserves should include a statement of the special limits within which the inferred reserves may lie.

7. RESERVES

A. The Bullard Vein (Measured 40,000 tons)

The Bullard vein covers an area of approximately 271,000 square feet. The vein averages 2.5 feet in thickness and is in a

fault zone dipping about 20 degrees to the south. The easterly edge of the bed is bound by what is believed to be a down-thrown normal fault. The south exposure of the vein is probably eroded for a short distance and possibly continues into the subsurface further south (see vertical section A'A" Plate 3).

There are about 678,000 cubic feet of mineralized reserves within the Bullard Vein, using a conservative average thickness of 2.5 feet. Computing this block at 13 cubic feet per ton, gives 52,000 tons of proven reserves, of which about 12,000 tons have already been mined. It is estimated, then, that 40,000 tons of proven mineralized reserves are still left in the Bullard Vein proper.

B. Area west of Stone Cabin in the State, Last Bean, Washington and Democrat Claims. (Indicated 55,384 tons).

This area was sampled from prospect holes and old workings and measures about 1200 feet long by an estimated 400 feet in width with an average thickness of 1.5 feet. The calculations are:

$$1200 \text{ ft.} \times 400 \text{ ft.} \times 1.5 \text{ ft.} = 720{,}000 \text{ cu. ft.}$$

$$\frac{720{,}000 \text{ cu ft.}}{13.0 \text{ cu ft.}} = 55{,}384 \text{ tons}$$

C. Fault Areas of the Sulla Claim (Indicated 28,846 tons)

This area has at least two major faults which are mineralized. These faults trend north-south with the westerly one dipping east

at about 45 degrees and the easterly one dipping west at about 45 degrees (see plate 3, section B'B"). These mineralized fissures may be as deep as 400 feet with an intersection point of about 100 feet. This intersection point would be an ideal objective for the exploration of a concentrated ore body. The thickness of this mineralized zone is at least 2.5 feet and may be much more in the subsurface. With these parameters the calculations are:

600 ft. X 1200 ft. X 2.5 ft. = 300,000 cu. ft.

$\frac{300,000 \text{ cu. ft.}}{13.0 \text{ cu. ft.}}$ = 23,077 tons (east fault)

600 ft. X 50 ft. X 2.5 ft. = 75,000 cu. ft.

$\frac{75,000 \text{ cu. ft.}}{13.0 \text{ cu. ft.}}$ = 5,769 tons

5,769 + 23,077 = 28,846 tons total

D. The Fault Zone of the International Claim (Inferred 18,461 tons)

Potential reserves in this area can only be inferred because along the faulted zone only intermittent mineralized outcrops are visible. An old shaft was noted at sample localities 123, 123a, 123b and 123c but access was impossible and its dimensions are not known. Samples from this mineralized area were assayed at 0.02 oz/ton Au, 0.10 oz/ton Ag and 2.58% copper, these concentrations seem uneconomical. However, it is felt the high copper content in sample Number 126 (7.9%) for example, is indicative of potentially better values in the immediate area or with depth, the estimated

Dimensions are 600 ft. long by 200 feet in depth by 2 feet in thickness. Therefore:

600 ft. X 200 ft. X 2.0 ft. = 240,000 cu. ft.

$$\frac{240{,}00 \text{ cu. ft.}}{13.0 \text{ cu. ft.}} = 18{,}461 \text{ tons}$$

E. The Bullard Extension (Inferred 553,800 tons)

The Bullard Extension is that fault zone as depicted in Plate 3 (section A'A"). The fault itself is suspected to exist but has not been confirmed in any way. Locals indicate that a well drilled near the stone cabin penetrated a thick zone of mineralization at 900 feet. There is absolutely no confirmation that such a hole was ever drilled or that even a shaft ever got to that depth. However, it is interesting that the Bullard mineralized zone, which is a fault, when projected to that area near stone cabin, intersects with the subsurface at about 800 to 900 feet. The inference is that if this fault is mineralized as suspected then considerable ore reserves may well be uncovered. Combination rotary and diamond drilling is being recommended for this area.

This suggests projection goes through Sansone Claims

The demensions of this theorhetical ore body is as follows:

1800 ft. X 1600 ft. X 2.5 ft. = 7,200,000 cu. ft.

$$\frac{7{,}200{,}000 \text{ cu. ft.}}{13.0 \text{ cu. ft.}} = 553{,}800 \text{ tons}$$

F. Other reserves

If the concept of Late Cretaceous - Early Tertiary faulting is correct then there may be several zones of flat-lying faults

which may have been rotated from their original high-angle, normal position. These could be very mineralized and add greatly to the reserves.

8. RESERVE SUMMATION

		Tons	
a.	Bullard Vein	40,000	Measured Mineralized Reserve
b.	West of stone cabin	55,384	Indicated Mineralized Reserve
c.	Sulla Claim	28,846	Inferred Mineralized Reserve
d.	International Claim	18,461	Inferred Mineralized Reserve
e.	Bullard Extension	553,800	Inferred Mineralized Reserve
	Total	696,491	tons

Bullard Extension goes through Sansone claims

696,491 tons at $144.00 per ton = $102,450,000.00

9. PROGRAM OF EXPLORATION

A. Geophysics

The exploration program will consist of a ground electromagnetic survey. The most intense mineralization is expected to be relatively flat-lying with dips of around 20 degrees with associated smaller veins at higher angles, perhaps 45 degrees or more. The flat-lying veins can be expected to be bound on all sides by possible tertiary faulting which could create a note-worthy anomaly. A magnetic survey should be considered and may be very useful for detecting sub-surface structrual manifestations. Induced polarization methods may also be of use. Resistivity surveys should be avoided in the

Bullard area due to poor results experienced in this desert enviorment.

The exploration program will consist of a ground geophysical survey. A grid system over the Bullard Vein will be established with a base-line in a N45W direction.

Twenty-two grid lines, 4000 feet long will then be established perpendicular to the base-line on 200 foot spacings. A 200 foot station interval will be established and data collected on the 100 foot intervals to reduce geologic noise and detect near-surface conductors.

This geophysical survey would consist of 17 line miles at current costs of $800.00 per line mile. This includes technicians, equipment and interpretation of the results. The purpose of this ground survey is to delineate the Bullard Vein in the southerly direction where past reports have indicated its locations. The geophysical results will be correlated with known geologic data to establish the continuity of the Bullard Vein within the grid system.

Total cost for this program is estimated at $15,000.00.

B. Drilling

It is recommended that all anomalies outlined by the previously described geophysical surveys be physically investigated by drilling. The initial phase of this program could be completed by rotary drilling to reduce the cost per foot. If the results

are encouraging, a diamond drilling program could be undertaken to determine grades and any change in the tenor of the mineralzation. At the present time, numerous rotary drills are available in the area. Present quotes range from $3.85 to $8.55 per foot, depending on the total footage of the contract. At this time no estimate of footage is possible until geophysical data is created and interpreted to determine location and depth of the anomalies.

Specific areas are recommended for diamond drilling (see plates 1 and 2). These are described as follows:

Diamond core drilling is recommended as follows:

1. DDH-1: Vertical drill to prove Bullard vein on the downthrown block east of present exposures and on the south flank of Bullard Ridge. Drill DDH-1A, B, C, etc. as necessary if ore mineralized zones are encountered. The expected depth is 50 to 100 feet maximum.

2. DDH-2: Angle drill at 60 to 45 degrees west to penetrate the mineralized fault zones at depth (see B'B", plate 3). Probable depth is about 200 feet. Add DDH-2A, B, C, etc., as determined if ore is intersected. These cores will be on the Sulla Claim.

3. DDH-3: Angle drill 60 to 45 degrees toward the north near stone cabin in the Democrat, Last Bean or even State Claims. This is to intersect the possible fault plane depicted in section A'A" of plate 3. Estimated depth is 900 feet plus. Add DDH-3A, B, C, etc., as necessary if ore is intersected.

4. DDH-4: This coring should be done as a vertical hole in the Avalanche and Sweepstake Claims. Depth to the fault objective is estimated at 200 to 300 feet. Add DDH-4A, B, C, etc. as needed.

10. PROGRAM OF MINE DEVELOPMENT

Mining could commence immediately by initiating work on the 40,000 ton Bullard Vein proper. This mineralized vein has been mined in 1979 by CMC at a profit and it could be stockpiled until milling and beneficiation equipment is installed. Mining could also begin on the 28,000 tons which lie in the Sulla Claim. Only a small amount of road work may be necessary to begin work here.

In any event, the following mine development plan is recommended for the Bullard Mine:

1. The plan includes current costs of equipment and labor. Initiation of the plan could commence as soon as funding is available. Equipment and personnel are readily available in the area and no environmental problems are anticipated.

2. The Bullard Vein on the Washington Mineral Claim was mined at a 200 ton-per-day rate during 1980 by Contract Mining Corporation of Yuma, Arizona. All development work including portals, haulways and truck loading areas has been completed. A room and pillar system was utilized by Contract Mining Corporation during their operation and it is recommended that this system of mining be continued. Costs are estimated at:

Drilling	$ .90
Blasting	.64
Loading	.68
Hauling	.52
Roof bolting	.64
Air & Water Supply	.14
Ventilation	.36
Power	.22
Development	.42
Supervision	.65
Engineering	.39
Repair & Maintenance	.86
Assay & Laboratory	.60
Taxes & Depreciation	.75
Amortization	1.25
TOTAL MINING COST PER TON	9.02

3. Engineering, Supervision and labor is based on current salary and wages paid in Arizona. Namely, Professional Engineers at $350.00 per day, Mine Supervisor at $3500 per month, Miners at $13.00 per hour and Laborers at $9.50 per hour.

Equipment requirements are:

Air Compressor	$20,000.00
Gen. Set	10,000.00
Air & Water Line	5,000.00

Air Drills with Legs ----------	$ 6,000.00
30 hp Slusher & Bucket ----------	12,000.00
10 hp Slusher & Bucket ----------	10,000.00
Mining Supplies ----------	25,000.00
TOTAL	88,000.00

A portable concentrating mill is available at this time for processing Bullard Vein material. Contract milling costs are quoted as $20.00 per ton. This includes all labor, milling supplies and fuel. This does not include the transportation of the concentrate to the smelter in Hayden, Arizona, approximately 200 miles from the Bullard Mine in Aguila, Arizona.

I firmly recommend a minimum of $300,000.00 be allocated for the initial phase of the Bullard Mine development.

11. ORE TREATMENT

Initial studies of the mineralized zones of the Bullard Mine indicate the observed mineralization would respond to a gravity separation after crushing to minus 40 mesh. This treatment should recover 95-97% of all sulphides. The follow-up treatment would be an acid copper leach process. Contract Mining Corporation has, in fact, carried out tests of this type with positive results. I would suggest however, that beneficiation studies be continued as mining an development proceeds to enhance concentration in the

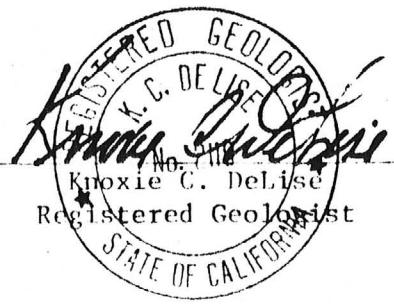
light of subsequent new data or should there be a large variation (unlikely) in the mineralized zones mined.

12. MISCELLANEOUS

A land survey should be done to firmly establish claim boundaries and markers for geophysical and other subsequent surveys.

San Diego, California

October 20, 1981



Kroxie C. DeLise
Registered Geologist

13. REFERENCES

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3. Flagg, Arthur L., July 20, 1936, "Report on the Bullard Mine", 11p.

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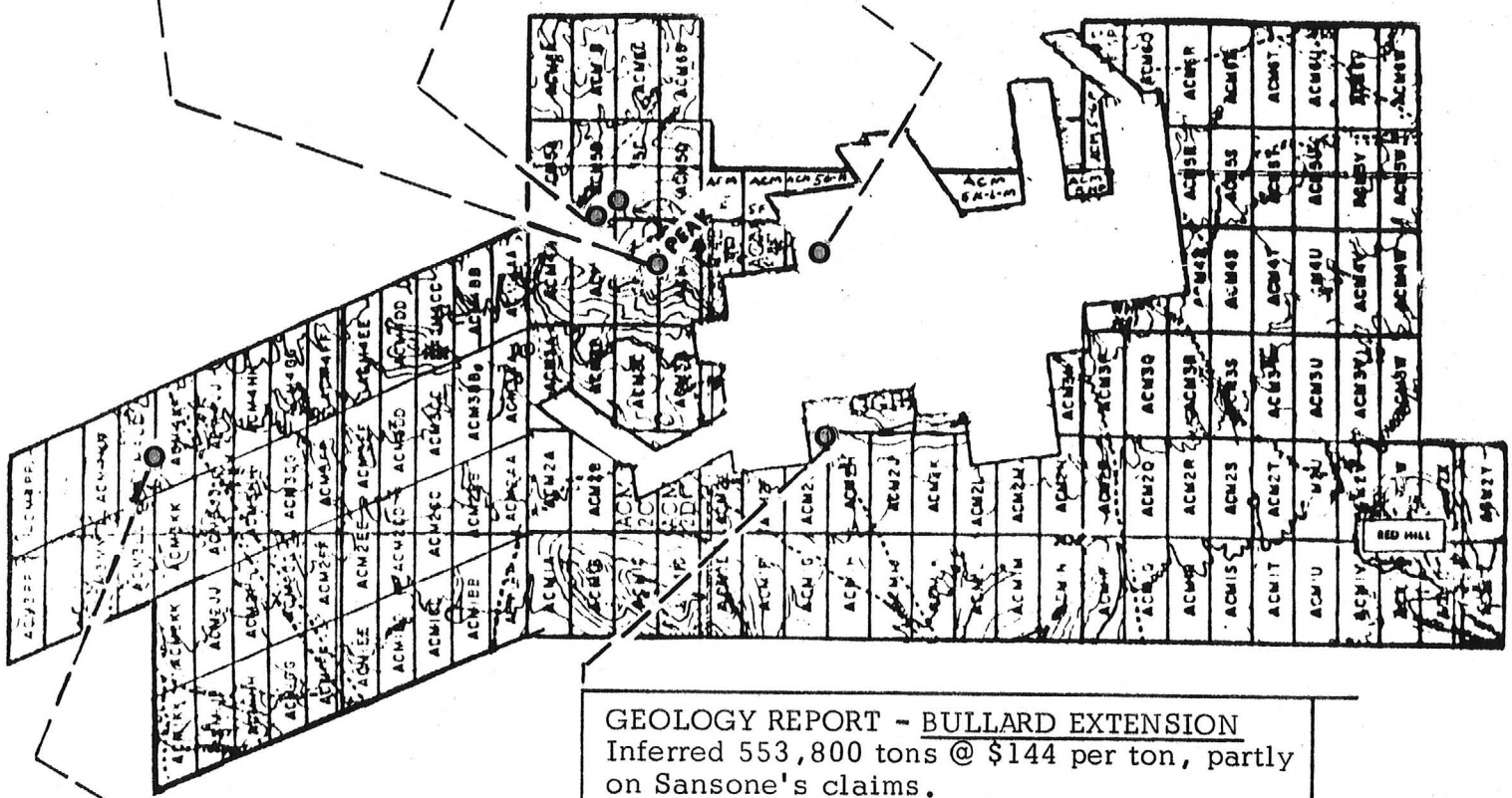
7. Reynolds, Stephen J., Keith, Stanley B., and Coney, Peter J., 1980, "Stacked Overthrust of pre-Cambrian Crystalline Basement and Inverted Paleozoic Section Emplaced over Mesozoic Strata, West-Central Arizona", Arizona Geological Society Digest, Vol. XII, p. 45 to 51.

8. Nicol, John M., October 7, 1926, "Auxillary Report Re: Bullard's Mine", 8p.

Page 22 of Geology [illegible]dy, 2nd paragraph from bottom. HIGHEST ASSAY IN REPORT.

SANSONE'S CLAIMS - [illegible]OLOGY REPORT per ton of ore:
Assay #135 - 0.83 oz gold; 0.70 oz silver; 7.9% copper
#136 - 0.78 oz gold; 0.25 oz silver; 2.4% copper

NRG PROPERTIES - GEOLOGY REPORT, per ton of ore:
Highest assay: #143 - 0.57 oz gold ; 0.15 oz silver; 2.1% copper.



GEOLOGY REPORT - BULLARD EXTENSION
Inferred 553,800 tons @ $144 per ton, partly on Sansone's claims.

Owl Deposit - Samples assayed May, 1983
1.96 oz to 2.21 oz. gold per ton of ore.

NOTE: All reports and studies show very rich copper content, and in many cases, rich silver deposits. Much semi-precious gemstone deposit in the form of turquoise is available.

Note: The E. W. DURFEE report which follows was produced sometime after 1907, and probably prior to 1920. The report was extracted from the records of the Department of Mineral Resources, State of Arizona, State Fairgrounds, 19th Avenue and McDowell Road, Phoenix, Arizona.

While this report does not directly relate to the Sansone 166 mining claims, it is indicative of mining activity on and around Bullard Peak beginning in the late 1800's.

T H E BULLARD MINES

Congress Junction, Arizona

LOCATION: The Bullard Mines are situated in the Pierce Mining District in the southwestern part of Yavapai County, Arizona, about 29 miles from Congress Junction, a station on the Santa Fe, Phoenix & Prescott Railway and about 9 miles from Aguila Station on the Arizona & California Railway. Aguila is about 80 miles from Phoenix, Arizona and about 400 miles from Los Angeles, California. There is a very good road from Congress Junction over nearly level country to the mines. No road has been made from the property to Aguila, but the conditions for one are ideal, there being an easy grade down hill all of the way to the station, with no gulches or sandy places to cross and but little brush to clear; the ground could be very easily driven over in its present condition.

The altitude at the mines is about 3000 ft. above sea level.

PROPERTY: The property comprises ten patented claims, located as shown by the blue print accompanying this report and named as follows:

Homestake
Sweepstake
Washington
Avalanche
International
Producer
Steller
Emily
North Star

covering 196 acres. Besides these patented claims there are ten locations adjoining them and water rights located on Date Creek, 18 miles distant from the mines. I am unable to show any of these locations by map but was told, however, that they cover all of the ground to and including the old smelter as well as some on the other side of the patented claims. The land, where the water rights are held was located by the owners of this property and sold, reserving the water rights for use in connection with this mining property. It is claimed that there is ample water for all purposes, and it can be conveyed to the mines by gravitation under a head of 270 ft. Some of the ground was located by the Bullards something like 30 years ago, and the patents secured in September 1907. Some of these claims were jumped, others were located and a smelter built about '87 or '88, which ran but a very short time. At that time the nearest railway station from which to haul coke and supplies was Maricopa, about 100 miles distant. There has been some litigation over the

REPORT

OF THE

BULLARD MINES

. . . . . .

PIERCE MINING DISTRICT

YAVAPAI COUNTY

ARIZONA

BY

E. M. DURFEE, E. M.,

Congress Junction

Arizona

claims that were jumped but the present owners won out in the suits.

GEOLOGY:

The mines are situated in the foothills of the Harcurar Mountains. The rocks are sedimentary, composed principally from highly metamorphosed limestone; some beds in the gulch near the north end of the property are conglomerate. The formation all has a fairly uniform dip of about 20 degrees from the horizontal, S 43 degrees 10' E and strike of about N 46 degrees 50' E. The source of mineralization is apparently from a series of parallel fissures, cutting across the formation north 5 degrees 30' E and dipping easterly about 65 degrees from the horizontal. I have indicated some of these fissures on the map, but have not attempted to locate all of them. There has been some movement along the plane of bedding which has opened channels through which the mineral bearing solutions could spread, and it is along this "plane faulting" or bedded vein where most of the ore is found. Besides the metaliferous minerals, the fissures seem to have been the source of a large amount of silica, and owing to the silification of these limestone beds, they have withstood the erosion to a much greater extent than the surrounding country, leaving a prominent butte in which the ore outcrops. As may be seen from the jagged peaks on either side of the mountain, the fissuring extends some distance bother easterly and westerly from the ore developments. In most places the limestone has been changed until very little semblance of the original remains, some of it appearing much like quartzite. Where sufficient development has been done to show it, the mineralization has extended along this bedded vein the entire distance between the fissues. Ore also occurs along some of the fissures where shafts have been sunk on them through strata lying underneath the bedded vein. This vein dips into the mountain from the north side, near the top, and has been exposed by erosion along the apex about 1875 feet; about 400 ft. across the west end and between 400 and 500 feet along the south side. At the westerly end of the mountain on both sides, for a distance of between 400 and 500 ft. and across the west end about 400 ft., the work and erosion show the ore to be continuous along this vein. Easterly from this, on the south side, the vein is not exposed and over 450 feet from the west end on the north side the copper stain is not much in evidence, except at points where work has been done, and it is still to be determined whether it is continuous; although were fresh surface to be exposed it would very likely show the copper to have been leached near the surface and that ore exists below. This "plane faulting" seems to be more pronounced as you follow it westerly.

Other systems of fissuring exist on the property which should be studied closely in connection with the mining as they may have an important bearing on the rich ore shoots.

DEVELOPMENT: ORE:

The development consists of tunnels, shafts, inclines, and open cuts, amounting to 2000 feet or more, nearly all of which has been done in ore, but the natural erosion has done most to develop the ore bodies.

The letters in quotation marks in the following paragraphs refer to maps accompanying this report.

At "F" is an incline about twelve feet deep, sunk on one of these mineralizing fissures showing about two feet of ore and at "G" an incline 150 ft. deep was started at the crossing of the bedded vein with one of these fissures but is too steep to follow the bedding, being at an angle of about 45 degrees. Some drifts and cross cuts have been driven from this shaft, but the cross cut in the bottom, about 40 feet into the hanging wall, has not been driven far enough to reach the vein.

About 300 ft. westerly from "G" a twelve foot incline on the vein shows no ore of consequence. This is the only work done between "G" and "H" so that this ground is not proven.

There are no workings between "L" and "I", but I have very little doubt that ore could be developed along that section.

At "C" there is an incline about 100 ft. deep to water with a drift at the 50 foot level something over 230 ft. long, reaching the surface in a small gulch at the southerly end. The vein is faulted at the shaft on the level, throwing it into the hanging wall, but farther down above the water, it can be seen coming in again in the back, but could not be reached fro sampling. Most of the ore has been stopped out above the level, and was probably taken to the smelter as there was very little left on the dump.

At "D" is an incline, said to be 107 feet deep which was sunk on the edge of a large wash, but has been completely filled with sand, washed in at times by heavy rains. A sample taken from a pile of several tons of ore on the dump gave 8.26% copper and $14.40 gold per tone. It is claimed that ore extends all of the way to the bottom of the shaft.

The workings at "E" are on an entirely different vein that dips much steeper, about 50 degrees. The collar of the shaft was badly caved and most of the workings were filled with water so that it was impossible to get into them, but from the size of the dump, many feet of openings must

have been at this point. Some ore left in the old bin showed some sulphides (chalcopyrite), the only place where I saw any, and a sample taken from this bin gave 7.87% copper and 80¢ gold per ton.

A few hundred feet southwesterly from the old smelter, some very nice looking ore has been taken from a shallow incline and both easterly and northeasterly from the main workings several shallow shafts have been sunk, mostly on cross fissures for title work and all show more or less copper ore. This shows the mineralization to be very extensive in the district. From the most easterly cropping of the bedded vein on the north side of the mountain to "D" shaft is something like 5000 ft. and from all appearances it is on the same "plane faulting".

In all probability other shoots of good ore could be developed along the strike of the vein, between the main workings and "D" or beyond this; and that the main shoot will continue to considerable depth in the direction of the dip and fissuring, beyond where erosion has cut through the vein. It is claimed that in sinking a well which was bored to a depth of 900 feet, at the smelter site, a stratum of ore seven feet thick was penetrated. I could get no reliable data regarding the depth at which it was encountered nor the character of the ore. The possibilities for ore in this direction are most promising, and I have no doubt future developments will show that the amount at present in sight is but a very small part of what the property contains.

The ore is highly silicious and generally very much iron stained, the values being principally in gold and copper with an average of one half ounce silver per ton. The copper is entirely oxidized and is mostly in the form of malachite with some oxides and silicates.

An amalgamation test on a sample made up from portions taken from each of my samples and crushed to pass a 40 mesh screen, gave an extraction of 91.3% of the gold, which shows it to be very free milling. To make this test I amalgamated the bottom of a copper-bottomed gold pan and agitated the pulp in this for a short time, assaying samples of the pulp taken before and after amalgamation, with the above results.

An average sample leached for twenty-four hours in a 7% sulphuric acid solution gave an extraction of 97% of the copper contents.

MINING:
MILLING:

The conditions for cheap mining of the ore developed in this property are very apparent. Advantage can be taken of gravity for delivering ore to the surface where in most places expensive hoisting plants and tower are necessary. In this case it is something like delivering ore to the lowest level of the mine without having to hoist it.

The ore is quite hard to drill but is friable and should break well. With a compressor plant and small machine drills, the total cost of the mining and delivering the ore to the surface ought not to exceed $2.00 per ton, and, considering that there is something like 8000 tons on the south side stripped and on the surface it ought to be done for less. In future developments, where the ore would have to be hoisted, it would cost more.

Milling costs for the simple amalgamating process could be done for fifty cents per ton, to which no doubt fifty cents more should be added if the copper were to be leached besides. 11 cents per lb. more for precipitating the copper.

LABOR: Labor at this point should cost about the same as at Congress District where miners (machine men) are paid $3.50, muckers $2.50, timber men $3.50, and timber men helpers $2.50, all for eight hour shifts; and ordinary laborers on the surface $2.00 to $2.25 for nine hours.

POWER: By the use of oil engines something like the De La Vergne, with California crude oil, power ought not to cost over $50.00 per H.P. year.

ORE TREATMENT: The oxidized condition of the copper in the ore makes it unsuitable for concentration, and its highly silicious character(about 80% insoluble), makes a hard smelting proposition unless it could be sold to some smelter for converter linings.

From my amalgamation tests on the gold and leaching test on the copper, it would seem that it might be profitably treated by first crushing with stamps and amalgamating the gold followed by leaching the copper. Mr. Austin's article "Leaching Applied to Copper Ores" in the December number of "Mines & Methods", where he describes the "Laszczynski" process, would indicate that this ore would be particularly adaptable for treatment in this way.

IMPROVEMENTS:

The surface improvements consist of a cooking cabin, a two room bunk house, stable and wagon sheds, located near the north end of the property, a blacksmith shop near the north end of the apex of the vein; and at the smelter site a good sized stone cabin and the frame of the old smelter in which the smelting stack and blower still stand.

ORE ESTIMATES: The assay map, which accompanies this report, is a longitudinal section on the vein and shows the locations, widths, percentage of copper and values in dollars in gold per ton for each of the seventy odd samples taken. These samples were taken across the full width of the vein and measurements made at right angles to the dip and noted in each case.

I have divided the ore developed into two blocks (Block "L" and block "M") called "Positive" ore and Block "N", "Probable" ore.

The average values for each block of ground, as indicated on the map, have been computed, as is customary among engineers as follows:

By multiplying the assay values in dollars or percentages by the width of ore sampled and dividing the sum of these products by the sum of the widths to get the average value, and the sum of the widths by the number of samples taken to get the average width of samples. In estimating the tonnage I have assumed that it would require twelve cubic feet of ore to yield one ton.

In the Block "L" forty-nine samples give an average width of 3.04 feet, assaying 2.95% copper and $7.34 per ton gold. This block gives 42,100 tons.

In Block "M" nine samples give an average width of 1.92 feet assaying 2.84% copper and $12.47 gold per ton, figuring 1,600 tons.

For Block "N" I assume the average width to be 2.5 feet which would give 34,100 tons that should average as good as the "Positive" ore.

This gives a total of 43,700 tons averaging 2.94% copper and $7.52 gold per ton for "Positive" ore and 34,100 tons of the same grade for "Probable" ore.

Figuring on saving 90% of the gold values on ore averaging $7.53 per ton gives a net recovery of $6.72 per ton, or for 43,700 tons, of $296,286.00. At a cost of $2.50 per ton for mining and milling, the expense would be $109,250.00, leaving a net value of $187,036.00 for the gold alone in the "Positive" ore. The net value of the "Probable" ore on the same basis would be 34,100 tons, $145,948.00, or a total net value of $332,984.00 for the gold in the "Positive" and "Probable" ore.

Net value of gold "Positive" ore,	43,700 ($7.53 x 90%-$2.50--	$187,036.00
" " " " "Probable"	" 34,100 ($7.53 x 90%-$2.50--	$145,948.00
" " of gold in"Positive" and "Probable"		$332,984.00

If 90% of the copper values can be saved, figuring copper at 14 cents less 1 cent for precipitating, 2.94%= 58.8 lbs. per ton @ 13 cents = $7.64. $7.64 x 90% = $6.88 per ton recovered. If this can be done at an additional cost of 50 cents per ton for milling the returns would be as follows:

Copper in "Positive" ore	$43,700	($7.64 x 90% - 50¢)	=	$278,806.00
Copper in "Probable" ore	$34,100	($7.64 x 90% - 50¢)	=	$217,558.00
Total net value copper in "Positive and "Probable" ore				$496,364.00

Cu and Au in "Positive" ore	$127,038.00	$278,806.00	=	$405,842.00
" " " " "Probable" "	$145,948.00	$217,558.00	=	363,306.00
Total net value of ore,.....				$829,348.00

Besides the ore figured in these blocks there are several hundred tons piled up in different places around the property. This ore has been sorted over to some extent so there is no doubt it would average better grade than the blocks.

My samples were taken at fifteen foot intervals, along the vein wherever it was possible. Many of the samples were taken where no work has been done to expose fresh surface, in which case the copper is pretty much leached out so that I have no doubt shows lower results than mining would give.

There seems to be no relation, whatever, between the gold and copper values, and I am unable to account for the much higher gold values along the northwesterly portion of the vein, as the ore all looks very much alike.

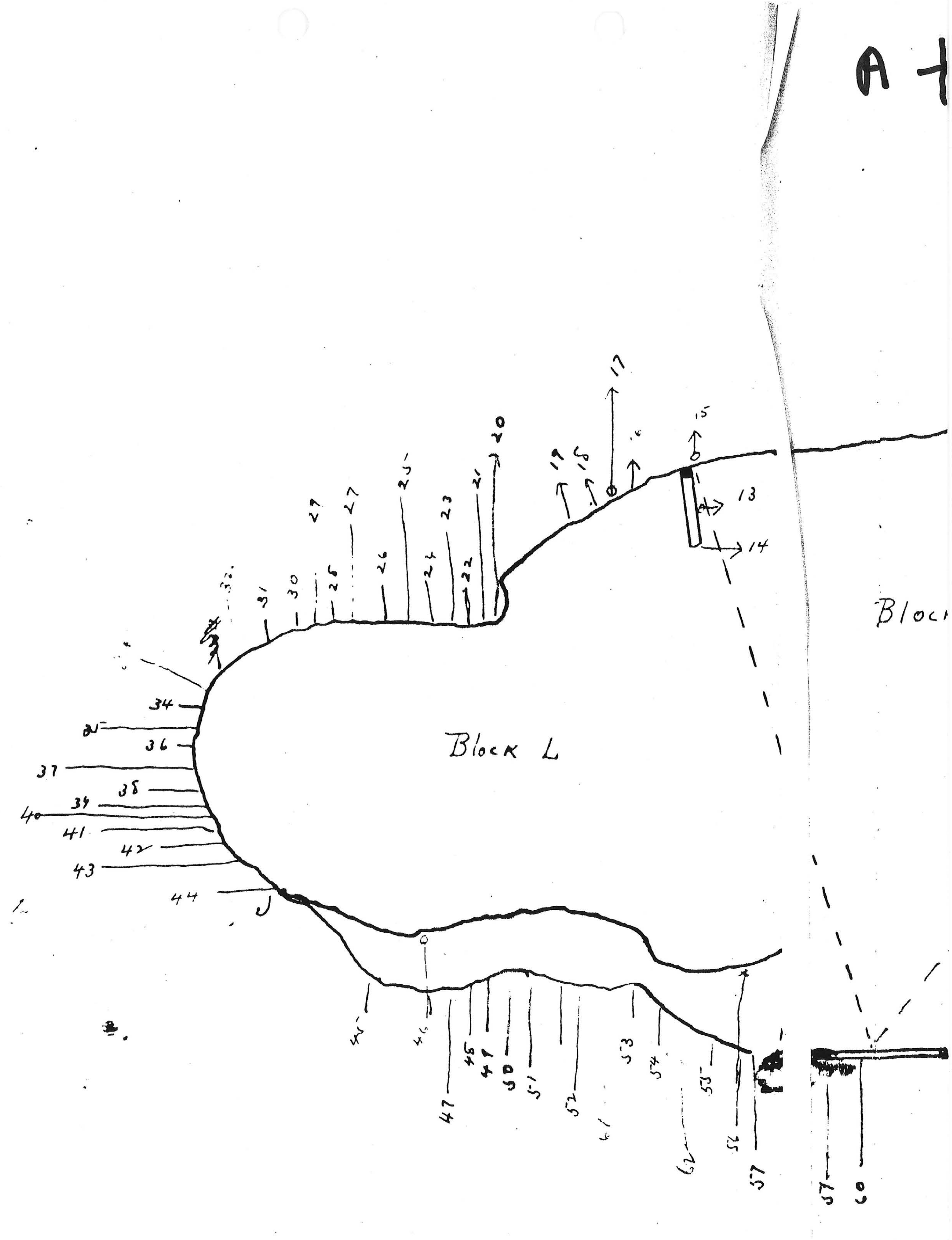
Ten samples taken along the drift at "C" gave an average width of 2.37 feet assaying 2.31% copper and $3.77 gold per ton.

CONCLUSION:

With the amount and grade of ore developed in this property, the probabilities and possibilities of much larger amounts there to be developed, the question of treatment of the copper contents at a reasonable figure, is about the only uncertain factor in the proposition. Judging from the successful operations of the plants described in the article referred to above, it would seem that there is little doubt that the "Laszozynski" process would be applicable to this ore and that a considerably better saving than the 90% estimated might be made. There is no question about being able to save the gold values by the simple amalgamation process.

Respectfully submitted,

(Signed) E. W. Durfee, E. M.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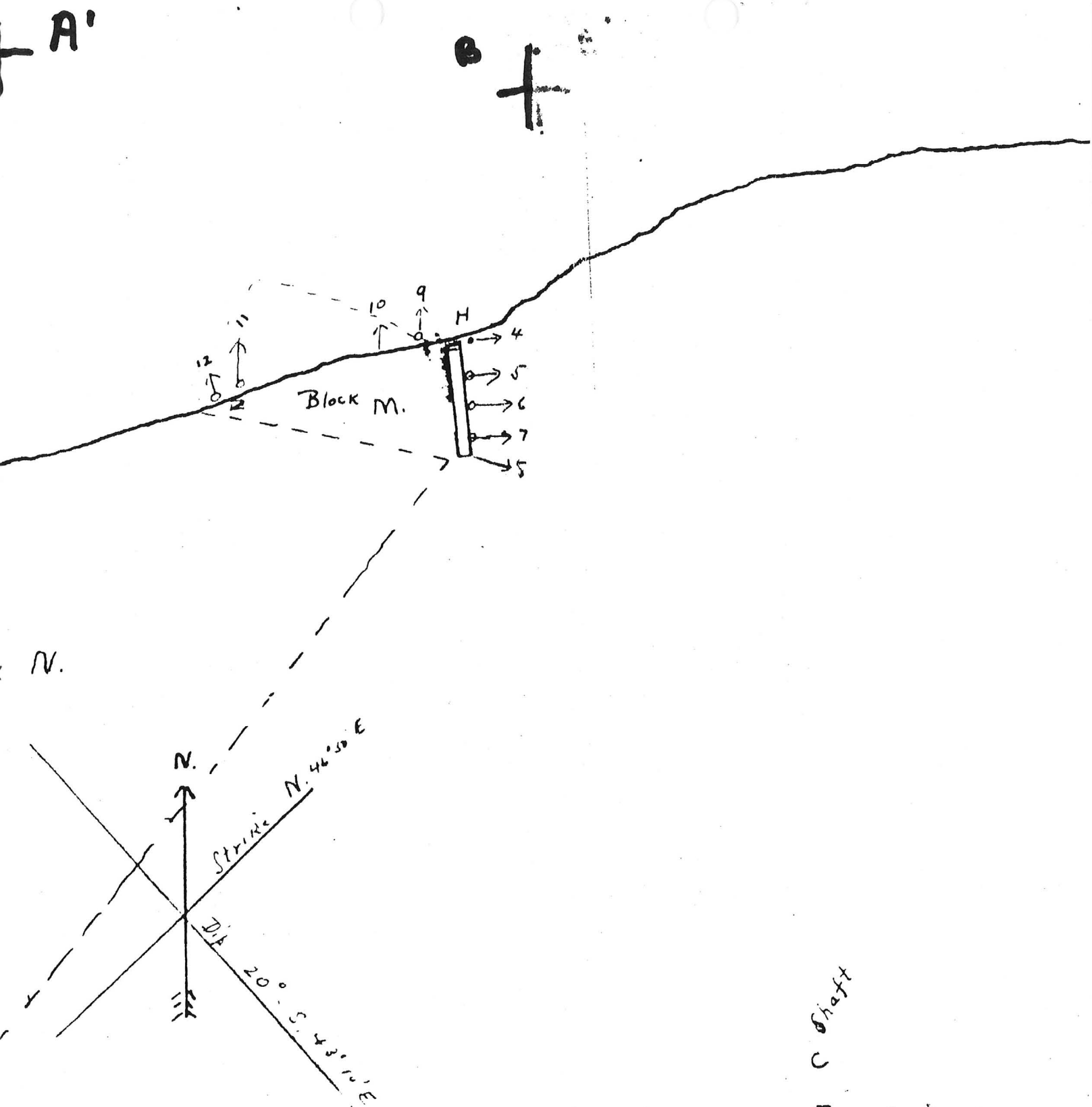
A'
B
10
9
H
11
12
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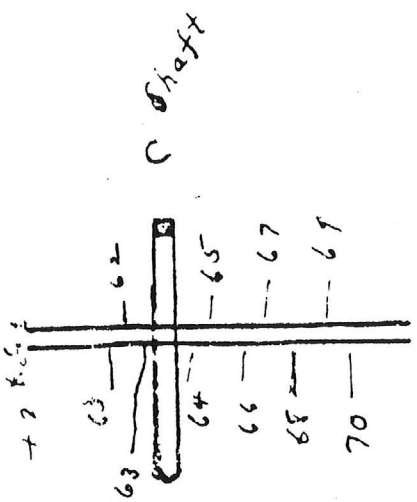
5
6
7
8
Block M.

N.
N.
Strike N. 46° 30' E
D.A. 20° S. 43° 30' E


C shaft
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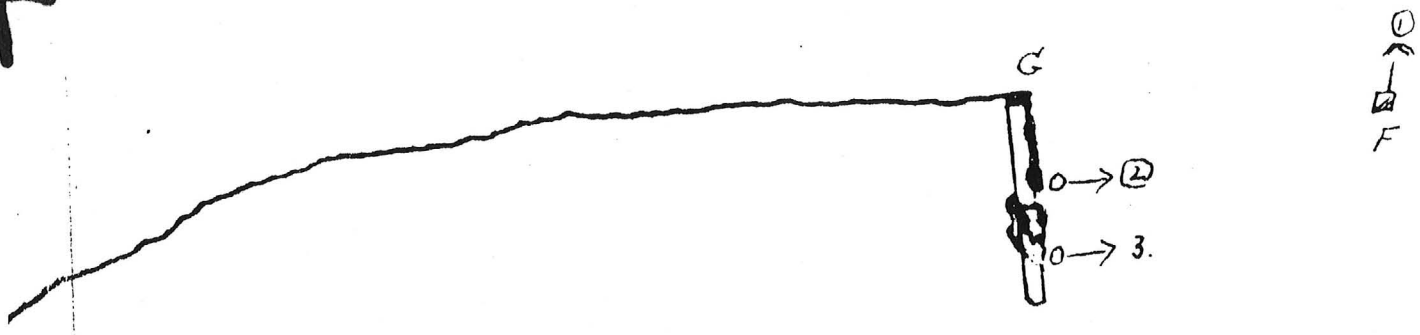
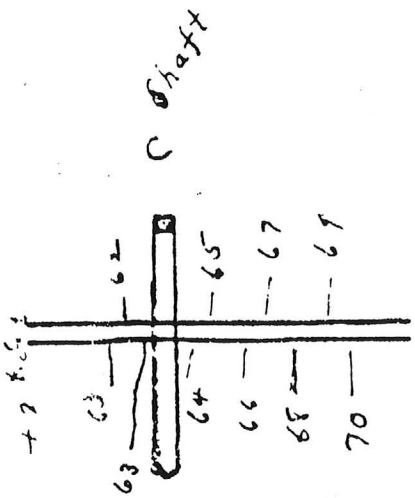


BULLARD MINE

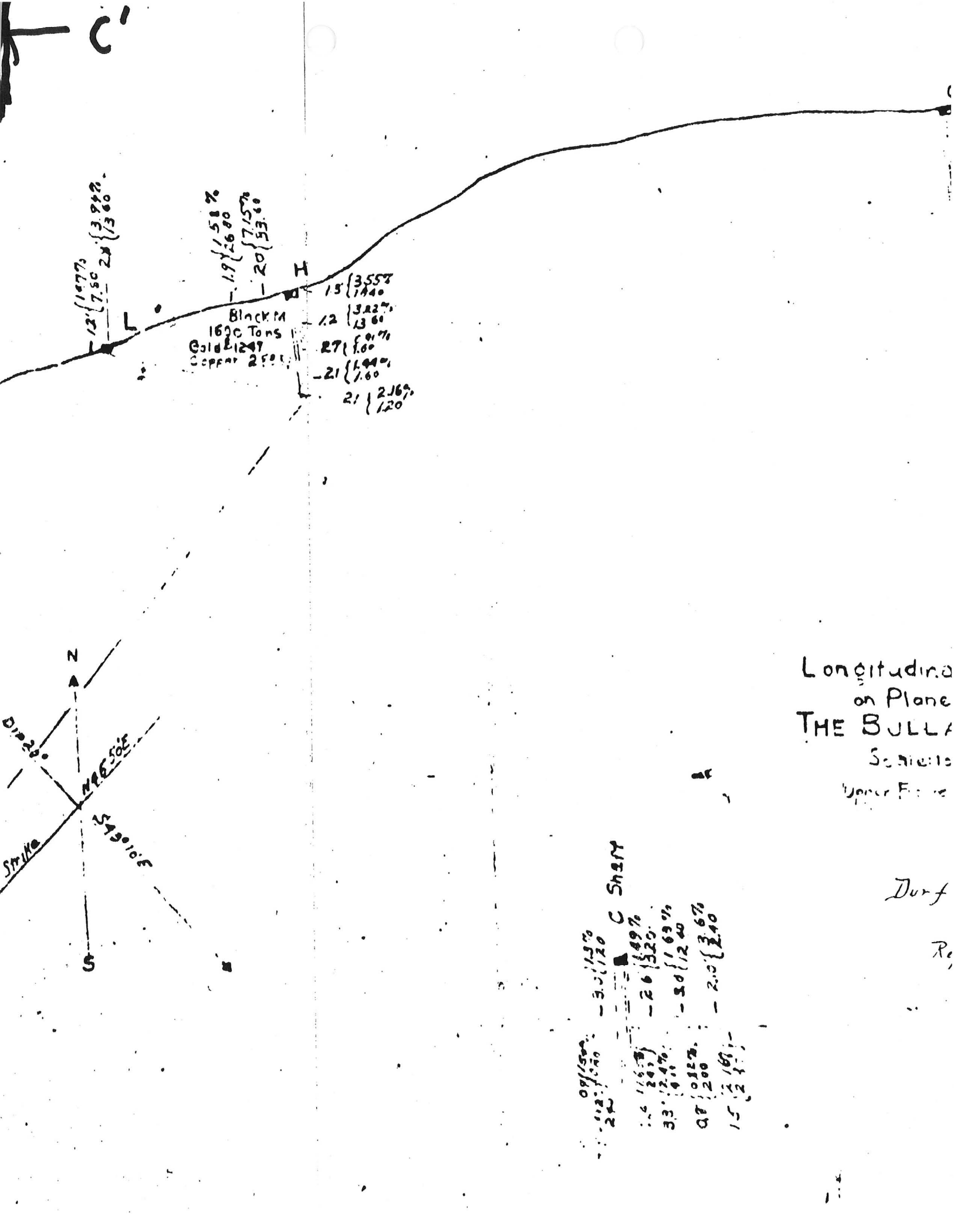
Section on Plane of Vein

Scale 100' = 1"

Assays. - Width -
Value of Gold
% of Copper



Block 'L'
42 100 Tons
Gold #7 34
Copper 2957%
Block 'N'
341000 Tons
J
K
L



Longitudina
on Plane
THE BULLA
Scale: 1
Upper F

Draft

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