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REPORT ON U.S. COPPER PROSPECT

MARICOPA CO.,ARIZ.

Edward Wisser June 30, 1951

RECONNAISSANCE REPORT ON THE

U.S. COPPER-GOLD PROSPECT, MARICOPA COUNTY, ARIZONA

Edward Wisser

June 30, 1951

SUMMARY STATEMENT

The U.S. copper-gold prospect, Maricopa Co., Arizona, lying about 30 miles southwest of Wickenburg, shows copper carbonates sporadically concentrated as small lenses along the margins of a series of diabase dikes intruding rhyolite flows. Beneath the flows at moderate depth lies pre-Cambrian schist and gneiss.

The primary mineralization took the form of quartz-chalcopyrite stringers and veins within the dikes, along fractures on the dike walls and as stockworks within the dikes. The amount of chalcopyrite-limonite in the quartz suggests that the copper content of unoxidized ore did not exceed 1%. The copper carbonate lenses, much higher in grade, were formed by migration of the copper and local concentration, by supergene solutions.

One dike carries a sizable stockwork averaging about $3 in gold, 0.5% copper and 70% silica, which material has been shipped as smelter flux. Two shafts, each about 500 feet deep, suggest by their dumps that they failed to pass below the zone of oxidation. The property, based on surface showings and the evidence of the shafts, seems to offer only an opportunity to mine and ship a little copper carbonate ore, and to ship on a somewhat larger scale, smelter flux at a marginal profit. However, speculative possibilities exist for a radical improvement in size and grade of ore at depth. While the prospect is better suited to a major mining company than to a syndicate, development of a possible high-grade copper-gold ore shoot in one shaft might yield a profit which could be applied to long-shot exploration.

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Geologic Plan in pocket at end of report

RECONNAISSANCE REPORT ON THE U.S. COPPER-GOLD PROSPECT, MARICOPA COUNTY, ARIZONA

INTRODUCTION

The writer spent some six hours on the U.S. property, June 24, 1951, accompanied by Mr. Carl Walters of Wickenburg. Mr.Walters proved a valuable guide, having sampled the property on behalf of Mr.E.R. Dickie, General Manager,Bagdad Copper Corporation,in 1943-1944,mined ore from the open cut shown on the accompanying plan,and shipped ore from the Main shaft dump. Results of the sampling and liquidations of the shipments were made available by Mr. Dickie, who furnished also patent surveys and other maps upon which the accompanying plan is based.

LOCATION; TOPOGRAPHY ; COMMUNICATIONS.

The U.S. prospect lies on the northeast slopes of the Big Horn Mountains,an irregular range of northwest trend, 25-35 miles southwest of Wickenburg. The principal workings and most important showings are situated on a north-south ridge which dies out to the north near the 90 Ft. shaft (see plan), and to the south near the fence shown on the ~~plan~~ plan.

The Big Horn mountains face on the northeast the Hassayampa Plain, on the northwest margin of which lie the Vulture Mountains and the Vulture mine,which latter is some 13 miles airline N60°E from the U.S. property. The latter property is reached by turning south off Highway U.S. 60-70 just west of Wickenburg (Rancho de los Caballeros) and crossing the Vulture Mountains to the Vulture Mine,about 15 miles over good county road,thence crossing the Hassayampa Plain in a SSW direction to the foothills of the Big Horn Mountains and proceeding northwest along the foothills to the property. Total distance about 38 miles from Wickenburg,of which all but the last 7 miles is fair to

good unpaved road. Portions of the last 7 miles are barely passable by truck but could be repaired at small cost.

CLAIMS; OWNERSHIP; HISTORY

The property consists of 10 patented claims, in a solid block trending north-south, parallel to the ridge and to the strike of the diabase dikes that carry the copper-gold mineralization (see Plan). The claims are held in the name of the East Vulture Mining Co., with which E.R.Dickie, General Manager, Bagdad Copper Corp.,is prominently associated.

Historical data are fragmentary. The main workings were completed by 1916, for they appear on the Patent Map of that date. The "High" shaft was sunk before the Main shaft,but by whom and when is unknown. Early in the present century W.E.Defty, a mining engineer of repute, started sinking the Main shaft 1000 ft. He had reached 500 ft. by 1916 or before,but his death about that time stopped the project.

In 1919 one Ray drove north 50 ft. on the 125 ft.Level, Main Shaft, stoping and shipping several hundred tons of copper-gold ore from above the drift, probably for smelter flux.

In 1943 Carl Walters sampled the property for the East Vulture Mining Co.. He was able to sample the 40 ft.and 80 ft. Levels,"High" shaft, and the 125 ft.Level, Main shaft,as well as most of the surface cuts and outcrops. About 1944 he shipped, for the East Vulture Mining Co., perhaps 1400 tons from the Main shaft dump, and mined and shipped about 600 tons from the Open Cut. The shipments went to the Hayden and Clarkdale smelters (siliceous flux) and to the Vulture mill.

Since War II the property has lain idle.

GENERAL GEOLOGY

The Reconnaissance Geologic Map of Lower Gila Valley Region (Plate VI, U.S.G.S. Water-Supply Paper 498,"The Lower Gila Region, Arizona", C.P.Ross, 1923) shows the Big Horn Mountains composed mainly of Tertiary volcanics,largely latites and rhyolites. The northern edge of the range,where the U.S. prospect lies,is shown as pre-Cambrian schist, gneiss etc. As stated in his text,only the margins of the range were examined by Ross.

Actually, the chief country rock on the property consists of latite or rhyolite,some of which may be intrusive but most of which is extrusive: rhyolite tuff is visible from the road east of the property, and flat-lying rhyolite lies above andesite in the same vicinity.

Intrusive into this series is a group of basic dikes striking roughly north-south,and forming an arcuate pattern convex to the east (see Plan). The rock of these dikes,dense,finely-porphyritic and dark where fresh,has been given the field designation "diabase".

A more coarsely porphyritic, lighter-hued rock,called in the field "andesite" occurs as a NNE dike in the eastern part of the area,and a similar dike,striking NNW, is found just west of the Main shaft.

Several pieces of schist or fine-grained gneiss were found on the "High" shaft dump,and Mr. Walters tells me that large exposures of schist occur just west of the property. It would seem therefore that a relatively thin cover of Tertiary volcanics overlies pre-Cambrian schist etc.("basal complex").

The major diabase dikes are three in number,called respectively the West, Central and East dikes on the plan. The West dike,which extend half a mile or more southwest of the segment mapped,ends sharply on the north,where it attains its greatest width. In the same way,the Central dike,which widens to the south, ends somewhere near the Main shaft,for

it cannot be traced south of the wash and dump material surrounding the shaft. The suggestion is strong that the West dike is the faulted extension of the Central dike. The schistose andesite dike west of the Main shaft may lie along the fault that accomplished this dislocation; at the north end of the West dike, a body of diabase or andesite may lie along the same supposed fault.

The Central dike, which continues some 3/4 mile north of where it ceases on the map, contains several gaps; it may pinch at these places, or be displaced by small transverse faults.

The East dike, which also continues well north of the segment mapped, narrows to the south, as shown on the Plan, and dies out in rhyolite.

DEFORMATION; FRACTURING; MINERALIZATION

Deformation, Fracturing.- East of the property the volcanics seem to lie flat. Within the mapped area however, the flow structure noted dips generally west at about 45° NNE of the Main shaft, as shown on the Plan, the flow structure swings from north-south to nearly east-west, and dips south, toward the Main shaft. The suggestion is that of a sag basin in the extrusives, the center of which might lie south of the Main shaft. The NNE and NNW andesite dikes together with the Central diabase dike suggest the northern half of a radial fracture pattern, with the center of the radiate pattern lying south of the Main shaft. This also suggests crustal sag in the rhyolites, possibly due to transfer of rhyolitic magma from the depths to the surface, because radial fissures characteristically accompany "blisters" or "boils" in the crust, whether the boil be upward, forming a dome, or downward, forming a basin.

In the case of a dome, the radial fractures,and also concentric fractures,which also may form, narrow downward; with basins both sets of fractures widen downward. This would account perhaps for the marked widening of the Central and West dikes as they approach the supposed basin. Since the principle metallization occurs along these two dikes, their continued widening in depth might offer speculative hope for larger mineralized bodies below.

Mr. H.K. Armstrong, who visited the property before the writer, originally suggested the possibility of a structural basin there.

All three diabase dikes carry along their eastern edges strong slips or faults;the Central dike at the Open Cut,where mineralization is the strongest in the whole area,carries a similar slip along its west wall also. These slips preceded or accompanied the mineralization, for they are accompanied by parallel quartz stringers. In the cut south of the 90 ft. shaft (see Plan) late movement took place on the slip there:hematite is slickensided,with fault striae pitching down the dip.

Mineralization.- Mineralization on the property is almost entirely confined to the three diabase dikes;within the dikes it is strongly associated with the contact slips mentioned. Such control is so strong within the West dike that primary mineralization seems confined to the slip along the east contact,which is now a quartz vein about 2.5 ft. wide. The rest of the dike,while iron-stained and spottily copper-stained,seems barren of primary mineralization.

In the same way,the Central dike north of the Open Cut shows its primary and most of its secondary mineralization confined to the slip along its east contact.Only at the Open Cut,where the dike is bounded both on the east and on the west by slips,does the primary mineralization spread clear across the dike.

The East Dike is no exception: while the entire dike is more or less mineralized at the 90 ft. shaft, the strongest quartz and best values are found along the slip bounding the dike on the east; south of the shaft mineralization along the slip continues but the dike as a whole is barren.

Primary Mineralization

All the copper on the property, as exposed on the surface and even in the deepest workings, is in the form of carbonate and silicate. It will be shown that much of this copper has migrated, at least to some extent, from its original position. The position of the primary mineralization is shown today by vein quartz containing chalcopyrite limonite.

With the exception of the quartz vein along the east edge of the East dike, quartz occurs as rather narrow stringers. Along the contact slips mentioned, these stringers while narrow are closely-spaced, concentrated along a zone in the immediate foorwall (i.e. west wall) of the slip, from a foot or so to as much as 6 or 8 ft. wide.

In places mineralization spreads much farther from the controlling slip, e.g. near the 90 ft. shaft and at the Open Cut. Here the primary mineralization takes the form of a stockwork formed by quartz stringers with every conceivable trend, subdividing the altered diabase in large and small, highly irregular blocks. Some of these reticulated, small fractures contain only hematite or limonite, and some are merely painted with limonite, accompanied on either side by a strip of diabase which is bleached more than elsewhere.

Some of the quartz is "dead-looking", solid; but considerable on being broken is seen to contain limonite boxwork of the chalcopyrite type. These blebs presumably indicate the source of the oxidized copper now exposed.

The proportion of copper originally deposited with the quartz at exposed horizons probably did not exceed 1%, to judge from the amount of chalcopyrite-limonite in the quartz, and the proportion of quartz to apparently barren diabase, in a mineralized area. No chalcopyrite-limonite was seen in diabase;its traces in this soft, iron-smeared rock may perhaps have been obliterated. Few or no pyrite casts were seen in diabase, a moderate amount in quartz;but transported limonite,of pyritic colors, is abundant in the diabase dikes and in places, in the rhyolite.

Gold travels during oxidation and solution much less than does copper; it tends to remain where first deposited, although sometimes residually concentrated by removal of iron, sulphur, etc. If the gold at the U.S. prospect travelled but little, it should show a consistent areal relation to quartz, regardless of the present copper content; copper that has migrated from its original quartz should carry but little gold unless it has deposited as carbonate on quartz. The most consistently high gold values are found in the Central dike at the Open Cut, where quartz is abundant and copper spotty but generally low. Farther north on the same dike, high copper values go with low gold and relatively sparse quartz.

Judging by the lack of notable cavities along the mineralized zones,residual enrichment of gold was probably slight,and present exposures show the gold, not only probably in about its original position, as outlined above, but with a grade not far above that of the primary ore. If so, the primary ore in the exposed horizons probably ran about $2 in gold (weighted average of samples from known localities).

If then the distribution of quartz with chalcopyrite-limonite plus that of consistent gold values indicates the location and shape of

primary ore shoots formerly existing at present exposed horizons, such shoots, and the tonnage per foot of depth they would have yielded, are as follows:

	Tons per ft. of depth
1. East Dike, along east Slip, 200' x 6', plus stockwork, 35' x 100'?.....	380
2. Central dike, north segment. Quartz narrow, spotty, along east Slip: no tonnage; possible shoot?	
3. Central dike, south segment, including narrow N stretch, 700' x 6', and wide segment exposed by Open Cut, 350? x 50'?.....	1700
4. West dike, 700' x 3', along east Slip.....	170
	2250

While some of these lenses may not persist in depth, others may come in as higher ones quit going down, so that the aggregate mineralized area shown on the surface may be roughly equalled at any given horizon. If so, then a 500 ft. depth extension of such an aggregate area would have produced about 1,000,000 tons of primary ore assaying about 1% copper and $2 in gold. Such a prospect is not enticing.

Secondary Mineralization

Azurite, malachite, and to a less extent chrysocolla are widely distributed over the surface, almost exclusively in the diabase dikes, and seen on shaft dumps. They occur mainly along the same fractures that controlled the primary mineralization; but they are localized, sometimes to the extent of making shipping ore, in pockets along these fractures, much smaller than the lenses of primary ore listed above. Evidently the supergene solutions travelled laterally along the gliding slipsand dropped their copper in local, favored places, making the high-grade pockets. Where they penetrated a wide fractured area such as that of the Open Cut, the grade of secondary copper is much lower:

	Au	Cu
Ore shipped from Open Cut	.105 oz	6.49%
Sample, East Slip	.03	3.72
" , West "	.21	1.14

That copper was simply leached from some places, deposited in others, without any general downward removal, is shown by the fact that the

general average of samples from known localities is 1.14% copper, compared with an estimate of 1% copper for the primary ore.

There seem to be only two commercial possibilities for mining this secondary ore: (1) shipping the small, erratic copper carbonate lenses strung along the faults bounding the dikes and (2) mining the larger Open Cut ore body for smelter flux. That body may be slightly better-grade just north of the Open Cut, for while shipments from the cut averaged $3.67 in gold , 0.49% copper and 70.7% silica, holes drilled in the bench on the north side of the cut averaged $7.52 in gold and 0.78% copper.

The Hayden smelter is said to be willing to waive treatment charge and pay railroad freight to obtain this material for flux. Evem so, the grade would indicate a slim profit margin if any. Any profit would hinge on large-scale mining and low mining cost. Low mining cost would come only from open cut mining, and open cut mining can be done only from the horizon of the Main shaft collar upward. I guess a possible 50,000 tons from that horizon to the outcrop. This forms no basis for aquiring the property for a mining operation; but if incentives could be found elsewhere, a small possible profit on this operation would be no detriment.

To what depth does the zone of spotty secondary copper extend? What may be expected below that zone? The answer to neither question is clear. As for the first, Walters entered and sampled the 40 ft. and 80 ft. levels of the "High" shaft. On the 40 ft. level is a 20 ft. drift north, a 40 ft. drift south; on the 80 ft. level, the north drift is 35 ft. long, accessible, like the upper levels, to its face; the south drift is caved at the station. The vein, along the east contact slip of the West dike, does not change its appearance from its surface aspect, but looks

the same on each level: a quartzy zone 2.5 ft. wide carrying copper carbonates. Sampling results were lost, but Walters claims the average of the samples from both levels was about $13 in gold and 6-8% copper. All three exposed drift faces he claims are in similar ore, but little of the developed shoot remains, because stoping from the 80 ft. level reaches nearly to the 40 ft. level. Walters could not get below the 80 ft. level, so that nothing is known of the lower 406 ft. of the shaft, although some old-timer told Walters there was a level, with stopes above it, at 180 ft. No sulphides appear on the dump.

The Main shaft is also a puzzle. Walters entered and sampled the 125 ft. level drift (north); it is 50 ft. long, and shows vein-matter greater than the width of the drift (5 ft.) and carrying quartz and carbonates. Three samples cut at 15 ft. intervals in this drift average .08 oz. gold ($2.80) and 1.67% copper. A pile of ore from the drift or the small stope mined by Ray above the drift assays .16 oz. gold ($5.60) and 1.99% copper. Ray is said to have shipped about 5 cars from the drift and stope. Walters could not get below this level; the shaft is bulkheaded below the level.

The material Walters shipped from the Main shaft dump, assaying .08 oz. gold ($2.80) and 0.48% copper, lay among the outer layers and was therefore among the latest stuff hoisted. Not over 500 tons were broken on the 125 ft. level and in the stope above it; Ray did not ship over 250 tons, leaving some 250 tons from here presumably on the dump. The north adit running toward the open cut at the elevation of the shaft collar may have produced another 150 tons, making 400 tons from these two places. And yet Walters shipped about 1400 tons from the dump, so that 1000 tons must have come from the shaft below the 125 ft. level, and judging from its position on the dump, possibly from the lowest 175 ft.

If this reasoning is sound, and since the material shipped from the dump was very similar in nature and grade to that shipped from the open cut, this siliceous body, assaying about $3 in gold and 0.5% copper, persists downward for over 500 ft. without essential change. It is not impossible that the shaft, vertical, persisted within the Open Cut ore body, which is also vertical near the surface at least; but it sounds fishy except under one condition: that the Open Cut ore body widened with depth. The slip along the east contact of the Central dike at the open cut was followed by the north adit just northeast of the Main shaft, at the elevation of the shaft collar, and also by the 125 ft. level north drift, according to Walters. As shown on the Plan, this mean that the west dip of this slip noted in the open cut persists in depth, and therefore that the slip approaches the shaft down its dip, at least to the horizon of the 125 ft. level. For the shaft to persist in, or reenter, the ore body near the bottom of the shaft means that this slip has turned over, dipping east at depth; and since the west border slip dips west at the open cut, the ore body probably widens with depth, suggesting confirmation of the theoretical possibility for such widening mentioned on page 5. If the grade should improve with depth as well, there might be a mine here.

What lies beneath the oxidized zone? Obviously, the more copper fixed as carbonate in the oxidized zone, the less may be expected in the secondary sulphide zone, if any. Further, the country is "tight" the diabase impervious and the quartz lacking large cavities. No large channels exist for the downward percolation of sulphate solutions that might deposit secondary sulphides at or near water-level. The primary

sulphides represented by the amount of chalcopyrite limonite in the outcrops would be too low-grade (1%?) to make ore. Plainly the property is unattractive unless reasons can be found to hope for an improvement in grade with depth.

CHANCES IN DEPTH

The only chance I see for the property lies in the possibility that the following chain of reasoning be correct:

1. Mineralization took place in the Tertiary, after extrusion of the rhyolite flows and intrusion of the diabase dikes.

2. According to Ross in the work cited, the Tertiary volcanics were not very thick.

3. The tops of ore deposits of the U.S. type do not reach within 1000 ft. or more of the surface existent at the time of metallization. Because erosion since that time may probably be measured in hundreds rather than thousands of feet, the present surface may expose the mineralized zone near its top. Many major ore bodies send up "leakage ore", offshoots toward the surface, often erratic and low in grade compared with the main ore body at depth. Exposures at the U.S. prospect may represent such high-level leakage ore.

4. Hence the Open Cut ore body, if it widens in depth might make a sizable mine at horizons where optimum metallization would be expected.

CONCLUSIONS

The U.S. copper-gold prospect appears to be an attractive long-odds speculation for a nation in need of copper or for a major mining company. It fulfills requirements of current philosophies of exploration, namely, that longer chances must be taken now, since the obvious mineralized showings have nearly all been tested, and that relatively un-

promising showings must be explored in the future, provided they suggest plenty of room for hidden ore bodies, at depth or laterally. Following the reasoning outlined above, the U.S. prospect contains abundant room for major ore bodies at depth.

A factor that might work for or against chances for ore at depth is the change of wall rock, from rhyolite to schist, that may be expected when workings reach the base of the rhyolites. Apparently the "High" shaft has penetrated the underlying schist. The bordering slips along the diabase dikes were probably localized by the sharp physical differences between rhyolite and diabase. Schist tends to be soft like diabase, and these ore-controlling slips may die out in schist. On the other hand, major copper ore bodies form in schist (e.g. United Verde). The shape and tenor of the ore bodies might well change, and quite possibly for the better, at depths where the country rock is schist, gneiss or even granite.

From the standpoint of a private syndicate, the U.S. prospect looks like too risky, and too expensive a gamble. It might be tackled, however, on the principle of graduated risk: a profitable ore shoot may exist in the "High" shaft area. The shaft collar needs replacing at once, but the shaft, aside from dry-rot of timbers, may be in good shape. Retimbering to below the 80 ft. level would cost little. If ore of the grade reported by Walters were found, it could be shipped at a profit. If it were not found, a syndicate should drop the property, but if it were found, the profit should be applied to pay, in part at least, for retimbering the Main shaft with a view to crosscutting the Open Cut ore body on the 500 level. Any radical improvement in that ore body there might lead to deepening the Main shaft.

These suggestions are tentative only, and plainly contingent on a detailed examination of the property confirming the observations and conclusions of this reconnaissance report.

Edward Wisser

Berkeley, Calif.
June 30, 1951

Edward Wisser
Consulting Geologist

NOTES ON OXIDATION & SOLUTION OF COPPER, SILVER AND GOLD.

General: Above water level, free oxygen furthers oxidation, solution. Below water level, ground water seals out O of air; that carried down by water is quickly used up by reducing reactions with minerals. In absence of O certain metals are ppted from the sulphate solutions which carry them down by primary sulphides. Thus the outcrops and oxidized zones are leached of metals, carrying them down and redepositing them in richer form near & below the ground water level.

Emmons, 1933, 395-396.

Water with dissolved O is the most powerful oxidizing agent; CO_2 also. These reacting with metallic sulphides form ferric sulphate and sulphuric acid.

Two main chemical changes within zone of oxidation: (1) oxidation, solution and removal of the valuable minerals; (2) the transformation in situ of metallic minerals into oxidized compounds.

Pyrite yields the chief solvents, ferric sulphate, $2Fe_2(SO_4)_3$ and H_2SO_4. ~~Former continuously being regenerated not only from pyrite but from ccpy & other sulphides.~~

$$FeS_2 + 7O + H_2O = \underset{\text{Ferrous sulphate}}{FeSO_4} + H_2SO_4$$

$$2FeSO_4 + H_2SO_4 + O = \underset{\text{Ferric sulph}}{Fe_2(SO_4)_3} + H_2O$$

$$6FeSO_4 + 3O + 3H_2O = 2Fe_2(SO_4)_3 + \underset{\text{ferric hydrox}}{2Fe(OH)_3} \longrightarrow \text{To hematite, goethite, limonite}$$

$$Fe_2(SO_4)_3 + 6H_2O = 2Fe(OH)_3 + 3H_2SO_4$$

The ferric sulphate itself is a strong oxidizing agent, attacking sulphides more or less as follows:

$$FeS_2 + Fe_2(SO_4)_3 = 3FeSO_4 + 2S$$

$$CuFeS_2 + 2Fe_2(SO_4)_3 = CuSO_4 + 5FeSO_4 + 2S$$

$$Cu_2S + Fe_2(SO_4)_3 = CuSO_4 + 2FeSO_4 + CuS$$

$$ZnS + 4Fe_2(SO_4)_3 + 4H_2O = ZnSO_4 + 8FeSO_4 + 4H_2SO_4$$

$$2Ag + Fe_2(SO_4)_3 = Ag_2SO_4 + 2FeSO_4$$

Most sulphates, except that of Pb, soluble. With pyrite absent, little solution occurs; sulphides changed in situ into oxides, primary sulphides not enriched. Ajo, ccpy to copper carb. Supergene chalcocite lacking pyrite on being oxidized, chalcocite not dissolved but converted to carbs, cuprite, native Cu. Ls reacts with copper sulphate to form carbs, no 2ndary sulphide enrichment.

HT altered monzonite has $CaCO_3$ +

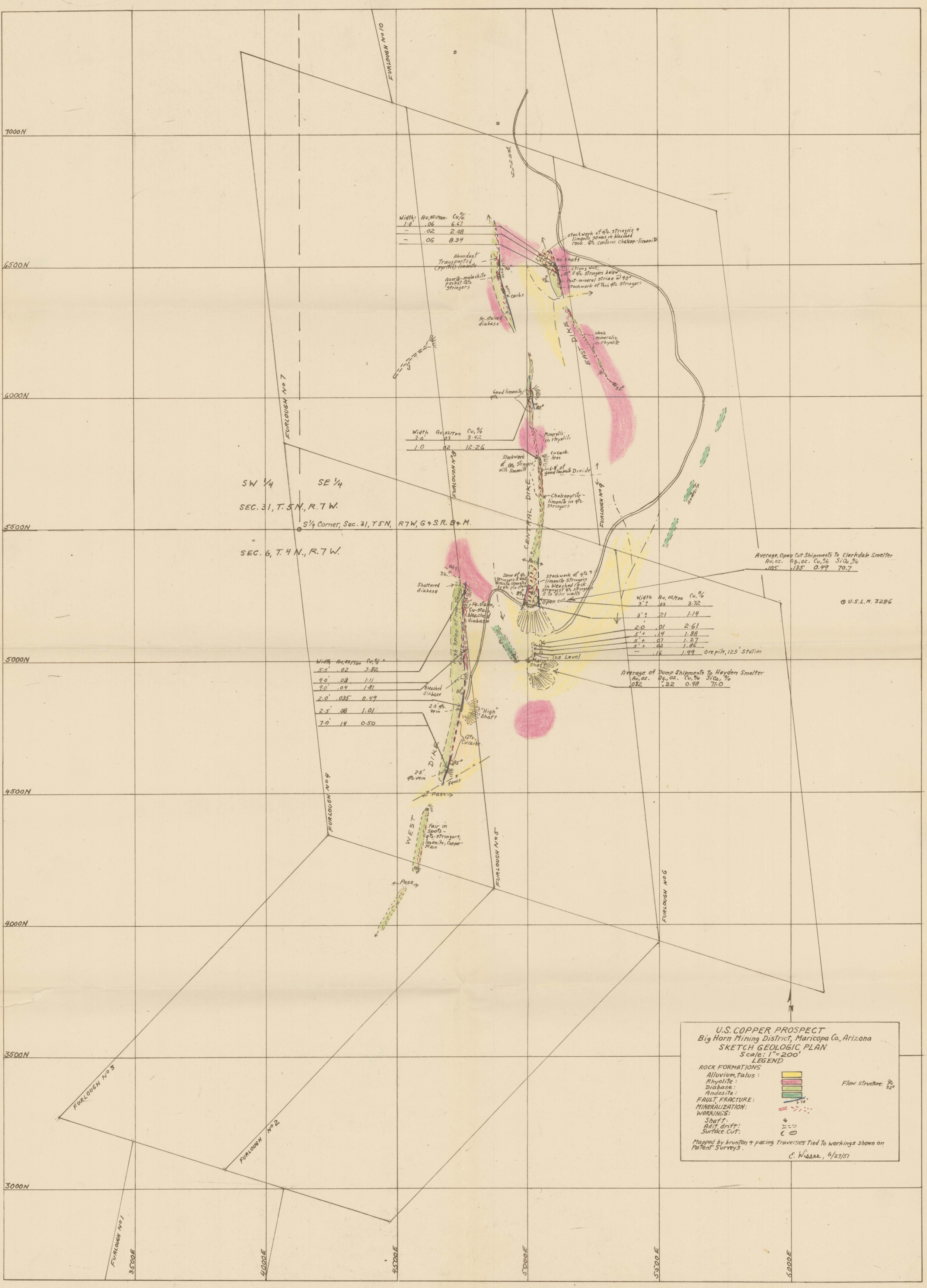
Bateman, 1950, 246-248.

Qtz. gang. If much copper in sulphide ore, not enough acid to carry off all the iron (there is enough with straight pyrite) because much used up in carrying off the copper. Hence when ccpy oxidized it leaves considerable limonite.

Feldspar gangue: mildly reactive, tends to ppt. limonite, even of pyrite, but outside original cavity. Ccpy plus to 50% py, limonite boxwork in cavity.

Emmons, op.cit., 398-399.

Gold generally resists solution, persists in oxidized zone. Bateman, 248.


U.S. COPPER PROSPECT
Big Horn Mining District, Maricopa Co., Arizona
SKETCH GEOLOGIC PLAN
Scale: 1" = 200'
LEGEND
ROCK FORMATIONS
Alluvium, talus:
Rhyolite:
Diabase:
Andesite:
FAULT, FRACTURE:
MINERALIZATION:
WORKINGS:
Shaft:
Adit, drift:
Surface Cut:
Flow structure:
Mapped by brunton & pacing traverses tied to workings shown on Patent Surveys.
E. Wisser, 6/27/51
FURLOUGH No 1
FURLOUGH No 2
FURLOUGH No 3
FURLOUGH No 4
FURLOUGH No 5
FURLOUGH No 6
FURLOUGH No 7
FURLOUGH No 8
FURLOUGH No 9
FURLOUGH No 10
SW 1/4
SE 1/4
SEC. 31, T. 5 N., R. 7 W.
S 1/4 Corner, Sec. 31, T 5 N, R 7 W, G & S.R. B & M.
SEC. 6, T. 4 N., R. 7 W.
7000N
6500N
6000N
5500N
5000N
4500N
4000N
3500N
3000N
3500E
4000E
4500E
5000E
5500E
6000E
EAST DIKE
CENTRAL DIKE
WEST DIKE
Stockwork of qtz. stringers & limonite seams in bleached rock. Qtz. contains chalcop.-limonite
40' shaft
Strong well, qtz. stringers below
Post-mineral striae @ 90°
Stockwork of thin qtz. stringers
Abundant transported (pyritic) limonite
Azurite-malachite pocket. Qtz. stringers
Carbs
Fe-stained diabase
Weak mineraliz. in rhyolite
Good limonite, qtz.
Mineraliz. in rhyolite
Cu carb. lens
6-8' of good limonite
Divide
Stockwork of Qtz. stringers with limonite
Chalcopyrite-limonite in qtz. stringers
Andesite
Shattered diabase
Zone of qtz. stringers & well breccia cemented by qtz. (Cu-stain)
Stockwork of qtz. & limonite stringers in bleached rock. Stringers ⊥ qtz. stringers ∥ to dike walls
Open cut
Fe-stain, Cu-stain, bleached diabase
High spine of iron stained diabase
125 Level
Main Shaft
Bleached diabase
2.5' qtz. vein
"High" Shaft
Qtz., Cu carb.
2.5' qtz. vein
Fence
Pass
Fair in spots - qtz. stringers, limonite, copper stain
Average, Open Cut Shipments To Clarkdale Smelter
Av, oz. Ag., oz. Cu, % SiO2, %
.105 .135 0.49 70.7
Width Au, oz/ton Cu, %
3' + .03 3.72
3' + .21 1.14
2.0' .01 2.61
5' + .14 1.88
5' + .07 1.27
5' + .02 1.86
— .16 1.99 Ore pile, 125' Station
Average of Dump Shipments To Hayden Smelter
Av, oz. Ag., oz. Cu, % SiO2, %
.082 .22 0.48 71.0
Width Au, oz/ton Cu, %
1.0' .06 6.67
— .02 2.08
— .06 8.34
Width Au, oz/ton Cu, %
3.0' .03 3.42
1.0 .02 12.26
Width Au, oz/ton Cu, %
5.5' .02 3.82
4.0' .03 1.11
9.0' .04 1.81
2.0' .035 0.49
2.5' .08 1.01
7.0' .14 0.50
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U.S. COPPER PROSPECT
Big Horn Mining District, Maricopa Co., Arizona
SKETCH GEOLOGIC PLAN
Scale: 1" = 200'
LEGEND
ROCK FORMATIONS
Alluvium, talus:
Rhyolite:
Diabase:
Andesite:
FAULT FRACTURE:
MINERALIZATION:
WORKINGS:
Shaft:
Adit, drift:
Surface Cut:
Flow structure:
Mapped by brunton & pacing traverses tied to workings shown on Patent Surveys.
E. Wisser, 6/27/51
FURLOUGH No 1
FURLOUGH No 2
FURLOUGH No 3
FURLOUGH No 4
FURLOUGH No 5
FURLOUGH No 6
FURLOUGH No 7
FURLOUGH No 8
FURLOUGH No 10
CENTRAL DIKE
EAST DIKE
WEST DIKE
SW 1/4
SE 1/4
SEC. 31, T. 5N., R. 7W.
S 1/4 Corner, Sec. 31, T5N, R7W, G&S.R. B&M.
SEC. 6, T. 4N., R. 7W.
7000N
6500N
6000N
5500N
5000N
4500N
4000N
3500N
3000N
3500E
4000E
4500E
5000E
5500E
6000E
Width Au, oz/ton Cu, %
1.0' .06 6.67
— .02 2.08
— .06 8.34
Abundant transported (pyritic) limonite
Azurite-malachite pocket. Qtz. stringers
Fe-stain diabase
Carbs
stockwork of qtz. stringers & limonite seams in bleached rock. Qtz. contains chalcop.-limonite
90' shaft
Strong well; ∥ qtz. stringers below
Post-mineral striae ∠ 90°
Stockwork of thin qtz. stringers
Weak mineraliz. in rhyolite
Good limonite qtz.
Width Au, oz/ton Cu, %
3.0' .03 3.42
1.0 .02 12.26
Mineraliz. in rhyolite
cu carb. leas
Stockwork of qtz. stringers, with limonite
6-8' of good limonite
Divide
Chalcopyrite-limonite in qtz. stringers
Shattered diabase
Zone of qtz. stringers ∥ wall. Breccia cemented by qtz. (Cu-stain)
Stockwork of qtz. & limonite stringers in bleached rock. Strongest qtz. stringers ∥ to dike walls
Open cut
Fe-stain, Cu-stain, bleached diabase
High spine of iron stained diabase
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125 Level
Main shaft
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fence
Pass
Fair in spots - qtz. stringers, limonite, copper stain
Pass
© U.S.L.M. 3286

Oxidation Separation of Metals. Gold generally persists in croppings as native Au;Zn,Cu removed,also Ag.

Oxidized Zone:Emmons: downward extension of OC;it continually encroaches downward on sulphide zone,primary or secondary. Lower part of oxidized zone often rich in metallic oxides,carbonates, sulphates,because oxidation usually precedes thorough leaching;also much oxid.product of rich 2ndary sulphs
Order of ease of oxidation,most common conditions:

Chalcocite Pyrrhotite Sphalerite	Cu usually leached from upper parts of oxide zone,concentrated in lower parts,;rich oxides at base of zone.
Bornite Chalcopyrite Pyrite Galena	Silver also often concentrated in lower part of oxide zone;but much may stay near surface,esp.in desert regions ,AgCl.

Au often not dissolved.residually enriched close to surface.But with acid waters containing Cl,in presence of MnO_2,may be leached from OC,carried down (?)

Copper:silver. Solution of Ag proceeds more slowly than that of Cu. AgCl formed in oxide zone. wo reasons why silver may remain in oxide zone.

Gold: not readily dissolved in sulphide deposits.

Bateman: Reactive power of gangues;to ppt. limonite.
Qtz.,barite:inert.
Fg.mixtures of qtz.,sericite,adularia: slowly reacting.
Coarse felds.,porous by partial kaolinization:moderately reacting.
Carbonates: rapidly reacting.

Slowly reacting or inert gangues,iron migrates far,permeates whole rock. False gossans: iron-stained area ,resembles true gossan in reworked by weathering. Differs from true gossan:lack of indigenous limonite,lack of sulphide voids,transported limonite.

Copper,like iron,may yield false croppings beneath which there is no OB. Kenya Colony: disseminated Cu OB,140' wide:copper had migrated laterally & down structure from eroded upward projections of narrow Cu-bearing fissures. Carbonate ore became exposed on a surface lowered by erosion. Recognized as transported copper because:(1)lack of sulphide voids;(2)lack of indigenous limonite;(3)lack of indigenous copper carbonate;(4)occurrence of the copper carb.as paint,impregnations, carb.-soaked clay,veinlets,and as open-space fillings with banding,gel structure;(5)lack of hypogene HT alteration.

If oxidized Cu minerals are as abundant as sulphide voids no copper has been removed,hence no 2ndary zone.

Where down-trickling oxidizing solutions meet precipitants above water table,oxidozed ore deposits may form in zone of oxidation. Native metals, carbonates,silicates, oxides.Cu,Zn,Pb,Ag. These ore deposited in lower part of zone of oxidation,and they precipitate in the following ways:
1.simple evaporation giving supersaturation:sulphates as veinlets,blebs, paint.Chuquicamata,copper sulphates.Brochantite,chalcanthite etc.
2. Oxidation,hydration.Iron,Manganese,copper.3.Reaction between solutions: NaCl in desert regions,reacts with sulphates.AgCl. Bcarbonate solutions

react with sulphates and sulphate solutions form carbonates pf metals.Azurite malachite. 4.Reaction with gangue or CR. Carbonate minerals react with sulphates to form Cucarbs. Silica, Cu silicate. Silver as Chloride only;if not,passes down oxide zone. But native Ag,Alamo vein. Silica to form silicate not quartz,but probably,colloidal silica set free during weathering. Globe, weathered dacite lost 20% of its silica ;beneath it in Old Dominion was one of largest known chrysocolla OBs. Porphyry also.

E Dike

Notes on U.S. Copper Prospect.

High Copper Occurrences:

90' shaft and adit: strong wall, parallel qtz. stringers. Stockwork of qtz. stringers to W. Carbonates concentrated along the wall; but gold, which averages .047 oz. or $1.65, may indicate that this was original shoot. Much qtz., ccpy limonite in it., but not in CR. Carbonates have migrated and been concentrated along the wall. Azurite, chrysocolla migrate more than malachite. These in majority here.

No samples across dike as a whole, which to N is a stockwork of qtz. stringers, limonite and iron-staining, making out from fractures, in bleached db., but to S as I remember is mainly bleached, iron-stained db. Vein-like portion next to wall is negligible in possible tonnage. If dike as a whole is mineralized, possibilities for tonnage must be sought in N extension, not examined. If most of the dike is mineralized here, copper grade would seem to be very low, because no ccpy limonite seen in db., only in qtz. ramaleo (Probably enough lime in weathered db. to ppt. copper as carbonate.)

~~Moderately high gold might indicate~~

Qtz stringers parallel to wall indicate control by latter of primary mine alization, including copper, shown by ccpy-limonite in qtz stringers, and gold, shown by fair gold values. Doubtful if primary copper content indicated by ccpy limonite is equivalent to copper content today, over 6%, in form of carbonates. Hence latter concentrated along wall by supergene processes. PM faulting along the wall, or near it, aided this secondary concentration.

Central Dike, N End. Here again both carbonates and to some extent qtz., are concentrated along HW slip. Carbonates in 2 or 3 pockets along wall, may be all transported. Much less evidence here of a primary ore shoot.

Central Dike, central part. Best showing. Primary ore shoot may be 1000 ft. long, although 2 northern carbonate pockets run very low in gold; each has good ccpy limonite, however. That good gold goes with quartz is shown by open cut area, where slip on E and W bounds dike, each slip being accompanied by parallel qtz stringers; central part of dike a stockwork of qtz and limonite stringers. Vertical drill-hole samples, exact location of most unknown, drilled in bench, in 4 groups, average as follows:

Ag	Cu	
.215 ($7.52)	0.78%	
.105 ($3.67)	0.49	Ore shipped from open cut
.21	1.14	West wall, " " OB
.03	3.72	East " " "

Concentration of copper carbonates along the slips is obvious.

East Slip samples

.03	3.72	Small tunnel, E edge open cut
.01	2.61	Tunnel below open cut
.08 ($2.80)	1.67	3 cut samples, 125' drift.
.08	0.48	Shipped from dump. Shaft left high-grade
	0.48	streak. Cf. stuff shipped from open cut.

Stuff shipped from dump was among latest placed on dump. 125 ft. level, drift produced 150 tons, stope if 40 ft. long, 20 ft. high, 320 tons, total say 500 tons. Ray shipped about 5 cars, at 50 tons is 250 T, so no more than 250 tons of this could have been on the dump. Since he shipped for

copper, 1919, his rejects would run low in copper. But far more material was shipped by Walters from the dump than could have come from the 125 ft. level drift and stope. Walters estimates total he shipped, from open cut and dump, at about 2000 tons. Of this, the open cut produced 600-700, leaving 1400 or 1300 tons shipped from dump.

~~It would seem that~~

However, the tunnel at the dump level produced also about 150 tons. This would still leave about 1000 tons, unaccounted for by either the 125 ft. drift and stope and the dump-level tunnel, shipped by Walters from the dump. Since this stuff is latest on dump, seems likely it came from near bottom of shaft, perhaps from the last 275' (50 ft. cross-section, x 275 = 12250 cu.ft., divided by 12 cu.ft./ton = 900 tons).

Since material shipped from open cut is very similar in composition to that shipped from the dump, if the above reasining is correct, the siliceous low-grade material, assaying about $2.20 in gold and 0.5% Cu, persists downward for over 500 ft. without essential change.

This may be the oxidized portion of a primary ore shoot, partly leached of copper and residually enriched, perhaps, in gold. However, it does not seem to contain enough copy limonite to have originally run much over 0.5% Cu. If not, the copper has simply oxidized, been converted to carbonate and silicate, and migrated locally, chiefly along the strong slips mentioned. This happened at Ajo and Rio Tinto, among the disseminated deposits, and at Azteca, a dike deposit (check). Calcite preciptated the copper at Ajo, Rio Tinto and probably at Azteca. The U.S. diabase dikes are especially altered in the mineralized zones, and probably calcitized as well as kaolinized. This would fix the copper as carbonate. At the Groom quartz is far stronger than at U.S., even where vein is a replacement of diabase; ~~xxxxxxx~~ the diabase where seen is on the whole fresher (DD core) although in places it has yielded, according to Wilson, coarse calcite.

Another factor which aided the fixation of copper in the oxidized zone at US is the tightness of the structures, which are far tighter than those of the Groom. Narrow stringers of quartz plus the occasional stockwork of qtz. stringers. Copper in solution couldn't travel far; its journey was impeded and it had ample time to react with whatever carbonates it found.

West Dike: Here again strong mineralization confined to east wall. Here is a real qtz vein. Best values.

U.S. Mine 6/24/51

Carl Walters

Hayden Smelter Liquidations –

Main Shaft Dump

Au	Ag	Cu	SiO2
.06	.08	(0.48) 0.39	71.5
.066	.16 (4)	(4) 0.41	70.4
(4) .139	(.52)	0.75 (3)	
.062	.13	0.37	71.0
(.082) .327	.89 (0.22)	1.92	21.29 (71)

Latest part of dump
copy lim. in qtz seen on dump.

3)14
.047
35
235
141
1.645

Clarkdale

Au	Ag	Cut	
.12	.06	.66	73.9
.07	.20	.42	68.8
.07	.04	.575	67.8
.175	.255	.53	71.2
(9) .11	.14	.55	71.9
.10	.105	(.49) .165	68.8
.09	.12	.63	74.9
.14	.17	.37	66.4 (70.7)
.08	.12 (.135)	.54	71.6
.95	1.21	4.43	63.53

Al_2O_3 6% ±. Increases with SiO_2

Sampling by Walters for Earnest R. Dickie, E. Vulture Mining Co, 1943-1944.

(.105)

Main Shaft. Vert. Sunk by W.E. Defty

Sunk to 500' in 1916 – no more.
High Cu price, 1919, – Ray put in bulkhead @ 125'. Vein, nearly vert., may have left shaft there. Sta., 50' drift to N. 5' vein. Qtz, cu carbs. Face in ore. Small stope above drift 5 cars ± shipped.
480' deep. Upper shaft. Walters down 80'. Lev. @ 40' – S 40', N 20'. Vein 2½" wide. Carbs. Level @ 80'. 2.5' vein. Drifts – S drift caved. 35' N drift. Stoping here – nearly to 40' lev.

Samples lost. On each level, $13.00 Au I, Copper 6% – 8%
Hearsay – level, ore stoped & shipped, @ 180'. Nothing on history of this

Tons shipped by Walters – couple of thousand tons from cut & dump
Some to Vulture mill. .5

NOTES FROM:

GEOLOGY OF THE LOWER GILA REGION, ARIZ.CLYDE P.ROSS,USGS PP 129, 1021.

Ba sal complex,S end of Big Horn Mts.,just N of Palo Verde mine,hill of chlorite schist.

Most of flows latites, qtz latites; some soda rhy/ Latites fg,show flow structure.

Structure:mainly normal faulting;no thrusts known.Only minor folds sinee pte-Cambrian.

Big Horn Mts. Irreg.,NW trend, 20 mi.NW, 10 mi.wide,25-35 mi.SW of Wickemburg.Mine on NE foothills. Map shows N or NE part Big Horns basal complex, rest volcanics.

July 3, 1951

Mr. K.G.Shhwegler
422 Acheson Bldg.
Berkeley 4, Calif.

To Edward Wisser, Dr.

To professional services, examination of U.S. copper prospect. Arizona, 1 day @ $100	$100.00
Preparation of report, 5 days @ $50	250.00
	350.00

EDWARD WISSER
MINING GEOLOGIST
422 ACHESON BLDG.
2131 UNIVERSITY AVE.
BERKELEY 4, CALIF.

TELEPHONE ASHBERRY 3-1366

July 3, 1951

Expense Account, June 1951 Trip to Groom Mine, Arizona

June 18	RR ticket, L.A. to Wickenburg	$23.45
19	Taxi	1.65
	Limousine to airport	1.10
	Lunch, tips	2.00
	Special plane trip to L.A.	20.00
	Limousine, L.A.	1.25
	Dinner, tips	3.00
	Taxi etc., L.A.	1.25
20	Porter	0.50
24	Breakfast, Wickenburg	1.50
	RR ticket, Wickenburg to L.A.	23.45
	Dinner	0.85
25	Taxi, tips	1.60
	Breakfast	1.50
	Plane ticket, Calif. Central Airlines, S.F. to Oakland	13.76
	Lunch	2.25
	Limousine to Burbank	1.25
	Checking bag, tips	0.75
	Limousine, Oakland	1.10
	Taxi, Oakland	1.65
	Supplies and miscellaneous	4.00
		$107.86