

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

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John Hope, Chief Geologist

Florence, Arizona

FROM

A. J. O'Connor, General Manager

CITY

June 9, 1949

TO

ZONIA COPPER GROUP, YAVAPAI COUNTY, ARIZONA

DATE

SUBJECT

Introduction:

On May 26 and 27, 1949, I examined the Zonia Copper Group of claims near Prescott, Arizona. On my examination, I was accompanied by Messrs. A. H. Mackenzie and J. L. Gillingham, the owners of the property.

Summary and Conclusions:

It is evident that the exploration done to date on the cuprite ore body by previous owners and the Bureau of Mines failed to develop a mineable ore body. The blocks of ore considered as reserves are too narrow, too small and too low grade to be economically mined and treated under present day conditions.

Since the copper metallization seen in the outcrops above the cuprite ore body is as strong, or stronger than any other showings examined, it stands to reason that the possibilities of developing larger mineable bodies of ore are rather remote. Therefore, the property does not deserve any further consideration.

Location:*R 4W, T 11N, Sec 12*

The Zonia Copper Group of claims is situated in the Walnut Grove mining district, some eleven miles east of Kirkland Junction in Yavapai County, Arizona. It lies within the confines of the Prescott National Forest near the center of the Bradshaw Mountains. Prescott is some 10 airline miles to the northeast.

Access to the property is easy over good, well maintained, dirt and gravel roads.

Claims and Ownership:

Two separate groups of claims make up the area of interest. The first and most southerly group is held both by bond and lease and by location by Mr. A. H. Mackenzie and associates of Prescott. This group consists of 16 unpatented claims containing the so-called cuprite ore body that will be more fully discussed later.

The second group consists of 14 patented claims and lies to the north of the Mackenzie group. These claims are owned by a Mr. J. L. Gillingham of Elgin, Arizona.

Both owners indicated that sufficient time would be given for geological mapping and drilling provided certain guarantees were made by us as to work performed each month. Mr. Mackenzie can arrange an outright sale of his interests but Mr. Gillingham evidently wants to participate in any venture by royalties or an outright interest.

Since the area must be taken in its entirety in the event any further consideration is given to additional investigations, the two property groups will be discussed here as a unit.

FROM John Hope, Chief Geologist
A. J. O'Connor, General Manager
TO
SUBJECT ZONIA COPPER GROUP, YAVAPAI COUNTY, ARIZONA

CITY Florence, Arizona
DATE June 9, 1949
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Geology:

The main geological feature of the area is a wide northeast-southwest trending belt of pre-Cambrian schist locally intruded by narrow lenticular bodies of granodiorite (also called monzonite porphyry). As a general rule, the attitude of the schist is N 20° E dipping at 45° to 60° to the west. The intrusions of granodiorite conform to the attitude of the schist and in marginal areas also exhibit some schistosity. To the north, one minor bed of intercalated limestone was noted. Several minor bodies of later andesite porphyry have conformably intruded the schist on the east and west flanks of the mineralized belt.

All in all, the area is one of remarkable conformity to the pre-Cambrian basement rock. No major cross structures were noted and the structural control exerted by the schist is readily apparent.

Mineralization and Development:

The pattern of mineralization is similar to that previously noted in the pre-Cambrian schist of other areas. The primary and secondary mineralization followed parallel zones in the schist depositing their metallic content mainly in the planes of schistosity. This tends to produce lenticular and not too continuous ore bodies parallel to the attitude of the country rock.

Several such zones were noted in the area. These zones of mineralization are usually separate and distinct from each other producing several tabular ore bodies of dubious value. The mineralization is readily traced on the surface because of the high iron content. Leaching of these zones has enhanced the color and also converted the primary chalcopryite and secondary chalcocite to various oxides.

Specularite is the main iron mineral but considerable evidence of pyrite remains in the leached outcrops. The specularite tends to remain in the outcrops but most of the pyrite has been leached out. As a rule, there is but little evidence of chalcopryite having been leached. Most of the copper oxides (malachite, cuprite and azurite) are the result of oxidization in place of previously deposited secondary chalcocite.

Oxidization in the area is of considerable depth. Evidence of a lowering water table may be seen in the fact that below the present secondary ore bodies, the ground has been oxidized and perhaps leached in a minor way to depths over 500 feet.

The ore bodies as such are the result of secondary enrichment of primary mineralized zones averaging about 0.3% copper as chalcopryite. Chalcocite is the main ore mineral but on the surface and to varying depths, the chalcocite has been oxidized in place to malachite, cuprite, and azurite. The bottom of the ore bodies is between 200 and 300 feet below the surface. Evidently, the erosion in the area has lagged only slightly the process of enrichment. The ore outcrops and is now in the process of being removed.

These tabular ore zones on the surface are generally not over 150 feet in width and do not exceed 1,000 feet in length. The metallization is not constant and the ore blocks in these zones are usually narrow bands up to 100 feet wide and 200 to 300 feet long.

FROM John Hope, Chief Geologist
A. J. O'Connor, General Manager
TO
SUBJECT ZONIA COPPER GROUP, YAVAPAI COUNTY, ARIZONA

Florence, Arizona
CITY
June 9, 1949
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Page 3.

The cuprite ore body is a typical example of this mode of occurrence. An area roughly 1,200 feet long and 300 feet wide has been explored by a deep shaft (875 feet) and several levels. The main level is the 210 which was developed to block out a fair tonnage of ore. Using narrow, up to 100 foot, blocks of indeterminate length and a lot of guessing in carrying the ore to the surface, an ore estimate of 1,213,000 tons of ore averaging 1.84% copper was made. Reports are that the ore bottoms near the 300 foot level. Most of this development work was done before 1930 by various owners.

In 1943, the Bureau of Mines spent \$17,500.00 diamond drilling and trenching the cuprite ore body. Their results failed to check the previous ore estimates by a considerable margin and the project was abandoned. Leaching tests on the ore showed a 71% recovery which brings the recovered grade down to 1.30% copper. Such a grade definitely precludes any present day operation.

Mr. Gillingham furnished considerable data from the churn drilling done on the cuprite ore body in 1910 by the Shannon Copper Company. Several churn drill holes to varying depths failed to cut any interesting columns of ore. However, the assay records of these holes were interesting because they showed the average grade of the primary metallization to be about 0.3% copper. The assays of the 875 foot shaft previously mentioned confirmed this.

Two or three other ore showings in the area have been superficially explored with approximately the same results. The Copperopolis is one of these with an inclined shaft to the 365 foot level. The "red hill" advertised by Mr. Mackenzie showed but little evidence of copper mineralization.

The surface indications of the cuprite ore body are at least as good as anything else seen in the area. Since attempts to develop that ore body proved uneconomical, it would be difficult to recommend any further exploration.

JH/ms

cc - Mr. E. N. Pennebaker

*John: Please return when you
are finished with this.*

ALBERT H. MACKENZIE

ATTORNEY-AT-LAW

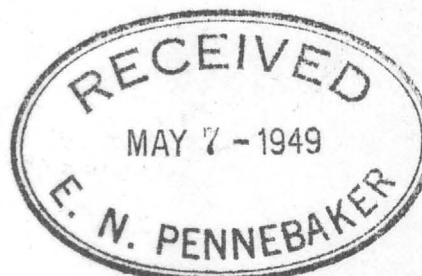
PRESCOTT, ARIZONA

May 5, 1949.

E. N. P.

ALBERT H. MACKENZIE
HENRY RUSH

Mr. E. N. Pennebaker
Consulting Geologist
P. O. Box 2996
Globe, Arizona



Dear Mr. Pennebaker:

Sorry to hear that you are leaving for South Africa so soon. We had pinned, and still do, considerable trust upon your expert judgment, especially since we are now in a position to show you the additional 14 patented Gillingham claims. In this connection, you will note the Oscar Hershey observations on the Fairplay (the 210' level drift in which, incidentally we plan to drive through to the other side of the hill and thus open it) to the effect that "by the time this locality has been fully explored a considerable tonnage may be added to the reserves".

Moreover, there is a very promising extension of the ore body on the Tourmaline claim, of which Mr. Hershey does not speak, for apparently since his time, a relatively large "quarry" has been cut across the surface exposing more ore than had been expected. In fact, I have had three groups of local men approach me for a right to "chloride" this open cut but have turned them all down.

Again leaving the Gillingham property and going to the Black Prince, you will note the assays across a 30 foot band average some 3.5% copper.

Further, as I stated to you in our conversation, our "red hill" on one of the Victory claims, about which no geologist has ever reported, and on which there are no workings whatever, the iron stains and channels in the surface rocks give positive evidence of an ore body beneath. In fact, it is Mr. Fowle's thought that a drilling program should not, under any circumstances, omit this iron stained hill.

Also, the prominent and extensive iron gossan outcrop just to the east is evidence of pronounced mineralization that ought not to be overlooked.

Still further, we have, since my discussion with you, located two more claims to the west and south in which silver and lead appears right at the surface. Pursuant to the periphery or perimeter theory, this is certainly corroborative evidence of an ore body in the center, near or beneath the "red hill". That is probably where the sulphide zone will be contacted, and as I have

Mr. E. N. Pennebaker
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said, no work, drilling or otherwise, has ever been initiated to discover it.

I recount these points at some length because I am thoroughly convinced that to pass up this property is, indeed, a mistake.

Since I have made all arrangements to have you taken over the group as a whole, could you not make a quick trip up to Prescott this Sunday? Better still, Charlie Brown and I can meet you at Kirkland Junction at a given time on Sunday morning and you can be on your way south again by supper time. I earnestly urge you to do this because I have learned from your reputation and standing that there are no more capable geologists in the country than yourself.

Moreover, I think I can say that you owe it to yourself not to miss a mighty good bet even though you are, later, going to shove off for South Africa.

My telephone number is Prescott-1029; and upon hearing from you Mr. Brown and I will be at Kirkland Junction on Sunday, May 8, at an appointed time.

Very sincerely yours,


Albert H. Mackenzie.

AHM:JM

Bunker Hill and Sullivan Mining and Concentrating Company

Kellogg, Idaho

May 2, 1949

Mr. E. N. Pennebaker,
Box 2996,
Globe, Arizona.

Dear Penny:

I received the other day the enclosed from Mr. Mackenzie at Prescott. I advised Mr. Mackenzie that we are not interested in explorations in Arizona at this time but knowing about your valiant efforts to find a new mine for Consolidated Copper-mines I am sending the dope along to you for whatever good it may do you.

Kindest personal regards.

Barney

JBHaffner/dc

Enc.



APR 28 1949

ALBERT H. MACKENZIE

ATTORNEY-AT-LAW

PRESCOTT, ARIZONA

April 25, 1949.

ALBERT H. MACKENZIE
HENRY RUSH

Bunker Hill & Sullivan M. & C. Co.
1022 Crocker Building
San Francisco, California

Attention - The General Manager

Gentlemen:

We bring to your attention the fact that we are owners in part and lessees and optionees of the balance of some 30 lode mining claims in the Walnut Grove Mining District, Yavapai County, Arizona; and enclose copy of a report made on part of the District by Oscar H. Hershey, dated January 10, 1930. Note that the report is on only part of the District.

Aside from the general showings reported, it is to be noted that the 1,210,000 tons of copper carbonate blocked out from the 210' level to the surface all occur within the practical limits of only one claim. The entire area which we cover, a zone roughly from 300 to 600 feet wide and some 12,000 feet long, is well mineralized. In fact there is evidence of enough gold and strategic minerals along with the copper to probably pay for operation and development expenditures.

In the hit-and-miss endeavors of the past, complicated by ventures invaded by the Depression (such as Loring and Hammon's in 1930-1932) the following essential steps have never been taken:

- 1 - To drill at one or more points angularly to the foot-wall to reach the enriched secondary zone;
- 2 - To drill at indicated points for the disclosure of the sulphide zone.

The object, therefore, of this letter is to advise your company that we would be pleased to arrange to escort your geologist over the integrated area at your earliest convenience.

If you will notify me 24 to 48 hours in advance of the arrival of your geologist or engineer I will see that appropriate arrangements are made for his examination of the claims. My telephone number is Prescott-1029.

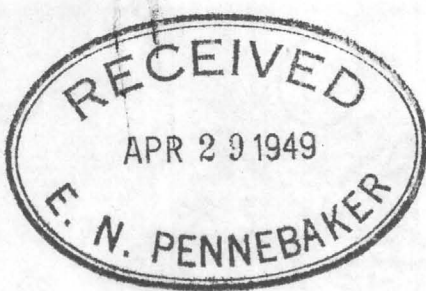
RECEIVED AT OFFICE OF
GENERAL MANAGER

MAY -2 1949
BUNKER HILL & SULLIVAN
M. & C. CO.

Very sincerely yours,

Albert H. Mackenzie
Albert H. Mackenzie.





ALBERT H. MACKENZIE
ATTORNEY-AT-LAW
PRESCOTT, ARIZONA

April 28, 1949.

ALBERT H. MACKENZIE
HENRY RUSH

Mr. E. N. Pennebaker
Consulting Geologist
P. O. Box No. 2996
Globe, Arizona

Dear Mr. Pennebaker:

Thank you for your letter of April 25 in response to our communications and discussions on the so-called "Zonia" area.

At the time I spoke to you, I had not as yet received word from either Mr. Fowles or Mr. Robert Hughes of the Miami Copper Co. concerning our property. Some two hours later I talked with Mr. Hughes and he told me that their company, as you probably know better than I, appears to be already lined up with some three other properties.

Nevertheless, since speaking to you, it has been our very good fortune to have had a long talk with the owner of the actual "Zonia" property, and it is his commitment to bring his 14 patented claims into our entire unification project. I learned, too, much additional valuable geological data concerning his area.

Moreover, my partner Charles H. Brown, subsequent to my interview with you, has located three more claims which carry lead and silver right at the surface. It appears that we had heretofore neglected these side line claims in our concern over the copper-bearing zone.

To answer one of your points directly, the Miami Copper Co. has definitely abandoned consideration of our project, albeit without knowledge on the part of either of us that subsequent to their decision we would make the fortunate Zonia arrangement above referred to.

Thus, in summary, we are ready to have you and Mr. Hope examine the property. The earlier the better, of course, in order not to overlap another investigation for which we are making arrangements.

Please telegraph me, or telephone me at Prescott-1029 (Home-1016-M) some 24 to 48 hours in advance of the visit planned so that Charles Brown, or I, or both of us, can be on the property to show you the lines, the zone, the area, etc. In this connection, plans should be made for a two-day examination because the underground workings will obviously consume a half day and the surface cannot be covered in the remaining half.

With best personal regards to you and to Mr. Hope, I remain

Very sincerely yours,

Albert H. Mackenzie
Albert H. Mackenzie.

AHM:JM

ALBERT H. MACKENZIE
Attorney-at-Law
Prescott, Arizona

April 28, 1949

Mr. E. M. Pennabaker
Consulting Geologist
P. O. Box No. 2996
Globe, Arizona

Dear Mr. Pennabaker:

Thank you for your letter of April 25 in response to our communications and discussions of the so-called "Zonia" area.

At the time I spoke to you, I had not as yet received word from either Mr. Fowles or Mr. Robert Hughes of the Miami Copper Co. concerning our property. Some two hours later I talked with Mr. Hughes and he told me that their company, as you probably know better than I, appears to be already lined up with some three other properties.

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With best personal regards to you and to Mr. Hope, I remain

Very sincerely yours,

AHM:JM

(S) Albert H. Mackenzie
Albert H. Mackenzie

May 1, 1949

Mr. Albert H. Mackenzie
Attorney-at-Law
Prescott, Arizona

Dear Mr. Mackenzie:

Thank you for your letter of April 28, 1949, with regard to the Zonia mineral area. Inasmuch as I am now preparing to leave for South Africa, I am turning all these data over to Mr. John Hope, Jr., who will visit the property in behalf of Consolidated Coppermines Corporation. Mr. Hope has a very full schedule in the near future, and it may be some little time before he can arrange a trip to examine these properties.

I note that you are making arrangements for other investigation of the property, presumably by some mining company. Please feel free to have others look over your ground because, as I say, Mr. Hope will be unable to visit your area promptly.

Thanking you for drawing these matters to our attention, I remain,

Yours very truly,

cc: Mr. John Hope, Jr.
Mr. Arthur C. O'Connor

May 9, 1949

Mr. Albert H. Mackenzie
Attorney at Law
Prescott, Arizona

Dear Mr. Mackenzie:

Thank you for your letter of May 5, 1949, which I received last Saturday evening on my return from Los Angeles. As I wired you, it was impossible for me to visit your property on Sunday, May 8, and there will be no further opportunity for me personally to examine this ground prior to my departure for South Africa next month.

Mr. John Hope, Jr. will visit your area just as soon as his very busy schedule permits him to make the trip. Mr. Hope is thoroughly qualified to conduct the examinations and we shall have complete confidence in his conclusions.

At the time Mr. Hope visits your area, he will inquire regarding the terms for which you are holding these consolidated properties. The general arrangement which our people seek is one permitting at least 12 months in which to perform geological and geophysical surveys and preliminary exploration before any payments are due. Only in exceptional cases could we modify this arrangement, and with present falling copper prices such a possible modification would be frowned upon by our people. Naturally, the terms for which you are holding these property groups will influence the preliminary attention we can give them. I suggest that you be prepared to discuss these matters when Mr. Hope visits you.

Thanking you for bringing these matters to our attention, I remain,

Yours very truly,

cc: Mr. John Hope, Jr.

April 25, 1949

Mr. Albert H. Mackenzie
Prescott, Arizona

Dear Mr. Mackenzie:

Thank you kindly for your letter of April 16, 1949, with the enclosed Hershey report on the Zonia area. I have made a copy of these data and herewith return the Hershey report to you.

It has come to my attention that this property near Zonia has also been presented to Miami Copper Company, which I also serve as consultant, and that their Mr. Fowells has recently examined this ground. Consequently, I shall be unable to look into this property in behalf of Consolidated Coppermines Corporation until such time as Miami may have abandoned its consideration of the project. If this occurs you may advise me and we can take up the matter again, possibly arranging for a visit by Mr. Hope.

Yours very truly,

cc: Mr. A. J. O'Connor
Mr. John Hope, Jr.

ALBERT H. MACKENZIE

ATTORNEY-AT-LAW

PRESCOTT, ARIZONA

April 16, 1949.

**ALBERT H. MACKENZIE
HENRY RUSH**

Mr. E. N. Pennebaker
Consultant Geologist
Ice House Cañon
Globe
Arizona

Dear Mr. Pennebaker:

Enclosed is a copy of the Oscar Hershey report of which I spoke, and of which I have had extra copies made. Inasmuch as, since seeing you, I have had a personal talk with Mr. Gillingham, the owner of the actual Zonia group of 14 patented claims, I include, in addition, Mr. Hershey's reference to the "Fairplay" and "Copperopolis" claims, which are in his group. We have his assurance that he will come into our unification project, and are now working out the elements of our agreement.

As I mentioned to you in our discussion the other morning, no report of any kind has touched upon the "red hill" to the south on the Victory claims, nor upon the iron gossan outcropping which is also to the south and east, and which add greatly to the understanding of this mineralized zone as a whole.

We are having a copy produced of a geological and mineralization map made by Charles H. James in 1920, which will be ready for your examination when you come up to the property.

I would thank you for returning the enclosed Hershey report when you have gone over it and copied it, if you wish.

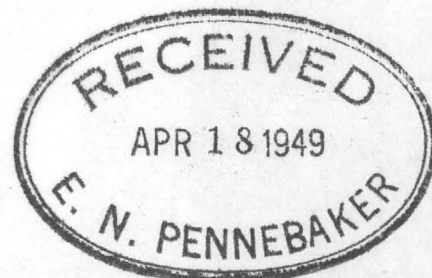
We look forward to your visit, but please give me at least 24 hours notice, so that I can get in touch with my partner Charlie Brown to take you and Mr. Hope over the area.

Very sincerely yours,

Albert H. Mackenzie

Albert H. Mackenzie.

AHM:JM



GEOLOGICAL REPORT ON THE PROPERTY OF THE ZONIA COPPER MINING
COMPANY IN YAVAPAI COUNTY, ARIZONA, BY OSCAR H. HERSHEY.

San Francisco, California
January 10, 1930

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FAIRPLAY OREBODY

At east crosscut 860 north on the 210-foot level of the Cuprite mine, a body of "near ore" has been reached and at the face of the drift the content has risen to 1.15% copper. This body has some greenish schist and may in part be altered chloritic schist, rich in quartz-limonite seams, with pockets of copper carbonate and silicate. I have some reason to think that associated with it is the orebody that emerges on the slope in the vicinity of the Fairplay shaft. This shaft is said to be 450 feet ahead of the present face of the north drift on the 210-foot level and I recommend that when work is resumed, this drift be driven out to the surface and the Fairplay orebody developed. The ore has remnants of cuprite and chalcocite. I can see traces of such material nearly to the bottom of the gulch below the shaft. By the time this locality has been fully explored, a considerable tonnage may be added to the reserves.

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COPPEROPOLIS OREBODY

The Copperopolis orebody was produced by the secondary enrichment process in a vein zone parallel to that in which the Cuprite body was formed. It has suffered more from erosion than have the orebodies mentioned above, but yet must contain considerable ore. At the Copperopolis shaft the deposit is about 100 feet wide. Efforts have been made to mine it, making a cut from the wall of which a set of assays across 44 feet ran 0.5, 2.5, 3.13, 3.13, 0.5 and 11.82% copper. Later the cut was extended farther toward the hanging wall and some bands yielded 5 and 6% ore. Stoping was begun in a south drift down the Copperopolis shaft and I have been told that 11 tons of ore that represented a width of 6 feet averaged 5.75% copper. This, however, seems to be an unusually good section of the orebody. If I may judge from the fractured and iron-stained appearance of the surface, from a wide distribution of copper carbonate stain, from a few old stopes on narrow rich streaks and from several shafts, the mineralized zone runs southward, varying from 40 to 100 feet wide and forks, the right-hand fork probably dying out in 500 feet, but the left-hand fork continuing strong into the Defiance claim. We undertook to develop this orebody, but at that time did not understand the nature of these deposits and sank the Copperopolis shaft too deep and ran a 330-foot level in the oxidized and leached zone below the orebody. Hence, we do not know the exact depth of the orebody, but there is evidently a considerable tonnage of such ore as that in the Cuprite orebody.

GEOLOGICAL REPORT ON THE PROPERTY OF THE ZONIA COPPER MINING
COMPANY IN YAVAPAI COUNTY, ARIZONA, BY OSCAR H. HERSHEY.

San Francisco, California
January 10, 1930

Mr. W. P. Hammon, President,
Zonia Copper Mining Company,
Balfour Building,
San Francisco, California

Dear Sir:

In compliance with your request for a comprehensive geological report on the property of your company in the Walnut Grove District, Yavapai County, Arizona, as determined on my various visits, the last of which was on April 19 of last year, I offer the following:

In a report dated February 1st, 1929, Mr. F. L. Sizer estimated the developed ore in the Cuprite Area as aggregating 1,093,242 tons of an average content of 1.916% copper. But Mr. Sizer rejected several low grade bands that Mr. W. J. Loring thought would have to be mined because of lying between ore bands and by including them in his estimate as of January 1st, 1929, the latter engineer derived as "developed ore", 1,221,355 tons of an average copper content of 1.84%. More ore was developed after that date, but after spending a day and a half in studying the showing underground and new cuts on the surface, I modified the blacks somewhat and, using 14 cubic feet as a ton, I secured the figure 1,213,599 tons as my estimate of the amount of developed ore in the Cuprite area. The necessary time and machinery to compute the probably average copper content of this ore were not available, but I saw no reason to question Mr. Loring's figure of 1.84%, especially as it agreed very well with the 1.81% average that I secured several years before from the main outcrop on the Cuprite Claim.

I was also convinced that Mr. E. L. Sweeney had determined the proper method of recovering the copper by leaching, and the costs of a plant and of the treatment of the ore. Hence, I considered the next thing in order to be the erection of a treatment plant. We knew that the property contains much more ore than the roughly 1,200,000 tons considered developed, but I felt that no great advantage could be secured by further development in the immediate future except preparing the ground for mining. After the plant is in operation, development should be resumed and kept steadily going and it cannot fail to add greatly to the ore reserves.

The above statements will serve as an introduction to, and reason for, a rather elaborate discussion of the geological features and mining possibilities of the property.

GENERAL GEOLOGY

The oldest rock formation in the district was a basic eruptive, largely gabbro and perhaps some diabase. This was extensively intruded by a quartz monzonite or granite porphyry in masses usually elongated

in a northeast direction. These old rocks in part remain massive in structure but in large part they have been acted upon by a shearing stress that has converted them, in zones or large lenses, into schists. The basic rocks have become dark green chloritic schists and the porphyry white to light gray sericitic schists. The mineral deposits occur in these belts of schists. They are usually elongated along the strike of the schists. In fact, traces of mineral may be found so persistently along certain lines, perhaps controlled by slight fissures in the schists, that I regard them as veins, though in reality they are a succession of weakly connected lenses.

The veins are of four types. In the sericitic schist of the largest porphyry area there are zones in which more or less malachite, azurite and chrysocolla are distributed through the rock in small seams and as a stain in the schist. Not much copper stain is seen at the immediate surface, but it comes in strong at a few feet below the surface. Digging down in these deposits, small seams and pockets of cuprite and chalcocite appear and my impression is that the carbonates and silicate have been formed by the weathering of the red oxide and sulphide.

In the second type, oxidized copper minerals including malachite, azurite and chrysocolla occur near the surface and go down into chalcopyrite and pyrite without the intervention of a zone of secondary sulphide enrichment.

In the third type, the surface material is a fine grained porous quartz rich in oxidized iron minerals, partly hematite, including some specularite locally, but no visible copper minerals. My impression is that the primary material is a fine-grained replacement quartz which is rich in pyrite and a little specularite. It has not been explored so as to determine whether it contains appreciable quantities of chalcopyrite. This type occurs in the chloritic schist and on the borders of the main porphyry mass.

In the fourth type, there are lenses of rather coarsely crystallized white quartz with a small percentage of sulphides, chalcopyrite and pyrite and some free gold. Also in a certain area there is galena, making small lenses of high-grade lead-silver ore. Near the surface the veins are oxidized but there is no zone of secondary sulphide enrichment.

It will be seen from the preceding paragraph that the Zonia property is situated in a well mineralized district. The first three types of deposits are strongly represented on it. In fact, so far as I know, the property covers all of the known occurrences of the first and best type and hence I will discuss the mode of origin of that type at some length.

In rather wide zones the sericitic schist was traversed by a network of small quartz seams with pyrite, chalcopyrite and small quantities of other sulphides including a little molybdenite. During the Tertiary period oxidation and leaching destroyed the sulphides near the surface, carried the copper salts down and re-deposited them as cuprite and chalcocite, forming a zone of secondary enrichment related to a plain surface that has since been destroyed by erosion except for a small remnant buried under basalt lava near the Cuprite Shaft. Subsequently the country was elevated and the present deep valleys eroded, which brought

the secondarily enriched zone into the zone of oxidation and most of the cuprite and chalcocite have been converted chiefly into malachite and a little chrysocolla. Some of the copper salts may have been leached but enough remains on the site of the original cuprite-chalcocite ore bodies to make the present orebodies. Oxidation and leaching have also operated to a depth of several hundred feet on the primary sulphite zone and made leached bodies under the orebodies.

CUPRITE OREBODY

A zone of sericitic schist up to several hundred feet in width runs lengthwise of the Cuprite Claim and dips westward from 45° to nearly vertical. In large part the zone is very lightly and sporadically mineralized by copper carbonate, a little silicate and in a few places a little chalcocite. At the surface commercial values appear in lenticular bodies of various sizes. One on the southern half of the claim I determined several years ago as 675 feet in exposed length and 48 feet in average width, with an average content of 1.81% copper. In addition there was a footwall band 440 feet long and 15.6 feet in average width, with an average content of 1.94% copper. Underground work has shown that these copper-bearing bodies go down to a roughly plane surface that slopes in the same direction as the Tertiary plain surface as the latter may be deduced from remnants. The orebody is much longer than the above figures indicate, as it is partly buried under shallow debris.

The 335-foot level as far as developed has proved to be in the leached zone below the orebody. A small amount of copper carbonate is visible in the rock but the assays almost invariably are very low. At only one place do I regard the Tertiary secondarily enriched zone as coming down to this level. In the drift at the mouth of the west crosscut 100 feet South, there is a bunch of carbonate ore that Mr. Loring says assayed 4% copper. It has the peculiar appearance characteristic of the compact carbonate ore in the ore zone and probably is the lower end of a tongue of ore that projects down from the main body. Except for these occasional sharp points, the bottom of the orebody is probably gently undulating, but as a whole descends toward the northeast at a low angle.

In the mine maps everything is recorded as being north or south of a line drawn through the Cuprite shaft. On that line the orebody on the 210-foot level is regarded as 88 feet wide. About 20 feet north a raise from the 335-foot level shows that ore extends down 45 feet to the 255-foot intermediate but only in part and we have used 30 feet below the 210-foot level as the base of our blocks from this vicinity northeastward, though it is practically certain that in much of the area in question, ore extends deeper. In the raise that comes up from the 335-foot level to the east crosscut 208 south, I have been told ore extends to 30 feet below the 210-foot level. At that point the orebody on the level is 88 feet wide, but it soon begins to narrow and at 130 feet has practically pinched. That simply means that the bottom has gone above the level. This is very clearly shown near the mouth of the west crosscut 312 south where a 14 foot section on the level gave assays of 0.15, 0.45, 0.40, and 0.3% copper, and the same section immediately above gave assays of 1.70, 4.00, 6.40 and 1.60% copper. This illustrates the abruptness with which the ore sets in

going up. The high assays here were due to the presence of a little chalcocite. At east crosscut 382 south there is on the 210-foot level, an oreband 8 feet wide that is exceptionally rich. A raise has been put up on it 57 feet along seams rich in chalcocite, besides considerable malachite, and these seams have caused the materials to average 7.98% copper. The extent of this relatively rich body is not clear and it may be considered as a tongue from the main orebody.

On the line 468 south only two assays (1.45 and 2.70%) indicate ore. Immediately above this section, 35 feet is represented by assays of 1.10, 1.20, 2.60, 7.85 and 1.30% copper showing a rapid increase upward. At 566 south a raise, crosscut and long drill hole indicate that at 30 to 40 feet above the level a width of 101 feet averages 1.63% copper. In the west crosscut 665 south, no sample assayed over 0.70% copper, but a raise was put up and a crosscut driven at 43 feet above the level. This crosscut shows 40 feet of ore. The raise has been continued up another 50 feet in the orebody and two inclined crosscuts driven at the top in good ore. The section indicates that a long drill hole should have penetrated this orebody, but I have been told that the hole flattened and was cut down the raise, suggesting that the orebody bottoms abruptly a short distance below the crosscut. However, it seems to be a fact that in general lower assays were secured from the drill holes than from crosscuts or raises afterwards driven along them.

Three long holes were drilled at 678 south. Only one short section exceeded 1.00% copper. Immediately beyond this point the 210-foot drift and a crosscut develop a body of what I will call "near ore", 75 feet in length and up to 20 feet in width. A raise at 868 south was put up in this body to a height of 95 feet but it failed to reveal anything better than near ore. The body seems to stand practically vertical. We know from the surface that the Cuprite main orebody passes this section strong and this raise either failed to go high enough or the ore lies to one side of it. However, because of the failure of this raise to reach ore, we terminate our blocks of "developed ore" at 665 south, on the basis that up to that line we have the bottom of the orebody reasonably well delineated and content determined by sampling.

Going northward from the line of the Cuprite shaft, the orebody maintains a rather uniform width, gradually decreasing from 88 feet to 70 feet near east crosscut 353 north. In this section the hanging-wall portion of the orebody makes an exceptionally fine showing because the copper carbonate is largely in cracks in the rock, making the walls and roof of the openings unusually green. Occasional assays of 3.00 and 4.00% copper are due to remnants of chalcocite and cuprite.

This main orebody seems to finger out in the vicinity of east crosscut 353 north, apparently because there appears some altered chloritic schist which in general is not as favorable to ore as is the sericitic schist. I terminate the longest finger just beyond east crosscut 425 north. Near east crosscut 525 north a small orebody was encountered and driven upon for 135 feet. The east crosscut 610 north shows it 35 feet wide. Its north end has not been exposed.

A small orebody was encountered beyond a fault at 735 north and west crosscut 710 north was driven into it. A raise up 23 feet has

yielded good ore. Under present development this orebody seems to be only 60 feet in length and we have not used it in our tonnage estimates.

Back of the Cuprite shaft on the 210-foot level an orebody 95 feet long and averaging 10 feet wide has been developed, but we have not included it in our estimates. There is also a "near orebody" proved 100 feet long and 8 to 12 feet wide. Width and content increase northeastward and there may be real ore in that direction.

One raise has been driven to the surface from the 210-foot level. It goes up 187 feet on a 65° inclination, following the schistosity of the orebody. Some sections are in good ore, some in poor, but it emerges on the border of the outcrop of a band of ore cut in a trench. None of the raises that begun in ore or penetrated ore have shown the top of the ore except this one that reached the surface. Furthermore, there is a marked resemblance in the character of the ore on the 210 foot level and above and at the surface. So there is an excellent reason to believe that the orebody is fairly uniform in size and content from the outcrop to the bottom as developed in the mine workings.

Now we have figured on ore only to the line 665 feet southwest from the Cuprite shaft. The main ore outcrop on the Cuprite claim extends about 480 feet further southwest, gradually decreasing in width from 120 to 30 feet. When underground work has shown the position and outline of the bottom of this section of the orebody, it is beyond question that the developed tonnage will be greatly increased. At any rate, I feel quite confident that the Cuprite orebody is good for at least 1,200,000 tons.

FAIRPLAY OREBODY (Not copied. See letter from Albert H. Mackenzie, Prescott, March 17, 1949)

BLACK PRINCE OREBODY

The copper-bearing formation continues southeast a long distance. Some new trenches on the Cuprite and Black Prince claims indicate another oreband extending from 1200 feet southwest of the Cuprite shaft to a cut 2340 feet from the shaft. The showing is especially good in the last cut where samples across 30 feet assayed 4.10, 3.40, 5.60, 3.60, 0.80, 2.10, 2.80 and 4.80% copper. There can be little question that another important orebody may be developed here.

RISING SUN OREBODIES

Copper showings occur at intervals for a long distance southwest from the Black Prince Claim. A map handed me today indicates that since my last visit there has been trenching on two probable orebodies on the Rising Sun and adjacent claims. The widths and assays are such as to encourage more work.

COPPEROPOLIS OREBODY (Not copied, See letter from Albert H. Mackenzie, Prescott, March 17, 1949)

OTHER POSSIBILITIES

This report has reached such length that I will not burden it

with the details of other possible ore occurrences on the property, but I want to mention the probability that when we get around to investigation of primary sulphides below the present zone of oxidation, we will find considerable bodies rich enough in copper to be commercial. In this connection, I am much interested in the lower portion of the Cuprite shaft, and I agree with Mr. Loring that when it is unwatered to get a water supply for the leaching plant, it should be carefully studied. With due respect to the people who sank the Cuprite shaft, as they failed to develop with it over 1,200,000 tons of 1.84% ore, they may have missed indications of other good things deeper in the shaft.

Respectfully submitted,

Oscar H. Hershey.

GEOLOGICAL REPORT ON THE PROPERTY OF THE ZONIA COPPER MINING
COMPANY IN YAVAPAI COUNTY, ARIZONA, BY OSCAR H. HERSHEY.

San Francisco, California
January 10, 1930

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FAIRPLAY OREBODY

At east crosscut 860 north on the 210-foot level of the Cuprite mine, a body of "near ore" has been reached and at the face of the drift the content has risen to 1.15% copper. This body has some greenish schist and may in part be altered chloritic schist, rich in quartz-limonite seams, with pockets of copper carbonate and silicate. I have some reason to think that associated with it is the orebody that emerges on the slope in the vicinity of the Fairplay shaft. This shaft is said to be 450 feet ahead of the present face of the north drift on the 210-foot level and I recommend that when work is resumed, this drift be driven out to the surface and the Fairplay orebody developed. The ore has remnants of cuprite and chalcocite. I can see traces of such material nearly to the bottom of the gulch below the shaft. By the time this locality has been fully explored, a considerable tonnage may be added to the reserves.

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COPPEROPOLIS OREBODY

The Copperopolis orebody was produced by the secondary enrichment process in a vein zone parallel to that in which the Cuprite body was formed. It has suffered more from erosion than have the orebodies mentioned above, but yet must contain considerable ore. At the Copperopolis shaft the deposit is about 100 feet wide. Efforts have been made to mine it, making a cut from the wall of which a set of assays across 44 feet ran 0.5, 2.5, 3.13, 3.13, 0.5 and 11.82% copper. Later the cut was extended farther toward the hanging wall and some bands yielded 5 and 6% ore. Stoping was begun in a south drift down the Copperopolis shaft and I have been told that 11 tons of ore that represented a width of 6 feet averaged 5.75% copper. This, however, seems to be an unusually good section of the orebody. If I may judge from the fractured and iron-stained appearance of the surface, from a wide distribution of copper carbonate stain, from a few old stopes on narrow rich streaks and from several shafts, the mineralized zone runs southward, varying from 40 to 100 feet wide and forks, the right-hand fork probably dying out in 500 feet, but the left-hand fork continuing strong into the Defiance claim. We undertook to develop this orebody, but at that time did not understand the nature of these deposits and sank the Copperopolis shaft too deep and ran a 330-foot level in the oxidized and leached zone below the orebody. Hence, we do not know the exact depth of the orebody, but there is evidently a considerable tonnage of such ore as that in the Cuprite orebody.

GEOLOGICAL REPORT ON THE PROPERTY OF THE ZONIA COPPER MINING
COMPANY IN YAVAPAI COUNTY, ARIZONA, BY OSCAR H. HERSHEY.

San Francisco, California
January 10, 1930

Mr. W. P. Hammon, President,
Zonia Copper Mining Company,
Balfour Building,
San Francisco, California

Dear Sir:

In compliance with your request for a comprehensive geological report on the property of your company in the Walnut Grove District, Yavapai County, Arizona, as determined on my various visits, the last of which was on April 19 of last year, I offer the following:

In a report dated February 1st, 1929, Mr. F. L. Sizer estimated the developed ore in the Cuprite Area as aggregating 1,093,242 tons of an average content of 1.916% copper. But Mr. Sizer rejected several low grade bands that Mr. W. J. Loring thought would have to be mined because of lying between ore bands and by including them in his estimate as of January 1st, 1929, the latter engineer derived as "developed ore", 1,221,355 tons of an average copper content of 1.84%. More ore was developed after that date, but after spending a day and a half in studying the showing underground and new cuts on the surface, I modified the blacks somewhat and, using 14 cubic feet as a ton, I secured the figure 1,213,599 tons as my estimate of the amount of developed ore in the Cuprite area. The necessary time and machinery to compute the probably average copper content of this ore were not available, but I saw no reason to question Mr. Loring's figure of 1.84%, especially as it agreed very well with the 1.81% average that I secured several years before from the main outcrop on the Cuprite Claim.

I was also convinced that Mr. E. L. Sweeney had determined the proper method of recovering the copper by leaching, and the costs of a plant and of the treatment of the ore. Hence, I considered the next thing in order to be the erection of a treatment plant. We knew that the property contains much more ore than the roughly 1,200,000 tons considered developed, but I felt that no great advantage could be secured by further development in the immediate future except preparing the ground for mining. After the plant is in operation, development should be resumed and kept steadily going and it cannot fail to add greatly to the ore reserves.

The above statements will serve as an introduction to, and reason for, a rather elaborate discussion of the geological features and mining possibilities of the property.

GENERAL GEOLOGY

The oldest rock formation in the district was a basic eruptive, largely gabbro and perhaps some diabase. This was extensively intruded by a quartz monzonite or granite porphyry in masses usually elongated

in a northeast direction. These old rocks in part remain massive in structure but in large part they have been acted upon by a shearing stress that has converted them, in zones or large lenses, into schists. The basic rocks have become dark green chloritic schists and the porphyry white to light gray sericitic schists. The mineral deposits occur in these belts of schists. They are usually elongated along the strike of the schists. In fact, traces of mineral may be found so persistently along certain lines, perhaps controlled by slight fissures in the schists, that I regard them as veins, though in reality they are a succession of weakly connected lenses.

The veins are of four types. In the sericitic schist of the largest porphyry area there are zones in which more or less malachite, azurite and chrysocolla are distributed through the rock in small seams and as a stain in the schist. Not much copper stain is seen at the immediate surface, but it comes in strong at a few feet below the surface. Digging down in these deposits, small seams and pockets of cuprite and chalcocite appear and my impression is that the carbonates and silicate have been formed by the weathering of the red oxide and sulphide.

In the second type, oxidized copper minerals including malachite, azurite and chrysocolla occur near the surface and go down into chalcopyrite and pyrite without the intervention of a zone of secondary sulphide enrichment.

In the third type, the surface material is a fine grained porous quartz rich in oxidized iron minerals, partly hematite, including some specularite locally, but no visible copper minerals. My impression is that the primary material is a fine-grained replacement quartz which is rich in pyrite and a little specularite. It has not been explored so as to determine whether it contains appreciable quantities of chalcopyrite. This type occurs in the chloritic schist and on the borders of the main porphyry mass.

In the fourth type, there are lenses of rather coarsely crystallized white quartz with a small percentage of sulphides, chalcopyrite and pyrite and some free gold. Also in a certain area there is galena, making small lenses of high-grade lead-silver ore. Near the surface the veins are oxidized but there is no zone of secondary sulphide enrichment.

It will be seen from the preceding paragraph that the Zonia property is situated in a well mineralized district. The first three types of deposits are strongly represented on it. In fact, so far as I know, the property covers all of the known occurrences of the first and best type and hence I will discuss the mode of origin of that type at some length.

In rather wide zones the sericitic schist was traversed by a network of small quartz seams with pyrite, chalcopyrite and small quantities of other sulphides including a little molybdenite. During the Tertiary period oxidation and leaching destroyed the sulphides near the surface, carried the copper salts down and re-deposited them as cuprite and chalcocite, forming a zone of secondary enrichment related to a plain surface that has since been destroyed by erosion except for a small remnant buried under basalt lava near the Cuprite Shaft. Subsequently the country was elevated and the present deep valleys eroded, which brought

the secondarily enriched zone into the zone of oxidation and most of the cuprite and chalcocite have been converted chiefly into malachite and a little chrysocolla. Some of the copper salts may have been leached but enough remains on the site of the original cuprite-chalcocite ore bodies to make the present orebodies. Oxidation and leaching have also operated to a depth of several hundred feet on the primary sulphite zone and made leached bodies under the orebodies.

CUPRITE OREBODY

A zone of sericitic schist up to several hundred feet in width runs lengthwise of the Cuprite Claim and dips westward from 45° to nearly vertical. In large part the zone is very lightly and sporadically mineralized by copper carbonate, a little silicate and in a few places a little chalcocite. At the surface commercial values appear in lenticular bodies of various sizes. One on the southern half of the claim I determined several years ago as 675 feet in exposed length and 48 feet in average width, with an average content of 1.81% copper. In addition there was a footwall band 440 feet long and 15.6 feet in average width, with an average content of 1.94% copper. Underground work has shown that these copper-bearing bodies go down to a roughly plane surface that slopes in the same direction as the Tertiary plain surface as the latter may be deduced from remnants. The orebody is much longer than the above figures indicate, as it is partly buried under shallow debris.

The 335-foot level as far as developed has proved to be in the leached zone below the orebody. A small amount of copper carbonate is visible in the rock but the assays almost invariably are very low. At only one place do I regard the Tertiary secondarily enriched zone as coming down to this level. In the drift at the mouth of the west crosscut 100 feet South, there is a bunch of carbonate ore that Mr. Loring says assayed 4% copper. It has the peculiar appearance characteristic of the compact carbonate ore in the ore zone and probably is the lower end of a tongue of ore that projects down from the main body. Except for these occasional sharp points, the bottom of the orebody is probably gently undulating, but as a whole descends toward the northeast at a low angle.

In the mine maps everything is recorded as being north or south of a line drawn through the Cuprite shaft. On that line the orebody on the 210-foot level is regarded as 88 feet wide. About 20 feet north a raise from the 335-foot level shows that ore extends down 45 feet to the 255-foot intermediate but only in part and we have used 30 feet below the 210-foot level as the base of our blocks from this vicinity northeastward, though it is practically certain that in much of the area in question, ore extends deeper. In the raise that comes up from the 335-foot level to the east crosscut 208 south, I have been told ore extends to 30 feet below the 210-foot level. At that point the orebody on the level is 88 feet wide, but it soon begins to narrow and at 130 feet has practically pinched. That simply means that the bottom has gone above the level. This is very clearly shown near the mouth of the west crosscut 312 south where a 14 foot section on the level gave assays of 0.15, 0.45, 0.40, and 0.3% copper, and the same section immediately above gave assays of 1.70, 4.00, 6.40 and 1.60% copper. This illustrates the abruptness with which the ore sets in

going up. The high assays here were due to the presence of a little chalcocite. At east crosscut 382 south there is on the 210-foot level, an oreband 8 feet wide that is exceptionally rich. A raise has been put up on it 57 feet along seams rich in chalcocite, besides considerable malachite, and these seams have caused the materials to average 7.98% copper. The extent of this relatively rich body is not clear and it may be considered as a tongue from the main orebody.

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Going northward from the line of the Cuprite shaft, the orebody maintains a rather uniform width, gradually decreasing from 88 feet to 70 feet near east crosscut 353 north. In this section the hanging-wall portion of the orebody makes an exceptionally fine showing because the copper carbonate is largely in cracks in the rock, making the walls and roof of the openings unusually green. Occasional assays of 3.00 and 4.00% copper are due to remnants of chalcocite and cuprite.

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Now we have figured on ore only to the line 665 feet southwest from the Cuprite shaft. The main ore outcrop on the Cuprite claim extends about 480 feet further southwest, gradually decreasing in width from 120 to 30 feet. When underground work has shown the position and outline of the bottom of this section of the orebody, it is beyond question that the developed tonnage will be greatly increased. At any rate, I feel quite confident that the Cuprite orebody is good for at least 1,200,000 tons.

FAIRPLAY OREBODY (Not copied. See letter from Albert H. Mackenzie Prescott, March 17, 1949)

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The copper-bearing formation continues southeast a long distance. Some new trenches on the Cuprite and Black Prince claims indicate another oreband extending from 1200 feet southwest of the Cuprite shaft to a cut 2340 feet from the shaft. The showing is especially good in the last cut where samples across 30 feet assayed 4.10, 3.40, 5.60, 3.60, 0.80, 2.10, 2.80 and 4.80% copper. There can be little question that another important orebody may be developed here.

RISING SUN OREBODIES

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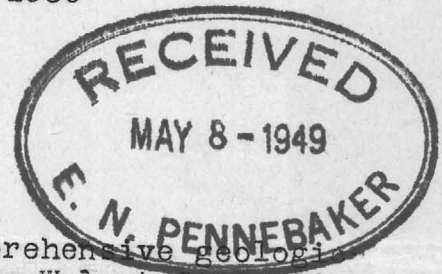
Respectfully submitted,

Oscar H. Hershey.

GEOLOGICAL REPORT ON THE PROPERTY OF THE ZONIA COPPER
MINING COMPANY, YAVAPAI COUNTY, ARIZONA, OSCAR H. HERSHEY

San Francisco, California
January 10, 1930

Mr. W. P. Hammon, President
Zonia Copper Mining Company
Balfour Building
San Francisco, California



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The oldest rock formation in the district was a basic eruptive, largely gabbro and perhaps some diabase. This was extensively intruded by a quartz monzonite or granite porphyry in masses usually elongated in a northeast direction. These old rocks in part remain massive in structure but in large part they have been acted upon by a shearing stress that has converted them, in zones or large lenses, into schists. The basic rocks have become dark green chloritic schists and the porphyry white to light gray sericitic schists. The mineral deposits occur in these belts of schist. In fact, traces of mineral may be found so persistently along certain lines, perhaps controlled by slight fissures in the schists, that I regard them as veins, though in reality they are a succession of weakly connected lenses.

The veins are of four types. In the sericitic schist of the largest porphyry area there are zones in which more or less malachite, azurite and chrysocolla are distributed through the rock in small seams and as a stain in the schist. Not much copper stain is seen at the immediate surface, but it comes in strong at a few feet below the surface. Digging down in these deposits, small seams and pockets of cuprite and chalcocite appear and my impression is that the carbonates and silicate have been formed by the weathering of the red oxide and sulphide.

In the second type, oxidized copper minerals including malachite, azurite and chrysocolla occur near the surface and go down into chalcopyrite and pyrite without the intervention of a zone of secondary sulphide enrichment.

In the third type, the surface material is a fine grained porous quartz rich in oxidized iron minerals, partly hematite, including some specularite locally, but no visible copper minerals. My impression is that the primary material is a fine-grained replacement quartz rich in pyrite and a little specularite. It has not been explored so as to determine whether it contains appreciable quantities of chalcopyrite. This type occurs in the chloritic schist and on the borders of the main porphyry mass.

In the fourth type, there are lenses of rather coarsely crystallized white quartz with a small percentage of sulphides, chalcopyrite and pyrite and some free gold. Also in a certain area there is galena, making small lenses of high-grade lead-silver ore. Near the surface the veins are oxidized but there is no zone of secondary sulphide enrichment.

It will be seen from the preceding paragraph that the Zonia property is situated in a well mineralized district. The first three types of deposits are strongly represented on it. In fact, so far as I know, the property covers all the known occurrences of the first and best type and hence I will discuss the mode of origin of that type at some length.

In rather wide zones the sericitic schist was traversed by a network of small quartz seams with pyrite, chalcopyrite and small quantities of other sulphides including a little molybdenite. During the Tertiary period oxidation and leaching de-

stroyed the sulphides near the surface, carried the copper salts down and re-deposited them as cuprite and chalcocite, forming a zone of secondary enrichment related to a plain surface that has been since destroyed by erosion except for a small remnant buried under basalt lava near the Cuprite shaft. Subsequently the country was elevated and the present deep valleys eroded, which brought the secondarily enriched zone into the zone of oxidation and most of the cuprite and chalcocite have been converted chiefly into malachite and a little chrysocolla. Some of the copper salts may have been leached but enough remains on the site of the original cuprite-chalcocite ore bodies to make the present ore-bodies. Oxidation and leaching have also operated to a depth of several hundred feet on the primary sulphide zone and made leached bodies under the ore-bodies.

CUPRITE ORE-BODY

A zone of sericitic schist up to several hundred feet in width runs lengthwise of the Cuprite claim and dips westward from 45° to nearly vertical. In large part the zone is very lightly and sporadically mineralized by copper carbonate, a little silicate and in a few places a little chalcocite. At the surface commercial values appear in lenticular bodies of various sizes. One on the southern half of the claim I determined several years ago as 675 feet in exposed length and 48 feet in average width, with an average content of 1.81% copper. In addition there was a footwall band 440 feet long and 15.6 feet in average width, with an average content of 1.94% copper. Underground work has shown that these copper-bearing bodies go down to a roughly plane surface that slopes in the same direction as the Tertiary plain surface as the latter may be deduced from remnants. The ore-body is much longer than the above figures indicate, as it is partly buried under shallow debris.

The 335-foot level as far as developed has proved to be in the leached zone below the ore-body. A small amount of copper carbonate is visible in the rock but the assays almost invariably are very low. At only one place do I regard the Tertiary secondarily enriched zone as coming down to this level. In the drift at the mouth of the west cross-cut 100 feet south, there is a bunch of carbonate ore that Mr. Loring says assayed 4% copper. It has the peculiar appearance characteristic of the compact carbonate ore in the ore zone and probably is the lower end of a tongue of ore that projects down from the main body. Except for these occasional sharp points, the bottom of the ore-body is probably gently undulating, but as a whole descends toward the northeast at a low angle.

In the mine maps everything is recorded as being north or south of a line drawn through the Cuprite shaft. On that line the orebody on the 210-foot level is regarded as 88 feet wide. About 20 feet north a raise from the 335-foot level shows that ore extends down 45 feet to the 255-foot intermediate but only in part and we have used 30 feet below the 210-foot level as the base of our blocks from this vicinity northeastward, though it is practically certain that in much of the area in question, ore extends deeper. In the raise that comes up from the 335-foot level to the east cross-cut 208 south, I have been told the ore extends to 30 feet below the 210-foot level. At that point the ore-body on the

level is 88 feet wide, but it soon begins to narrow and at 130 feet has practically pinched. That simply means that the bottom has gone above the level. This is very clearly shown near the mouth of the west cross-cut 312 south where a 14 foot section on the level gave assays of 0.15, 0.45, 0.40, and 0.63% copper, and the same section immediately above gave assays of 1.70, 4.00, 6.40 and 1.60% copper. This illustrates the abruptness with which the ore sets in going up. The high assays here were due to the presence of a little chalcocite. At east cross-cut 382 south there is on the 210-foot level an ore-band 8 feet wide that is exceptionally rich. A raise has been put up on it 57 feet along seams rich in chalcocite, besides considerable malachite, and these seams have caused the material to average 7.98% copper. The extent of this relatively rich body is not clear and it may be considered as a tongue from the main ore-body.

On the line 468 south only two assays (1.45 and 2.70%) indicate ore. Immediately above this section, 35 feet is represented by assays of 1.10, 1.20, 2.60, 7.35 and 1.30% copper showing a rapid increase upward. At 566 south a raise, cross-cut and long drill hole indicate that at 30 to 40 feet above the level a width of 101 feet averages 1.63% copper. In the west cross-cut 665 south, no sample assayed over 0.70% copper, but a raise was put up and a cross-cut driven at 43 feet above the level. This cross-cut shows 40 feet of ore. The raise has been continued up another 50 feet in the ore-body and two inclined cross-cuts driven at the top in good ore. The section indicates that a long drill hole should have penetrated this ore-body, but I have been told that the hole flattened and was cut down the raise, suggesting that the ore-body bottoms abruptly a short distance below the cross-cut. However, it seems to be a fact that in general lower assays were secured from the drill holes than from cross-cuts or raises afterwards driven along them.

Three long holes were drilled at 678 south. Only one short section exceeded 1.00% copper. Immediately beyond this point the 210-foot drift and a cross-cut develop a body of what I will call "near ore", 75 feet in length and up to 20 feet in width. A raise at 868 south was put up in this body to a height of 95 feet but it failed to reveal anything better than near ore. The body seems to stand practically vertical. We know from the surface that the Cuprite main ore-body passes this section strong and this raise either failed to go high enough or the ore lies to one side of it. However, because of the failure of this raise to reach ore, we terminate our blocks of "Developed ore" at 665 south, on the basis that up to that line we have the bottom of the ore-body reasonably well delineated and content determined by sampling.

Going northward from the line of the Cuprite shaft, the ore-body maintains a rather uniform width, gradually decreasing from 88 feet to 70 feet near east cross-cut 353 north. In this section the hanging wall portion of the ore-body makes an exceptionally fine showing because the copper carbonate is largely in cracks in the rock, making the walls and roof of the openings unusually green. Occasional assays of 3.00 and 4.00% copper are due to remnants of chalcocite and cuprite.

This main ore-body seems to finger out in the vicinity of east cross-cut 353 north, apparently because there appears some altered chloritic schist which in general is not as favorable to ore as is the sericitic schist. I terminate the longest finger just beyond east cross-cut 425 north. Near east cross-cut 525 north a small ore-body was encountered and driven upon for 135 feet. The east cross-cut 610 north shows it 35 feet wide. Its north end has not been exposed.

A small ore-body was encountered beyond a fault at 735 north and west cross-cut 710 north was driven into it. A raise up 23 feet has yielded good ore. Under present development this ore-body seems to be only 60 feet in length and we have not used it in our tonnage estimates.

Back of the Cuprite shaft on the 210-foot level an ore-body 95 feet long and averaging 10 feet wide has been developed, but we have not included it in our estimates. There is also a "near ore-body" proved 100 feet long and 8 to 12 feet wide. Width and content increase northeastward and there may be real ore in that direction.

One raise has been driven to the surface from the 210-foot level. It goes up 187 feet on a 65° inclination, following the schistosity of the ore-body. Some sections are in good ore, some in poor, but it emerges on the border of the outcrop of a band of ore cut in a trench. None of the raises that begun in ore or penetrated ore have shown the top of the ore except this one that reached the surface. Furthermore, there is a marked resemblance in the character of the ore on the 210-foot level and above and at the surface. So there is an excellent reason to believe that the orebody is fairly uniform in size and content from the outcrop to the bottom as developed in the mine workings.

Now we have figured on ore only to the line 665 feet southwest from the Cuprite shaft. The main ore outcrop on the Cuprite claim extends about 480 feet further southwest, gradually decreasing in width from 120 to 30 feet. When underground work has shown the position and outline of the bottom of this section of the orebody, it is beyond question that the developed tonnage will be greatly increased. At any rate, I feel quite confident that the Cuprite ore-body is good for at least 1,200,000 tons.

FAIRPLAY OREBODY

At east cross-cut 860 north on the 210-foot level of the Cuprite mine, a body of "near ore" has been reached and at the face of the drift the content has risen to 1.15% copper. This body has some greenish schist and may in part be altered chloritic schist, rich in quartz-limonite seams, with pockets of copper carbonate and silicate. I have some reason to think that associated with it is the ore-body that emerges on the slope in the vicinity of the Fairplay shaft. This shaft is said to be 450 feet ahead of the present face of the north drift on the 210-foot level and I recommend that when work is resumed this drift be driven out to the surface and the Fairplay orebody

developed. The ore has remnants of cuprite and chalcocite. I can see traces of such material nearly to the bottom of the gulch below the shaft. By the time this locality has been fully explored a considerable tonnage may be added to the reserves.

BLACK PRINCE ORE-BODY

The copper-bearing formation continues southeast a long distance. Some new trenches on the Cuprite and Black Prince claims indicate another ore-band extending from 1200 feet southwest of the Cuprite shaft to a cut 2340 feet from the shaft. The showing is especially good in the last cut where samples across 30 feet assayed 4.10, 3.40, 5.60, 3.60, 0.80, 2.10, 2.80 and 4.80% copper. There can be little question that another important ore-body may be developed here.

RISING SUN ORE-BODIES

Copper showings occur at intervals for a long distance southwest from the Black Prince claim. A map handed me today indicates that since my last visit there has been trenching on two probable ore-bodies on the Rising Sun and adjacent claims. The widths and assays are such as to encourage more work.

COPPEROPOLIS ORE-BODY

The Copperopolis ore-body was produced by the secondary enrichment process in a vein zone parallel to that in which the Cuprite body was formed. It has suffered more from erosion than have the ore-bodies mentioned above, but yet must contain considerable ore. At the Copperopolis shaft the deposit is about 100 feet wide. Efforts have been made to mine it, making a cut from the wall of which a set of assays across 44 feet ran 0.5, 2.5, 3.13, 3.13, 0.5 and 11.82% copper. Later the cut was extended farther toward the hanging-wall and some bands yielded 5 and 6% ore. Stoping was begun in a south drift down the Copperopolis shaft and I have been told that 11 tons of ore that represented a width of 6 feet averaged 5.75% copper. This, however, seems to be an unusually good section of the ore-body. If I may judge from the fractured and iron-stained appearance of the surface, from a wide distribution of copper carbonate stain, from a few old stopes on narrow rich streaks and from several shafts, the mineralized zone runs southward, varying from 40 to 100 feet wide and forks, the right-hand fork probably dying out in 500 feet, but the left-hand fork continuing strong into the Defiance claim. We undertook to develop this ore-body but at that time did not understand the nature of these deposits and sank the Copperopolis shaft too deep and ran a 330-foot level in the oxidized and leached zone below the ore-body. Hence, we do not know the exact depth of the ore-body, but there is evidently a considerable tonnage of such ore as that in the Cuprite ore-body.

OTHER POSSIBILITIES

This report has reached such length that I will not burden it with the details of other possible ore occurrences on the property, but I want to mention the probability that when we get around to investigating the primary sulphides below the present zone of oxidation we will find considerable bodies rich enough in copper to be commercial. In this connection, I am much interested in the lower portion of the Cuprite shaft, and I agree with Mr. Loring that when it is unwatered to get a water supply for the leaching plant, it should be carefully studied. With due respect to the people who sank the Cuprite shaft, as they failed

to develop with it over 1,200,000 tons of 1.84% ore, they may have missed indications of other good things deeper in the shaft.

Respectfully submitted,

Oscar H. Hershey.