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THE CANANEA CONSOLIDATED COPPER COMPANY, S. A.

CANANEA, SONORA, MEXICO.

COPIA

July 22, 1952

Mr. V. D. Perry, Chief Geologist
Anaconda Copper Mining Company
818 Kearns Building
Salt Lake City 1, Utah

Dear Mr. Perry:

Following your letter of February 21, 1952, at Inspiration, Mr. E. F. Reed and I have mapped the area on the 850 level, and the accessible parts of the grizzly level above, in which leaching operations have been recently started. On the Inspiration coordinate system, this section lies roughly between coordinates 4150N and 4350N, and 10950E and 11200E, and is southwest of the old Pinto section. It includes mining blocks 40, 41, 42, and 44. The workings in and around Block 50, to the west of the area now being leached, were also mapped. As it was expected that the area below Blocks 40, 41, 42 and 44 would soon be inaccessible, hand specimens were collected from all the workings mapped at approximate ten foot intervals, and are stored at Inspiration.

The weeks of March 4th, March 17th and April 14th were devoted to underground mapping, and the Block 50 grizzly level was mapped on May 21st. Since the mapping was completed, available time has been used to review hand specimens and to prepare maps at Inspiration and Cananea. Several specimens of altered schist and porphyry were sent to Mr. Charles Meyer, of the Butte laboratory, for description. Two geologic plan maps for the area studied on the 850 level and the grizzly level accompany this letter.

As you know, two short reports were written in 1930 by the writer on general geologic problems at Inspiration, and in 1950 Mr. E. C. Stephens and assistants compiled a detailed report on the district. No general background material, therefore, will be included in this letter. For the present work all available geologic notes from earlier mapping have been used as well as those taken by Reed and myself. The following paragraphs summarize the information obtained:

INTRODUCTION.

The present study was undertaken to obtain as much information as possible on the area in which appreciable amounts of primary chalcopyrite mineralization were recognized through the relative insolubility of that mineral in the Inspiration leaching process. Such mineralization was found in considerable amount in Block 44, and proposed development of adjoining Block 45 was dropped for this reason. To the west of the area mapped, in a section which could not be mapped as it is now inaccessible, Diamond Drill Hole 179 was drilled due west from 98E XCS, and disclosed another considerable section with

an appreciable insoluble copper content which was assumed observed to be chalcopyrite in specimens from the core. The location of this area is south of the Inspiration Main Shafts, west of the Joe Bush fault, and in the hanging wall of the Bulldog fault.

Averages of samples taken in old crosscuts East through the area mapped are posted upon the geologic plan of the 850 level, but no good assay records were kept of the more recently driven crosscuts South nor of the grizzly level workings. A grizzly level connection with the Pinto area, driven for ventilation, had been carefully sampled, and assay averages are shown on the grizzly level map. Several diamond drill holes were drilled for assay information; however, the entire cores from these holes were assayed, and thus are not available for study.

GENERAL GEOLOGY.

As shown on the accompanying maps, geologically the area studied is entirely within the schist, north of the main contact between the Pinal schist and the lobe of granite porphyry which extends northward from the main mass of the Schultz granite intrusive. The area lies east of the steep Joe Bush fault, and is well in the footwall of the Pinto fault zone. The Bulldog fault, projected eastward from its exposures on the 850 level, would pass several hundred feet below Blocks 40-41. The Bulldog fault probably passes through Diamond Drill Hole 156, the vertical deep drill hole recommended by Billingsley west of the Joe Bush fault, about 275 ft. below the 850 level. The contact of the schist and granite porphyry on the 850 level, cannot now be seen, and is placed on the attached maps as shown by earlier work. developed by projection, has been placed on the attached maps as used by other geologists.

GENERAL DESCRIPTION OF SCHIST: Sericite Zone ← Capitalize

The recent mapping showed a large and irregular area of strongly sericitised and silicified schist to occur in the vicinity of Blocks 40, 41, and 42, and Block 50, and to grade outward to the south into the less altered biotite schist found in Block 44. Presumably, although the section cannot now be mapped, the biotite schist extends southward to the main schist-granite porphyry contact.

From the biotite remnants found within the sericite zone, it is believed that the sericite schist area has been developed by alteration of original biotite schist. The sericite zone is bleached to a gray-white color, and is particularly hard and tough, possibly from the fine silica included in it. In Block 42, within the sericitised schist, it was necessary to undercut a much greater area than is normally needed to induce caving. The sericitization does not appear to be related to schistocity, or to any particular band of original rock in the schist. The contacts between the sericite and biotite schist zones are gradational.

Mineralization in the sericitised schist is composed of quartz, pyrite, chalcocite and traces of chalcopyrite and molybdenite in disseminations and seams which both cut and parallel the schistocity. Almost all the sulphide mineralization within area shows some chalcocite enrichment, although copper content in the sericite zone on the 850 level, as shown by available assays, is not particularly high.

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BIOTITE SCHIST

The biotite schist mapped in Block 45, and south of Blocks 40, 41, 42 and 50, contains some scattered development of sericite, and some patchy, gray-white, clayey alteration. The schist is dark in color, and is notably less hard and tough than the sericitized zones. There is almost a complete lack of chalcocite enrichment, but the available assays show the copper content is greater than the slightly enriched mineralization of the sericitized zone. As before, disseminations and seams of mineralization both follow and cut across schistocity. The minerals are chiefly quartz, pyrite, chalcopyrite, traces of molybdenite, and very little chalcocite. The mineralization appears to be essentially primary, and indicates a more intense original metallization in this section than in other parts of the Inspiration-Miami ore zone.

QUARTZ PORPHYRY AND PROBABLE PRIMARY MINERALIZATION.

On the 850 level at the south ends of the crosscuts mapped there are numerous small dikes and areas of fine quartz porphyry. On the grizzly level above a continuous band of sericitized quartz porphyry can be traced across the grizzly level workings. This porphyry may more closely resemble an irregular finger than a sheet-like dike. To the east in the Pinto 850 level workings Mulchay in 1930 mapped a narrow dike structure as "aplite". This intrusive occurs along the general trend of the porphyry recently mapped.

The intrusive porphyry mapped on the grizzly level is a white, fine grained, sericitized and siliceous quartz porphyry with fine quartz phenocrysts. It includes blocks of altered schist, and there are fine seams and disseminations of quartz, pyrite, chalcocite, and probably chalcopyrite. This quartz porphyry does not resemble megascopically the granite porphyry found to the south of the main schist-granite porphyry contact. The porphyry dike, or finger, appears to end at the east boundary drift of the grizzly level, and a small point extends northeasterly within and parallel to a prominent steep, northeast shear zone. Along the trend of this shear zone and some thirty-five feet north of the porphyry in sericitized schist, heavy sulphides are found near the back of the crosscut.

This mineralization occurs as pods and bunches up to 12 inches in diameter, and is composed of high-grade chalcopyrite, bornite, and chalcocite with little glassy quartz. Meyer believes this mineralization is of primary origin. The surrounding schist is highly bleached and sericitized. Although the mineralization is found along the shear zone, it is not elongated or controlled by the shears, and appears roughly to be lined up toward the end of the porphyry finger. The shear zone probably developed after mineralization along a pre-existing zone of weakness. The close spatial relationship of probable primary mineralization and the quartz porphyry structure, and the small amounts of similar metallization within the porphyry suggest that this type of quartz porphyry may be closely related to the original primary mineralization of the Inspiration-Miami ore zone.

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ADJACENT AREAS.

West of the section developed in Blocks 40, 41 and 42, sericite alteration extends westward in 4300N XCE toward the Joe Bush fault, although there are irregular areas in which there is considerable residual biotite. The crosscuts east immediately south of 4300N XCE, namely 42 1/2N, 42N, 41 2/3N and 41N, show increasing amounts of biotite to the south. Generally only biotite schist is found at this elevation along the Joe Bush fault zone. On the grizzly level driven to develop Block 50, the schist is strongly sericitized except in the southwest corner of the block near the Joe Bush fault where a portion of the block development was dropped because of very weak mineralization in biotite schist. At least in this area it is apparent that better primary mineralization did not reach the Joe Bush fault zone.

Northwest from 4300N XCE, the same type of sericite alteration is found in the main crosscut, and is also found in the accessible part of 44 7/8N XCE. Alteration in 44 7/8N XCE appears less well developed than in the workings to the south, but detail is difficult to obtain as the walls are coated with post-mine oxide minerals, and the crosscut sill is covered with 8 to 20 inches of water. A narrow diabase dike was mapped near the intersection of the main crosscut southeast and 44 7/8N XCE.

STRUCTURE.

Although the entire area mapped is cut by many small faults and slips, the mapping did not develop any structural control which might have localized ore deposition or the sericitic alteration. The many small mineralized seams are very irregular, generally discontinuous, and both cut the schistocity and parallel it. As previously mentioned, the boundary between the sericite schist and biotite schist is gradational. In a general way the only important structural features in the east part of the Inspiration ore zone appear to be the main schist-granite porphyry contact, and the later post-mineral major faults.

Schist-Granite Porphyry Contact — Capitulo

In relation to the schist-granite porphyry contact, the area mapped lies to the north of the apparently steep dipping, but rather irregular, contact noted by other geologists on the Inspiration 6th and 850 levels east of the Joe Bush fault. Still further to the east, the contact swings north and northeast near the Inspiration-Miami Copper property line, but does not extend into the old Pinto area.

West of the Joe Bush fault, the schist-granite porphyry contact has a dip of approximately 46° from surface to the 850 level with the granite-porphyry extending upward and outward over the schist above the 850 level. Below the Bulldog fault, as indicated by DDH 156, the dip of the contact is probably steep.

Reconstruction in a general way of the schist-granite porphyry contact before faulting makes it evident that the apparent movement on the Joe Bush fault may be much less than previously believed. East of the Joe Bush fault the contact

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was probably steep between the 6th and 850 levels with a possible northward flare toward surface, and an abrupt northerly swing near the Inspiration-Miami property line. On the west side of the Joe Bush fault the contact flared upward and outward to the north over the schist above the 850 level, but steepened below the Bulldog fault. The apparent horizontal component of throw on the Joe Bush fault at the 6th level was about 1000 ft. However, similar measurement on the 850 level was much less in amount, and presumably the continued south dip of the porphyry on the west side of the Joe Bush fault below the 850 level would make the apparent offset at the 10th level elevation still smaller. It might be surmised, therefore, that at about the present location of the Joe Bush fault zone the contact originally had a swing to the northwest with a flat, outward flare, and that the shape of the contact has not been greatly modified except by limited vertical movement along the Joe Bush fault.

If it is assumed that the contact has not been greatly modified by this faulting, there may be a steep trough in this area along the main schist-granite porphyry contact. At Cananea, and elsewhere, the shape and distribution of the late intrusive quartz porphyries have largely determined the localization of the major ore zones. Similarly at Inspiration, a steep trough-like indentation in the main schist-granite porphyry contact could have provided a channelway for the intrusion of late quartz porphyry dikes and masses, and for following slightly later, primary ore solutions. It would not be necessarily true that only one locus of primary mineralization might exist along the entire length of the Inspiration-Miami ore zone, but the intrusives and metallization under discussion might easily have been related to the formation of the nearby high-grade Pinto and Captain orebodies. (The quartz porphyry dike, which extends eastward through the main Miami Copper ore zone and terminates against strands of the Miami fault, might also be associated with the porphyry intrusives of this area.)

CONCLUSIONS.

Diamond drilling of the area mapped with inclined down holes from 4300N XCE, as suggested by Mr. Sales and Mr. Reed, appears a logical method to explore the downward extension of the better primary mineralisation found in and around Block 14. Such exploration could, in addition, determine further the extent of sericite alteration, the shape of the schist-granite porphyry contact, and explore the projection of the quartz porphyry intrusives below the 850 level.

As the entire area lies in the hanging wall of the Bulldog fault, encouraging results in the proposed diamond drill holes would necessitate detailed study of the Bulldog fault to determine, insofar as possible, the amount and direction of movement along that fault. Upon completion of such study, additional drilling to prospect for expected extension of the primary mineralization zone below the fault could be recommended.

Yours very truly,

Roland B. Mulchay

REM:je
cc Mr. R. H. Sales
Mr. R. S. Newlin
Mr. P. D. I. Honeyman
Mr. S. F. Reed
Encls.

REPORT ON

THE POSSIBILITY OF AN ORE DEPOSIT IN THE HANGING WALL OF THE MIAMI FAULT WITHIN GROUND OWNED BY THE INSPIRATION CONSOLIDATED COPPER COMPANY

INTRODUCTION

Detailed geologic mapping of the Inspiration - Miami ore area and the surrpunding surface has brought out the possibility that the faulted eastward extension of the secondary ore body mined by the Miami Copper Company has been thrown northward by the Miami fault into ground owned by the Inspiration Consolidated Copper Company. In addition to the recognized Joe Bush, Pinto, and Bulldog faults, the mapping has shown the presence of a series of northeast striking, east dipping faults that are approximately parallel to the Miami fault. The observed similarity of these faults and the Miami fault has led to a careful examination of the geologic features upon which an estimate of the amount and direction of throw of the Miami fault can be made.

GENERAL GEOLOGY

The known Inspiration - Miami copper belt extends for about two miles in a gentle arc, concave to the southeast, along the contact of pre-Cambrian Pinal schist with a nose of granite porphyry and quartz porphyry which

extends northward from the main mass of the Schultz granite. Small, irregular diabase dikes cut the schist, and are apparently older than the granitic intrusion. The commercial chalcocite orebodies have been formed as a secondary ore blanket derived from a quartz, pyrite, chalcopyrite protore that was intruded into the schist and porphyry along the contact. After the formation of the secondary orebodies, a series of dacite flows covered the surface that had developed during the period of enrichment of the orebodies. After erosion had in places cut through the dacite flows, again exposing schist and porphyry, there was a large thickness of ill assorted gravels and silts deposited over the region; this deposit, known as the Gila conglomerate, contains no marker beds that can be used for correlation. The conglomerate attains a thickness of over 2000 feet, as a drill hole put down by the Miami Copper Company about 800 feet east of their No. 5 Shaft was stopped after 2050 feet of conglomerate had been penetrated. A hole drilled by the Van Dyke Copper Company about 1800 feet S 55° E from the Miami No. 5 Shaft went through 1600 feet of conglomerate before it was stopped.

Following the deposition of the conglomerate, there was a regional tilting of the district to the west, and the complicated fault pattern that is now found in the ore area was developed.

The intrusive granite mass has three distinct facies whose boundaries appear to be gradational rather than sharp. The main body, which is southwest of the town of Miami, is a coarse grained, fresh granite that, north of Bloody Tanks wash, grades into a granite porphyry cut by numerous quartz stringers. Farther north at the schist contact, the intrusive is a quartz porphyry, and there are several dikes of this porphyry that extend into the schist.

The orebodies have a thickness vertically of from 250 - 300 feet, and a width that is largely dependent on the faulting that has taken place; the length of the ore is about two miles, extending westerly from the Miami fault, and the position of the various orebodies in respect to the present surface is due to the regional tilting and faulting that has taken place since the formation of the commercial orebodies.

The faults that have displaced the Miami and Inspiration orebodies can be classified into four groups; the age relationship of these faults has not been entirely determined, but a classification based on strike and movement can be made. The most important group comprises the Miami fault, and the series of northeast striking faults that offset the Inspiration orebodies near the western end of the ore belt. The second group includes the northwest striking, steep south dipping Joe Bush fault, which has a horizontal movement of about 1000 feet; the south or hang-

ing wall side of the fault has moved to the northwest in relation to the footwall. The third group includes the Bulldog and Pinto faults, which have a northwest strike, and a flat dip to the north; the movement of these faults appears to have been nearly directly down the dip. The fourth group includes the Sulphide fault, an E-W, north dipping fault that is found in the southwestern part of the ore belt, and whose effect on the orebodies is not clearly demonstrated.

THE MIAMI OREBODY

The Miami orebody, where it is cut off by the Miami fault, had a width of about 2500 feet along the footwall side of the fault; the first 1200 - 1400 feet, measuring from the south boundary of the orebody, averaged over 2% Cu., and the remainder to the north averaged from 0.8 - 1.0% Cu. The higher grade portion had a vertical thickness of about 300 feet, and below this for 400 feet vertically, ore assaying 0.8% Cu. has been developed down to the Miami 1000 level.

The extent of the mineralized zone cut off by the fault strongly suggests that the offset eastward extension of the Miami orebody under the Gila conglomerate is of considerable size. However, two possibilities suggest themselves in opposition to this view.

The first concerns the actual extension of the primary mineralization to the east. The developed orebodies do not in any case extend more than 1000 feet away from the schist - porphyry contact. On the map attached to this report it can be seen that there is a tendency for the schist - porphyry contact to swing rather sharply to the southeast close to the fault. It is a matter of conjecture whether the contact continues to swing in this direction and thereby minimizes the chances for any considerable body of ore to be found in the hanging wall of the fault, or not. It is probably more likely, however, that the contact straightens out toward the east, for the granite porphyry that extends across the area south of the orebodies is cut off along a wide front by the fault.

The second possibility is concerned with the duration of the movement along the fault. The Miami fault is a strong feature along which continued movement over a very long period of time might easily have been the cause of a large erosional valley, which would now be filled with Gila conglomerate. There is some evidence that a valley did exist in the present hanging wall of the fault, as the drilling southeast of the Miami No. 5 Shaft shows a much greater thickness of conglomerate than is developed on the Miami 1000 level northwest of the No. 5 Shaft. Such an erosional feature might have cut deeply into the primary mineralization and thereby caused a thinning, or perhaps a complete obliteration

of any secondary orebody that may have been formed. Such a condition is distinctly possible, but a reconstruction of physiographic features of the pre-conglomerate surface must necessarily be largely based on conjecture, and must be viewed in that light.

The two possibilities just described would obviously preclude the finding of any considerable body of ore in the hanging wall of the Miami fault. However, they do not seem to have sufficient probability to eliminate such ore possibilities. The Miami Company orebody was terminated by the footwall strands of the fault, and there was no appreciable diminution of grade or amount of ore as the fault was approached. In fact, the grade of this orebody was the highest known in the district for any considerable tonnage, and rather than a fraying out of the orebodies to the east, it is possible that the eastward extension of the Miami orebody would compare favorably in size and grade with that mined in the footwall of the fault.

THE MIAMI FAULT

The Miami fault, as exposed at the surface, is a strong, persistent fault structure, in some places consisting of several parallel gouges which vary from a few inches to four feet in thickness. It can be traced for a distance of three and one-half miles along a general N 20 - 25° E course. The dips vary from 35 - 60° to the east, and a projection of the fault plane from the surface to its position on the Miami 1000 level shows a dip of 55° E.

Striations along the fault plane at the surface strike N 55 - 65° E, and indicate that the latest movement along the fault has been in that direction.

MOVEMENT ON THE MIAMI FAULT

Movement on the Miami fault of normal type has taken place since the deposition of the Gila conglomerate. The hanging wall side of the fault on the surface is Quaternary Gila conglomerate, while the footwall is pre-Cambrian Pinal schist and the granite porphyry phase of the Schultz granite. The absence of a marker formation that can be found in both the hanging wall and footwall of the fault makes a determination of the movement along the fault extremely difficult, and one which must finally be an approximation rather than an actual measurement of the throw of the fault.

A logical grouping of the Miami fault with the northeast series of faults that are found in the western portion of the ore belt indicates that the movement along the Miami fault should be to the northeast and have a large horizontal component. The movement on the Porphyry, No. 5, and Keystone faults of the northeast series is of this type. For example, the movement on the two four inch clay strands of No. 5 fault, measured on the offset of a breccia zone that occurs at the base of the dacite flows, is approximately 700 feet in a northeasterly direction. When these relatively

small clays are compared with the four feet of clay gouge of the hanging wall strand of the Miami fault, the magnitude of the Miami fault may be more fully appreciated.

The direction of movement as well as an indication of its amount is given in the offset of a strong quartz porphyry dike by a footwall strand of the Miami fault. This clay is about 4 inches thick, and it offsets the dike from its position in the high grade portion of the Miami orebody about 200 feet to the northeast. The dike in the Miami mine is said to be steep south dipping, and although the part of the dike that is seen between strands of the fault appears to have a flat, south dip, this is probably due to the drag of a movement to the northeast.

Development on the Miami 1000 level in the hanging wall of the Miami fault has shown the presence of broken iron stained schist and a mass of fresh coarse grained granite. This granite greatly resembles the granite of the main mass of the Schultz granite which is found on the surface some 6000 feet to the south and well in the footwall of the fault. No granite is known to exist north of this point on the 1000 level. Therefore, a probable fault movement with a horizontal component of close to 6000 feet is indicated by this mass of granite found in the hanging wall of the fault.

CONCLUSIONS.

The geologic evidence pointing toward a possible faulted extension of the Miami orebody within Inspiration ground to the northeast of the Miami orebody is as follows:

(1) The general character of the Miami fault, traceable several miles on the surface and comprising many thick parallel gouges separated by zones of intense shearing and crushing, gives it the appearance of a major earth movement with a possible throw of several thousand feet.

(2) The fault definitely cuts off the Miami orebody.

(3) Other faults in the district classified as belonging to the Miami fault system (Porphyry, No. 5, Keystone) have indicated large horizontal movement to the northeast.

(4) Striations along the Miami fault planes strike N 55 - 65° E.

(5) A quartz porphyry dike is offset 200 feet to the northeast by a single footwall strand (4 inch clay gouge) of the Miami fault.

(6) Fresh granite similar to the granite 6000 feet south of the orebody has been faulted opposite the mineralized zone on the Miami 1000 level.

Opposed to this view are the two possibilities that:

(1) Primary mineralization may not have

extended much farther east than the developed Miami orebody.

(2) Erosion may have removed any secondary ore in the area east of the fault before the deposition of the Gila conglomerate.

Although the geologic evidence is far from conclusive, the indicated amount and direction of throw along the Miami fault would be sufficient to place the offset eastward extension of the Miami orebody within Inspiration ground. The possibility of the discovery of an orebody comparable in size and grade to the one mined by the Miami Copper Company would make a limited drilling campaign in the ground east of the Inspiration concentrator advisable. One to three churn drill holes to a depth of 2500 feet would be necessary for the completion of an exploratory drilling campaign, the location and depth of the second and third holes depending upon the results of the first one.

Respectfully submitted,

No Map
HMC 10/20/94

REPORT ON

THE ADVISABILITY OF A DRILLING CAMPAIGN AT INSPIRATION, ARIZONA, TO DISCOVER A BODY OF PRIMARY ORE

INTRODUCTION

The ore bodies of the Inspiration Company have been formed by secondary enrichment processes operative upon a disseminated primary mineralization of chalcopyrite and pyrite along the contact of Pinal schist and quartz porphyry. The recent discovery in La Colorada mine at Cananea, Sonora, Mexico, of a high grade concentration within a quartz porphyry plug of primary bornite and chalcopyrite ore which, near the surface, is associated with a body of secondarily enriched disseminated ore, has indicated that under certain conditions disseminated primary mineralization may be derived from a source or concentration of primary minerals that is well within the vertical range of mining activity. During the period from February to October, 1930, a detailed geologic examination of the surface surrounding the Inspiration ore bodies was made, directed toward the finding of surface indications that might lead to the discovery of a concentration of primary ore such as that found in La Colorada.

GENERAL GEOLOGY

Pre-Cambrian Final Schist, into which at various times fine and coarse grained granites, quartz-porphyry, diabase and diorite have been intruded, is the oldest formation in the Inspiration - Miami district. The quartz porphyry with which the Inspiration primary metallization appears to be associated, is a phase of the Schultz granite, the main mass of which is a brown coarse grained granite that lies southwest of the town of Miami. Structurally the quartz porphyry, highly sericitized and iron stained, lies at the end of a broad nose that extends northward from the main body of granite. Intermediate between the quartz porphyry and the brown, blocky granite, and occupying the major portion of the nose, is a whitish gray granite that near the quartz porphyry is cut by a network of quartz stringers which extend in every direction. The boundaries between these three phases of the Schultz granite are gradational as nearly as can be determined.

After the intrusion of the Schultz granite the primary copper mineralization was intruded along the contact of the quartz porphyry and the schist, and to a lesser extent into the whitish gray granite; no copper mineralization, however, is found in the main mass of the Schultz granite. During the succeeding erosion cycle secondary enrichment processes caused the formation of the present commercial orebodies.

Dacite flows covered the surface at the close of this erosion cycle, and the surface detritus that was consolidated at that time at the base of the flows now is apparent on the surface as large breccia outcrops and residual boulders. After the dacite flows, renewed erosion cut through the dacite in places again exposing schist and porphyry, and this rough erosional surface was then covered by a large thickness of Gila conglomerate. The deposition of the conglomerate was followed by a regional tilting of the district to the westward, and successive faults shifted the segments of the secondary ore blanket into their present positions.

FAULTING

Faulting which preceded the primary mineralization is not prominent, but there are several small discontinuous silicified breccias that suggest an age of faulting existent at the time of the primary mineralization. However, since the formation of the secondary ore blanket faults with several hundred feet displacement have been common within the area around the orebodies. The faults that offset the ore blanket can be classified upon a basis of structural similarity; the age relations of these faults is not entirely clear.

1. The first group comprises a series of

northeast striking faults that have a flat dip to the east. The movement along these faults is to a large extent lateral to the northeast, and in the case of the Miami fault, which terminates the Miami orebody on the east, may reach a magnitude of 6000 feet. The Porphyry fault, No. 5, and at least four other faults that appear to the west of the Miami fault are of this type.

2. The second group is represented by the Joe Bush fault, a northwest striking, steep south dipping structure that offsets the main Inspiration orebody about 1000 feet horizontally, the south, or hanging wall side, having moved to the northwest in relation to the footwall side.

3. The third group includes the Pinto and Bulldog faults which have a northwest strike, and a flat dip to the northeast. The movement on these faults has been nearly directly down the dip.

4. The Sulphide fault is an E-W, steep north dipping fault that is found in the southwestern part of the ore area. Its movement has not been determined in direction or amount.

5. In the grizzly level workings above the Sulphide Tunnel there is a strong thrust fault exposed which brings porphyry into contact with the schist, the

porphyry overlying the schist. The strike of this fault varies from N 70° E to E-W, and its dip is from 10-20° to the south. No other exposures of this fault are known, and the extent of the movement along it cannot be determined. It is distinctly possible, however, that this fault is to a large extent responsible for the apparent lobe of quartz porphyry that extends out over the schist in the western portion of the ore area.

THE SCHULTZ GRANITE

The main mass of the Schultz granite batholith lies southwest of the town of Miami. This granite is a coarse grained, blocky, brown soda granite that weathers into rough abrupt hills. A very few one to two inch quartz seams carrying a little pyrite represent the extent of the mineralization in it.

A broad nose extends northward across Bloody Tanks wash and Liveoak Gulch from the main mass of the batholith. Immediately north of Bloody Tanks Wash the brown granite grades into a finer grained, whitish gray granite which is cut by some quarter inch quartz seams, and has a little disseminated oxide copper mineralization on the surface. Northward across Liveoak Gulch this granite is cut by an increasing number of quartz seams, and its

texture is more irregular; in some areas it becomes a granite quartz porphyry. Zones of stringers of quartz, pyrite and possibly some chalcopyrite also begin to appear just north of Liveoak Gulch.

The northern end of the nose at the contact with the Final schist is a quartz porphyry that appears gradational from the granite porphyry. The contact of the quartz porphyry and the schist dips generally to the south from 60° - 70°; however, in the western part of the Inspiration ore area there is a lobe of quartz porphyry that extends out over the schist. The position of this lobe-like mass of porphyry may at least in part be due to faulting, rather than to a sheet like character of intrusion.

The quartz porphyry has two phases. Close to the schist contact and extending eastward from the fault block south of the main Liveoak shaft to the caved area east of the Old Colorado shaft the quartz porphyry is highly broken, well sericitized and iron stained. Eastward from the Colorado shaft the contact is within caved ground, but it appears probable that the highly altered porphyry extends along the contact to the Miami fault; dikes of highly altered quartz porphyry found within the schist area of the Miami Copper Company orebody indicate that this eastward extension of altered quartz porphyry exists.

The second phase of the quartz porphyry is

found in the area around the Sulphide Tunnel. The quartz porphyry is partially silicified, carries a great deal of copper stain and some sulphide copper, and is not broken as is the zone of highly altered porphyry near the schist contact.

An irregular zone of partially altered porphyry in which the feldspars are softened and have a pinkish coloration is gradational between the two types of quartz porphyry.

In the area between the Taylor tunnel, the portal of the Inspiration supply tunnel and the Inspiration incline shaft there are several conspicuous zones of silicification and copper staining. These zones are very discontinuous, but have a general alignment of about N 10-20° W. The hill immediately south of the Inspiration incline is the most highly silicified area found, and it carries from 0.5% - 0.7% copper in oxide form.

MINERALIZATION AND OREBODIES

The primary mineralization that invaded both the schist and the porphyry along their contact was composed of pyrite, chalcopyrite, molybdenite and quartz. This metallization is found in seams and stringers cutting the schist and porphyry, and disseminated through the mass. The copper content of this mineralization averaged 0.4% - 0.6%, and a drill hole from the Inspiration 800 Level showed

that this low grade, pyritic copper mineralization extends to a depth of at least 1700 feet below the surface along the contact. Although primary mineralization is extremely irregular, in the eastern portion of the ore area small discontinuous zones o f mineralized stringers have a general N 50° E trend, while in the area around the Sulphide tunnel the stringers have a N 20-30° W strike; in both cases the dip is to the south.

The mineralization of the secondary ore blanket which was developed along the contact consists essentially of chalcocite replacing pyrite and chalcopyrite; quartz and some molybdenite remain from the primary mineralization. The grade of the secondary orebodies averaged between 1% and 2% copper, with occasional small blocks averaging 2% - 3%.

The developed orebodies extend westward from the Miami fault for a distance of about two miles in a direction a little south of west. The width of the ore assaying above 1% in copper does not exceed 1500 feet, but the Miami Copper Company has developed an additional 1000 feet of 0.7% - 1.0% copper north of their main orebody. The vertical thickness of the ore has a maximum of 350 feet although here again the Miami Company has developed about 400 feet of 0.7% - 1.0% below their main orebody.

The mineralization of quartz seams and stringers that appear to the south of the contact within the

whitish granite and granite porphyry is of an earlier period than the sulphide mineralization. There are, however, within this area some stringers carrying little pyrite and chalcopyrite that cut the earlier quartz mineralization, and are probably the same age as the mineralization at the contact.

GENERAL GEOLOGY AT LA COLORADA

Within a quartz porphyry plug intrusive into highly altered volcanic rocks there is a concentration of high grade bornite and chalcopyrite ore. The volcanic flows and the porphyry surrounding this high grade ore are impregnated with a pyritic mineralization which carries some copper. In the upper levels of the mine there has been enough enrichment of this disseminated mineralization to form a secondary chalcocite orebody. That the disseminated primary mineralization has been derived from solutions intimately connected with high grade bornite-chalcopyrite ore seems definitely proven by its position around the high grade core.

The high grade primary mineralization within the porphyry plug is accompanied by intense brecciation that is probably a slumpage phenomena, or produced through alteration and volume change of the porphyry. The mineralization is localized in a small area, and major structural

relations which might have caused the intrusion of the porphyry plug at the place that it is found are not known.

The area surrounding the Colorada orebody is entirely free from major fault structures, either pre-mineral or post-mineral. The Carranea district as a whole is lacking in the fault pattern that is generally present in a region of intense igneous activity.

CONCLUSIONS

Few factors are in evidence at Inspiration upon which an intelligent prospecting campaign, having as its object the discovery of a body of primary ore minerals such as that found at La Colorada, can be based. The factors which would recommend such a campaign are:

1. The presence of a large mass of quartz porphyry that is a part of a batholithic intrusion from which concentrations of primary ore might be derived.

2. A widespread dissemination of a quartz-pyrite-chalcopyrite mineralization similar to that at La Colorada.

3. Zones of silicification which carry some copper mineralization, but whose significance is unknown at the present time.

In opposition to these general favorable factors are the two unfavorable groups of factors.

I. Criteria which would indicate any one favorable zone in quartz porphyry are lacking.

1. The quartz porphyry at Inspiration covers a large area, and the possible concentration of primary ore minerals, as shown at La Colorada, is probably localized within a small area.

2. Diamond drilling has shown that the primary mineralization extends at least 1700 feet below the surface; an adequate drilling campaign would therefore have to cover a large vertical range.

3. Slumpage brecciation such as encountered at La Colorada is not present at Inspiration to indicate a possible favorable zone.

II. The possibility that the disseminated deposits at Inspiration are not derived from a nearby concentration of primary minerals.

1. In a region of long continued igneous activity and fracturing, as at Inspiration, the probability of a concentration of primary minerals is much less than in a district in which there has been a small amount of fracturing.

2. The schist-porphyry contact might easily serve as a conduit for the ascending mineral-

izing solutions proceeding from a primary concentration localized at a great depth beneath the surface.

3. The possibility that the quartz porphyry is a near surface simple cooling phase of the Schultz granite rather than a deep seated segregation from the granite mass which might be expected to contain a concentration of copper mineralization.

In the light of present knowledge of the source of the primary mineralization of disseminated orebodies it appears that the odds at this time are overwhelmingly against the successful prosecution of a drilling campaign at Inspiration directed to discover a concentration of ore minerals such as that found at La Colorada.

Respectfully submitted,

Roland B. Mulchay

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Inspiration, Arizona,
October 1930.