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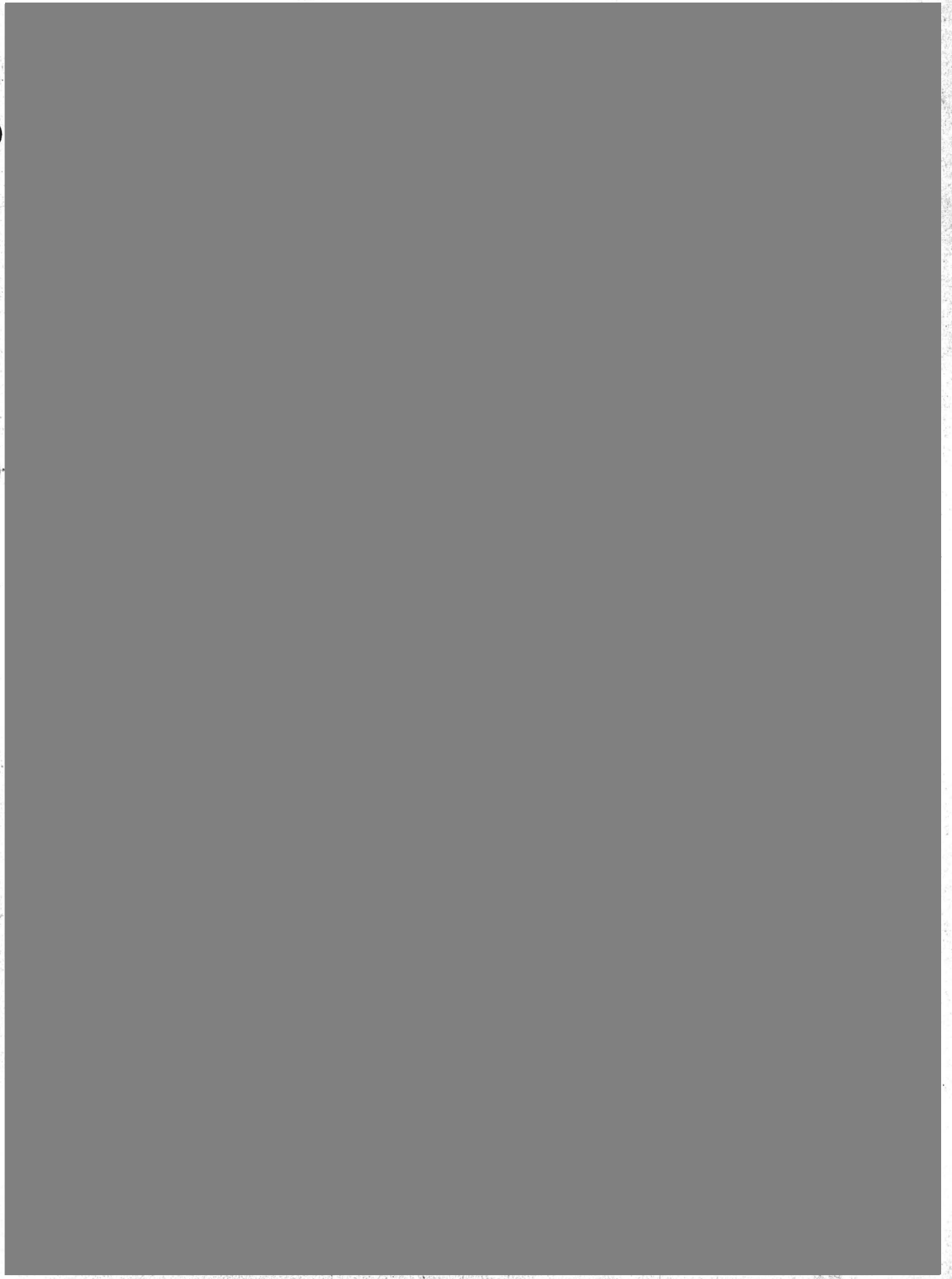


JOHN E. KINNISON

J E Kinnison

Control Mine
JEK File

UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey

Some Copper Deposits of the Old Hat Mining District, Pima County, Arizona

by

Nels P. Peterson, and S.C. Creasey

September 21, 1943

Introduction

From August 20, 1942, to January 20, 1943, a field party of the Geological Survey, United States Department of the Interior, studied a part of the Old Hat mining district, in the Santa Catalina Mountains, Arizona. The area mapped is about 25 miles northeast of Tuscon, in T.11S., R.16 E., Gila and Salt River meridian, in the northeast corner of Pima County. It may be reached by way of Oracle, Arizona, by 35 miles of oiled road and 25 miles of graded dirt road. The topography of the area is rugged, with altitudes ranging from 5400 to 7700 feet, and it is largely occupied by a single hill whose summit lies a little east of Oracle Ridge.

The principal object of the work was to find additional reserves of copper though an outlying scheelite prospect at the south end of the area also was examined. The work wasd done chiefly by Nels P. Peterson and S.C. Creasey, with the assistance for short periods of J.B. Hadley and H.H. Sullwold, Jr. The United States Bureau of Mines furnished a survey that facilitated mapping the Geesman Mine, and Eldred Wilson of the Arizona Bureau of Mines furnished a partially completed geologic map of the Daily mine that was helpful. Individual property owners assisted in many ways that cannot be adequately acknowledged.

History and Production

There is no record of production previous to August, 1937, when the Catalina Consolidated Copper Company leased the Camp Apache group of claims and the adjoining property of the Daily Arizona Consolidated Copper Company. The Catalina Consolidated built a 90 ton flotation concentrating mill on the property of the Daily Arizona Consolidated Copper Company and mined and treated ore from both the Geesman and Daily properties. From August 15, 1937 until the close of their operations in May, 1938, this company treated approximately 13,000 tons of ore averaging 2.7% copper.

In October, 1939, the Control Mines, Inc. bought the consolidated mill and leased the Daily Arizona property. They acquired the Geesman property in the spring of 1940 from the Phelps Dodge Corporation. In 1940 the Control Mines Inc. mined and milled from the Geesman and Daily properties 24,000 tons of ore which yielded 1, 394,000 pounds of copper. The table gives the production figures for the Control Mines, Inc. for the year 1941 and through September of 1942. (Figures for 1943-1949 were taken from Minerals Yearbook).

The Geesman mine is the only active mine in the district at the present time. It is operating with a personnel of from 30 to 40 men which includes the mill operators. The Daily mine, owned by the Daily Mines Company, was active in 1939 and 1940 while under lease to the Control Mines, Inc. The owners have recently stated their intention to reopen the mine in the near future.

Control Mines, Inc.
copper production 1941 and 1942

	1941 dry tons of concentrate	pounds of copper
January	219.3530	125,512
February	217.7080	118,787
March	277.2140	152,042
April	189.5275	100,470
May	181.6710	97,501
June	218.5175	117,927
July	160.0630	87,128
August	176.8745	94,677
September	185.9275	102,222
October	172.7535	90,610
November	138.1165	77,764
December	149,2045	81,535
	1942	
January	113.1120	59,221
February	99.1525	50,805
March	200.6810	108, 394
April	113.7165	59,611
May	65.4425	33,456
June	206.8620	109,629
July	105.0000	51,483
August	114.5660	56,649
September	55.9510	27,997

Data subsequent to this report derived from Minerals Yearbook.

1943 - The Daily and Geesman groups and the flotation mill on the property were purchased June 26, 1943, by the Control Mines Co. from Control Mines, Inc. A total of 11,676 tons of copper ore was treated during the year from operations of both companies. The remainder of the district output was 142 tons of high-grade copper ore shipped directly to a smelter from the Giant claim.

1944 - Control Mines Co. operated the Geesman mine and the mill continuously throughout the year. Approximately 13,700 tons of copper ore were treated by flotation and 44 tons of similar ore shipped to a smelter. The Daily Mines Co. produced 1,593 tons of copper ore from the Daily mine, which was treated in the Control Mines Co. mill.

1945 - 10,600 tons of copper ore from the Geesman mine was treated by flotation at the Control Mine Co. mill. 979 tons of similar ore were shipped directly to the copper smelter at Hayden. Operations were continuous throughout the year.

1946 - Control Mines Co. operated the Geesman mine until May 1, 1946, when it was abandoned and allowed to fill with water. During the first four months of the year the company treated 700 tons of copper ore in its mill and shipped 516 tons of similar ore to the Hayden smelter. The mill was dismantled in June. 106 tons of copper ore was produced from a claim operated by Newton Wells.

1947 - 979 tons of copper ore containing 12 ounces of gold, 1,930 ounces of silver, and 116,311 pounds of copper was produced from the Daily, Leatherwood, and Hartman properties.

1948 - The Hartman mine was worked most of the year by Shanklin and Adams. 109 tons of copper and 38 tons of lead-copper ore were shipped to smelters, and 390 tons of zinc-lead-copper ore were hauled to the Eagle-Picher mill for custom treatment. 200 tons of copper ore were produced from the Giant and Leatherwood mines.

1949 - Leasing operations at the Leatherwood mine produced 84 tons of copper ore.

Geology

The mines and prospects in the area all lie near the border of a mass of marble that is about a mile and a quarter in legnth from east to west and about three-quarters of a mile wide. It is mostly from this rock that the hill mentioned in the introduction is carved, though the summit consists of a small overlying mass of quartzite. On the west, northwest, and southwest the marble is in contact, partly faulted, with an underlying series of metamorphosed sedimentary rocks that consists chiefly of quartzite, sandstone, and impure limestone, but includes a little shale. Igneous rocks, mainly dioritic, have been intruded into the sedimentary strata.

The formations beneath the marble have not been positively identified. They are believed, however, to include the pre-cambrian Dripping Springs quartzite, represented by massive slabby sandstone and quartzite interbedded with shale which had been metamorphosed to siliceous hornfels and chloritic schist. They rpobably include, also, the Mescal limestone, of pre-cambrian age, and a small thickness of the Troy quartzite.

The marble forming the knob is massive and coarsely crystalline, and its original textures have almost been wholly obliterated by metamorphism. Its age is probably Paleozoic, and its general appearance indicates that its lower part may be Mississippian and its upper part Pennsylvanian. At any rate, it is older than the igneous rocks, which are intrusive into it, and is altered along the intrusive contacts to tactite, which consists mainly of brown garnet, epidote, and quartz.

The intrusive igneous rocks include hornblende-diorite, hornblende-quartz diorite, and diabase, but these varieties are not distinguished from one another on the maps. Small masses of diorite and diabase, most of them sills but some of them dikes, have been injected into the marble. The main intrusive contact between the diorite and the marble tends to follow the bedding, but in detail, it is very irregular, with numerous rolls, and many tongues of diorite cut across the bedding. Closely associated with the tactite is a rock that is believed to be an altered facies of the diorite, because it grades into unaltered diorite and partly resembles it in texture. At least some of the diabase is much later than the diorite.

In its eastern part the marble is immediately underlain by the diorite. On the south and east sides of the marble mass, the contact has a low dip - from 10 to 18 degrees - but along parts of the north side the dip becomes as steep as 60 degrees. Dikes of diabase cut the diorite as well as the marble and the tactite, and a diabase dike of low dip crosses the Geesman ore body.

The principal structures in the marble are a series of east to northeast striking antiâlines and synclines, which apparently have not controlled the localization of the ore. Faulting is subordinate to folding; only a few small faults of measurable displacement were recognized. Fracturing is common; northeast-striking fractures predominate, but northwest-striking fractures occur also.

The predominant structure in the pre-cambrian rocks is a series of northeast-striking faults which are younger than the Paleozoic marbles. The strike and dip of the rocks are in general fairly uniform, apart from folding near the faults. A mineralized fault zone striking about north-northeast forms part of the boundary between the Mississippian (?) and older rocks at the Hartman mine. Northwest-striking tension fractures are common in both the Hartman and the Stratton workings.

Ore Deposits

All of the ore deposits are in the metamorphosed sedimentary rocks near the diorite contact, the mineralization being of the pyrometasomatic type, commonly called contact metamorphic. No two of the deposits, however, are altogether similar in their relations to both country rock and structure.

Ore control - The Daily and Geesman deposits, on the northeast slope of the marble hill, are both in well-defined zone of tactite between the supposedly Mississippian marble and diorite. The ore shoots in the Daily mine are localized along the crests and flanks of three small rolls, of ridge-like form, on the marble-diorite contact, which here dips northwestward at a low angle. The rolls are no more than wrinkles in the surface of contact, and are apparently unrelated to any major structures in the limestone. The localization of the ore in the rolls is probably due to minor fractures in the tactite along their axes. In the Geesman mine, the nature of the structural control determining the position of the ore is not entirely clear. Apparently, however, the ore shoot is localized in a recess limited by a shallow, steeply pitching trough in the diorite contact forming the footwall, and above by an irregular tongue of diorite that extends from the main intrusive mass into the marble. Little evidence remains of any major fractures that may have influenced the mineralization; if such fractures once were present they have been almost completely healed. Faint traces of rather persistent north-south fractures are indeed visible in the stopes, but they are not associated with especially rich ore; in places, on the contrary, they are marked by silicified ribs that are poorly mineralized.

At the Hartman-Homestake workings, on the northwest side of the hill, both the Mississippian (?) marble and the older sedimentary rocks are exposed. The outer parts of the adits are thought to be in the Dripping Spring quartzite. Dioxite crops out northwest of the workings, but the workings do not reach the intrusive contact. The metamorphic effect of the diorite is shown, however, by the fact that the marble in the vicinity is partially altered to tactite. Ore Minerals are disseminated in a bed of garnetized limestone that is apparently at the base of the Mississippian marble, but they are not abundant enough to make ore. Stronger mineralization has taken place in both the Mississippian (?) and older rocks, along the fault zone striking N 70 E and dipping southward, and also along minor northwest-striking cross fractures.

The Stratton workings, on the south side of the marble hill, are apparently all in the rocks underlying the marble. They are several hundred feet from the main body of diorite, but the rocks are highly metamorphosed. Mineralization has occurred in tactite, or garnet rock, formed by alteration of the Mescal (?) limestone. The mineralizing solutions appear to have risen along fault fissures of easterly to northeasterly strike.

The Leatherwood workings, on the southwest side of the marble hill, are all close to the diorite contact and partly in the diorite. The mineralization is mainly in tactite, which appears to be altered Mescal Limestone.

The Corregidor scheelite prospect, at the south end of the area shown, is in quartzite, presumably of the older series, near its contact with intrusive diorite.

Mineralogy

The dominant ore mineral in the Daily, Geesman, and Stratton mines is chalcopyrite, which is accompanied by subordinate amounts of bornite and chalcocite and a little pyrite and magnetite. The gangue consists of brown to red garnet, epidote, and quartz. In the Hartman mine, chalcopyrite, galena, and sphalerite are enclosed in a gangue consisting of siliceous hornfels, pyrite-bearing chlorite schist, and a little brown garnet. The oxidized zone is very shallow, sulphides being found in many shallow prospect pits within ten feet of the surface. Little secondary enrichment has occurred. Oxidation is most in evidence in the Leatherwood mine, from which a little oxide ore has been shipped. Considerable magnetite occurs in this property. Scheelite occurs in the Daily and Geesman mines and in the Corregidor prospect, but not, so far as has yet been shown, in any large quantity. A little molybdenite is found on the Stratton property.

Reserves

The minable reserve, in the Daily and Geesman mines together, of measured ore averaging from 3 to 4 percent copper is estimated to be not over 5,000 tons. A 3% cut-off grade is being used by the Control Mines, Inc. because of the high mining costs that result from operating at less than half capacity. If the company continues to produce 30 to 40 tons of ore per day, this reserve will be exhausted in about six months. An additional 10,000 tons of inferred ore is estimated to be available in undeveloped ground between the levels of the Geesman mine. Probably a well-organized and well-executed program of development and porspecting could open up enough ore to support continued operations at full capacity (80 to 90 tons per day) for at least as much as a year. Operation at full capacity should make it possible to mine ore of lower grade, with a resulting increase in the minable reserves and in the productive life of the mine.

The reserves of scheelite ore containing more than one percent WO_3 that can be mined in the Daily and Geesman workings are estimated to be less than 100 tons, and the minable bodies of scheelite are too discontinuous for extensive mining. The scheelite can probably only be mined at a profit in conjunction with the copper mining and then only along the marble-tactite contact between the P.D. drift and part of the 100-foot level west of the hoisting shaft of the Geesman mine.

The Hartman mine is estimated to have, in the fault and fracture zones, reserves of about 8,000 tons of indicated ore plus 15,000 tons of inferred ore, which will average about 2.8 percent copper, 7.2 percent lead, and 8.8 percent zinc. The tactite in this mine does not contain enough copper to be classed as ore. The reserves in the southern mineralized zone on the Stratton property are estimated at 2,000 tons of indicated ore, and 8,000 tons of inferred ore. The copper content of the ore exposed for 100 feet in the inclined adit is judged from inspection to be between 2 and 3 percent. The most northerly mineralized zone on the Stratton property is estimated to contain about 15,000 tons of mineralized tactite, which may, however, be too poor in copper to be ore.

Mines

See production table for history since 1943

Daily mine - The Daily Mines Company has 17 patented claims, which make up an irregular area trending eastward from the center of the marble mass. Approximately 2,500 feet of marble-diorite contact lies on the property.

The Daily mine workings, reached through an adit driven under the tactite zone, consist of a fairly continuous stope locally subdivided by large pillars. As the stoping followed the mineralized tactite, the elevation of the floor varies irregularly through the mine. Practically no development work has been done outside the stope.

The mined ore bodies, which occupied the crests and flanks of three small, gently plunging ridges on the contact, were roughly crescent-shaped. From the size of the old stope, the ground comprising the three ore bodies is estimated to have been about 160 feet long and 140 feet broad. Their thickness was variable but probably averaged ten feet. The ore taken from the Daily mine by the Control Mines Inc., is said to have avergaed about 2.95% in copper.

The only measurable reserves in the Daily mine consists of the ore left in the pillars. The chances of finding additional ore down the plunge of the rolls are uncertain. Ore has been followed below the main level, but the workings below that level are now under water, and reports as to what is exposd in the face are conflicting. The ore-bearing horizon along the contact probably rises abruptly northward, however, from the flooded northernmost workings, to emerge on the north edge of the trough-shaped mass of limestone.

Rolls similar to those in the Daily mine occur on the contact north of the mine, and tactite under these rolls shows oxidized copper minerals, which may indicate the presence of ore bodies.

Scheelite has been found in the Daily mine in two small pockets, each estimated to contain less than 10 tons, on the tactite-marble contact at the southeast end of the most northerly roll.

Geesman mine - The Geesman mine is owned and operated by Control Mines, Inc., which holds 15 patented claims north and south of the Daily Mines Company's property. The Geesman mine was the only operating mine in the district when the field work was being done.

The mine workings comprise an inclined shaft following the contact zone, three main levels, and two sublevels. The main levels, designated as the 100-, 200-, and 250- levels, are 78, 175, and 226 feet respectively below the collar of the shaft. An adit connecting the 100-foot level with the surface serves as the main haulageway. The 100-foot level has the most extensive lateral development, with drifts and stopes extending 400 feet east and 500 feet west of the hoisting shaft.

The ore shoot in the Geesman mine pitches from 35 to 50 degrees SW. It is approximately 200 feet wide, 300 feet along, and from 15 to 20 feet thick. The ore shoot appears to be bottomed east of the hoisting shaft by the junction of a tongue of diorite with the main mass. The pitch of the junction projected westward would carry it a short distance west of the hoisting shaft, indicating that the ore does not extend far below the floor of the stope.

From January 1940, to the end of September 1942, the Geesman mine produced about 3,200,000 pounds of copper from 52,200 tons of ore containing on the average approximately 3.4 percent copper.

Sporadic traces of scheelite are found throughout the Geesman mine, but the only places where scheelite ore can possibly be mined are along the tactite-marble contact in the P.D. drift and on the 100-foot level west of the hoisting shaft. In both these localities the ultra violet lamp indicates the presence of scheelite whereever the contact is exposed, but the mineralized zone is less than two feet wide in most places.

Hartman-Homestake mine - The Hartman-Homestake property comprises 4 patented claims and about 14 unpatented claims. The mine lies about 6,000 feet by airline due west of the Geesman mine. It is accessible by a trail about 3 miles long, which starts from the Geesman mine. The trail climbs 900 feet to the top of Oracle Ridge and drops about 300 feet on the other side to the mine workings.

Exploration work consists of four adits, two of which have cross-cuts along mineralized fault and fracture zones. The mineralization is localized along a fault and a fracture zone striking about N 70 E. and dipping steeply southward, along northwest-striking cross-fractures, and in favorable garnetized beds, presumably at the base of the Mississippian (?) marble. These have been mineralized parallel to the bedding for an unknown distance down the dip.

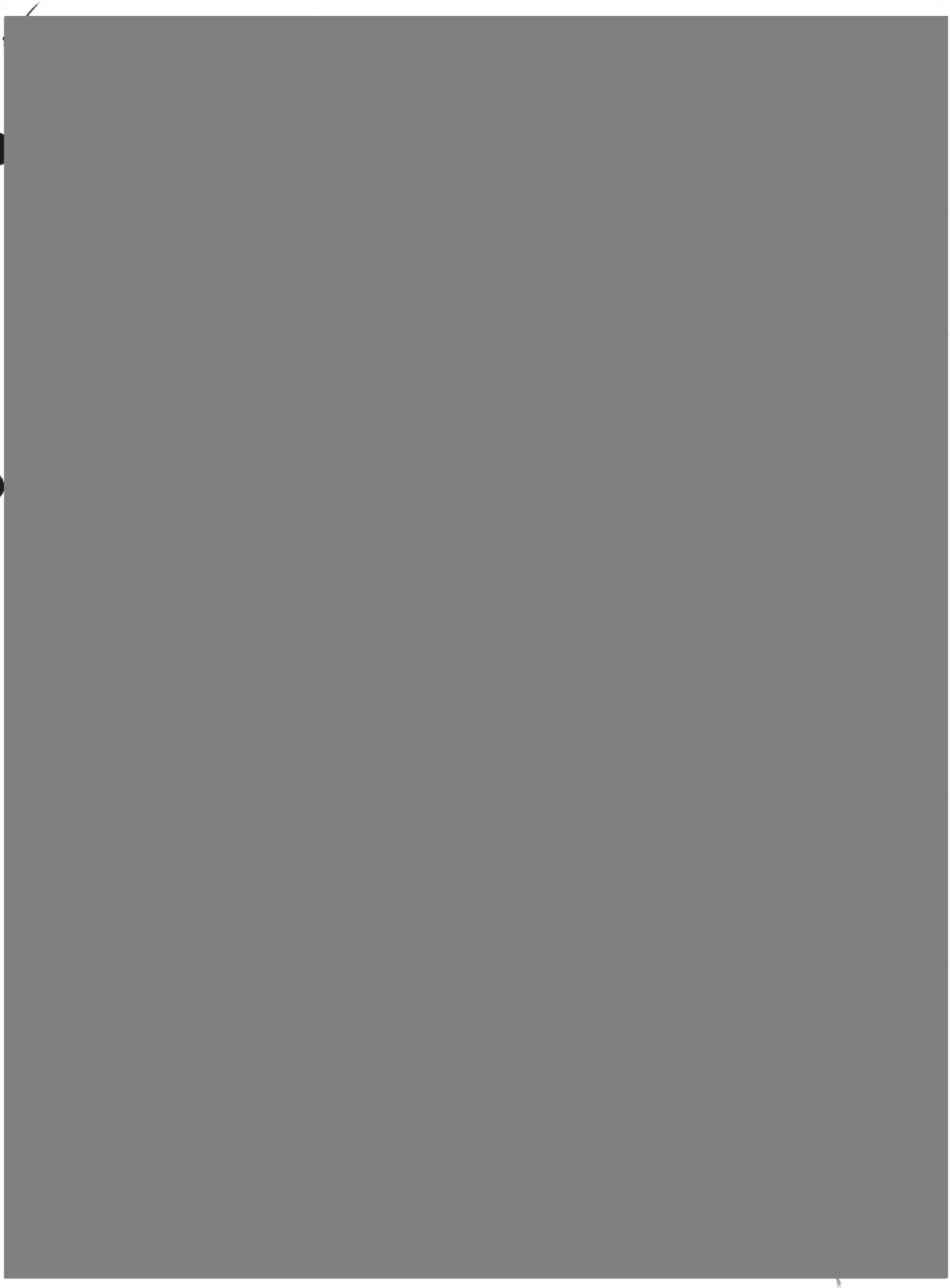
The principal metal disseminated in the garnetized marble beds is copper. The copper content of this rock is about half as great as that of the ore - containing also lead, zinc, and silver - that occurs in the fracture zones. Assays of that ore, according to a private report by L.C. Orem, show, on the average, 2.8% copper, 7.2% lead, and 8.8% zinc.

Leatherwood property - The Leatherwood property, held by Control Mines, Inc., lies 1½ miles by road south of that company's mill. The accessible workings consist of several adits less than 100 feet in length and two longer adits with cross-cuts. Near the portal of most of the adits is a brecciated tactite, which locally, at its contact with thin basic dikes, contains oxidized ore that can be hand sorted to 12% copper. Leasers have been shipping about 2 cars a year of the hand sorted ore.

Only traces of coppersulphide were visible in the accessible adits. On one dump, however, there are several tons of copper ore composed of chalcopyrite and bornite in a tactite gangue. No sulphide ore was seen on the other dumps. The known production from Leatherwood ground amounts to about 7 cars of oxide ore, shipped during 1940, 1941, and 1942.

Stratton property - The Stratton Copper Company's property, consisting of 12 unpatented claims, adjoins the Leatherwood property on the west. It lies about 2,500 feet west of Control road and 400 feet higher, and is accessible only by a trail that branches from the road about 2 miles south of the mill of the Control Mines, Inc. The development work consists of a 100-foot inclined adit, two adits less than 50 feet in length, a 50-foot inclined adit, and several prospect pit

The copper mineralization is in a garnetized zone at the base of a layer of impure limestone lying between quartzites. In the 100-foot inclined adit, it is restricted to the bottom 5 feet of the tactite and forms a zone not over 2½ feet in average thickness.

The outcrop shows both copper sulphide and oxide mineralization for 350 feet at both the north and south end of the area. To the south a fault striking N 45-55 E. shifts the mineralized tactite zone about 500 feet to the northeast, and from this fault the tactite can be traced at least 200 feet northwestward. The tactite on the southeast side of the fault contains a few northeast-striking quartz-molybdenite-chalcopyrite stringers, and a little molybdenite is disseminated in the sheared tactite rock adjacent to the large fault.

No ore has been shipped from the property.