
KAP WR 4/17/87: In a conversation with John Kuhn, Consulting Geologist, (card) regarding the properties he is trying to promote I asked if any were leachable oxide copper deposits. Although none were, he said there was good oxide copper ore at the Christmas Mine (file) Gila County. He explained that the deposit is a porphyry loacted on the downthrown side of the Joker fault. It contains 100 million tons of 0.47% Cu, 30 million tons of which runs 0.6% Cu and a lesser amount which will run 0.7% to 1.0% Cu. There is sufficient pyrite on the property to consider making sulfuric acid on site.

CHRISTMAS MINE Gila County

KAP WR 6/20/80: Mrs JohnMediz of Copper City Rock Shop in Globe reported that they have a contract with Inspiration Consolidated Copper Company to produce mineral specimens and gem material from all of Inspiration holdings in Arizona. They have recently produced kinoite and native silver specimens from Inspiration's Christmas Mine, Gila County. They have not produced any specimen material from Inspiration Mines at Inspiration in the last two years. The last production included chrysocolla, azurite, malachite, velvet malachite, and drusy quartz over chrysocolla.

KAP Mine Visit Report, Reymert Mine, Pinal County (file) 2/10/84:
Inspiration Mines Incorporated is the leasee and Nichols Development Co (c) of Globe is the operator. (See Reymert (file))

CHRISTMAS MINE GILA COUNTY

Robert H. Marshall, Gen. Supt., left for Pima Mining Co. Skillings 3-15-70

Active Mine List May 1970 - 290 men - Robert H. Marshall, Gen. Supt.

John G. Kuhn has been named superintendent of new mine development for the Christmas division of Inspiration Consolidated Copper Co. at Christmas, Arizona. And is responsible for engineering as well as mine development. Prior to rejoining the company in July 1969, he was employed by Chas. Pfizer and Co. Inc. as quarry superintendent at Lucerne Valley, California. Formerly he served with Inspiration at the Christmas copper project from 1955-1967. Mr. Kuhn holds a B.S. degree in geology from University of New Mexico. Skillings 6-13-70

Douglas W. Middleton has been appointed General Supt. of the Christmas division of Inspiration Consolidated Copper Co. at Christmas, Arizona to succeed John J. Theiler. Skillings June 6, 1970

Robert E. Green formerly mine superintendent for Marcona Mining Co. at San Juan, Peru has joined Inspiration Consolidated Copper Co. as mine superintendent for the Christmas Division at Christmas, Arizona. Skillings 10-10-70

Active Mine List Oct. 1970 - 280 men - Gen. Supt. ?

Christmas operated at its regular rate. FTJ QR 4-5-71

Dir. of Mining - August 1971 - 280 employees.

Christmas mine of Inspiration operated without any changes during the quarter. FTJ 3rd¼71-7

Development and production of the Red Hill Mine continued and Black Copper Mine was producing as was the Ox Hide and Christmas Mine. FTJ 4 ¼ '72

Active Mine List - October 1972 - Empl. 297 (1971 Figures, 1,537,833 T Ore, 6,247,876 T Was 7,710 T Cu)

Inspiration Copper Company continued mining at the Ox Hide and Christmas mines. FTJ Annual Report 6/28/73

Bob Jones, Mineralogical Society of Arizona, reported that a quantity of kionite has recently been discovered at Inspiration's Christmas mine ($Ca_2Cu_2Si_3O_{10}2H_2O$). KAP WR 8/4/75

CHRISTMAS MINE

GILA COUNTY
Banner District

Mr. Bert Reed, Geologist, Inspiration, said Christmas mine improving. The "so-called" open pit runs about .7% FTJ WR 11-26-65

Visited Christmas Mine, learned Tom Billson is now mine foreman, Thompson is in engineering. Mr. Hyde said he expected production to be up to capacity in April. FTJ WR 1-28-66

Active Mine List April 1966 - R. R. Hyde, Gen. Supt. - Inspiration Cons. Copper Co.

Bert Reed said that Inspiration is considering application for a subsidy for the Christmas operation for enlargement of mill to treat lower grade ores. He said a huge tonnage of low grade ore is available at Christmas. FTJ WR 5-27-66

Christmas mine has tentative plans to enlarge their copper operation. FTJ QR 7-8-66

Visited with Dick Hyde, Supt. of Christmas. They are milling about 3500 tpd from the open pit operation. Ultimate target is 5000 tpd. FTJ WR 11-25-66

Christmas mine was mining from their open pit only. FTJ QR 2nd Quarter 66-67

Active Mine List Nov. 1967 - 235 men
Active Mine List Apr. 1968 - 227 men
Active Mine List Oct. 1968 - 227 men

Production and recovery have been improved at the Christmas mine, according to a recent report by H. Myles Jacob, President of Inspiration Consolidated Copper Co. During the third quarter treatment averaged 4,429 tons per day, compared with 4,173 tons in the second quarter.
Metallurgical recoveries also improved, increasing both copper available for sale and net profit, Jacob said. He also pointed out that alterations are now being made in the concentrator ore bin which will permit increasing ore treatment to at least 5000 tons/day. Taken from Pay Dirt 11-68

Active Mine List April 1969 - 259 men - Robert Marshall, Gen. Supt.

Visited the Christmas mine - went through the mine with John Theiler, Supt. FPK WR 6-4-69

The new open pit development on the surface of the Christmas underground copper mine was commenced by Inspiration in 1966 and the new pit is getting into noticeable size. The ore mined here is all handled by large front end loaders rather than power shovels. The Christmas mine milling operation is also unique in that flotation which is generally applicable only to sulphide ore, also recover a substantial portion of the oxide ore values. Taken from Skillings Mining Review July 5, 1969

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ive Mine List Oct. 1969 - 281 men - Robert H. Marshall, Gen. Mgr.

CHRISTMAS MINE
BANNER DISTRICT GILA COUNTY

Interview with Carroll Weed and Bert Reed, 9/27/63

Mr. Weed said that mine production is currently at about 2000 tons per day, up a little recently. A modified room and pillar stoping method with narrower stope sections is being instituted. Slushers will deliver the muck to a main haulage room where the large loaders will pick it up. The pillars may be lagged off, if it is found that this will increase pillar recovery. Gobbing is done with wet tailings.

MEMO LAS 9/27/63

Active Mine List Oct. 1963 - 340 men

Visited Christmas Mine. Learned from Dick Hyde, Gen. Supt., the expected tonnage of 4000 has now been reached.

E. G. WILLIAMS 5/27/64 WR

Visited the Christmas Mine. The mine is still having trouble, heavy ground, poor ventilation and mechanical breakdowns. Interviewed Norman Thompson, Supt. who has just returned from Leads, S. D. and Butte, Mont. where he has been observing various kinds of mining in view of making some changes at Christmas. The tonnage is now 3000-3200.

EGW WR 1/29/65

Visited Christmas mine. interviewed Dick Hyde, Gen. Supt. Learned that crusher trouble had stopped production for a few days early in the month and they haven't been able to get fully organized since. Ventilation is still a big problem.

EGW WR 3/26/65

Visited Christmas Mine and talked to Mr. Bruce Crowley, planning engineer, Mr. Norm Thompson, mine superintendent and Dick Hyde, general superintendent. Drilling on surface near old or No. 3 shaft for possible small open pit operation to increase tailings for mine fill.

F. T. Johnson, Field Engineer WR 5/28/65

Christmas Mine starting a small open pit operation. The material mined will assay about .7% and is hoped the operation will break even as the tails are needed for mine fill.

FTJ WR 10/1/65

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine: Christmas Mine
Date: Sept. 14, 1962
District: Banner Dist., Gila Co.
Engineer: Ernest G. Williams
Subject: Mine Visit - Sept. 14, 1962

Visited Christmas Mine of Inspiration Consolidated Copper Co. at Christmas, Ariz., Bruce Whitney, Gen. Supt., Norman Thompson, Mine Supt.

The mine is working three shifts and has 142 men in the mine dept. At present, the only stoping is on 1400' mining level. This along with the development is making from 600 to 800 tons per day. The stopes are from 12' to 18' wide, 18' high. Drilling is done with Ingersol-Rand and Joy jumbos. Mucking is done with Sanford Day Transloaders. The back of the stopes are held with roof bolts and plates.

The mine is now pumping 2500 g.p.m. using three Hazleton pumps 750-940 g.p.m. capacity, 600 h.p. motors.

Bert Reed, Chief Geologist, stated that Inspiration was still confronted with a serious water problem at Christmas. However, it is hoped that this problem will soon be resolved.

MEMO - LEWIS A. SMITH - Interview with Bert Reed, Chief Geologist, Inspiration Copper Co., 11-29-62

Interview with Carroll Weed, General Manager, Inspiration Copper Co., 1-30-63

Mr. Weed stated the Christmas Mill is now handling over 2200 t.p.d. The water situation seems under better control.

MEMO - LEWIS A. SMITH 1-30-63

EXPLORATION CONTINUES AT INSPIRATION

A drilling program at Inspiration Consolidated Copper Co. is being conducted to determine the feasibility of developing a new open pit which will augment ore now being produced in the Live Oak and Thornton pits. Drilling during 1961 was partly completed in one sector of an area north of the Live Oak pit. If further work confirms expectations, about 24,000,000 tons of ore with a copper content of 0.62 percent would become available for mining. Tentative plans envision eventual mining of the deposit at a stripping ratio of about two to one. The company's Christmas mine is nearing the production stage and is expected to be regularly delivering ore for treatment by mid-year. The mine has reserves estimated at about 20,000,000 tons, of proven and probable ore, averaging 1.83 percent copper.

Taken from MINING CONGRESS JOURNAL, April 1962, p 98

Inspiration Consolidated Copper Company reports that the main 1600 level haulage drift at its Christmas mine, connecting the ore body with the McDonald shaft and the beneficiation plant, has been completed, and first movement of ore to the mill is to start shortly. Underground water, in some areas, has continued to make development progress slow and difficult.

Taken from MINING WORLD, June 1962, p 44.

CHRISTMAS MINE

GILA COUNTY
BANNER DISTRICT

The McDonald shaft at the CHRISTMAS MINE of INSPIRATION CONSOLIDATED COPPER COMPANY was completed to final 1,780 foot depth recently, and driving of the 1600-foot level main haulage drift toward the development shaft and ore body was started. Two headings are being driven from the underground development shaft and ore body toward the McDonald shaft with progress in one of these drifts being slow and difficult because of water. The hoist and compressor building, warehouse, change house, and office are all in use on the surface. Heavy crushing machinery has been ins talled, and construction of crusher buildings and auxiliaries is nearing completion,as is the fine ore storage building and its feed and conveyor system. Mill foundations and machinery placement are well advanced, though considerable w ork remains to be done on building erection, piping, wiring, and auxiliaries.

Taken from MINING WORLD, October, 1961, p 38

Bert Reed, Chief Geologist for Inspiration Copper Co., stated that he believed that the intrusives at the Christmas Mine were differentiates of the same magma. These include the diroite, andesite porphyry, monzonite porphyry, and quartz latite. He also stated that the principal mineralization in the diorite is in the form of a pipe.

Development work on the 1600 level is continuing.

MEMO - LEWIS A. SMITH - 11-22-61

Bert Reed said that the main drift south from the McDonald shaft had reached between 2300 and 2400 feet. At the same time the drift from the south was advancing well. The north drift is estimated to be about 1200 feet from its goal. The south drift will penetrate under the main ore areas. No notable ore was encountered in the north drift. Eventually pockets will be raised from the main drift into the ore areas. Water is still a problem, but is is felt that this may have lessened somewhat of late.

MEMO - Lewis A. Smith - Conference with Bert Reed, Geologist, Inspiration Copper Co. - 1-19-62.

Mine/active 2-1962 - B. B. Whitney, Gen. Supt., Inspiration Cons. Copper Co.,
and Mill Inspiration, Ariz. - 123 men working.

CHRISTMAS MINE

Frank Knight, Jr. (Sam Knight - Mill Super. Vice P-
Winkelman, Ariz. C.B. Hanraty)

5/16 - 1st
6/9 - Complete

1937	A&4R-N.	29,847 T.	1,469,804 Lb.
1938	A&4R-N.	6,361	338,041
1939	A&4R-N.	21,329	947,470
		2,762	112,007
1940	A&4R-N.	26,241	1,250,233
		86,540	4,117,555

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

ROSE MOFFORD, GOVERNOR
RANDOLPH WOOD, DIRECTOR

JOINT NOTICE OF PROPOSED ACTION

by the

U. S. Environmental Protection Agency
Region 9 (W-5-1)
215 Fremont Street
San Francisco, CA 94105

Telephone: (415) 974-8105

On Application for National Pollutant Discharge Elimination System (NPDES) Permit to Discharge Pollutants to Waters of the United States

State of Arizona
Department of Environmental Quality
2005 North Central Avenue-Room 202
Phoenix, AZ 85004

Telephone: (602) 257-2270

On Application for Certification for Compliance with Applicable Effluent Limitations and Appropriate Requirements of the State of Arizona

The Environmental Protection Agency (EPA), Region 9, San Francisco, California, and the Arizona Department of Environmental Quality (ADEQ) are jointly issuing the following notice of proposed action under the Clean Water Act (CWA).

The Environmental Protection Agency, Region 9, San Francisco, California, has received a complete application for a National Pollutant Discharge Elimination System (NPDES) permit and has prepared tentative determinations regarding the permit.

On the basis of preliminary review of the requirements of the Clean Water Act, as amended, the implementing regulations, the Regional Administrator, Region 9 Environmental Protection Agency, proposes to issue an NPDES permit to discharge to the following applicant, subject to certain effluent limitations and special conditions.

Public Notice No. 16-89-AZ July 3, 1989

Cyprus Miami Mining Company
P. O. Box 4444
Claypool, Arizona 85532
NPDES Permit No. AZ0020516

The applicant operates the Christmas Mine, located in the Christmas area, Gila County, Arizona. The existing discharge consists of storm water runoff. They have two (2) discharge points: No. 002 located at latitude 33° 05' 24" N, longitude 110° 42' 36" W and No. 003 located at latitude 33° 05' 55" N, longitude 110° 44' 52" W. Both discharges are to Dripping Springs Wash tributary to the Gila River. This segment of the Gila River (San Carlos Lake to San Pedro River) has protected uses of Aquatic and Wildlife, Full Body Contact and Agriculture Livestock Watering. The proposed permit contains effluent limits for Cadmium, Copper, Lead, Mercury, Zinc, Cyanide, Sulfides and pH. The proposed permit will expire approximately five (5) years after it becomes effective.

The State of Arizona is considering a request to certify the discharge described above, pursuant to Section 401 of the Clean Water Act. The certification will set forth any limitations and monitoring requirements necessary to assure compliance with water quality standards under Section 303, areawide waste treatment management plans under Section 208(e), effluent limitations under Sections 301 and 302, standards of performance under Section 306, or prohibitions, effluent standards or pretreatment standards under Section 307 of the CWA, and any other appropriate requirement of State law.

The State may certify a draft permit and specify conditions which are more stringent than those in the original draft permit, where the State finds such conditions necessary to meet the requirements of the CWA. For each more stringent condition, the certifying State agency shall cite the CWA or State law references upon which that condition is based. Review of appeals of limitations and conditions attributable to State certification shall be made through the applicable procedures of the State.

The Administrative Record, which includes the application, draft permit conditions and other relevant documents, is available for public review Monday through Friday from 9:00 a.m. to 4:00 p.m. at the EPA address below. A copy of the draft permit and other pertinent documents may be obtained by calling or writing to the addresses below.

Persons wishing to comment upon or object to the proposed determinations or request a public hearing pursuant to 40 CFR 124.12 should submit their comments or request in writing within 30 days from the date of this notice, either in person or by mail to:

U. S. Environmental Protection Agency
Region 9 (W-5-1)
Attn: Jon Hangartner
215 Fremont Street
San Francisco, CA 94105

Telephone: (415) 974-8299

State of Arizona
Department of Environmental Quality
Attn: Wayne H. Palsma - Room 202
2005 North Central Avenue
Phoenix, AZ 85004

Telephone: (602) 257-2270

All comments or objections submitted within 30 days from the date of this notice will be considered in the formulation of the final determinations regarding the application. If the response to this notice indicates a significant degree of public desire for a public hearing, the Regional

Administrator shall hold one in accordance with 40 CFR 124.12. A public notice of such hearing will be issued at least 30 days prior to the hearing. A request for a public hearing shall be in writing and shall state the nature of the issues proposed to be raised in the hearing.

The permit will become effective 33 days following the date of mailing by the EPA of the final permit. If no comments request a change in the draft permit, the permit will become effective three (3) days from the date of mailing.

A request for an evidentiary hearing may be submitted to the Permits Record Coordinator, (W-5-1), within 33 days following the mailing of the final determination, in accordance with 40 CFR 124.74. If granted, applicable provisions of the permit will be stayed pending the hearing.

Please bring the foregoing notice to the attention of all persons you know would be interested in this matter.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine	Christmas Mine	Date	9-22-61
District	Banner Dist., Gila Co.	Engineer	Lewis A. Smith

Subject: Interview with Carrol Weed, General Manager of Inspiration Copper Co. and Johnson (Geologist)

The surface plant near to the McDonald shaft is nearing completion. Skips and cages are now installed in the shaft. The main 1600' level drift is progressing well under a contract. Up to 35 feet of progress has been made in 24 hours in the drift. Water is yet causing considerable trouble, but this will be welcome once the mill is in operation. 113 men are now working at Christmas. It is believed that present haulage drift development will be finished sometime in 1962.

Mr. Johnson, (Bert Reed's assistant) stated that a recent hole and drifts had disclosed that it now appeared that the diorite central core might, in part, be quartz monzonite porphyry. The diorite next to quartz-latite dikes in the core was well mineralized, as well as around its periphery. This development, if at all wide spread, may increase the prospectable area appreciably. He mentioned that both the quartz-latite and monzonite were well mineralized.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine 'Christmas Mine

Date February 8, 1961

District Banner Dist., Gila Co.

Engineer Frank P. Knight, Director

Subject: Visited the Christmas Mine.

McDonald shaft sinking is at 1635 ft. depth. 1600 station is cut. Shaft is to go to 1785 ft. depth. Connection with No. 3 shaft for haulage at 1600' level progressing from No. 3 but not yet started from McDonald shaft. Cutting 1600' pocket. Don't yet know whether concreting will be necessary but afraid a sizeable fault cutting the pocket may make it so.

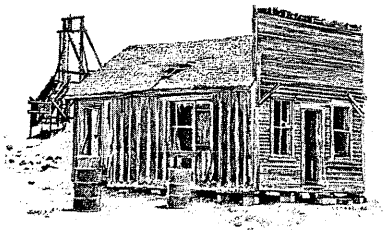
Pouring of mill foundations has started. Old mill idle at time of visit. They don't expect to get into operation before 1962.

1987, there has been a moratorium on issuing new mineral leases and renewing existing ones. The uncertainty regarding the future royalty rate has been the cause of consternation for the mining industry, as well as the Department, but there is optimism that the situation will soon be resolved.

Oil and gas rental income has dropped markedly during the past 5 years as a result of the industry slump. If oil or gas were ever discovered on State land, the Trust would receive a minimum of 12 $^1/_2$ percent of the market value of the oil or gas produced.

Mineral-material royalties have grown steadily during the past 5 years. Resources in this category include sand, gravel, rock, building stone, riprap, cinders, decomposed granite, topsoil, and any other mineral material used in the construction industry. After the Land Department receives an application to purchase mineral materials, it conducts an appraisal and the material is sold at public auction to the highest bidder. Revenue is guaranteed on each lease because the company must pay an annual minimum royalty. Rentals from mineral-material operations greatly increased in 1987-88 when the department began basing the rental figure on a percentage of land value. Total revenue from the sale of mineral materials during the past 5 years is only slightly less than that received from mineral-lease royalties.

Total revenues from subsurface leasing for the current fiscal year are expected to surpass those received in 1987-88. The continuing high price of copper has allowed several companies to increase production. This is excellent news for the industry, as well as the beneficiaries of the State Trust.



NEW AZGS PUBLICATION

The following publication may be purchased from the Arizona Geological Survey (AZGS), 845 N. Park Ave., #100, Tucson, AZ 85719. For price information on this and other publications, contact the AZGS office at (602) 882-4795.

Welty, J.W., and Schnabel, Lorraine, 1989, Bibliography for metallic mineral districts in Gila, Maricopa, Pinal, and Yavapai Counties, Arizona: Open-File Report 89-1, 123 p.

This report is the fourth in a series of county bibliographies for metallic mineral districts in Arizona. The others, Circulars 24, 25, and 26, were published by the AZGS in 1986. Nearly 1,600 citations are included in this compilation. The report has been open-filed to permit timely access to the public. After editing and printing, it will be released as a circular.

AZGS Accepts BOM Diamond-Drill Core

In early March 1989, the Arizona Geological Survey accepted a donation of nearly 32,000 feet of diamond-drill core from the U.S. Bureau of Mines (BOM). The core comes from 13 separate properties across the State (Table 1). The core was shipped from the BOM Twin Cities Research Center, where it had been stored, by the Minnesota Air Guard to Davis-Monthan Air Force Base in Tucson and then trucked to the Mission Unit of ASARCO Inc., where it remains in temporary storage. We thank members of the Minnesota Air Guard; Davis-Monthan personnel; Robert Willard, BOM Twin Cities Research Center; Michael Greeley, BOM State mineral specialist; and James Litchenthan, mine superintendent at the Mission Unit; for their generosity in enabling the AZGS to accept and store this drill core. Information about the geologic setting and logs for each drill hole can be found in the references listed in Table 1. For localities with no listed references, no published information is available. Please call our office (602-882-4795) to make an appointment if you wish to examine any of this core.

Table 1. Listing of BOM diamond-drill core localities.

Mineral District	Mine Name	Commodity Sought	Total Footage[1]	Number of Holes	Reference[2]
Ajo	Copper Giant	Cu	1,400	2	Romslo and Robinson (1952)
Apache Iron	Apache Iron	Fe	1,200	15	Stewart (1947)
Artillery Peak	Maggie Canyon	Mn	3,700	69	Kumke and others (1957)
Big Bug	Iron King	Cu	600	4	n.a.
Christmas	Christmas	Cu	3,700	7	Tainter (1948)
Cochise	Keystone	Cu, Zn	10,800	18	Romslo (1949)
Helvetia	King in Exile	Cu	100	1	n.a.
Hualapai	Antler	Cu, Zn	2,100	6	Romslo (1948)
Lakeshore	Lakeshore	Cu	200	1	Romslo (1950)
Pima	Esperanza	Cu	1,450	3	Tainter (1947)
Tiger	Crown King	Cu	1,400	3	n.a.
Wallapai	Cerbat	Pb, Zn	2,800	8	n.a.
Wallapai	Civitation	Cu	3,400	6	n.a.

[1] Total footage is rounded off to the nearest 100 feet drilled.
[2] "n.a." indicates that no references are available for this core.

References

Kumke, C.A., Ross, C.K., Everett, F.D., and Hazen, S.W., Jr., 1957, Mining investigations of manganese deposits in the Maggie Canyon area, Artillery Mountain region, Mohave County, Arizona: U.S. Bureau of Mines Report of Investigations RI 5292, 87 p.

Romslo, T.M., 1948, Antler copper-zinc deposit, Mohave County, Arizona: U.S. Bureau of Mines Report of Investigations RI 4214, 14 p.

____ 1949, Investigation of Keystone and St. George copper-zinc deposits, Cochise County, Arizona: U.S. Bureau of Mines Report of Investigations RI 4504, 21 p.

____ 1950, Investigation of Lake Shore copper deposits, Pinal County, Arizona: U.S. Bureau of Mines Report of Investigations RI 4706, 24 p.

Romslo, T.M., and Robinson, C.S., 1952, Copper Giant deposits, Pima County, Arizona: U.S. Bureau of Mines Report of Investigations RI 4850, 9 p.

Stewart, L.A., 1947, Apache Iron deposit, Navajo County, Arizona: U.S. Bureau of Mines Report of Investigations RI 4093, 88 p.

Tainter, S.L., 1947, Amargosa (Esperanza) molybdenum-copper property, Pima County, Arizona: U.S. Bureau of Mines Report of Investigations RI 4016, 15 p.

____ 1948, Christmas copper deposit, Gila County, Arizona: U.S. Bureau of Mines Report of Investigations RI 4293, 58 p.

Washington, D.C.
Sept. 8, 1943

SUBJECT: Christmas Copper

Negotiations practically completed with H. O. King last week were about finished today at lunch when Col. Moulton, DeWitt Smith and I agreed that Christmas would have 27¢ for its copper and a retroactive premium to make up for its losses.

This is a compromise which makes the best of losing out on the previous deal. Christmas will be in better shape leaving the Mudd interests out, I think.

I talked to Roland Knight in Boston today and he seems to be well satisfied with the deal, which I believe will be consummated in a few days, not later than next week.

It will please me very much to have this matter settled after all this time.

The arrangement will give them a development fund to go ahead in the lower workings, and will also leave the approval with Facilities Bureau I fought so hard to get, intact, so that if showings are satisfactory, the milling end can be taken up later without reapproval. Money will be provided for camp improvement and road betterment.

Bill Broadgate

Washington, D.C.
Sept. 12, 1943

SUBJECT: Christmas Copper
Willis memo Sept. 10

Thanks a lot for the kind remarks about the work on Christmas.

It has been quite a battle.

I had a conference with Moulton Saturday Morning, and took King to lunch later, and I think it will be OK.

The final settlement should be made this week, and Roland Knight is to be down here, probably this evening.

Bill Broadgate

P. S. I think that Roland Knight, at least, is appreciative of our efforts in their behalf.

Washington, D.C.
Sept. 15, 1943

SUBJECT: Christmas Copper Corp.

I am glad to say that the Christmas deal is all signed, sealed and delivered after a hectic day yesterday.

Roland Knight seems to be pleased, as he should be.

Bill Broadgate

December 10, 1943

Mr. Frank Knight
Christmas Copper Co.
Winkelman, Arizona

Dear Frank:

I am enclosing a memorandum regarding your access road and the general access road situation which I have just written to Bill Broadgate.

I suggest that you contact your brother, Roland, as soon as possible and get him to get in touch with Bill Broadgate and get busy if you really want your road.

With best wishes, I am

Yours very truly,

J. S. Coupal, Director

JSC:LP
Enc.

Washington, D.C.
March 15, 1945

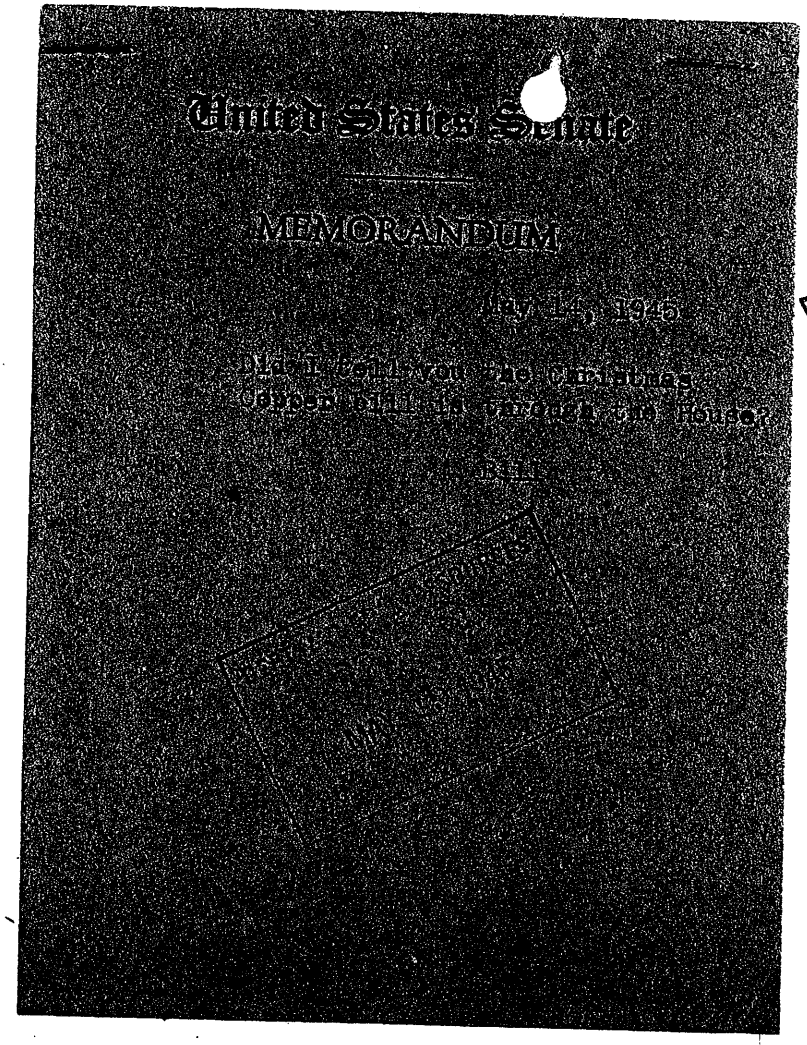
TO: C.H.DUNNING
FROM: W.C.BROADGATE
ABOUT: CHRISTMAS COPPER CORP

I suppose I told you that the drilling program we promoted for this mine by Bureau of Mines now in under way.

I am further glad to tell you that the private bill for the relief of Christmas to the amount of $18,700 we today had reported out of the House Reclamation and Irrigation Committee with a "do pass" recommendation. I wrote the report myself so it should be favorable!

The bill will now go on the consent calendar and I trust will be passed very shortly.

Bill Broadgate



United States Senate

MEMORANDUM

Dec. 14

Roland Knight of the Christmas Copper Co is here. Had lunch with him and a long talk.

I think he will appear before the Committee and tell of his experiences with the WPB about Wednesday.

Ickes slipped out on us on the pretext of having to make a trip West, but promised to appear early in January.

Bill Broadgate

COPY

NATIONAL MILITARY ESTABLISHMENT
MUNITIONS BOARD
Washington 25, DC

Refer to
MB 410.2 Copper

14 July 1948

Honorable Zales N. Ecton
United States Senate

Dear Senator Ecton:

Reference is made to your letter of 30 June 1948, concerning the Christmas Copper Company. That Company's letter of 21 June to the Munitions Board has been referred to the Bureau of Federal Supply for handling, inasmuch as that Bureau has the responsibility of negotiating all purchases for the stockpile.

The only reaction that we can give to the Christmas Copper Company's proposal at this time is that we certainly feel it to be worthy of thorough investigation and we have proceeded in that direction.

Sincerely yours,

s/ R. W. Paine
Rear Admiral, U. S. Navy
Director for Materials & Foreign Trade

cc: Mr. H. C. Maull, Jr.
Bureau of Federal Supply

NATIONAL MILITARY ESTABLISHMENT
MUNITIONS BOARD
WASHINGTON 25, D.C.

Refer to
MB 410.2 Copper

26 JUL 1948

Honorable Carl Hayden

United States Senate

Dear Senator Hayden:

This will acknowledge receipt of your letter of 13 July 1948, with regard to your interest in the Christmas Copper Company of Arizona.

In accordance with your request, we are inclosing a copy of our reply of 14 July to Senator Zales N. Ecton on this subject.

Sincerely yours,

R. W. Paine

R. W. PAINE
Rear Admiral, U. S. Navy
Director for Materials and Foreign Trade

1 Incl.
Ltr dtd 14 Jul to
Sen Ecton fr MB

United States Senate

COMMITTEE ON APPROPRIATIONS

July 28, 1948

Mr. Roland H. Knight
Christmas Copper Corporation
29 West Street
Beverly Farms, Massachusetts

My dear Roland:

For your information and file I am attaching hereto a copy of a reply I have just received from Rear Admiral R. W. Paine, Director for Materials and Foreign Trade of the Munitions Board, together with the text of his response of July 14, to Senator Zales N. Ecton who wrote to Admiral Paine on behalf of the Christmas Copper Company at the request of our mutual friend, Bill Broadgate.

With kindest personal regards, I am,

Yours very sincerely,

Carl Hayden

September 24, 1957

TO: Mr. Frank P. Knight, Director

FROM: Lewis A. Smith, Field Engineer

Subject: CHRISTMAS MINE: INSPIRATION COPPER CO.

At present (Sept. 1957) the only activities were confined to block hole development drilling and the preparation of a new shaft site to the Northwest of the present shaft. The broken drums on the hoist at the old shaft have been replaced and the hoist is operating. No shipping is being done at present. Results of the development program were considered to be fair. Mr. Thompson is Superintending, acting under H. Carol Weed from Miami.

Information from MINE INSPECTOR'S OFFICE - August 15, 1957

CHRISTMAS MINE Banner Dist., Gila Co. CU 2-7-57

Inspiration - Cu Co.

R. S. Newlin, N. Y., Pres.
H. M. Jacop " Sec.
Norman Thompson, Globe, Supt.

2500 tons per mo.
Development.
62 men

COPPER - 4727 tons monthly (underground) - 67 men 5-20-57

L.A.S.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Christmas Mine | Date September 22, 1960

District Banner Dist., Gila Co. | Engineer Lewis A. Smith

Subject: Interview with Bert Reed, Chief Geologist and Carroll Weed, General Manager of Inspiration Copper Co.

Mr. Weed stated that the MacDonald shaft had now been sunk to 1100 feet of the 1750 feet goal. Some accessory buildings were now well along. A conference with Bert Reed revealed some pertinent facts about the geology south of the Sleeping Beauty Pit (Huffman property)(in an area described in the Huffman Mine visit report).

CHRISTMAS MINE

GILA COUNTY
BANNER DISTRICT

INSPIRATION CONSOLIDATED COPPER COMPANY is nearing completion of its new McDonald headframe for the CHRISTMAS MINE at Winkleman, Arizona, and shaft sinking equipment is being installed. Orders have also been placed for ore hoisting and crushing equipment. The warehouse building is finished and mine change house and office are almost ready for use. Pilot mill testing has been going on and a final decision on a mill flow sheet is expected soon. The property is scheduled for production in about three years.

Taken from MINING WORLD, December, 1959

A conference with Bert Reed, Inspiration, revealed that the Christmas shaft is now below the 1600' level where it will remain for the time being. Three lateral workings are now being driven on the 1600' level.

LEWIS A. SMITH, Weekly Report - 1-20-61

CHRISTMAS COPPER CORPORATION

CHRISTMAS, VIA WINKELMAN
ARIZONA

May 22, 1943

Mr. J. S. Coupal, Director,
Department of Mineral Resources,
413 Home Builders Bldg.,
Phoenix, Arizona.

Dear Sam:

Many thanks for your letter of May 20th.

Have just written Charley that we've had so many kicks in the pants for many years past, we're afraid to accept good news. But we trust the project here will advance rapidly to justify in part your many efforts on behalf of the small operators, and that other projects in Arizona will follow.

Bill has done a swell job for us, and needless to say we are grateful.

With kindest personal regards, I am

Sincerely yours,

Frank P. Knight Jr.

Vice President

CHRISTMAS COPPER CORPORATION

CHRISTMAS, VIA WINKELMAN
ARIZONA

August 9, 1943

Mr. J. S. Coupal, Director,
Department of Mineral Resources,
413 Home Builders Bldg.,
Phoenix, Arizona.

Dear Sam:

Re your general letter of August 5th, please send us 45 of the white forms and a couple of the yellow. mailed

Re your July 30th memorandum on rubber tires for wheelbarrows, Sam has written the local rationing board as suggested, but we believe the matter will have to go to Washington. The tire manufacturers say O.P.A. will allow rubber tires to power machinery only. W.P.B. told us at Washington they could do nothing about it. However, we hope Mr. Eck can get an order through.

Lt. Col. Herbert G. Moulton, who replaced Frank Ayer, personally checked on Christmas last week. He talked continuing present production of fluxing ore and dropping the expansion project. The defeatist attitude with respect to man power for all mines has already borne fruit in the serious, general falling off of production. Surely 2 to 4 tons of copper per month is important enough to get the necessary men to produce it from somewhere, somehow - and without taking from the small to feed the large mines to thereby help total production to drop further.

Sincerely yours,

Frank P. Knight Jr

Vice President

CC: Roland H. Knight

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

WESTERN UNION

(156)

SYMBOLS

DL=Day Letter
NT=Overnight Telegram
LC=Deferred Cable
NLT=Cable Night Letter
Ship Radiogram

A. N. WILLIAMS, PRESIDENT
NEWCOMB CARLTON, CHAIRMAN OF THE BOARD
J. C. WILLEVER, FIRST VICE-PRESIDENT

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

CA265 9 COLLECT=SN WASHINGTON DC 20 237P

1943 MAY 20 PM 12 59

ARIZONA DEPT OF MINERAL RESOURCES=

413 HOME BUILDERS BLDG PHOENIX ARIZ=

CHRISTMAS COPPER PROJECT APPROVED BY FACILITIES CLEARANCE BOARD=

W C BROADGATE.

May 20, 1943

Dear Sam,

I was pleased to be able to give you the good news on Christmas so you could communicate it to ~~Frank Kingk~~ Frank Knight first.

The freeze is definately broken. White Pine will be acted on by tomorrow morning. This does not interest you directly, but I have high hopes of it passing and if it does, I will have the Michigan delegation behind me 100%.

Jim England has been with me the last couple of days and I have been helping him a littel with an export license, etc.

Roland Knight will be here tomorrow.

Michault will be here Monday. As I expected, the Departmental reports have raised a crop of questions in SWPC.... all I wanted was a list of mines which would be helped by a custom mill and a guess on production. It never pays to go too far with the SWPC.

Bill Broadgate

Washington, D.C.
July 24, 1943

SUBJECT: Christmas Copper

This project is approaching the conclusion of the Metals Reserve lease arrangements.

The delays have been due to outstanding debts to be gathered in and creditor's standbys are now 99% in hand.

There will be, according to Roland Knight, some additional technical requirements from the attorneys, but he sees nothing that should hold up matters very long.

I shall be very happy to get this approved and under way, as it very specially has been my baby, as you know.

Bill Broadgate

Sam; — Wiseman told me (confidentially) they had been requested to take over this project. WPB made the request

May 20, 1943

Mr. Frank P. Knight, Jr.
Christmas Copper Company
Winkelman, Arizona

Dear Frank:

Congratulations!

I have just received the following wire from Bill Broadgate and you undoubtedly have also been advised:

"CHRISTMAS COPPER PROJECT APPROVED BY FACILITIES CLEARANCE BOARD."

With best wishes and hoping this means that you are now off to a good start, I am

Very truly yours,

J. S. Coupal, Director

JSC:kk

Washington, D.C.
May 10, 1943

SUBJECT: Christmas Copper

I just talked long distance with Roland Knight.

He is very pleased with the work we have been doing on Christmas and that it is one of the two test cases to be presented to Facilities Bureau by the Copper Division at my request.

Bill Broadgate

Copper ~~Ritka~~ Division is about to put out a questionaire to determine in detail the local labor situation. I went over it with the Deputy Director and suggested an additional point.... the number of men who had been drafted each month for the past year... so I can put the bee on Hershey. We are complaining bitterly about the continuation of drafting of mine workers in spite of the directives Hershey has issued.

United States Senate

MEMORANDUM

Dec. 15

Was with Roland Knight of Christmas Copper again today for a while.

Knight will appear before the United States Special Committee to Study Problems of American Small Business tomorrow and tell his experiences with WPB. It looks as though we could make out a good Mexican labor case out of this as Christmas is a Mexican camp and McNutt promised the importation of plenty of Mexicans if needed.

Bill Broadgate

Washington, D.C.
Feb. 10, 1943

SUBJECT: Christmas Copper Corp.

Roland ~~Tom~~ Knight was in today. He filed a letter with the Copper Branch indicating that the labor situation is not bad.

I have asked them to put the project through Facilities Bureau ~~again~~ and I am trying to catch it on the way through with an endorsement from Nelson's office and also to bring it to the attention of Wilson.

Bill Broadgate

Washington, D.C.
Dec. 17, 1942

SUBJECT: WPB policy

Since the Hearings on the Christmas case, Doug Corner has gotten a clearance from WPB. He dropped in last night and said "that must have been some fire you built under WPB" etc.

Also, Christmas has been told to present a formal request for reopening the case.

I have not been able to break loose the Boulder case as yet, but hope to yet manage it somehow. Its a tough one.

Bill Broadgate

Washington, D.C.
Dec. 16, 1942

SUBJECT: Christmas Copper Co
WPB policy re small mines.

The hearings on this case were held today and I especially tried to have brought out, as this is a Mexican Camp, that if McNutt would get busy on his promised Mexican miner imports, this and other cases would be solved. Also rang in the matter of restricted materials to the mining industry.

We showed that the truble was not with the Copper Branch but somewhere higher up in the WPB where small projects are turned down, etc.

Busy day.

Bill Broadgate

CONFIDENTIAL

Washington, D.C.
May 11, 1943

SUBJECT: Copper projects, frozen list

It looks as though, in my attempt to put Christmas, Silver Bell, etc over the top, I may have made a powerful enemy..... Mrs. Greenway-King.

I have heard it from many sources that she is determined to put Harry up as the next Senatorial candidate from Arizona if the atmosphere can be properly set.

She is mending fences all over the capitol and certainly cannot thank me for dragging Harry's skeletons out in public so that she has to do so much covering up.

She sent Harry up to see Senator Murray today and make peace with him, and to explain his actions.... fortunately, the Senator called me into the conference and so I was able to turn it the right way.

But, shortly afterward, I discovered accidentally that she has invited Scrugham to dinner Thursday, where I won't know what goes on, though I hope to have a pre-conference with the Senator tomorrow.

I certainly have stirred up a hornet's nest.... I have managed to walk on a lot of eggs so far without cracking any too badly, but it may be I have cracked a few this time.

Greenway cannot afford to have Harry in bad odor with the producers if he goes ahead with political ambitions. I don't know how far she might go to try and spike my guns, but I am keeping a sharp eye open for storms.

Perhaps I am getting ahead of myself a little, but I am seeing a little too much Greenway in the background for comfort these days.

Bill Broadgate

xxxxxxxxxxxxxxxxxxxxxxx

413 Home Builders Bldg.

June 22, 1942

Mr. Frank P. Knight, Jr., Vice President
Christmas Copper Corporation
Christmas, via Winkelman, Arizona

Dear Frank:

In reply to your letter of June 16 I am enclosing four forms for intention to hold unpatented mining claims. I am not sending you the 24 as intention to hold more than one claim can be filed on the same notice. We have provided in this form 12 lines so that any company filing its intention to hold on 12 claims can file or include them on one form.

If you need the additional forms, please advise me and I will send them to you.

Yours very truly,

J. S. Coupal, Director

JSC:LP
Enc.

SURVEY OF OPERATING MINES

By: Fred H. Perkins

June 8, 1942

CHRISTMAS MINE

Problems:

From a long talk would say Mr. Knight's problems are financial. He is trying to arrange for a loan so he can get the mill to going.
His bonus money on copper price is slow in arriving.

CHRISTMAS COPPER CORPORATION

CHRISTMAS, VIA WINKELMAN
ARIZONA

June 16, 1942

Mr. J. S. Coupal, Director,
Department of Mineral Resources,
Home Builders Building,
Phoenix, Arizona.

Dear Sam:

I note in Pay Dirt that the Department has available forms for notices of intention to hold unpatented mining claims under the recent act.

Will you please send us 24 forms and let us know the charge if any.

Yours very truly,

Frank P. Knight Jr

Vice President

FPKJR:m

CHRISTMAS COPPER CORPORATION

CHRISTMAS, ARIZONA

May 31, 1941

Mr. Charles F. Willis
Chairman, Board of Governors
Arizona Department of Mineral Resources
520 Title & Trust Building
Phoenix, Arizona

Dear Charley,

I am glad to note in your letter of May 29 that you are led to believe that some kind of a proposition with the government can be made to permit the marginal mines to work.

I am sorry our questionnaire is delayed, but we considered it best to refer the matter to Mr. Mudd. His reply should be forth-coming right away; and if he does not prefer to file the questionnaire himself, we will, in all probability, submit it as quickly as possible.

With kindest personal regards,

Yours very truly,

Frank P. Knight Jr.

FPKJr:LL

Cc: B.F.

FRANK P. KNIGHT, PRES.
FRANK P. KNIGHT, JR., VICE PRES.
ROLAND H. KNIGHT, TREAS.

CHRISTMAS COPPER CORPORATION
29 WEST STREET
BEVERLY FARMS, MASSACHUSETTS

June 4, 1941

Mr. Charles F. Willis
Chairman Board of Governors
Arizona Department of Mineral Resources
Capitol Building
Phoenix, Arizona

Dear Mr. Willis:

We are sending you herewith the two completed questionnaires. The lessee, Mr. H. S. Mudd, is informed of and approves the answers to that questionnaire which relates among other things to the amount of copper which could be produced at different prices.

We certainly commend your efforts in this direction and hope that they will meet with a measure of success.

In the first questionnaire the question "What would be your ideas on financing and carrying out such a plan as is indicated by these questions?" does not seem applicable in our particular case in view of the other answers to the questionnaire. Generally speaking, however, we would feel that a commitment by the government to purchase copper at a profitable price and in quantity sufficient to make reasonably certain the return of the capital required would have the result that properties of merit would be able promptly to obtain financial assistance to the extent that their situations warrant.

Sincerely yours,

CHRISTMAS COPPER CORPORATION

By Roland H. Knight

RHK:TR
Encs.
CC F.P.Knight,Jr.
CC H. S. Mudd

FRANK P. KNIGHT, PRES.
FRANK P. KNIGHT, JR., VICE PRES.
ROLAND H. KNIGHT, TREAS.

CHRISTMAS COPPER CORPORATION
29 WEST STREET
BEVERLY FARMS, MASSACHUSETTS

June 9, 1941

Mr. Charles F. Willis
Chairman Board of Governors
Arizona Department of Mineral Resources
Capitol Building
Phoenix, Arizona

Dear Mr. Willis:

Mr. Mudd calls attention to what on the face of it might be regarded as conflicting statements in the two questionnaires filed with you recently. Under the Ore Reserves heading there is set out Harrison Schmitt's opinion that geological conditions suggest the strong probability of 1,800,000 tons of ore remaining below the 500 level West of the Christmas fault; whereas in the other questionnaire the statement is made that "It is doubtful if enough ore can be found to continue profitable operations for more than three years." Mr. Mudd's office suggests that we write to you again and explain that it would not now be prudent or conservative to assume that more than one-third of Mr. Schmitt's estimate will contain sufficient copper to be handled at a reasonable profit with a copper price of 15 to 16¢ per pound.

Sincerely yours,

CHRISTMAS COPPER CORPORATION

By Roland H. Knight

RHK:TR

CC to Mr. H.S.Mudd
Mr.F.P.Knight Jr.

September 22, 1941

Mr. Frank P. Knight, Jr.
Christmas Copper Corporation
Winkelman, Arizona

Dear Frank:

Many thanks for the letter of September 17, and I have handed the copy to Mr.Leeson who made the inquiry. He appreciates the information given and is expecting his people in for investigation some time this week. I am in hopes that this may lead to some definite action and you will undoubtedly be advised direct from Mr. Leeson.

With best wishes, I am

Very truly yours,

J. S. Coupal

JSC:LP

CHRISTMAS COPPER CORPORATION

CHRISTMAS, VIA WINKELMAN
ARIZONA

September 16, 1941

Mr. J. S. Coupal, Director,
Department of Mineral Resources,
518 Title and Trust Building,
Phoenix, Arizona.

Dear Mr. Coupal:

Your letter of September 13th is at hand. Following our conversation last Friday evening, I have given some thought to the possibilities of the Christmas property as a supplier of lime for manufacture of cement, but of course have not gone into the matter very thoroughly.

In so far as I know, some 15,000 feet vertical of limestone, which in this vicinity we call the Tornado and Martin series, of Carboniferous and Devonian ages, are the limestones in which a cement plant within a 150 mile radius of Phoenix would necessarily be interested. The Martin series represent about the lower one-fifth of the total, and is less pure, more dolomitic. We happen to have analysed three of the Carboniferous beds exposed at Christmas, and found them to contain over 85% $CaCO_3$.

We are poorly posted about lime quarries for cement plants, but at the requirement of 300 tons a day, the limestones available for quarrying at Christmas seem to be good as to quality and more than adequate as to tonnage, with practically no over-burden. The cost of delivery to the railroad should be well under 75¢ per ton.

There are several advantageous factors here at Christmas. A branch of the Southern Pacific runs to the property. A Government power line from Coolidge Dam crosses the property and the distributing lines for the Christmas mine are interconnected with it, also with the Christmas 1,800 H.P. diesel plant. There should be no interference between mining operations and the extraction of limestone, and mutual benefits would be

9/16/41

likely.

The property at present is leased to Harvey S. Mudd of Los Angeles. Mr. Mudd's agent is at the property, and Mr. Leeson or anyone he might send here is welcome to examine the limestone possibilities.

Thanking you for bringing the matter to our attention.

Yours very truly,

F. P. Knight Jr.

Vice President

FPKJr:LL

cc: Enc.
cc: B.F.

2D

SURVEY OF OPERATING MINES

By: Fred H. Perkins

June 8th, 1942

CHRISTMAS MINE

Christmas Copper Corporation

Sam Knight, Lessee

Address: Winkelman, Arizona

Christmas Mine

Located at Christmas, Arizona

1941 Production all in copper. 1,300,000 pounds copper ore
* sold to A. S. & R. Smelter, Hayden Plant.
Average of 40 men employed
High silica content makes this ore valuable to smelter.

1942 Production to May 1, 1942, 442,000 pounds copper.
Average men employed 50
1000 tons of ore per month produced
This years' ore just a little higher in copper content over 1941 production. A 500 ton plant on the property idle as the Smelter takes mine run at rate of 1000 tons a month.

* Average copper content 2½% per ton for first 4 months of 1942.
Silica 60% or over.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine CHRISTMAS MINE Date October 1st, 1942

District Engineer FRED H. PERKINS

Subject: PRODUCTION POSSIBILITY SURVEY

CHRISTMAS COPPER CORPORATION - Sam Knight, Lessee - Address: Winkelman, Arizona.

Christmas Mine is located at Christmas, Arizona. This mine production is all in copper. 1,300,000 pounds of copper ore was sold to American Smelting and Refining Company, Hayden Plant, during 1941 and an average of forty men were employed. High silica content of the mine run makes this ore so desirable to the smelter.

In 1942 to date 639,200 pounds of copper has been sold to the American Smelting and Refining Company.

There has been an average of fifty men employed per month.

A 500 ton concentrating plant, complete, is on the ground but idle. The American Smelting and Refining Company has contracted to use 1000 tons mine run per month.

The average copper content is $2\frac{1}{2}$% per ton during the past year.

Silica 60% or over.

PROBLEMS:

After a long talk with the Lessee, Mr. Knight, I would say his major problems are financial. He would like to borrow to remodel the mill and make a sale of his concentrates instead of his mine run.

INCREASE PRODUCTION SURVEY October 1, 1942

By: FRED H. PERKINS CHRISTMAS MINE

CHRISTMAS COPPER CORPORATION

Sam Knight, Lessee

Address: Winkelman, Arizona.

Christmas Mine is located at Christmas, Arizona.

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The average copper content is 2½% per ton during the past year.

Silica 60% or over.

INCREASE PRODUCTION SURVEY October 1st, 1942

By: FRED H. PERKINS CHRISTMAS MINE

PROBLEMS:

After a long talk with the Lessee, Mr. Knight, I would say his major problems are financial. He would like to borrow to remodel the mill and make a sale of his concentrates instead of his mine run.

ODT

DEPARTMENT OF MINERAL RESOURCES

REPORT TO OPA ON ACTIVE MINING PROJECT

Date 3/20/45

Name of Mine Sam Knight's Lease

Owner or Operator Ray L. Stater

Address Wickenburg Ariz

Mine Location Contract hauler for Knight.

Filing Information

File System

File No.

This chart to be used for gallons of gasoline required per month.

PRESENT OPERATIONS: (check X)

Production X; Development ; Financing ; Sale of mine ;

Experimental (sampling) ; Owner's occasional trip ;

Other (specify)

PRODUCTION: **Past and Future.**

	Tons
Approx. tons last 3 months	
Approx. present rate per 3 months	
Anticipated rate next 3 months	Considerable
If in distant future check (X) here	

EQUIPMENT OPERATED:

Type	Quantity or Horse Power	Miles or Hours Per Month	Gallons Required Per Month
Personal Cars			
Light or Service Trucks			
Ore Hauling Trucks	1	1800	300
Compressors			
Other Mine or Mill Eqpt.			

PRODUCT PRODUCED OR CONTEMPLATED: Name metals or minerals.

Copper

REMARKS:

Stater is a contract hauler for Knight who is a producer at Christmas Mine.

ARIZONA DEPARTMENT OF MINERAL RESOURCES

By Chas. F. Willing

ARIZONA DEPARTMENT OF MINERAL RESOURCES
CAPITOL BUILDING, PHOENIX, ARIZONA

NAME OF PROPERTY Christmas Mine

LOCATION AND ACCESSIBILITY OF PROPERTY Banner Mining District, Gila County on branch of Southern Pacific Railroad

HISTORY OF OWNERSHIP See attached table

PRODUCTION HISTORY See attached table

GENERAL GEOLOGY (BRIEF) "The geological setting at Christmas is that of a quartz-biotite-diorite plug which has intruded a thick series of limestones, shales, sills and volcanic rocks which normally dip about 12 degrees southeast. At and near the contact of the plug with the wall rocks there are concentrations of silicates, oxides and sulphides largely in sedimentary rock hosts. Modern nomenclature classifies such deposits as contact pyrometasomatic. They previously would have been termed contact metamorphic." (Harrison Schmitt, Feb. 18, 1940)

ORE OCCURRENCE The ore occurs in subhorizontal beds varying from 5 to 70' in thickness, but as a rule under 15' with the lateral dimensions exceeding the vertical by 10 or more times.

600,000

ORE RESERVE (QUANTITIES AND VALUES). "The geological conditions at the Christmas mine are such as to suggest the strong probability of the existence of an additional 1,800,000 tons of ore west of the Christmas fault, largely in the country below the 500 level down to the Troy quartzite which is 700 feet below this level, i.e., at the 1200 ft. level. There is probably an additional large tonnage of ore east of the Christmas fault at an unknown depth. Too little is known about this latter possible ore, however, to consider it seriously in this appraisal, although it's likely existence makes the risk of financing the mine more attractive." (Harrison Schmitt, Feb. 18, 1940)

ACCESSORY METALS OF VALUE. Gold and silver in amount yielding about 3/4¢ per pound of copper produced.

DEVELOPMENT WORK DONE. The mine is developed by various shafts and adits. The main working shaft is the No. 3 which was retimbered in 1937 to the 770 foot level, though it is actually 908' deep. Stations are maintained on the 200, 300, 400, 635 and 770 levels. There have been driven between 40,000 and 50,000 feet of drifts and raises of which probably one-half have been abandoned and are now inaccessible.

PLANTS (WITH CAPACITY) ALREADY ON PROPERTY. The equipment includes a 500 ton concentrating mill, 1800 h.p. Diesel engine plant, machine and carpenter shops, compressors, hoists and numerous buildings. For the year ended April 30, 1931, when the mill was closed, production was 220,000 tons. Some repairs and replacements, particularly in underground tools and equipment, housing facilities and mill repairs will be necessary before this production can be handled, but all of the many necessary pieces of heavy equipment are intact and in good condition with the single exception of one gyratory crusher.

DATE June 4, 1941 SIGNED CHRISTMAS COPPER CORPORATION

By Lawrence Wright
Treasurer

CHRISTMAS MINE PRODUCTION

Time	Producer	All ore dry tons produced & sold	Copper paid for lbs.
1882-4	(2 small furnaces installed and small amount produced.)		
1905-7	Saddle Mountain Mining Company	113,322	4,484,374
1908-15	Small amount from development-not shipped		
1916	Gila Copper Sulphide Co. (A.S.&R.)	71,788	3,738,913
1917	" " " " (")	90,358	4,128,264
1918	" " " " (")	90,870	4,606,461
1919	" " " " (")	92,640	4,584,957
1920	" " " "	62,510	2,678,389
1921	" " " "	2,694	105,256
1922-24	" " " "	None	
1925	" " " "	5,967	286,027
1926	Christmas Copper Company	44,142	2,053,361
1927	" " "	37,687	1,586,630
1928	" " "	38,019	1,459,707
1929	" " "	129,741	4,417,770
1930	" " "	216,433	6,924,735
1931	" " "	78,644	2,447,780
1932	" " "	5,040	214,359
1933-36		None	
1937	Christmas Copper Corporation	29,692	1,225,982
1938	" " "	6,098	275,303
1939	" " "(Lease)	24,790	889,698
1940	" " "(Lease)	25,357	1,007,999
		1,165,792	47,115,965

average = 40.41 lbs. cu per ton. mined

ARIZONA DEPARTMENT OF ERAL RESOURCES, CAPITOL LDING, PHOENIX, ARIZONA

QUESTIONNAIRE

RELATING TO SURVEY OF POTENTIAL COPPER PRODUCTION FROM ARIZONA SMALL AND MARGINAL MINES FOR NATIONAL DEFENSE PURPOSES;

NAME OF MINING PROPERTY Christmas

LOCATION Banner Mining District, Gila County, Arizona

OWNERSHIP Christmas Copper Corporation

NAME OF MANAGER Frank P. Knight, Jr.

POST OFFICE ADDRESS Winkelman, Arizona

COPPER PRODUCTION (POUNDS) DURING EACH OF THE PAST FIVE YEARS:

1936 none 1937 1,225,982 1938 275,303

1939 889,698 1940 1,007,999

1941 RATE OF COPPER PRODUCTION BASED UPON FIRST FOUR MONTHS 1,100,000

HOW MUCH COPPER COULD THIS PROPERTY PRODUCE ANNUALLY

ON A 14 CENT PRICE? doubtful

ON A 16 CENT PRICE? 10,000,000#

ON AN 18 CENT PRICE?

ON A 20 CENT PRICE?

WHAT PRICE COPPER IS NECESSARY FOR THIS PROPERTY? 16 CENTS PER POUND?

WHAT PLANT FACILITIES WOULD BE REQUIRED AND HOW MUCH IS THE ESTIMATED COST IN THE EVENT A 14 CENT PRICE COULD BE ASSURED?

A 16 CENT PRICE COULD BE ASSURED? development work $150,000
mine and mill equipment and housing $150,000

18 CENT PRICE?

20 CENT PRICE?

FOR WHAT LENGTH OF TIME WOULD ASSURANCE OF PRICE AND SALE OF FULL PRODUCTION BE NECESSARY? 3 years 1942 to 1944 inclusive

HOW LONG WOULD IT TAKE, AFTER FINANCING HAS BEEN PROVIDED FOR, BEFORE PRODUCTION ON THE ABOVE BASIS COULD BE REACHED? 8 months

DOES YOUR ORGANIZATION HAVE THE FACILITIES FOR RAISING THE NECESSARY CAPITAL TO INCREASE PRODUCTION TO THE AMOUNT STATED? Lessee has facilities for raising capital if assured of 16 cents copper price for 1942-1944 inclusive.

IF NOT, DO YOU BELIEVE THAT YOUR COMPANY WOULD BE AMENABLE AND AGREEABLE TO GOVERNMENT FINANCING?

DO YOU BELIEVE THAT YOU COULD FINANCE THE CAPITAL INVESTMENT YOURSELF ON SOME SUCH BASIS AS A GUARANTEE OF SALE OF OUTPUT AT A FIXED PRICE AND FOR A DEFINITE PERIOD, WITH DAMAGES TO COVER UNAMORTIZED PORTION OF CAPITAL INVESTMENT IN THE EVENT THE GOVERNMENT FAILED TO TAKE THE OUTPUT FOR THE AGREED UPON TIME - OR SOME SIMILAR ARRANGEMENT? Lessee could do so under conditions indicated below.

PLEASE LET US HAVE YOUR COMMENTS ON THE PROBABILITY OR POSSIBILITY OF YOUR ORGANIZATION PARTICIPATING IN SUCH A PROGRAM FOR NATIONAL DEFENSE PURPOSES

The Christmas Mine is now being explored at greater depths than those previously worked. These explorations may possibly disclose the presence of higher grade ore than was produced in past operations. If they disclose more ore but of no better grade than that previously mined, there will be little incentive to put more capital into the property unless there is a reasonably assured copper price of at least 15¢ to 16¢ per pound for the years 1942, 1943, and 1944. Wages have been raised at the property recently, it must be expected that wages will increase still further, and that costs of supplies will gradually increase. It is possible that the smelting charges will also be increased as a result of increased costs of smelter operation, increased freight on products to market, etc. In view of these anticipated increases in operating costs it is very doubtful that a price of 14¢ will be sufficient to pay more than operating costs, without including about 1¢ per pound of copper which will be required to return in three years the investment necessary to put the property on a production basis of about 10,000,000 pounds per year. It is doubtful that enough ore can be found to continue profitable operations for more than three years.

With a guaranteed price of 16¢ per pound, it is our opinion that the lease holder, who is now carrying on explorations could be induced to make the investment necessary to produce at the rate of about 10,000,000 pounds of copper per year. Further important new discoveries of ore will be necessary before there will be justification for producing at a considerably higher rate.

WHAT WOULD BE YOUR IDEAS ON FINANCING AND CARRYING OUT SUCH A PLAN AS IS INDICATED BY THESE QUESTIONS?

KINDLY LIST NAMES AND ADDRESSES OF OTHER POTENTIAL COPPER PRODUCERS IN ARIZONA WHOSE OPERATIONS SHOULD BE INCLUDED WITH THIS SURVEY

DATE June 4, 1941 SIGNED CHRISTMAS COPPER CORPORATION

By [illegible]

Treasurer

Silver City, New Mexico
February 18, 1940

To: Christmas Copper Corp.
Christmas
Arizona

From: Harrison Schmitt

Subject: The Christmas Copper Mine

Conclusions: At end of report

Appendix: Map A, Sections AA', BB', CC' and SS'. Fig. 1 and reports by Hershey, et al (1912), Locke, et al (1920), G. A. Packard (1934) and H. Schmitt (1939).

The Christmas Copper mine is in the Banner mining district a little over a mile west of the Gila River at an elevation of around 3000 ft. A ten mile branch line from the Southern Pacific railroad runs up the river from Winkelman and terminates on the river 700 ft. below the mine. Further details on the geography are given by Ross.

Ross, Clyde P., "Ore deposits of the Saddle Mountain and Banner Mining Districts, Arizona". U. S. Geol. Survey Bull. 771, 1925.

At present the only connections between the railroad and the mine are a dirt road, power line and pipe lines for concentrates and water. The camp water supply is obtained from the mine and the mill supply is pumped from wells near the river. The mine makes about 20 gallons of water a minute at this time. The part of this which comes from a heading on the 5th level is used for domestic water.

Power is obtained from four diesel engines whose total output is 1800 H.P. This provides sufficient power for the mine and mill and, at this time, with only the mine operating, surplus power is sold to the Federal Government and delivered to the power line which runs past the mine from Coolidge Dam.

The mine is said to have been located by a man named O'Brien in about 1883 who sold his claims to the Phelps-Dodge interests. It

was found later that the claims were on the San Carlos Indian reservation and the Phelps-Dodge people were forced to withdraw. In 1902 a part of the reservation which included the mine was returned to the public domain. The mine was then relocated by George B. Chittenden on Christmas Eve 1902, and the locality named Christmas. A corporation, named the Saddle Mountain Mining Company, was later formed to hold and prospect the ground. This company built a small smelter and mined and smelted about 113,000 tons of ore, but failed in 1907 or 1908, apparently because of inefficient management coupled with the high cost of supplies. For the purpose of reorganization the Gila Copper Sulphide Company was then formed but it was not until the American Smelting and Refining Company agreed to lend the Gila Company the money necessary to put the property on a producing basis that the reorganization was made effective. The Smelting Company agreed to smelt the ore for ten years, but was to manage the mine until the loan was repaid. Shipments began about the middle of February 1916 and by November that year the loan was repaid. The Smelting Company continued to manage the property for a fee until January 20, 1919. In the meantime certain bonds were in default and a receiver for the stockholders, who had been given possession of the property to prevent foreclosure undertook the operation of the mine. A few months later the company was declared solvent by a court decision and the operation returned to the stockholders. The mine was closed at the time of the 1921 depression. Sometime between then and 1926 the bondholders instituted foreclosure proceedings and a corporation known as the Christmas Copper Company was formed to hold and operate the property. Operations were resumed in 1926 and continued to 1932 when the property was again closed down. About this time the company was reorganized as the Christmas Copper Corporation under article 77B of the bankruptcy act.

After retimbering the No. 3 shaft the mine was reopened in 1937 but was shut down later in the same year because of low copper prices. In 1938, because of better prices and a favorable smelting contract, mining was resumed by leasing and up to the time of this report the property has been producing about 80 tons of fluxing ore a day.

The Christmas Copper Corp. owns 552.731 acres of patented land at Christmas according to Packard (1934) and in addition holds several unpatented claims. Table No. 1 below gives the production record to December 31, 1939 in tons and grade of ore produced. Production in 1940 is continuing at the same rate as in 1939 and the grade of the ore is comparable.

Table 1 (See App. A)
Christmas Mine Production

Time	Producer	All ore dry tons produced & sold	% Cu	Copper paid for lbs.
1882-4	(2 small furnaces installed and small amount produced.)			
1905-7	Saddle Mountain Mining Company	113,322	2.48	4,484,374
1908-15	Small amount from development-not shipped			
1916	Gila Copper Sulphide Co. (A.S.&R.)	71,788	2.87	3,738,913
1917	" " " " (")	90,358	2.68	4,128,264
1918	" " " " (")	90,870	2.93	4,606,461
1919	" " " " (")	92,640	2.94	4,584,957
1920	" " " "	62,510	2.54	2,678,389
1921	" " " "	2,694	2.65	105,256
1922-24	" " " "	None		
1925	" " " "	5,967	2.797	286,027
1926	Christmas Copper Company	44,142	2.725	2,053,361
1927	" " "	37,687	2.505	1,586,630
1928	" " "	38,019	2.319	1,459,707
1929	" " "	129,741	2.047	4,417,770
1930	" " "	216,433	2.043	6,924,735
1931	" " "	78,644	2.059	2,447,780
1932	" " "	5,040	2.526	214,359
1933-36		None		
1937	Christmas Copper Corp.	29,692	2.465	1,225,982
1938	" " "	6,098	2.657	275,303
1939	" " "(Lease)	24,790	2.194	889,698
		1,140,335	2.438	46,107,966

The ore has always been desired for fluxing by the Hayden smelter throughout the history of the mine because of an excess of iron and

lime. However, in 1928 a 500 ton mill was built and some 300,000 tons of ore was milled. This ore as mined was of lower grade than the direct shipping ore. In 1937, 38 and 39 only shipping ore was mined.

It does not seem appropriate at this time to detail the financial condition of the company. This, of course, will be ascertained by those seriously interested in the mine. The property has tax and other liens against it, of which the tax lien at least must be cleared up before new interests can consider the investment necessary for new development and operation.

Geology*

*The factual data used below are largely from maps and reports by Burch, Caetani and Hershey (1912), Locke, Bjorge and Blanchard (1920) Packard (1934) Moon and Schmitt (1937-40). These reports without maps are in the appendix.

Geological setting

The geological setting at Christmas is that of a quartz-biotite-diorite plug which has intruded a thick series of limestones, shales, sills and volcanic rocks which normally dip about 12 degrees southeast. At and near the contact of the plug with the wall rocks there are concentrations of silicates, oxides and sulphides largely in sedimentary rock hosts. Modern nomenclature classifies such deposits as contact pyrometasomatic. They previously would have been termed contact metamorphic.

The porphyry plug measures approximately 4000 by 2000 ft. and the long axis trends N55E. The west end of the porphyry, however, has a marked westerly trend, which parallels much of the faulting and fissuring in the same area. The north and south contacts dip approximately 65 degrees north. The bedded rocks at the south contact, according to my correlation, appear to be approximately 100 ft. lower than the equivalent beds on the north contact (Sect.CC'). This suggests that the strong east-west shear in the vicinity of the No. 3 shaft marks a zone of faulting, apparently high-angle reversed movement, because the dips of the fissures are usually north, i.e., parallel with the porphyry contacts.

Localization of the porphyry

The ore bodies appear to be limited or cut off in the northeast direction by a strong, northwest trending, northeast dipping, normal fault which severs the porphyry plug as well as the sedimentary rocks. This fault is also known to cut the ore, because there is ore drag in the gouge, but since the hanging wall may have dropped more than

1700 ft., as suggested by the result of the diamond drill hole put down from the bottom of the No. 4 shaft and yet the horizontal shift of the porphyry contacts does not exceed 100 ft., it seems probable that most of the off-set occurred before the plug was intruded. That the fault localized the porphyry is not unlikely. Possibly the precise area selected was due to the intersection of the fault by the east-west shear previously noted. Some of the stopes on the south contact of the porphyry show strong, northeast shear that localized ore. This shear may have been a third factor influencing localization of the porphyry.

Localization of the ore

Even casual inspection of the mine discloses the dependence of the ore on three factors common to most deposits of this type. These are, 1) a deep cutting intrusive, 2) favorable limestone beds, and 3) crosscutting fractures and faults. Modern theory does not concede that the agents which caused the mineralization in this type of deposit came directly from the adjacent magma. In all examples I have seen, and this one is no exception, the magma had solidified before the silicates and sulphides were deposited because these minerals are found to some extent in fissures and faults which cut the porphyry. Therefore the fluids or emanations which caused the mineralization came from a source which presumably was deeper, possibly deeper portions of the magma which were last to solidify.

Granted the porphyry was solid when the ore was deposited, the localization of the garnet and sulphides generally not more than 200 ft. from porphyry contacts demands explanation. Probably the principal factor was the deformation suffered by the walls adjacent to the porphyry. At many places the contacts appear to have been surfaces of movement after intrusion and solidification of the magma as indicated by associated gouge, breccia and the bending of adjacent sedimentary beds. The bedded rocks appear to have been fissured, faulted and otherwise broken to a greater extent in a zone 50-200 ft. wide adjacent to the porphyry than farther out. The porphyry, too, was shattered, but whether to a greater extent near the contact is not known to me, though the porphyry is more altered near ore than away from ore. In any event the shattering of bedded rocks and porphyry made a permeable zone through which the metal bearing fluids could move. The porphyry was found to be an inhospitable host, though some silicates, quartz and sulphides are found in it. The bedded rocks, especially the purer limestones, were readily replaced by garnet and magnetite, the shales altered to hornstone and epidote.

That the sulphides are largely later than the garnet is well established and has been remarked upon by several geologists who have examined the property. The pyrite and chalcopyrite appear to always cut the garnet as veinlets along shear zones and other fractures and fissures. The garnet and magnetite appear to have replaced the good limestone directly as massive blocks of these minerals. More magnetite and pyrite are found near the porphyry and porphyry "fingers" than farther out. Only a very minor amount of sulphide ore seems to replace the limestone directly; most of it has a garnet gangue. Why this is true is not clear. It may be that the massive garnet and magnetite was more brittle under the conditions existing than the massive limestone and shale, was readily shattered which resulted in openings for the deposition of sulphides. It is known that pure

coarse limestone tends to flow under pressure and so post-silicate fissures in it may have been tighter or obliterated when at the same time they would stand open in massive garnet magnetite.

Detailed mapping of the stopes revealed in close localization of the ore by fractures and faults of small throw, which, if not wholly post-garnet in age, were certainly re-opened in post-garnet, pre-sulphide time.

Mineralogy

The minerals common to the mine according to Ross (1925, p 37) include andradite garnet, epidote, magnetite, pyrite and chalcopyrite. In addition wollastonite and vesuvianite and other minor minerals are reported to be present. The common oxidized and carbonate minerals of copper and iron are found and there is minor supergene chalcocite and bornite. There appears to have been only minor supergene enrichment, but this seems to have raised some marginal ore to stoping grade in a few places.

Igneous rocks

The igneous rocks are discussed in detail by Locke, et al (1920 pp 23-27). The cross-cutting plug is composed of quartz-biotite-diorite of two ages, an early fine and a late coarse grained phase. On top of the limestone is a thick series of andesitic volcanic rocks of variable character according to Hershey (1912, p 10). These rocks are now known to be Colorado in age (Ross, 1925, p 14). There are a few fine grained biotite-hornblende-diorite sills in the section that according to Hershey (1912, p 16) are younger than the andesite. In addition to these sills, later sills of the plug porphyry type of rock appear to be common in certain parts of the contact areas.

Ore beds and bedded rocks

The ore shows a marked preference for particular beds and groups of beds, but transgresses less favorable intervening beds, progressively coalescing all into single thick ore bodies, in proportion as the mineralization intensity is greater.

I have gone into considerable detail (Fig.1) to correlate the Tornado Peak columnar sections measured by Locke et al (1920) and Hershey (1912) and the sections of the north and south contacts disclosed by the various maps. In my opinion the Locke and Hershey sections can be nearly perfectly matched and I believe the correlation of these with the ore beds of the north and south contacts as I have indicated on Fig. 1 is likely to be correct. The Upper Copper Knob ore bed of the north contact appears to be equivalent to the Quarry bed of the south contact, the Lower Copper Knob ore bed and Upper Johnny ore beds to the "J" beds, and the Lower Johnny to the "K" bed. The Lower Las Novias zone on the south contact appears to lie between the 500 level and the 400 level in the vicinity of 514 stope (Sect.AA'). The lower several hundred feet of diamond drill hole 6 appears to be in the massive crinoidal (recrystallized) limestone just below the Las Novias zone. The thick Las Novias stope is in a crinoidal limestone horizon. Other facts of interest can best be

seen on Fig. 1. The correlation will be amplified further when recommendations for development are made.

Description of the mine

The mine is developed by various shafts and adits. The lowest adit (Map A) is on the 375 (400) level, comes in from the east side, and is the main haulage to the mill. On the north side an old adit connects with the 275 (300) level. There are numerous old shafts connecting with the mine and providing additional ventilation, but the main working shaft at this time is the No. 3 which was retimbered in 1937 to the 770 ft. level, though it is actually 908 ft. deep. It is in excellent shape with an adequate hoist and headframe. At this time stations are maintained on the 200, 275 (300), 375 (400), 635 and 770 levels. All the ore mined is trammed directly to the outside by electric locomotive on the 375 (400) level. Ore mined below the 375 (400) level is raised in the No. 3 shaft and loaded on cars on the 375 (400). At this time the 275 (300) level is used as a transfer level and a small electric mule is used for tramming.

Methods of mining

The ore, as previously discussed, occurs in sub-horizontal beds varying from 5 to 70 ft. in thickness, but as a rule under 15 ft. with the lateral dimensions exceeding the vertical by 10 or more times. The backs stand well enough in the country above the 375 (400) level so that such support as is provided by occasional pillars is usually adequate. The average distance between pillars in the old stopes appears to be about 25 ft. The conditions outlined more or less fix the methods of mining that can be used. Raises often as high as 75 ft. or more are required for ore passes and the ore must be moved to them by shovels, wheelbarrows and scrapers. One raise, however, may serve a number of beds. Experience with modern scrapers indicates that the raise interval may be increased to 150 ft. or more where there is sufficient tonnage to justify scraper installation, costs and upkeep.

On the lower levels, where stoping has been done, the ground contains many dike "fingers" and is still wet because of incomplete drainage and ventilation. As a consequence, the ground is heavy and what ore was mined in 1937 was extracted by square set stoping; apparently the only feasible method under the conditions prevailing. Conditions will doubtless improve when this area is dried out, though square setting may still be necessary in the dike "finger" country. The ground north of the "fingers", however, where recently cut by the 635 drift, seems to be similar to the upper levels in character and when drained and ventilated is likely to lend itself to open stope mining with pillars. It is of interest to note that some of the stopes in the upper levels required square setting when they were wet, but now, since they are dried out, can be robbed of their timber with safety.

For backs that require support such as the wet dike "finger" country such methods as overhead cut and fill, top slicing and caving have been considered. Top slicing and caving are usually out of the question because undeveloped country above may be ruined. Overhead cut and fill requires so much preparation in proportion to the tonnage

as to not appear feasible particularly as the outline, height, etc. of ore must be pretty well known before starting. Square-setting, however, requires no advance preparation for fill, except in especially heavy ground, can be started without previous definition of the limits of the ore, and facilitates ore following and clean mining.

The ore in the upper levels may be called medium ground. Fifty feet of hole per machine shift can be drilled easily, powder consumption seldom exceeds one pound per ton, and little or no secondary blasting is required.

Mine plant equipment

The stationary mine equipment is complete and includes adequate machine and carpenter shops located at the collar of the No. 3 shaft. Here also are two compressors, one a 1,200 cu. ft. Ingersoll Rand Imperial type, the other a 625 cu. ft. Sullivan type WJ3 angle compound, and a good hoist. A third compressor not in use is located at the No. 4 shaft. This is a duplicate in type of the Sullivan at the No. 3 shaft and could be put in use should it be needed.

The underground equipment includes drills, cars and two storage battery locomotives. When milling is started a new (extra) battery for the locomotive and a number of new cars will be needed for the mill tram. Several new drifters will be needed for development work, and when mining is started on a larger scale new mine cars, drills and scrapers will be needed.

Description of the mill

The mill at Christmas is reached by direct tram from the 375 (400) level adit. The tram distance from the No. 3 shaft is a little less than 2000 ft. The tramming is done by electric locomotive.

The mill is a flotation type with primary crushing done by a gyratory crusher, secondary by a Symons 4 ft. cone crusher, and grinding by two Cole-Bergman 5x10 ball mills with rake classifiers in closed circuit. Beyond the crushing plant the mill is divided into two independent units of 200 tons daily capacity each. Southwestern pneumatic flotation cells are used and the concentrate is delivered to the filter plant at the railroad by a 3 inch pipe line. An Oliver drum type filter is used.

The mill apparently gives excellent results on the sulphide ore with recoveries usually over 90 per cent on sulphides, and 50 per cent on oxidized material (Appendix E), and is said to be easy to operate. One side of the mill was put in working order in 1937 and would be ready to operate with few repairs and a new gyratory crusher.

Power Plant

Power is obtained from the company's fine 1800 H.P. diesel engine plant located on the river at the railroad terminal. The plant is composed of four 450 H.P. Chicago pneumatic engines each coupled to 350 KW. generators. The cylinder liners are worn and will

need gradual replacement, though the plant can probably get by for another two years by using special rings some of which have already been installed. The plant is now in operation supplying power to the mine and surplus power is pumped into the government power line as needed. Surplus power to the mine plant can be supplied by the government by the same line in favorable years.

Ore reserves

When estimating the ore reserves and possibilities for new ore a clear-cut, natural division can be made into the upper level and lower level country, i. e., into ground above and ground below the 500 ft. level. These two general ore horizons appear to be separated by a barren, in part shaly, horizon. For purposes of discussion a further three-fold division of each of these can be made: 1) the north "contact" zone, 2) the south "contact" zone and 3) the dike "finger" country which on the west end separates the "contact" zones and contains ore with an abnormally high content of pyrite and magnetite both above and below the 500 level.

Appendix B is a tabulation of the ore reserves as of February 1, 1940. The ore blocks and location, etc. are shown on Map A. The estimate of the reserves for the ground above the 500 level were compiled from maps, average assays and estimates submitted to me by Frank Knight, Jr. I have studied these data, observed the development and working faces, added some data and am willing to back the estimate. The supporting data are available in the Christmas Copper Corp. files and in my own. The prospects for new ore in the upper levels now appear better than they did a year ago although in the meantime more than 25,000 tons of fluxing ore averaging 2.2% Cu. have been mined. This average grade, incidently, is the same as the average grade calculated in the reserve reduced by 10% to allow for dilution. This, too, is significant support for the individual stope grades and tonnage as calculated and listed.

To those who watched the development and mining in the upper country in 1938, starting with the belief shared by many that the upper areas were worked out and arriving at a point today when prospects seem excellent for continued production at a rate of at least 100 tons a day, it is not difficult to believe that more than 100,000 tons of additional ore will be produced. This, after all, is only ten per cent of the total production to date. It seems to be comparatively easy to find extensions of the old ore beds, and new beds above and below the old ones. Besides unexplored beds, some of which are cut by raises but unexploited, and pillars which may be partially robbed, there is a large block of largely unexplored ground west of a strong reversed (?) fault which makes the west wall of the large 356 stope in the Las Novias ore horizon. A cross-cut is being driven beyond this fault into the block of ground beyond (See Map A N4360, E4090). Good ore was encountered immediately beyond the fault, the grade then decreased to 1.5% Cu. as the cross-cut progressed and then increased at station + 28 ft. to 2.8% Cu. This discovery is important and should lead to a large tonnage of new ore. Incidentally, the new ore on the north 633 level and 633A raise is in the same new block of ground.

In connection with this discovery it should be noted that

previously stoping throughout the mine often had been stopped at structural walls such as dike contacts and faults. Much of the new ore has been found by breaking through such apparent walls.

On the south contact a block of ground including block 2 and vicinity (See Map A and Sect. CC') largely above the 500 level, but in part below it, according to my correlation seems to represent the Las Novias Horizon. If this is the case the development work in the area has been inadequate. Ore is being produced from one stope (block 1) and low grade ore is known in the four raises put above the 500 level in this area. Some good ore remains unmined just below the 500 level.

Much of the upper level garnet ore, as it is partially oxidized, is suitable only for fluxing ore.

The estimate of the upper level ore reserves is summarized as follows:

	Tons	Grade % Cu
Positive	6,490	2.45
Probable	20,191	2.45
Total	26,681	2.45

The grade reduced 10% for dilution is 2.20% Cu. This part of the estimate indicates that the present rate production at the present grade can be maintained for at least a year more. I believe that another 75,000 tons of what may be called geologically prospective ore is a reasonable expectation and think the chances are good that this will stope out with a grade higher than 2.2% because much of it will be from new country particularly in the north "contact" area, which in the past always produced higher-than-average grade ore. The average of the past production in this zone was around 3.0% Cu. The Las Novias stopes were of the best grade and those should be repeated beyond the reversed (?) fault above mentioned.

The lower level ore reserves are also listed in Appendix B. From this country in all 14,872 tons has been produced averaging 2.7% Cu. In 1937-38 7,357 tons was produced averaging 3.19% Cu. Practically all of this ore was from the central or intermediate dike "finger" country and had bad mining characteristics due to the wet heavy ground in and around dikes and sills necessitating a large proportion of square set mining, and bad milling characteristics due to pyrite and magnetite which, if 25% Cu. concentrates are to be made, requires regrinding. Drainage and particularly ventilation of this country will result in lower mining costs and regrinding will not be necessary when this ore is mixed with a preponderance of normal "contact" garnet ore.

The future of the lower levels, in my opinion, does not wholly or even partially lie in the development and exploitation of the dike "finger" country, any more than it did in the upper levels of the mine, even though the grade of the lower level ore has been consistently higher than that normal for the upper levels. It is the north and south "contact" country that holds the main promise and is yet to be explored except at a few places. In general the country below the 500 level includes most of the Escobrosa and all of the Martin limestones (Sect.CC'). In southeastern Arizona these

are more favorable horizons than the shaly Pennsylvanian which lies above them. This may explain why the lower level ore has in general been of higher grade on the average than the upper level ore above the Las Novias beds.

Last summer the 817 cross-cut on the 770 level cut through the porphyry and reached metamorphosed limestone, which, from the sections (CC') appears to belong to the north "contact" zone. Some low grade ore (2.14% Cu) was encountered. Several years ago the 633 drift on the 635 level had been advanced past the same porphyry contact and had exposed typical garnet "contact" ore. The drift then caved some distance back from the face and no sample could be taken. This year the drift was retimbered and advanced. Ore which caved from the back assayed over 4% Cu and in February this year a raise (633A) has been in ore from 8-20½ ft. From 8-17 ft. above the rail the average assay was 3.97% Cu. The back was still in ore at 22½ ft. about February 15, this year. The new discovery has exposed a section 40 ft. long and 13 + ft. high which may average 4% Cu and the limits are not known. This ore is typical north "contact" ore but of higher grade and greatly strengthens the argument for a bright future for the lower levels.

This winter a raise (779A) has also been put up from the 779 drift in the dike "finger" country and has been in ore from the start to 38 ft. which marked the back about February 15 this year. From 7 to 28 feet seven samples averaged 3.54% Cu. This ore seems to be the extension of 770 stope (Map A). In the No. 3 shaft below the 770 level from 883 ft. to the bottom of the shaft at 908 ft. is 25 ft. of ore which averages 3.42% Cu. The bottom of the shaft is in ore. This ore seems to be in a bed at the top of the Martin limestone (Sect. CC'). Below should be the O'Carroll ore bed which contains ore on the old London-Arizona property at Tornado Peak several miles east from Christmas. Low grade ore was cut in DDH 1 (C.C.Co) at a horizon about equivalent to the O'Carroll ore bed. This zone may make better ore near the contact of the porphyry (Sect. CC').

The upper levels have produced a little over 1,100,000 tons of ore to date and apparently will have produced over 1,200,000 tons before they are worked out. This tonnage came from a vertical section of approximately 400 ft. of beds. Below this is a country with potential ore bearing horizons whose total height aggregates about 600 ft. Since the length and width of the porphyry contact zone is likely to be the same in the lower country we can estimate the total potential tonnage in depth to be 50% larger than the upper levels, i.e., 1,800,000 tons. This may have an average grade of 3.00% Cu, if the average grade of the ore mined and in place can be taken as indicative.

The estimate of lower level ore is summarized as follows:

	Tons	Grade % Cu
Positive	11,500	3.36
Probable	21,558	3.36
Total	33,058	3.36

This grade reduced 10% for dilution is 3.02% Cu.

A recapitulation of the ore reserves is as follows:

Conventional tonnage estimate

Upper levels		
Positive	6,490	2.20
Probable	20,191	2.20
	26,681	2.20
Lower levels		
Positive	11,500	3.02
Probable	21,558	3.02
	33,058	3.02
All levels		
Positive	17,990	2.66
Probable	41,743	2.66
	59,733	2.66

Geological estimate
(additional ore)

Upper levels	75,000	2.44 *
Lower levels	1,800,000	3.02 **

*Average of total past production (Appendix A).
**Average of present lower level reserves

The ore probably existing in depth east of the Christmas fault cannot be considered in this appraisal except as a prospect which may be exploited should the known ore and more immediate prospects put the mine on a paying basis and "long pull" development can be considered. This ore has a potential tonnage greater than the ground west of the fault, if the length of the intrusive contact east of the fault may be considered as a criterion. In other words it has a potential possibility, other things being equal, of greater than 3,000,000 tons. Much of the andesite east of the fault is strongly mineralized. The No. 4 shaft and the diamond drill hole below it contains low grade copper ore in andesite.

Cost of mining

In 1938 the Christmas Copper Corp. supplied me with mining costs (Schmitt 1939, p 2) for open and square set stopes that were compiled from past records and increased to take care of new taxes and labor changes. In the table below these are compared with the actual outcome of leasing operations in open stopes by C.B. Hanraty from January 1 to November 14, 1939, and by Sam and Frank Knight in November and December 1939.

Table 2
Costs per dry ton

	Estimate for Schmitt, 12/28/38 Square set*	O.stope*	C.B.Hanraty 1/1-11/1/39 Open stopes**	S.K.&F.P.K,Jr. Nov.-Dec.1939 Open stopes**
Labor direct	$ 1.16	$ .58	$ .66	$ .65
Soc.Sec.& Ins.	.13	.06	.08	.07
Explosives	.10	.13	.09	.14
Lumber	.39	.01		
Air & drill steel, etc.	.15	.15	.13	.12
Hoisting	.12	.12	.05	.05
Gen.U.G.(Incl.pumps and U.G.repairs)	.23	.23	.27	.22
	2.29	1.28	1.28	1.25
Haulage & trucking	.08	.08	.34	.34
	2.36	1.36	1.62	1.59
Development	.40	.40	.37	.41
Overhead	.20	.20	.27	.25
Total mine	$2.96	$1.96	$2.26	$2.25

*Based on 250 tons daily for each catagory or 500 tons total for the mine. Estimated by Frank Knight.

**Average produced about 80 tons daily.

From these data it is apparent that even with a rate of production less than twenty per cent of that considered in the original estimates, the actual cost of mining in open stopes was only 10 per cent higher than the estimate, but this is lower by $.61 than the cost I have estimated for fluxing ore on a 500 ton capacity (table 3, p 14). The discrepancy is largely in labor costs and suggests my estimate of men needed is conservative. Mr. Frank Knight tells me that there has been a decided improvement in efficiency since they have ceased employment of men of Spanish-American descent. On the other hand I suggested that more dead work, i.e., preparation for mining will have to be done in the future as the fluxing ore gets farther away from the old workings. At any rate it does not seem that it will be possible to produce more than 4 or 5 tons per man shift under average conditions in this mine unless larger ore bodies are found and, besides some square setting must be done which increases the cost for labor. The estimated overhead per ton for the 500 ton rate is slightly lower than the actual overhead per ton in 1939-40 for the 100 ton rate.

The ore recently disclosed on the north 635 level in the 633 drift and 633A raise appears to be typical of the garnet ore of the upper levels and when drained and ventilated doubtless can be mined without square setting. When the lower levels are developed, drained and ventilated it is my belief that only the ground near dike "fingers" will need to be square setted. Such ground should not exceed twenty per cent of the total ground stopes and this proportion is considered when estimating the items of labor and timber in the cost detail (Appendix C).

At the Pewabic mine of the Peru Mining Company at Hanover,

New Mexico, where the mineral deposit is the contact pyrometesomatic type and the ore lies in beds of thickness and size comparable to the Christmas mine the total costs, direct plus overhead, and including primary crushing and areal tramming to the railroad, do not exceed $1.80 per dry ton. The ground is harder and 50 per cent of the blasting is secondary. Wages, however, are lower, fewer pillars are needed, and the stopes are of slightly greater average thickness.

In Appendix C and D are given estimated detailed costs for mining and for overhead for rates of 300 tons and 500 tons daily production. These data are summarized below:

Estimated total daily and per ton mine costs*

	300 tons daily		500 tons daily	
	Total	Per ton	Total	Per ton
Mine labor	$405.33	$1.35	$ 631.53	$1.26
Powder	38.25	.13	63.50	.13
Timber	40.00	.13	66.40	.13
Supplies (Misc.)	50.00	.17	83.00	.17
Power	67.40	.22	85.00	.17
Total	$600.98	$2.00	$ 929.43	$1.86
Development	120.00	.40	200.00	.40
Overhead (plus taxes)	104.26	.35	104.26	.21
	$825.24	$2.75	$1233.69	$2.47

*6½ hour day, 25 day month

By the development of sufficient stopes and careful management it may be possible to reduce the number of men on the third shift on the 500 ton production basis or to eliminate this shift entirely. The possibilities for doing this would be particularly favorable if the development, done in advance of the mining as recommended, showed good results and if skip hoisting were introduced. If a large amount of development must be done along with mining three full shifts may be necessary for a 500 ton daily production.

Development costs

Development costs in the Christmas mine usually have been around $.40 a ton. This figure seems high for this character of ground but it may be reduced by careful geological control. Development costs at the Peru mine including dead work seldom exceed $.20 a ton.

The direct development cost per foot of heading in 1937-38 for 1410 ft. of drifts and raises in the lower levels, where much timbering was necessary in the dike and sill areas, averaged $11.52. No hoisting is included in this but should be about $.50 per foot. The work was done largely under adverse conditions including heavy ground and poor ventilation. Direct development costs were $6.83 per foot during the 1939 leasing period in the upper levels.

Probably $10.00 a foot may be taken as safe for the average of the mine when ore is being produced, with about $2.00 a foot to be added for hoisting, air and supervision. If only development work were done, at a rate of about 500 ft. a month, the total costs per

foot including overhead would probably be about $14.00.

Cost of milling

The Christmas sulphide ore by experience has been found to be easy to grind and float. Appendix E gives the results of milling in 1929-31 and Appendix F and G give the labor costs for 200 and 400 tons daily respectively. The following summary of costs was supplied me by Sam Knight.

Total mill costs per day

		200 tons	400 tons
Labor		$113.80	$154.40
Supplies		81.20	157.20
Power		46.60	56.00
Misc.		4.00	8.00
	Total	$245.60	$375.60
	Per ton	1.23	.94

These estimates must be nearly right for they are almost exactly the same as the costs of a 300-500 ton mill in New Mexico that mills a one-metal garnet-sulphide ore, though the metal in this case is zinc.

Summary of all costs

The costs discussed above are summarized as follows:

300 tons basis

	Milling ore (200 tons, 1 mill unit)	Fluxing ore (100 tons)
Mining	$2.00	$2.00
Development	.40	.40
Overhead	.35	.35
Milling	1.23	
Hauling		.26
	$3.98	$3.01

500 tons basis

	Milling ore (400 tons, both mill units)	Fluxing ore (100 tons)
Mining	$1.86	$1.86
Development	.40	.40
Overhead	.21	.21
Milling	.94	
Hauling		.26
	$3.41	$2.73

Smelter return for fluxing ore

Appendix H is a summary of the fluxing ore schedule now in force with the Hayden smelter at Winkelman, Arizona. Appendix I is a tabulation based on this schedule for different grades of ore and prices of metal.

Smelter return for concentrates

The smelter schedule now in force for Christmas mine concentrates is summarized in Appendix J. Appendix K is a tabulation of the returns per ton of ore for varying grade in, and price of copper. A recovery of 90% of the copper and a concentrate grade of 25% cu is assumed. This grade and recovery can be easily made on the normal garnet ore. I am told, however, that the ore with high magnetite and pyrite such as occurs in the dike "finger" country does not result in such good concentrate, but that the grade can be raised above 25% Cu by regrinding and refloating the concentrate. A dangerous amount of this latter ore is not anticipated even though much of it is now exposed in the dike "finger" country in the 770 level. Most of the new ore developed on the north and south main contacts should be of the normal garnet type such as disclosed by the new work on the 633 drift.

Indicated outcome

The various net returns in dollars for different rates of production, grades of ore and prices are tabulated below:

"Gross" profits per ton in dollars for various grade and prices (not including amortization or royalties)

300 tons daily

(A) Milling ore (cost $3.98)

Cu%	Cu per pound			
	10	11	12	13
2.0	-1.38	-1.06	-.71	.39
2.5	- .73	- .33	.11	.50
3.0	- .08	.40	.93	1.40
3.5	.57	1.14	1.74	2.30

(B) Fluxing ore (cost $3.01)

Cu%	Cu per pound			
	10	11	12	13
2.0	-.78	-.54	-.37	-.20
2.5	-.05	.29	.56	.83
3.0	.67	1.11	1.48	1.85
3.5	1.39	1.93	2.40	2.87

500 tons daily

(C) Milling ore (cost $3.41)

Cu%	10	11	12	13
2.0	- .81	- .99	-.14	-.18
2.5	- .16	.24	.68	1.07
3.0	.49	.97	1.50	1.97
3.5	1.14	1.71	2.31	2.87

(D) Fluxing ore (cost $2.73)

Cu%	10	11	12	13
2.0	-.50	-.26	-.09	-.08
2.5	.23	.57	.84	1.11
3.0	.95	1.39	2.13	2.50
3.5	1.67	2.21	2.68	3.15

The profits on the higher copper prices would be slightly lower than

tabulated because of the higher wages and possibly costs for material that would ensue.

A production of 300 tons a day of a 3% grade on a $.1125 market should show a $.53 "gross" profit per ton on milling ore and $1.20 on fluxing ore or a weighted average of $.75 per ton. A production of 500 tons on the same market and grade should show $1.10 "gross" profit per ton on milling ore and $1.57 on fluxing ore or a weighted average of $1.19 per ton.

A 2.5% average assay on 500 tons a day, on the present ($.1125) market should return an average "gross" profit of $.41 a ton, on a $.12 market $.63.

Total possible profit

If 1,800,000 tons is assumed as the total potential production west of the Christmas fault, the realization of a 3.00% grade and $.1125 market should give a "gross" profit of $2,142,000. Apparently a small "gross" profit can be made on a market as low as $.10 a pound.

Recommendations

General

The chance for new ore of favorable grade and the possible profits to be won appears to justify a serious attempt to settle the various liens against the property and to attempt to find enough new ore to justify complete rehabilitation. The conclusion is based primarily on my belief that (1) much new ore will be found, (2) the average grade of it will be higher than the ore mined in the past and (3) the price of copper will average more than $.11 a pound for the next two or more years. These three factors are critical, and, of course, the possible investor will have to judge their validity for himself. It seems to me that the chances are better than even that the war in Europe will, before long, cause a further rise in prices of metals. Furthermore, the political situation in the United States appears to be shifting to the right which should have a favorable effect on business and therefore prices.

Detail

Should a new program of development and mining be undertaken it should obviously start with new development, and, presumably, mining of the fluxing ore would continue. A feasible and economical program would be to continue mining at the present 80 tons per day, or more if the smelter will take it, and, at first to plan a development rate of 500 ft. of headings per month and 500-700 ft. of diamond drilling. This would mean the maintenance of about eight headings and one diamond drill shift per day. The development work would be stepped up to 750 ft. a month in the second and third months so that approximately 2000 ft. of new heading development and 2000 ft. of diamond drilling would be done in not more than three or four months. This work, properly executed, should give a basis for final decision on the future course to be followed. It should be preceded and accompanied by a comprehensive program of engineering and geological

work. A good deal of engineering and geological map work must be done in order to bring the mine maps up to date and this should start at least a month before the final development program is laid out, although, in the meantime, several ventilation raises should be put through, etc. This amount of work should with luck develop 150,000 tons of positive and reasonably prospective ore. This would have been about the amount of ore developed by similar expenditures when the mine was operated in the past. Added to the present reserve would give a good basis for starting mining and milling on the 500 ton rate.

The three months program may not need to be carried through as an independent expenditure if especially good results are had at the outset. In other words it may be feasible to stop short of completion and commence rehabilitation of mine and mill for actual operation. Development would be started again when mining started. The direct cost of the three months program with one month of preliminary planning would be about as follows:

Month	Detail		Cost
1	Preliminary engineering and geological work		$1,500.00
2	Engineering and geological work	$1500.00	
	500 ft. of heading at $12.	6000.00	
	500 " " diamond drilling at $3.00	1500.00	
	Overhead	1000.00	
	Contingencies	1000.00	11,000.00
3	Engineering and geological work	1500.00	
	750 ft. of heading at $12.00	9000.00	
	750 " " diamond drilling	2250.00	
	Overhead	1500.00	
	Contingencies	1500.00	15,750.00
4	Same rate and expenditures as 3rd month		15,750.00
	Total		$44,000.00

This expenditure would be partially offset by the profits on the fluxing ore. The capital outlay needed for the above development program would be about

Shovel loader	$2500.00
2 Leyners	900.00
Industrial commission deposit	3000.00
Other equipment	1000.00
Contingencies	1000.00
	$8400.00

Should the development work reach a point where the outlook was favorable and rehabilitation of the plant appeared to be in order the capital expenditure needed would be about as follows:

Table 4

Cost of starting mine and mill

Equipment needed for mine*

	No.	300 tons	No.	500 tons
Stopes	5	$1,925	10	$3,850
Jackhammers	5	1,500	10	3,000
Repairs to present machines		375		375
Slushers	2	1,500	4	3,000
Air and water hose		450		900
Haulage cars	15	1,875	30	3,750
Tram cars	10	1,000	20	2,000
Haulage battery	1	1,186	2	2,372
Misc.		500		1,500
Surface and camp		1,000		5,000
Industrial Commission advance deposit		4,000		4,000
Contingencies		3,000		5,000
		$18,311		$34,747

*Estimate by Frank Knight and H. Schmitt

Repairs and equipment needed for mill*

Crusher (plus freight)	$4,500	$4,500
Preparatory costs	5,000	6,900
House repair	1,000	1,200
Tailing dam preparation	2,100	2,100
Emergency fund	5,000	5,000
	$17,600	$19,700
Total	$35,911	$54,447

*Estimate by Sam Knight

The total capital outlay indicated then for development and rehabilitation if all the preliminary development were needed before starting 500 tons daily is as follows:

Development equipment, etc.	$8,400.00
" work	44,000.00
Rehabilitation of mine	34,747.00
" " mill	19,700.00
Total	$106,847.00

Proposed development work

Development work in the upper levels of the mine in areas which are largely or partially stoped out will doubtless be continued in about the same manner as at present. That is, short drifts and raises will be driven from present stopes and/or levels. Such methods in 1939 progressively bettered the ore reserves.

The new ore just found in the footwall of the Las Novias fault and on the 635 level at the end of the 633 cross-cut indicates that

the large block of ground west of the Las Novias fault hitherto unprospected, is of considerable promise. For a time this block can be developed from the 356 stope and the 633 cross-cut by drifting and raising. Plan A shows proposed drifting and crosscutting from the 633 face. Before anything more is done on the 635 level, however, it will be necessary to raise to the 500 level for ventilation, as shown on Section CC', and before new work is started on the 770 (north side) a raise now started should be connected to the 635 for the same purpose (Sec. CC').

Two diamond drill holes, shown on section CC', are proposed in order to test the country below the 770 level not too distant for the porphyry contacts.

No other specific work is suggested at this time since it is believed that most of the development planning should be deferred until considerably more engineering and geological work has been done.

As pointed out by Locke, et al, since in many places the ore is in distinct beds the proportion of raising needed in exploration is higher than in most mines. Much drifting is required, however, not only to provide basis for raising and stoping, but what is especially important, to disclose crosscutting structural and alteration features of which an accurate knowledge is necessary for the intelligent planning of the raises.

In this type of ground development by headings can be over-done. Much of the ultimate development should be carried out by following the ore.

Proposed geological and engineering work

A new surface topographic and geologic map should be made I believe. No accurate topography is available and a much better understanding of the structure and metamorphism than is now had can be obtained by a close study of the surface. It should be possible to find "marker" beds in the andesite volcanic rocks and by means of them to determine the amount of throw on the Christmas fault.

Much more underground geological mapping and study is needed in order to guide the development work intelligently. When understood the post-garnet fracturing, since it localizes the ore, should make the development work more efficient. The alteration, when studied and mapped, should restrict the development work to particular areas.

CONCLUSIONS

1. The geological conditions at the Christmas mine are such as to suggest the strong probability of the existence of an additional 1,800,000 tons of ore west of the Christmas fault, largely in the country below the 500 level down to the Troy quartzite which is 700 feet below this level, i.e., at the 1200 ft. level. There is probably an additional large tonnage of ore east of the Christmas fault at an unknown depth. Too little is known about this latter possible ore, however, to consider it seriously in this appraisal, although it's likely existence makes the risk of financing the mine more attractive.

2. The grade of 14,872 tons of ore mined on the lower levels to date averaged 2.79% Cu and 7,357 tons produced in 1937-38 averaged 3.19% Cu. Based on this, the grade of the ore at the bottom of the No. 3 shaft (3.42% Cu for a height of 28 ft.), at the face of the 633 drift (3.97% Cu) and other places, which brings the average of the ore reserve in the lower levels to 3.02% Cu (reduced 10%), it seems reasonable to assume that the lower level ore can be mined with a grade maintained at 3% Cu. This is higher than was mined during the 1920-1929 decade, but not much higher than was mined in the years 1916 to 1919. The country in the lower levels includes the Escobrosa and Martin limestone (Section CC') both of which should be more hospitable hosts than the shaly Pennsylvanian which I believe is the horizon above the Las Novias stopes.

3. The grade of the 24,790 tons of fluxing ore produced in 1939 from the stopes largely above the 400 level averaged 2.194% Cu. The present costs for fluxing ore, as reported to me, are $2.25 (including haul and $0.40 for development) per ton. On todays $0.1125 market and the existing smelter schedule ore of the above grade returns $2.85. This leaves a profit of $0.60 a ton. With a little additional development I believe the grade in the upper stopes at this time can be maintained at 2.5% Cu. This would result in a profit of $1.12 per ton which is nearly twice as large. Only 100 tons of ore a day is accepted by the smelter on the present fluxing schedule.

4. The estimated ore reserves are as follows:

Conventional Estimate

	Tons	% Cu	
Upper levels			
Positive	6,490	2.20	(reduced 10% for dilution)
Probable	20,191	2.20	"
	26,681	2.20	"
Lower levels			
Positive	11,500	3.02	"
Probable	21,558	3.02	"
	33,058	3.02	"
All levels			
Positive	17,990	2.66	
Probable	41,743	2.66	

Geological estimate (additional ore)

Upper levels	75,000	2.44 *	(* next page)
Lower "	1,800,000	3.02 **	(**next page)

* Average of total past production.
** Average of present reserves.

5. The price of copper is likely to average over 11¢ a pound so long as the European war continues. This is my personal opinion offered for what it is worth. That the present 11¼¢ market is largely the result of a seasonal recession and that business is likely to accelerate in the summer and fall of 1940 is a commonly held opinion. Such a seasonal trend occurred in 1938 and 1939.

6. The production of 200 tons of milling ore (one unit of the mill) and 100 tons of fluxing ore per day should show about the following costs:

	Milling Ore	Fluxing Ore
Mining	$2.00	$2.00
Development	.40	.40
Overhead	.35	.35
Milling	1.23	
Hauling		.26
	$3.98	$3.01

For 400 tons of milling ore (both mill units) and 100 tons of fluxing ore the costs should be about

	Milling Ore	Fluxing Ore
Mining	$1.86	$1.86
Development	.40	.40
Overhead	.21	.21
Milling	.94	
Haulage		.26
	$3.41	$2.73

7. On a basis of 400 tons of milling and 100 tons of fluxing ore produced per day on the present $0.1125 market, present smelter schedule and costs given in conclusion 4, and a 3.0% Cu grade assumed for the milling and fluxing ore from the lower levels, the indicated average "gross" profit per ton is $1.19.

8. In an attempt to revive the mine the first step indicated is the prosecution of new development work. The plant is in such condition that work can be started with the expenditure of not more than $8400. for a mucking machine, a few new drills, etc. It is my opinion that the expenditure of $44,000. for development work, if the work is carefully controlled as to costs and geology, will result in the blocking out of 150,000 tons of positive and reasonably assured ore. The work should include about 3000 ft. of diamond drilling. The needed expenditures would possibly be twice as large if it were not for the fact that most of the preliminary work such as shaft retimbering, cross-cutting and other dead work is done and from now on the principal task is to push on in the north and south contact ore zones. Development of the ore in the bottom of the shaft should be deferred pending results of the first campaign.

The cost of rehabilitation of the mill for a 200 ton daily capacity

(one unit) is about $17,600 and for 400 tons $19,700. New mine equipment and miscellaneous would cost about $18,311 for the 300 tons out-put and $34,747 for 500 tons out-put.

Expenditures for rehabilitation if mining and milling are started

	300 tons	500 tons
Mill	$17,600	$19,700
Mine	18,311	34,747
	$35,911	$54,447

Total maximum expenditure needed for starting up on a 500 ton basis appears to be about $110,000 not including the costs of settling taxes, debts, etc. which is not considered in the report but which must be thoroughly investigated, of course. At 300 tons a day the total maximum expenditure needed may be in the neighborhood of $90,000. The sums advanced on development would be taken care of by the mining costs, as submitted, if the campaign should be successful.

9. On the 500 ton basis with a $0.1125 market and 3% ore and assuming an ultimate production of 1,800,000 tons the total "gross" profit may reach $2,100,000. From this must be subtracted costs for shaft deepening and such new equipment as may be ultimately necessary for deeper level work. On the other hand there may be additional profit from ore east of the Christmas fault.

Yours very truly,

S/ Harrison Schmitt