CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

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Arizona Department of Mines and Mineral Resources Mining Collection

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FOR IMMEDIATE RELEASE
December 18, 1990

MAGMA Contact - Richard Johnson
(602) 575-5600
Alta Contact - Bruce Whitehead
(801) 531-9768

MAGMA COPPER AND ALTA GOLD
PURCHASE ROBINSON MINING DISTRICT

TUCSON, Arizona - Magma Copper Company (AMEX:MCU) and Alta Gold Co. (NASDAQ:ALTA) have purchased the 12,000-acre Robinson Mining District from Kennecott Corp. following multiparty transactions.

Magma Copper has acquired and consolidated a 51% interest in the property ownership and mineral interests in the property, and Alta Gold now holds a 49% interest in the mining district.

Magma has paid $10.2 million to Kennecott to acquire the 51% interest in the Robinson copper property and $10.5 million to Alta Gold and Echo Bay, Inc. to acquire a 51% interest in the existing gold operation. The $10.5 million includes $5.5 million paid to Alta Gold for 1.67 million shares of Alta Gold stock which Magma had previously purchased and has now returned.

Alta Gold, for its 49% interest, paid approximately $2.0 million, having received credits for royalties totalling approximately $8.0 million paid to Kennecott from gold mining operations conducted on the property.

Future development and operating activities will be conducted in a joint venture with Alta Gold Co.

Feasibility studies completed to date indicate potential to develop nearly 200 million tons of ore containing 0.68% copper and 0.012 ounces of gold per ton of ore. The deposit could yield over 2.5 billion pounds of copper and over 1.2 million ounces of gold over an 18 year mining life. According to the study, development costs in excess of $200 million would be required to re-establish copper mining in the district. Continuing feasibility and development work is planned for 1991.

The existing shallow gold deposits have adequate known reserves to support operations for approximately four to five more years at a rate of 50 - 70 thousand annual ounces. The property is considered to have additional gold exploration potential.

more ---

Burgess Winter, Magma's CEO, sees this acquisition fitting perfectly into Magma's strategic plan. "One of my concerns was the lack of long term copper reserves to ensure that concentrates produced by Magma controlled mines supplied the majority of the feedstock for our large smelting\refining complex for the long term. The development of the Robinson property, apart from being a low cost copper producer and significant gold producer, could supply quality feedstock for the smelter for twenty years."

Magma is a major primary copper producer with underground, and open pit mines at San Manuel, Superior, Miami, and Prescott, Arizona and a large smelter, refinery, and rod casting plant in San Manuel.

Dan S. Bushnell, Chairman and Chief Executive Officer of Alta Gold, indicated the joint venture with Magma Copper is a major milestone accomplishment which will position his company for long-term growth as a diversified mining company.

Alta Gold, in addition to operations at the Robinson District, also has three other open pit gold mines and an underground zinc-copper-silver-lead-cadmium mine, all in Nevada. Alta Gold also is a 33.3% partner in the recently commissioned Cyanco sodium cyanide manufacturing facility near Winnemucca, Nevada.

# # #

CLARKSON

APPLICATION BULLETIN

SAND FILL PLANT 6.0-10

Clarkson Series H Valves play key role in operation of Miller Sand Fill System

MAGMA COPPER COMPANY SUPERIOR, ARIZONA

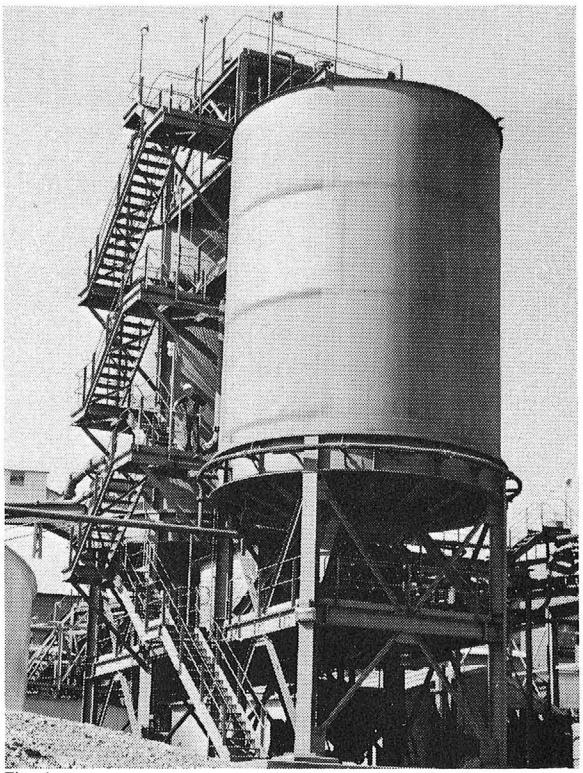


Fig. 1
Close-up of the two large tanks used in the sand fill plant at Magma Copper Company. The plant is designed for three tanks, but only two have been built to date. Each of the two tanks holds 700 tons of sand. The desliming cyclones are located on a platform above the tanks. The control room is located between the tanks near the bottom.

Purpose Although sand-filling of underground mines has been widely practiced for many years, the preparation plant designs used in this operation vary greatly. The Miller Sand Fill System appears to provide many of the essential requirements for sound backfill. With a capacity of 1400 tons of clean sand storage at the mill plus an additional 500 tons storage at the mine, backfill operations at Magma Copper Company can proceed without dependence on other surface operations. Sand can be provided at nearly 70% solids up to 150 tons per hour. The deslimed sand provides rapid drainage underground. Drainage requirements are also minimized by filling at high percent solids.

Operation After passing through cyclones at the mill, the underflow tailings product of approximately 30% solids is pumped directly to the Krebs cyclones mounted above the sand tanks. The slime overflow from these cyclones is routed to the tailing thickeners. By decanting water off of the top, the solids can be raised to approximately 80% or 85%. Each tank is completely filled and decanted prior to use.

When sand filling operations are to be started, the operator selects at the control panel the Series H Valve he wishes to be opened (See Fig. 3). With some experience, operators have demonstrated their ability to deliver a constant flow and density (65% to 70% solids) merely by selecting the appropriate location and number of Series H Valves on the jet water. The sand feeds uniformly through the bottom without bridging or "rat holing".

It is interesting to observe that the total power required for the sand filling operation is approximately 10 hp on the water pump, feeding the slurrying jets. A 40 or 50 hp motor on the cyclone feed is the only other power required for these surface operations.

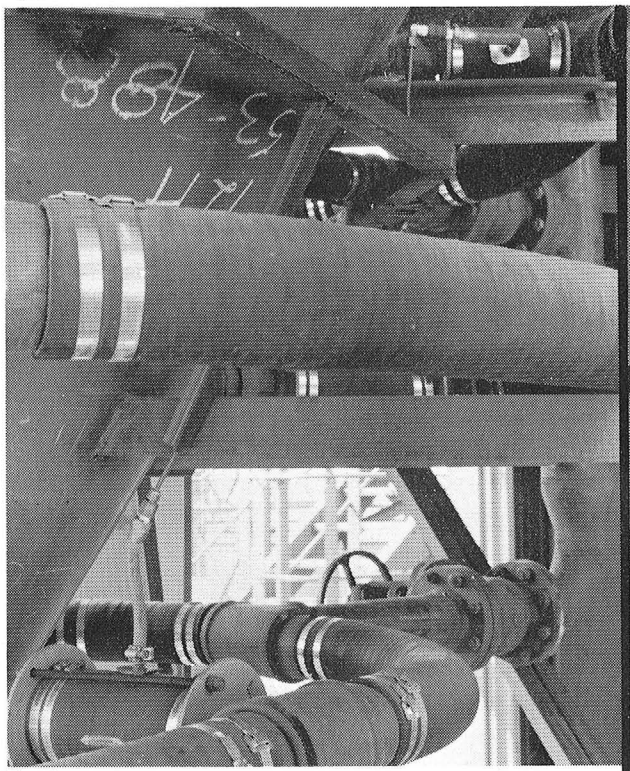


Fig. 2
This photo shows the three sets of Series H Valves used for slurrying the sand. These valves are supplied with water at about 20' of head. There are fifteen of these valves located in the 60° cone section. Internally, the water is directed tangentially for maximum effectiveness in reslurrying sand.

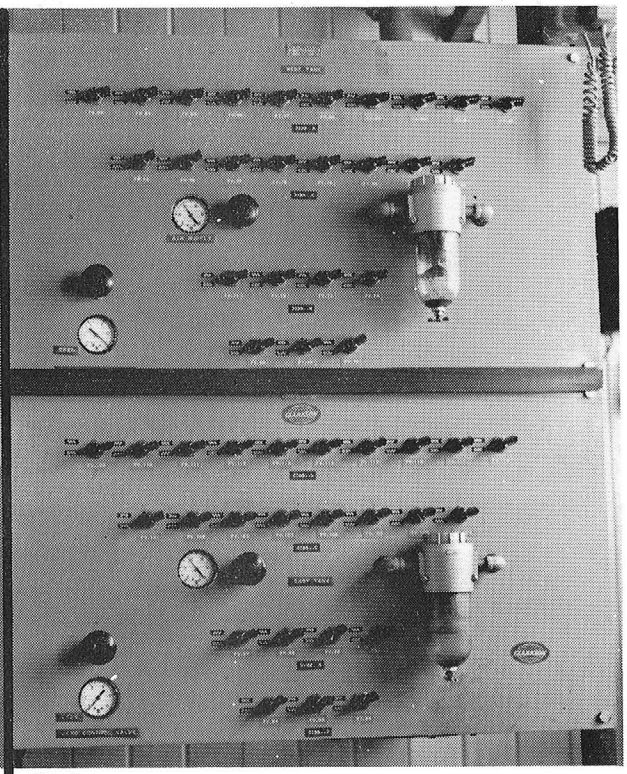


Fig. 3
The control panels, designed and supplied by the Clarkson Company, are arranged in graphic form. The three bottom rows of switches control the Series H Valves mounted on the cone section (Fig. 2). The top row controls the clean-up valve mounted on the perimeter of the main tank (Fig. 4).

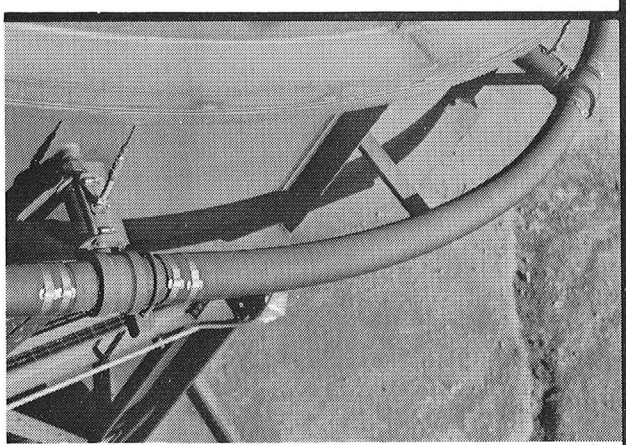


Fig. 4
Looking down on the header and Series H Valves located on the lower perimeter of the main tank. These valves are normally used for final clean-out. Normal sand flow is accomplished using water in the cone section only.

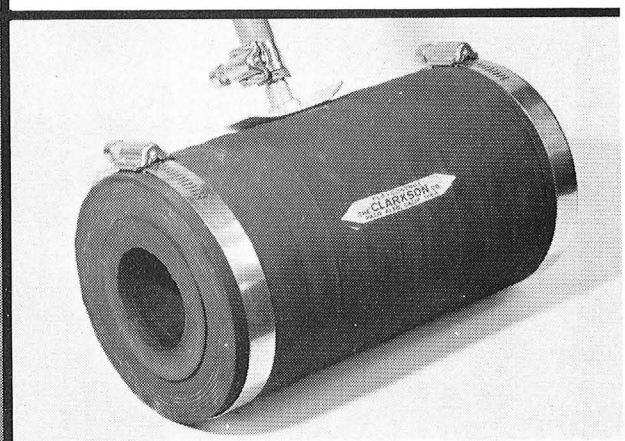


Fig. 5
THE CLARKSON SERIES H VALVE The H Valve was selected for this application because of the simplicity of its operation—it's a pneumatic, non-mechanical pinch valve; because its flexibility lends itself ideally to use in a hose header; and also because its light weight permits use in the line without reinforcement.

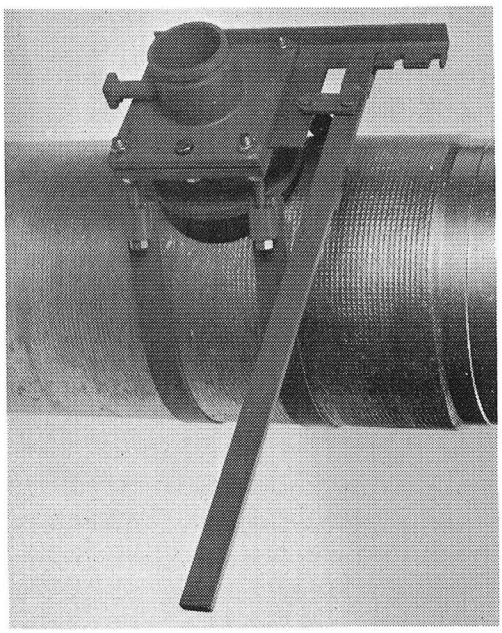
In addition to the Magma application described herein, other Clarkson Valves are serving in many kinds of flow-control applications: thickener underflow, cyclone feed, pressure letdown, filter level, pump isolation, pump control, slurry routing, sump level control, tailings spigoting and others. For no-cost, no-obligation recommendations on improving performance in flow-control systems, Clarkson invites your inquiry.

CLARKSON **THE CLARKSON COMPANY**
735 Loma Verde Ave., Palo Alto, CA 94303, U.S.A. Tel. (415) 494-1010 Cable: CLARKSONCO Telex 34-5544

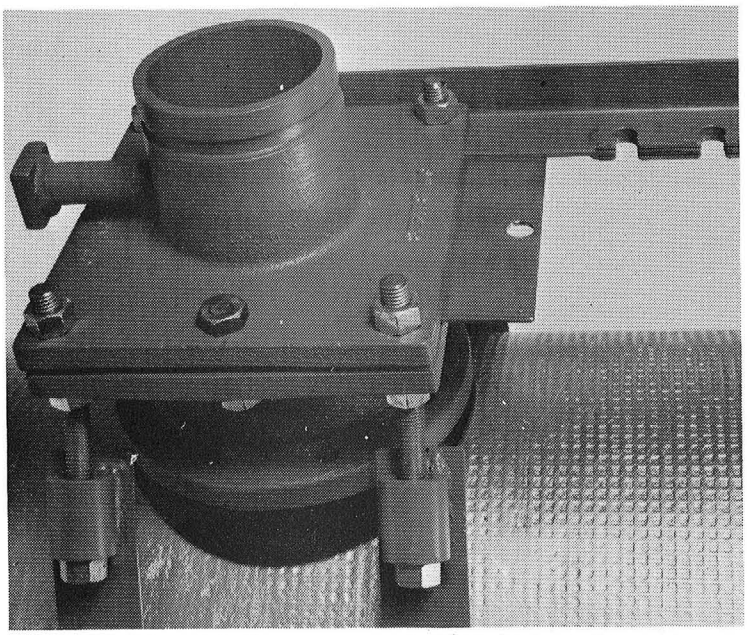
CLARKSON

PRODUCT BULLETIN

Tailing Valve 9.0-2



A 4" KG Valve is shown mounted at approximately 45° on a 12" Class 100 Transite pipe section.



Note the unique ratcheting arrangement. The valve is easily opened under all conditions—never requires brute strength.

THE KG TAILING VALVE for spigot or cyclone

Mounts directly on perimeter line in any position—vertically, at 45° or horizontally. Operates equally well in all positions.

Fits any line. The valve comes with a saddle adapter, of tough polyurethane, which is molded to fit flush with both the inside and outside diameters of your perimeter line. Specify your line size and the saddle adapter will be furnished to fit it exactly. Straps for fastening valve to line are also supplied.

Fast, easy installation. Drill the hole, apply gasket and saddle adapter, put the valve in place, pass the straps around the line and tighten. One man can easily install six valves in an hour.

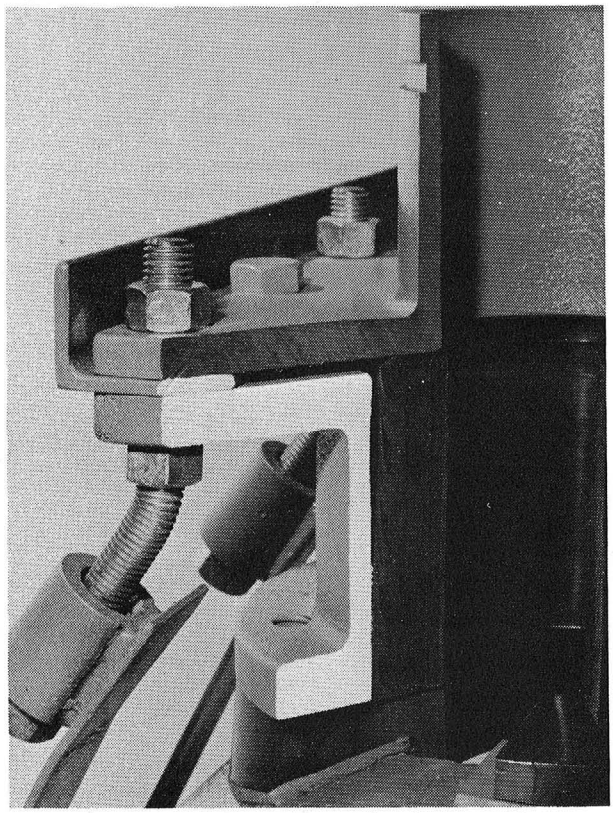
Unrestricted flow. If tramp will flow out of the cyclone or spigot line, it will flow through the valve. When this valve is open, it is "line size" open.

No maintenance. This valve is always ready, from 60° below to 130° above. The gate is stainless steel and the seal is rubber to stainless steel. Even if left open or closed for months, it still will work.

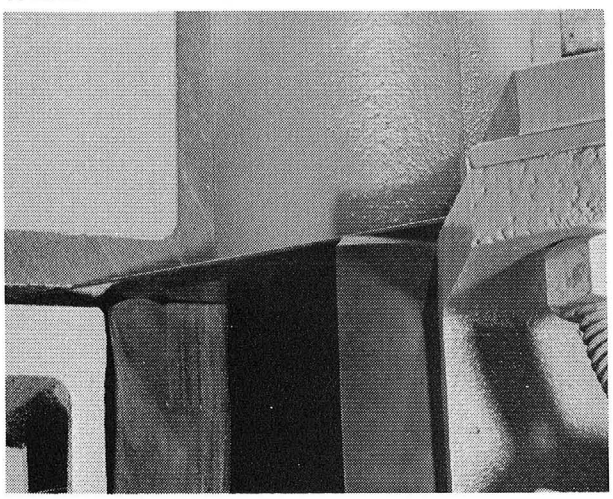
No line wear. Wear in the line is prevented because the saddle adapter fits the inside diameter of the line, resulting in little or no turbulence, either from the flow past closed valve or into an open one.

No lubrication. Nothing *to* lubricate. You don't even have to service the valve prior to use.

THE NEW KG TAILING VALVE 9.0-2



This cutaway detail shows the saddle adapter, gasket, heavy rubber liner and Victaulic outlet, as well as the strap end detail. Note the absence of any obstruction to flow.



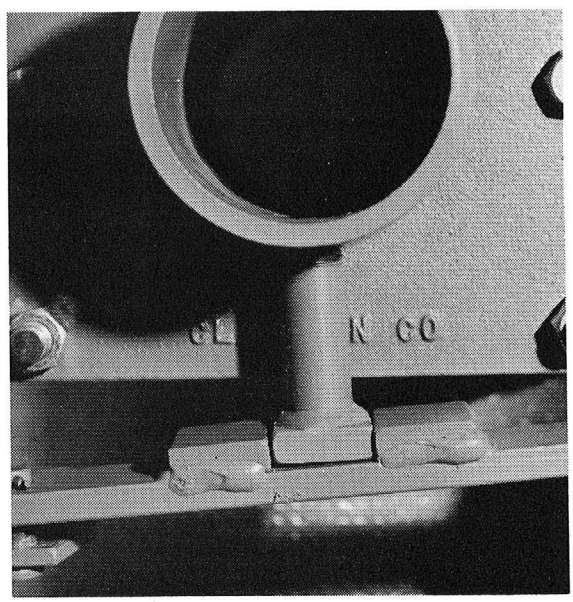
This photo shows the detail of the seal between the slide gate and the body liner. Seal remains tight even at 150 psi. Simple, positive action.

Drains complete. A drain is provided just above the gate so the spigot or cyclone feed line can be completely drained. The operating handle is equipped with a wrench fitting so the drain can always be opened.

No binding or freezing. Binding usually results from rust. The clearances on this valve are sufficiently large that even with rust the stainless steel gate will continue to work. Ice in the valve will not hamper operation. Neither will sand, in either the open or closed position, keep it from operating.

Tamper proof. The handle is removable, to prevent the valve from being operated by anyone other than authorized personnel.

Sizes available. 2", 3", 4", and 6". All sizes can be made to fit any perimeter line size.

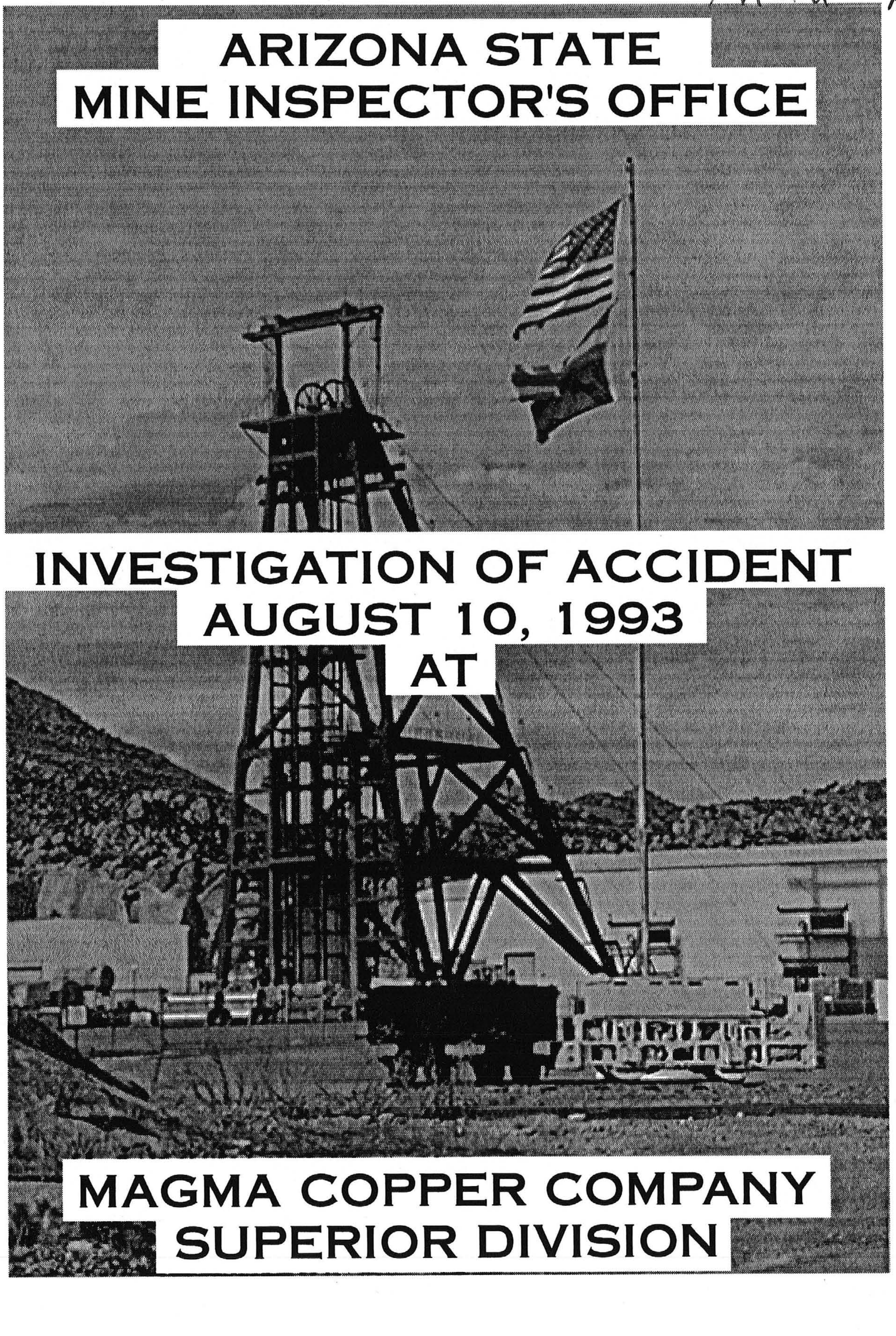


The handle (at bottom of photo) includes a wrench for opening the drain. Drain can be opened even if it has been rusted for years.

THE CLARKSON COMPANY
735 Loma Verde Ave., Palo Alto, CA 94303, U.S.A. Tel. (415) 494-1010 Cable: CLARKSONCO Telex 34-5544

Printed in U.S.A. 1974

ARIZONA STATE MINE INSPECTOR'S OFFICE



INVESTIGATION OF ACCIDENT AUGUST 10, 1993 AT

MAGMA COPPER COMPANY SUPERIOR DIVISION

OFFICE OF THE ARIZONA STATE MINE INSPECTOR
1700 W. WASHINGTON, SUITE 400
PHOENIX, ARIZONA 85007
(602) 542-597

FATAL OR SERIOUS ACCIDENT INVESTIGATION REPORT

This report is based on an investigation made pursuant to Arizona Revised Statute Section 27-124, which was conducted on:

_____ by GARY COTHRUN
Date Deputy

NOTIFICATION OF STATE MINE INSPECTOR

How Notified: Phone Date: 8/11/93 By Whom: Gene Halsey Time: 2:00AM

Information for this report was obtained by visiting the scene of the accident and by interviewing company personnel.

EMPLOYEE INFORMATION

Name: CHRISTIANSEN, JEFF SS#: 601-16-2168 DOB: 8/30/71 Age: 21 Sex: M

Years of Mining Experience: 1.3 Years With Present Company: 1.3

Regular Occupation: SUPPORT TECH. Experience at Regular Occupation: 1.3 Yrs

COMPANY INFORMATION

Company Name: MAGMA COPPER COMPANY

Mine/Plant Name: SUPERIOR DIVISION

Location/Address: P. O. BOX 37

City: SUPERIOR County: PINAL Phone: 229-4230 ID#: 416

Company Officials: (Names and Titles)

DOUG MCGREGOR	GENERAL MANAGER
STEVE LAUTENSCHLAUGER	MINE MANAGER
KELLY STOLP	SAFETY MANAGER

FORM #101-139

ACCIDENT INVESTIGATION REPORT - (PAGE 2)

COMPANY INFORMATION (Continued)

Description of Operation:

Number Employees: 140 Number Shifts: 3 Hrs per Shift: 8 Days per Week: 7

Type of Operation: UNDERGROUND Principal Product: COPPER

Principal Components of Operation: SHAFTS, DRIFTS, STOPES, RAISES

PARTICIPANTS IN INVESTIGATION

Company: ALISON SHELTON, MAGMA CORPORATE ATTORNEY

MARK N. SAVIT, JACKSON & KELLY ATTORNEYS AT LAW

MSHA: SAFETY SPECIALIST: BILL WILSON, JIMMIE L. JONES, AND TYRONE GOODSPEED

MSHA TECHNICAL SUPPORT: BOB FERRITER, JAMES WARREN ANDREWS, AND JERRY DAVIDSON

STATE: GARY COTHRUN, DEPUTY MINE INSPECTOR

PHIL HOWARD, ASSISTANT STATE MINE INSPECTOR

DOUGLAS K. MARTIN, ARIZONA STATE MINE INSPECTOR

OTHER:

ACCIDENT INVESTIGATION REPORT - (PAGE 3)

ACCIDENT INFORMATION

Date of Accident: 8/10/93 Time of Accident: 9:45 PM Time Victim was Found: 7:30 AM

Location of Accident: 865 ORE PASS, 4000 LEVEL

Hour Regular Work Began: 3:00 PM Hour Work Began When Accident Occurred: 5:00 PM

Work Assignment in Which Employee was Engaged When Accident Occurred:

LOADING MUCK CARS FROM THE 865 RAISE ON THE 4000 LEVEL

What Victim was Doing at Time of Accident: ATTEMPTING TO CLEAR A HANGUP IN THE 865 RAISE

Name of Supervisor: ALFRED D. EDWARDS

Name/Title of Person from whom Employee Received Work Instruction:

ALFRED D. EDWARDS

Type and Extent of Injury: A. TRANSECTION OF BODY.

B. MULTIPLE FRACTURES INVOLVING RIBS, SPINE, SKULL, AND PELVIS.

C. LACERATIONS OF RIGHT KIDNEY, LIVER, INTESTINES AND URINARY BLADDER.

IF FATAL:

Date of Death: August 11, 1993 Time of Death: 10:50 AM

Official Cause of Death (Quote from Death Certificate):

INTERNAL INJURIES DUE TO BLUNT FORCE TRAUMA.

Pronounced Dead By: PINAL CO. SHERIFFS' DETECTIVE TOM SOLIS, BADGE #18

Pronounced Dead At: MAGMA SUPERIOR MINE
(Location)

IF NON-FATAL:

Where Victim Hospitalized:

ACCIDENT INVESTIGATION REPORT - (Page 4)

ACCIDENT INFORMATION (Continued)

Names & Job Titles of Persons With Whom Employee Was Working When Accident Occured:

JOHN H. DALTON, GROUP LEADER

ALFRED D. EDWARDS, TEAM LEADER

NICHOLAS P. TRUETT, SUPPORT TECH.

Names & Job Titles of Witnesses to Accident:

Cause of Accident:

Direct: FALL OF MATERIAL

Contributory: STRUCTURAL FAILURE OF RAISE

Physical Factors Involved: (Describe conditions and practices pertinent to the accident leading up to, during and after accident. How did the accident occur? Describe equipment involved, etc.)

(Please attach sketch, blueprint or any other pertinent data)

OFFICE OF THE ARIZONA STATE MINE INSPECTOR
1700 W. WASHINGTON, SUITE 400
PHOENIX, ARIZONA 85007
(602) 542-597

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_____ by GARY COTHRUN
Date Deputy

NOTIFICATION OF STATE MINE INSPECTOR

How Notified: Phone Date: 8/11/93 By Whom: Gene Halsey Time: 2:00 AM

Information for this report was obtained by visiting the scene of the accident and by interviewing company personnel.

EMPLOYEE INFORMATION

Name: DALTON, JOHN H. SS#: 585-48-4571 DOB: 5/4/55 Age: 38 Sex: M

Years of Mining Experience: 20 Years With Present Company: 4

Regular Occupation: GROUP LEADER Experience at Regular Occupation: 1

COMPANY INFORMATION

Company Name: MAGMA COPPER COMPANY

Mine/Plant Name: SUPERIOR DIVISION

Location/Address: P. O. Box 37

City: SUPERIOR County: PINAL Phone: 229-4230 ID#: 416

Company Officials:	(Names and Titles)
DOUG MCGREGOR	GENERAL MANAGER
STEVE LAUTENSCHLAEGER	MINE MANAGER
KELLY STOLP	SAFETY MANAGER

ACCIDENT INVESTIGATION REPORT - (PAGE 2)

COMPANY INFORMATION (Continued)

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Type of Operation: UNDERGROUND Principal Product: COPPER

Principal Components of Operation: SHAFTS, DRIFTS, STOPES, RAISES

PARTICIPANTS IN INVESTIGATION

Company: ALISON SHELTON, MAGMA CORPORATE ATTORNEY

MARK N. SAVIT, JACKSON & KELLY ATTORNEYS AT LAW

MSHA: SAFETY SPECIALIST: BILL WILSON, JIMMIE L. JONES, AND TYRONE GOODSPEED

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DOUGLAS K. MARTIN, ARIZONA STATE MINE INSPECTOR

OTHER:

ACCIDENT INVESTIGATION REPORT - (PAGE 3)

ACCIDENT INFORMATION

Date of Accident: 8/10/93 Time of Accident: 9:45 PM Time Victim was Found: 3:15 AM (8/11)

Location of Accident: 865 ORE PASS, 4000 LEVEL

Hour Regular Work Began: 3:00 PM Hour Work Began When Accident Occurred: 5:00 PM

Work Assignment in Which Employee was Engaged When Accident Occurred:

MR. DALTON WAS THE GROUP LEADER IN CHARGE OF HAULAGE AND SUPPLIES

What Victim was Doing at Time of Accident: ATTEMPTING TO CLEAR A HANGUP IN THE 865 RAISE

Name of Supervisor: STEVE LAUTENSCHLAEGER, MINE MANAGER

Name/Title of Person from whom Employee Received Work Instruction:

STEVE LAUTENSCHLAEGER, MINE MANAGER

Type and Extent of Injury: A. CRUSH INJURY OF HEAD

B. MULTIPLE FRACTURES

C. LACERATION OF LIVER

IF FATAL:

Date of Death: 8/10/93 Time of Death: 9:45 P.M.

Official Cause of Death (Quote from Death Certificate):

INTERNAL INJURIES DUE TO BLUNT FORCE TRAUMA

Pronounced Dead By: R. RYAN, SHERIFF DEPUTY BADGE #326

Pronounced Dead At: MAGMA SUPERIOR MINE
(Location)

IF NON-FATAL:

Where Victim Hospitalized:

ACCIDENT INVESTIGATION REPORT - (Page 4)

ACCIDENT INFORMATION (Continued)

Names & Job Titles of Persons With Whom Employee Was Working When Accident Occured:

ALFRED D. EDWARDS, TEAM LEADER

JEFFREY CHRISTIANSEN, SUPPORT TECH.

NICHOLAS P. TRUETT, SUPPORT TECH.

Names & Job Titles of Witnesses to Accident:

Cause of Accident:

Direct: FALL OF MATERIAL

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Physical Factors Involved: (Describe conditions and practices pertinent to the accident leading up to, during and after accident. How did the accident occur? Describe equipment involved, etc.)

SEE ATTACHED REPORT

(Please attach sketch, blueprint or any other pertinent data)

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(602) 542-597

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Date Deputy

NOTIFICATION OF STATE MINE INSPECTOR

How Notified: Phone Date: 8/11/93 By Whom: Gene Halsey Time: 2:00AM

Information for this report was obtained by visiting the scene of the accident and by interviewing company personnel.

EMPLOYEE INFORMATION

Name: EDWARDS, ALFRED D. SS#: 502-56-0844 DOB: 4/11/37 Age: 56 Sex: M

Years of Mining Experience: 36 Years With Present Company: 3.4

Regular Occupation: TEAM LEADER Experience at Regular Occupation: 3.4

COMPANY INFORMATION

Company Name: MAGMA COPPER COMPANY

Mine/Plant Name: SUPERIOR DIVISION

Location/Address: P. O. BOX 37

City: SUPERIOR County: PINAL Phone: 229-4230 ID#: 416

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Hour Regular Work Began: 3:00 PM Hour Work Began When Accident Occurred: 5:00 PM

Work Assignment in Which Employee was Engaged When Accident Occurred:

TEAM LEADER FOR MUCK HAULAGE AND SUPPLIES

What Victim was Doing at Time of Accident: ATTEMPTING TO CLEAR A HANGUP IN THE 865 RAISE

Name of Supervisor: JOHN H. DALTON

Name/Title of Person from whom Employee Received Work Instruction:

JOHN H. DALTON

Type and Extent of Injury: A. BLUNT FORCE TRAUMA

B. ATHEROSCLEROTIC HEART DISEASE

IF FATAL:

Date of Death: 8/10/93 Time of Death: 9:45 P.M.

Official Cause of Death (Quote from Death Certificate):

DUE TO BLUNT FORCE TRAUMA

Pronounced Dead By: PINAL COUNTY SHERIFFS' DETECTIVE TOM SOLIS BADGE #18

Pronounced Dead At: MAGMA SUPERIOR MINE
(Location)

IF NON-FATAL:

Where Victim Hospitalized: _____

ACCIDENT INVESTIGATION REPORT - (Page 4)

ACCIDENT INFORMATION (Continued)

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JEFFREY CHRISTIANSEN, SUPPORT TECH.

NICHOLAS P. TRUETT, SUPPORT TECH.

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How Notified: Phone **Date:** 8/11/93 **By Whom:** Gene Halsey **Time:** 2:00AM

Information for this report was obtained by visiting the scene of the accident and by interviewing company personnel.

EMPLOYEE INFORMATION

Name: TRUETT, NICHOLAS P. **SS#:** 526-95-2392 **DOB:** 11/5/73 **Age:** 19 **Sex:** M

Years of Mining Experience: 1.2 **Years With Present Company:** 1.2

Regular Occupation: SUPPORT TECH. **Experience at Regular Occupation:** 1.2

COMPANY INFORMATION

Company Name: MAGMA COPPER COMPANY

Mine/Plant Name: SUPERIOR DIVISION

Location/Address: P. O. BOX 37

City: SUPERIOR **County:** PINAL **Phone:** 229-4230 **ID#:** 416

Company Officials: (Names and Titles)

DOUG MCGREGOR	GENERAL MANAGER
STEVE LAUTENSCHLAUGER	MINE MANAGER
KELLY STOLP	SAFETY MANAGER

ACCIDENT INVESTIGATION REPORT - (PAGE 2)

COMPANY INFORMATION (Continued)

Description of Operation:

Number Employees: 140 Number Shifts: 3 Hrs per Shift: 8 Days per Week: 7

Type of Operation: UNDERGROUND Principal Product: COPPER

Principal Components of Operation: SHAFTS, DRIFTS, STOPES, RAISES

PARTICIPANTS IN INVESTIGATION

Company: ALISON SHELTON, MAGMA CORPORATE ATTORNEY

MARK N. SAVIT, JACKSON & KELLY ATTORNEYS AT LAW

MSHA: SAFETY SPECIALIST: BILL WILSON, JIMMIE L. JONES, AND TYRONE GOODSPEED

MSHA TECHNICAL SUPPORT: BOB FERRITER, JAMES WARREN ANDREWS, AND JERRY DAVIDSON

STATE: GARY COTHRUN, DEPUTY MINE INSPECTOR

PHIL HOWARD, ASSISTANT STATE MINE INSPECTOR

DOUGLAS K. MARTIN, ARIZONA STATE MINE INSPECTOR

OTHER:

ACCIDENT INVESTIGATION REPORT - (PAGE 3)

ACCIDENT INFORMATION

Date of Accident: 8/10/93 Time of Accident: 9:45 PM Time Victim was Found: _____

Location of Accident: 865 ORE PASS, 4000 LEVEL

Hour Regular Work Began: 3:00 PM Hour Work Began When Accident Occurred: 5:00 PM

Work Assignment in Which Employee was Engaged When Accident Occurred:

MUCK HAULAGE FROM THE 865 RAISE ON 4000 LEVEL

What Victim was Doing at Time of Accident: ATTEMPTING TO CLEAR A HANGUP IN THE 865 RAISE

Name of Supervisor: ALFRED D. EDWARDS

Name/Title of Person from whom Employee Received Work Instruction:

ALFRED D. EDWARDS

Type and Extent of Injury:

A. LACERATION OF LIVER, RIGHT KIDNEY, DIAPHRAGM, ILIAC VEIN

B. FRACTURES OF RIBS, PELVIS, STERNUM

C. PULMONARY CONTUSIONS

IF FATAL:

Date of Death: 8/10/93 Time of Death: 9:45 P.M.

Official Cause of Death (Quote from Death Certificate):

INTERNAL INJURIES DUE TO BLUNT FORCE TRAUMA

Pronounced Dead By: PINAL SHERIFF DETECTIVE TOM SOLIS BADGE #18

Pronounced Dead At: MAGMA SUPERIOR MINE
(Location)

IF NON-FATAL:

Where Victim Hospitalized: _____

ACCIDENT INVESTIGATION REPORT - (Page 4)

ACCIDENT INFORMATION (Continued)

Names & Job Titles of Persons With Whom Employee Was Working When Accident Occured:

JOHN H. DALTON, GROUP LEADER

ALFRED D. EDWARDS, TEAM LEADER

JEFF CHRISTIANSEN, SUPPORT TECH.

Names & Job Titles of Witnesses to Accident:

Cause of Accident:

Direct: FALL OF MATERIAL

Contributory: STRUCTURAL FAILURE OF RAISE

Physical Factors Involved: (Describe conditions and practices pertinent to the accident leading up to, during and after accident. How did the accident occur? Describe equipment involved, etc.)

(Please attach sketch, blueprint or any other pertinent data)

PHYSICAL FACTORS

On August 10, 1993, approximately 9:45 PM, four (4) Superior Division, Magma Copper Company employees were fatally injured while working in the 865 Transfer Raise above the 4000 level of the Superior Mine.

The primary purpose of the 865 Transfer Raise is to provide ore handling access from the stopes (ore extraction excavations) between 4000 level and 3600 level to the skip hoisting installation at No. 9 Shaft. The 865 Transfer Raise is a two compartment, near vertical (about 81 degrees from horizontal) timbered structure connecting the 4000 track haulage level upward to the 3636 stope level (vertical distance of about 364 ft). The orepass compartment inside dimensions are 6 X 8-ft cross section. The manway compartment inside dimensions are 6 X 6-ft cross section. The manway also serves a secondary escapeway via ladders from the 4000 level. Blasted, broken ore is hauled by diesel powered wheel loaders (LHDs) from the stopes and dumped into the 865 Transfer Raise at three stope level locations (3763 level, 3700 level, and 3636 level). Broken ore in the raise is loaded into rail cars using a vibratory feeder (Syntron) at the 4000 level Syntron Loading Station, hauled to No. 9 Shaft and dumped into the 4000 level loading pocket.

The primary structural support and ground control of the 865 Transfer Raise is forty-four (44) timber sets constructed of 10 X 10-in. Douglas fir posts, wallplates, and dividers erected on approximate 7 ft-8 in. centers. The orepass compartment is separated from the manway compartment by 6 X 8-in. Douglas fir cribbing held in place by "birdcage" (a Magma nomenclature for this type of construction) steel channels installed on raise set posts. Set #1 just above the 4000 level Syntron Loading Station has been concreted in place and is the bearing set for the raise structure.

ACCIDENT INVESTIGATION

This section of the report is based on statements from persons who were in contact with the victims prior to the accident, and statements from participants in the rescue extrication. There were no eyewitnesses.

The four victims, John H. Dalton, (Group Leader), Alfred D. Edwards, (Team Leader); Jeff Christiansen, (Support Tech), and Nicholas P. Truett, (Support Tech); reported for work on the afternoon "B" shift (3:00 PM to 11:00 PM) of August 10, 1993, and attended a team meeting conducted by Dalton. Approximately 5:00 PM, Edwards, Christiansen and Truett descended on the man cage in the No. 9 Shaft to their work levels. Dalton remained in the shift foreman's office at the surface. Edwards left the cage on the 3600 level and walked down the ramp to the 3800 level looking for a LHD loader. At the same time Christiansen and Truett (assigned as the materials handling crew) proceeded to their work area on the 4000 level. Christiansen and Truett were to pull muck from the 865 Transfer Raise and haul to the 4000 level No. 9 Shaft dump pocket. They had pulled ten cars when the 865 Transfer Raise hung up, according to witnesses Ernest Villaverde, Joe Castaneda, and Nathan Spry (Dynatec Corp. construction employees who were working in the area). Christiansen told Villaverde (who was working on the decking of the Syntron) the raise was hung up and he was going to call Edwards for instructions. After phone contact, Christiansen and Truett proceeded to the powder magazine to obtain explosives to blast down the hang-up. Christiansen then alerted Castaneda and Spry, who were working in the manway compartment above the 4000 level in the 865 Transfer Raise, to climb down to the 4000 level so the materials handling crew could blast in the 865 Transfer Raise. Christiansen prepared and placed an explosive charge in the vicinity of raise sets #7-11. At this time, Villaverde, Castaneda, Spry, and Truett walked toward the station and guarded access to the 865 Transfer Raise from the 4000 level. Christiansen lit the fuse on the explosive charge and then climbed up the raise to prevent anyone from descending into the blasting zone. After the blast was shot and cleared, Christiansen and Truett returned to pulling the muck. Villaverde, Castaneda and Spry returned to the 865 Syntron and continued working on the replacing the decking. An undetermined amount of muck was dislodged, but the raise hung up again after they pulled an estimated two more cars. Approximately 7:50 PM, Christiansen and Truett walked again to the powder magazine and returned with more powder and fuse. While placing the powder and capped fuse near raise set #12 for the second blast, Christiansen dropped the explosive charge down the orepass compartment into the Syntron Feeder. According to Villaverde, Christiansen and Truett started the Syntron Feeder to look for the explosive charge. The capped fuse was found, but the powder could not be located.

According to the chippy hoistman, Douglas C. Eyler II, approximately 8:00 PM, Edwards traveled from the 3800 level up to the 3500 level. Approximately 8:20 PM, Dalton took the No. 9 Shaft man cage to the 3600 level to talk to William G. Wilson (Dynatec Lead Miner), about the Dynatec crews' work on the 865 Transfer Raise at the 3600 level. Approximately 8:45 PM, Christiansen notified Edwards by phone the 865 Transfer Raise was still hung up. Edwards then took the chippy cage from the 3500 level to the 4000 level. As he left the cage on the 4000 level he was seen by Villaverde, Spry, and Castaneda. Edwards told them he was going to the 865 Transfer Raise. Villaverde, Spry, and Castaneda took the chippy cage to the 3600 level for their next work assignment. Approximately 9:10 PM, Edwards called William S. Purcella , the LHD operator on the 3763 level, and told him to stop dumping muck into the 865 raise and to rope off all transfer points at the 3763 level dump, the 3700 level dump, and the 3636 level dump. Dalton, who was on the 3600 level, was also on the phone system with them at this time. After the conversation, Dalton took the chippy cage from the 3600 level to the 4000 level. At 9:30 PM the chippy hoistman (Eyler) heard Edwards and Dalton talking on the phone system. Edwards was using the phone at the 4000 dump station at No. 9 Shaft and Dalton was using the phone at the 865 Syntron Loading Station on the 4000 level. Dalton asked Edwards to bring him a 1 in.-diameter X 6-ft long blow pipe from the dump station. Edwards said he would have to cut it and that he would bring it back to the 865 Transfer Raise. This was the last communication that was heard by witnesses between the four victims. At 10:50 PM, Joe F. Giarrizzo (Team leader on "C" shift) tried to contact Dalton and Edwards on the mine phone system. Normally, Dalton and Edwards were in the surface foreman's office at least 30 minutes before shift change to brief the on coming shift. At the 11:00 PM shift change there still had been no communication with either the 4000 level materials handling crew, Dalton or Edwards. At 11:15 PM, Mary C. McConnel and Christopher E. Allison (materials handling crew on "C" shift) took the No. 9 Shaft man cage to the 4000 level. They had been assigned by their Team Leader to haul muck from the 865 Transfer Raise to the 4000 level dump pocket. On arriving at the station, they noted the lunch buckets of the "B" shift crew were still at the station, and the motor (battery locomotive) and ore cars were not at the shaft station. They proceeded to walk to the 865 Transfer Raise to relieve the "B" shift crew. Arriving at the Syntron Loading Station, they saw the motor parked ahead of the 865 loading area. The first ore car was empty and a muck pile covered the second ore car.

McConnel and Allison climbed the ladder up to the Syntron feeder platform and observed the manway compartment of the 865 Transfer Raise was full of muck and dislodged timbers. They saw a boot sticking out of the muck pile and identified Dalton's cap lamp battery caught on a steel beam above the feeder. McConnel then used the phone at the Syntron Loading Station to alert Craig Dahlstrand (Team Leader) there had been a serious accident at the 865 Transfer Raise on the 4000 level. At 11:30 PM, Dahlstrand, Mike Borseth, Giarrizzo, and Ron Hanson (C shift Team Leaders) took the No. 9 Shaft man cage to check on the reported accident. Giarrizzo and Hanson got off on the 3700 level to check the top of the 865 Transfer Raise. Dahlstrand and Borseth went to the 4000 level station where they met McConnel. Dahlstrand used the phone on the 4000 level station to contact the hoistman and have him relay messages to the Safety Manager, Kelly Stolp, the Construction Group Leader, Johnny Brake and the No. 9 Shaft Security Officer Rita Ortega. They were advised there was an emergency situation on the 4000 level. Dahlstrand and Borseth walked to the Syntron Loading Station and observed water running out of the loading chute and an ore car buried under a pile of muck and timber. Allison showed them the boot and Dalton's cap lamp battery that were first seen by McConnel. They continued looking around the raise and Syntron feeder area, but found no other evidence of the missing B shift crew. Dahlstrand called Don Graham (Production Team Leader) from the phone at the Syntron Loading Station to request that the power and water supplying the 4000 level be shut off. Borseth, who is member of the Magma Emergency Response Team, returned to the 4000 station, and sent out an alert for the Emergency Response Team to report to the 4000 level. Borseth briefed the Emergency Response Team members as they arrived at the 4000 level and rescue attempts began. Approximately 35 employees were involved in the rescue effort. Due to the unknown condition of the 865 Transfer Raise, rescue efforts proceeded slowly throughout the night. Stulling and spiling of the loose material had to be completed before the extrication of the victims could be accomplished. Dalton's body was recovered approximately 3:15 AM, and the remaining three victims were recovered and removed from the mine approximately 10:45 AM, August 11, 1993. The evidence and locations of the victims indicate they were all working in the manway compartment of the raise at the time of the accident. The victims were pronounced dead at the scene by Pinal County Sheriffs' Deputies. The victims were transported by the Superior Mortuary and Pinal County Medical Examiner to Tucson Medical Center.

OBSERVATIONS AND CONCLUSIONS

Video camera reconnaissance of the 865 Transfer Raise on August 18, 1993, revealed all or most of the 6 X 8-in. timber crib dividers between the orepass compartment and manway compartment in raise sets #17, #16 #15, #14, and #12 had failed. This allowed broken rock and dislodged timbers to spill into the manway compartment burying and crushing the victims below.

The actual sites of the divider failures remain inaccessible to State investigators at this time Conclusions to the causes of the failure are based on engineering design drawings, a scale model of the raise structure, observations by investigators of the accessible portions of the raise above 3763 level, video camera reconnaissance of the raise below 3763 level, and transcripts of witness statements.

The mine operator was aware the raise was in need of maintenance and repair due to the settling of the raise sets and loss of blocking behind the sets. The 865 Transfer Raise was kept in operation even though a compromise of the structural integrity was known indicating unsafe conditions may exist. Repair work had been planned by the mine operator for the contractor (Dynatec) to begin installation of bearing sets on weekends when the raise was not needed for production. The mine operator did recognize hang-up blasting was damaging the raise and issued a verbal directive to use blasting only as a "last resort" in hang-ups at 865 Transfer Raise. Hang-up blasting was done in the 865 Transfer Raise prior to the structural failure of the divider panels on August 10, 1993.

VIOLATIONS AND RECOMMENDATIONS

Compliance with the following violations/recommendations should prevent recurrence of similar accidents. It is the responsibility of management and supervisors to see that these violations/recommendations are complied with.

1. ARS 27-304 Operator Responsibility

   A. The operator shall conduct his operation with due regard to health and safety. The mine operator failed to correct unsafe structural conditions that had developed in the 865 raise. The operator continued to operate the 865 Transfer Raise in an unsafe condition.

2. ARS 27-304 Operator Responsibility

   A. The operator shall conduct his operation with due regard to health and safety. The 865 Transfer Raise design was inadequate for the loads imposed on the structure.

3. ARS 27-304 Operator Responsibility

   A. The operator shall conduct his operation with due regard to health and safety. There was minimal quality control by the mine operator during the 865 Transfer Raise construction and operation. There was little or no inspection of the blocking on the sets. The framework integrity and load bearing capacities were dependent upon the installed blocking.

4. ARS 27-304 Operator Responsibility

   D. The operator and his supervisory personnel shall enforce safety regulations and issue such orders as may be necessary to safeguard the life, health and safety of employees. A company memo dated May 5, 1993, had been issued stating that a Team Leader must be present when a crib raise hang-up is blasted. The swing shift materials handling crew on the 4000 level blasted at the 865 Transfer Raise on August 10, 1993, with no Team Leader present.

5. **ARS 27-324 Blasting**

Before firing blasting charges, the blasting crew shall clear the vicinity surrounding the blast site of all personnel, make provision to guard all means of access to the area, and give warning in every direction from which access may be had to the place where blasting is being done. Witnesses stated that when blasting in the 865 transfer raise, the person assigned to guard the upper raise entrance was stationed in the raise less than fifty feet from the blast.

6. **ARS 27-344 Timbering Support**

A. Minimum standards for proper timbering or other ground support of any working place shall be suitable to the conditions of the mining system. The 865 Transfer Raise timbering was inadequate for the loads imposed on the structure, therefore unsuitable for the conditions of the mining system.

7. **R11-1-231 Storage of Explosives**

A. All Class A, Class B, Class C explosives shall be kept in magazines which meet the requirements of this section. Fused caps were found on the 4000 level to be improperly stored. An improperly stored electric blasting cap was found behind the powder magazine on the 4000 level.

8 **R11-1-237 Storage within Magazines**

A. When any kind of explosive is removed from a magazine for use, the oldest explosive of that particular kind shall be removed first. Examination of the explosives magazine on the 4000 level revealed that the explosives stock was not being properly stored to allow usage of the oldest explosive first.

9 **R11-1-237 Storage within Magazines**

B. Open containers of explosives shall be securely reclosed when stored in a magazine. A box of explosives in the powder magazine on 4000 level was observed without a lid.

10. **R11-1-271 Use of Explosives and Blasting Agents, general provisions**

A. Blasting operations shall be under the direct control of authorized persons. The swing shift materials handling crew on the 4000 level were not under direct control of authorized persons while blasting a hang-up in the 865 Transfer Raise on August 10, 1993.

11. R11-1-271 Use of Explosives and Blasting Agents, General Provisions

B. Containers of an approved type shall be used for taking detonators and other explosives from storage magazines to the blasting area. Witnesses state that on August 10, 1993, the swing shift materials handling crew on the 4000 level were hand carrying explosives and caps up the 865 Transfer Raise. No approved explosives and cap transport containers were used.

12. R11-1-271 Use of Explosives and Blasting Agents, general provisions

M. Explosives shall be kept separate from detonators until charging is started. Witnesses state that on August 10, 1993, explosive charges had been made up on the Syntron deck and carried up the 865 Transfer Raise by the swing shift materials handling crew on the 4000 level.

13 R11-1-272 Loading of Explosives

D. After loading for a blast is completed, all excess explosives and detonators shall be returned immediately to their separate magazines. According to witnesses on August 10, 1993, the "B" shift materials handling crew working in the 865 transfer raise on the 4000 level, dropped an explosive charge down the orepass compartment of the 865 Transfer Raise. The fused cap was recovered, but not the explosive charge. The cap was detonated in the drift. Both the powder and fused cap were not properly returned to the magazine.

Recommendations:

1. If the mine operator chooses to recover, repair, or reconstruct the 865 Transfer Raise at the Superior Mine, the design calculations and drawings should be certified as approved for construction by a professional structural engineer registered in State of Arizona. The reasons for this recommendation are:

   A) The disastrous structural failure of 865 Transfer Raise on August 10, 1993 resulting in four (4) fatalities.

   B) The cross-sectional dimensions, timber support design and height of the 865 Transfer Raise are unique to the past and present mining practices of the Superior Mine.

2. During the course of the accident investigation it was determined that blasting training and practices at the Superior Mine were inadequate and inconsistent. It is recommended that the mine operator update existing blasting and explosives handling training plans and all persons involved with explosives be retrained. This will allow all employees to receive consistent training in the updated procedures.

REPORT PREPARED BY: Gary Cotter - Deputy Mine Inspector

Signature & Title

REPORT CLEARED FOR RELEASE BY: Douglas K. Martin

Arizona State Mine Inspector

Phil A. Howard

Assistant State Mine Inspector

January 25, 1994

Date

NOTES


MINE INSPECTOR
STATE OF ARIZONA

Magma Copper Company
CONSOLIDATED BALANCE SHEETS
(in thousands)

	September 30, 1990	December 31, 1989
ASSETS		
Current Assets:		
Cash & short-term investments	$109,881	$ 49,361
Accounts receivable	58,040	50,684
Inventories:		
Metals	68,622	95,215
Materials and supplies	30,179	34,451
Prepaid expenses	3,186	795
Total current assets	269,908	230,506
Property, Plant and Mine Development, net:		
Mining claims and land	30,073	30,615
Equipment and buildings	487,092	497,954
Deferred mine development costs	169,205	169,338
Net property, plant and mine development	686,370	697,907
Other	30,249	25,723
Total Assets	$986,527	$954,136
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current Liabilities:		
Accounts payable	$ 10,883	$ 14,937
Accrued liabilities	55,096	61,036
Current portion of long-term debt	—	13,750
Income taxes payable	6,431	—
Total current liabilities	72,410	89,723
Accrued Pension, Retirement and Facility Abandonment Costs	17,238	19,138
Deferred Income Taxes	20,690	11,017
Long-Term Debt	362,393	384,929
Stockholders' Equity:		
Series B cumulative convertible exchangeable preferred stock	9	9
Class B common stock	289	282
Capital in excess of par value	417,412	411,982
Retained earnings	98,174	39,067
Dividend payable in common stock	1,192	1,192
Unearned stock grant compensation	(3,280)	(3,203)
Total stockholders' equity	513,796	449,329
Total Liabilities and Stockholders' Equity	$986,527	$954,136

MAGMA COPPER COMPANY
7400 N. ORACLE
SUITE 200
TUCSON, AZ 85704

Magma Copper Company

Third Quarter 1990 Letter to Stockholders

For the three Months Ended
September 30, 1990

MAGMA

Letter to Stockholders

To Magma Stockholders:

Magma Copper Company achieved record earnings for the second consecutive quarter as a result of continuing strong copper prices and a downward trend in unit production costs due to higher productivity.

Cash flow from operations was excellent and $32 million was used to repay all remaining bank debt. Cash was $110 million as of September 30, 1990.

FINANCIAL RESULTS

Net income for third quarter 1990 was a record $28.9 million, or $.69 per common share, fully diluted, compared to $16.8 million, or $.41 per common share, fully diluted for third quarter 1989 and $23.4 million, or $.56 per common share, fully diluted, for second quarter 1990.

Net income for the first nine months of 1990 was $64.0 million, or $1.54 per common share, fully diluted, compared to $52.6 million, or $1.29 per common share, fully diluted, for the first nine months of 1989.

Net cash provided by operations for third quarter 1990 was $43.5 million, compared to $17.4 million for the same period in 1989 and $60.0 million for second quarter 1990. The cash balance at September 30, 1990 remained fairly even at $110 milion, compared to $108 million at June 30, 1990, due largely to bank debt repayment.

COMMON STOCK ACTIVITY

Magma's common stock, listed on AMEX under the symbol MCU traded in a range of $6¾ to $4⅞ during the quarter with an average daily volume of 131,000 shares.

MARKETING AND SALES

Revenue for third quarter 1990 was $202.9 million compared to $174.5 million for the same period in 1989 and to $204.9 million for second quarter 1990.

Copper sales, including rod conversion premiums, contributed 89% of the total revenue for third quarter 1990 of $180.7 million. The average revenue per pound of copper sold for third quarter 1990, including rod conversion premiums, was $1.27 compared to $1.21 for third quarter 1989, and $1.18 for second quarter 1990.

Magma has implemented a "Market Insurance Strategy," which includes forward sales contracts designed to ensure operating profits from its highest cost production, the San Manuel Underground Mine, even if market copper prices should decline. Forward sales contracts equal to the San Manuel Underground Mine production, approximately 180 million pounds per year, were entered into at $0.98 and $0.93 per pound for 1991 and 1992, respectively.

OPERATIONS

The San Manuel Mining Division in-situ leaching operations and the Pinto Valley Mining Division concentrator and SXEW operations achieved record production for third quarter 1990. Other significant operational achievements for third quarter 1990 include smelter production of 137 million pounds, total electrolytic copper production of 171 million pounds, a $.02 per pound reduction in cash operating cost and the first production from the Superior Mining Division and the Kalamazoo Mine.

The percentage of copper produced from Magma's lower-cost leaching SXEW processes was 26% for third quarter 1990, compared to 23% for 1989, primarily as a result of improved solution recovery at the San Manuel in-situ leaching program.

The Superior Mining Division, now at full production of 1,000 tons per day, has an average ore grade of 5.9% and will produce approximately 27 million pounds of copper per year over an estimated mine life of 8 to 9 years. The Kalamazoo Mine will be mined at the rate of 6,000 tons per day by the end of 1990.

Sincerely yours,

J. Burgess Winter
President and Chief Executive Officer

Donald J. Donahue
Chairman of the Board

Magma Copper Company
CONSOLIDATED STATEMENTS OF CASH FLOWS

(In thousands)

	Nine Months Ended September 30	
	1990	**1989**
Net income	$ 64,040	$ 52,633
Adjustments to reconcile net income to net cash provided by operating activities:		
Depreciation, depletion and amortization	24,848	22,273
(Gain) loss on sale of assets	(2,043)	20
Other	1,641	2,003
Change in certain assets and liabilities:		
(Increase) decrease in:		
Accounts receivable	(7,356)	15,881
Inventories	30,120	(27,522)
Prepaid expenses	(2,391)	(1,152)
Increase (decrease) in:		
Accounts payable and accrued expenses	(7,044)	(13,659)
Income taxes payable	6,431	303
Accrued pension and facility abandonment costs	(1,900)	(9,194)
Deferred income taxes	9,673	9,755
Total adjustments	51,979	(1,292)
Net cash provided by operating activities	116,019	51,341
Cash flows from investing activities:		
Capital expenditures	(22,224)	(38,373)
Proceeds from sale of assets	8,748	270
Other	(4,523)	518
Net cash used in investing activities	(17,999)	(37,585)
Cash flows from financing activities:		
Long-term borrowing	—	33,000
Long-term debt repayment	(37,500)	(125,500)
Issuance of Reset Debentures	—	100,000
Debt issuance costs	—	(3,526)
Preferred stock dividends—cash portion	(1,214)	(1,043)
Issuance of non-interest-bearing notes	1,214	1,043
Net cash provided (used) by financing activities	(37,500)	3,974
Net increase in cash	60,520	17,730
Cash at the beginning of the period	49,361	6,545
Cash at the end of the period	$109,881	$ 24,275
Supplemental disclosure of cash flow information:		
Cash paid during the year for—		
Interest	$ 38,777	$ 39,274
Income taxes	$ 8,015	$ 9,501

Magma Copper Company
SELECTED FINANCIAL AND OPERATING DATA
(in millions, except per pound amounts)

	Three Months Ended,		
	September 30, 1990	June 30, 1990	September 30, 1989
Electrolytic pounds produced from:			
Magma sources	110.9	127.8	108.4
Purchased concentrates	21.8	23.7	3.4
Other purchases	2.8	4.0	—
Toll customers	35.3	18.1	32.0
Total electrolytic production	170.8	173.6	143.8
Percentage of SX-EW copper contained in Magma production (1)	26%	26%	23%
Pounds sold from:			
Magma sources	112.0	133.5	115.7
Purchased concentrates	21.8	23.7	3.4
Other purchases	9.1	4.0	6.8
Total sales quantities	142.9	161.2	125.9
Sales of copper	$180.7	$189.7	$152.3
Price realized per pound	$ 1.27	$ 1.18	$ 1.21
Cost of products sold:			
Cost of copper sold—			
Magma sources	$ 92.3	$110.4	$ 98.4
Purchased concentrates	26.7	26.3	3.5
Other purchases	11.3	4.6	7.3
Tolling	6.8	3.5	7.0
Other	5.2	3.4	9.5
Total cost of products sold	$142.3	$148.2	$125.7
Per pound cost of products sold:			
Magma sources			
Before credits	$ .82	$ .83	$ .85
Credits (2)	(.12)	(.11)	(.11)
Net	$ .70	$ .72	$ .74
Purchased concentrates	$ 1.22	$ 1.11	$ 1.03
Other purchases	$ 1.24	$ 1.15	$ 1.07

(1) Based on copper, contained in concentrate and SX-EW output, produced from Magma sources.

(2) Deductions for rod premiums and profits on by-products, custom processing and toll conversion.

Magma Copper Company
CONSOLIDATED STATEMENTS OF OPERATIONS
(in thousands, except per share amounts)

	Three Months Ended September 30,		Nine Months Ended September 30,	
	1990	1989	1990	1989
Sales	$202,866	$174,504	$589,331	$459,965
Cost of sales:				
Cost of products sold	(142,278)	(125,700)	(430,272)	(315,230)
Depreciation, depletion and amortization	(8,247)	(9,058)	(24,848)	(22,273)
General and administrative	(3,013)	(2,579)	(8,317)	(7,281)
Marketing and delivery	(3,307)	(1,802)	(11,327)	(8,499)
Income from operations	46,021	35,365	114,567	106,682
Other income (expense):				
Interest expense	(14,519)	(15,247)	(44,042)	(45,079)
Other	6,458	120	12,824	1,943
Income before income taxes and extraordinary item	37,960	20,238	83,349	63,546
Income tax provision	(10,929)	(3,875)	(22,489)	(20,294)
Income before extraordinary item	27,031	16,363	60,860	43,252
Extraordinary item:				
Utilization of net operating loss carryforward	1,882	451	3,180	9,381
Net income	$ 28,913	$ 16,814	$ 64,040	$ 52,633
Preferred stock dividends	(1,622)	(1,842)	(4,933)	(5,155)
Net income available for common stock	$ 27,291	$ 14,972	$ 59,107	$ 47,478
Earnings per share, primary:				
Income before extraordinary item	$ .93	$ .58	$ 2.09	$ 1.53
Extraordinary item:				
Utilization of net operating loss carryforward	.06	.02	.11	.34
Net income	$ .99	$ .60	$ 2.20	$ 1.87
Preferred stock dividends	(.05)	(.07)	(.17)	(.19)
Earnings per share of common stock	$ .94	$ .53	$ 2.03	$ 1.68
Earnings per share, assuming full dilution:				
Net income	$ .69	$ .41	$ 1.54	$ 1.29
Weighted average common shares outstanding:				
Primary	29,129	28,199	29,129	28,198
Fully diluted	41,717	40,787	41,717	40,786

MAGMA COPPER COMPANY FILE

Metals Week's
Copper Conference
December 12, 1989

Preparing For The Worst In The Copper Industry

By
J. Burgess Winter
President and Chief Executive Officer
Magma Copper Company

MAGMA

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WHAT LIES AHEAD FOR COPPER? ONE MAN'S VIEW

MR. CHAIRMAN, DISTINGUISHED PANELISTS, LADIES AND GENTLEMEN:

Our hosts from Metals Week call this conference "Copper: Preparing for the Worst." It sounds like an invitation to the copper industry to batten down its hatches because a copper Hugo or a San Francisco earthquake is about to strike.

The warning is understandable. Copper has always been a volatile industry with soaring booms and wrenching busts. In the last sixteen years there have been two such cycles. In 1973 and early 1974 demand for copper was insatiable and prices soared. Then the energy crisis provoked a worldwide recession and the bottom dropped out of the copper market. Again a wave of double-digit inflation in 1979 and early 1980 pushed copper prices to new all-time highs. But the brief era of record demand and high prices was followed by a deep trough between 1982 and early 1987 -- a period the producers will long remember.

During these and earlier periods of high prices, supply was over-stimulated and the groundwork laid for loss of markets.

New mines were opened and existing operations expanded. High prices prompted consumers to look to alternative materials as substitutes for copper.

Observers such as Metals Week are concerned that history will repeat itself and, of course it will -- again and again. The average U.S. producer price for copper of $1.19 a pound in 1988 was the highest for any recorded year. And when 1989 has been completed, the average price seems likely to be at over $1.25 a pound for the full year.

Yet, even though these are the highest copper prices ever reported in terms of current -- or, historical -- dollars, are they really so high?

The U.S. Bureau of Labor Statistics currently employs the year 1967 as its standard reference year. On the basis of consumer prices in 1967 represented by 100, the 1989 CPI equivalent will be about 368.

In the standard year 1967 the average price of copper was 38.2¢ a pound in the United States. Because of inflation fears arising from the country's involvement in Viet Nam, the Johnson administration had pressured domestic producers to keep the price of copper from rising to the equivalent of the world market. The average London Metal Exchange price in 1967 was 52.2¢ a pound -- and this was more representative of world conditions that year than the controlled U.S. price.

The U.S. producer price of copper in 1967, converted into 1988 dollars, was $1.35 a pound, 12% higher than the 1988 average price, while the LME equivalent was $1.85/lb.

To put the last 22 years in the copper market into a proper perspective, Chart I shows U.S. annual average producer prices both on a current basis and on a constant 1988 dollar basis.

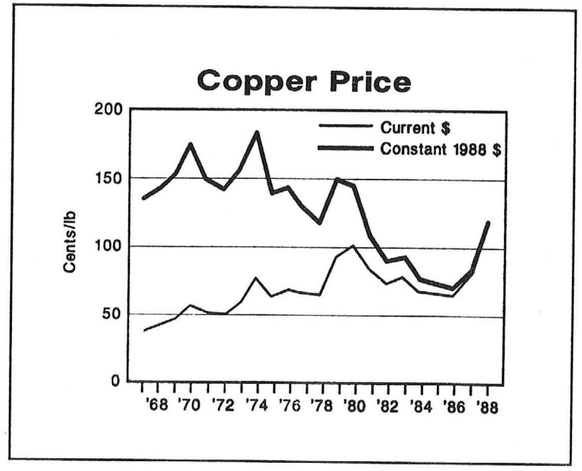

Figure 1

It is clear that throughout the period 1967 to 1980 on a constant price basis the average U.S. producer quotation was well above the 1988 average. It was only between 1982 and 1987 that copper prices, converted into 1988 dollars, were below the equivalent of $1 a pound in today's currency value.

The copper market does not exist in a vacuum. Copper competes in the market place with other

industrial raw materials. Among the non-ferrous metals its chief competitors are aluminum, zinc, and stainless steel. I do not have comparable data for stainless steel prices, but information on aluminum and zinc prices over this 22-year stretch is readily available.

The next two charts show U.S. prices for aluminum and zinc during the period 1967-1988 in terms of current dollars and constant 1988 dollars.

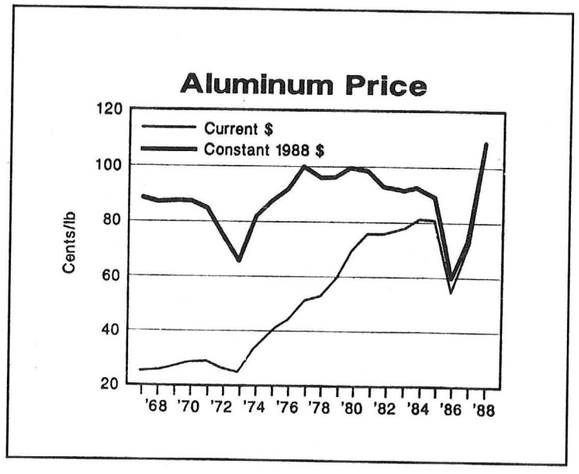

Figure 2

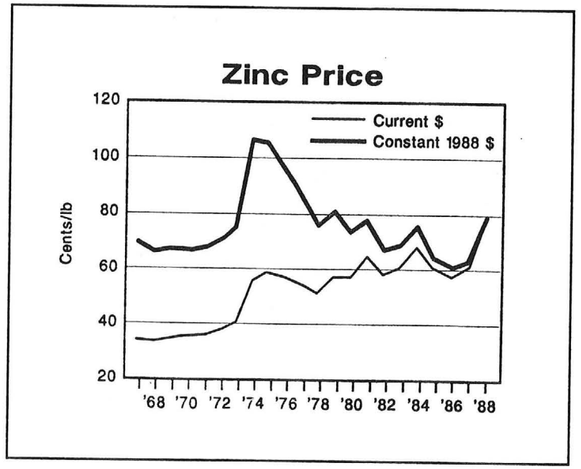

Figure 3

Both these metals followed price patterns quite different from those experienced by copper. In comparison with the 12% loss in the U.S. average producer copper price between 1967 and 1988, the constant dollar price of aluminum between those two years rose by 24% and the constant dollar price of zinc between those two years rose by 23%.

The fourth chart compares copper, aluminum and zinc prices in constant 1988 dollars over the period of this study. It makes clear how copper's competitive position has changed in relation to these other metals.

Prior to the energy crisis copper at times was more than twice as expensive as aluminum. Gradually, as rising energy prices raised the cost of producing aluminum, the gap between the prices of the two metals narrowed.

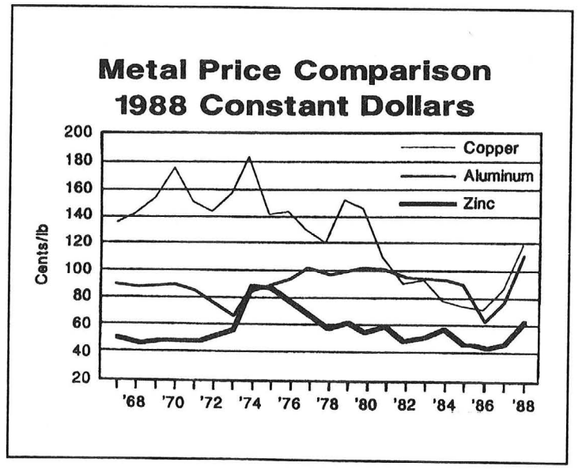

Figure 4

By 1983 aluminum and copper sold at approximately equal prices. In 1984 and 1985 aluminum

was actually more expensive than copper.

Thus the strong price incentive that existed in the sixties and early seventies to replace expensive copper with cheap aluminum no longer prevails.

As for zinc, during the early years zinc cost about a third as much as copper. Recently its price has been half that of copper.

Substitution of other materials due to technological developments is a different situation. In telecommunications copper wire has been replaced in some applications by fiber optics. But this loss was not due to price. Most substitution by fiber optics happened in the early and mid-eighties when copper prices in constant dollar terms were at or close to their all-time lows.

What has copper's consumption pattern been?

Between 1950 and 1974, despite loss of some markets through substitutions, copper consumption in the market-economy countries increased at a compound rate of just under 4% annually. This was a vigorous expansion that required the industry to add plant capacity year by year.

After 1974 demand for industrial raw materials was impacted by two severe recessions. The world economy suffered from uncertainties arising from the energy crisis, political instability, severe inflation, volatile foreign exchange rates, and the debt crisis

facing many developing nations. Thus consumption of all industrial commodities suffered.

Nevertheless by the end of the seventies consumption of copper in the market-economy countries reached record levels.

The average consumption of refined copper over the three years -- 1978, 1979, and 1980 -- was 8.1 million short tons annually. This is the base by which one can measure what has happened since, as shown on the next chart.

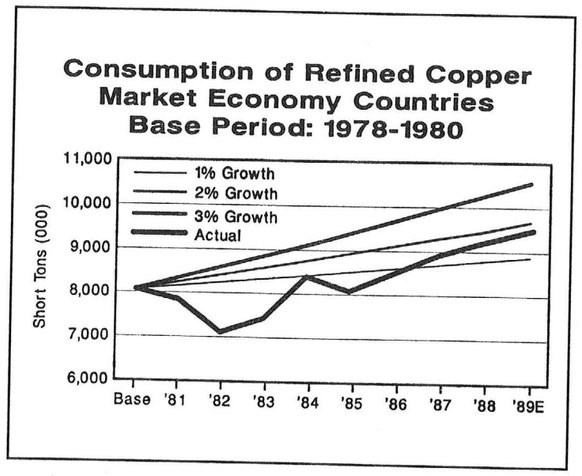

Figure 5

There are four lines on this chart. Three show assumed levels of consumption, year by year since 1980, if the compound growth rates were 1%, 2% or 3%. The fourth line shows what actually happened through 1988, with an estimate for 1989, a growth rate of about 1.5% a year.

Copper consumption can certainly be expected to rise as the world economy expands. The recovery phase of the current business cycle is already the longest peacetime recovery since the end of World War II, but most economists feel that a recession or at least a slowing in the rate of expansion is probable within the next year or two, maybe sooner.

How should the copper industry face up to such a situation?

The copper industry is frequently blamed for being obsessed with its production problems and indifferent to its marketing problems. Whether true or not for the past, in the high-tech world of the present the managements of copper companies must recognize the need for research and promotion of their product in competition with rival commodities. The copper industry of the world and the U.S. has been very dilatory in developing new uses and markets for copper and even in the assiduous protection of traditional markets like the automobile radiator. There is no point in exploring for new copper reserves unless a market exists for the product.

Formation of the new International Copper Association is a step in the right direction. Its mission is to coordinate and supplement the individual national efforts to find new uses for copper and to promote them in world markets. The organization should have the support of all major world-class producers, both in the private and in the public sectors and heavy demands put on the organization to perform.

Copper prices, adjusted to a constant dollar basis, have not risen sufficiently to discourage demand or threaten the metal's competitive position, but have provided a definite stimulus to expand copper supplies.

In part this is the consequence of the industry's great success in reducing production costs. Low prices in 1982-1986 caused heavy losses for many producers and resulted in the closing of a significant number of marginal mines.

To survive, corporate managements undertook measures that improved productivity. New technology was introduced, fat corporations were reorganized, operations were divested, modern management methods took over from old, top heavy systems.

By 1986 the industry had reduced labor cost dramatically by the elimination of unions or by negotiating contracts which actually reduced wages and benefits and increased productivity to more internationally competitive levels.

The consequence of lower production costs and rising copper prices in 1987 and 1988 was a sharp increase in profits of the industry.

With this improvement, the investment community once again was eager to finance expansion of copper capacity -- both new mines and incremental additions to producing properties.

Most of the new capacity is on the part of private sector enterprises -- Escondida and Disputada in Chile; Morenci, Ray and Mission in the United States; Ertsberg in Indonesia; and perhaps a major expansion of the Olympic Dam mine in Australia.

The question that faces the copper industry today is whether the current round of capacity expansion can be digested without provoking another prolonged period of low prices and disastrous financial outcomes, such as was experienced in 1982-1986.

Visible stocks play a strong role in copper price determination and recent history as depicted on John Gross's famous graph of LME and Comex stocks suggests that the critical point may be about 250 or 300,000 tons.

When stocks in exchange warehouses exceed that range, prices tend to weaken, when stocks are below that range, prices tend to strengthen.

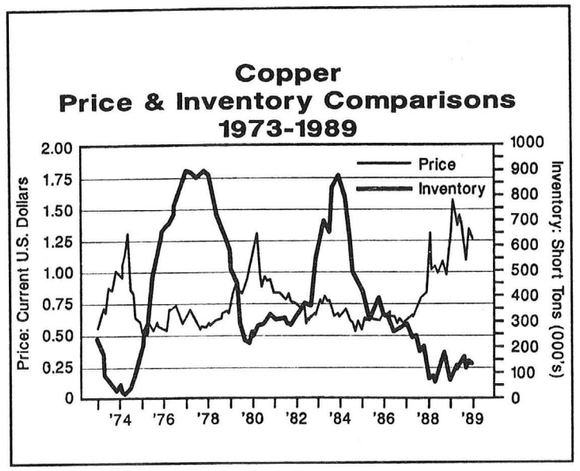

Figure 6

Prognosticating on the copper price for one or two years out is a hazardous occupation at best. Undoubtedly, there will be many unpredictable developments which will impact the copper price during this period -- developments in the Soviet bloc being just one of them.

I've been trying to forecast copper price since 1959 when I first got into the industry in Northern Rhodesia, and my monthly bonus was directly indexed to the LME price of copper.

I do not intend here to forecast the copper price for the next few years but, I can tell you that after much internal deliberation, Magma Copper Company has sold a third of our production for 1990 and 1991 at fixed prices in excess of $1.03/lb. over the two year period. We have done this by selling cathodes f.o.b. our refinery at San Manuel for payment immediately upon release so that the fixed price at which we have sold our copper is our net realized price.

MAGMA STRATEGY

On the assumption that ultimately some world economies will sustain a recession, stocks of copper will rise, the price of copper may fall to lower levels, it behooves the U.S. copper industry in general, and Magma Copper in particular, to develop and be prepared to implement contingency plans to ensure survival or better during the next downturn. Indeed, as we have seen already this decade, there are considerable prizes to be gained by the bold and liquid during a downturn.

Magma's strategy is underway and, while the copper company was not well poised to take full advantage of the great price scenario of the last three years, nevertheless the company is now well placed to enjoy what might be the last year of a bull market for copper in 1990.

The basic elements of the strategy, some of which have already been achieved, are as follows:

CORPORATE REORGANIZATION

The physical reorganization of the company has been virtually completed. The unwieldy, inefficient, traditional structure has been modified to eliminate complete management layers and to facilitate accountability and direct action. All the services supplied by Newmont as agent have reverted to Magma and have been refined and simplified. The marketing function has been moved from New York to San Manuel.

FINANCIAL RESTRUCTURING

This was an enormous project for a company which had not had time to develop the resources required to handle such a venture. The prime main elements were the repurchase of the preferred and common stock held by Newmont and Consolidated Goldfields for $219 million and the payback of the restrictive secured bank credit of $146 million.

These transactions took advantage of the liquidity of the financial markets by completing a public offering of $210 million of copper price/interest indexed bonds, the injection of $93 million in equity capital from Warburg Pincus Capital Company, $200 million in unsecured bank loans and revolver financing and $100 million in subordinated debentures.

The recapitalization was very successful and the

highly innovative copper indexed bonds were particularly attractive in the market place as well as providing an excellent hedge against lower copper prices for Magma.

Magma, by the end of 1989, will have sufficient cash in hand to offset the outstanding bank debt. By the end of 1990, if the copper price averages $1.00/lb., we will have reduced our debt to total capitalization ratio from 62% in 1987 to 31%.

PLANT MODERNIZATION

The major capital expenditure program, a $300 million investment, is virtually complete and the plants are close to achieving design production and cost levels.

The retrofit of the smelter/refinery complex was the key element in the program and this profit center forms the nucleus of the new Magma Copper Company. The designed capacity of 1.1 million tons of concentrate per annum has been reached and the cost of production is very attractive. The flash furnace has the capacity to achieve production of at least 10 percent over design and the refinery and ancillary equipment are being expanded accordingly.

Magma's leaching programs are now well established and technologically varied with two in-situ operations, an oxide ore leaching operation, a tailings leach plant and conventional waste dump leach process. All of these low cost leaching operations are

attached to solvent extraction and electrowinning plants, providing the opportunity to produce electrowon cathode copper in addition to the electrorefined copper produced by the conventional smelting/refining route.

By the judicious blend of higher cost underground mining, low cost open pit and leaching operations and a strong profit center in the smelter/refinery complex, Magma has put together a combination of production processes which will be profitable even at low copper prices.

LABOR/MANAGEMENT RELATIONS

The labor contract in place at the spin off of Magma Copper was negotiated in 1986 when the price of copper was 63 cents/lb. The unions had conceded a 21% reduction of wages and benefits equivalent to $3.00/hour in a last ditch effort to keep the operations going in the face of mounting losses. A bonus formula was developed on a sliding scale indexed to the price of copper and production. With the meteoric rise in copper prices in 1987 and particularly 1988 the bonus formula took effect and huge bonuses of nearly $2,800 per quarter were paid to each employee. Unfortunately the cost of production had not yet been reduced and the bonus skimmed off the profits that would have helped to reduce bank debt, ensure liquidity and allow the company to diversify faster.

Our objective in the 1989 labor negotiations was to ensure, that the unions understood clearly the cost

structure of the company, and that the concessions made in 1986, were necessary in terms of job security of Magma employees and stability of the unions. It was important to understand that coordinated bargaining would work against Magma with its high cost operations and that Magma and its unions have to tailor-make labor contracts on the basis of individual company conditions.

The new contract was negotiated in June 1989 when the price of copper was $1.25/lb., twice the 1986 level. Expectations were high and some very hard bargaining resulted. The bonus formula was replaced with a wage enhancement formula which is triggered at a copper price of 95¢/lb. At a copper price of $1.10/lb. the old formula would have paid a quarterly bonus of $2,800 per employee, whereas the new formula pays a wage enhancement bonus of $140 for the quarter. After a modest $1/hr. increase in the first year and 25¢/hr. in each of the next two years wages will still be more than $1.50/hr. lower than in 1986. In addition the unions and management, recognizing the inherent weakness in the low grade, deep underground orebodies and in the realization that job security in the high cost areas was directly related to the concept of wage flexibility, have agreed to develop a participative concept unique in the unionized copper industry.

After several days of joint strategic planning a union/management communique was issued in October which was designed to tell all management, salaried and hourly employees, that the old confrontative

approach is over and that unions and management will work closely together to eliminate waste, develop innovative work methods, study and implement gainsharing plans to drive the production costs down further and thus enhance job security. I am very enthusiastic and excited about this initiative and the beginning of a dramatic cultural change in the company is already evident.

MARKETING

Until early 1989 the purchasing and sales of Magma's feedstocks and products were carried out under a service agreement with Newmont's marketing office in New York.

After the financial restructuring of November 30, 1988 and the buyout of Newmont's interest, it was decided to restructure and relocate the entire marketing function. Since that time a completely new marketing group has been developed at San Manuel, the corporate headquarters of Magma Copper. In addition, Magma's old marketing philosophy has been restructured, undergoing radical changes.

Because the current expansion projects in world mine production have not been accompanied by corresponding increases in smelter capacity, the balance of the concentrate market has swung in favor of smelters. Magma Copper is committed to a role as a custom smelter and purchased/toll concentrates account for about 50 percent of the more than 1 million tons of concentrates treated annually at San

Manuel. Our smelting and refinery costs are very low and we intend to capitalize on our size, technology, quality and competitive position to generate maximum profits. Our feed sources are being diversified to include Magma's own mines, other U.S. producers and imported concentrates from Mexico and elsewhere.

Magma has focused on the major trends developing in the industry for overall strategy but there are regional developments that impact us considerably. Under the new US-Canada trade pact import tariffs on copper will be phased out during the 1990's. The schedule provides that by 1993 blister and electrorefined copper will have free entry and rod will be virtually free by 1999. Current trade negotiations may also accelerate these schedules. The inference is that Canadian copper will take an ever increasing share of the Eastern U.S. market.

Almost half of U.S. imports of refined copper already come from Canada since the freight rates to the N.E. and Central U.S. Markets are unbeatable. Since Magma is the most Westerly electrorefined producer, the Canadian situation will have greatest impact on us. However, this potential liability can become a considerable asset when we see the opportunities in the export market. In the Asian markets, with their great deficiency in copper and tremendous growth rates we also see major reductions developing in the tariffs. We intend to take advantage of the situation by expanding our sales of electrorefined cathode there. Our San Manuel smelter and refinery are situated eight hours by truck from the

port of Long Beach with two weeks ocean freight to Far East destinations. The combination of low cost ocean freight, pricing on the LME and payment on arrival can be more favorable to us than some sales in the U.S. market.

All offshore sales will be as electrorefined cathode which will reduce our sales of continuous cast rod. Our San Manuel rod plant will have sufficient capacity to produce all domestic requirements and the Chicago facility will be closed at the end of 1989.

CONCLUSION

I have discussed the history and cyclic nature of the demand for and, hence, price of copper. Relationships between demand and price of competitor metals indicate that copper has suffered some substitution but in general is still underpriced.

In my opinion the great weakness in our industry, particularly in the U.S., lies in the marketing of our products. The industry must immediately develop an aggressive concerted effort to fiercely protect our traditional markets while spending substantial sums of money in the development of new uses and markets for copper.

Magma's strategy has been outlined in terms of debt reduction, flexible costs, labor initiatives, etc., and the management and organizational concepts being implemented should serve the company well.

I believe that Magma Copper Company is well on the way to becoming an organization of innovation, quick reactions, high incentive and team work at all levels of the company which will enormously enhance performance. The results will, I believe, ensure maximization of profits at good copper prices and survival even at very low prices such as we have already encountered this decade.

Management consultant, Tom Peters, wrote in his latest best-seller, Thriving on Chaos, that we are all living in "an era of unprecedented uncertainty." I don't think he was speaking specifically about the mining business when he wrote this chapter, but his observations could be applied to us.

Success in the copper business in the 1990's will require a high degree of flexibility and a management philosophy that allows for quick responses to market conditions. At Magma Copper we have spent a lot of management time developing contingency plans for various possible scenarios. We are ready to make tough choices -- and make them quickly, -- to modify our high-cost mining operations and rely more on our strength as a low-cost custom smelter, if necessary.

We have also made great progress in simplifying our management structure. We have no bloated staffs or multi-layered bureaucracy to slow down our decision-making, and our board of directors is very active, skilled and quick to respond.

Our line managers have significant authority and

are expected to use it. Over the past year we have done a pretty good job of anticipating market direction and we have acted quickly and decisively when confronted with unforeseen disruptions of our concentrate supplies.

We have considerable flexibility in our financial structure. The innovative copper index bonds, which I mentioned earlier, are a good example of this flexible approach, as are our labor and power costs.

I am proud of the actions we have taken over the past year to reduce costs, streamline operations, strengthen our management team and bring our large smelting/refining complex to full production. As producers of a basic industrial commodity, we have no control over the price we receive in the marketplace, but we have many options as to how we choose to run our business depending on the circumstances. I am confident of our ability to maximize Magma's profitability to succeed in the 1990's.

MAGMA

SUPERIOR (MAGMA)
MINE FILE

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GENERAL INFORMATION

MAGMA COPPER COMPANY

Superior Division
P. O. Box 37
Superior, Arizona 85273
Telephone 602-689-2444

A Subsidiary of Newmont Mining Corporation

THE SUPERIOR DIVISION

Producing Arizona Copper Since 1911

The Superior Division of Magma Copper Company consists of an underground copper mine, concentrator and related production facilities. The Division has been producing copper since 1911. In 1973, a totally new mine and mill facilities, costing approximately $70 million went into production. Current ore reserves are approximately 5,000,000 tons of ore having an average grade of 5.5% copper.

Magma Copper Company is a highly integrated producer of primary copper, controlling the entire process from underground mining through smelting and refining.

Magma was founded in 1910 by William Boyce Thompson who had purchased the Silver Queen Mine near Superior and began to explore and develop its high grade copper veins. Mining eventually reached the 4800' level. The company operated a smelter at Superior between 1924 and 1971.

In 1969, Magma became a wholly owned subsidiary of Newmont Mining Corporation, an international firm specializing in the development and production of diversified mineral resources.

THE MINE

The Mine is one of the high grade copper mines of the world. There has been continuous mining in the Superior area for the past 100 years. The stoping method is under cut and fill. When a long ore panel has been mined out -- by miners using jacklegs to drill and heavy timbering to support the panel -- it is then backfilled with cemented tailings from the mill. During the backfilling process the miners continue to drive other panels.

All stope miners are on incentive bonus earnings which increases their basic hourly earnings. The mining cycle consists of drilling, blasting, mucking, and timbering. The mucking is done by "Cavo" mucking machine. Many stopes have two or more panels being mined at the same time in which case 1½ cycles are obtained every 24 hours. Typically, a single blast 20' high and 10' wide will produce 130 tons. Typically, a miner produces about 13 tons ore each contract shift.

THE TOWN, THE AREA

Superior is located approximately 63 miles east of Phoenix, Superior is an incorporated town with a population of approximately 5,000 people. Housing in the area is somewhat limited; however, adequate housing is available within a 30-mile radius of Superior. Zoning allows mobile homes and there are some rental properties.

Superior is within a one hour drive to the dams and lakes of the Salt River Project (Roosevelt Dam) which have excellent fishing and water skiing. Within a two hour drive from Superior are the White Mountains where there is lake and trout fishing, ski resorts, hunting, and abundant recreation opportunities.

Superior provides mild and sunny winters, and an ideal year-around climate.

Superior has a progressive school system, kindergarten through high school, which provides both scholastic education and an active athletic program. Superior High School has maintained a fine reputation for providing candidates for higher education who have fared well in many institutions of higher learning. Various scholarships are available upon graduation. The town provides excellent police services, and complete shopping.

EMPLOYEES

Number of employees, December 1981

Hourly paid	1,204
Salaried	229
Total	1,433

1981 payroll - $35,398,280

1981 fringe benefit payments - $9,503,562

Engineering categories:

Mining	Civil	Ventilation
Metallurgical	Safety	Maintenance
Mechanical	Electrical	Geological

Major departments employment:

Mine	919	Maintenance	263
Mill	92	Railroad	7
Engineering	15	Geology	7
Administration	105		

Major fringe benefit programs:

Medical/Surgical	Retirement
Dental Plan	Tuition Refund
Hospitalization	Paid Vacation
Life Insurance	

Magma was a pioneer in employee insurance when it started its first plan in 1925.

CURRENT PRODUCTION

Mine	- 3000 tons per day copper sulfide ore at average grade of 4.5% copper.
Mill	- 3400 tons per day mine ore and waste.
Sand Fill	- 1500 tons per day de-slimed mill tailings returned to mine stopes for cemented sand fill.

Concentrates - 550 tons per day average shipped to Magma's San Manuel Smelter for Processing via Magma Arizona Railroad, Southern Pacific Railroad, and San Manuel Arizona Railroad.

San Manuel Production - Capacity of 200,000 tons per year of refined electrolytic copper in form of cathode or continuous cast 5/16" redraw rod. By-products include sulfuric acid, molybdenite, and precious metal slimes containing gold, silver, selenium.

MINE FACILITIES

No. 9 Shaft and yard, east of Superior, Arizona is a modern mine plant completed in 1973. It consists of a 4843 foot deep multipurpose, 22' diameter concrete lined shaft. Ore is hoisted to pockets at the level 1100' below collar, intercepting a 9700' long hualage tunnel at the level of the mill.

Mine operating levels begin 3582' below collar and extend to 4682'.

Mine surface facilities include new hoists, air compressors, cooling and refrigeration facilities, electrical and mechanical shops, warehouse, offices, and changerooms.

MINE PRODUCTION METHODS

Undercut and fill in limestone replacement ores with average thickness of 100'. Stoping on a horizontal plane with steep ore passes and ventilation raises driven from footwall drifts. Multiface undercut and fill stopes. Mucking with rubber tire load and carry. Cemented sand fill placed in mined out top slice on timber beam, cross pole and wire mesh floors. System provides safe and efficient back to mine under.

In thinner ore zones, use traditional timber sets, roof bolts, and sand fill. Underground haulage with 9-ton battery locomotives pulling 5 or 6, 115 cu. yd. Telluride dump cars. Utility locomotives are 5-ton battery operated.

VENTILATION AND COOLING

Magma Mine was pioneer in air conditioned underground mines. The first system in 1937, personally designed by Dr. Willis H. Carrier, consisted of six centrifugal refrigeration units installed on 3600 and 4600 levels.

New system generates 2000 tons of refrigeration to cool 280,000 cubic feet per minute of intake air down to 75°. System consists of surface cooling towers and refrigeration units plus underground shell and tube heat exchangers, coils, and water chillers.

ORE HAULAGE

Two 15-ton diesel locomotives and 15 - 230 cu. ft. bottom dump ore cars from 1100' level loading station, to plant area. Ore is dumped either in bin or on ground.

CONCENTRATOR AND PLANT FACILITIES

Crushing - Primary, 18" x 36" Traylor Jaw Crusher
Secondary, 4' Symons Standard Cone Crusher
Tertiary, 5½' Symons Standard Cone Crusher
Size 3/8" to 2200 ton Fine Ore Bins

Concentrating - 2 - 9'6" x 10' Marcy Grate Discharge Ball Mills
2 - 8' x 7' Allis Chalmers Grate Discharge Ball Mills
10 - Krebs Cyclone Classifiers
40 - Agitair Rougher Flotation Cells, 100 cu. ft.
16 - Agitair Cleaner Flotation Cells, 100 cu. ft.
2 - 5' x 10' Chalmers and Williams Overflow Ball Mills
1 - 6½ x 12' Marcy Overflow Ball Mill
2 - 55' Eimco Concentrate Thickeners
3 - 10' x 22" Eimco Belt Filters
Ground storage, 3000' tons
Rougher tails to 2 - 100' Eimco Thickeners
Pyrite Plant, 7 - 100 cu. ft.
Agitair Flotation Machines, with sand to 3 storage silos with total capacity of 1650 tons

RECLAIM WATER SYSTEM

100% water reclamation system recirculates process water.

OTHER PLANT FACILITIES AT SUPERIOR

Timber Sheds — General Offices
Warehouses — Hospital
Maintenance Yards

Older adits and shaft access to orebody and #9 Shaft.

MAGMA ARIZONA RAILROAD COMPANY

An ICC licensed common carrier founded in 1914 and operating from Superior, 28.11 miles to Magma Junction with the Southern Pacific. Freight carried in 1981 was 264,000 tons.

Locomotives: 2 Baldwin 800 HP Diesel Electrics
1 Baldwin 1600 HP Diesel Electric

Employees: 7

A wholly owned subsidiary of Magma Copper Company.

LABOR UNIONS

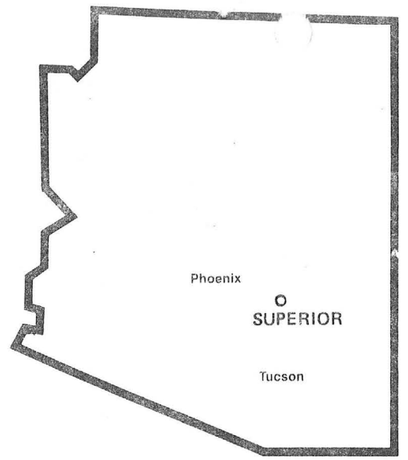
United Steelworkers of America
International Association of Machinists and Aerospace Workers
International Brotherhood of Boilermakers
United Transportation Union
Internal Brotherhood of Electrical Workers

MISCELLANEOUS

- Ore Production: 1,020,000 tons per year.
- Copper content of concentrates: 44,000 tons per year.
- Magma Copper Company purchases in Arizona: $72,000,000.
- Magma Copper Company's Arizona Taxes: $21,000,000.
- Magma Copper Company's Production capacity: 200,000 tons per year of electrolytic copper.

MANAGEMENT AND STAFF

General Manager - Frank M. Florez
Mine Superintendent - Tim Acton
Mill Superintendent - Richard Johnson
Maintenance Superintendent - Joseph Clark



SUPERIOR EMPLOYMENT STRUCTURE

	Percent of Total
Agriculture & Mining	67.6%
Construction	0.2
Manufacturing	0.7
Transportation, Communication & Public Utilities	1.0
Wholesale Trade	1.5
Retail Trade	13.4
Finance, Insurance & Real Estate	0.9
Services	10.0
Public Administration	5.0

Source. Arizona Office of Economic Planning & Development, 1978

LABOR FORCE DATA

	1970	1980
Civilian Labor Force	1,584	2,189
Employed	1,473	1,967
Unemployed	111	222
Unemployment Rate	9.6%	10.1%

Source: Arizona Department of Economic Security.

GROWTH INDICATORS

	1979	1980	1981
Postal Receipts ($)	85,102	84,022	94,589
Median Family Income ($)	18,356	19,602	N/A
School Enrollment	1,329	1,218	1,131
Net Assessed Valuation ($)*	3,663,986	3,232,734	3,909,704

*Due to recent changes in assessment ratios for certain property classes, 1980 and 1981 figures are not directly comparable with 1979 figures.

PROPERTY TAX RATE PER $100 ASSESSED VALUATION

	1979	1980	1981
Unified School District	$7.51	$2.18	$1.23
Community College	1.45	1.45	1.56
Pinal County	4.03	3.76	3.81
State of Arizona	.48	1.25	.95
Total Outside City	13.47	8.64	7.55
Superior	.00	.00	.00
Total	13.47	8.64	7.55

Source: Arizona Tax Research Association

Superior, Arizona Community Profile

INTRODUCTION

Superior is located 63 miles east of Phoenix on U.S. 60 at the junction of AZ 177. The town lies in a mountainous setting at an elevation of 2,820 feet surrounded by peaks as high as Iron Mountain at 6,056 feet. The Pinal County community was named after one of the many mines in the area, Lake Superior and Arizona Mining Company. The Magma Copper Company was established in 1910, ten years after the post office. A smelter was built in 1924 and remained in operation for 47 years. Superior was incorporated in 1976.

WEATHER

Month	Average Temperature (°F) Daily Max.	Daily Min.	Average Total Precipitation (Inches)
January	60.4	43.7	2.15
February	63.5	44.9	1.40
March	67.3	48.1	1.85
April	76.1	54.8	0.76
May	85.7	62.9	0.29
June	94.6	71.5	0.19
July	97.2	75.9	1.77
August	94.6	73.9	2.72
September	91.5	71.4	1.32
October	82.7	62.6	1.10
November	70.1	52.1	1.23
December	62.2	45.3	2.28
Year	78.8	58.9	17.06

Average Total Snow, Sleet and Hail Annually: 2.2 inches
Based on a thirty year average.

PRINCIPAL SUPERIOR AREA ECONOMIC ACTIVITIES

Superior is a mining community developed adjacent to Magma Copper Company's underground mine. The mine is a principal employer and ships its ore to the Magma smelter at San Manuel. Mining activity in the area has expanded recently with the development of other minerals such as perlite and various gemstones.

Agriculture, while of significant importance to the Pinal County economy, is of little importance to Superior, although some ranching is conducted in the surrounding area.

The trade and service sectors of the Superior economy primarily serve mining company employees and retired persons living in the area. With the recent installation of a modern sanitary sewer and town incorporation, the community is in a better position to grow and diversify.

POPULATION

	1970	1980	1970-1980 Annual Compounded Percentage Change
Superior	4,975	4,600	-0.8%
Pinal County	68,600	90,918	+2.9
Arizona	1,775,399	2,718,215	+4.4

Sources: Arizona Department of Economic Security
U.S. Bureau of the Census

OFFICE OF THE GOVERNOR
ARIZONA OFFICE OF ECONOMIC PLANNING AND DEVELOPMENT
1700 WEST WASHINGTON • ROOM 505 • PHOENIX, ARIZONA 85007 • (602) 255-5725

FINANCE

Valley National Bank: 1 Branch

TRANSPORTATION

Highways: Arizona Route 177 and U.S. 60

Railroad: Southern Pacific

Trucks: Hopper ONC Truck Lines, United Parcel Service (Interstate), Pacific Motor Trucking Co.

Bus: Greyhound and Continental

Airport: Municipal, one 3,000 foot runway

COMMUNICATIONS

Newspapers: Weekly: Superior Sun
Arizona Silver Belt (Globe)

Daily: Arizona Republic (Phoenix)
Arizona Daily Star (Tucson)

Radio: All Phoenix stations received

Television: Ten stations received from Tucson and Phoenix and 12 Cable stations.

UTILITIES

Electricity: Arizona Public Service Company

Natural Gas: Southwestern Gas Corporation

Telephone: Mountain Bell

Water: Arizona Water Company

Sewer: Superior Sanitary District

MEDICAL FACILITIES

Hospital: 1 (35 beds), (private, for Magma employees)

Physicians: 4

Dentist: 1

Optometrist: 1

GOVERNMENT SERVICES

Local Government: Mayor, 6 councilmembers

Town Police Department: 1 Chief, 1 Lieutenant, 9 officers, 5 reserve officers

Sheriff's Department: 14 deputies

Fire Department: 20 volunteers

Underwriters Rating: Grade 7

CHURCHES

1 Catholic

1 Church of Jesus Christ of Latter Day Saints

2 Protestant

1 Jehovah's Witness

2 Pentecostal

2 Baptist

EDUCATIONAL FACILITIES

	No.	Faculty	Enrollment
Public Elementary	1	30	563
Public Junior High	1	23	248
Public High School	1	25	320

Extension courses, including vocational education, are conducted by college staff from Central Arizona College.

COMMUNITY FACILITIES

Library: 1

Pool: 1

Parks: 1 with 1 football, 1 softball, and 1 baseball field

Little League Field: 1

SCENIC ATTRACTIONS

Magma Copper Company Mine on the edge of the townsite is one of the few underground copper mines in Arizona. Tourists view the mine from the entrance 6-1/2 miles east of town atop Apache Leap.

East of town on U.S. 60 are Queen Creek Bridge and tunnel. One the eastern side of Queen Creek Canyon is Apache Leap where Apaches were supposed to have jumped from rather than surrender to U.S. troops.

Boyce Thompson Southwestern Arboretum Desert Biology Station (four minute drive west of town on U.S. 60) is world famous for its display of desert plants and flora.

LODGING AND MEETING FACILITIES

Motels: 4 with 39 units

R.V. Park: 1

Meeting Facilities: 3 facilities with the largest seating up to 200 persons.

This profile was prepared in cooperation with the Town of Superior.

For further information, contact.

Town of Superior
Box 158
Superior, AZ 85273
(602) 689-5752

3/82


5223

Most Cards now have specimen #
and specimens are stored in the museum MM-K202

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 1, collected by B. Van Voorhis Date 6-15-40

(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue

Depth at which taken 1800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim Magma Copper Co.

Group

District Pioneer

County Pinal

Location (distance and direction by highway from what town) Superior

Owner of property Magma Copper Co.

Operator Magma Copper Co. "

Mine active or inactive Active

If inactive, when operated

Specimen presented by Magma Copper Co.

Notes: The following 44 cards are th
key to specimens, all taken fr
the magma mine by the same
collector.

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES NOT FOUND

Specimen No. 2, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Lead Ore

Minerals contained Galena

Gangue _____

Depth at which taken 1800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K203

Specimen No. 3, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite

Gangue Quartz

Depth at which taken 4200 level

Approximate mineral content (in terms of average per ton):

Quantity or %	Value
Copper _____	$ _____
Gold _____	_____
Silver _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K204

Specimen No. 4, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite

Gangue _____

Depth at which taken 3600 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-R205

Specimen No. 5, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcocite & Bornite

Gangue _____

Depth at which taken 2550 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES NO SPECIMEN

Specimen No. 6, collected by _____ Date 6-17-40

(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Sphalerite & Chalcopyrite

Gangue _____

Depth at which taken 1600 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES NM-K206

Specimen No. 7, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite & Bornite

Gangue _____

Depth at which taken 3400 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K207

Specimen No. 8, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue _____

Depth at which taken 2250 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K208

Specimen No. 9, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Complex Zinc Ore - Oxides (SPHALERITE) NJN-09

Gangue _____

Depth at which taken 1900

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K209

Specimen No. 10, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite

Gangue Quartz

Depth at which taken 3800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K210

Specimen No. 11, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Lead & Zinc Ore

Minerals contained Galena & Sphalerite

Gangue _____

Depth at which taken 1800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K211

Specimen No. 12, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Cuprite & Chalcocite

Gangue Quartz

Depth at which taken 1800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K212

Specimen No. 13, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue _____

Depth at which taken 1800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

NO SPECIMEN

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 14, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite & Chalcopyrite

Gangue Quartz

Depth at which taken 3800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K213

Specimen No. 15, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcocite & Bornite

Gangue _____

Depth at which taken 2550 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES NO SPECIMEN

Specimen No. 16, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue _____

Depth at which taken 4000 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES NO SPECIMEN

Specimen No. 17, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Sphalerite & small amount of galena

Gangue _____

Depth at which taken 1800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K214

Specimen No. 19, collected by _____ Date 6-13-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite & Chalcopyrite

Gangue Quartz.

Depth at which taken 4200 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-R215

Specimen No. 20, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Complex Zinc Oxide ore.

Gangue _____

Depth at which taken 1900 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K216

Specimen No. 21, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcocite & Bornite

Gangue _____

Depth at which taken 2600 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MM-K217

Specimen No. 18, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite & Pyrite

Gangue Quartz.

Depth at which taken 4000 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES NO SPECIMEN

Specimen No. 22, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite & Chalcopyrite

Gangue Quartz

Depth at which taken 4200 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 23, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Sphalerite & some Galena

Gangue _____

Depth at which taken 1700 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 24, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite

Gangue Quartz

Depth at which taken 3600 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 25, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue _____

Depth at which taken 4000 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

10 g
0 x 4 x 5 cm

MM X220

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 26, collected by ____________ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Sphalerite & Chalcopyrite

Gangue ____________

Depth at which taken 1600 Level

Approximate mineral content (in terms of average per ton):

Quantity or %		Value
Copper		$
Gold		
Silver		

Name of mine or claim ____________

Group ____________

District ____________

County ____________

Location (distance and direction by highway from what town) ____________

Owner of property ____________

Operator ____________

Mine active or inactive ____________

If inactive, when operated ____________

Specimen presented by ____________

Notes: ____________

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 27, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcocite & Bornite

Gangue _____

Depth at which taken 2550 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 28, collected by _____ Date 6-13-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite

Gangue Quartz

Depth at which taken 3800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 29, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite

Gangue Quartz

Depth at which taken 4000 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

WT 1# 6 oz
4 x 6 x 2 in

MM K221

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 30, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue _____

Depth at which taken 4200 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES MMK222

Specimen No. 31, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Sphalerite, Chalcopyrite, & Galena

Gangue _____

Depth at which taken 1700 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

Big Breck

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 32, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue _____

Depth at which taken 3800 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

Big Piece M4ᵗʰ 14 X 12 X 7 cm

MM K 223

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 33, collected by ______ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite

Gangue Quartz

Depth at which taken 3600 Level

Approximate mineral content (in terms of average per ton):

Quantity or %		Value
Copper		$
Gold		
Silver		

Name of mine or claim ______

Group ______

District ______

County ______

Location (distance and direction by highway from what town) ______

Owner of property ______

Operator ______

Mine active or inactive ______

If inactive, when operated ______

Specimen presented by ______

Notes: ______

If more space is desired for notes, use other side

OT 4 #22 g
2X10X9 cm

MM K224

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 34, collected by ____________ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite & Chalcopyrite

Gangue ____________

Depth at which taken 2250 Level

Approximate mineral content (in terms of average per ton):

Quantity or %		Value
Copper		$
Gold		
Silver		

Name of mine or claim ____________

Group ____________

District ____________

County ____________

Location (distance and direction by highway from what town) ____________

Owner of property ____________

Operator ____________

Mine active or inactive ____________

If inactive, when operated ____________

Specimen presented by ____________

Notes: ____________

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 35, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Complex zinc carbonate & Silicate ore

Gangue _____

Depth at which taken 1900 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 36, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite

Gangue Quartz

Depth at which taken 4200 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 37, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcopyrite

Gangue Quartz

Depth at which taken 3400 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 38, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Sphalerite & Chalcopyrite

Gangue _____

Depth at which taken 1800 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

7 of 43
4.5 x 10.0 x 7.0

MM R 226

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 39, collected by _____ Date 6-13-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcocite & Bornite

Gangue _____

Depth at which taken 2550 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

UA 3#19
N X 10 X 9 cm

MMK227

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 40, collected by ______________ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite & Chalcopyrite

Gangue Quartz

Depth at which taken 3800 Level

Approximate mineral content (in terms of average per ton):

Quantity or %		Value
Copper	______	$ ______
Gold	______	______
Silver	______	______

Name of mine or claim ______________

Group ______________

District ______________

County ______________

Location (distance and direction by highway from what town) ______________

Owner of property ______________

Operator ______________

Mine active or inactive ______________

If inactive, when operated ______________

Specimen presented by ______________

Notes: ______________

If more space is desired for notes, use other side

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 41, collected by _____ Date 6-17-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Zinc Ore

Minerals contained Sphalerite & Chalcopyrite

Gangue _____

Depth at which taken 1600 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MM K 229

9 X 6 X 3 cm

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 42, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Chalcocite & Bornite

Gangue _____

Depth at which taken 2600 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

Wt 12g
2½ x 1½ x 1¾"

mm K 250

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 43, collected by _____ Date 6-15-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite

Gangue _____

Depth at which taken 1800 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

MMK231

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 44, collected by _____ Date 6-17-40

(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Enargite & Chalcopyrite

Gangue Quartz

Depth at which taken ~~X~~ 4200 level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper		$
Gold		
Silver		

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side

1#49.
13x5-x5 cm

mm K 232

MINERAL SPECIMEN FOR DEPARTMENT OF LIBRARY AND ARCHIVES

Specimen No. 45, collected by _____ Date 6-14-40
(Wrap each specimen, or place in a substantial bag, separately, with a number identical with the number on this card)

Name of ore Copper Ore

Minerals contained Bornite & Chalcocite

Gangue _____

Depth at which taken 2250 Level

Approximate mineral content (in terms of average per ton):

	Quantity or %	Value
Copper	_____	$ _____
Gold	_____	_____
Silver	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Name of mine or claim _____

Group _____

District _____

County _____

Location (distance and direction by highway from what town) _____

Owner of property _____

Operator _____

Mine active or inactive _____

If inactive, when operated _____

Specimen presented by _____

Notes: _____

If more space is desired for notes, use other side