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James Doyle Sell Mining Collection

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ARIZONA DEPARTMENT OF MINERAL RESOURCES
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WEK - WDP

ASARCO Incorporated
JUL 2 1981
S.W. Exploration

7/81

F.C. Geer "Ore Reserves"

TABLE

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
ANAMAX MINING COMPANY	Twin Buttes	Sulfide	305	0.65	With 0.03% Mo; cutoff @ 0.2% Cu
	"	"	300	0.80	Pub. 1973; "outside current mine plans"; cutoff @ 0.4% Cu
	"	Oxide	41	0.96	Cutoff @ 0.6% Cu
	"	"	28	0.49	Pub. 1973; cutoff @ 0.4% Cu
	Helvetia	Sulfide	320	0.64	Pub. 1973; cutoff @ 0.3% Cu
	"	Oxide	20	0.55	Pub. 1973; acid soluble Cu; cutoff @ 0.3% acid soluble Cu
	Peach Elgin	Mixed	23	0.75	Pub. 1973; cutoff @ 0.4% Cu
ASARCO INCORPORATED	Mission	Sulfide	94.003	0.76	With 0.14 oz Ag/ton
	Poston Butte	Mixed		0.47	Pub. 1972; 32-42.5 Mt possibl
	Sacaton (OP)	Sulfide	13.503	0.70	Pub. 1980
	Sacaton East (UG)	"	14.898	1.25	Pub. 1980
	San Xavier	"	165.805	0.52	With 0.06 oz Ag/ton
	Silver Bell	"	19.627	0.67	With 0.05 oz Ag/ton
	"	Oxide			
AZTEC MINING CORPORATION	Mame	Oxide	2	1.00	Unpublished est.
BS & K MINING COMPANY	Atlas	Mixed			
CASA GRANDE COPPER COMPANY	Casa Grande	Mixed	351.4	1.05	Pub. 1980

TABLE

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
CF&I STEEL CORP.	Dragoon	Oxide			
CITIES SERVICE COMPANY	Cactus	Mixed			
	Copper Cities	Sulfide			
	Miami	"			
	Miami East	"	6	3.14	Reported 1981
	Old Dominion	"			
	Pinto Valley	"	413.4	0.41	Includes "probable" ore
? COCHISE DEVELOPMENT GROUP	Bisbee- North	Mixed (?)	20	0.80	Unpublished est.
? COCHISE MINING CORP.	San Juan	Oxide	20	0.50	Unpublished est.
CONTINENTAL OIL COMPANY	Poston Butte	Mixed	800	0.40	Pub. 1979
CYPRUS MINES CORP.	Bagdad	Sulfide	326	0.49	Pub. 1979; with 0.03% Mo
	"	Oxide	38	0.33	Pub. 1979; acid soluble Cu
	"	"	97	0.19	Pub. 1979; stockpile; acid soluble Cu after prior leachi
	Bruce	Sulfide	0.1276	3.73	Pub. 1976; with 12.8% Zn
	I-10	Mixed	100	0.52	Unpublished est.; with 0.02% Mo
	Johnson	Oxide	6.643	0.50	Pub. 1980; acid soluble Cu
	"	Mixed	10	0.60	Pub. 1974
CYPRUS PIMA MINING CO.	Pima	Sulfide	144.959	0.498	Pub. 1980
DUVAL CORP	Esperanza	Sulfide	54.959	0.27	With 0.033% Mo
	"	Oxide			
	Mineral Park	Sulfide	43.832	0.19	With 0.051% Mo
	"	Oxide			
	Sierrita	Sulfide	398.752	0.30	With 0.035% Mo
EISENHOWER MINING CO.	Palo Verde	Sulfide	147.0029	0.64	
EL PASO COMPANY	Emerald Isle	Oxide	1.5	0.40	Pub 1977; or 3Mt @+ 0.1% Cu
FREEPORT MCMORAN INC.	Santa Cruz	Mixed			

TABLE

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
INSPIRATION CONSOLIDATED COPPER COMPANY	Christmas (OP)	Sulfide	11.613	0.62	
	" (OP)	Oxide			
	" (UG)	Sulfide	20.131	1.78	Includes "probable" ore.
	Inspiration Area	Mixed	245.224	0.58	Pub. 1980
	Ox Hide	Oxide	29.309	0.31	Pub. 1980; plus recoverable Cu remaining in leach pads
	Sanchez	Oxide	79.362	0.36	
KENNECOTT CORP.	Chilito	Mixed			
	Lone Star	"	2000	0.41	Reported 1977
	Lone Star Ext.	"			
	Ray	Sulfide	606.144	0.70	Pub. 1981; with 0.01% MoS_2
	Ray	Silicate	225.760	0.68	Pub. 1981
KERR-MCGEE CORPORATION	Red Mountain	Sulfide		0.71	Pub. 1970; 100Mt possible
KEYSTONE MINERALS INC.	Korn Kob	Oxide	8	0.50	Pub. 1973
MAGMA COPPER CO.	Copper Creek	Sulfide			
	Kalamazoo	"	565	0.72	Pub. 1969
	San Manuel	"	474	0.67	Reported 1978
	"	Mixed	130	0.70	Pub. 1969
	Superior	Sulfide	9.8	4.80	Reported 1978
	Vekol Hills	"	105	0.56	Pub. 1978; minable by open pit; with 0.014% Mo; 16Mt oxide Cu
MCALESTER FUEL COMPANY	Zonia	Oxide	20.5	0.53	Pub. 1981
NAVAJO TRIBE (?)	White Mesa	Oxide	2	0.75	Pub. 1955
NORANDA MINES LTD.	Four Metals	Sulfide	6.3	0.26	Reported 1965; with 0.29% MoS_2
	Lakeshore	Sulfide (dissm)	241	0.70	Pub. 1969
	"	" (tactite)	23.6	1.69	"
	"	Oxide	207	0.71	"
	Ventura	Sulfide	3	0.82	Reported 1965
ORACLE RIDGE MINING PARTNERS	Oracle Ridge	Mixed (?)	11	2.25	Reported 1977; with 0.64 oz Ag/ton (Pub. 1979)

TABLE

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
S. B. OWENS	Carlota	Oxide	4	0.85	Reported 1979
PHELPS DODGE CORPORATION	Copper Basin	Sulfide	175	0.55	Pub. 1974; minable by open pit; with 0.02% Mo
	Copper Queen	Mixed			
	Dos Pobres	Sulfide	400	0.72	Pub. 1977
	Lavender	"			
	Metcalf	"	415.970	0.77	Pub. 1975
	Morenci	"	662.462	0.80	"
	New Cornelia	"	126.623	0.63	"
	United Verde	"			
	"	Oxide			
	Western Copper	Sulfide	175	0.60	Unpublished est. (Castle Hot Springs ?)
RANCHERS EXPLORATION & DEVELOPMENT COMPANY	Bluebird	Oxide	65	0.50	As of June 30, 1980
V.B. SMITH ESTATE	Dynamite	Sulfide			
SQUAW PEAK MINING CO.	Squaw Peak	Sulfide	30	0.35	Unpublished est.; with 0.012%Mo
STANDARD METALS CORP.	Antler	Sulfide	5.1	1.95	Pub. 1979; with 4.13% Zn, 0.94% Pb, & 1.05 oz Ag/ton; additional 2.5 Mt "possible" ore (Pub. 1980)
STRONG & HARRIS	Strong & Harris	Mixed	60	0.60	Unpublished est.; with 0.70% Zn
SUPERIOR OIL	Pine Flats	Sulfide	12	0.50	Unpublished est.

TABLE

COPPER RESERVES IN ARIZONA 1/

COMPANY	DEPOSIT	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE CU CONTENT (%)	REMARKS
UNDETERMINED	Mineral Hill	Mixed			
UNION OIL	Turquoise	Oxide	10	0.50	Pub. 1975
UNITED STATES GOVERNMENT	Park Hill	Mixed (?)	30	0.45	Unpublished est.
UNITED STATES GOVERNMENT & U.S. METALS CORP.	Apex	Mixed (?)			
VAN DYKE COPPER CO. & SHO-ME COPPER CO.	Van Dyke	Oxide	100	0.50	Pub. 1977

Source: Company Annual Reports, Form 10-K's, and Prospectus; Professional Publications.

1/ Reserves are given with a grade of average total copper content as of December 31, 1980, unless stated otherwise under "Remarks." As used in this table, reserves generally mean those estimated quantities of ore which under presently and reasonably foreseen technical and economic conditions may be profitably mined and sold or processed for the extraction of their constituent values.

ARIZONA DEPARTMENT OF MINERAL RESOURCES
STATE OFFICE BUILDING
416 WEST CONGRESS
TUCSON, ARIZONA 85701

with Ore Reserves

WLA

Recap of calculated values from Prospectus', etc.

Mine/Years	Ave Cu Grade	Ave Recoverable Recov. of Cu	Average Recovered per ton of processed ore: Oz Silver	Oz Gold	% Molybdenum
Berkely Open-Pit					
1971-1975	0.64%	74.8%	0.145	0.001	NA
Continental East Open-Pit					
1974-1975	0.47%	76.2%	0.032	0.000	NA
Butte UG Mine					
1971-1975	3.16%	94.5%	9.85	0.002	NA
Jerrington					
1971-1975 Sulfide	0.54%	83.1%	NA	NA	NA
1971-1975 Oxide	0.43%	73.2%	NA	NA	NA
Twin Butte					
1971-1974	0.86%	72.3%	0.085	NA	0.010
1973-1977 Sulfide	-	72.0%	-	-	-
1975-1977 Oxide	-	72.0%	-	-	-
Utah Copper					
1972-1976	0.64%	NA	0.068	0.008	0.015
Chino					
1972-1976	0.85%	NA	0.004	0.0002	0.003
Ray					
1972-1976	0.99%	NA	0.020	0.0001	0.002

To Tom Osborne NU

WLL copy file On Reserves

Part A

DRAFT

Best Rated

COPPER DEPOSITS WITH PRODUCTION POTENTIAL OF 75,000 TPY, OR MORE:

		Planned Yearly Copper Production*	Start of Production*	Reserves*
1.	Sar Chesmeh Iranian Govt.	145,000(m)	1978	412M** tons @ 1.12% Cu 1st 5-10 yrs @ 1.5%
2.	La Caridad, Son.Mexico Mexicana de Cobre (Govt.44%, private 56%)	100,000(m)	Sept. 1978	700M tons @ .70% Cu 1st 5-10 yrs @ .80%
3.	Cerro Colorado, Pan. Texas Gulf S and Panamanian Govt.	200,000(m)	1982(?)	+600M tons @ .70% Cu
4.	OK Tedi, New Guinea Govt.-20%, operator, BHP-30%, Amoco-30%, Gesellschaft-20%.	120,000(m)	1985	250M tons @ .94% Cu, .5gms Au
5.	Disputada, Chile Exxon	300,000(m)	1985(?)	+500M tons ~~(5)~~ @ 1.2% Cu
6.	Tenke Fungurume, Zaire Soc.Miniere de T.F.	130,000(m)	?	55M tons @ 5.6% Cu, .45% ~~Co~~ COBALT
10 ~~12~~	Michiquillay, Peru Mineroperu 51% Japanese 49%	130,000(m)	?	460M tons @ .75% Cu + 1st 5 yrs, .90% Cu
13 ~~8~~	Quebrada Blanca Chile, Codelco	100,000(m)	?	165M tons @ 1.00% Cu
9.	Safford - Phelps Dodge		?	400M tons @ .72% Cu or/±200M tons @ .90% Cu
7 ~~10~~	Andacolla, Chile Enami, Noranda			350M tons @ .70% Cu
11.	Toromocho, Peru Centromin	100,000(m)	?	330M tons @ .78% Cu
12.	Valley Copper, B.C. Cominco (81%)	70,000(m)		800M tons @ .48% Cu
8 ~~13~~	El Abra, Chile Codelco			1,500M tons @ 1.00% Cu
14.	Stikine, B.C. Kennecott-Hudson Bay			138M tons @ 1.38% Cu
17 ~~15~~	El Arco, Mexico Industrial Minera Mexico			630M tons @ .60% Cu
16.	El Pachon, Argentine St.Joe	100,000(m)	?	780M** tons @ .59% Cu
15 ~~17~~	Quellaveco Centromin			200M tons @ .80% Cu

* Metric tons except in USA and Canada (m)

* * Million

J.H. Courtright

Revised numbers on list given to TCO by phone 1-25-78

1-23-78

Part B

DRAFT

Harold: Following list of copper deposits not yet on stream with capacity to produce more than 75,000 tons Cu/year. Partly developed deposits listed highest in potential order of development then from there by grade with open pit favored over underground and some consideration for politics and geography - which can't be ignored. Location and ownership you already know.

1. Sar Cheshmeh
2. La Caridad
3. Andacollo
4. Tenge-Fungurume
5. Disputada
6. Quelleveco
7. El Abra
8. Quebrada Blanca
9. OK Tedi
10. Toro Mocho
11. Michiquillay
12. Cerro Colorado

(+75,000 tons Cu/yr possible from here up)

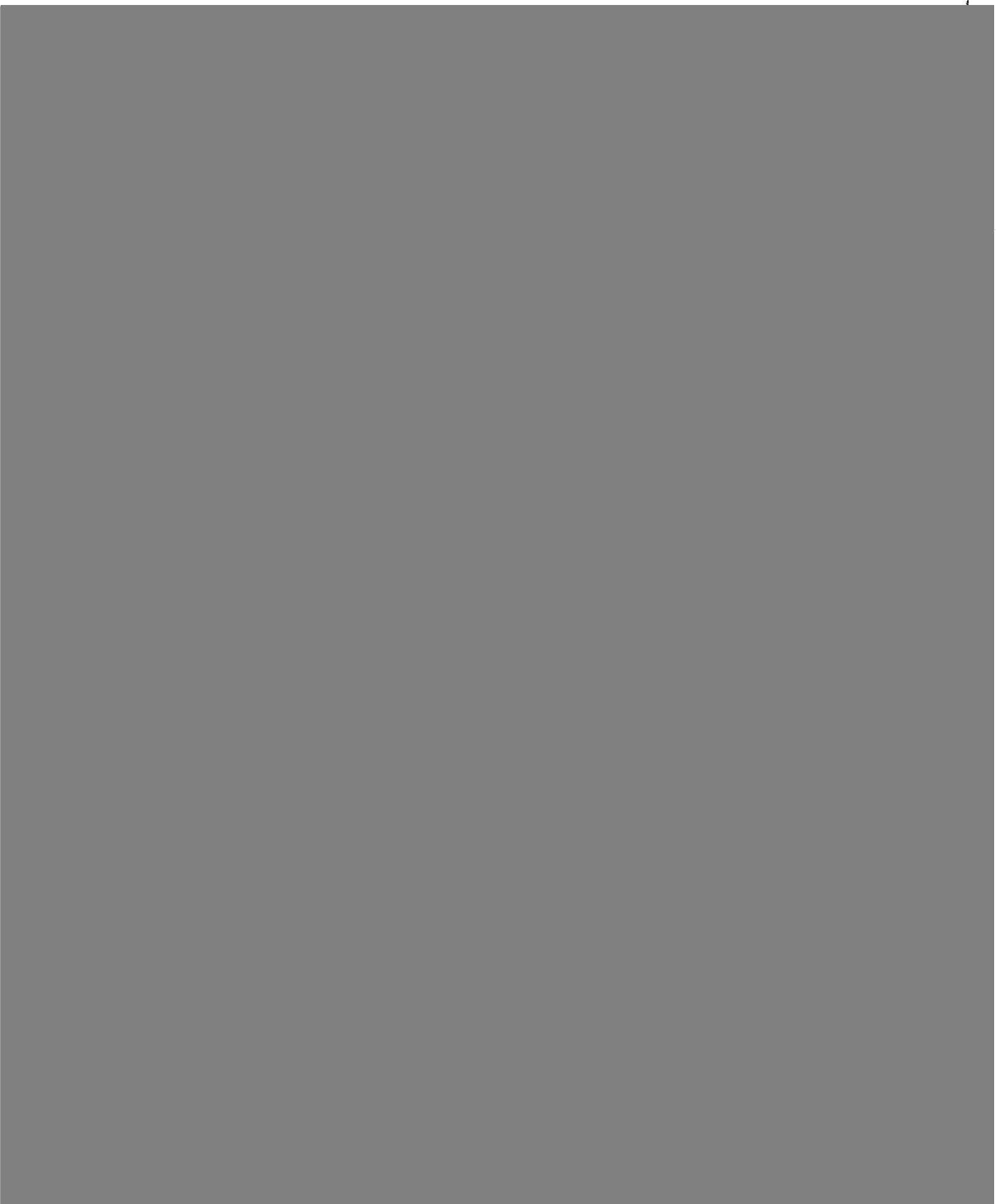
- unlikely from here down

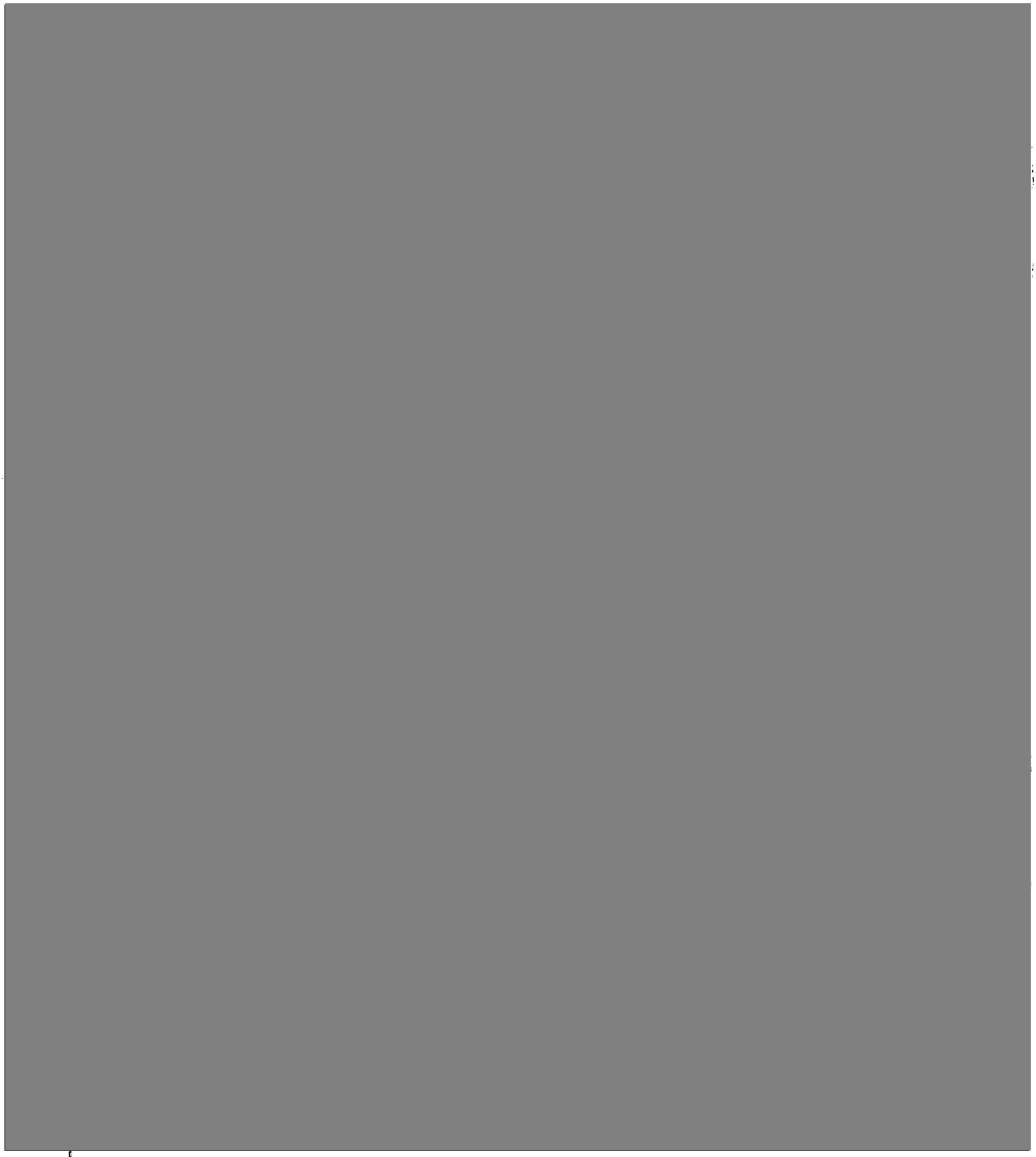
13. PD Safford
14. Hanna Getty - Casa Grande
15. El Arco
16. Stikine
17. Pachon
18. Santa Rosa-Pilares
19. Valley Cu (.48% Cu)
20. Helvetia E
21. Greater Butte

I made the assumption that with less than 0.9% Cu block cave or less than 0.5% Cu open pit would not exceed 75,000 tons Cu/year.

FTG

Ore Reserves





Bill,

Of perhaps passing interest is the attached production data from Kennecott's 10-K report.

John

cc: J.H.C.

JBS → work file on reserve

SECURITIES AND EXCHANGE COMMISSION
Washington, D. C. 20549

FORM 10-K

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF
THE SECURITIES EXCHANGE ACT OF 1934

for the fiscal year ended December 31, 1973 Commission file number 1-1369

KENNECOTT COPPER CORPORATION
(Exact name of registrant as specified in its charter)

New York	13-5178150
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
161 East 42nd Street, New York, N. Y.	10017
(Address of principal executive offices)	(Zip Code)

Registrant's telephone number, including area code 212-687-5800

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Name of each exchange on which registered
Capital stock, $5 par value	New York Stock Exchange Boston Stock Exchange
7-7/8% Debentures due 2001	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act:

None
(Title of Class)

Indicate by check mark whether the registrant (1) has filed all annual, quarterly and other reports required to be filed with the Commission and (2) has been subject to the filing requirements for at least the past 90 days.
Yes X No ___

COOPERS & LYBRAND
CERTIFIED PUBLIC ACCOUNTANTS

titanium slag and Sorelmetal, there are other materials which, at appropriate price levels, can compete with these products. With respect to iron powders, the Company's principal market is the United States, in which it competes with both other sellers of iron powders and sellers of competitive materials.

Copper

Kennecott owns and operates four open-pit copper mines located in the western part of the United States. These mines contain large amounts of low-grade copper ore overlain or flanked by waste rock which must be removed before the ore can be mined. Molybdenum, gold, and silver, as well as certain other non-ferrous metals, are contained in small quantities in the ore and are extracted as by-products. At or near the location of each of its mines, Kennecott also owns and operates concentrating mills which convert the ore from the nearby mines into copper concentrates through a process of crushing, grinding and flotation, and smelters which process the copper concentrates into blister copper. The blister copper so produced is then either electro-refined at the Company's two electrolytic refineries, one of which is located near Salt Lake City, Utah and the other near Baltimore, Maryland, or, in some cases, fire refined at Chino Mines Division. Waste rock removed at each of the mines is hauled to waste dumps where it is subjected to a leaching process. An acidic solution is pumped to the top of the dumps and, percolating downward, leaches the soluble copper contained in the waste material. The resulting copper-bearing solution is treated in a nearby precipitation plant to produce precipitate copper, which is shipped to the smelter, except for small quantities sold directly to customers.

Throughout 1973 the Company's three largest mines and all of its smelters operated on a seven-day week. The smallest mine operated on a six-day week until March, 1973 and has operated on a seven-day week since that time.

Utah Copper Division. Kennecott's largest mine is located at Bingham, Utah, approximately 28 miles southwest of Salt Lake City. Ore from this mine is transported by the division's railroad approximately 15 miles to concentrating and smelting facilities located near Magna, Utah. The table on the following page shows certain production data with respect to the Utah Copper Division for the three years ended December 31, 1973:

	Waste Removed (Thousands of tons)	Ore Mined (Thousands of tons)	Grade of Ore (Copper)	Copper Produced (tons) (1)	Molybdenum Produced (lbs.)	Gold Produced (ozs.)	Silver Produced (ozs.)
1971	84,504	35,008	0.69%	261,783	12,384,115	291,837	2,291,969
1972	89,572	34,952	0.68%	258,037	13,491,215	328,577	2,822,779
1973	99,596	38,268	0.65%	254,965	12,809,526	310,547	2,703,338

(1) Includes copper produced from precipitates obtained by leaching waste dumps as follows:

1971, 48,571 tons; 1972, 48,517 tons; 1973, 45,574 tons.

Chino Mines Division. Kennecott's Chino mine is located near Silver City, in the southwestern part of New Mexico. Ore is transported by rail approximately nine miles to concentrating, smelting and fire refining facilities located at Hurley, New Mexico, where fire refined copper and, on occasion, blister copper, is produced. The following table shows certain production data with respect to the Chino Mines Division for the three years ended December 31, 1973:

	Waste Removed (Thousands of tons)	Ore Mined (Thousands of tons)	Grade of Ore (Copper)	Copper Produced (tons) (1)	Molybdenum Produced (lbs.)
1971	19,664	7,257	0.94%	71,469	423,533
1972	18,334	6,345	0.88%	73,403	396,671
1973	22,129	8,102	0.88%	67,836	608,098

(1) Includes copper produced from precipitates obtained by leaching waste dumps as follows:

1971, 27,806 tons; 1972, 25,779 tons; 1973, 22,859 tons.

Ray Mines Division. Kennecott's Ray mine is located approximately 10 miles northwest of Kearny, Arizona. Two types of ore are mined from this property - a sulfide ore which is processed by customary concentrating and smelting facilities located at Hayden, Arizona, approximately 20 miles south of the mine, and a silicate ore which is

subjected to a hydrometallurgical process at a plant located adjacent to the mine site. The following table sets forth certain production data with respect to the Ray Mines Division for the three years ended December 31, 1973:

	Waste Removed (thousands of tons)	Ore Mined (thousands of tons)	Grade of Ore (Copper)	Copper Produced (tons) (1)	Molybdenum Produced (lbs.)	Gold Produced (ozs.)	Silver Produced (ozs.)
1971:							
Sulfide	23,243	7,647	0.90%	66,835	512,461	1,265	239,798
Silicate		2,631(2)	1.39%	16,596	-0-	-0-	-0-
1972:							
Sulfide	26,600	7,747	0.89%	70,243	31,538(3)	1,405	268,301
Silicate		2,617(2)	1.25%	19,931	-0-	-0-	-0-
1973:							
Sulfide	27,393	8,619	0.91%	74,194	611,307	1,213	234,994
Silicate		3,704(2)	1.35%	24,714	-0-	-0-	-0-

(1) Includes copper produced from precipitates obtained by leaching waste dumps as follows:

1971, 16,507 tons; 1972, 16,471 tons; 1973, 14,595 tons.

(2) Figure represents silicate ore treated in leaching vats.

(3) Molybdenum recovery was suspended during most of 1972 due to depressed molybdenum prices.

Nevada Mines Division. Kennecott's smallest copper property is located at Ruth, Nevada, in the eastern part of the state. Ore produced at this property is shipped by Company railroad approximately 20 miles to concentrating and smelting facilities located at McGill, Nevada. The following table shows certain production data with respect to the Nevada Mines Division for the three years ended December 31, 1973:

	Waste Removed (thousands of tons)	Ore Mined (thousands of tons)	Grade of Ore (Copper)	Copper Produced (tons) (1)	Molybdenum Produced (lbs.)	Gold Produced (ozs.)	Silver Produced (ozs.)
1971	30,278	6,788	0.83%	39,459	33,053	46,687	129,002
1972	29,472	6,832	0.97%	38,962	60,134	19,511	100,287
1973	30,472	7,849	0.78%	50,012	259,385	30,296	202,732

(1) Includes copper produced from precipitates obtained by leaching waste dumps as follows:

1971, 1,683 tons; 1972, 1,682 tons; 1973, 1,831 tons.

SLC calculations based on Tucson cost estimates

SILVER STATE PROJECT

Open Pit Design and Grade Production Schedule

1) Pit designed for 0.8 oz/ton silver cutoff. Flexible grade production schedule at 7.0 MTY.

1st	5 years of grade	1.742 oz/ton	w/	1: .311	ore:waste
next	1	"	1.569	"	"	1: .429	"
"	4	"	1.244	"	"	1: .640	"
"	1	"	1.166	"	"	1: .772	"
"	2	"	1.100	"	"	1: .885	"

2) Pit designed for 0.8 oz/ton silver cutoff. Uniform grade production schedule at 7.0 MTY.

13 years of grade 1.433 oz/ton w/ 1: .544 ore:waste

3) Pit designed for 0.5 oz/ton silver cutoff. Flexible grade production schedule at 7.0 MTY.

1st	5 years of grade	1.742 oz/ton	w/	1: .311	ore:waste
next	1	"	1.569	"	"	1: .429	"
"	4	"	1.244	"	"	1: .640	"
"	1	"	1.135	"	"	1: .984	"
"	4	"	1.042	"	"	1: 1.280	"

4) Pit designed for 0.5 oz/ton silver cutoff. Uniform grade production schedule at 7.0 MTY.

15 years of grade 1.365 oz/ton w/ 1: .719 ore:waste

5) Pit designed for 0.5 oz/ton silver cutoff. High-grade followed by uniform grade production at 7.0 MTY.

1st	2 years of grade	2.00 oz/ton	w/	1: .313	ore:waste
next	13	"	1.199	"	"	1: .313	"

SLC Calculations based on Tucson Cost Estimates

SILVER STATE PROJECT

DCF-ROR Outcome

50 Million Cap. Invest. - 80% Recovery

Price Ag	* Pit Design Cutoff and Production Schedule				
	1) 0.8 oz Flex Prod	2) 0.8 oz Unif Prod	3) 0.5 oz Flex Prod	4) 0.5 oz Unif Prod	5) 0.5 oz Hi Gr. + Unif Prod
$2.50/oz	5.9 %	4.8 %	4.0 %	3.5 %	4.2 %
3.00/oz	12.4	10.0	11.9	8.8	10.5
3.50/oz	17.6	14.5	17.3	13.1	15.5

50 Million Cap. Invest. - 90% Recovery

2.50/oz	10.2 %	8.2 %	9.6 %	6.9 %	8.4 %
3.00/oz	16.4	13.5	16.0	12.1	14.3
3.50/oz	21.5	18.0	21.2	16.5	19.5

60 Million Cap. Invest. - 80% Recovery

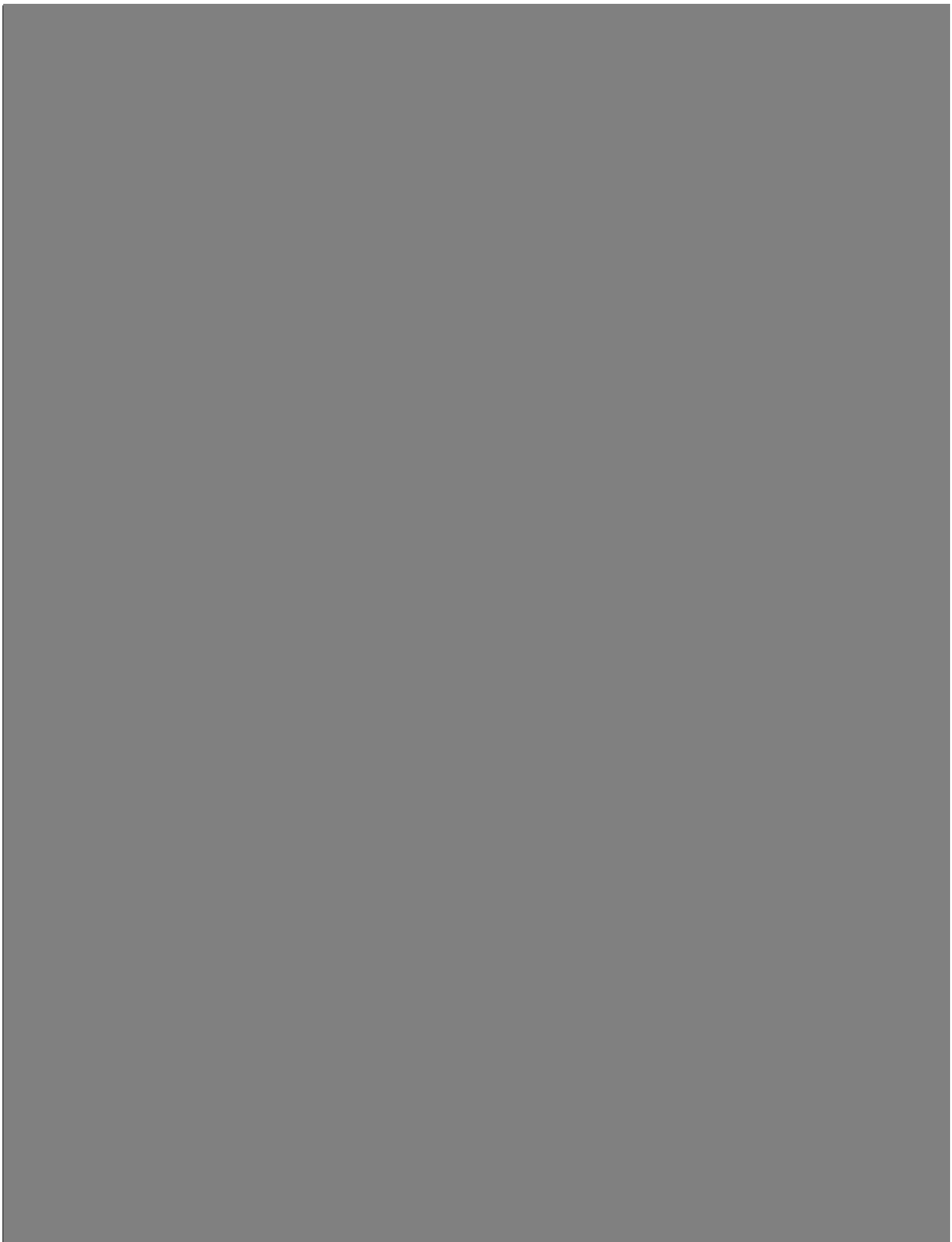
2.50/oz	3.3 %	3.2 %	1.3 %	2.0 %	1.9 %
3.00/oz	9.6	7.9	9.2	6.9	8.1
3.50/oz	14.2	11.9	14.0	10.8	12.5

60 Million Cap. Invest. - 90% Recovery

2.50/oz	7.6 %	6.3 %	7.0 %	5.8 %	6.1 %
3.00/oz	12.2	11.0	12.9	9.9	11.5
3.50/oz	17.9	15.0	17.6	13.8	15.9

* See following page for explanation

Copper in the U.S.—a Position Survey

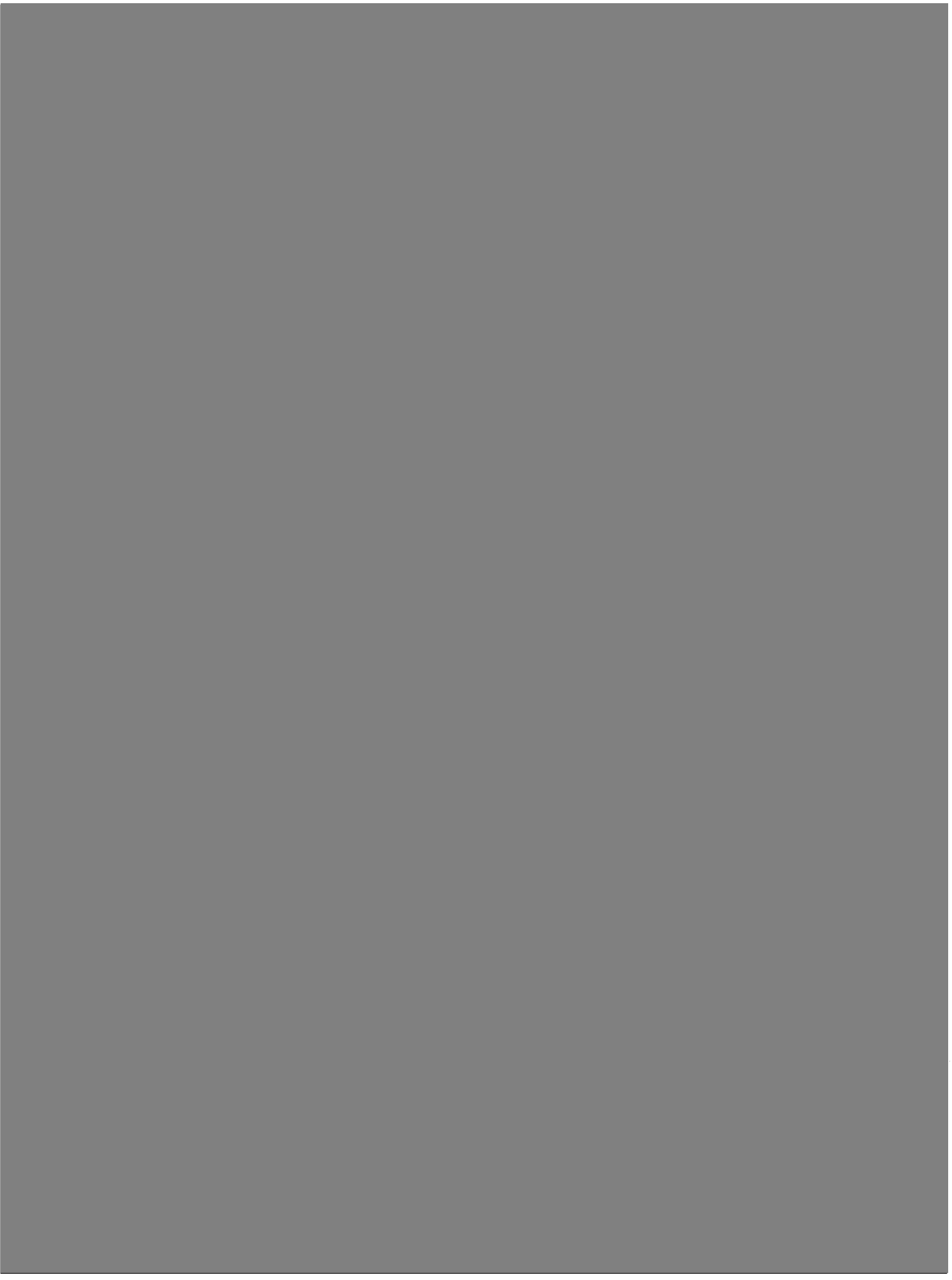


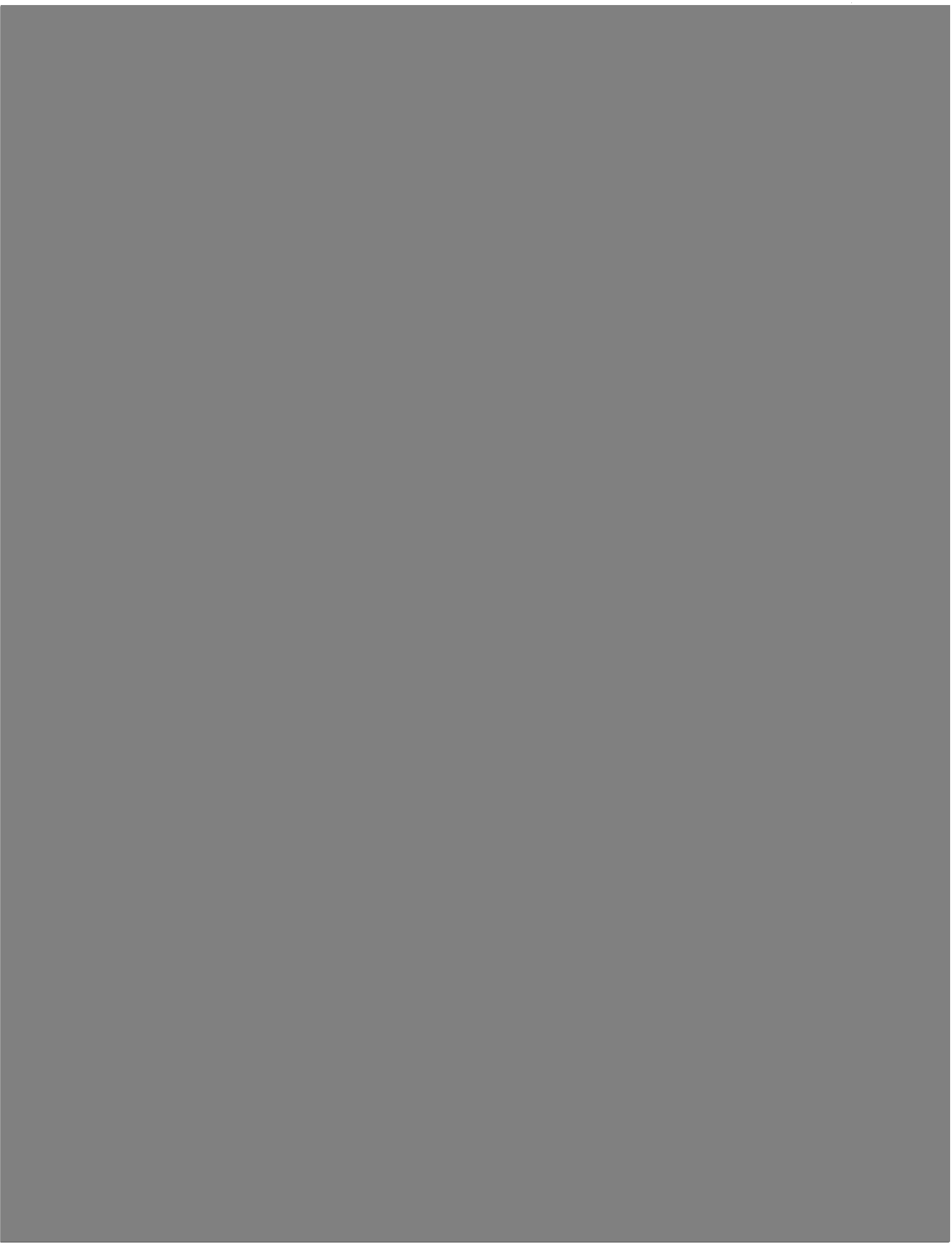
Company & property name & location	Yr. of initial prod.	Surface or under-ground	Reduction plant	Ore & waste tpd	Ore tpd	Avg. Cu content %	Avg. MoS_2 content %	Ore minerals	Gangue rock	Milling cap. tpd.
Asarco										
Silver Bell, Az	1954	S	concen. heap leach	44,000	10,500	n.a.	n.a.	chalcocite chalcopyrite molybdenite	igneous, sediment.	10,500
Mission, Az	1961	S	concen.	90,000	22,500	n.a.	n.a.	chalcopyrite molybdenite	argillite hornfels tactite	22,500
San Xavier North, Az	1973	S	vat leach	15,000	4,000	n.a.	n.a.	Cu oxides	arkose argillites	none
Anaconda Co.										
Butte, Mt. UG	1880's	U	concen.	—	3,600	n.a.	0	bornite, chal-	pyrite, quartz	2,600
Butte, Mt. OP	1955	S	heap leach	253,000	48,200	n.a.	0	cocite, chal-	sericitized	48,200
Butte, Mt. HL								copyrite, en-	qtz. monz.,	
								argite, ten-	qtz. porph.	
								monite,		
								covellite		
Yerington, Nv	1953	S	vat leach concen.	65,000	28,000	n.a.	0	chrysocolla chalcopyrite	qtz. monz. porph.	14,000
Twin Buttes, Az	1969	S	concen.	360,000	32,000	n.a.	n.a.	chalcopyrite molybdenite	qtz., qtz. monz., ls.	32,000
Bagdad Copper Corp.										
Bagdad, Az	1937	S	concen. heap leach solv. extrac. elec. winning	30,000	5,600	0.70	0.03	chalcopyrite chalcocite molybdenite bornite, oxides	qtz. monz.	6,000
Cities Service Co.										
Copperhill, Tn	1899	U	concen. smelter	6,900	6,900	1.00	0	pyrite, pyrrhotite chalcopyrite sphalerite		6,900
Miami, Az	1911		leach							
Copper Cities, Az	1955	S	concen. heap leach	28,000	14,000	0.50	0.007	chalcopyrite	qtz. monz.	14,000
Copper Range Co.										
White Pine, Mi	1955	U	concen. smelter		22,800	1%	0	Cu, Ag chalcocite	shale, sandstone	24,500
Duval Corp.										
Esperanza, Az	1959	S	concen. heap leach	37,000	15,000	0.37	0.053	chalcocite chalcopyrite ox. & carbs.	igneous, metamorphs	15,000
Mineral Park	1964	S	concen. heap leach	38,000	19,000	0.42	0.052	as above	as above	19,000
Battle Mountain, Nv	1967	S	concen. heap leach	33,000	4,535	0.84	0	as above	igneous, sed., metamorph.	4,535
Sierrita, Az	1970	S	concen.	220,000	83,000	0.29	0.048	chalcopyrite bornite	igneous	83,000
Inspiration Consolidated Copper Co.										
Inspiration, Az	1915	S	concen. heap leach vat leach smelter elec. ref.	39,157	21,290	0.709	0.0121	chalcocite chrysocolla malachite azurite	schist granite	20,000
Christmas, Az	1962	S	concen.	30,357	5,111	0.798	—	chalcopyrite bornite chalcocite covellite	met. ls., qtz. diorite, andesite	5,500
Ox Hide, Az	1968	S	heap leach	9,671	6,705	0.344	—	ox & carbs	schist, qtz. monz. porph.	none
Kennecott Copper Corp.										
Bingham, Ut	1904	S	concen. heap leach smelter elec. ref.	376,543	106,560	0.677	0.0483	chalcopyrite bornite molybdenite	granite, porph., ls., quartzite	108,500
Ruth, Nv	1908	S	concen. heap leach smelter	118,250	21,500	0.8	0.012	chalcopyrite chalcocite	qtz. monz., ls.	21,500
Chino, NM	1909	S	concen. heap leach smelter	87,196	22,970	0.865	0.013	chalcocite chalcopyrite	ls., shale, granodiorite, qtz. diorite	22,800
Ray, Nv	1911	S	concen. heap leach vat leach smelter elec. winning	115,000	35,400	0.94	0.025e	chalcocite chalcopyrite molybdenite chrysocolla	diabase, schist, qtz. monz., quartzite	25,400
Magma Copper Co.										
Superior, Az	1912	U	concen.	3,500	1,600	4.5	0	chalcopyrite bornite	ls., primary hematite, pyrite	4,000
San Manuel, Az	1956	U	concen. smelter elec. ref.	62,500	62,500	0.69	0.025	chalcopyrite chalcocite pyrite molybdenite	qtz. monz. porph.	62,500
Phelp's Dodge Corp.										
Copper Queen, Az UG	1878	U	concen.	—	2,648	4.4		chalcocite	qtz. porph.,	19,000[5]
Copper Queen, Az OP	1954		heap leach	21,700	14,700	0.64	—	chalcopyrite bornite	ls.	—
Morenci, Az	1942	S	concen. heap leach smelter	171,000	58,600	0.83	—	chalcocite chalcopyrite covellite	monz. porph., granite, ls., diabase	60,000
New Cornelia, Az	1917	S	concen. smelter	97,000	33,500	0.70	—	chalcopyrite bornite chalcocite	qtz. monz., rhyolite	34,000
Tyrone, NM	1969	S	concen. heap leach	189,000	48,000	0.85	—	chalcocite	qtz. monz.	48,000
Pima Mining Co.										
Pima, Az	1957	S	concen.	140,000	53,500	0.5	0.017	chalcopyrite molybdenite	metased.	53,500
Ranchers Exploration										
Bluebird, Az	1964	S	heap leach solv. extrac. elec. ref.	25,000	12,000	0.5	—	chrysocolla	schist, granite	none

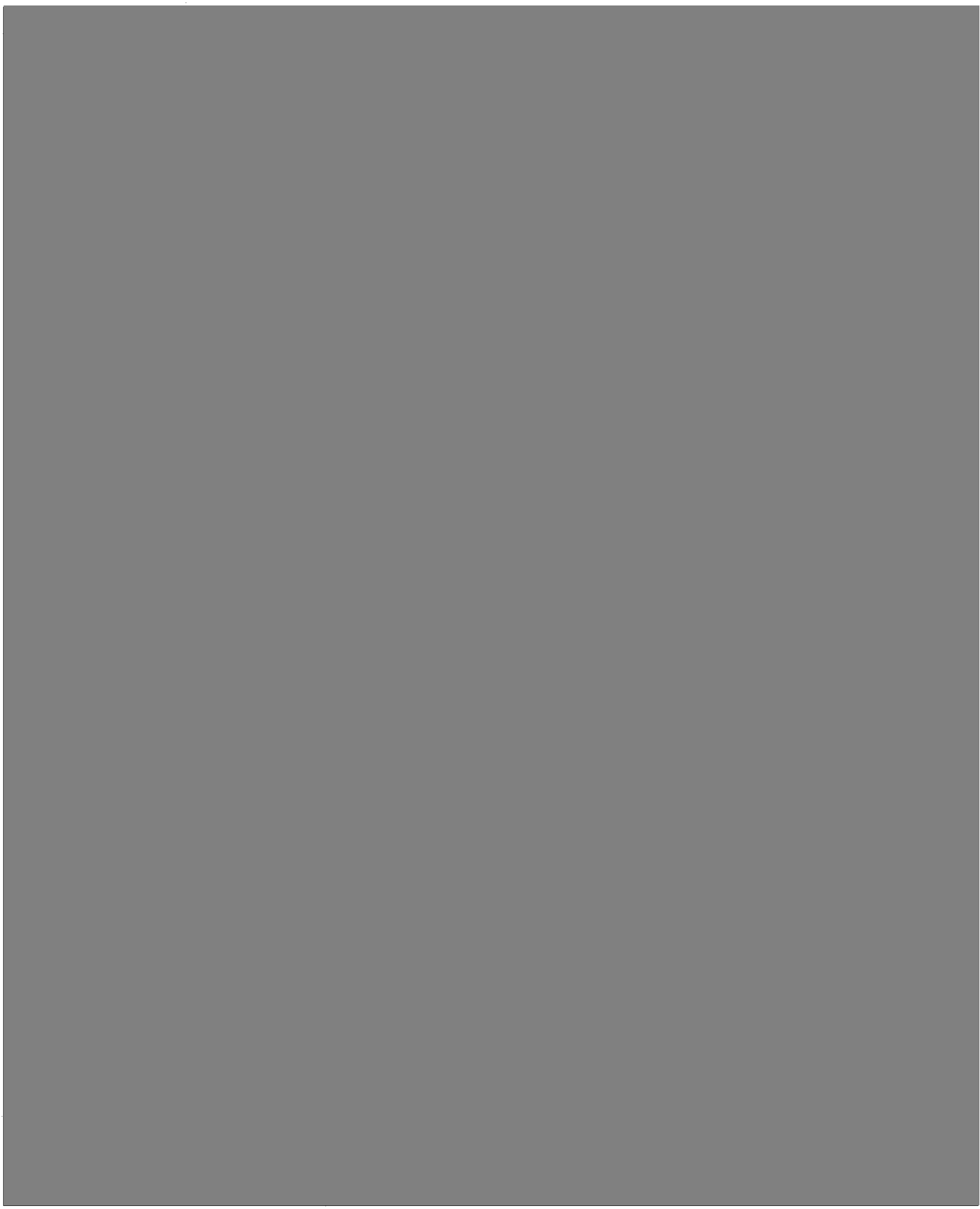
Notes: [1] Production curtailed August 1972 [2] Cathode Cu by electrowinning [3] Tentative [4] Includes Miami Personnel [5] Includes Lavender pit ore [6] Total for branch [7] At 38.27% Mo [8] Ore Body blasted; leach in place

Rated Capacities and/or 1972 Production

Total Cu production tpy	Cu in concentrates tpy	% Cu in cons.	Total Cu recovery %	Cu in ppts tpy	MoS_2 production tpy	Products	Product shipped to	No. of employees wages	No. of employees salaried	New or expanded prod. tpy	Completion date
20,000	15,300	28	n.a.	4,700	120[1]	cons ppts	Hayden, Az El Paso, Tx	330	n.a.	none	
45,000	45,000	28	n.a.	0	1,800	cons	Hayden, Az El Paso, Tx	620	n.a.	none	
11,000	—	—	—	11,000	0	ppts	Hayden, Az El Paso, Tx	35	n.a.		
26,523	n.a.	26	n.a.	—	0	cons	Anaconda, Mt	715	85	none	
83,937	n.a.	26	n.a.	—	0	anodes	Anaconda, Mt	1,340	140	none	
24,000			97.8	24,000	0	ppts	Anaconda, Mt	125	18		
38,500	18,500	30	n.a.	20,000	0	ppts cons	Anaconda, Mt	458	102	none	
75,000	75,000	29	n.a.	0	1,850	cons	Hayden, Inspiration, Az	1,350	300	7.3 MM ore	7/74, 1/75
19,579	12,279	32	88	7,300[2]	384	cons cathodes	Hayden, Az White Pine, MI	438	71	54,000[3]	1975
21,000	21,000	20	n.a.	0	0	blister Cu sulfate H_2SO_4 Fe pellets Zn cons	market	1,700	40[n]	as stated	1973
				6,100		ppts	Douglas, Az			none	
22,300	20,000	27	87	2,300	180	cons ppts	Inspiration, Az	521[4]	156[4]	none	
72,000	n.a.	31	80.65	0	0	fire refined	market	2,424	516	none	
20,285	17,624	25	87	2,661	2,044	cons ppts	custom smelt	336	85	none	
26,559	22,091	20	76.3	4,468	2,919	cons ppts	custom smelt	310	101	none	
16,322	9,492	25.3	69.4	6,830	0	cons ppts	custom smelt	235	84	none	
68,940	68,940	26.1	84.5	0	9,731	cons	custom smelt	1,259	305	none	
53,987	25,347	38.24	76.41	22,738	370	ppt cathodes rod	market	1,344	311	9.1 MM ore	1973
11,244	11,244	20.43	71.97	0	0	cons	Inspiration	251	37	none	
4,848	—	—	41.7	4,848	0	ppt	Inspiration	51	6	none	
258,037	210,714	27.06	89.07	n.a.	11,254	cathodes anodes ppts	market	5,743	1,495	none	
45,000	42,000	18.5	78	3,000	110	blister ppts	Maryland	1,150	322	none	
75,700	55,800	20.0	79.3	n.a.	423	blister fire refined	market	1,047	318	none	
103,478	64,336	18	82	14,600	559	ppts anodes cathodes	Maryland Hurley, NM	1,590	475	none	
24,000	24,000	25	96.5	0	0	cons	San Manuel, Az	968	186	1.01 MM ore	8/73
144,000	144,000	28	92.7	0	4,200	cathodes rod	market	3,000	615	none	
26,900	23,000	17.4	94.8	0	0	cons &	P.D. smelters	1,504[6]	—	none	
21,600	16,600	10.3	69.3	5,000	0	direct smelt. ppts			—		
120,000	107,800	22.2	75.2	12,200	0	anodes	P.D. refine	2,445[5]	—	none	
57,900	57,900	30.3	84.6	0	0	anodes	P.D. refine	1,288[6]	—	none	
100,000	96,000	21.3	77.5	4,000	0	cons ppts	P.D. smelters	671[6]	—	100,000	7/72
82,500	82,500	26	85	0	1,500[7]	cons	Douglas & San Manuel, Az	775	175	none	
7,500	—	—	50	0	0	cathodes	market	95	10	25,000[8]	







J. W. STILL
CONSULTING MINING ENGINEER
TUCSON, ARIZONA

J. H. C.

NOV 21 1973

CAPITAL COSTS PER TON & PER LB RECOVERABLE CU.

Property	Year	Ore Reserve (1000's t)	Lbs Cu Rec Total (1000's	/ton	Capital Cost (1000's)	CC/ton	CC/lb Rec	Remarks
Silverbell	1952	32,000 @ .90	460,800	14.40	$17,000	53.1¢	3.68¢	
Copper Cities	54	33,000 @ .73	396,000	12.0	8,413.4	25.5¢	2.12¢	Bought plant cheap from RMC
Esperanza	59	48,815 @ .65/.0216	585,780	12.0(1)	22,752	46.6¢	3.88¢	
Toquepala	1960	1,100,000 @ 1.0	19,250,000	17.50	251,493	22.9¢	1.31¢	
Bethlehem	63	82,425 @ .614	860,517	10.44	19,150	23.2¢	2.23¢	
Mineral Park	65	70,596 @.492/.0415	756,083	10.71(2)	29,136	41.3¢	3.85¢	
Palabora	66	315,000 @ .68	3,619,350	11.49	112,000	35.5¢	3.09¢	
Twin Buttes	67	382,310 @ .83/.033	4,962,383	12.98	198,000	51.8¢	4.00¢	
Tyrone	68	304,896 @ .81	3,799,004	12.46	100,000	32.8¢	2.63¢	
Marcopper	69	85,700 @ .75	1,125,241	13.13	45,000	52.5¢	4.00¢	
Sierrita	1970	538,000 @.329/.033	4,239,440	7.88(3)	178,000	33.1¢	4.20¢	
Lornex	71	293,000 @.427/.014	2,478,780	8.46(4)	138,000	47.1¢	5.57¢	
Island Cu	71	280,000 @.52/.025	2,875,600	10.27(6)	68,500	24.5¢	2.38¢	
Gibraltar	72	358,000 @.373/.016	2,409,340	6.73(5)	67,000	18.7¢	2.78¢	at 30,000 tpd
Similkameen	72	75,363 @ .526	694,093	9.21	71,000	94.2¢	10.23¢	

Notes: (1) 10.92 lbs Cu + 1.08 lbs Cu-Mo Equiv
(2) 8.14 " " + 2.57 " " " "
(3) 6.51 " " + 1.37 " " " "
(4) 7.86 " " + 0.60 " " " "
(5) 5.97 " " + 0.76 " " " "
(6) 9.10 " " + 1.17 " " " "

Data derived from various company annual reports, prospectus information, etc.

The ore reserves above are those reported - but it is probable that most of the properties will eventually mine out more than the original reserves. Three of them - Silverbell, Copper Cities & Esperanza are still operating, having mined out the original reserve some years since. It would appear that Similkameen (a Newmont property) must have potential for at least 150,000,000 tons.

J. H. C.

NOV 21 1973

RECENT NEW CANADIAN OPEN PITS

Company	Year	Ore reserve Tons	%Cu/%Mo	Capital Cost	Tons/day	Capital cost per ton day
Brenda	1969	177,000,000 @	0.183/.049	$62,500,000	35,000	$2500
Lornex	1971	293,000,000 @	0.427/.014	$138,000,000	38,000	$3305
Island Cu	1971	280,000,000 @	0.52/ .025	$68,500,000	33,000	$2075
Gibraltar	1972	358,000,000 @	0.373/.016	$67,000,000	30,000	$2233
Similkameen	1972	75,363,000 @	0.526	$71,000,000	15,000	$4867
Saccatun	1973			36,700,000	9,000	4078
"				25,000,000	9,000	2,700 — without premium stripping

WLIC

FIG - Porph Cu Great Ore reserves

FIRST GENERATION - PORPHYRY COPPERS

Mine	Type	Start	Ore Reserve at start MT Ore-Grade-MT Cu	MT Cu pro thru '67	Est Ore reserves 1/1/68 MT Ore-Grade- MT Cu	Operating Rate tons/day	Indicated Life-years
Utah*	OP	1905	12.4 @ 2.0% 0.248	9.001	1297.3 @ 0.74% 9.600	99,000	40
Humboldt-Morenci	UG	1907	? @ 1.9% ?	0.625	------DONE--------	------	-----
Nevada Con	OP	1908	8.1 @ 2.0% 0.163	2.042	113.7 @ 0.74% 0.556	22,400	15
Braden	UG	1910	10.0 @ 2.7% 0.272	6,478	445.4 @ 1.83% 8.151	26,600	40
Miami	UG	1911	18.2 @ 2.58% 0.469	1.247	-----DONE--------	------	-------
Ray*	OP	1911	50.0 @ 2.25% 1.125	1.861	306.5 @ 0.84% 2.478	25,900	35
Chino*	OP	1912	19.0 @ 2.59% 0.492	2.570	121.5 @ 1.02% 1.579	24,000	15
Inspiration*	OP	1915	45.3 @ 2.0% 0.906	1.939	98.9 @ 0.67% 0.668	20,270	13.7
Chuqui	OP	1915	203.3 @ 2.23% 6.764	9.241	1194.9 @ 1.40% 16.728	66,400	50
Ajo	OP	1917	60.0 @ 1.5% 0.900	2.363	151.9 @ 0.66% 1.003	33,400	25
Sac Hill Bisbee	OP	1923	11.2 @ 1.7% 0.190	0.218	------DONE----------	------	-----
Andes	UG	1927	127.4 @ 1.51% 2.075	1.743	------DONE----------	------	------

Note: * Indicates leach production in addition to milled ore - Production figures include leach

MT Ore & MT Cu indicates millions of tons.

SECOND GENERATION - PORPHYRY COPPERS

Mine	Type	Start	Ore Reserves at start MT Ore-Grade-MT Cu		MT Cu Pro thru '67	Est Ore reserves 1/1/68 MT Ore-Grade- MT Cu		Operating Rate tons/day	Indicated Life-years
Morenci-Clay*	OP	1942	284.0 @ 1.04%	2.942	3.081	767.1 @ 0.73%	5.600	60,725	40
Bagdad*	OP	1943	36.7 @ 0.98%	0.360	0.275	27.5 @ 0.87%	0.242	6,000	12
Castle Dome	OP	1943	40.4 @ 0.72%	0.290	0.290	-------Done-------		-----	---
Yerington	OP	1953	52.2 @ 0.92%	0.483	0.457	45.2 @ 0.84%	0.380	16,000	10
Lavender*	OP	1954	?	? 0.494	0.485	61.0 @ 0.57%	0.347	17,450	10
Copper Cities*	OP	1954	32.9 @ 0.73%	0.239	0.268	43.5 @ 0.55%	0.242	12,000	10
Silverbell*	OP	1954	32.0 @ 0.90%	0.288	0.299	36.9 @ 0.65%	0.242	11,250	10
San Manuel	UG	1956	457.9 @ 0.75%	3.420	0.899	777.0 @ 0.73%	5.672	40,000	55
Pima	OP	1957	7.8 @ 1.64%	0.128	0.261	118.0 @ 0.58%	0.685	30,000	12
El Salvador	UG	1958	300.0 @ 1.63%	4.890	0.753	253.8 @ 1.63%	4.137	16,000	48
Esperanza*	OP	1959	48.8 @ 0.65%	0.317	0.205	39.9 @ 0.48%	0.192	14,700	8
Toquepala	OP	1960	1100.0 @ 1.00	11.000	1.212	829.4 @ 1.18%	9.787	37,600	70
Mission	OP	1961	80.0 @ 0.92%	0.736	0.294	56.7 @ 0.78%	0.442	17,500	9.5
Mineral Park*	OP	1965	53.4 @ 0.54%	0.288	0.072	42.4 @ 0.51%	0.217	16,800	8
Palabora	OP	1966	315.0 @ 0.68%	2.142	0.151	292.8 @ 0.68%	1.991	33,000	24

Note * Indicates leach production in addition to milled ore - Production figures include leach.

MT ore & MT Cu indicates millions of tons.

PLANTS PRESENTLY UNDER CONSTRUCTION

Mine	Type	Start	Indicated Ore Reserves	Operating Rate	Indicated Life
Tyrone (PD)	OP	1969	126,750,000 @ 0.78%	25,000	15
Twin Buttes	OP	1969	300,000,000 @ 0.75%	40,000	20
Sierrita	OP	1971	420,000,000 @ 0.355%	60,000	20
Exotica	OP	1970	150,000,000+ @ 1.35%	31,000	13.4

Notes on above:

PD in annual report gave only the expected grade and the 25,000 t/d milling rate - Assuming that PD would not tie into one at a $100,000,000 capital cost unless it was good for a minimum of 15 years - the above reserve for Tyrone is estimated from a probable 15 year life.

Anaconda on Twin Buttes has put out only the expected 40,000 t/d milling rate. I have estimated the grade - and on the magnitude of the project costs, figured it had to have a 20 year minimum life - and figured the ore reserve tonnage on this basis.

See the two attached xerox sheets for published data on Duval-Sierrita & Exotica - from which the above ore reserves were taken or deduced.

From: T. C. OSBORNE

To: W Tkurtz. 9/14

In case you haven't seen this.

J. H. C.

SEP 19 1973

RECEIVED

SEP 17 1973

S. W. U. S. EXPL. DIV.

(b) For the purpose of computing the ratio of earnings to fixed charges, earnings consist of income before extraordinary items, fixed charges, provision for taxes on income, and equity in earnings of investees. Fixed charges consist of interest expense and one-third of rental expense included in Note 13 of Notes to Consolidated Financial Statements.

(c) The pro forma ratio of earnings to fixed charges for the twelve-month period ended June 30, 1973, computed as provided in Note (b) above, after giving effect to the issuance of $90,400,000 of Pollution Control Notes (assuming an interest rate of 6¼%), the 4⅜% Bond Due 1980 and the 7% Note Due 1987, is 7.31.

Any material change in the price received by the Corporation for its copper has a material effect on its net income. The price received by Phelps Dodge for its mined copper in wire bar form increased from 42¢ per pound in 1968 to 60¢ per pound in April 1970. By the beginning of 1971, the price had been reduced to 53¢ per pound and it remained within a range of 50¼¢-53¢ during 1971 and 1972. In February 1973 the price was increased from 53¢ to 56¢ and in March the present price of 60¢ per pound was established.

Operating revenues and net income for 1968 and 1971 were adversely affected by strikes. Increases in operating revenues and net income in 1969 and 1970 reflect termination of the earlier strikes, initiation of production at the Tyrone, New Mexico mine and sales of copper at higher prices. Although the strike-affected production from the Corporation's mines in 1971 was below 1970 production, sales of the Corporation's mined copper in 1971 were slightly higher than sales of such copper in 1970. Copper production from the Corporation's mines and sales of its mined copper in 1972 exceeded production and sales of such copper in 1971 by approximately 9% and 13%, respectively.

Net income for the periods shown above included the following dividends received, after income taxes, on the Corporation's 16% investment in Southern Peru Copper Corporation ("Southern Peru"): 1968—$7,377,000; 1969—$9,222,000; 1970—$5,217,000; 1971—$4,414,000; 1972—$2,323,000. Dividends have been omitted since June 30, 1972 as a result of increased expenditures required to meet the construction schedule for development of Southern Peru's Cuajone copper orebody under a contract with the Peruvian Government.

BUSINESS AND PROPERTIES

Copper Mining

Current Operations. Phelps Dodge owns and operates open-pit copper mines at Morenci, Ajo and Bisbee, Arizona, and Tyrone, New Mexico, and underground copper mines at Bisbee. At each of these four locations Phelps Dodge owns and operates a concentrator, which converts ore from the adjacent mines into copper concentrates through a process of crushing, grinding and flotation. The concentrates are then smelted at one of Phelps Dodge's three smelters (see "Copper Smelting" below). At the Bisbee underground mines, veins and small deposits of higher grade ore are mined; most of this ore is concentrated at the Bisbee concentrator, and the balance is shipped directly to a smelter.

During the years 1970-72, Phelps Dodge produced the following tonnages of copper at its mines: 1970—312,881; 1971—279,807; 1972—304,926. The table below shows the quantities of waste

removed and copper ore mined, the average grade of such ore, and the tons of copper produced at each of the Corporation's mines for the three years ended December 31, 1972:

	Waste Removed (thousands of tons)	Ore Mined (thousands of tons)	Grade of Ore (copper)	Copper Produced (tons)
Morenci				
1970	34,516	19,173	0.85%	129,438
1971	36,347	16,590	0.85%	113,598
1972	33,013	17,215	0.83%	119,763
Ajo				
1970	15,875	10,562	0.68%	63,097
1971	18,198	9,244	0.67%	53,000
1972	18,518	9,792	0.70%	57,876
Tyrone				
1970	33,882	9,148	0.87%	59,046
1971	37,689	8,798	0.90%	60,189
1972	45,426	11,425	0.89%	78,756
Bisbee open-pit				
1970	13,225	4,850	0.77%	29,716
1971	6,733	4,575	0.68%	24,017
1972	1,798	3,761	0.64%	21,632
Bisbee underground				
1970	—	829	4.36%	31,584
1971	—	768	4.31%	29,003
1972	—	643	4.41%	26,899

Production at all mines was adversely affected in 1971 by strikes which began July 1 and extended to August 2, 1971. Production at the Tyrone mine increased in 1972 as a result of the completion in July 1972 of a program to expand this mine's annual productive capacity from 60,000 to 100,000 tons.

Phelps Dodge expects that ore reserves at the Bisbee open-pit mine will be exhausted by the end of 1973 and that the open-pit mine will then be shut down. The Bisbee underground mines are expected to continue for a time thereafter, depending upon the relationship between production costs and the price of copper.

In 1969 Phelps Dodge began development of the new Metcalf mine near its Morenci mine in Arizona. This mine is expected to be ready for production by January 1, 1975, with an estimated annual rate of production in excess of 50,000 tons of copper. It is anticipated that both open-pit and underground mining techniques will be employed at the Metcalf mine, with the initial production coming from open-pit operations. The cost of developing the Metcalf mine, including the cost of pre-production overburden removal and construction of a concentrator, is presently estimated at $180,000,000 of which $101,896,000 was expended through June 30, 1973.

All the ore at Phelps Dodge's mines is classified as sulphide ore, except for some oxide ores at the Bisbee underground mines. As of January 1, 1973, Phelps Dodge estimated the copper ore reserves at its mines at not less than 1,580,000,000 tons of ore containing an estimated 9,430,000 tons of recover-

able copper. The table below sets forth such ore reserves (expressed in thousands of tons), together with average ore grades, at each of such mines:

	Ore Reserves	Grade of Ore
Morenci	700,000	0.80%
Ajo	146,000	0.63%
Bisbee		
Open-Pit	4,000	0.91%
Underground	1,000	5.40%
Tyrone	364,000	0.80%
Metcalf		
Open-Pit	221,000	0.73%
Underground	144,000	0.92%

Note: The term "ore reserves" means material which the Corporation considers may be profitably mined and treated for the extraction of its copper content. Grade means percentage of contained copper. It is not practicable to recover all the contained copper from copper ores. Estimates of reserves are based on the Corporation's engineering evaluations of assay values derived from samplings of drill holes and other mine openings.

Production costs at Phelps Dodge's operating mines, per pound of copper mined, are lowest at Morenci and Tyrone, its largest mines, and are by far the highest at the Bisbee mines. Phelps Dodge anticipates that production costs at the Metcalf mine, when it begins operation, will be appreciably lower than those at Bisbee.

Development and Exploration. Phelps Dodge is currently conducting a preliminary development program on a low-grade sulfide copper deposit owned by the Corporation near Safford, Arizona. Phelps Dodge expects that this preliminary development program will be completed in 1973 at an estimated cost of $15,000,000. The deposit, which the Corporation estimates to contain a probable 250,000,000 tons of ore averaging 0.92% copper, lies roughly 1,000 to 2,000 feet below the surface; the Corporation expects that mining will be by underground caving methods. The Corporation has not yet decided when development of this property will be continued to the production stage. The cost of full development of the property to the mining stage will be very substantial.

A Phelps Dodge subsidiary has discovered two zones containing copper, lead, zinc and silver mineralization in the northwestern part of the Cape Province of the Republic of South Africa. Drilling in the first zone indicates that if the mineralization is continuous in thickness and grade the zone may contain 70,000,000 tons of ore averaging 0.8% copper, 2.2% lead, 0.4% zinc and ½ ounce of silver per ton, a significant portion of which could be mined by open-pit methods. Drilling is continuing with encouraging results, but more drilling will be required in both zones. Feasibility studies to evaluate the commercial significance of the two discoveries are under way.

Copper Smelting

Phelps Dodge's copper smelters are located at Morenci, Ajo and Douglas, Arizona. The smelters have sufficient capacity to treat all production from the Corporation's presently operating mines, as well as some custom material for others. See "Environmental Quality" herein for a description of the impact of Federal and state air quality laws on the Corporation's smelters.

To provide adequate smelter capacity for ore mined at Tyrone after production at the Metcalf mine begins, Phelps Dodge is building a new smelter in Hidalgo County in southwestern New Mexico. The

file Ore reserves

5-23-13

Cypress

Thompson Creek Mo, Idaho

100 million tin 0.148% Mo

TABLE ONE

GLOBE SUBDISTRICT

Name of Mine	Discovery Year	Status x Year	Type of Operation	Production		Reported Reserves	Additional Estimated Reserves
				Tons of Ore	Pounds of Copper	Tons @ % Copper	Tons @ % Copper
1. Defiance	1930	Closed 1948	Under-ground	1,500	Minor Pb-Zn-Ag-V Production ($100,000.00?)		
2. Vacey Constance	1886	Closed 1886	Under-ground	250	Minor Ag Production ($100,000.00)		
3. Highland	1929	Closed 1929	Under-ground	2,000	400,000	--	--
4. Irene	1880	Closed 1890	Under-ground	2,000	Minor Pb-Ag Production ($15,000.00)		
5. Superior-Boston	1907	Closed 1926	Under-ground	65,000	19,556,000 (plus 1,343,000 oz.Ag)		--
6. Eureka	1906	Closed 1907	Under-ground	40,000	3,000,000	--	--
7. Iron Cap	1912	Closed 1928	Under-ground	683,000	60,000,000 (plus 1,256,500 oz.Ag)		--
8. Arizona Commerical	1906	Closed 1930	Under-ground	800,000	92,000,000 (plus 580,000 oz. Ag)		--
9. Old Dominion	1882	Closed 1931	Under-ground	8,000,000	765,000,000 (plus 4,536,000 oz.Ag)		40,000,000 @ 1.0
10. Albert Lea	1944	Closed 1946	Under-ground	1,200	Minor Cu-Pb-Zn-Au-Ag Production $28,500.00)		
Subtotal				9,594,950	939,956,000	--	40,000,000

TABLE ONE - Cont'd.

COPPER CITIES-CACTUS SUBDISTRICT

Name of Mine	Discovery Year	Status x Year	Type of Operation	Production Tons of Ore	Production Pounds of Copper	Reported Reserves Tons @ % Copper	Additional Estimated Reserves Tons @ % Copper
11. Porphyry Reserve	1929	Closed 1930	Leaching	Surface Leaching	350,000	--	--
12. Copper Cities	1953	Operating 1971	Open Pit	56,755,205	662,841,497	9,000,000 @ 0.5	20,000,000 @ 0.5
13. Diamond H	1970	Operating 1972	Open Pit	Minor (Included w/Copper Cities)		19,000,000 @ 0.55	--
14. Altered Zone	--	--	--	--	--	--	300,000,000 @ 0.3
15. Continental	1896	Closed 1929	Under-ground	Development Minor -- May be partially stripped for Pinto Valley.			
16. Castle Dome	1943	Closed 1970	Open Pit	41,442,617	578,183,368	Now site of Pinto Valley Operations.	
17. Pinto Valley	Announced 1973	Under Development	Open Pit	--	--	350,000,000 @ 0.45	300,000,000 @ 0.4
18. Carlota	1929	Closed 1944	Under-ground	5,000	440,000	8,600,000 @ 1.3	7,000,000 @ 1.0
19. Cactus	1908	Closed 1929	Under-ground	Development Minor		20,000,000 @ 0.5	20,000,000 @ 0.5
20. Black Bess	1920	Closed 1935	Under-ground	1,000	Minor Cu-Zn Production ($15,000.00?)		
Subtotal				98,203,822	1,241,814,865	406,600,000	647,000,000

TABLE ONE - Cont'd.

MIAMI-INSPIRATION SUBDISTRICT

Name of Mine	Discovery Year	Status x Year	Type of Operation	Production		Reported Reserves Tons @ % Copper	Additional Estimated Reserves Tons @ % Copper
				Tons of Ore	Pounds of Copper		
21. Smelter	1969	Drill Holes 1972	Under-ground	--	--	--	Several deep holes in mineral.
22. Miami East	1968	Under Development 1973	Under-ground	--	--	80,000,000 @ 1.0	150,000,000 @ 0.8
23. Occidental	1969	Drilling 1973	Under-ground	--	--	--	100,000,000 @ 1.0
24. Van Dyke	1929	Closed 1945	Under ground	70,000	11,851,700	Part of Occidental-AMAX (22) Operations.	
25. Warrior	1904	Closed 1919	Under-ground	300,000	30,500,000		
26. Miami	1911	Leaching 1971	Leaching	152,702,609	2,512,879,221	28,000,000 @ 0.8	100,000,000 @ 0.7
27. Red Hill	1967	Under Development 1972	Open Pit	--	--	64,000,000 @ 0.6	30,000,000 @ 0.5
28. Inspiration	1914	Operating 1971	Open Pit	238,843,111	4,251,951,861	85,000,000 @ 0.9	100,000,000 @ 0.7
29. Blue Bird	1962	Operating 1971	Open Pit	13,304,700	56,869,467	75,000,000 @ 0.52	20,000,000 @ 0.5
30. Barney	1970	Drilled Out 1972	Open Pit	--	--	15,000,000 @ 0.5	--
31. Montezuma	1972	Drilling 1973	Open Pit?	--	--	--	75,000,000 @ 0.7(?)

TABLE ONE - Cont'd.

MIAMI-INSPIRATION DISTRICT - Cont'd.

Name of Mine	Discovery Year	Status x Year	Type of Operation	Production		Reported Reserves	Additional Estimated Reserves
				Tons of Ore	Pounds of Copper	Tons @ % Copper	Tons @ % Copper
32. North Oxhide	1968	Operating 1971	Open Pit	11,593,552	31,174,822	35,000,000 @ 0.4	10,000,000 @ 0.4
22. South Oxhide	1968	Under Development 1973	Open Pit	--	--	50,000,000 @ 0.4	35,000,000 @ 0.4
Subtotal				416,813,972	6,895,227,071	432,000,000	620,000,000

TABLE ONE - Cont'd.

TOTALS

Name of Dist.	Average	Production Tons of Ore	Production Pounds of Copper	Reported Reserves Tons @ % Copper	Additional Estimated Reserves Tons @ % Copper
Globe District	97.96# Cu/ton recovered	9,594,950	939,956,000	--	40,000,000
Copper Cities District	12.65# Cu/ton recovered	98,203,822	1,241,814,865	406,600,000	647,000,000
Miami District	16.64# Cu/ton recovered	416,813,972	6,895,227,071	432,000,000	620,000,000
Superior (Magma)	103.57# Cu/ton recovered				
Ray	20.02# Cu/ton recovered				
San Manuel-K	13.16# Cu/ton recovered				
TOTAL		524,612,744	9,076,997,936	838,600,000	1,307,000,000

Name of Mine	Discovery Year	Status X Year	Type of Operation			
OTHER						
Superior (Magma)	1911	Operating 1971	Under-ground	16,414,285	1,700,088,749	10,200,000 @ 5.8 / 10,000,000 @ 5.0
Ray	1911	Operating 1971	Open Pit	216,656,509	4,337,125,555	736,310,000 @ 0.82 / 200,000,000 @ 0.8
San Manuel-K	1955	Operating 1971	Under-ground	189,118,417	2,489,495,468	1,003,000,000 @ 0.7 / ?

Ore reserves Mr Kurtz

FINANCIAL TIMES

January 11, 1973

ANGLO'S OPTION IN MEXICO

An option until March 7, with a provision for a 30-day extension, has been granted by Patino of The Hague to Hudson Bay Mining and Anglo American of Canada to purchase its 38 per cent. shareholding in Lytton Minerals of Vancouver.

Lytton has an option on a 49 per cent. shareholding in Minas del Otono S.A., of Mexico, which owns the La Verde copper deposit in that country and has the right to designate the Mexican companies or nationals who may acquire the remaining 51 per cent. The proven ore reserves are reported as 81.3m. short tons averaging 0.699 per cent. copper plus gold and silver values.

THE WALLACE MINER

November 9,1972

NOV 28 1972

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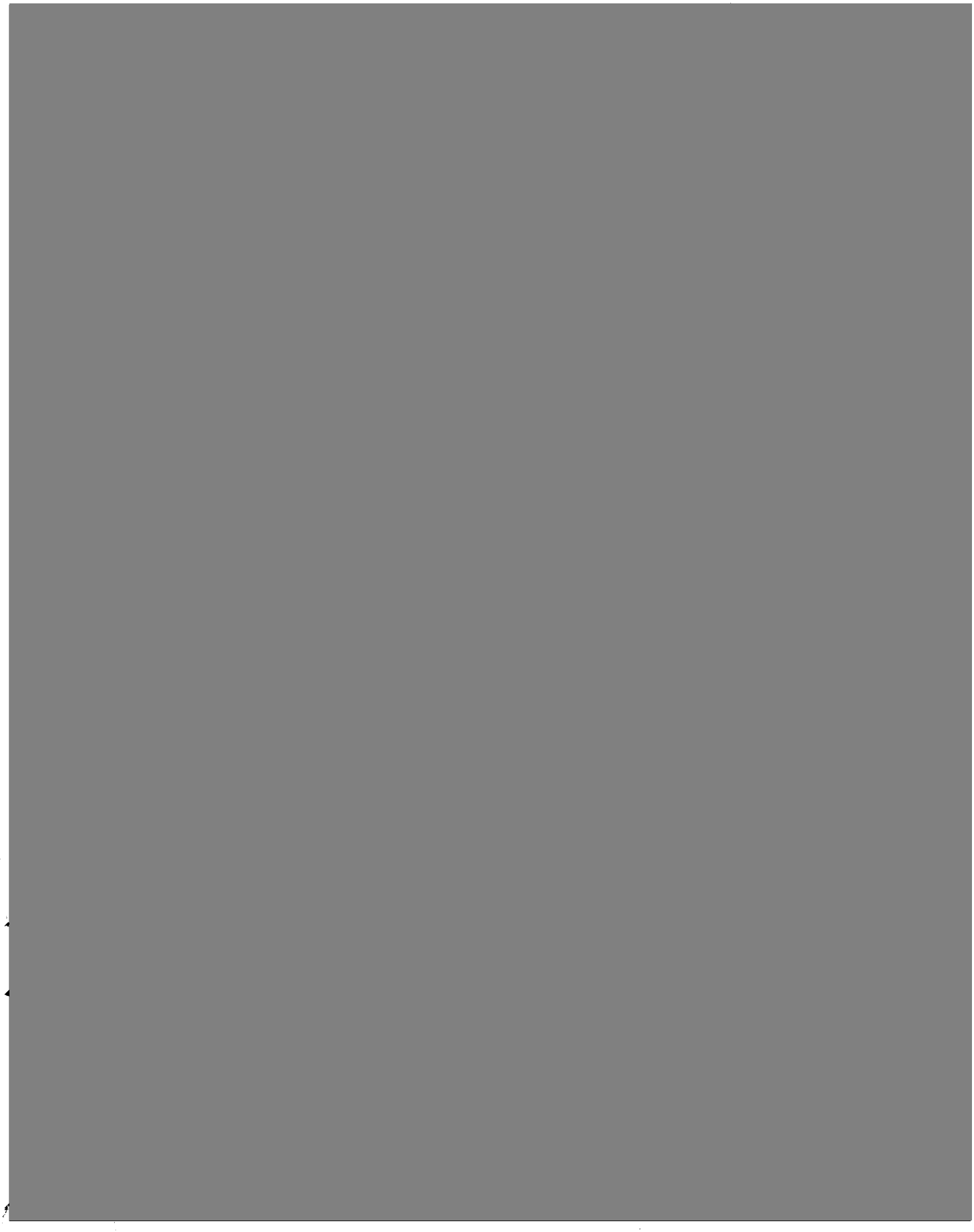
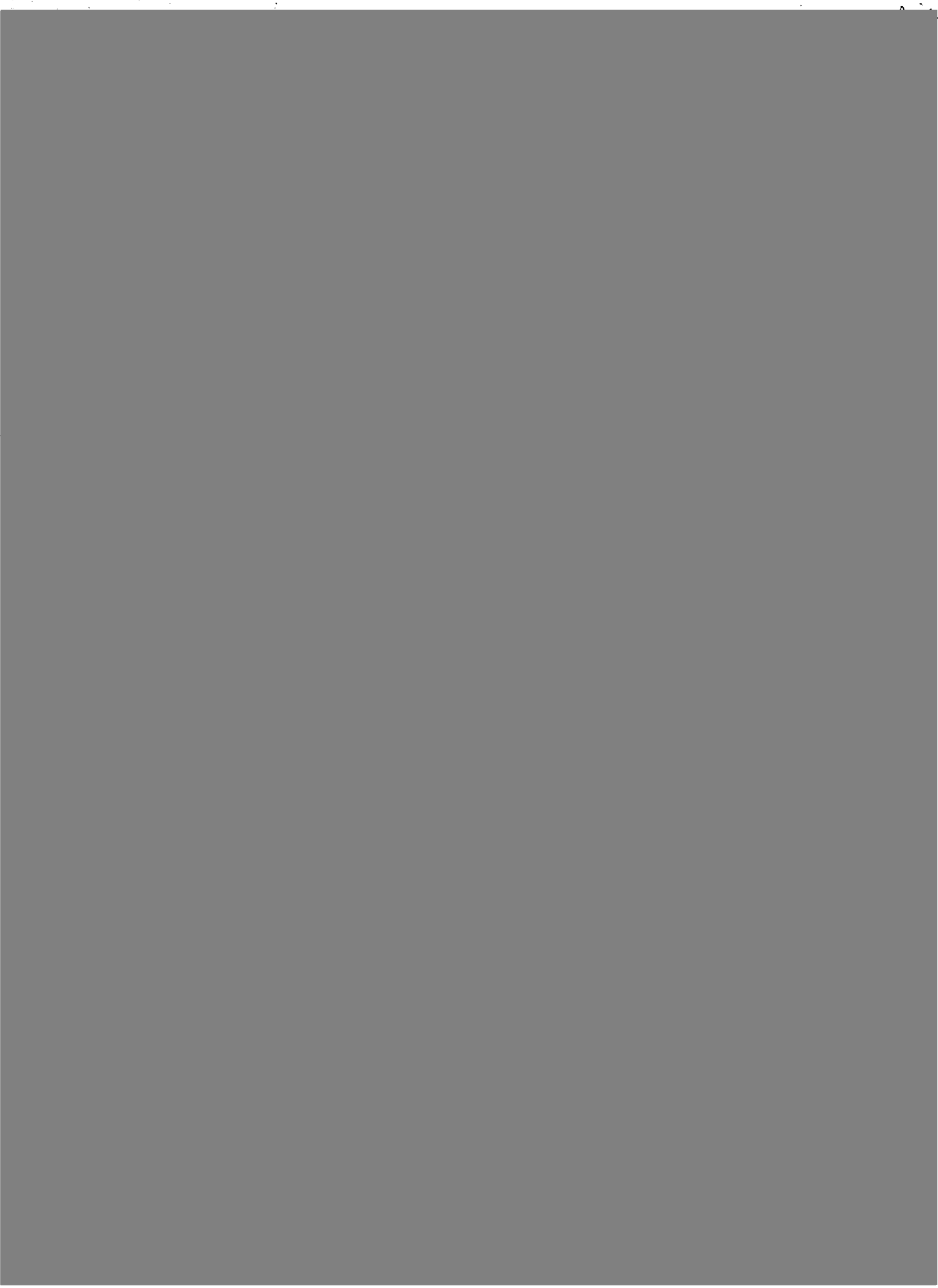
From: J. J. Collins

To:

Ore RESERVES





Cpy to JHC

W. L. K.

JAN 13 1972

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

January 6, 1972

Memorandum

TO: W. L. Kurtz

FROM: J. D. Sell

Reserve Figures - Copper
Major Deposits

This memorandum is to upgrade and supplement my memo to W. E. Saegart (June 16, 1971) entitled: Production - Grade - Reserves, Major Mines - Superior East Project Area. The figures, by company, are based on published reports unless otherwise indicated.

Anaconda Company. Sulfide reserves Sept. 1, 1968; World Mining, vol. 4, no. 13, p. 56, December 1968.

Twin Buttes	292,000,000 tons of	0.88%
Twin Buttes	20,000,000 tons of	0.8% oxide stockpiled (Verbal)
Eisenhower (Palo Verde)	76,400,000 tons of	0.65%(?) 1962 Mineral Yearbook
Yerington	67,000,000 tons of	0.54%
Yerington	28,000,000 tons of	0.57% oxide
Butte, open pit	414,000,000 tons of	0.74%
Butte, underground	12,500,000 tons of	4.27%
Cananea	177,000,000 tons of	0.81%
Cananea (Proposed Pit)	825,000,000 tons of	0.73% Pay Dirt, Sept. 1971

ASARCO. Prospectus, Jan. 1, 1968.

Mission	113,360,000 tons of	0.68%
Silver Bell		
Oxide Mine	21,140,000 tons of	0.68%
El Tiro Mine	27,343,000 tons of	0.73%
Leach Dumps	40,822,000 tons of	0.35%
San Xavier		
Sulfide	69,076,000 tons of	0.51%
Oxide	7,292,000 tons of	0.83%
Sacaton		
Open-pit	22,400,000 tons of	0.86% sulfide
Underground	14,558,000 tons of	1.36% sulfide

Bagdad Copper Company - 1969.

Bagdad	46,000,000 tons of 0.69%
"	200,000,000 tons of 0.50%
"	110,000,000 tons of 0.40%

Cities Service Company - December 31, 1968.

Copper Cities	18,000,000 tons of 0.55%
Diamond H	13,000,000 tons of 0.55% sulfide
Diamond H	6,000,000 tons of 0.55% oxide
Pinto Valley	350,000,000 tons of 0.45% (Verbal communication suggests at least twice this amount and possibly three times.)

Miami Mine -- Expansion to NW into Inspiration townsite plus common boundary area with ICC Thorton pit suggests ± 100,000,000 tons at ± 0.5%.

Central zone of Copper Cities - Diamond H altered area is known to contain minor chalcocite and primary values running 0.3-0.35% copper under +300 feet of leached capping. Chalcocite is not sufficient to support stripping at this time. Note in U of A Porphyry Copper Volume, p. 154, reports..... "Recent drilling to the west (of Copper Cities), outside the pit, has shown a significant increase in copper with depth. A thickness of 200 to 300 feet of material averaging +0.4 percent total copper is overlain by 700 to 1000 feet of material averaging about 0.1 percent total copper." Area and thickness of primary suggests +300,000,000 tons of +0.3%.

Also, verbal pit foreman 1969, ore continues under the shallow dipping Drummond fault northeast side of Copper Cities pit. The "barren" hanging wall material will not presently carry the stripping necessary to expose ± 20,000,000 tons of 0.5% in this area.

Miami East. From reported depths and assays of the three companies involved in the faulted offset, it is suggested that Miami's portion may be ± 300,000,000 tons of ± 1.0%. Also verbal, the present Miami feasibility study probably is in the best area and involves some 80,000,000 tons. Underground work is being pushed into this area.

Cactus Area. The area is underlain by a flat fault which cuts off a chalcocite-enriched mineral deposit suggested to be some 15-20,000,000 tons of ± 0.5%. Abundant oxide copper overlies and surrounds the sulfide body. Calculation of the size of altered schist breccia and possible grade suggests some 40,000,000 tons of +0.5% oxide copper in the block controlled by Cities Service.

Duval Corporation. Reserves of January 1, 1968. Mining World, v. 5, no. 3, p. 51, March 1969 and also see Prospectus.

Ithica Peak	54,538,000 tons of 0.49% Cu + 0.044% Mo
Esperanza	41,215,000 tons of 0.45% Cu + 0.032% Mo
Copper Canyon (Nev.)	18,237,000 tons of 0.74% Cu
Copper Basin (Nev.)	3,437,000 tons of 1.43% Cu
Sierrita (1971)	524,000,000 tons of 0.33% Cu + 0.033% Mo

El Paso-Hecla.

Lakeshore	207,000,000 tons of 0.71% oxide
"	241,000,000 tons of 0.7% sulfide
"	24,000,000 tons of 1.69%, tactite sulfide

Homestake Production. Verbal and visual information.

Carlotta	3,600,000 tons of 1.65% Kelly ore (fault zone)
"	5,000,000 tons of 1.03% Carlotta ore (breccia)
"	(based on property boundary and mineral location it is calculated that the Carlotta block contains some 15,000,000 tons of ore.)

Inspiration Consolidated Copper Co. Annual Report for 1970, with reserves to January 1, 1971

Inspiration area	1,507,622,000 pounds of recoverable copper
Christmas, underground	567,605,000 " " " "
Christmas, open-pit	278,122,000 " " " "
Sanchez	160,917,000 " " " "

Kennecott Copper Corporation. "Proven" reserves as of January 1, 1971. World Mining, vol. 24, no. 6, p. 48, June 1971.

Ray	736,310,000 tons of 0.82%
Chino	452,307,000 tons of 0.78%
Nevada	63,100,000 tons of 0.79%
Utah	1,773,000,000 tons of 0.71%
Safford	1,000,000,000(?) tons of +0.4%(?) (Not published)

Newmont Mining Company. January 1, 1969. Various sources.

San Manuel	496,800,000 tons of 0.728% sulfide
San Manuel	130,000,000 tons of 0.70% mixed; of which 0.47% is oxide copper
Kalamazoo	565,000,000 tons of 0.72% sulfide
Superior	10,400,000 tons of 5.7%
Vekol	107,000,000 tons of 0.55% Cu + 0.015% Mo

Occidental Minerals. Calculated from drill pattern and published reports indicates some 100,000,000 tons averaging between 0.50 and 1.2% copper as oxide.

Phelps Dodge Corporation. "Economic" ore reserves of January 1, 1971. Prospectus dated June 16, 1971.

Morenci	736,800,000 tons of 0.80%
Metcalf, open-pit	220,600,000 tons of 0.74%
Metcalf, underground	126,700,000 tons of 0.92%
Ajo	138,000,000 tons of 0.70%
Bisbee, open-pit	8,100,000 tons of 0.94%
Bisbee, underground	1,900,000 tons of 5.41%
Safford, underground	250,000,000 tons (probable) of 0.92%
Tyrone	292,200,000 tons of 0.81%

Pima Mining Company. January 1, 1969.

Pima	216,000,000 tons of 0.56%

Ranchers Exploration. Annual report, reserves of January 1, 1971.

Blue Bird	75,000,000 tons of 0.52% (open-ended)
Old Reliable	4,000,000 tons of 0.74%
Big Mike (Nev.)	400,000 tons of 3%(?) in place
Big Mike (Nev.)	300,000 tons of 2%, mixed, in stockpile

James D. Sell

JDS:lad

Ore Reserves

call Joseph C. Gruel

Feb 9, 1971

Vekol +100 mill 0.55 0.015 Mo
14¢ Au, Ag

Sanchez 200 mill 0.5 Cu - 50% ox ; 50% S

2.4 million feet of drilling for uranium, a slight increase over the 2.2 million feet drilled in the prior year. In Texas, several small ore deposits and potential ore bodies tributary to the new mill were located. In New Mexico and Wyoming, large mineralized trend areas were defined. A significant portion of the 3.2 million feet of drilling scheduled for 1972 will be located on close-spaced patterns within these trend areas in an effort to determine whether commerical ore bodies actually exist there.

During 1971 Conoco continued upgrading its uranium land holdings. Tracts of prospective land were acquired in Wyoming, New Mexico, and Texas. In addition to acreage in these states, the Company holds land in Colorado and Utah. Conoco's uranium land holdings now total 584,000 net (618,000 gross) acres, compared with 648,000 net (772,000 gross) acres held at the end of 1970.

Metallics

Drilling at the Company's Florence, Arizona copper prospect has confirmed the presence of an ore body which contains substantial tonnage of copper-sulphide ore overlain by an equally large oxide-ore zone. Indicated total ore reserves are about 500 million tons with an average grade slightly above 0.5% copper. During 1971 a first phase feasibility study of possible mining methods and ore-treatment processes was completed by an engineering contractor. The conclusions reached were encouraging, but additional drilling as well as engineering and marketing studies will be required to resolve certain ground water problems and to determine whether the ore can be mined profitably at currently projected prices. In 1972 selected drilling will be conducted to give a more accurate determination of the grade and tonnage of this deposit. Also, detailed studies of alternative mining plans and metallurgical processes will begin during the year.

Although the bulk of Conoco's metallics exploration has been directed toward the Arizona copper prospect, the Company is expanding the range of its metallics exploration interests. Exploration programs also are being conducted in Nevada, Colorado, New Mexico, and selected areas of the southeastern states. Late in 1971, the boards of directors of Conoco and Hudson's Bay Oil and Gas Company Limited, a 54.9%-owned subsidiary, approved a joint venture between the two companies to explore for minerals in Canada. This venture, which became effective January 1, 1972, will place primary emphasis on exploration in British Columbia and in the southern portion of the Precambrian Shield area of east-central Canada.

Industry Perspective

Domestic uranium demand is expected to grow at an average annual rate of about 15% for the next 10 years. Although current levels of uranium supply should be adequate to meet demand until the late 1970's, uranium demand is expected to rise sharply toward the end of the decade. As a result, current mining and milling capacity will have to be tripled by the mid-1980's, and current levels of exploratory activity must be measurably increased in the immediate future in order to meet the long-range requirements.

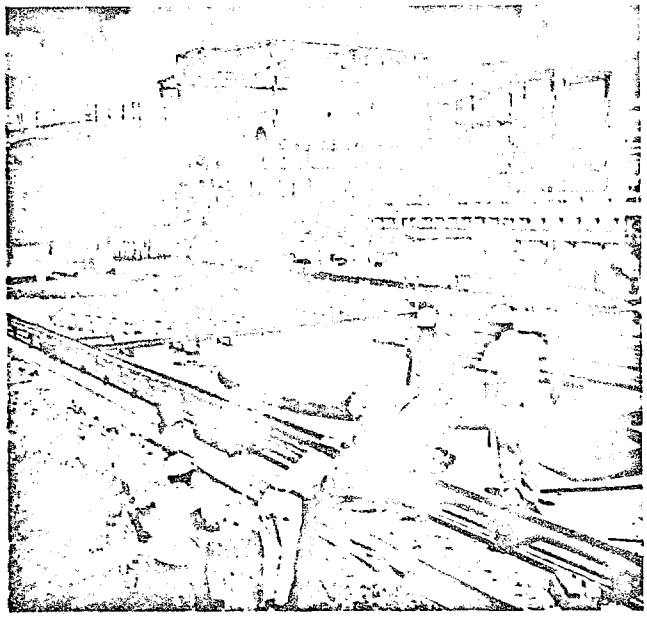
1. The Powder River Basin of Wyoming is one of the areas where Conoco is presently exploring for uranium.

2. Uranium ore is removed from several small surface mines in Karnes County, Texas and trucked to the nearby processing plant.

3. Construction of the Karnes County processing plant was completed, and the mill went into full operation during February 1972.

4. Geologists study core samples to detect mineralization. Mineral composition of the core samples is then determined in laboratories using modern analytical equipment.

3



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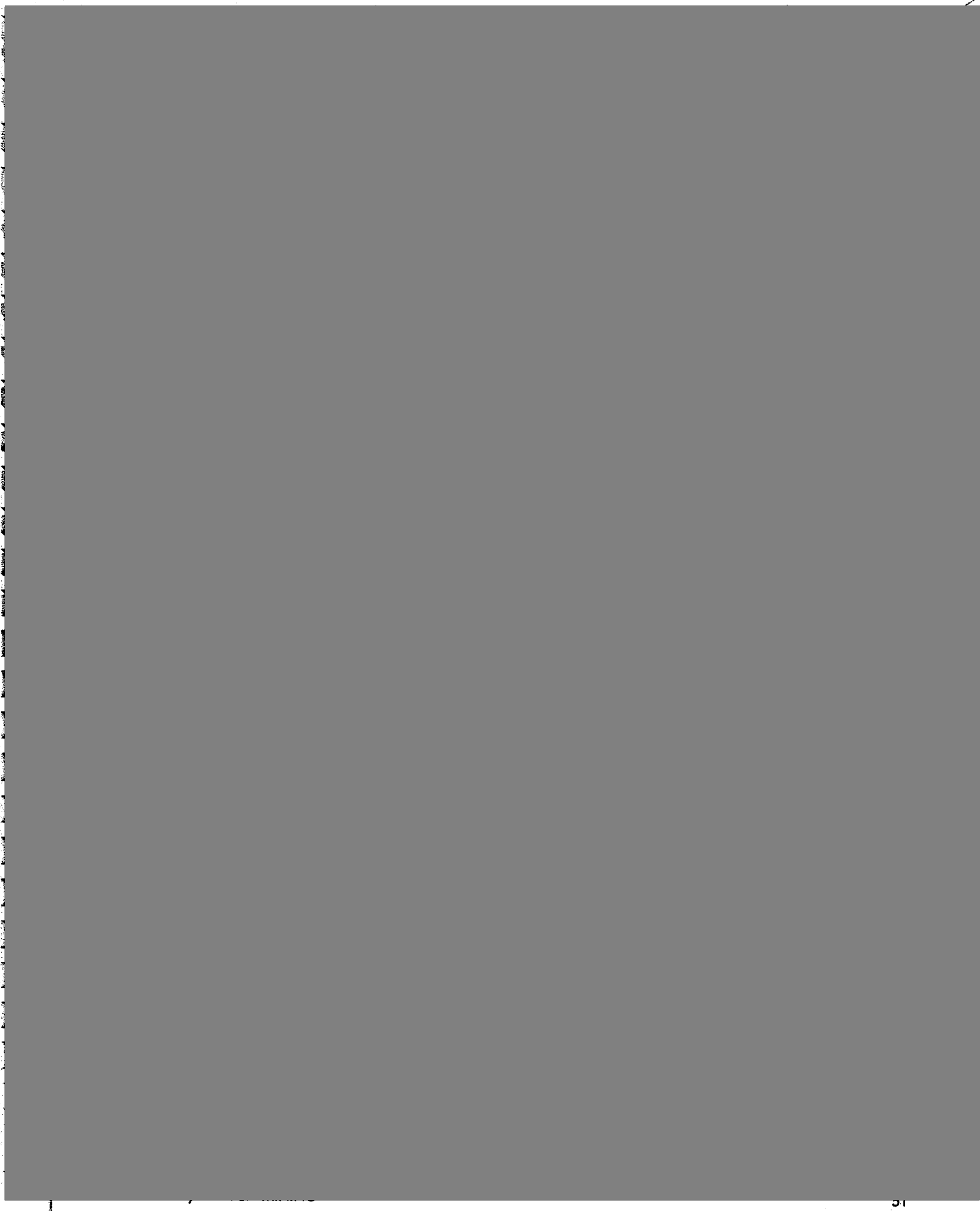
CONOCO
1971 Annual Report.



WLK

FROM: J. H. COURTRIGHT

To: J.J. Collins

Enclosed are two xerox copies of SURVEY OF FREE WORLD INCREASES IN COPPER MINE, SMELTER AND REFINERY CAPACITIES 1971 - 1977 (April 1972).

cc: W.L. Kurtz w/1 encl.
L.P. Entwistle w/1 encl.
R.K. Kirkpatrick/S. Von Fay w/1 encl.
M.P. Barnes w/1 encl.
K. Whiting/J. Balla w/1 encl.
R.B. Sprague w/1 encl.
D.M. Fletcher w/1 encl.
S.A. Anzalone w/1 encl.

International Wrought Copper Council

P. 7251

SURVEY OF FREE WORLD INCREASES IN COPPER MINE, SMELTER AND REFINERY CAPACITIES, 1971 - 1977

Prepared on behalf of the International Wrought Copper Council by the World Bureau of Metal Statistics.

Price (including postage):	Swiss Francs	1,000
	£	100
	U.S. $	260

April 1972

ADDENDUM

Since the Survey was prepared, the following additional information has been reported :

SECTION 3

Pages 3 – 12

Zambia – Chingola Division

Expanded output from Stage 2 is now expected to reach 55,000 tons annually by 1st July, 1974 rather than 1st January.

Pages 3 – 28 (et seq.)

U.S.A.

(2) Asarco

The new San Xavier leaching plant will now come into operation in mid-1973 at an annual rate of 9,000 tons.

Development of the Sacaton deposit will now proceed with production to begin in late 1974 at an annual rate of 19,000 tons.

(3) Cities Services – Tennessee Copper Division

The Pinto Valley orebody development is now to go ahead at a production rate of 57,000 tons per year. It is expected to take 2½ years to come into production.

(9) Hecla/El Paso

Production from the Lakeshore deposits is not now expected to begin until 1975.

APPENDIX 2

Page 1

Germany F.R.

The smelter of Metallhutte Kall GmbH closed down in the autumn of 1971.

The capacity for Huttenwerke Kayser A.G. at Lunen was 60,000 tons at the end of 1971.

APPENDIX 3

Page 1

Germany F.R.

The list of refinery capacities has been extended as follows, thus giving a more complete picture :

Company	Location	Capacity (Metric Tons)
Norddeutsche Affinerie	Hamburg	270,000
Berliner Kupfer-Raffin GmbH	Berlin-Willmersdorf	15,000
Huttenwerke Kayser A.G.	Lunen	84,000
Kabel-und Metallwerke Gutehoffnungshutte	Osnabruck	48,000
Diehl	Nurnberg	3,500
Metallhutte Carl Fahlbusch	Rastatt	12,000
Felten & Guilleaume Kabelwerke	Koln-Mulheim	15,000
Friedrich Kemper	Duisburg	1,800
Kabelwerk Rheydt	Rheydt	7,000
Vereinigte Deutsche Metallwerke	Frankfurt-Heddernheim	13,200

4th July, 1972

CONTENTS

.../...

CONTENTS (Cont.)

SECTION I

SUMMARY TABLES OF ANNUAL INCREASES IN CAPACITIES, 1971 -1977

Table 1: Mine Capacities

Table 2: Smelter Capacities

Table 3: Refinery Capacities

Basis of Assessment

The figures shown in the tables are intended to indicate the amount of capacity which will be available for production during each year. For example, where a new mine is expected to come into operation in the middle of a year, half of the total capacity has been included in that year and the balance in the following year.

TABLE 1. FREE WORLD MINE CAPACITY : ANNUAL INCREASES, 1971 - 1977

Thousands of Metric Tons

	PRODUCTION			CAPACITY													
				1970	1971		1972		1973		1974		1975		1976		1977	
	1969	1970	1971	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total
EUROPE																		
Austria	2	2	3	2	1	3	-	3	-	3	-	3	-	3	-	3	-	3
Finland	33	31	28	37	1	38	3	41	4	45	-	45	-	45	-	45	-	45
France	1	1	1	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
Germany F.R.	1	1	1	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
Greece	-	-	1	-	1	1	-	1	1	2	2	4	-	4	-	4	-	4
Irish Republic	6	8	12	8	6	14	2	16	4	20	-	20	-	20	-	20	-	20
Italy	3	2	2	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3
Norway	21	20	23	24	2	26	-	26	4	30	2	32	-	32	-	32	-	32
Portugal	4	4	5	5	-	5	-	5	-	5	-	5	-	5	-	5	-	5
Spain	19	20	38	20	14	34	6	40	-	40	-	40	-	40	6	46	-	46
Sweden	23	23	28	30	2	32	3	35	5	40	-	40	-	40	-	40	-	40
Yugoslavia	91	98	107	105	10	115	15	130	5	135	5	140	-	140	-	140	-	140
Total	204	210	249	236	37	273	29	302	23	325	9	334	-	334	6	340	-	340
AFRICA																		
Algeria	1	1	1	1	-	1	9	10	3	13	-	13	-	13	-	13	-	13
Angola	1	2	2	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
Botswana	-	-	-	-	-	-	-	-	7	7	9	16	-	16	-	16	-	16
Mauritania	-	-	4	-	4	4	18	22	3	25	-	25	-	25	-	25	-	25
Morocco	3	3	3	4	1	5	1	6	-	6	-	6	-	6	-	6	-	6
Rhodesia	21	23	24	26	1	27	3	30	3	33	-	33	-	33	-	33	-	33
South African Republic	127	144	148	145	5	150	-	150	28	178	9	187	3	190	-	190	-	190
South West Africa	26	23	25	32	- 1	31	7	38	-	38	-	38	-	38	-	38	-	38
Uganda	17	18	16	18	- 2	16	-	16	-	16	-	16	-	16	-	16	-	16
Zaire	364	387	408	390	20	410	15	425	78	503	10	513	20	533	50	583	64	647
Zambia	720	684	651	705	-45	660	49	709	73	782	51	833	67	900	-	900	-	900
Total	1,280	1,285	1,282	1,323	-17	1,306	102	1,408	195	1,603	79	1,682	90	1,772	50	1,822	64	1,886
ASIA																		
Burma	1	1	1	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
Cyprus	21	20	18	21	-	21	-	21	-	21	-	21	-	21	-	21	-	21
Formosa	3	3	2	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4
India	10	10	11	10	-	10	4	14	17	31	16	47	-	47	-	47	-	47
Indonesia	-	-	-	-	-	-	-	-	40	40	19	59	-	59	-	59	-	59
Iran	1	1	1	1	-	1	-	1	-	1	-	1	50	51	50	101	45	146
Israel	11	11	11	12	-	12	-	12	-	12	-	12	-	12	-	12	-	12
Japan	120	119	120	135	-	135	- 5	130	- 5	125	-	125	-	125	-	125	-	125
Malaysia	-	-	-	-	-	-	-	-	17	17	23	40	-	40	-	40	-	40
Philippine Republic	131	160	175	170	15	185	20	205	10	215	-	215	-	215	-	215	-	215
South Korea	2	2	2	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3
Turkey	31	31	30	32	-	32	20	52	20	72	-	72	-	72	-	72	-	72
Total	331	358	371	389	15	404	39	443	99	542	58	600	50	650	50	700	45	745

TABLE 1 CONTINUED

Thousands of Metric Tons

	PRODUCTION			CAPACITY														
				1970	1971		1972		1973		1974		1975		1976		1977	
	1969	1970	1971	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total
MINE CAPACITY (CONTINUED)																		
NORTH/CENTRAL AMERICA																		
Canada	520	611	653	620	75	695	25	720	114	834	106	940	40	980	40	1,020	10	1,030
Cuba	7	7	7	8	-	8	-	8	-	8	-	8	-	8	-	8	-	8
Haiti	2	5	5	5	-	5	-	5	-	5	-	5	-	5	-	5	-	5
Mexico	66	61	64	70	7	77	16	93	10	103	3	106	60	166	60	226	-	226
Nicaragua	4	3	4	4	1	5	-5	-	-	-	-	-	-	-	-	-	-	-
Puerto Rico	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	48
U.S.A.	1,401	1,560	1,391	1,648	44	1,692	50	1,742	19	1,761	32	1,793	112	1,905	-	1,905	-	1,905
Total	2,000	2,247	2,124	2,355	127	2,482	86	2,568	143	2,711	141	2,852	212	3,064	100	3,164	58	3,222
SOUTH AMERICA																		
Bolivia	8	9	10	10	-	10	-	10	-	10	-	10	--	10	-	10	-	10
Brazil	4	5	5	7	1	8	2	10	12	22	25	47	-	47	21	68	11	79
Chile	688	686	708	756	94	850	35	885	35	920	104	1,024	-	1,024	-	1,024	-	1,024
Peru	199	212	193	220	5	225	-	225	-	225	6	231	26	257	60	317	70	387
Total	899	912	916	993	100	1,093	37	1,130	47	1,177	135	1,312	26	1,338	81	1,419	81	1,500
OCEANIA																		
Australia	131	158	174	160	19	179	34	213	28	241	17	258	-	258	-	258	-	258
Bougainville	-	-	-	-	-	-	120	120	60	180	7	187	-	187	-	187	-	187
Total	131	158	174	160	19	179	154	333	88	421	24	445	-	445	-	445	-	445
TOTAL	4,845	5,170	5,116	5,456	281	5,737	447	6,184	595	6,779	446	7,225	378	7,603	287	7,890	248	8,138
Allowance for increases not yet announced					-		-		-		-		100		100		150	
GRAND TOTAL	4,845	5,170	5,116	5,546	281	5,737	447	6,184	595	6,779	446	7,225	478	7,703	387	8,090	398	8,488

TABLE 2. FREE WORLD SMELTER CAPACITY : ANNUAL INCREASES 1971 - 1977

Thousands of Metric Tons

	PRODUCTION			CAPACITY														
				1970	1971		1972		1973		1974		1975		1976		1977	
	1969	1970	1971	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total
EUROPE																		
Austria	11	11	11	12	-	12	3	15	1	16	1	17	1	18	2	20	2	22
Belgium	56	54	54	62	-	62	-	62	-	62	-	62	-	62	-	62	-	62
Finland	35	35	33	50	-	50	-	50	-	50	-	50	-	50	-	50	-	50
France	10	9	7	11	-	11	-	11	-	11	-	11	-	11	-	11	-	11
Germany F.R.	185	219	201	220	-	220	50	270	50	320	-	320	-	320	-	320	-	320
Italy	2	2	2	8	-	8	-	8	-	8	30	38	30	68	-	68	-	68
Norway	28	32	34	34	-	34	-	34	-	34	-	34	-	34	-	34	-	34
Portugal	4	4	5	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4
Spain	40	40	69	90	-	90	5	95	12	107	-	107	-	107	-	107	-	107
Sweden	52	51	58	65	-	65	-	65	-	65	-	65	-	65	-	65	-	65
Yugoslavia	83	90	94	90	15	105	15	120	10	130	5	135	5	140	-	140	-	140
Total	506	547	568	646	15	661	73	734	73	807	36	843	36	879	2	881	2	883
AFRICA																		
Rhodesia	21	23	24	23	2	25	-	25	-	25	-	25	-	25	-	25	-	25
South African Republic	127	145	150	150	-	150	-	150	-	150	-	150	-	150	-	150	-	150
South West Africa	28	27	29	35	-	35	-	35	-	35	-	35	-	35	-	35	-	35
Uganda	17	17	16	18	-	18	-	18	-	18	-	18	-	18	-	18	-	18
Zaire	364	386	408	435	-	435	30	465	30	495	15	510	-	510	-	510	-	510
Zambia	704	683	644	732	15	747	15	762	-	762	61	823	72	895	-	895	-	895
Total	1,261	1,281	1,271	1,393	17	1,410	45	1,455	30	1,485	76	1,561	72	1,633	-	1,633	-	1,633
ASIA																		
Formosa	3	4	4	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4
India	10	9	10	10	-	10	4	14	17	31	16	47	-	47	-	47	-	47
Japan	501	606	605	679	145	824	176	1,000	44	1,044	-	1,044	-	1,044	-	1,044	-	1,044
S. Korea	6	5	6	8	-	8	-	8	-	8	13	21	2	23	-	23	-	23
Turkey	19	19	18	30	-	30	20	50	20	70	-	70	-	70	-	70	-	70
Total	539	643	643	731	145	876	200	1,076	81	1,157	29	1,186	2	1,188	-	1,188	-	1,188

TABLE 2(CONTINUED)

Thousands of Metric Tons

	PRODUCTION			CAPACITY														
				1970	1971		1972		1973		1974		1975		1976		1977	
	1969	1970	1971	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total
NORTH/CENTRAL AMERICA																		
Canada	388	465	462	512	-	512	-	512	-	512	75	587	30	617	-	617	-	617
Mexico	57	60	59	95	-	95	7	102	5	107	-	107	-	107	-	107	-	107
U.S.A.	1,509	1,561	1,421	1,650	-	1,650	4	1,654	46	1,700	100	1,800	-	1,800	-	1,800	-	1,800
Total	1,954	2,086	1,942	2,257	-	2,257	11	2,268	51	2,319	175	2,494	30	2,524	-	2,524	-	2,524
SOUTH AMERICA																		
Brazil	4	5	5	4	-	4	-	4	15	19	20	39	-	39	-	39	-	39
Chile	647	647	625	810	-	810	-	810	-	810	-	810	--	810	-	810	-	810
Peru	170	176	167	210	-	210	-	210	-	210	-	210	-	210	-	210	-	210
Total	821	828	797	1,024	-	1,024	-	1,024	15	1,039	20	1,059	-	1,059	-	1,059	-	1,059
OCEANIA																		
Australia	124	120	151	149	-	149	25	174	-	174	50	224	-	224	-	224	-	224
TOTAL	5,205	5,505	5,372	6,200	177	6,377	354	6,731	250	6,981	386	7,367	140	7,507	2	7,509	2	7,511
Allowance for increases not yet announced					-		-		-		200		250		350		400	
GRAND TOTAL	5,205	5,505	5,372	6,200	177	6,377	354	6,731	250	6,981	586	7,567	390	7,957	352	8,309	402	8,711

TABLE 3. FREE WORLD REFINERY CAPACITY : ANNUAL INCREASES 1971 - 1977

Thousands of Metric Tons

	PRODUCTION			CAPACITY														
				1970	1971		1972		1973		1974		1975		1976		1977	
	1969	1970	1971	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total
EUROPE																		
Austria	19	22	22	19	1	20	3	23	1	24	1	25	1	26	2	28	2	30
Belgium	287	338	313	390	10	400	20	420	-	420	-	420	-	420	-	420	-	420
Finland	34	34	32	48	-	48	-	48	-	48	-	48	-	48	-	48	-	48
France	37	34	29	42	-	42	-	42	-	42	-	42	-	42	-	42	-	42
Germany F.R.	402	406	400	466	-	466	-	466	-	466	-	466	-	466	-	466	-	466
Italy	17	14	9	33	-	33	-	33	-	33	30	63	30	93	-	93	-	93
Norway	22	26	28	32	-	32	-	32	-	32	-	32	-	32	-	32	-	32
Portugal	4	4	4	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4
Spain	76	83	70	130	-30	100	-30	70	35	105	-	105	-	105	-	105	-	105
Sweden	52	51	50	55	-	55	-	55	10	65	-	65	-	65	-	65	-	65
United Kingdom	198	206	188	280	10	290	-	290	-	290	-	290	-	290	-	290	-	290
Yugoslavia	82	89	93	90	15	105	15	120	10	130	5	135	5	140	-	140	-	140
Total	1,230	1,307	1,238	1,589	6	1,595	8	1,603	56	1,659	36	1,695	36	1,731	2	1,733	2	1,735
AFRICA																		
Egypt	1	1	1	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
Rhodesia	21	23	24	22	2	24	-	24	-	24	-	24	-	24	-	24	-	24
South African Republic	61	75	79	78	-	78	-	78	-	78	-	78	-	78	-	78	-	78
Zaire	182	190	200	230	-	230	-	230	-	230	-	230	-	230	-	230	-	230
Zambia	603	581	534	611	-	611	-	611	52	663	52	715	36	751	-	751	-	751
Total	868	870	838	942	2	944	-	944	52	996	52	1,048	36	1,084	-	1,084	-	1,084
ASIA																		
Formosa	3	4	4	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4
India	10	9	10	10	-	10	4	14	17	31	16	47	-	47	-	47	-	47
Japan	629	705	713	833	52	885	172	1,057	44	1,101	-	1,101	-	1,101	-	1,101	-	1,101
S. Korea	6	5	5	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6
Turkey	12	14	15	15	-	15	-	15	-	15	-	15	-	15	-	15	-	15
Total	660	737	747	868	52	920	176	1,096	61	1,157	16	1,173	-	1,173	-	1,173	-	1,173

TABLE 3 - (Continued)

	PRODUCTION			CAPACITY													
				1970	1971		1972		1973		1974		1975		1976		1977	
	1969	1970	1971	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total	Increase	Total
Refinery Capacity (Cont'd)																		
North/Central America																		
Canada	488	493	478	488	-	488	-	488	-	488	52	540	40	580	-	580	-	580
Mexico	57	54	60	72	-	72	-	72	-	72	-	72	-	72	-	72	-	72
U.S.A.	2,009	2,034	1,784	2,450	34	2,484	180	2,664	-	2,664	-	2,664	-	2,664	-	2,664	-	2,664
Total	2,474	2,581	2,322	3,010	34	3,044	180	3,224	-	3,224	52	3,276	40	3,316	-	3,316	-	3,316
South America																		
Brazil	4	5	4	4	-	4	-	4	15	19	20	39	--	39	--	39	-	39
Chile	453	461	468	653	-	653	-	653	-	653	-	653	-	653	-	653	-	653
Peru	32	36	32	52	-	52	-	52	-	52	-	52	-	52	-	52	-	52
Total	489	502	504	709	-	709	-	709	15	724	20	744	-	744	-	744	-	744
OCEANIA																		
Australia	139	146	156	160	-	160	-	160	-	160	50	210	-	210	-	210	-	210
TOTAL	5,060	6,143	5,805	7,270	94	7,372	364	7,736	184	7,920	226	8,146	112	8,258	2	8,260	2	8,262
Allowance for increases not yet announced											100		250		250		400	
GRAND TOTAL	5,060	6,143	5,805	7,270	94	7,372	364	7,736	184	7,920	326	8,246	362	8,608	252	8,860	402	9,262

SECTION 2: SUMMARY LIST OF MAJOR INCREASES

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
EUROPE		**MINES**			
Austria	Kupferbergbau Mitterberg Ges. m.b.H.	Muhlbach, Salzburg	2,000	3,000	1975
Finland	Outokumpu Oy	Vuonnos	-	6,500	1972
Greece	Hellenic Chemical Products and Fertilizer Co. Ltd.	Kassandra	-	n.a.	1972
Irish Republic	Northgate Exploration Ltd.	Tynaph	3,000	6,000	1972
	Discovery Mines Ltd.	Avoca	-	6-9,000	1971-73
Norway	Folldal Verk A/S	Repptarfjord	-	4,500-6,000	1973
Spain	Rio Tinto Patino Ltd.	Cerro Colorado	-	20,000	1971
Sweden	Boliden	Aitik	10,000	20,000	1974
Yugoslavia	State Owned	Bor	105,000	140,000	1974
	State Owned	Bor		200,000	n.a.
		SMELTERS			
Austria	Montanwerke Brixlegg G.m.b.h.	Brixlegg	12,000	18,000	1975
Finland	Outokumpu Oy	Harjavalta	50,000	n.a.	n.a.
Germany F.R.	Norddeutsche Affinerie	Hamburg	-	100,000	1972
Italy	AMMI	Aussa - Corno	-	60,000	1975
Spain	Rio Tinto Patino Ltd.	Huelva	40,000	75,000	1972-73
Yugoslavia	State Owned	Bor	90,000	140,000	1974
	State Owned	Bor		200,000	n.a.
		REFINERIES			
Austria	Montawerke Brixlegg G.m.b.h.	Brixlegg	19,000	26,000	1975
Belgium	Metallurgie Hoboken - Overpelt	Olen	240,000	270,000	1971
Italy	AMMI	Aussa - Corno	-	60,000	1975
Spain	Rio Tinto Patino Ltd.	Huelva	40,000	75,000	1972-73
Sweden	Boliden Aktiebolag	Ronnskar	55,000	60-65,000	1973
United Kingdom	Williams Harvey	Liverpool	-	10,000	1972
Yugoslavia	State Owned	Bor	90,000	140,000	1974
	State Owned	Bor		200,000	n.a.

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
		MINES			
AFRICA					
Algeria	Government	Kef-Oum-Theboul and other areas	1,000	13,000	1973
Botswana	Botswana R.S.T.	Pikwe	-	15,500	1973
Ethiopa	Nippon Mining Co.	Asmara	-	100,000?	n.a.
Mauritania	Somima	Akjoujt	-	25,000	1972
Morocco	State/Japanese Companies	Bou Kerzia	-	n.a.	1971
	State	Beni Mellal	-	1,400	1971
Rhodesia	R.T.Z.	Empress	-	4-4,300	1972
	Messina	Shackleton	-	8,000	1971
	MTD Mangula	Norah	-	n.a.	1972
	MTD Mangula	Silverside	-	n.a.	1972
	MTD Mangula	Hans, Avondale and Angwa	-	n.a.	n.a.
	Coronation Syndicate	Inyati	3,400	4,600	1971-72
South Africa	Consortium of South African and U.S. Companies	Prieska	-	40,000	1974
S. W. Africa	Oamites Mining Co.	Windhoek	-	8,000	1972
Zaire	Gecamines	Several mines	386,000	460,000	1974
	Gecamines	Several mines		560,000	1978
	Sodimiza	Musoshi	-	53,000	1972
	Sodimiza	Tshinsenda	-	74,000	1976
	Simz		-	n.a.	n.a.
	Sozatef	Tenke - Fungurume	-	100,000?	1975?
Zambia	R.C.M.	Mufulira	130,000	190,000	1973
	R.C.M.	Chambishi	24,000	48,000	1973
	R.C.M.	Kalengwa	-	17,000	1971
	R.C.M.	Baluba	-	22,000	1973
	R.C.M.	Baluba		50,000	n.a.
	N.C.C.M.	Bwana Mkubwa	-	15,000	1971
	N.C.C.M.	Kansanshi	-	15,000	1975?
	N.C.C.M.	Nchanga	250,000	270,000	1972
	N.C.C.M.	Nchanga		315,000	1974-75
	Miniera de Frangna Chilamberto	Mkushi	-	6,000	1971
		SMELTERS			
Zaire	Gecamines	Lullu	125,000	170,000 (cathodes)	1972
	Gecamines	Lubumbashi	125,000	155,000	1973
Zambia	Roan Consolidated Mines	Mufulira	200,000	230,000	1971
	Nchanga Consolidated Copper Mines	Total	410,000	500,000	1974-75

REFINERIES

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
AFRICA (Cont'd)					
Rhodesia	Coronation Syndicate	Inyati	-	n.a.	1971
Zambia	Roan Consolidated Mines	Mufulira	185,000	247,000	1973
	Nchanga Consolidated Copper Mines	Total	296,000	356,000	1974-75

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
		MINES			
ASIA					
Formosa	Government	Chimei	-	n.a.	n.a.
India	Hindustan Copper Corp.	Khetri	-	21,000	1973-74
	Hindustan Copper Corp.	Kolihan	-	10,000	1973-74
	Hindustan Copper Corp.	Agnigundala	-	n.a.	n.a.
	Hindustan Copper Corp.	Rakha	-	3,500	1973-74
Indonesia	Freeport Indonesia Inc.	Erstberg	-	59,000	1973
Iran	Sar Chesmeh Copper Company of Kerman	Sar Chesmeh	-	145,000	1975-76
	Government/Japanese	Qaleh Zari	-	18,000	n.a.
Israel	Timna Copper Mines	Timna	12,000	n.a.	1973
Malaysia	Mamut Mine Development Co.	Sabah	-	40,000	1973
Philippine Republic	Atlas Consolidated	Biga	48,000	77,000	1971
	Labo Mines Inc.	Luzon	-	1,400	1971
Turkey	Black Sea Copper Mines	Murgul, Kure & Espiye	32,000	72,000	1972
		SMELTERS			
India	Hindustan Copper Corporation	Khetri	-	31,000	1974
		Ingladhal	-	n.a.	n.a.
Iran	Government	Sar Chesmeh	-	n.a.	n.a.
Japan	Onahama Smelting & Refining Co.	Onahama	90,000	288,000	n.a.
	Hibi Kyodo Smelting Co.	Tamanao	-	84,000	1972
	Sumitomo	Toyo	-	96,000	1971
	Nippon Mining	Hitachi	60,000	120,000	1972
	Nippon Mining	Saganoseki	120,000	240,000	n.a.
Turkey	Black Sea Copper Mines	Samsun	-	40,000	1972
		REFINERIES			
India	Hindustan Copper Corporation	Khetri	-	31,000	1974
Iran	Government	Sar Chesmeh	-	n.a.	n.a.
Japan	Hibi Kyodo Smelting Co.	Tamanao	-	84,000	1972
	Sumitomo	Niihama	120,000	144,000	1971
	Sumitomo	Toyo	-	48,000	1972
	Nippon Mining	Hitachi	72,000	132,000	1972
	Mitsubishi	Naoshima	84,000	120,000	1972
	Mitsui Metal Mining	Takehara	76,000	84,000	1971

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
NORTH/CENTRAL AMERICA					
		MINES			
Canada	Gibraltar Mines Ltd.(Placer)	Gibraltar/Pollyana	-	n.a.	1972
	Inco	Sudbury	161,000	191,000	1972
	Rio Algom	Lornex	-	51,000	1972
	Sherritt Gordon Mines Ltd.	Ruttan Lake	-	35,000	1973
	Utah International Inc.	Port Hardy	-	50,000	1971/72
	Valley Copper Mines Ltd. (Cominco-Bethlehem Copper Corp)	Highland Valley	-	n.a.	1973/74
	Gaspe Copper Mines (Noranda)	Copper Mountain	8,000	24-27,000	1972/73
	Granisle Copper	Babine Lake	n.a.	n.a.	1972
	Highmont Mining/Teck Corp.	Highland Valley	-	n.a.	1973
	Mattabi Mines	Sturgeon Lake	-	n.a.	1972
	Noranda	Newman	-	13,500	1972
	Opemiska (Falconbridge)	Opemiska	18,000	27,000	1971/72
	Similkameen Mining Co. (Newmont)	Princetown	-	n.a.	1972
	Alwin Mining Co.		-	5-7,000	1972
	Dison Development (Crownex/Pechiney)	Sunro	-	n.a.	1971
	Hudson Bay Mining	Two new mines	-	n.a.	1972
	Hudson-Yukon Mining	Wellgreen	-	2,700	1972
	Selection Trust (Selco)	Uchi Lake	-	3,000	1971
	Stall Lake Mines (Falconbridge)	Snow Lake	-	n.a.	1972
Guatemala	Basic Resources International	Oxec	-	n.a.	1972
Mexico	Asarco Mexicana	Inguaran	-	13,000	1971
	Asarco Mexicana & Others	La Caridad	-	120,000	1976
	Cia Minera de Cananea S.A. de C.V.	Cananea	37,000	60,000	1974
	Met-Mex Penoles S.A.		6,000	7,200	n.a.
Panama	Japanese Consortium	Petaquilla	-	n.a.	n.a.
	Pavonia S.A.	Cerro Colorado	-	n.a.	n.a.
Puerto Rico	Ponce Mining Co. (Kennecott-Amax)	Adjuntas	-	40,000	1977
U.S.A.	Anaconda	Several Mines	227,000	272,000	1975
	Asarco	San Xavier	-	11,000	n.a.
	Duval	Sierrita	59,000	68,000	1974/75
	Phelps Dodge	Tyrone	54,000	90,700	1972/73
	Phelps Dodge	Metcalf	-	45,000	1974
	Pima Mining Co. (Cyprus Mines)	Pima	59,000	72,600	1971
	Newmont	San Manuel	91,000	136,000	1971/72
	Newmont	Superior	19,000	36,000	1973/74
	Hecla/El Paso	Lakeshore	-	32,000	1974/75
	Ranchers	Bluebird	4,500	5,900	1972
	Ranchers	Bluebird		6,600	1973
	Kerr Addison Mines	Blue Hill	-	n.a.	1972/73
	Shield	O.K.	n.a.	n.a.	1971
	Earth Resources	Nacimiento	-	6,400	1971
		SMELTERS			
Canada	Noranda Mines Ltd.	Murdochville (Gaspe)	63,000	88,000	1973/74

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
		SMELTERS (Cont'd)			
Canada (Cont'd)	Noranda Mines Ltd.	Noranda	204,000	254,000	1973/74
	Inco		170,000	200,000	1974/75
Mexico	Asarco Mexicana S.A.	San Luis Potosi	30,000	42,000	n.a.
	Asarco Mexicana S.A.	La Caridad	-	n.a.	n.a.
Puerto Rico	Ponce Mining (Kennecott-Arnax)	Ponce	-	n.a.	n.a.
U.S.A.	Phelps Dodge	Southern Hidalgo	-	? 91,000	1974
	Newmont	San Manuel	85,000	135,000	1974
		REFINERIES			
Canada	Falconbridge	Decancour	-	10,000	1975
	Inco		170,000	200,000	1974/75
	Canadian Copper Refiners	Montreal	318,000	370,000	1974/75
Mexico	Asarco Mexicana S.A.	San Luis Potosi	-	45,000	n.a.
Puerto Rico	Ponce Mining (Kennecott-Amax)	Ponce	-	n.a.	n.a.
U.S.A.	Newmont-Magma	San Manuel	-	181,000	1971
	Southwire	Carrollton	-	65,000	1971

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
SOUTH AMERICA					
		MINES			
Brazil	Cia Brazileira de Cobre	Camaqua	8,000	12,000	1973
	Pignatari Group	Caraiba	-	35,000	1973
	Pignatari Group	Caraiba		70,000	?1976
Chile	Cia Minera Exotica	Exotica	-	102,000	1971-72
	Cia Minera Andina	Andina	-	61,000	1971-72
	Cia Cuprifera de Sagasca	Sagasca	-	24,000	1972
	Enami	Small Mines	51,000	96,000	1972
	Chile Exploration	Chuquicamata	280,000	354,000	1973-74
Peru	Southern Peru Copper Corporation	Cuajone	-	130,000	1976
	Minero Peru	Cerro Verde	-	31,500	1974
	Minero Peru	Tintaya	-	n.a.	1974
		SMELTERS			
Brazil	Pignatari Group	Caraiba	-	35,000	?1973
	Pignatari Group	Caraiba		70,000	?1976
Chile	Enami	Las Ventanas	43,000	100,000	n.a.
	Enami	Paipote	33,000	n.a.	n.a.
		REFINERS			
Brazil	Pignatari Group	Caraiba	-	35,000	?1973
	Pignatari Group	Caraiba		70,000	?1976
Chile	Enami	Las Ventanas	85,000	120,000	n.a.

COUNTRY	COMPANY	DEVELOPMENT	CAPACITY 1970	CAPACITY FINAL	DATE
OCEANIA					
		MINES			
Australia	Mt. Lyell Mining & Railway Co.	Mt. Lyell	15,000	30,000	1973
	Mt. Isa Mines Ltd.	Mt. Isa	100,000	150,000	1973
	Peko Mines N.L.	Warrego	-	10,000	1972
	Peko Mines N.L.	Geko	-	n.a.	71972
	Samin Co.	Burra	-	5,600	1971
	Electrolytic Zinc	Roseberry	1,500	3,000	1971
	North Broken Hill/Broken Hill South/Electrolytic Zinc/ McPhar Geophysics	Kanmantoo	-	7-8,000	1971
	Cobar Mines Pty. Ltd.		10,100	20,300	1974
	Mitsubishi/Consolidated Goldfields	Gunpowder	-	10,000	n.a.
	Jododex Australia Pty. Ltd.	Tarago	-	n.a.	n.a.
Papua/New Guinea	Bougainville Copper Pty. Ltd(R.T.Z)	Bougainville	-	107,000	1972/74
		SMELTERS			
Australia	Peko	Tennant Creek	-	25,400 +	1972
	Mt. Isa Mines Ltd.	Mt. Isa	100,000	150,000	1974
		REFINERIES			
Australia	Copper Refineries Pty. Ltd.	Townsville	100,000	150,000	1974

SECTION 3

NOTES ON DEVELOPMENTS IN INDIVIDUAL COUNTRIES

EUROPE

1. Austria

Mine Capacity

This is scheduled to increase from 2,000 to 3,000 tons per year between 1970 and 1975.

Smelter Capacity

Scheduled to increase from 12,000 to 18,000 tons per year between 1970 and 1975, with a further increase to 22,000 tons per year over 1976 and 1977 envisaged.

Refinery Capacity

Scheduled to increase from 19,000 to 26,000 tons per year between 1970 and 1975, with a further increase to 30,000 tons per year over 1976 and 1977 envisaged.

2. Belgium

Smelter Capacity

No increases have been announced.

Refinery Capacity

The capacity of the electrolytic refinery of Metallurgie Hoboken-Overpelt at Olen was increased during 1971 by 30,000 tons to 270,000 tons. No developments have been announced concerning the fire refinery (capacity 150,000 tons).

3. Finland

Mine Capacity

A new nickel-copper mine at Vuonnos was due to be brought into operation by Outokumpu Oy by the end of 1971. Nickel ore only will be mined during the first year using open pit methods. The underground mining of copper ore will start during 1972 at a rate of 300,000 tons of ore per year, containing 3% copper. Capacity is currently estimated at 6,500 tons per year (copper content).

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3. Finland (Cont'd)

Smelter Capacity

The copper smelter at Harjavalta is being expanded to cover increased mine production.

Refinery Capacity

No increases have been announced.

4. France

No developments have been reported.

5. Germany F.R.

Mine Capacity

No developments have been reported.

Smelter Capacity

Norddeutsche Affinerie are building a new smelter with a capacity of 400,000 tons of concentrates per year for completion in mid - 1972.

Refinery Capacity

No developments have been reported.

6. Greece

The Hellenic Chemical Products and Fertilizer Co. Limited is developing the copper pyrites deposits at the Kassandra Mine and expects production to start in early 1973. Deposits are estimated at 2 million tons with a copper content of 1.5 - 2.0%. Mining rate will be 250,000 tons of ore per year.

Pechiney is reported to have taken over the rights in the Skouries and Stavros deposits from Placer Developments Limited. Skouries is a copper - gold deposit with proven reserves of 11.8 million tons open pit sulphide ore grading 0.72% copper, and a minimum 7 million tons of underground marginal grade material containing 1.05% copper. Stavros, in the Chalkidike Peninsula has probable reserves of 1 million tons with copper content of 2.5 - 3.0%.

7. Irish Republic

The capacity of the Tynagh mine (lead - zinc - silver - copper) operated by Northgate Exploration Limited, is being expanded to provide an additional 640,000 tons of ore per year (roughly double present capacity, i.e. an increase of 3,000 tons copper content per year). This increase is due to underground development (present production is by open pit) and is scheduled to begin late in 1972.

The Avoca mine in Country Wicklow (Discovery Mines Limited, owned by Avoca Mines Limited) was re-opened and production resumed at the end of 1970. Capacity is thought to be 6,000 tons per year and is expected to rise to 9,000 tons (copper content) by 1973.

.../...

7. Irish Republic (Cont'd)

At Allihies in County Cork, Argosy Mining Corporation (a subsidiary of Denison Mines) is examining the possibility of re-activating an old copper mine in conjunction with Cerro Corporation. At Aherlow, Limerick, Argosy is investigating a copper - silver prospect.

8. Italy

Mine Capacity

No new developments have been reported.

Smelter Capacity
Refinery Capacity

AMMI has completed plans for a new electrolytic copper plant with an annual capacity of 60,000 tons at Aussa - Corno in the Province of Udine. Completion is due by 1975.

9. Norway

Mine Capacity

The Bidjovagge copper ore deposit in Finnmark was being developed by A/S Bidjovagge Gruber and was planned to come into operation in 1970. The Kautokeino mine was expected to produce concentrates containing 4,000 tons of copper per year, which were to be sent by road to the coast at Alta.

Ore deposits at Reptarfjord in Finnmark are to be developed by Folldal Verk A/S. Reserves are estimated at 10 million tons grading 0.7% copper on average. Mining and milling will be at a rate of 600,000 tons per year to produce 15,000 tons of 30 - 40% copper concentrates annually (4,500 to 6,000 tons copper). Production is scheduled to start early in 1973.

Smelter Capacity

No increases have been announced.

Refinery Capacity

No increases have been announced.

10. Portugal

No new developments have been reported.

11. Spain

Mine Capacity

Rio Tinto Patino's new Cerro Colorado mine is expected to produce 20,000 tons of copper in concentrate at full capacity. The concentrating plant was completed in December 1970.

Union Explosives - Rio Tinto and Rio Tinto - Patino continued exploration near Santiago de Compestela, North - Western Spain.

11. Spain (Cont'd)

Enough copper ore has been discovered to give a production of 10,000 tons of copper per year. The technical study has been completed and Rio Tinto Patino were examining financing during 1971.

Metallgesellschaft has acquired a 40% interest in Andaluza de Piritas which is to develop pyrite deposits at Aznalcollar, Southern Spain. The 50 million ton deposit is estimated to contain 250,000 tons of copper. The Company plans to extract 1.5 to 2 million tons per year of pyrites from 1975 as the initial stage (7,500 - 10,000 tons of contained copper).

Smelter Capacity
Refinery Capacity

The capacity at the new 40,000 tons per year smelter/refinery complex at Huelva is due to rise to 75,000 tons by the end of 1972. This is to replace the old smelter/refinery (18,000 tons).

The refinery of SECEM at Cordoba closed during 1971.

12. Sweden

Mine Capacity

Boliden are expanding operations at the Aitik copper mine to enable an increase in ore production from the present 2 million tons per year to 5 - 6 million tons per year. The average copper content of the ore will decline from 0.5% to 0.4%. This is expected to produce an additional 10,000 tons of copper per year. The expansion is scheduled for completion by the end of 1973.

Smelter Capacity

No developments have been reported.

Refinery Capacity

Electrolytic capacity will be increased to 60 - 65,000 tons per year from 1973.

13. United Kingdom

Mine Capacity

Rio Tinto Zinc are drilling in Snowdonia (North Wales) to determine the feasibility of an open pit development.

Exploration work is being carried out in Scotland by a number of companies.

Refinery Capacity

Williams Harvey have now the capacity to produce 10,000 tons per year of refined copper.

14. Yugoslavia

Development of the Bor Complex has continued rapidly and capacity has now reached the 130,000 ton level. Further plans for increased production have been announced. Output is now expected to expand to 200,000 tons of copper per year, 10,000 tons of the extra 70,000 to come from existing sources and the remainder from new sources.

A major low grade porphyry deposit has been located at Krivelj, between Bor and Majdanpek. This is estimated to contain 400 million tons of 0.4% ore. It has been suggested that this should be capable of producing 70,000 tons of copper per year. Negotiations are at present underway for foreign financial support to develop the mine.

A loan has been made to Vardor Import - Export of Skopje by the Export - Import Bank of the U.S. to finance a feasibility study of copper deposits near Radovis, Macedonia. The project would involve development of an open pit mine and flotation concentrator.

Amongst other finds of copper are 70 million tons of mineable ore (295,000 tons contained copper) at Bucin and an ore body near Mojkovac grading 0.2% to 0.7% copper.

AFRICA

1. Algeria

It was reported that the Algerian Government had established a four year economic development plan, the mining sector of which included the projected re-opening of copper and iron pyrites mines in the Kef-Oum-Theboul area. The four year plan set a target for a total national production of 13,000 tons per year of copper by 1973.

2. Botswana

Revised sales and financing plans have been agreed for the Selebi-Pikwe project of Botswana RST. Construction began in 1970 of a plant which will consist of a concentrator and smelter equipped to produce copper-nickel matte. Since ore requirements in early years can be supplied from mining the Pikwe deposit (richer nickel area) alone, the completion of facilities to permit mining at Selebi (other than the mining shaft) will be deferred until 1979.

Through changes in mining plans and improvements in the proposed metallurgical operations, it has been possible to increase the scheduled production rate, particularly in earlier years. This is reported to be 42,000 tons of copper - nickel matte which was to yield 17,000 tons of nickel and 15,500 tons of copper for the first five years, starting in the second half of 1973.

Agreement has been reached on a 15 year sales contract with Metallgesellschaft for two - thirds of the nickel produced and all the copper.

Amax has agreed to purchase from Metallgesellschaft up to one half of the nickel and to participate in an undemnity to Metallgesellschaft against certain obligations that Metallgesellschaft will undertake.

Bamangwato Concessions Limited which owns the mining concession (and in which the Botswana Government owns a 15% interest, leaving BRST with 85%) also owns mining rights for deposits which have been explored at Matsitama.

Anglo American Corporation of South Africa Limited, launched an intensive prospecting programme in the Tati area at the beginning of 1971.

.../...

3. Ethiopia

Nippon Mining Company of Japan is believed to have located considerable copper pyrites deposits, assaying 3% copper in the Asmara district. The Company has announced that Ethiopian copper production could soon amount to 100,000 tons per year of high grade copper.

4. Mauritania

The first shipment of concentrates from the new copper mine near Akjoujt being developed by SOMIMA (44.6% owned by Charter Consolidated) took place at the beginning of April, 1971. 7,000 tons of concentrate were to have been shipped by the end of 1971 and as the copper content is high, i.e. 60% this would represent about 4,000 tons of copper. Full capacity should be reached in the second quarter of 1972 i.e. 40 - 44,000 tons of concentrate, 24 - 26,000 tons of contained copper.

5. Morocco

Mine Capacity

Several projects are proceeding for the exploitation of deposits of copper ores.

At El Bleida, south of Casablanca, Mitsui Mining and smelting are reported to have outlined 3 million tons of 3% copper ore. Nittetsu Mining and French mining interests have agreed to form a joint mining venture. If exploitation is feasible a production of 10,000 tons per year of copper is envisaged.

Also, Nittetsu Mining and Marubeni Iida were to join with the state run Bureau de Recherches et de Participations Miniere (BRPM) to develop a copper - lead - zinc deposit at Bou Kerzia. Start up was set for late 1971. No production details have so far been announced.

A copper ore benefication plant, owned by the state mining agency, was inaugurated in mid - 1971 at Tansrift near Beni Mellal in East Morocco. This will produce 4,000 tons of concentrates per year (36% copper).

The French mining concern S.A.C.E.M. is to finance prospecting and surveying work on copper ore deposits in the Tafilalet province of S. E. Morocco. The agreement provides for equal participation in an exploitation company by S.A.C.E.M. and B.R.P.M., should a commercial discovery be made.

6. Rhodesia

Mine Capacity

The new RTZ Empress copper - nickel mine is expected to come into full operation during 1972. Ore reserves are estimated at 15.8 million tons containing 0.81% nickel and 0.62% copper. Annual ore mining rate is expected to be 720,000 tons with a copper content of 4 - 4,300 tons.

6. Rhodesia (Cont'd)

The new Shackleton mine (Messina) was officially opened in October 1971. Full milling capacity is 480,000 tons per year which it is hoped will yield 8,000 tons per year of copper.

MTD (Mangula) Limited was to bring the Norah and Silverside mines into production early in 1972. Silverside, a copper - silver mine, will operate at 180,000 tons of ore per year. Norah will be a 600 tons per day ore operation initially, eventually doubling. The mines are not expected to reach optimum output for several years. Leaching of stockpiled oxide ore will be phased out during 1974. The Company's production of copper is therefore expected to vary between 15,000 tons and 17,200 tons during the next few years, but the planned average for the next five years is 16,300 tons.

MTD plans to develop the Hans and Angwa deposits which are in the same area. With Avondale, they will offset the declining production at Alaska, which will carry on at a reduced rate until the end of 1972.

The milling rate of the Inyati mine of Coronation Syndicate should rise from 272,000 to 372,000 metric tons in the current year. In June, 1971, ore reserves were put at 1,107,000 tons, grading 2.37% copper.

Copper will be a by - product of the nickel mining operation planned by the Shanghai Mining Corporation. An initial rate of 60,000 tons of ore per month is planned, from which 4,500 tons of nickel would be obtained.

Smelter Capacity -
Refinery Capacity -

The Anglo American Corporation is building a new nickel smelter refinery at Bindura, which will also produce a small quantity of copper.

It was acknowledged during 1971 that a smelter was operating at the Inyati mine of Coronation Syndicate and also that a small refinery had been installed during 1970 to produce some copper in a more marketable form.

7. South Africa

Mine Capacity

In a joint operation by Anglo Transvaal Consolidated Investment Company Limited, Middle Witwatersrand Limited and United States Steel Corporation, the major copper - zinc mine at Prieska will be brought into production early in 1973. The initial milling rate will be 100,000 tons per month and this will rise to 227,500 tons per month during the second half of 1974. The latter rate should yield about 40,000 tons per year of copper in concentrates.

Contracts have been concluded to sell Prieska's copper concentrates at L.M.E. prices to Norddeutsche, Italys Ammi and O'Okiep. The contracts are for a ten year period.

7. South Africa (Cont'd)

The Palabora Mining Company is carrying out a feasibility study of a further mine and processing plant expansion but no decisions have been announced.

Smelter Capacity -
Refinery Capacity -

No expansions to existing capacities have been announced.

8. South West Africa

Mine Capacity

Oamites Mining Company (Pty) (a subsidiary of Falconbridge Nickel Mines Limited) brought its new copper mine near Windhoek into production during the fourth quarter of 1971. The milling rate was expected to have reached 40,000 tons of ore per month by the end of the year, with an increase to 50,000 tons per month in the first quarter of 1972. This latter rate should yield 8,000 tons per year of copper in concentrate.

In a joint venture with Nord Resources Corporation, Penarroya intends exploration and a feasibility study is to be undertaken in 1972 at its Gorob property. So far 1 million tons of 2.6% copper mineralisation have been reported.

The Matcheless Mine of Tsumeb, opened in June 1970, was closed in January 1972 as it was unprofitable.

Smelter Capacity

No expansions to the Tsumeb smelter have been announced.

9. Uganda

No announced plans for expansion.

AFRICA (Cont'd)

10. Zaire

Mine Capacity

Gecamines (La Generale des Carrieres et Mines du Zaire) plans to increase production from the 1970 figure of 386,000 tons to 560,000 tons by 1978. The project will be carried out in two stages, the first to raise output to 460,000 tons annually by 1974 and the second to 560,000 tons by 1978. The supply of electric power is presently being studied to ensure that development of copper production capacity is not held up by a shortage of electricity.

Sodimiza is developing two mines in the South of the Province of Shaba. Production at the first one, Musoshi, is scheduled to begin in October 1972 and the total production (53,000 tons of copper per year) will be exported to Japan in the form of concentrates (36% copper). The second site is at Tshinsenda which has an estimated 32 million tons of 5% copper ore. Work was begun at Tshinsenda in 1971, with the underground mine scheduled to open in 1976 with capacity of 74,000 tons copper per year.

In 1970 two more companies were organised, Simz and Sozatef. They have identical ownership by a consortium of five companies - Charter Consolidated Limited, Standard Oil of Indiana, Leon Templesman and Sons of New York, Mitsui and Company and Bureau de Rocherches Geologique, France. The Zairian Government holds a 20% interest. Sozatef is the company which is carrying out drilling and a feasibility study in the Tenke-Fungurume area. When completed an investment proposal will be submitted to the Government. The type of operation and amount of investment will depend on the results of the study but, the construction of complete facilities including refining plants is promised. It is thought that production could start in 1975 at an annual rate of 100,000 tons of copper.

Falconbridge Nickel Mines Limited is also prospecting in Zaire, near Pweto.

If all these projects come into operation the production of copper in Zaire could reach 800,000 tons of copper annually by 1980.

Smelter, Electrowinning and Refinery Capacity

In 1972 an extension of the facilities at Luilu will raise output from the present level of 125,000 tons to 170,000 tons of cathodes per year. Production of blister copper at Lubumbashi will also be raised by 30,000 tons by installing an oxygen producing unit in 1973.

No announcements have been made so far regarding any increases in refinery capacities.

11. Zambia

Mine Capacity

Roan Consolidated Mines

Published information suggests that main developments will be as follows. It is possible, however, that the precise pattern of development will be subject to some alteration.

(1) Mufulira :

Under the original planned expansion programme, capacity was to have been raised from 165,000 tons in 1968 to 190,000 tons by early 1971. Because of the disaster in September, 1970, this tonnage is now expected during 1973.

(2) Chambishi :

An expansion from the current 24,000 tons per year will be brought in gradually to reach 48,000 tons per year early in 1973. This increase will come from underground workings as the open pit will be gradually phased out over the next seven years.

(3) Kalengwa :

The concentrator started operations in March 1971 and by June 1971 most sections of the plant were operating satisfactorily. The mine should operate for six years at 17,000 tons of copper per year.

(4) Baluba :

To be developed for an initial production of 22,000 tons per year of copper. This rate should be reached by the second half of 1973 and will eventually be increased to 50,000 tons per year to offset the expected decline of production at Luanshya. This will bring Luanshya division up to 120,000 tons per year.

(5) Total Capacity

Taking the Mufulira disaster into account, total capacity was expected to be about 240,000 tons during 1971, rising to 400,000 tons by 1975.

N'Changa Consolidated Copper Mines

(1) Rokana Division :

Mining at depth is becoming increasingly difficult but drilling has revealed a possible considerable extension to existing ore reserves. Open pit production will commence in 1973 from oxide zones

.../...

11. Zambia (Cont'd)

(1) Rokana Division (Cont'd)

overlying the Central and Mindola North ore bodies. An output rate of 95,000 tons of ore per month is expected and design work on the extra concentrating facilities required is in progress. The Bwana Mkubwa mine near Ndola was re-opened and first concentrates were delivered in April, 1971. Full annual capacity is 15,000 tons and the mine is expected to be in operation for 8 years.

By 1974 Rokana's production will have increased from 100,000 to 125,000 tons.

(2) Chingola Division :

A major solvent extraction unit is being installed at Nchanga to treat low grade tailings and oxide concentrates. Leach cementation is being used for Stage 1 which was to be commissioned in October, 1971 - this should add 20,000 tons of copper annually to production. Stage 2 will be a liquid ion exchange process to replace leach cementation. Expanded output is scheduled to rise to 55,000 tons annually by 1st January, 1974 and to continue for twelve years.

By 1974 Chingolas production will have increased from 250,000 to 315,000 tons.

(3) Konkola Division :

It is planned to re-open the Kansanshi mine at an annual rate of 15,000 tons of copper. It was originally planned to treat the ore using the Torco process but investigations are now in progress on treatment by solvent extraction.

By 1975 Konkola production will have increased from 45,000 to 60,000 tons.

(4) Total Capacity :

Total Capacity is forecast to reach 500,000 tons by late 1974.

Mwinilunga (1970) Limited

This Company is continuing its work on the promising areas of mineralisation at Lumwana, discovered by R.S.T., in the North Western Province. The areas are believed to contain 200 million tons of copper mineralisation at a grade of just under 1%.

Mkushi Copper Mines

An Italian Company, Miniera de Fragna Chilamberto,

.../...

11. Zambia (Cont'd)

Mkushi Copper Mines (Cont'd)

has developed the small Mkushi open pit mine, 150 miles south east of the main copperbelt. Ore reserves are 5 million tons grading 2.5% copper. Concentrate is being smelted at Rokana and delivery started in April, 1971. Actual production is likely to be 6,000 tons per year (copper content).

Smelter and Electrowinning Capacity

(1) Roan Consolidated Mines

The expansion in capacity at Mufulira from 200,000 to 230,000 tons was completed in May, 1971.

(2) N'changa Consolidated Copper Mines

Total capacity is expected to rise from 410,000 tons in 1971 to 500,000 tons in 1974/75.

Refinery Capacity

(1) Roan Consolidated Mines

Expansion at Mufulira from 185,000 tons to 247,000 tons is due during 1973.

(2) N'changa Consolidated Copper Mines

(a) Refinery Tankhouse Capacity - Total refining capacity will rise from 296,000 tons in 1971 to 356,000 tons in 1974/75.

(b) Refinery Furnace Capacity - This remains constant at 271,000 tons.

Note : In its annual report, Mindeco stated that current plans envisaged an expansion to 900,000 tons production by 1975, but, that some slight delays may be encountered.

ASIA

1. Burma

Mine Capacity

Japanese interests are studying a plan to provide technical assistance in the development of copper reserves at Monywa, north - west of Mandalay. Estimated reserves are put at 15 million tons of ore, grading 1.3 to 1.5 per cent copper.

2. Cyprus

Mine Capacity

Some existing deposits are now nearly worked out. Possible new ore bodies are being investigated but it seems probable that these will be used to replace worked out deposits and will not result in any significant increase in capacity.

3. Formosa

Mine Capacity

The government is to assist in the development of copper deposits in the Chimei district. Reports quote reserves as 300,000 tons of porphyritic ore.

4. India

Mine Capacity

After many postponements, the Hindustan Copper Corporation's Khetri copper project was officially inaugerated in August, 1970. Initially there was to be experimental production on a limited scale with any ore extracted being stockpiled as concentration is not scheduled to start until 1972. The project is expected to reach full production by 1973 - 1974 at a rate of 21,000 tons per year (copper content) from the Khetri mine and 10,000 tons from the Kolihan mine if there are no further delays.

New copper - lead deposits at Agnigundala seem likely to be developed by the Hindustan Copper Corporation.

There are three zones of mineralization :

Bandalamottu : Ore reserves 1.0 million tons grading 1.03% copper

Nallakonda : Ore reserves 3.7 million tons grading 2.00% copper

Dhukonda : Ore reserves 2.2 million tons grading 1.53% copper

No details are so far available on when development is likely to begin.

Large copper deposits have been discovered in Bihar (Rakha copper mine). These will also be developed by the Hindustan Copper Corporation. A production of 3,500 tons of copper per year is envisaged. Total reserves are estimated at 13.9 million tons grading 1.5% copper. No production date has been announced but it seems likely to be 1973 - 1974.

Copper deposits have been discovered in Kalyadi in Mysore State. Recent reports give ore reserves of 1.5 million tons averaging 1.5% copper.

Large copper deposits have been revealed in Malenjguni area of the Balaghat district in Madhya Pradesh but no details are available.

Smelter Capacity -
Refinery Capacity -

The Khetri and Kolihan mines will be served by a new smelter/refinery complex at Khetri. Production could begin in 1973 with full capacity being reached in 1974. Capacity will be 31,000 tons.

On the strength of the discovery of the Kalyadi deposit, it is expected that a smelting plant will be set up at Ingladhal where the state owned Chitradurga Copper Company is already functioning.

The Indian Copper Corporation (the government has recently taken over management, prior to its nationalisation) was expanding smelter capacity from 10,000 to 16,500 tons of copper per year. This expansion was due for completion by October 1971. Initially, production would only increase by 3,500 tons annually. The remaining 3,000 tons will be produced after the Rakha mine comes into production.

.../...

5. Indonesia

The Ertsberg copper project in West Irian (western half of New Guinea) is being developed by Freeport Indonesia Inc. (subsidiary of Freeport Sulphur) for production and initial shipment of concentrates scheduled for January 1973. The open pit mine is expected to produce 59,000 tons per year (copper content of concentrate). Two thirds of production will be supplied to Japan and the remaining third to Western Germany.

6. Iran

Mine Capacity

It was announced at the end of 1971 that the Iranian Government is to go ahead and develop Sar Chesmeh.

The Sar Chesmeh Copper Company of Kerman is to be formed to take over the project. This is planned to come into production in four years at 145,000 tons per year of copper for the first decade. Proven reserves are 400 million tons averaging 1.2% copper.

A Japanese concern and a private Iranian company will jointly explore the Qaleh Zari copper mine in Khorrasan. Ore reserves are reported as 2 million tons grading 5% copper. It is hoped to produce 50,000 tons of concentrates per year (36% copper).

Rumania has agreed to join in a search for copper in south - eastern Iran.

Smelter Capacity -
Refinery Capacity -

A smelting/refining complex is planned to treat the mine output. The Government has indicated that it will seek to form some of the output into finished products such as sheet and cable.

7. Israel

Timna Mines are reported to be opening a second underground mine for operation in 1973. It is expected that this will boost current output of copper ore at Timna beyond the 1 million tons per year rate. It is not known whether this will result in a large increase in copper production or not.

8. Japan

Mine Capacity

Mine production is not expected to rise in Japan and is eventually expected to decline. This decline is likely to be accelerated because of pollution problems when smelting pyrite which is a by - product of many of the ores. Mitsubishi announced the closing of three mines, the Myoho mine in March 1972, the Washiaimori mine in September 1972 and the Ikuno mine in March 1973. Mining has reduced production at its big Yanahara mine. Sumitomo has announced the closure of the Besshi mine in March 1973 for safety reasons. The capacity of this mine (one of Japan's largest)is at present about 5,000 tons contained copper. A new copper ore vein has been discovered by Furukawa Mining in Akita prefecture. The deposits are thought to contain 1 million tons of 2% copper ore.

Smelter Capacity

(1) Onahama Smelting & Refining Co.

Capacity is currently 144,000 tons per year and this is due to double.

(2) Hibi Kyodo Smelting Company (55% Mitsui, Nittetsu, Furukawa) -

built a new 84,000 ton per year smelter at Tamanao and which was due on stream by January 1972.

(3) Sumitomo

The new Toyo flash smelter was commissioned in 1971 and has a capacity of 96,000 tons.

(4) Nippon

(a) Plans to increase the capacity of the Hitachi smelter to 120,000 tons per year. The expansion would be completed in the latter half of 1972. This expansion design also should help to reduce air pollution.

(b) Plans to increase capacity at Saganoseki to 240,000 tons per year.

Refinery Capacity

(1) Hibi Kyodo Smelting Company (55% Mitsui) -

built a refinery (associated with the flash smelter) with an annual capacity of 84,000 tons at Tamanao. Start up was due for January, 1972.

(2) Sumitomo -

The Niihama refinery has recently been expanded to 144,000 tons capacity. Also a 40,000 ton capacity electrolytic refinery is due for completion by July or August, 1971 at the Company's Toyo smelter.

.../...

8. Japan (Cont'd)

(3) Nippon -

Capacity at the Hitachi refinery will reach 132,000 tons on completion in April, 1972 of a refining plant with 60,000 tons capacity.

(4) Mitsubishi -

Capacity at the 84,000 ton per year Naoshima refinery was to be increased to 120,000 tons by 1972.

(5) Mitsui Metal Mining -

were expanding capacity at Takehara from 76,000 tons to 84,000 tons by 1971.

(6) A number of Japanese companies may build a smelter/refinery on Okinawa.

9. Malaysia

Mine Capacity

The Mamut Mine Development Company (in which a Japanese consortium has 51% interest) is ready to sign a contract with the Malaysian Government on the development of the copper deposits in the Mamut area of Sabah. Ore reserves are estimated at 76 million tons averaging 0.66% copper. There has been some delay due to the depressed copper market. The Japanese hope to import 40,000 tons of copper in concentrate annually. Production is due to start up in July 1973.

10. Philippine Republic

Mine Capacity

(1) Atlas Consolidated has expanded production by constructing a new mill near the present one at the Greater Biga - Barot pit area on Cebu. The ore will come from the expanded low grade Biga pit. Total production from both mills is to be 77,000 tons contained copper per year starting September 1971, an increase of 29,000 tons over the 1970 production. All concentrates produced will be supplied to Mitsubishi.

(2) Labo Mines Inc. was to start production from a surface copper deposit on Luzon Island. Expected production was about 1,400 tons of copper in the first year with deliveries starting in mid - 1971.

(3) Nippon Mining Company and local interests plan to develop the Dizon copper mine. Reserves are put at 75 million tons of ore averaging 0.5% copper. Production is expected to be 70,000 tons of concentrates (containing 14,000 tons of copper) per year and all production will go to Japan. Production was expected to commence in January 1974 but there is now a possibility of some delay.

.../...

10. Philippine Republic (Cont'd)

(4) A small deposit owned by Batong Buhay Gold Mines Company and Nippon Mining Company (25%) was expected to be brought into production during 1975 at a rate of 10,400 tons of concentrates per year. However, this too may be delayed.

(5) Benguet Consolidated Inc. has discovered a new deposit of 660,000 tons of 3.08% copper ore.

Smelter Capacity

The Philippine Government is reported to be considering construction of a copper smelter with a capacity of 60 - 100,000 tons of copper per year. If plans are realized it would be in operation by 1974.

11. Korea S.

Mine Capacity

No reported developments.

Smelter Capacity

The Department of Commerce and Industry is planning to install a 15,000 tons per year smelter in Musan with production scheduled for 1974. The country's existing capacity is reported as 7,400 tons per year.

12. Turkey

Mine Capacity

Black Sea Copper Mines (49% Etibank and 51% consortium of private banks) is due to come into full operation in 1972. The development programme covers expansion of existing mines at Murgul, Kure and Espiye. This will provide an extra 40,000 tons copper content annually to feed the new smelter at Samsun.

Refinery Capacity

No plans have been announced so far for expansion of the two existing refineries or the establishment of a new one.

NORTH/CENTRAL AMERICA

1. Canada

Mine Capacity

During the next few years there will be a considerable number of new developments and expansions to existing facilities resulting in a rapid increase in Canadian mine capacity.

(1) Major New Projects

(a) Gibraltar Mines Limited (Placer 100%)

The Gibraltar/Pollyana copper - molybdenum properties at Williams Lake in British Columbia are to be brought into production at a rate of 27,000 tons of copper - molybdenum ore per day. Ore reserves are 324.8 million tons averaging 0.373% copper and 0.016% molybdenite, cut - off grade is 0.25% copper. The pit is being planned so that 49.9 million tons with an average copper equivalent grade of 0.436% can be mined in the early years of the operation. Production is scheduled to begin in June, 1972. A sales contract has been signed with Nippon Mining Company for the sale of all concentrates produced to December, 1981.

(b) Granduc Mines Limited (Newmont - Asarco) :

The Granduc mine started up in November, 1970. Ore reserves are 40 million tons averaging 1.73%. Capacity of 38,000 tons per year was not expected to be reached until late 1971. All concentrate will be exported to Japan.

(c) Inco :

Copper capacity was due to be increased by 40,000 tons to 191,000 tons per year by 1972 through six new nickel mines, mainly in the Sudbury area. However, it is not yet known what effect the cut-back to 70% of nickel capacity will have on copper production.

(d) The Lornex Mining Corporation (Rio Algom) : is developing a major new low grade copper - molybdenum ore body. Reserves are 265 million tons of ore averaging 0.427% copper. Production is scheduled for start-up in the second quarter of 1972. Full annual capacity of 51,000 tons per year copper content is not expected to be reached until 1975 although, the bulk of capacity will come on stream in the first two years of production. All concentrate will be shipped to Japan for the first twelve years. It is not yet known whether the current Japanese request for a 20% cut-back in shipments will be agreed to.

(e) Sherritt Gordon Mines Limited : is to bring the Ruttan Lake copper - zinc property into operation at an initial ore milling rate of 9,000 tons per day by 1st January 1973, with full production to be reached by

.../...

1. Canada (Cont'd)

1st July 1973. Ore reserves so far are 46 million tons grading 1.47% copper and 1.61% zinc. Mining will be from an open pit for the first five years at a rate of 3.2 million tons of ore per year. Production seems likely to be in the region of 35,000 tons per year copper content.

(f) Utah International Inc : has developed a major copper-molybdenum mine near Port Hardy on Vancouver Island. Ore reserves are 255 million tons averaging 0.52% copper and 0.029% molybdenum. Tune up of the mill started in October 1971 and initial production of concentrates was due early in 1972. Full annual capacity will be 50,000 tons copper content. 60% of the concentrate will go to Mitsui Mining and Smelting for the first 10 years and 30% will go to Dowa and Mitsubishi for the first 5 years.

(g) Valley Copper Mines Limited (Cominco-Bethlehem Copper Corporation)

A number of alternatives have been studied to determine the most feasible method of bringing this large copper property into production. The deposit extends into Bethlehem Copper's property. A milling rate of 36,000 tons per day is now envisaged. Ore reserves are 685 million tons averaging 0.48% copper. Negotiations were reported to be taking place with a Japanese consortium for disposal of much of the concentrates. Production is unlikely to begin before 1973 - 1974.

(2) Other New Developments and Expansions.

(a) Gaspe Copper Mines (Noranda) : will triple the mining and concentrating capacity at the Company's Copper Mountain Mine, where an estimated 109 - 136 million tons of new open pit ore has been found grading 0.36% copper. This should lead to more than double the current concentrate production of 33,000 tons per year and the corresponding amount of copper in concentrate (currently 8 - 9,000 tons per year). Work on this increase is due to begin early in 1972 and to be completed by the second quarter 1973.

(b) Granisle Copper : due to increased ore reserves at its Babine Lake mine is increasing the milling rate from 5,900 tons per day to 12,700 tons per day. This is to be completed by September, 1972.

(c) Highmont Mining Corporation/Teck Corporation :

The decision has been made to put this copper - molybdenum property in Highland Valley into production. The operating rate will be 22,700 tons per day of ore and large scale production is scheduled for mid-1973. Ore reserves are 136 million tons grading 0.285% copper and 0.051% molybdenite. In the initial years

.../...

1. Canada (Cont'd)

45.95 million tons of ore with a 0.463% copper equivalent are available.

(d) Mattabi Mines (Mattagami Lake Mines 60%, Abitibi Paper Co. 40%) :

Will bring the copper - zinc - silver mine at Sturgeon Lake into production by 1st July 1972. A milling rate of 2,700 tons per day is planned. Ore reserves for this zone are 12 million tons averaging 0.91% copper. Mattagami Lake mines, has discovered at least one new ore body, the Lyon Lake desposit, in the same area.

(e) Noranda (Bell Copper Division) :

To bring the Newman copper property on Babine Lake into production in late 1972 at a rate of 9,000 tons per day of ore. Reserves are 46.3 million tons assaying 0.5% copper. Capacity will be 13,500 tons per year copper.

(f) Opemiska Copper Mines (Falconbridge Nickel Mines) :

Capacity was being raised by 50% to 2,700 tons of ore daily during 1971 - 1972 to give an additional 9,000 tons of copper per year.

(g) Similkameen Mining Co. (Newmont Mining Corp.) :

Is to bring its property near Princetown into production at a mining rate of 13,600 tons per day of ore. Initial concentrate production is expected in late 1972. Reserves are 68.9 million tons averaging 0.53% copper, all of which can be mined by open pit methods. Newmont have signed a contract for the sale of concentrates to Mitsubishi.

(3) Small Mines

(a) Alwin Mining Company :

A new mine was to begin production early in 1972 with a capacity of 5 - 7,000 tons contained copper per year. The concentrates will be shipped to Hamburg for a five year period.

(b) Dison Development (Crownex/Pechiney) : was to restore to production the Sunro mine at Jordan River, at a rate of 1,400 tons per day by end of 1971. Proven and probable ore is 1,593,000 tons of 1.21% copper after 20% dilution.

(c) Hudson Bay Mining :

Developing two new mines in the Flin Flon area. These are :

1. Canada (Cont'd)

(i) White Lake Mine (copper - zinc - silver), due to come into production in mid - 1972 at a milling rate of 249 tons per day. Ore reserves are 319,000 tons averaging 2.22% copper and 6.2% zinc.

(ii) Ghost Lake Mine (copper - zinc - silver), planned to begin production early in 1972 at an ore milling rate of 218 tons per day. Ore reserves are 236,800 tons averaging 1.42% copper and 11.6% zinc.

(d) Hudson-Yukon Mining (93.16% Hudson Bay) : plans to bring its Wellgreen copper - nickel mine in the Yukon into production in mid - 1972. Ore reserves are 670,000 tons grading 2.04% nickel and 1.42% copper. The annual ore milling capacity will be 180,000 tons. The concentrates, which are expected to yield 2,700 tons of copper and approximately 3,500 tons of nickel per year, will be shipped to Japan.

(e) Selection Trust Limited (Selco) : brought the copper - zinc - silver mine at Uchi Lake into production in July 1971 through its subsidiary South Bay Mines. Annual capacity is expected to be 3,000 tons copper content.

(f) Stall Lake Mines (Falconbridge) :

Scheduled to bring its mine at Snow Lake into production during 1972 at a mill rate of 360 - 450 tons per day. Ore reserves are 609,000 tons grading 5.38% copper and 2.28% zinc.

(4) Potential Additional Developments under Review

(a) Bethlehem Copper Corporation : hopes that its J-A Zone will be in production in the second half of 1974 and that between this zone and the present Highland Valley operations, production will reach 24 - 27,000 tons of ore per day. This is nearly double the current milling rate of 14,000 tons per day. Drilling so far on the J-A Zone indicates 272 million tons of 0.45% copper or better. A preliminary open pit has been designed containing about 113 - 136 million tons of 0.603% copper and 0.018% molybdenum. A production decision will be made by October 1972.

At the Company's Maggie property, drilling has now outlined 181 million tons of copper and molybdenum ore grading 0.40% copper equivalent. However this deposit is now taking second place to the J-A Zone.

(b) Casino Silver Mines (Brameda Resources) :

Feasibility studies were being carried out on Casino's copper - molybdenum property in the Yukon by Brameda. Work to date has indicated 162 million tons grading 0.37% copper and 0.039% molybdenite or 0.45% copper equivalent.

.../...

1. Canada (Cont'd)

(c) Falconbridge Nickel Mines :

A large low grade deposit, the Catface Copper Mines project on Vancouver Island, was under study during 1971.

(d) Great Lakes Nickel Corporation : decided to bring into production its big copper - nickel deposits at Thunder Bay, Ontario, and is trying to arrange financing. A 5.5 million tons per annum mining and milling rate is reported to be technically and economically viable. Ore already detailed is in excess of 90 million tons grading 0.4% copper and 0.2% nickel. It is hoped to start mine development at an early date and commence production within three years. Annual capacity should be approximately 20,000 tons of copper per year.

(e) Hudson Bay Mining and Smelting :

A copper - zinc ore body to be called the Centennial Mine has been discovered near Flin Flon. Reserves so far indicated are 1.4 million tons averaging 2.06% copper.

(f) Liard Copper Mines (Hecla) :

Considering development of its low grade copper - molybdenum deposit at Schaft Creek. Reserves now stand at 256 million tons grading 0.40% copper and 0.038% molybdenite for a combined grade of 0.51% copper equivalent. An open pit operation is indicated with a possible rate of 27,000 tons per day of ore.

(g) Sturgeon Lake Mines (Falconbridge) :

Drilling on the Sturgeon Lake deposit indicates 1,749,000 tons mineable by open pit methods averaging 3.0% copper, 7.85% zinc and 4.54 oz. silver per short ton. Also indicated is a further 234,000 tons grading 1.39% copper, 2.85% zinc and 1.65 oz. silver per short ton that may be recoverable by ramp mining. Minimum rate for an operation on this deposit would be 900 tons of ore per day but more likely to be 1,400 tons per day.

(5) Mine Closures

(a) Kerr Addison's Quemont Mine - June, 1971

(b) Churchill Copper's Magnum Mine - October, 1971

(c) Anaconda - Cominco's Caribou Mine - November, 1971

Smelter Capacity

(1) Noranda Mines Limited :

Plans to increase capacity at its Gaspe Copper Mines Limited, smelter at Murdochville by 25,000 tons per

.../...

1. Canada (Cont'd)

year by the end of 1973.

At Noranda an increase of 50,000 tons is planned by the end of 1973.

(2) Inco :

Increases in mine production will mean increases in smelting capacity and this is being done. Capacity is expected to rise by 30,000 tons by the end of 1974.

(3) Bethlehem Copper Corporation :

Currently studying the feasibility of a copper smelter, start to coincide with the possible mining of the J-A Zone.

(4) Cominco :

Looking at the possibility of a 63,500 tons per year smelter for Kimberley, B.C. Should it prove feasible it could be in production in two years.

Refinery Capacity

(1) Falconbridge Nickel Mines Ltd : to build a new nickel/copper refinery at Becancour with start-up expected in 1975, a year later than originally planned. The nickel/copper matte feed will come from the smelter at Falconbridge and the annual capacity of the refinery will be 10,000 tons of copper and 13,600 tons of nickel. Cobalt and sulphur will also be produced.

(2) Inco :

Increases in mine production will mean increases in refinery capacity and this is being done. Capacity is expected to rise by 30,000 tons by end of 1974.

(3) Canadian Copper Refiners :

Increasing capacity by 52,000 tons from the current 317,500 tons by the end of 1973.

(4) Ontario is studying the possibility of a smelter/refinery complex to serve its small producers. No single producer being large enough to build one.

2. Cuba

No new developments have been reported.

3. Dominica

There are known to be copper deposits in the Cordillera central area with reserves estimated at up to 50 million tons, averaging 1% copper.

There are also three potential development areas where preliminary examinations indicated substantial tonnages assaying more than 4% copper. The areas are :

El Mayor - Copper (Sulphide)
El Cuaron - Copper - Gold
El Recodo - Copper - Silver - Gold

4. Guatemala

Basic Resources International of Canada commenced work during 1971 on the Company's high grade copper property at Oxec. This will be brought into production at a rate of 900 tons per day of ore, probably during 1972. Proven reserves are 1.33 million tons of ore grading 2.58% copper. Another zone has probable reserves of 216,000 tons grading 2.131% copper.

5. Haiti

No developments have been reported.

6. Mexico

Mine Capacity

Asarco Mexicana has developed a new mine at Inguaran (State of Michoacan). Production began early in 1971 at an annual rate of 13,000 tons. Reserves are 4.4 million tons averaging 2% copper.

A new Company, Cia Mexicana de Cobre S.A., has been formed by Asarco Mexicana S.A. and others to develop a new mine, La Caridad near Nacozari. Reserves are 635 million tons of 0.8% copper. Full capacity of 120,000 tons is expected to be reached by 1976.

Cia Minera de Cananea S.A. de C.V. (49% Anaconda) plans to increase production at Cananea to 60,000 tons per year from the current 37,000 tons per year by 1974. A further increase to 127,000 tons per year is envisaged in 1980 - 1982.

Met-Max Penoles S.A. plans to increase production by 20% from the current 500 - 600 tons per month of copper.

A considerable amount of exploration is being undertaken and several promising ore bodies are reported to have been discovered. However, no firm development programmes have been announced.

Smelter Capacity

Asarco Mexicana S.A. has begun work on the expansion of the San Luis Potosi smelter from its current 30,000 tons per year to 42,000 tons

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6. Mexico (Cont'd)

per year to allow smelting of the Inguaran concentrates.

A Smelter/refinery will be built to process the production from La Caridad. The Government has suggested that this is done as a joint operation with the Cananea Company because of the large amount of investment required.

Refinery Capacity

A new electrolytic refinery with a capacity of 45,000 tons per year will be built at San Luis Potosi by Asarco Mexicana S.A.

7. Nicaragua

The Falconbridge subsidiary La Luz Mines is phasing out its Rosita copper mine due to declining copper prices and a deterioration in the grade of ore.

8. Panama

A Japanese Consortium has decided to finance the exploration of the copper deposits in the Azuero Petaquilla area. Copper reserves have been confirmed in three places totalling some 300 million tons averaging 0.7 - 0.75% copper.

Pavonia S.A. (affiliate of Canadian Javelin) is continuing its exploration of the Cerro Colorado copper property. This is a massive copper/molybdenum porphyry deposit in the Chiriqui Province of Western Panama.

9. Puerto Rico

A final decision by the Government of Puerto Rico is awaited concerning the proposed development by Kennecott and Amax (through Ponce Mining Co.) of two mines at Adjuntas. A smelter/refinery at Ponce to process the concentrate is planned. Capacity is expected to be 48,000 tons per year. Production does not seem likely before 1977.

10. U.S.A.

Mine Capacity

A major expansion of mine production is expected to take place during coming years.

Among principal developments are :

(1) Anaconda

The Company has stated that it intends to increase domestic mine production from the current 227,000 ton level to 272,000 tons per year by 1975 and that Twin Buttes should be expanded.

(2) Asarco

A leaching plant is to be constructed at the San Xavier mine to handle some of the copper bearing silicoous ore at present being used as converter flux. Additicnal annual copper production seems likely to be 11,000 tons. No firm production date has been announced as the project has been delayed because of a law suit brought by the Papago Tribe.

A feasibility study of the Sacaton deposit is now in progress. Ore reserves are 29.9 million tons grading 0.76% copper susceptible to open pit mining and 12.7 million tons grading 1.37% susceptible to underground mining.

(3) Cities Services - Tennessee Copper Division

A new sulphide ore body at Pinto Valley is being studied. If feasible production could begin in 1975 at the rate of 45,000 tons of copper per year. This is also dependent upon availability of smelting capacity.

(4) Duval

Production at the new Sierrita mine in Arizona will be increased from the current 59,000 tons per year to 68,000 tons per year by 1974/1975. However, in December 1971, the Company closed the Esperanza mine for 9-12 months due to a build up of excess concentrates for smelting. Capacity at Esperanza was 22,700 tons per year.

(5) Phelps Dodge

Capacity at the Tyrone mine is currently being expanded from 54,000 tons to 90,700 tons. Completion is expected in late 1972 or early 1973.

The new Metcalf mine is being developed for production to begin in mid 1974 at an annual rate in excess of 45,000 tons.

The increase in capacity at Tyrone will offset the loss of production at the Bisbee mine which is to close due to exhaustion of ore, probably early in 1973.

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 U.S.A. (Cont'd)

Phelps Dodge (Cont'd)

Preliminary development at the Safford project in Arizona is being carried out. A decision on when to continue development of this property to the production stage will not be made for some time.

(6) Kennecott

Studies are continuing at the Spar Lake, Montana project.

(7) Pima Mining Co (Cyprus Mines 50%)

Expansion at the Pima mine was expected to be completed by the end of 1971. Output at Pima would therefore increase by 13,600 tons to 72,600 tons of copper in concentrates annually.

(8) Newmont

Capacities at both San Manuel and Superior are being increased to give a total additional capacity of 62,000 tons. The San Manuel expansion (45,000 tons) due to have been completed in late 1971 and Superior (17,000 tons) is due by 1973 - 1974.

(9) Hecla/El Paso

These companies plan to develop jointly the Lakeshore deposits (Arizona). Ore reserves are 22 million tons of tactite ore averaging 1.69% copper and 406 million tons of sulphide and oxide ores averaging 0.70% copper. Capacity is expected to be 32,000 tons and production is due to begin in late 1974. The company has also constructed a pilot oxide ore leaching plant and may produce some additional copper from oxide ore.

(10) Ranchers Exploration and Development Corp.

At the Bluebird mine in Arizona production is expected to increase from the 1971 production of 5,400 tons to 5,900 tons in 1972 and 6,600 tons in 1973. Ore reserves have also been increased considerably to some 68 million tons grading, on average, 0.52% copper.

(11) Kerr Addison Mines

The copper - zinc property of Black Hawk Mining near Blue Hill, Maine is to be brought into production by the end of 1972. Ore reserves are 513,000 tons grading 16.8% zinc and 0.62% copper, plus 222,000 tons grading 2% copper. In addition to possible high grade zinc ore there are possible reserves of 816,000 tons of copper ore in the extensions of the proven and the probable zones. The planned mining rate is 900 tons per day of ore.

(12) Shield

Production at the O.K. open pit started up in May 1970 at a milling rate of 18,000 tons ore per month and reached a rate of 41,000 tons per month by June, 1971. The rate was scheduled to reach 54,000 tons by August, 1971 when the Maria orebody would be brought in.

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10. U.S.A. (Cont'd)

(13) Earth Resources

The small open pit at Nacimiento in New Mexico was started up at the end of May, 1971. Planned production rate is 6,350 tons of copper in concentrates per year for 5 years.

(14) Copper Range

Planned expansions at White Pine have now been deferred indefinitely.

Smelter Capacity

(1) Phelps Dodge

A new smelter will be built in Southern Hidalgo County, New Mexico. It will be designed to treat the full output of the Tyrone mine which is being expanded to 90,700 tons per year copper for early 1973.

(2) Newmont

The Magma smelter at Superior has been closed and the San Manuel smelter is being expanded to take additional mine capacity from both San Manuel and Superior. One or more of the existing reverberatory furnaces will be replaced with one or more flash smelting furnaces as a part of the emission control plans. Production increase seems likely to be in the region of 50,000 tons and full capacity should be reached by 1974.

(3) Cities Services (Tennessee Copper)

Included in expansion and modernisation programme at Copper Hill are new smelting facilities. This could give a 25% increase in production of copper by mid - 1972.

Refinery Capacity

(1) Newmont

The new refinery built by Magma at San Manuel was due to enter production on 1st December, 1971. Capacity is 181,000 tons of copper per year.

(2) Southwire

The Company's new secondary refinery at Carrollton, Georgia was started up in June 1971. Full capacity of 65,000 tons per year was due to be reached by December 1971.

(3) Phelps Dodge

The Company closed an outmoded section of the Laurel Hill refinery at the beginning of November 1971. The capacity was therefore reduced by 33,000 tons to 65,000 tons.

SOUTH AMERICA

1. Argentina

Falconbridge have been awarded exploration rights for five years for copper, molybdenum and other minerals in Neuquen province.

Several companies including Cities Services Co., Rio Tinto Zinc, Union Mines of South Africa and Noranda are among those seeking a contract to develop potentially large deposits of copper and other minerals at Catamarca. The property is owned by an Argentine state mining agency (YMAD). Cities Services is also hoping to develop a separate property at Catamarca, close to the YMAD area.

2. Bolivia

No developments have been reported.

3. Brazil

A number of new copper deposits have been discovered, principally in North West Brazil.

The Cia Brazileira de Cobre is planning to increase capacity to 12,000 tons per year of copper in concentrate by 1973 at its Camaqua mines (Rio Grande do Sul).

Development is also planned of the copper deposits at Caraiba, Bahia. The ore grades 1.50 - 2.12% copper and start-up is hoped to be mid - 1973. Initial capacity will be 35,000 tons per year, rising eventually to 70,000 tons.

Copper production in Brazil is envisaged at 79,000 tons per year by 1976.

Smelter Capacity -
Refinery Capacity -

The Caraiba development programme provides for a smelter and refinery at Jaguarari with an initial capacity of 35,000 tons of electrolytic copper rising to 70,000 tons per year.

4. Chile

Mine Capacity

The latest official Chilean announcement on expected production for the large mines gives a 22% increase over 1971 to 720,000 tons for 1972 and a 45% increase over 1971 to 840,000 tons for 1974. It is now expected that Chilean production will not reach 1 million tons until 1974.

The following increases to capacity were planned.

(1) Exotica

Production commenced at the end of 1970 and production was building up during 1971. Full capacity will be 102,000 tons.

(2) Rio Blanco

The first shipment of production took place at the beginning of 1971. Full annual capacity will be 61,000 tons and two thirds of production will be supplied to Japan for the first 10 years.

(3) Sagasca

Due to come into full production in 1972 at an annual rate of 24,000 tons. Half this production is to go to Dowa for the first 6 years.

(4) Small Mines

Enami planned to increase capacity of small mines by 45,000 tons by 1972 through expansion of some existing mines and development of new mines to give a total capacity of 96,000 tons.

A potential new mine is the Sierra Gorda project of Atlas Explorations which would proceed as a joint venture with the Chilean Government. The deposit is estimated to contain 18 million tons of sulphide mineralization with an average grade of 1.0% copper and 0.15% molybdenite.

The U.N. Development programme reported finding 300 million tons of 1% copper ore at Las Pelambres, 750,000 tons of 2% ore at Augustinas, 400,000 tons of 2% ore at El Rubio, near Las Serena, and an estimated 500,000 tons of 2% copper at Braillador also near La Serena.

Smelter Capacity

It is proposed to increase the capacity at Las Ventanas to 100,000 tons. Some increase is also proposed for Paipote.

Refinery Capacity

The capacity of the Las Ventanas refinery is to be increased to 120,000 tons.

SOUTH AMERICA

5. Ecuador

A U.N. exploration team has discovered copper deposits in the Chauca Valley. Deposits are indicated to be of 100 million tons grading 0.5% - 0.8% copper. Japan's Overseas Mineral Resources Development Co. has signed a contract for exploration and development with the Government and will start preparations for full scale development if reserves of more than 50 million tons are confirmed. Work has begun on access roads into the Chauca area.

6. Peru

Mine Capacity

The following major projects are now expected to be brought into operation :

(1) Cuajone (Southern Peru Copper Corporation) - capacity 130,000 tons is to brought into production, probably during 1976.

(2) Cerro Verde

British Smelter Construction Limited and Wright Engineers of Vancouver are to exploit and develop this mine. Minero Peru will operate the mine when construction is completed in mid - 1974. Reserves are now estimated as 150 million tons of ore grading 1.09% copper. By late 1974 it is hoped that the mine will be producing at a rate of 31,500 tons copper annually. At a later stage it is hoped to expand production to 50,000 tons per year.

(3) Tintaya

Minero Peru has been authorised to put this mine into production during 1974.

A recent statement put Peruvian copper production at 400,000 tons per year by 1975 against the current 200,000 tons. This increase would come from the above developments. A further increase to 700,000 tons per year would result from the development of Michiquillay, Quellaveco, Antamina and Ferrobamba with the co-operation of foreign concerns.

Smelter Capacity
Refinery Capacity

The Peruvian Government is reported to be having discussions with Japanese concerns over the construction of a 150,000 ton/year copper refinery at Ilo. If an agreement is reached the refinery could possibly be completed within 3 years.

OCEANIA

1. Australia

Mine Capacity

An intensive exploration programme involving many companies is taking place. Developments now scheduled for production include :

(1) Mount Lyell (Tasmania) : is doubling capacity to 30,000 tons by 1973 through the development of new shafts.

(2) Mount Isa

Capacity is expected to rise to 150,000 tons by mid-1973 consequent upon the commissioning of new shafts and concentrator.

(3) Peko :

The new Warrego mine is expected to come into production in June, 1972 reaching full capacity of 10,000 tons by 1973 when it will be the largest mine in the Tennant Creek area. Reserves are 5 million tons grading 2.6% copper. Development is also taking place at the smaller Geko mine in the same area for a planned milling rate of 100,000 tons of ore per year. Reserves are 1.4 million tons averaging 3.8% copper. Start-up could now be during 1972. The Company has ceased operations at the Ivanhoe mine.

(4) Samin Co.

The Burra mine was reopened in May, 1971 for initial treatment of 300 tons per day of ore (105,000 tons per year giving 1,600 tons per year copper content). A second stage was to be commissioned by November, 1971, bringing final ore production to 1,000 tons per day (350,000 tons per year, giving 5,600 tons per year copper content). Ore reserves are 3.3 million tons averaging 1.6% copper.

(5) Electrolytic Zinc

Expansion to double production to 3,000 tons per year was completed late in 1971.

(6) North Broken Hill/Broken Hill South (51%)/Electrolytic Zinc/McPhar Geophysics

A consortium of these companies was developing the Kanmantoo deposit for probable initial production late in 1971. The ore is to be mined by open pit methods at a rate of 750,000 tons per year for 7 years, giving an output of 7/8,000 tons per year copper content. Reserves are 5.3 million tons averaging 1% copper. Concentrates are likely to be smelted at Port Kembla.

(7) Cobar Mines Pty. Limited

Doubling mine capacity to 20,300 tons copper content of concentrates by 1974.

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OCEANIA

1. Australia (Cont'd)

(8) Pacific Copper Explorations Limited

Feasibility study completed on its Cadia properties shows aggregate ore reserves at 27.77 million tons grading 0.7% copper with supplementary precious metal content. The Company is negotiating for financing to bring the properties into production at a rate of 4,000 tons per day of ore for 22 years.

(9) Mitsubishi/Consolidated Gold Fields : To establish a joint company to produce 10,000 tons per year of contained copper at the Gunpowder copper treatment plant of Surveys and Mining which they have taken over. All production will go to Japan.

(10) Jododex Australia Pty. Ltd. (St. Joe Minerals/Phelps Dodge) :

To go ahead with mining its copper - silver - lead deposit at Tarago, N.S.W. Ore reserves are 7.1 million tons averaging 2.9% copper (mining to begin in 1973?).

Smelter Capacity
Refinery Capacity

Capacity is expected to increase in line with the expansion of mine production.

Peko : Completed construction at the end of January, 1972 of its new flash smelter at Tennant Creek. Capacity is to be in excess of 25,400 tons per year of copper.

2. Bougainville

The RTZ development on Bougainville Island (Solomon Islands) by Bougainville Copper Pty. Limited is due to start up in April, 1972, earlier than scheduled. The annual capacity is expected to be 187,000 tons. Agreement was reached with the Japanese industry for the supply of 950,000 tons of copper in concentrate over 15 years starting in 1972. It is reported to have been agreed that 10% (9,500 tons per year copper content) of the concentrates will be toll smelted in Japan and returned to Bougainville Copper in ingots from June, 1972 to March, 1974. (The Japanese originally requested a 20% cut back in shipments). The balance of production will be supplied to West Germany and Spain.

Appendix I

PRINCIPAL MINE CAPACITIES AT END OF 1971

COUNTTY	COMPANY	MINE/AREA	CAPACITY (METRIC TONS)
EUROPE			
Austria	Kupferbergbau Mitterberg Ges.m.b.H.	Muhlbach, Salzburg	3,000
Finland	Outokumpu Oy	Outokumpu (Keretti)	10,000
	Outolumpu Oy	Several smaller mines	28,000
Irish Republic	Gortdrum Mines Ltd.	Gortdrum	6,000
	Discovery Mines Ltd.	Avoca	6,000
Norway	A/S Borregard	Tverrfjellet	6,000
	A/S Sulitjelma Gruber	Sulitjelma	5,800
	A/S Didjovagge Gruber	Didjovagge	4,000
Spain	Compania Espanda de Minas de Rio Tinto S.A.	Rio Tinto	17,000
	Rio Tinto Patino S.A.	Cerro Colorado	20,000
Sweden	Boliden Aktiebolag	Aitik	10,000
	Boliden Aktiebolag	Many small pyrites mines	22,000
Yugoslavia	State owned	Bor) Majdanpek)	115,000
AFRICA			
Mauritania	SOMIMA	Akjoujt	22,000
Rhodesia	Messina	Mangula) Guai River)	21,000
		Shackleton	8,000
	Coronation Syndicate	Inyati	4,600
South African Republic.	Palabora Mining Company	Palabora	98,000
	Messina	Messina	13,000
	O'OKiep	Nababeep South) Nababeep Kloof) East O'OKiep & Others)	36,000
S. W. Africa	Tsumeb	Tsumeb) Kombat)	30,000
Uganda	Kilembe Copper Cobalt Co.	Kilembe	16,000
Zaire	Gecamines	Several mines	410,000
Zambia	New Nchanga Consolidated Copper Mines Ltd.	Rokana	105,000
	" " "	Chingola	270,000
		Konkola	45,000
	Roan Consolidated Mines Ltd.	Luanshya	100,000
	Roan Consolidated Mines Ltd.	Chambishai	34,000
	Roan Consolidated Mines Ltd.	Chibuluma	24,400
	Roan Consolidated Mines Ltd.	Kalengwa	17,000
	Roan Consolidated Mines Ltd.	Mufulira	96,000 (rate of 8,000 per month)

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PRINCIPAL MINE CAPACITIES AT END OF 1971 (Cont'd)

COUNTRY	COMPANY	MINE/AREA	CAPACITY (METRIC TONS)
ASIA			
Cyprus	Cyprus Mines Corporation) Cyprus Sulphur & Copper Co. Ltd.) Hellenic Mining Co. Ltd.)	Several small mines	21,000
Japan	Dowa Mining Co.) Furukawa Mining Co.) Mitsubishi Metal Mining) Mitsui Mining & Smelting) Nippon Mining Co.) Sumitomo Metal Mining)		130,000
Philippine Rep.	Atlas Consolidated	Greater Biga-Darot	77,000
	Marcopper Mining Co.	Labo	40,000
	Marinduque Mining	Sipalay & Bapacay	41,000
	Lepanto Consolidated	Lepanto	30,000
	Philex Mining	Tuba	18,000
Turkey	Black Sea Copper Mines (Etibank)	Murgul	
		Kure and Espiye	32,000
NORTH/CENTRAL AMERICA			
Canada	Bethlehem Copper Corporation	Jersey	22,000
	Brenda Mines Ltd.(Noranda)	Brenda	16,500
	Granduc Mines Ltd. (Newmont-Asarco)	Granduc	38,000
	Inco		161,000
	Sherritt Gordon Mines Ltd.	Fox Lake	20,000
	Sherritt Gordon Mines Ltd.	Lynn Lake	6,000
	Hudson Bay Mining & Smelting	Various	45,000
	Craigmont Mines	Merritt	18,000
	Falconbridge Nickel Mines Ltd.	Several	22,000
	Gaspe Copper Mines	Needle Mountain) Copper Mountain)	37,000
	Noranda	Horne) Geco)	51,000
	Ecstall Mining (Texas Gulf Sulphur)	Kidd Creek	52,000
	Selection Trust (Selco)	Uchi Lake	3,000
	Opemiska Copper Mines	Springer) Perry) Robitaille)	29,000
	Patino Mining Corp.	Copper Rand) Portage Island)	15,000
	Utah International Inc.	Port Hardy	50,000
Mexico	Cia Minera de Cananea S.A.de C.V.	Cananea	40,000
	Asarco Mexicana S.A.	Inguaran	13,000
U.S.A.	Asarco	Silver Bell) Mission) San Xavier)	73,000
	Anaconda	Twin Buttes) Berkley) Weed Heights) Others)	227,000

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PRINCIPAL MINE CAPACITIES AT END OF 1971 (Cont'd)

COUNTRY	COMPANY	MINE/AREA	CAPACITY (METRIC TONS)
U.S.A. (Cont'd)	Bagdad Copper Corp.	Arizona	18,000
	Copper Range	White Pine	74,000
	Duval	Sierrita	59,000
	Duval	Ithica Peak	23,000
	Duval	Battle Mt.	14,000
	Inspiration Consolidated	Inspiration)	
		Christmas)	65,000
		Ox-hide)	
U.S.A.	Kennecott Copper Corp.	Bingham (Utah)	201,000
	Kennecott Copper Corp.	Ruth (Nevada)	45,000
	Kennecott Copper Corp.	Ray (Arizona)	102,000
	Kennecott Copper Corp.	Chino (N.M)	86,000
	Magma Copper Corp (Newmont)	San Manuel)	109,000
		Superior)	
	Phelps Dodge	Morenci	130,000
	Phelps Dodge	Ajo	65,000
	Phelps Dodge	Bisbee	55,000
	Phelps Dodge	Tyrone	54,000
	Pima Mining Co.(Cyprus Mines)	Pima	73,000
	Tennessee Copper Co.		44,000
SOUTH AMERICA			
Chile	El Teniente S.A.	El Teniente	180,000
	Compania de Cobre Salvador S.A.	El.Salvador	100,000
	Anaconda	Exotica	34,000
	Andina Mining Co.	Andina	61,000
	Compania de Cobre Chuquicamata S.A.	Chiquicamata	300,000
	Cia Minera Disputada de la Condes	Disputada/Soldado	36,000
	Empress Minera de Mantos Blancos	Mantos Blancos	35,000
	ENAMI		51,000
Peru	Southern Peru Copper Corp.	Toquepala	140,000
	Cerro de Pasco	Cobriza)	35,000
		Morococha)	
AUSTRALIA	Mt.Lyell Mining & Railway Co.	Mt. Lyell	15,000
	Mt.Isa Mines Ltd.	Mt. Isa	110,000
	Cobar Mines Pty. Ltd.	Cobar	10,000
	Peko/Wallsend	Peko)	
		Orlando)	10,000
		Ivanhoe)	

PRINCIPAL SMELTER CAPACITIES AT END OF 1971

COUNTRY	COMPANY	SMELTER	CAPACITY(METRIC TONS)
EUROPE			
Austria	Montanwerke Brixlegg G.m.b.h.	Brixlegg	12,000
Belgium	Metallurgie Hoboken	Hoboken	45,000
	Metallo-Chimique S.A.	Beerse	17,000
Finland	Outokumpu Oy	Harjavalta	50,000
France	Societe Francais d/Affinage du Cuivre	Poissy	11,000
Germany F.R.	Norddeutsche Affinerie	Hamburg	75,000
	Berliner Kupfer-Raffin G.m.b.H.	Berlin-Willmersdorf	15,000
	Duisburger Kupferhutte	Duisburg	30,000
	Metallhutte Kall G.m.b.H.	Kall (Eifel)	20,000
	Huttenwerke Kayser A.G.	Lunen	42,000
Spain	Rio Tinto Patino S.A.	Huelva	40,000
	Rio Tinto Patino S.A.	Rio Tinto	18,000
	Electrolysis del Cobre S.A.	Barcelona	15,000
	Industrias Reunidas Minera-Metalurgicas S.A.	Asua	18,000
Sweden	Boliden Aktiebolag	Ronnskar	60-65,000
Yugoslavia	Rudarsko Tapionicarsk Bazen Bor	Bor	105,000
AFRICA			
Rhodesia	Messina-Rhodesia Smelting & Refining Co. Ltd.	Alaska	23,000
S. African Rep.	Messina Transvaal Development Co.	Messina	20,000
	Palabora Mining Co. Ltd.	Palabora	89,500
	O'OKiep Copper Co. Ltd.	Nababeep	40,000
S. W. Africa	Tsumeb Corporation Ltd.	Tsumeb	35,000
Uganda	Kilembe Mines Ltd.	Jinja	18,000
Zaire	Gecamines	Likasi-Shituru	185,000
	Gecamines	Lubumbashi	125,000
	Gecamines	Liulu	125,000
Zambia	Roan Consolidated Mines	Mufulira	230,000
	Roan Consolidated Mines	Luanshya	122,000
	NCCM	Chingola)	420,000 (including electrowinning)
	NCCM	N'Kana)	
ASIA			
Japan	Mitsubish Metal Mining	Naoshima	146,000
	Onahama Smelting & Refining	Onahama	90,000
	Furukawa Mining Co.	Ashio	38,000
	Dowa Mining Co.	Kosaka)	54,000
	Dowa Mining Co.	Okayama)	
	Mitsui Mining Co.	Hibi	47,000
	Nippon Mining Co.	Hitachi	60,000

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PRINCIPAL SMELTER CAPACITIES AT END OF 1971 (Cont'd)

COUNTRY	COMPANY	SMELTER	CAPACITY (METRIC TONS)
Japan (Cont'd)	Nippon Mining Co.	Saganoseki	120,000
	Sumitomo Metal Mining Co.	Kunitomi	16,000
	Sumitomo Metal Mining Co.	Besshi	108,000
	Sumitomo Metal Mining Co.	Toyo	96,000
	Rasa Industry	Miyako	24,000
	Toho Zinc	Onahama	18,000
India	Indian Copper Corp.	Moubhander	10,000
Turkey	Etibank	Murgul	11,000
	Etibank	Ergani	19,000
NORTH/CENTRAL AMERICA			
Canada	Inco	Copper Cliff	(170,000
	Inco	Coniston	(
	Falconbridge Nickel Mines Ltd.	Falconbridge (Ont.)	30,000
	Gaspe Copper Mines Ltd.	Murdochville (Que.)	63,000
	Hudson Bay Mining & Smelting Co. Ltd.	Flin Flon	45,000
	Noranda Mines Ltd.	Noranda (Que.)	204,000
Mexico	Asarco Mexicana S.A.	San Luis Potosi	30,000
	Campania Minera de Cananea S.A.	Cananea	37,000
	Cia Minera Nacocozac S.A.	Conception del Oro	25,000
	Cia Minera de Santa Rosalia	Santa Rosalia	10,000
U.S.A.	American Metal Climax Inc.	Cartaret	40,000
	Asarco	Tacoma	105,000
	Asarco	El.Paso	77,000
	Asarco	Hayden	80,000
	Anaconda	Anaconda	170,000
	Inspiration Consolidated	Miami	70,000
	Kennecott Copper Corp.	Garfield (Utah)	300,000
	Kennecott Copper Corp.	Hurley (Chino)	100,000
	Kennecott Copper Corp.	McGill (Nev.)	100,000
	Kennecott Copper Corp.	Hayden (Ray)	100,000
	Magma	San Manuel	85,000
	Phelps Dodge	Douglas	140,000
	Phelps Dodge	Morenci	80,000
	Phelps Dodge	Ajo	70,000
	Copper Range	White Pine	81,000
	Bagdad (electrowinning)	Arizona	6,500
SOUTH AMERICA			
Chile	Andes Copper Mining Co.	Potrerillos	100,000
	Chile Exploration	Chuquicamata	319,000
	Sociedad Minera El Teniente S.A.	Caletones	255,000
	Cia Minera Disputada de las Condes S.A.	Chagres	30,000
	ENAMI	Las Ventanas	43,000
	ENAMI	Paipote	33,000
	Mantos Blancos	Mantos Blancos	30,000
Peru	Southern Peru Copper Corp.	Ilo	160,000
	Cerro de Pasco Corp.	La Oroya	50,000
AUSTRALIA	Mt. Isa Mines Ltd.	Mt. Isa	100,000
	Electrolytic Refining & Smelting Co.	Port Kembla	40,000

Appendix 3

PRINCIPAL REFINERY CAPACITIES AT END OF 1971

COUNTRY	COMPANY	REFINERY	CAPACITY (METRIC TONS)
EUROPE			
Austria	Montanwerke Brixlegg G.m.b.H.	Brixlegg	20,000
Belgium	Metallurgie Hoboken	Olen	270,000
	Metallo-Chimique S.A.	Beerse	40,000
Finland	Outokumpu-Oy	Pori	40,000
France	Cie Gle d'Electrolyse du Palais	Le Palais	32,000
Germany F.R.	Norddeutsche Affinerie	Hamburg	270,000
	Berliner Kupfer-Raffin G.m.b.H.	Berlin-Willmersdorf	15,000
	Huttenwerke Kayser A.G.	Lunen	97,000
	Metallhuttenwerke Lubeck A.G.	Lubeck-Herrenwyk	20,000
	Osnabrucker Kupfer und Drahtwerke	Osnabruck	13,000
Italy	Societa Metallurgica Italiana	Fornaci di Barga	23,000
	A. Tonolli e C°	Paderno Dugnano	10,000
Norway	Falconbridge Nikkelverke A/S	Kristiansand	26,000
Spain	Rio Tinto Patino	Huelva	40,000
	Electrolisis de Cobre S.A.	Palencia	12,000
	Industrias Reunidas Minero-Metalurgicas S.A.	Asua	16,000
Sweden	Boliden Aktiebolag	Ronnskar	55,000
United Kingdom	British Copper Refiners	Prescott) electrolytic & fire Widnes) refining	173,000
	Elkington Copper Refiners	Walsall	25,000
	Enfield	Brimsdown	66,000
	Williams Harvey & Co. Ltd.	Liverpool	10,000
	I.M.I. Refiners Ltd.	James Bridge	50,000
Yugoslavia	Rudarsko Topionicarsk Buzen Bor	Bor	105,000
AFRICA			
Rhodesia	Messina-Rhodesia Smelting & Refining Co. Ltd.	Alaska	20,000
S. African Rep.	Messina	Messina	20,000
	Palabora Mining Co.	Palabora	57,500
Zaire	Gecamines	Likasi-Shituru	230,000
Zambia	Roan Consolidated Mines	Nufulira	185,000
	Roan Consolidated Mines	N'dola	130,000
	NCCM	Chingola	271,000 (Furnace)
	NCCM	Rokana (N'Kana)	200,000 (Tankhouse)
ASIA			
Japan	Mitsubishi Motal Mining	Naoshima	120,000
	Mitsubishi Metal Mining	Osaka	84,000

PRINCIPAL REFINERY CAPACITIES AT END OF 1971 (Cont'd)

COUNTRY	COMPANY	REFINERY	CAPACITY (METRIC TONS)
Japan (Cont'd)	Onahama Smelting Refining Co.	Onahama	120,000
	Dowa Mining Co.	Kosaka	44,000
	Dowa Mining Co.	Okayama	11,000
	Furukawa Mining Co.	Nikko	48,000
	Nippon Mining Co.	Hitachi	72,000
	Nippon Mining Co.	Saganoseki	168,000
	Sumitomo Metal Mining Co.	Besshi	144,000
	Toho Zinc	Onahama	14,000
	Mitsui Metal Mining Co.	Takehara	84,000
NORTH/CENTRAL AMERICA			
Canada	Inco	Copper Cliff	170,000
	Canadian Copper Refiners	Montreal	318,000
Mexico	Cobre de Mexico, S.A.	Atzacapotzalco	72,000
U.S.A.	AMAX	Carteret	236,000
	ASARCO	Baltimore	208,000
	ASARCO	Perth Amboy	152,000
	ASARCO	Tacoma	142,000
	Anaconda	Great Falls	172,000
	International Smelting & Refining Co. (Anaconda)	Raritan	136,000
	Inspiration Consolidated	Inspiration	64,000
	Kennecott Copper Co.	Garfield (Utah)	169,000
	Kennecott Copper Co.	Hurley (N.M.)	93,000
	Kennecott Refining Corp.	Maryland	250,000
	Phelps Dodge	El Paso	404,000
	Phelps Dodge	Laurel Hill	65,000
	Copper Range	White Pine	81,000
	Cerro Copper Products (Cerro Corp)	St. Louis	40,000
	Chemico	Alton (Ill.)	30,000
	Newmont-Magna	San Manuel	181,000
	Reading Metals	Ontelaunee (Pa.)	18,000
	Southwire	Carrolton	65,000
SOUTH AMERICA			
Chile	Andes Copper Mining Co.	Potrerillos	72,000
	Chile Exploration	Chuquicamata	369,000
	ENAMI	Las Ventanas	85,000
	Sociedad Minera El Teniente	Caletones	100,000
Peru	Cerro de Pasco Corporation	La Oroya	52,000
AUSTRALIA	Copper Refineries Pty. Ltd.	Townsville	100,000
	Electrolytic Refining & Smelting Co.	Port Kembla	60,000

file: Copper

COPPER AND BRASS

Another strong year ahead for copper

PD's Munroe sees tight supply in '70 and an easing market for following years

With foreign and dealer copper priced in the 75¢ range, with domestic producer copper at 52¢, with copper production and consumption—both domestic and foreign—at record levels, and with copper inventories by and large near rock bottom, high copper prices may well prevail for much—if not all—of 1970. This forecast of next year's copper market was advanced by Phelps Dodge president George B. Munroe at a recent meeting of the Investment Analysts Society of Chicago.

"However, world copper mining capacity will increase in 1970 and over the next several years at a faster rate than it has recently," Munroe stated. "And this should bring about a gradual easing of market conditions."

"Near-term forecasts for copper are fraught with uncertainties," Munroe said. "Foremost among these is the level of business activity in the US in 1970. . . Other question marks are the level of economic activity in Europe and Japan, progress in bringing the Vietnam war to an end, and uncertainties arising out of labor disputes and political considerations." But high prices should prevail.

Free World copper mine capacity is scheduled to increase by almost 10% in 1970 and 32% by the end of 1973, Munroe said (*see table below*). Since this yields a cumulative annual production increase of 7.2% a year—against a historical rate of increase in consumption of 4½% a year—there is an indicated excess of copper production over consumption for the 1971-1973 period. However, Munroe stated, it is not anticipated that this will do more than provide copper consumers reasonable protection with regard to future copper supply.

As to the wide spread between the prices of domestic producer copper and all other copper, Munroe said, this differential causes undesirable distortions in the copper consuming sector of the economy, and he expressed his belief that over some reasonable period of time this spread will have to be eliminated.

HOW FREE WORLD COPPER CAPACITY WILL GROW

(tpy)

	Est. capacity at end of 1969	Additional capacity scheduled for completion 1970	1971	1972	1973	Total planned 1970-1973	Est. capacity at end of 1973
North America							
United States	1,775,000	115,000	65,000	65,000	215,000	460,000	2,235,000
Canada	685,000	67,500	14,000	104,000	(15,000)	170,500	855,500
Other	95,000	(2,500)	4,000	—	10,000	11,500	106,500
Subtotals	2,555,000	180,000	83,000	169,000	210,000	642,000	3,197,000
South America							
Chile	830,000	217,500	108,000	15,000		340,500	1,170,500
Peru	240,000	—	5,000	50,000	50,000	105,000	345,000
Other	11,000	—	—	—	—	—	11,000
Subtotals	1,081,000	217,500	113,000	65,000	50,000	445,500	1,526,500
Africa							
Zambia	825,000	46,000	25,000	—	25,000	96,000	921,000
Republic of the Congo	385,000	—	—	58,000	—	58,000	443,000
Republic of South Africa	140,000	—	—	—	30,000	30,000	170,000
South West Africa	38,000	2,000	—	—	—	2,000	40,000
Other	41,000	30,000	—	—	15,000	45,000	86,000
Subtotals	1,429,000	78,000	25,000	58,000	70,000	231,000	1,660,000
Asia							
Japan	140,000	5,000	5,000	5,000	5,000	20,000	160,000
Philippines	140,000	40,000	—	30,000	—	70,000	210,000
Other	85,000	—	—	208,000	120,000	328,000	413,000
Subtotals	365,000	45,000	5,000	243,000	125,000	418,000	783,000
Australia	150,000	22,000	—	12,000	—	34,000	184,000
Europe							
Yugoslavia	85,000	5,000	15,000	—	—	20,000	105,000
Finland	40,000	—	7,000	—	—	7,000	47,000
Other	95,000	25,000	4,000	—	—	29,000	124,000
Subtotals	220,000	30,000	26,000	—	—	56,000	276,000
Provision for unannounced increases					50,000	50,000	50,000
Total net increases planned		572,500	252,000	547,000	505,000	1,876,500	
Total free world capacity	5,800,000	6,372,500	6,624,500	7,171,500	7,676,500		7,676,500
Percent increase		9.9%	4.0%	8.3%	7.0%	7.2% per year	

Source: Phelps Dodge

Miami - District

To J.H.C Copper

PROSPECTUS

OCT 10 1969

EXCHANGE OFFER
TO HOLDERS OF COMMON STOCK OF

Cities Service Company

2,370,000 Shares

Atlantic Richfield Company

Common Stock
(Par Value $5)

EXCHANGE OFFER

Cities Service Company ("Cities") hereby offers to exchange 2,370,000 shares of Common Stock ("Atlantic Richfield Common Stock") of Atlantic Richfield Company ("Atlantic Richfield") owned by Cities for shares of Cities Common Stock in the ratio of

1 SHARE OF ATLANTIC RICHFIELD COMMON STOCK
for
2 SHARES OF CITIES COMMON STOCK

Holders of $4.40 Cumulative Convertible Preferred Stock of Cities ("Cities Preferred Stock") and holders of $2.25 Cumulative Convertible Preference Stock of Cities ("Cities Preference Stock") may make arrangements to tender Cities Common Stock by delivering Cities Preferred Stock or Cities Preference Stock, or by converting Cities Preferred Stock or Cities Preference Stock, and then tendering Cities Common Stock, all as more fully set forth herein under "Exchange Offer".

THE EXCHANGE OFFER WILL EXPIRE AT 3:30 P. M. NEW YORK TIME, ON OCTOBER 22, 1969, UNLESS EXTENDED BY CITIES AS PROVIDED HEREIN.

The First Boston Corporation and Loeb, Rhoades & Co. have been retained by Cities as Dealer Managers to form and manage a group of Soliciting Dealers, including the Dealer Managers, to solicit exchanges under the Exchange Offer. Each Soliciting Dealer will be paid a fee by Cities of 75¢ for each share of Cities Common Stock exchanged under the Exchange Offer through the efforts or facilities of such Soliciting Dealer, as evidenced by the appearance of the name of such Soliciting Dealer on Exchange Forms, subject to a maximum aggregate fee of $1,500 to Soliciting Dealers with respect to shares exchanged by any one beneficial owner. Cities will also pay the Dealer Managers in the aggregate a fee equivalent to $50,000 plus 5¢ for each share of Cities Common Stock exchanged under the Exchange Offer, plus all reasonable out-of-pocket expenses, including counsel fees, incurred by them. Cities has agreed to indemnify the Dealer Managers and Soliciting Dealers against certain liabilities. See "Solicitation of Tenders and Expenses" herein for additional information.

THESE SECURITIES HAVE NOT BEEN APPROVED OR DISAPPROVED BY THE SECURITIES AND EXCHANGE COMMISSION NOR HAS THE COMMISSION PASSED UPON THE ACCURACY OR ADEQUACY OF THIS PROSPECTUS. ANY REPRESENTATION TO THE CONTRARY IS A CRIMINAL OFFENSE.

The First Boston Corporation — Loeb, Rhoades & Co.

The date of this Prospectus is October 1, 1969.

Cities Service

Cities Service operates fertilizer plants at Cedartown, Georgia; Tuscaloosa, Attalla, Montgomery and Decatur, Alabama; and New Albany, Indiana. In addition, it operates 249 fertilizer bulk blending plants in the Midwest, Southeast and in western Texas.

Cities Service owns a majority interest in a phosphatic fertilizer, sulfuric acid and phosphoric acid plant in Cubatao, Brazil; a 68.7% interest in a mixed fertilizer blending plant in Corinto, Nicaragua; and a 49.65% interest in a Belgian company engaged in the production and marketing of nitrogen fertilizers.

The fertilizer industry is being adversely affected by a general condition of over capacity in terms of present demand.

Industrial Chemicals

Inorganic chemical products include sulfuric acid produced at Copperhill, Tennessee; East Tampa, Florida; Augusta, Georgia; and Lake Charles, Louisiana. In addition, the Copperhill complex produces liquid sulfur dioxide, copper chemicals, sodium hydrosulphite, secondary zinc oxide, ferric sulfate and a variety of sulfonation products. Aluminum sulfate also is produced at Augusta and Cedar Springs, Georgia and Fernandina Beach, Florida. Chemicals produced at East Tampa, other than plant foods, are sodium fluosilicates and hydrofluosilicic acid. Chlorosulfonic acid and potassium sulfate are produced at Lockland, Ohio and other specialized chemicals are produced at East Point, Georgia.

Metals

Ducktown Basin, Tennessee

Engineering studies are underway for a 25% expansion in operations along with extensive modernization of the Copperhill facilities. The limits of the ore body are not established but the proven reserves would sustain the increased rate for 20 years. The average ore mining rate for the past 5 years has been 1,565,996 tons per year. Beneficiation and smelting of this ore provides sulfur dioxide (which is converted into sulfuric acid), copper, iron sinter (approximately 68% iron), and zinc concentrate (approximately 60% zinc).

The operations at Copperhill were suspended on September 15, 1969 as a result of a strike. Negotiations between the Company and unions representing the employees are continuing.

Globe-Miami Mining District, Arizona

The Copper Cities and Diamond H open pit mines are estimated to have ore reserves (as of December 31, 1968) of 31 million tons of .55% ore—approximately 290 million pounds of recoverable copper. The average ore mining rate over the past 5 years was 3,427,372 tons per year. Copper is recovered from this ore by milling and flotation. The Copper Cities mine also currently produces annually 5 million pounds of copper by leaching and precipitation.

Leaching operations at the block-caved Miami mine currently produce 13 million pounds of copper annually. This rate will decline gradually over a number of years.

Leaching operations are also conducted at the Castle Dome property. Current production is one million pounds of copper annually which has declined to the point that this operation will be discontinued later this year.

Internal Consumption

A part of the copper produced is fabricated at Company owned plants into plate, sheet, strip and roll copper at Seymour, Connecticut and into insulated wire and cable at Chester, New York.

Approximately 12 million pounds of copper per year are used in the production of copper chemicals at Copperhill, Tennessee.

Exploration

On the Miami East project, in a down-faulted block of the Miami-Inspiration ore body, 6 holes drilled in 1969 have encountered copper mineralization at depths ranging from 2,460 to 3,300 feet.

The average thickness of mineralization is 465 feet containing 1.51% copper. The distance between the present extremities of the drilling is about 1,900 feet. It is estimated that 6 additional holes will be drilled by the end of this year.

During the past six years, 150 drill holes have proved the occurrence of widespread low grade copper mineralization in the immediate vicinity of the old Castle Dome mine, about 8 miles northwest of Miami, Arizona. A computer study of the data from this drilling is being made to optimize tonnage and grade of prospective ore and waste in order to evaluate the open pit mining feasibility of this project. Preliminary estimates indicate over 300,000,000 tons of possible ore containing .45% copper.

Cities Service has a 34% interest in Union Minera del Sur, S. A. de C. V., a Mexican company engaged in exploration for sulfur and other minerals in Mexico. A sulfur discovery by this company was announced on November 12, 1968.

A total of 60 holes has been drilled on two of the seven concession areas held. Sulfur with a net thickness of three feet or more has been encountered in 20 of the holes in two separate mineralized areas. Exploration indicates sulfur reserves exceeding 1,500,000 tons, but the full extent and value of the deposit is not known. Drilling is continuing.

Other Operations

Marine

The vessels comprising the marine fleet owned by Cities Service traveled 825 thousand miles and transported 24 million barrels of crude oil and petroleum products and 25,000 long tons of grain during the first six months of 1969. The 15 vessels in this fleet range in size from T-2 class to three 70,000-ton tankers. Total fleet tonnage is 610,000 deadweight tons. Cities Service tankers are in both foreign and domestic service and are used for Cities Service movements and for chartering to others, including the Military Sea Transport Service. Barges and shallow draft tankers are also chartered for domestic movements.

Helium

Cities Service owns and operates the Jayhawk Helium Plant 13 miles east of Ulysses, Kansas. The plant, located on a 200-acre site in the Hugoton natural gas field, processes in excess of 500 million cubic feet of natural gas daily for the extraction of crude helium. Pursuant to a firm contract with the United States Government, Cities Service for 22 years from 1961 will tender to the United States Government the helium output and the Government will pay for such helium, whether taken or not, at an initial price of $11.78 per Mcf, subject to escalation, but limited to a maximum amount of $9,100,000 annually. The General Accounting Office has filed a report with Congress recommending that certain helium supply contracts, including the Cities Service contract, negotiated by the Department of the Interior be amended to include provision for price redetermination. The results of such recommendation are indeterminable at this time.

The Jayhawk Plant also processes crude helium delivered by pipeline from the Company's 50% owned Sunflower Plant, located near Scott City, Kansas. The crude helium produced in excess of Government requirements is refined and sold either as a gas or liquid.

Real Estate

Cities Service owns several office buildings in the financial district of New York City. The more important buildings are those located at 52 Wall Street, 60 Wall Street and 70 Pine Street (also known as Sixty Wall Tower). The latter is located on land partly owned in fee and partly held under long-term lease; while the other buildings are located on land owned in fee.

Cities Service also owns a 50% interest in two office buildings under construction. In Atlanta, Georgia, a building is scheduled for completion in early 1970 in which Cities Service will lease approxi-