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BANNER COMPANY FILE

BANNER MINING COMPANY

PROXY STATEMENT

Not incorporated in 1972 final Reserves tabulation

Special Meeting of Stockholders

April 13, 1973

This Proxy Statement is furnished in connection with the solicitation of proxies by the management of Banner Mining Company ("Banner"), a Nevada corporation, for use at the special meeting of stockholders to be held April 13, 1973 and any adjournments thereof.

The special meeting has been called to consider and take action upon a proposal whereby Banner will be merged (the "Merger") with Amax Copper Mines, Inc. ("ACM"), a wholly-owned subsidiary of American Metal Climax, Inc. ("Amax"), under the terms and conditions described in the Agreement of Merger between Banner and ACM (Exhibit A hereto) and in an agreement ("Banner Agreement") among Banner, ACM and Amax (Exhibit B hereto).

Upon effectiveness of the Agreement of Merger each outstanding share of Common Stock of Banner will be converted, without further action on the part of the holder of such share, into 0.137553 of a share of Amax Series A Convertible Preferred Stock. Accordingly, each 7.2699 shares of the Banner Common Stock will entitle the holder thereof to one share of the Amax Series A Convertible Preferred Stock.

For information concerning the proposed related merger of Tintic Standard Mining Company ("Tintic"), one of Banner's principal stockholders, see "Interests of Certain Persons in Matters to be Acted Upon — Tintic Standard Mining Company".

Unless otherwise indicated, all references to Amax include its consolidated subsidiaries. Amax's principal offices are at 1270 Avenue of the Americas, New York, N. Y. 10020 and its telephone number is (212) 757-9700. Banner's principal offices are at 240 North Stone Avenue, P. O. Box 4220, Tucson, Arizona 85717 and its telephone number is (602) 623-5487.

As used in this Proxy Statement, the term "ore reserves", when used in respect of copper and other minerals, means those estimated quantities of ore that under present technical and economic conditions may be profitably mined and sold or processed for the extraction of their constituent values. Except as otherwise noted, stated tonnages and grades of ore reserves do not include allowances for waste dilution in mining. References to "tons" and "tonnes" are to short tons of 2,000 pounds avoirdupois and to metric tonnes of 2,204.6 pounds avoirdupois, respectively, unless otherwise noted.

This Proxy Statement also constitutes Amax's prospectus to Banner's stockholders voting upon the Merger and may be used in connection with sales of Amax Series A Convertible Preferred Stock by affiliates of Banner following the Merger. See "Information Concerning Proposed Sales by Certain Affiliates" and "Registration Statement".

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 date of this Proxy Statement is March 15, 1973.

SUMMARY OF CERTAIN HIGHLIGHTS

For the convenience of stockholders, there follows a general summary of certain highlights of the proposed Merger described in detail on pages 10 to 13. This summary is necessarily incomplete and selective, and stockholders should carefully read the more detailed sections of this Proxy Statement. This summary is qualified in its entirety by reference to those sections, particularly the specific sections referred to.

General

Amax proposes to acquire Banner by means of a merger of Banner with a wholly-owned subsidiary of Amax. In the Merger, Banner stockholders would receive shares of Amax Series A Convertible Preferred Stock for their shares of Banner Common Stock. Amax wishes to acquire Banner primarily because Amax desires to develop Banner's principal property, the Twin Buttes mine, in partnership with The Anaconda Company ("Anaconda"), which now operates that mine under a long-term lease from Banner.

Of Banner's 6,960,360 shares of Common Stock outstanding on March 9, 1973, the record date for the special meeting, an aggregate of 3,480,515 shares (approximately 50%) were held by directors and officers of Banner and certain other principal stockholders, including those referred to under "Interests of Certain Persons in Matters to be Acted Upon". All of these directors, officers and other persons have informed the management of Banner that they expect to vote these shares in favor of the proposed Merger. The affirmative vote of the holders of a majority of Banner's outstanding Common Stock is required to authorize the Merger.

The Merger

It is proposed that Banner be merged with ACM (a wholly-owned subsidiary of Amax) and upon the Merger become a wholly-owned Amax subsidiary. In the Merger, Banner stockholders will receive shares of Amax Series A Convertible Preferred Stock for their Banner shares. See, generally, "The Merger".

Exchange Ratio. Each Banner share will become approximately 0.138 of a share of Amax Series A Convertible Preferred Stock, so that each 100 shares of Banner will become approximately 13.8 shares of such Preferred Stock. If the Merger occurs after May 10, 1973, each Banner share will become approximately 0.139 of a share of Series A Convertible Preferred Stock, since the June 1, 1973 dividend on such Preferred Stock will not then be payable on the shares issued in the Merger. Thus, in such event, each 100 Banner shares would become approximately 13.9 shares of such Preferred Stock.

Effective Date. It is currently expected that the Merger will become effective on or about April 16, 1973.

Tax Status. The Merger is intended to be tax free to Banner stockholders for Federal income tax purposes. See "Federal Tax Status".

Dissenters' Rights. Under Section 78.521 of the Revised Statutes of Nevada, Banner stockholders do not have appraisal or similar rights in the event they dissent from the Merger.

Amax Series A Convertible Preferred Stock

Dividend Rate. A preferred cumulative annual dividend of $5.25 per share is payable quarterly on March 1, June 1, September 1 and December 1.

Convertibility. Each share is convertible into approximately 2.43 shares of Amax Common Stock.

Redemption. The Series A Convertible Preferred Stock is not redeemable prior to September 1, 1976 but is redeemable at $105 per share commencing on that date. The redemption price will then be reduced by $1.25 biennially until September 1, 1984, at which date it will become and remain at $100.

Voting Rights. Each share is entitled to one vote on all matters presented to Amax shareholders.

Listing. The Series A Convertible Preferred Stock is listed on the New York, Midwest and Pacific Stock Exchanges.

See, generally, "Description of Capital Stock of Amax".

Businesses of Amax and Banner

Amax. Amax was incorporated in 1887 and is engaged in the exploration for and mining of ores and minerals, and in smelting, refining and other treatment of minerals and metals. Its principal products are molybdenum, aluminum, iron ore, coal, copper, lead, zinc and potash. Amax does not mine copper in the United States. Amax also fabricates and markets various aluminum products. In addition, Amax has substantial foreign operations and investments in other mining companies. See "Business and Properties of Amax."

Banner. Banner was incorporated in 1935 to engage in the business of mining copper. Banner's principal mineral properties, including the Twin Buttes mine, are located in Pima County, Arizona, and are leased to Anaconda under a long-term agreement. Payments to Banner under the agreement have been Banner's principal source of revenue since 1968. See "Business and Properties of Banner".

Amax-Anaconda Arrangements

Amax proposes to enter into a partnership arrangement with Anaconda effective upon the Merger pursuant to which Amax and Anaconda would contribute, among other things, their respective interests in the Banner lease agreement and would immediately proceed with the development and expansion of the Twin Buttes mine, with an expected expenditure exceeding $200,000,000 in the next three years. Amax's obligation to proceed with the Merger is conditioned, among other things, on the satisfactory completion of its arrangements with Anaconda. See "The Amax-Anaconda Arrangements".

Financial and Other Data

The factors considered by the Board of Directors of Banner in recommending the Merger are summarized below under "Recommendation of the Board of Directors". Comparative per share information, including information concerning net income, book value, dividends and market prices of Amax and Banner securities, is set forth under "Comparative Per Share Data", and financial information concerning Amax and Banner is included in the financial statements listed in the Index to Financial Statements.

The following table summarizes certain basic financial statistics for Amax and Banner for the periods shown:

	In Thousands of Dollars, Except Per Share Amounts					
Amax	1967	1968	1969	1970	1971	Nine Months Ended September 30, 1972
Net sales	$478,260	$570,594	$753,488	$ 840,715	$ 756,924	$ 635,184
Net earnings	56,533	67,521	69,366	84,232	51,314	47,434
Primary earnings per share of Common Stock	2.47	2.90	2.93	3.43	2.03	1.87
Fully diluted earnings per share of Common Stock	2.40	2.82	2.87	3.29	2.00	1.85
Total assets	677,080	783,030	942,050	1,068,900	1,255,066	1,293,854
Shareholders' equity	416,335	455,655	553,780	611,080	626,199	645,757

Banner	1968	1969	1970	1971	1972	Nine Months Ended September 30, 1972
Income	$5,914	$1,978	$2,079	$2,326	$1,884	$1,414
Net income	1,610	727	874	1,012	681	527
Per share	0.23	0.10	0.13	0.15	0.10	0.08
Net income per share giving pro forma effect to change in accounting method*	0.23	0.10	0.20	0.08	0.10	0.08
Total assets	8,607	7,864	7,493	7,275	8,243	7,967
Stockholders' equity	2,769	1,964	1,307	2,320	3,001	2,847

* See Note 1 to Banner Statement of Income.

Related Tintic Merger

Tintic is Banner's largest stockholder and controls Banner. Tintic owns 11.33% of Banner's outstanding Common Stock, and Tintic, Tintic's directors and their immediate families, and a company affiliated with Tintic own in the aggregate approximately 30% of Banner's Common Stock. Five of Banner's nine directors are also directors of Tintic, and two of these common directors serve as members of Banner's three-man executive committee. Three of the four members of the committee of Banner directors which negotiated the terms of the Banner Merger are also directors of Tintic.

Information concerning the proposed related merger of Tintic appears under "Interests of Certain Persons in Matters to be Acted Upon". The Tintic merger is not a condition to the Banner Merger but will not occur if the Banner Merger does not occur.

Inquiries from Department of Justice

Amax and Anaconda have received requests from the Department of Justice, Antitrust Division, for certain information relating to the Merger and the proposed arrangements with Anaconda. The most recent such request was received on February 20, 1973. Amax and Anaconda have supplied data to the Department and are cooperating with it in its inquiry.

COMPARATIVE PER SHARE DATA

Net Income Per Share

The following tabulation presents on a per share basis the historical net income of Banner, the historical consolidated net income of Amax, and the pro forma consolidated net income giving effect to both the Merger and the proposed arrangements between Amax and Anaconda. See "The Amax-Anaconda Arrangements". For an explanation of the computation of the Amax pro forma income per share figures, see "Pro Forma Combined Financial Statements — Pro Forma Combined Statement of Earnings". All Amax figures are based on primary earnings per share.

Under the Agreement of Merger each share of Common Stock of Banner would become 0.137553 of a share of Series A Convertible Preferred Stock of Amax, which is convertible into 2.43351 shares of Common Stock of Amax (each share of Banner Common Stock, in effect, being convertible into 0.334737 shares of Amax Common Stock). The exchange ratio of Banner Common Stock into Amax Series A Convertible Preferred Stock is subject to adjustment after May 10, 1973 as set forth under "The Merger — Agreement of Merger — Payment of Dividends". For purposes of the pro forma calculations in this Proxy Statement, the pre-May 10, 1973 exchange ratio of 0.137553 is used.

Per share amounts are based on the average number of shares of Banner's Common Stock and the average number of shares (excluding treasury shares) of Amax Common Stock outstanding during each period. Amax per share pro forma amounts are given on the alternate assumptions that (a) all and (b) none of the shares of Amax Series A Convertible Preferred Stock is converted. Until conversion, holders of the Amax Series A Convertible Preferred Stock are entitled only to fixed dividends. Accordingly, pro forma amounts per share of Banner are given only on the assumption that all shares of Amax Series A Convertible Preferred Stock are converted. See "Dividends" below for information regarding the pro forma dividend per share of Banner Common Stock assuming no conversion of Amax Series A Convertible Preferred Stock. The Banner pro forma per share figures represent Amax's pro forma combined

BUSINESS AND PROPERTIES OF BANNER

Banner was incorporated in Nevada in 1935 to engage in the business of mining copper. Since 1964, Banner has been primarily engaged in holding, exploring for and developing mineral properties, and its income has been primarily derived from advanced and production royalties, payments under a custom mining and milling contract, and sales of mineral properties under contracts of sale and lease option agreements.

ANACONDA LEASE

Banner's principal mineral properties are located in the Twin Buttes, Mineral Hill and Helvetia areas of Pima County, Arizona, 15 to 25 miles south of Tucson. These properties are leased to Anaconda under a long-term lease agreement dated March 1, 1963, as amended (the "Lease"). Payments to Banner under the Lease have been Banner's principal source of revenue since 1968. See "The Lease — Payments to Banner". Banner is not entitled to control or direct the operations covered by the Lease. No assurance can be given that such operations will produce a profit with resulting production royalty payments to Banner.

The Lease

Term. Anaconda has a leasehold interest in all of Banner's Pima County mineral properties for an initial term of 60 years expiring in 2024, with options to extend the lease for as long thereafter as is necessary to exhaust the mineral deposits located on the properties. The Lease also covers any other mineral properties acquired by either Banner or Anaconda which are located in the vicinity of the properties initially covered, under specified conditions. Anaconda may terminate the Lease as to any portion of the properties at any time by giving Banner not less than 120 days' notice. Any termination as to any significant portion of the leased property is considered by Banner to be unlikely in view of Anaconda's substantial investment in the properties. The Lease may be terminated by Banner after notice upon Anaconda's bankruptcy or its default in making any payment required to be made thereunder, but as to any other default by Anaconda, Banner's relief is limited to court action for damages and equitable relief.

Payments to Banner. Advanced royalties (payments agreed to be made in advance of the production of minerals) aggregating approximately $11,455,000 were paid to Banner from 1965 through 1971 pursuant to the Lease, and were Banner's principal source of revenue for the years 1969 through 1971. No advanced royalties were payable after 1971 when production royalties became Banner's sole source of revenue under the Lease. See Banner Statement of Income.

The Lease provides for the payment to Banner of a production royalty (less the deductions described in the next paragraph) equal to 55% of the net profits, if any, from operations under the Lease as determined under accounting rules specified in the Lease. See "Lease Accounting" below. A production royalty is earned by Banner in any year in which the operations result in net profits as so determined, and is payable on February 28 of the succeeding year. See Banner Statement of Income and Note (1) thereto concerning Banner's policy as to the recognition of income from production royalties.

For each year through 1978, the first $1,750,000 ($954,109 in 1978) of Banner's production royalty, if any, for such year is to be paid to Banner. The excess, if any, of the production royalty over that amount is first to be applied by Anaconda to pay specified amounts to Anaconda and the unused portions of the production royalty is then to be paid to Banner. These amounts to be paid to Anaconda after December 31, 1972 aggregated approximately $8,587,000 and consisted of $595,000 for advanced royalties paid to Banner under the Lease and not yet repaid, $4,403,000 for principal and accrued interest on loans made to Banner under the Lease, and $3,589,000 for Banner's share of cumulative net losses from operations under the Lease (as defined). See Banner Statement of Income. After 1978,

deductions on account of such amounts are to be made without provision for a minimum production royalty payment to Banner, except that if production royalties are to be applied by Anaconda to repay the principal of loans made to Banner under the Lease, Banner will first receive an amount equal to its estimated federal and Arizona income tax liability on the amount of the production royalty so applied to such repayment.

Advanced royalties and loans (together with interest thereon) received by Banner pursuant to the Lease and Banner's 55% share of any losses incurred in the operations covered by the Lease are recoverable by Anaconda only out of future production royalties, except that any then unpaid loans (together with interest thereon) must be repaid in 10 equal annual instalments upon expiration or termination of the Lease.

There is set forth below certain unaudited financial information concerning operations under the Lease since 1969 prepared from information supplied to Banner and Amax by Anaconda. Anaconda has advised that the information supplied has been prepared by Anaconda in accordance with the accounting rules specified in the Lease as described under "Lease Accounting" below.

	Year Ended December 31,		
	1970	1971	1972
Net Sales	$69,676,320	$55,510,206	$80,056,790
Miscellaneous income and (expense) net	(2,528)	54,830	(53,957)
	69,673,792	55,565,036	80,002,833
Cost of sales, excluding item shown separately below (1)	$32,473,215	$43,769,799	$56,728,290
Amortization of property-acquisition costs(2)	17,331,383	18,320,124	18,770,442
	49,804,598	62,089,923	75,498,732(3)
Income (loss) for royalty computation purposes	$19,869,194	$(6,524,887)	$ 4,504,101(3)

(1) Inventories are valued at cost (which is lower than market) using the last-in, first-out method. Amounts of opening and closing inventories used in the computation of cost of sales for the years shown were as follows:

January 1, 1970	$ 3,737,246
December 31, 1970	14,859,044
December 31, 1971	15,668,975
December 31, 1972	15,165,573

(2) In accordance with the terms of the Lease, property-acquisition costs are amortized using the straight-line method over the period which ends December 31, 1981. See "Lease Accounting" below.

(3) In 1972 costs were reduced, and income for royalty computation purposes was increased, by $2,023,364 as a result of the settlement of certain claims against an equipment manufacturer.

The loss in 1971 was attributable to declining copper prices, lower copper assay content of ore processed, a four week industry wide strike and a five week shutdown due to smelter machinery breakdowns and restrictions on shipments of concentrates to smelters because of state and federal environmental regulations limiting smelting activities.

Lease Accounting. Annual net profit or net loss under the Lease is determined by deducting from gross receipts for such year all costs and charges incurred by Anaconda attributable to lease operations for such year together with the additional deductions referred to below. Specified items, including income taxes, percentage depletion allowances and royalties paid to Banner, are not deducted

in the computation. In addition, no deduction is to be made for interest applicable to the general financing of the operations under the Lease. "Property-acquisition costs", which include substantially all capital and deferred expenditures of Anaconda made in connection with Lease properties or operations until the Twin Buttes mine commenced commercial production on November 1, 1969, are amortized in determining net profit or loss. So long as Twin Buttes remains the only producing mine, property-acquisition costs incurred or to be incurred in respect thereof by Anaconda are being amortized over a period of 12 years which commenced on January 1, 1970. The amount of such unamortized deferred costs was $186,334,745 at December 31, 1972. In the event of commencement of production of minerals in commercial quantities from an additional mine on the leased properties, unamortized accumulated property-acquisition costs are to be allocated and reallocated among all mines in a fair and reasonable manner and then amortized with respect to each mine over a period of 12 years or the expected life of such mine, whichever is shorter.

Processing. To date, all sulphide ores produced from the Twin Buttes mine have been treated there by Anaconda. Under the Lease Anaconda may from time to time enter into smelting and refining contracts for the treatment of ores and concentrates produced from operations covered by the Lease on the best terms and conditions that are available, taking into account transportation costs. All copper and other metals produced from operations under the Lease are to be marketed by Anaconda. Copper is required to be sold at the domestic producer's price then prevailing for electrolytic copper delivered to destinations in the United States, determined as provided in the Lease. Other metals and mineral products are required to be sold at the best available prices. See "Competition, Environmental and Other Factors" below for information concerning copper prices.

Curtailment of Production. If Anaconda decides to curtail production at its domestic copper operations because of relative oversupply or lack of demand for copper or copper products, production from operations covered by the Lease is not to be curtailed to an extent materially greater than at Anaconda's other domestic operations. In no event, however, is Anaconda required to conduct operations under the Lease at a net loss (as defined).

Disputes with Anaconda

Management of Banner believes that Anaconda has not fulfilled its obligations to Banner under the Lease and there are now a number of unresolved disputes between Banner and Anaconda. These disputes involve, among other things, Banner management's dissatisfaction with Anaconda's planning, design, development and operation of the Twin Buttes mine which they believe has not been in conformity with the Lease, Anaconda's failure to construct and equip oxidized ore treatment facilities, and Anaconda's failure to develop Banner's other Pima County properties, as well as disputes concerning the computation of royalty income and the furnishing to Banner of full information concerning Anaconda's operations under the Lease. Anaconda has informed Banner's management that it disagrees with these contentions and believes it has fully performed all its obligations under the terms of the Lease. In the event the Merger is not consummated, Banner will attempt to settle these disputes and also to work out with Anaconda a plan for the development of the Lease properties. If an agreement acceptable to Banner could not be reached, Banner might be required to protect its rights by litigation. Although no assurance can be given as to the outcome of any such litigation, or as to the type and effect of the relief which might be obtained, Banner believes that if such litigation were successful, the relief which might be obtained could be significant. The Board of Directors of Banner took Banner's claims against Anaconda and the potential financial and other effects thereof into account when approving the Merger.

Properties Leased to Anaconda

The leased properties comprise approximately 10 square miles in the Twin Buttes area, 11 square miles in the Mineral Hill area and nine square miles in the Helvetia area.

During the term of the Lease, Anaconda is required to pursue a systematic program of exploration and development of the properties covered by the Lease for the purpose of increasing ore reserves and

to engage in mining, milling, leaching or other processes for treating commercially profitable ores from such properties. The Lease provides that Anaconda shall not as a policy treat the ore reserves on the leased properties as a reserve to be held in reserve for some distant exploitation.

The leased properties contain sulphide and oxidized copper ores. These ores also contain small quantities of molybdenum and silver. The Lease requires Anaconda to bring into production in an orderly manner and consistent with sound business practice such commercially profitable sulphide orebodies as it shall have developed. The Lease also requires Anaconda to treat oxidized copper ores if Anaconda shall have determined, considering all of the facts and circumstances existing at the time, that such treatment will provide a fair return and be a reasonably prudent investment.

Twin Buttes Mine. Anaconda began the development of the Twin Buttes open pit mine in 1965, and it reached the producing stage on November 1, 1969. By that date approximately 270,304,650 tons of overburden and waste were removed in preparation for mining, and Anaconda had expended approximately $200,000,000 to bring the Twin Buttes mine to the producing stage and to purchase, construct and install milling and related facilities and equipment.

Milling of sulphide ore containing principally copper and lesser amounts of molybdenum and silver began in late 1969 and produces a copper concentrate and a molybdenum concentrate. Copper concentrate produced in the milling process is normally shipped by rail to smelting facilities owned by others at two locations in Arizona for smelting to produce anodes and blister copper which is later electrolytically refined and made into copper wirebars of high quality. Molybdenum concentrates are sold by Anaconda without further refining. Anaconda has mined and stockpiled large tonnages of oxidized copper bearing ores.

There is set forth below certain information concerning concentrating activities at Twin Buttes prepared from information supplied to Banner and Amax by Anaconda.

	November and December 1969	Year Ended December 31, 1970	1971	1972
Tons of ore processed	1,030,654	8,975,192	7,666,009	10,738,748
Average total copper assay content of ore processed*	1.008%	1.236%	0.988%	0.975%
Average concentrator recovery*	67.75%	80.01%	71.72%	75.50%
Net tons of copper concentrates produced at mill	20,559	285,023	175,280	276,903
Net tons copper contained in concentrates produced at mill	6,787	87,876	53,331	77,860

* Ore processed also contained an average of .02 to .04% molybdenum. The silver content of the ore is contained in the copper concentrate and is recovered in the refining process. The concentrating facility is designed to produce copper concentrates from sulphide ore and not oxidized ore. Ore processed in the facility includes some mixed oxidized and sulphide ore, most of the oxidized copper assay content of which is not recovered.

Information below concerning sales of refined copper from ores mined at Twin Buttes has been prepared from information supplied to Banner and Amax by Anaconda. No sales were made in 1969.

	Year Ended December 31, 1970	1971	1972
Pounds of refined copper sold	89,589,134	104,079,243	151,032,204
Average sales price per pound refined copper	$0.581	$0.514	$0.509
Gross sales of refined copper and copper concentrates*	$72,347,848	$53,447,773	$76,887,027

* In 1970 includes $20,300,887 attributable to the sales of concentrates containing 36,818,164 pounds of copper. Gross sales of refined copper and copper concentrates do not reflect sales of molybdenum concentrates, gold and silver which amounted to $1,380,964, $2,937,592 and $4,426,630, for the years ended December 31, 1970, 1971 and 1972, respectively.

See the text following the table under "The Lease — Payments to Banner" for information regarding the decline in sales in 1971.

Mineral Hill. The Mineral Hill area, which includes the Palo Verde, Daisy, and Mineral Hill mines, is known to contain substantial mineralization, and Banner conducted extensive drilling in the Palo Verde portion. See "Reserves and Related Matters". Anaconda has not commenced development of a mine in the Mineral Hill area. The Palo Verde property is immediately adjacent to the Mission Mine of Asarco. See "The Amax-Anaconda Arrangements" concerning possible development of this property.

The Palo Verde portion of the Mineral Hill area consists of approximately 208 acres under two mineral leases from the State of Arizona to Banner, both of which expire in 1974. The lessee, under a state mineral lease, is entitled to preferential right of renewal of the lease if it has been maintained in good standing, but no assurance can be given that such lease will be renewed. Since 1964, Anaconda has had the obligation to maintain these leases in good standing, except for the payment of annual rents which have been made by Banner.

Banner formerly conducted underground (as opposed to open pit) mining operations in the Mineral Hill area, but ceased all mining operations there in 1963.

Helvetia. Prior to 1963, drilling by Banner disclosed the existence of mineralization in the Helvetia properties. Anaconda has since then engaged in extensive drilling and related exploratory work on the Helvetia properties and has further established the existence of substantial mineralization. See "Reserves and Related Matters". Anaconda has not commenced the development of a mine and surface facilities on the Helvetia properties and has advised Banner that it is continuing geologic and economic evaluation of such a development.

Substantially all of the Helvetia properties are held by Banner under agreements with owners that require Banner to make purchase payments annually to hold the properties. As of December 31, 1972 $2,933,765 had been paid on these properties, leaving a balance of $3,811,481 to be paid in order to acquire full ownership. By the provisions of the Lease, Anaconda is required under certain conditions to make the Helvetia payments and has made them since January 1, 1965. These payments by Anaconda aggregate $2,804,790. Helvetia payments made by Anaconda are "property-acquisition costs" under the Lease and the resulting amortization of these costs affects Banner's receipts as described above under "Anaconda Lease — The Lease — Payments to Banner".

General. The mineral properties which are subject to the Lease consist principally of patented and unpatented mining claims and mineral leases of state-owned land. While Banner has not warranted title to Anaconda as to the properties covered by the Lease, Banner is unaware of any material title defects pertaining to such properties. Titles to Banner's unpatented mining claims are subject to the risks and conditions normally attendant upon ownership of that type of claim, some of which could arise from circumstances of which Banner may not be aware. Titles to patented mining claims are held under United States mineral patents. The terms of mining leases on lands belonging to the State of Arizona are 20 years. See the statement above, in connection with the Palo Verde leases, with reference to the renewal of such leases.

Reserves and Related Matters

Anaconda has supplied Banner and Amax with the following ore reserve information:

Summarized below are the most recent estimates by Anaconda's Twin Buttes Mine Staff of ore reserves on the properties Anaconda has leased from Banner. The estimates represent interpreta-

tions by Anaconda's professional personnel of factual data such as drilling logs, core samples and assays, all of which data Anaconda has made available to Banner as it was accumulated and to Amax during the course of the latter's investigation of the properties. Information of this nature, however, is subject to differences of interpretation, analysis and value judgments. Anaconda is continuing exploration and development work on these properties. Although the results of this work cannot be predicted, it will undoubtedly lead to revisions in these estimates, and it may reveal the presence of additional quantities of copper mineralization.

Mining reserves at Twin Buttes are estimated to be approximately 447,000,000 tons of sulphide ore with an average grade of 0.63% copper and 0.03% total molybdenum and approximately 55,000,000 tons of oxide ore with an average grade of 1.20% total copper (0.82% acid soluble).

The foregoing reserve estimate represents tonnages that may be excavated and treated under several alternative mining plans Anaconda and Amax are jointly considering. The sulphide ore reserve was calculated using a 0.2% copper cutoff and includes materials too low in grade to be mined separately but containing sufficient copper to be treated if removed from the mine in order to expose higher grade ore. The oxide ore reserve was calculated at a cutoff grade of 0.6% total copper. It is estimated that approximately 68% of the total copper content of the oxide ore is acid soluble and subject to recovery in the oxide sulfuric acid leaching plant now planned for construction at Twin Buttes. Approximately 21,000,000 tons of this higher grade oxide ore have been mined and stockpiled on the surface. In addition to the oxide ore referred to above, the mining plans provide for the excavation of an additional 28,000,000 tons of oxide material with an average grade of 0.49% total copper, calculated at a cutoff grade of 0.4% total copper. Although this oxide material is too low in grade to be considered mill feed for the proposed oxide plant at this time, depending upon operating costs, market conditions or other factors, it may well be treated at a later time. Not all of the copper contained in the sulphide and oxide ores to be mined will be recovered because of normal operational and metallurgical losses.

In addition to the above ore reserves, widely spaced drill hole intercepts and other geological work in the Twin Buttes mineral zone provide the basis for an estimate that there may be approximately 300,000,000 tons of mineralized material with an average grade of 0.8% total copper (above a cutoff of 0.4% total copper) both below and outside the lateral limits of the joint mining plans being considered. Some of this material is contained in small pockets located up to several thousand feet from the boundaries of the mining plans and some of it is at such great depths that extraction could only be by underground mining methods, which are more expensive than the open pit operations now being utilized and may not be economically feasible. The drill hole intercepts also indicate the presence of substantial additional tonnages of copper bearing material too low in grade to be mined separately but containing sufficient copper to be treated to the extent such material might have to be removed in order to expose higher grade material. Whether any of this material can be mined at some future date will depend on further geological work, development of viable mining plans, metallurgical and other technological advances, market conditions and other factors.

Drilling and other exploration work have indicated the presence at Palo Verde (Mineral Hill) of approximately 95,000,000 tons of sulphide material with an average grade of 0.74% copper, calculated using a 0.35% copper cutoff, and at the Helvetia properties of approximately 320,000,000 tons of sulphide material with an average grade of 0.64%, calculated using a 0.3% copper cutoff, approximately 20,000,000 tons of oxide material with an average grade of 0.55% acid soluble copper, calculated using a 0.3% soluble copper cutoff, and, in another mineralized zone about two miles from the foregoing, approximately 23,000,000 tons of mixed oxide-sulphide material averaging 0.75% copper, calculated using a 0.4% copper cutoff. Whether any of this material may at a future date be classified as ore reserves depends upon additional exploration, acquisition

of necessary surface land rights (much of the Helvetia area is in a national forest and such acquisition may present special problems), development of viable mining plans, market conditions and other relevant factors.

In addition to the foregoing properties, the land covered by the Lease includes areas of exploratory interest as to which exploration either has not been undertaken or has not been completed.

Amax has conducted an investigation of Banner's Pima County properties, including core drilling and a review of geologic, financial and other records. Amax has advised Banner that the core drilling and other work performed by it in its investigation at Twin Buttes has been intended to enhance the degree of confidence Amax has in estimates of ore reserves developed by it from data supplied by Anaconda and to assist it and Anaconda in the development of plans for mining operations and expansion at Twin Buttes. On the basis of such work and information, Amax concurs generally in the foregoing information from Anaconda concerning ore reserves and mineralized material at Twin Buttes, but it has in its own planning and analysis of the Merger estimated that the average grade of sulphide ore in the Twin Buttes reserves is 0.67% (rather than 0.63%) sulphide copper, and it has not made an estimate of the tonnage of ore grade material below and outside the lateral limits of the joint mining plans being considered for Twin Buttes, although it believes this tonnage to be substantial.

Other Properties and Assets

In addition to Banner's properties leased to Anaconda, Banner holds interests in mineral properties in Greenlee and Pinal Counties, Arizona, and Mineral and Clark Counties, Nevada. None of these properties has been fully explored, and their present values do not represent a material part of the assets of Banner.

In 1967 mineral properties in Lordsburg, New Mexico, formerly mined by Banner, were leased with an option to purchase for $700,000. At December 31, 1972, the unpaid balance to exercise the option and complete the purchase was $223,230. This amount is payable to Banner in quarterly installments of not less than $20,000. Banner's mineral properties in Elko County, Nevada were sold in 1969 for $420,000. At December 31, 1972, a balance of $230,000 was owed to Banner by the purchaser payable in monthly installments of not less than $3,000. Both the Lordsburg and Elko contracts provide for production royalties which are to be credited against (and may not exceed) the unpaid balance of the purchase price.

Banner's general offices are located in a 15,000 square foot office building in Tucson, consisting of 8,000 square feet of office space and 7,000 square feet of under roof parking, purchased by Banner in 1971 for $137,500 and renovated at a cost of $44,800.

Banner has been engaged in research aimed towards the discovery of new and different processes for treatment of low grade mineral ores, particularly copper concentrates and oxidized copper ores in limestone gangues. In connection with this research Banner has established a research center and pilot mill for the study and development of these processes. It has invested approximately $550,000 in such facilities. None of these processes has been used commercially. While Banner's research has resulted in the filing of patent applications and the issuance of some patents, its business and prospects are in no way dependent upon any patent or group of patents.

Employee Relations

Banner has approximately 20 full-time employees and considers its relations with such employees to be satisfactory. Banner's business is directly affected by Anaconda's employee relations at the facilities covered by the Lease. Anaconda is a party to a collective bargaining agreement with several unions, which expires in 1974. A significant work stoppage was experienced by Anaconda in 1971.

September 24, 1974

MEMO TO: T. W. Mitcham

FROM: John E. Kinnison

SUBJECT: Arizona Copper Resources; Mega-Districts

The attached "total resource" tabulation may be of interest in future discussion or consideration of current efforts in the Miami and Safford regions. I define the "total resource" of a deposit as its past production plus reserves, and prefer to report this in pounds of copper. The three major Arizona copper resource "centers", by this definition are:

Morenci-Safford
Ray-Miami
Pima-Rosemont.

Data for reserves here presented derive in some instances from published or at least publicly quoted tonnage and grade, but in other cases the figures are my own estimates and/or reliable private information. A reduction for unusual losses which probably will be encountered in leach operations, or which are estimated to be probable for other reasons, has been incorporated in my calculations. Normal milling loss (7-15%) has not, however, been deducted. It is probable, actually, that the reserves presented are conservative.

Past production (through 1970) has been accurately compiled from published data.

The three districts tabulated herein are the largest in Arizona. Individual deposits in the plus-6 billion pounds category occur in several other districts, but only the three regions tabulated have such a large combined copper concentration.

JEK/mk
Att. (1)
cc:Doug Martin

John E. Kinnison

ARIZONA MAJOR COPPER RESOURCES

TOTAL RESOURCES

District	Deposit	Production Through 1970 Bill.lbs. Cu	Estimated Reserves Bill.lbs.Cu	Total Bill.lbs.Cu
Morenci-Safford	Lonestar		6.545	
	Metcalf		8.000	
	Morenci	8.382	6.400	
	Safford (PD)		8.100	
	Sanchez		.388	
	San Juan		.150	
	Total	8.382	29.583	37.965
Ray-Miami	Bluebird	.020	.468	
	Cactus		.200	
	Castle Dome	.257		
	Chilito		.416	
	Christmas	.214	.229	
	Copper Cities	.665	.495	
	Diamond-H		.110	
	Inspiration/Red Hill	3.945	1.300	
	Magma	1.693	1.163	
	Miami	2.500		
	Miami East		2.525	
	Old Dominion	.850	.504	
	Ox Hide	.021	.066	
	Pinto Valley		3.150	
	Ray	4.150	12.100	
	Total	14.315	22.726	37.041
Pima-Rosemont	Esperanza	.533	.510	
	Helvetia		.480	
	Mission-Pima	1.822	7.300	
	Palo Verde		1.826	
	Rosemont		3.360	
	San Xavier		1.060	
	Sierrita	.067	2.800	
	Twin Buttes	.198	6.600	
	Total	2.620	23.936	26.556

file copy

J. J. Durek
Oakland, California

June 30, 1972
Revised February 1, 1973
John E. Kinnison
Tucson, Arizona

File
Blue

Arizona Copper Resources;
Production and Reserves

I have reviewed past copper production, using various sources, and compiled production data tabulated on the attached sheets. I believe these figures are reasonably accurate, with only minimal record gaps which were easily estimated. The data herein transmitted supercedes that of my earlier memo (6/30/72) and incorporates corrected production figures for Ajo, Inspiration, Mission, and Morenci. These changes are minor, and were reported to you in my memo of 1/24/73. Attachments C and D have been somewhat regrouped to indicate current properties which are on-stream. The small reserve at Turquoise has been deleted from Attachment A, and its geographical neighbor, Johnson Camp, remains unlisted.

Reserves as tabulated have been carefully screened, and although some of the figures are from second-hand private sources, I am reasonably confident that no great errors are incorporated. Reserves which stem from published data are undoubtedly understated in some cases. A few reserve estimates such as Poston Butte, may eventually be determined to be exaggerated, even though I have applied a reduction for unusual losses. The "total copper (in lbs.)" figures are based directly on tonnage vs. grade without reduction for normal milling loss. All heap leach reserves, however, have been reduced due to above-normal processing loss. An estimated reduction has also been applied to reported block-cave tonnages which appear to be "rough estimates," not worked out according to a mining plan, and which may suffer loss during extraction.

DESCRIPTION OF ATTACHMENTS

Attachment A is a summary based on geographic location, and is of interest to the extent that the major centers of mineralization in Arizona are indicated. I will not comment further at this time; however, I hope that this and like compilations may assist our thoughts on exploration. A general geologic map has been previously forwarded which shows the location of all deposits.

Attachment B is a simple reference list indicating ownership of the deposits herein tabulated.

Attachment C is a straight forward summary of operating properties' production and reserves (including some which are mined out). I should note that in addition to those deposits of the "porphyry copper" type, I have tabulated two major veins (Magma and Old Dominion) and the pre-Cambrian Jerome district.

ARIZONA MAJOR COPPER RESOURCES

District	Deposit	Production Through 1970 Bill.lbs. Cu	Estimated Reserves Bill.lbs.Cu	Total Bill.lbs.Cu
Ajo	Ajo	3.517	2.800	6.317
Bagdad	Bagdad	.561	3.593	4.154
Bisbee	Copper Queen	6.152	.200	
	Lavender	1.083	.060	
	Sacramento	.437		
	Total	7.672	.260	7.932
Bradshaw	Copper Basin		.560	
	Pine Flat		.200	
	Jerome	3.617		
	Total	3.617	.760	4.377
Cerbat	Mineral Park	.302	.592	.894
Morenci-Safford	Lonestar		6.545	
	Metcalf		8.000	
	Morenci	8.382	6.400	
	Safford		8.100	
	Sanchez		.388	
	San Juan		.150	
	Total	8.382	29.583	37.965
Pima-Rosemont	Esperanza	.533	.510	
	Helvetia		.480	
	Mission-Pima	1.822	7.300	
	Palo Verde		1.826	
	Rosemont		3.360	
	San Xavier		1.060	
	Sierrita	.067	2.800	
	Twin Buttes	.198	6.600	
	Total	2.620	23.936	26.556
Ray-Miami	Bluebird	.020	.468	
	Cactus		.200	
	Castle Dome	.257		
	Chilito		.416	
	Christmas	.214	.229	
	Copper Cities	.665	.495	
	Diamond-H		.110	
	Inspiration/Red Hill	3.945	1.300	
	Magma	1.693	1.163	
	Miami	2.500		
	Miami East		2.525	
	Ox Hide	.021	.066	
	Pinto Valley		3.150	
	Ray	4.150	12.100	
	Total	13.465	22.222	35.687

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District	Deposit	Production Through 1970 Bill.lbs. Cu	Estimated Reserves Bill.lbs.Cu	Total Bill.lbs.Cu
Sacaton-Poston Butte	Blackwater		.800	
	Poston Butte		3.500	
	Sacaton		.730	
	Total		5.030	5.030
San Manuel-Copper Creek	Kalamazoo		8.136	
	San Manuel	2.330	5.600	
	Old Reliable		.024	
	Total	2.330	13.760	16.090
Silver Bell	Silver Bell	.694	1.120	1.814
Slate-Vekol	Lakeshore		6.608	
	Reward		.900	
	Total		7.508	7.508
	GRAND TOTAL	43.160	111.164	154.324

SOME ARIZONA COPPER DEPOSITS' OWNERSHIP

Mine or Deposit	Company
Ajo	Phelps Dodge Corporation
Bagdad	Bagdad Copper Corporation
Blackwater	Duval Corporation
Bluebird	Ranchers Exploration and Development Corp.
Cactus	Cities Service Minerals Corporation (Miami Copper)
Chilito	Kennecott Copper Corporation
Christmas	Inspiration Consolidated Copper Company
Copper Basin	Phelps Dodge Corporation
Copper Cities	Cities Service Minerals Corporation (Miami Copper)
Copper Creek	Newmont Exploration Ltd.
Copper Queen	Phelps Dodge Corporation
Diamond-H	Cities Service Minerals Corporation (Miami Copper)
Dragoon (or Johnson Camp)	Cyprus Mines Corporation - Superior Oil Company
Esperanza	Duval Corporation
Inspiration	Inspiration Consolidated Copper Company
Kalamazoo	Newmont Exploration Ltd.
Lakeshore	Hecla Mining Company
Lavender	Phelps Dodge Corporation
Lonestar	Kennecott Copper Corporation
Magma	Magma Copper Company
Metcalf	Phelps Dodge Corporation
Miami	Cities Service Minerals Corporation (Miami Copper)

Mine or Deposit	Company
Mineral Park	Duval Corporation
Mission	American Smelting and Refining Company
Morenci	Phelps Dodge Corporation
Old Reliable	Ranchers Exploration and Development Corp.
Ox Hide	Inspiration Consolidated Copper Company
Eisenhower (Palo Verde)	Anaconda Company
Helvetia (Peach or Elgin deposit)	Anaconda Company
Pima	Pima Mining Company
Pine Flat	?
Pinto Valley	Cities Service Minerals Corporation (Miami Copper)
Poston Butte	Continental Oil Company
Ray	Kennecott Copper Corporation
Red Mountain	Kerr McGee Corporation
Reward	Newmont Exploration Ltd. - Superior Oil Company
Rosemont	Anaconda Company
Sacaton	American Smelting and Refining Company
Safford	Phelps Dodge Corporation
Sanchez	Inspiration Consolidated Copper Company
San Juan	Producers Mining Corporation
San Manuel	San Manuel Copper Company
San Xavier	American Smelting and Refining Company
Sierrita	Duval Corporation
Silver Bell	American Smelting and Refining Company
Turquoise	Union Oil Company of California
Twin Buttes	Anaconda Company

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S U M M A R Y

OPERATING ARIZONA COPPER PROPERTIES
PRODUCTION AND RESERVES

Mine	Starting Date	Production Through 1970 Bill.lbs. Cu	Estimated Reserves	Total
Ajo	1917	3.517	2.800	6.317
Bagdad	1938	.561	3.593	4.154
Bisbee: Copper Queen*	1880	6.152	.200	6.352
Lavender	1954	1.083	.060	1.143
Sacramento	1923	.437	Mined out 1931	.437
Bluebird	1968?	.020	.468	.488
Castle Dome	1943	.257	Mined out 1953	.257
Christmas	1905	.214	.229	.443
Copper Cities - Diamond H	1954	.665	.605	1.270
Esperanza	1959	.553	.510	1.063
Inspiration	1915	3.945	1.300	5.245
Jerome (United Verde and U.V.X.)	1888	3.617	Mined out 1953	3.617
Lakeshore	Under development		6.608	6.608
Magma	1911	1.693	1.163	2.856
Miami	1910	2.500	Mined out 1958	2.500
Mineral Park	1964	.302	.592	.894
Mission	1961	.869	5.140	6.009
Morenci-Metcalf	1872	8.382	14.400	22.782
Old Dominion	1881	.850	Mined out 1931	.850
Ox Hide	1969	.021	.066	.087
Pima	1955	.953	2.700	3.653
Pinto Valley	Under development		3.150	3.150
Ray	1905	4.150	12.100	16.250

*Includes all underground production from Bisbee district.

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Mine	Starting Date	Production Through 1970 Bill.lbs. Cu	Estimated Reserves	Total
Sacaton	Under development		.730	.730
San Manuel-Kalamazoo	1956	2.330	13.736	16.066
San Xavier North	Under development		.520	.520
Sierrita	1969	.067	2.898	2.965
Silver Bell	1954	.694	1.120	1.814
Twin Buttes	1969	.198	6.600	6.798
	TOTAL	44.030	81.288	125.318

CLASSIFICATION
ARIZONA COPPER RESERVES

HIGH-GRADE RESERVES AT OPERATING MINES

Mine or Deposit	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Ajo	175	.8%Cu	2.800
Bagdad	50	.6	.600
Copper Queen	-	-	.200
Inspiration, Live Oak	50	.7	.700
Red Hill	50	.6	.600
Lakeshore (Under development)	472	.7	6.608
Lavender	-	-	.060
Magma	10.2	5.7	1.163
Metcalf (Under Development)	500	.8	8.000
Mission, Tactite	40	.75	.600
Argillite	50	.6	.600
North Extension	20	1.0	.400
San Xavier, Tract II	30	.9	.540
Morenci	400	.8	6.400
Ray, Sulphide	500	.85	8.500
Silicate	200	.9	3.600
Sacaton (Under development)	48	.76	.730
San Manuel, Original	400	.7	5.600
Kalamazoo	565	.72	8.136
Silver Bell	80	.7	1.120
Twin Buttes	550	.6	6.600
	TOTAL		63.557

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LOW GRADE RESERVES AT OPERATING MINES

	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Bagdad, Low Grade, Phase 1	215	.51%Cu	2.193
Low Grade, Phase 2	100?	.4	.800
Bluebird	75	.52	.468*
Christmas	22	.52	.229
Copper Cities	45	.55	.495
Diamond H	10	.55	.110
Esperanza	50	.51	.510
Mineral Park	58	.51	.592
Mission, Low Grade	300	.5	3.000
Old Reliable (Under development)	4	.5	.024*
Ox Hide	10	.55	.066*
Palo Verde (Eisenhower)**	163	.56	1.826
Pima	300	.45	2.700
Pinto Valley (Under development)	350	.45	3.150
San Xavier North (Under development)	51	.51	.520
Sierritta	400	.35	2.898
		TOTAL	19.581

*Includes reduction for unusual losses, as shown by master list.

**Here classified with operating properties due to side-line mining agreement between Mission (Asarco) and Palo Verde (Anaconda), but not listed as operating property on Att. C.

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HIGH GRADE AT NON-OPERATING PROPERTIES

Mine or Deposit	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Copper Basin	50	.7%Cu	.560
Helvetia (Peach or Elgin deposit)	30	.8	.480
Miami East	110	1.35	2.525
Reward	75	.6	.900
Rosemont	280	.6	3.360
Safford (P.D.)	450	.9	8.100
	TOTAL		15.925

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LOW GRADE AT NON-OPERATING PROPERTIES

	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Blackwater	200	.4%Cu	.800*
Cactus	20	.5	.200
Chilito	65	.4	.416*
Dragoon (or Johnson Camp)	100	.5	1.000
Lonestar	700	.55	6.545*
Pine Flat	25	.4	.200
Poston Butte	500	.5	3.500*
Sanchez	75	.37	.388*
San Juan	15	.5	.150
Turquoise	10	.5	.100
	TOTAL		13.299

* Includes reduction for unusual losses, as shown by master list.

ESTIMATED ARIZONA COPPER RESERVES
DATA SHEETS

Mine or Deposit	Reduction**	Ore Mill Tons	Grade	Copper*** Bill.lbs.	Comments
Ajo		175	.8%Cu	2.800	Operating pit, pri sulph.
Bagdad		50	.6	.600	Operating pit, pri sulph & oxide leach.
Low-grade Phase 1		215	.51	2.193	Primary available to pit.
Phase 2		100?	.4	.800	Primary available to pit.
Blackwater	50%	200	.4	.800	Marginal or sub-marginal oxide deposit. Tonnage questioned.
Bluebird	40%	75	.52	.468	Published. Operating pit-leach.
Cactus		20	.5	.200	Sub-marginal deposit, chalcocite, available to pit.
Chilito	20%	65	.4	.416	Sub-marginal.
Christmas		22	.52	.229	Operating pit, pri sulph in tac-
Low-grade		850*	.4	---*	tite. Tonnage highly questionable.
Copper Basin	20%	50	.7	.560	Slightly enriched--available to pit.
Copper Cities		45	.55	.495	Operating pit, pri sulph and some chalcocite.
Copper Creek		?	.55	---	Deep pri sulph.
Copper Queen		-	-	.200	Operating underground, 4-yr. proj 72-75, end of life.
Diamond-H		10	.55	.110	Operating pit, adjoins Copper Cities.
Dragoon (or Johnson Camp)		100	.5	1.000	Pri sulph in tactite.
Esperanza		50	.51	.510	Tonnage/grade questioned. Recent production .42%Cu.
Inspiration, Live Oak		50	.7	.700	Live Oak - thornton pit areas, tonnage questioned.
Red Hill		50	.6	.600	Adjacent to Live Oak pit, planned new pit expansion.
Kalamazoo		565	.72	8.136	Eventual block cave.
Lakeshore		472	.7	6.608	Oxide, sulph, avail to open pit. High-grade tactite, U.G. mine.

* Too questionable to include in totals.
** Reduction due to estimated unusual losses.
*** Includes % reduction as shown.

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Mine or Deposit		Reserves Ore Mill Tons	Grade	Copper*** Bill.lbs.	Comments
Lavender		-	-	.060	End of mine 1972.
Lonestar	15%	700	.55	6.545	Grade questionable--either up or down. Mixed oxide-sulph in part Cc enriched.
Magma		10.2	5.7	1.163	Operating underground, 2000 tpd. New reserves permit increase in capacity to 3,000 tpd in 1974. Pri sulph.
Metcalf		500	.8	8.000	Potential pit and block cave, Cc ore.
Miami East	15%	110	1.35	2.525	Deep, block cave potential. Faulted segment of old Miami Cc ore body.
Mineral Park		58	.51	.592	Operating pit, Ccore, enrichment weak.
Mission, Tactite		40	.75	.600	Operating pit, pri sulph in tac-
Argillite		50	.6	.600	tite and argillite. Low-grade
Low-grade		300	.5	3.000	reserve is JEK guess.
North extension		20	1.0	.400	
Morenci		400	.8	6.400	Operating pit, Cc.
Old Reliable	40%	4	.5	.024	Planned in-place leach of Bx pipe in Copper Creek dist.
Ox Hide	40%	10	.55	.066	Operating pit, heap leach.
Palo Verde (Eisenhower)		163	.56	1.826	Adjacent to Mission. Potential pit.
Helvetia (Peach of Elgin deposit)		30	.8	.480	Potential pit when cheap acid is available. ½ reserve oxide in limy host. ½ pri sulph.
Pima		300	.45	2.700	Operating pit. Reserve mostly in argill.
Pine Flat		25	.4	.200	Sub-marginal. Available to pit.
Pinto Valley		350	.45	3.150	Published, open pit deferred in 1970; pri sulph.
Poston Butte	30%	500	.5	3.500	700 feet overburden, heavy water inflow. Part oxide.

** Reduction due to estimated unusual losses.
*** Includes % reduction as shown.

6-30-72 Retyped 2-1-73

Mine or Deposit	Reduction**	Reserves Ore Mill Tons	Grade	Copper*** Bill.lbs.	Comments
Ray, Sulphide		500	.85	8.500	Operating pit, chalcocite blanket.
Silicate		200	.9	3.600	Operating pit, leach.
Red Mountain		unknown	.3-.7	-	Deep pri sulph.
Reward		75	.6	.900	(Unconfirmed 100 mill tons). Avail. to open pit. Pri sulph in tactite and diabase.
Rosemont		280	.6	3.360	Pri sulph in alt. sediments (?)
Sacaton		48	.76	.730	Chalcocite ore available to pit and blcok cave. 15-20 mill pit reserve, early benches will average 1.4% Cu.
Safford (P.D.)		450	.9	8.100	Pri sulph in andesite and porph. Potential block cave.
Sanchez	30%	75	.37	.388	Published. Available to pit. Oxide in shear? zone in andesit
San Juan		15	.5	.150	Leach (?)
San Manuel		400	.7	5.600	Operating block cave, 174 mill tons prod. through 1970.
San Xavier North		51	.51	.520	Potential open pit. Upper benches include nucleus of 10 mill tons leach @ .75% Cu and 12 mill tons Cc @ .75% Cu.
San Xavier (Tract II)		30	.9	.540	Available to pit, pri sulph in tactite.
Sierrita		400	.35	2.800	
Silver Bell		80	.7	1.120	Source quoted grade at .8% Cu, believed to be high.
Turquoise		10	.5	.100	Sub-marginal.
Twin Buttes		550	.6	6.600	Operating pit. Total reserves may include ½ as block cave. 1970 prod. + 1% Cu. Pri sulph in tactite.
TOTAL				112.264 Bill. lbs. Copper	

** Reduction due to estimated unusual losses.
*** Includes % reduction as shown.

6-30-72 Retyped 2-1-73

J. J. Durek
Oakland, California

January 24, 1973

John E. Kinnison
Tucson, Arizona

File
Blue
T. F. O'Neill

ARIZONA COPPER PRODUCTION, 1960-1970

The attached data sheets for Arizona Operating Mines will supplement production and reserve data transmitted by my memo to you of June 30, 1972.

I have not attempted to deal with the grade of mill feed statistically, but I believe it is evident that the general trend during the past decade has been that of declining grade at most properties. Data available for Silver Bell during 1971 indicate an upturn in mill feed, possibly in response to decreased copper price. In general, the 1971 data at hand and shown is too fragmentary to warrant conclusions.

I should note that my calculations are based on gross production figures, which leave unresolved certain possible extraneous influences. For example, during both of the last two strike periods (and during the past three years of restricted smelter capacity) some mines have accumulated a stock pile of copper concentrates. Whether the stock piles have been reported as yearly production is not clearly stated in every case by the source references. It would appear, however, that copper stock piled in concentrates has not unduly influenced data as presented. Daily mill capacity has been calculated on a 360-day basis, and in most instances corresponds closely to publicized (privately or published) daily mill capacity. However, a few properties--Ajo, for example--appear to use a publicized mill capacity based on a nominal six-day week.

The mill recovery used herein for calculation of the grade of feed is an estimate of my own, based only on inferred character of the ore as deduced by mineralogy and general appearance. For only a few properties do I have what could be termed "inside" information on this subject. No allowance was made for the few percent of loss in smelting. Although production data listed for some properties may be based on actual smelter output, most data apparently refer to copper contained in concentrates, and in some instances specific reference is made to copper concentrates.

In compiling the total production summaries, I have found a few arithmetic errors in the results previously transmitted to you last June. The changes are minimal and are as follows:

CORRECTIONS
TOTAL MINE PRODUCTION

	Reported 6-30-72			
Ajo	3.586 Bill	change to	3.517 Bill	#Cu
Inspiration	3.950 Bill	change to	3.945 Bill	
Mission	.874 Bill	change to	.869 Bill	
Morenci	8.832 Bill	change to	8.382 Bill	

/fn
Attach.

Operating Arizona Copper Mines
Production Data

ADDENDUM

After typing was complete on the production sheets to which this note is added, I realized that an inconsistency during the years 1969 and 1970 was incorporated. For the most part, data given during the decade of 1960-1970 were derived from the Minerals Yearbooks published by the U.S. Bureau of Mines, which data combine the yearly copper production obtained by leaching and precipitation with that obtained by concentration. The 1969 and 1970 data are taken from a compilation by the Arizona Bureau of Mineral Resources (a copy of which is on file at Oakland), and which separates precipitate copper from total copper production. The data given for the two years in question refers only to copper produced from concentrates, unless specifically noted as has been done on the Bagdad and Ox Hide tabulations.

It should be borne in mind, therefore, that the actual mill feed for years prior to 1969 is slightly lower than calculated at properties which produced precipitate copper as well as concentrates. The data for 1969 and 1970, however, reflect actual mill feed because precipitate copper has been deleted from the total production.

The mines which produce precipitate copper in significant quantity are tabulated below. The approximate percentage represented by precipitate copper for the year 1969 is also there shown, but it should be remembered that this percentage cannot be projected to prior years at the same ratio, because the general trend has been a progressively increasing amount of precipitate copper during the decade of the Sixties.

John E. Kinnison

Mine	1969 Precipitate Cu Appr. % of Total
Copper Cities	10
Esperanza	8
Inspiration	10
Lavender	11
Mineral Park	12
Morenci	9
Silver Bell	12
Ray	20*

* This high percentage is due to treatment of the "silicate" ore body, operative only in late 60's.

AJO
(New Cornelia)

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	10.562	126.2	11.8	93	12.7	.64	29,000	
1969	10.736	135.6	12.6	93	13.6	.68	30,000	
1968	9.018	117.1	13.0	93	14.0	.70		Strike
1967	6.078	80.1	13.2	93	14.7	.73		Strike
1966	10.487	136.7	13.0	93	14.0	.70	28,000	
1965	10.650	141.8	13.3	93	14.3	.72	29,600	
1964	10.371	141.6	13.6	93	14.7	.73	28,800	
1963	9.370	134.4	14.4	93	15.4	.77	26,000	
1962	9.648	142.0	14.7	93	15.8	.79	26,800	
1961	9.358	140.7	15.0	93	16.2	.81	26,000	
1960	9.066	133.4	14.7	93	15.8	.79	25,200	
Total 1960-70		1,429.6						

Production Summary

1905-1955	1.574	Bill #Cu; Parsons
1956-1959	.513	" " ; U.S. Bureau of Mines
1960-1970	1.430	" " ; do - - see above tab.
Total	3.517	Bill #Cu

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads* #Cu/T	Calc Heads* %Cu	Calc Tpd	Notes Actual Heads
1971								
1970	2.030	34.6	17.0	90	18.5	.94	5,640	.81% Cu
1969	2.030	35.2	17.4	90	19.3	.97	5,640	.75
1968	2.100	38.2	18.2	90	20.1	1.05	5,840	.65
1967	2.100	37.3	17.8	90	19.7	.99	5,840	.77
1966	2.090	40.6	19.4	90	21.6	1.08	5,800	.94
1965	2.090	41.0	19.6	90	21.8	1.09	5,800	.83
1964	2.060	39.3	19.1	90	21.2	1.06	5,730	
1963	2.090	35.3	16.9	90	18.8	.94	5,800	Range: .6-1.0% Cu
1962	1.970	28.5	14.5	90	16.1	.85	5,470	
1961	1.810	21.9	12.1	90	13.5	.67	5,030	
1960	1.820	23.9	13.1	90	14.6	.73	5,060	
Total 1960-70		375.8						

Production Summary

1938-1955	103.7	Mill #Cu; Parsons
1956-1959	81.5	" " ; U. S. Bureau of Mines - Min. Yearbooks
1960-1970	375.8	" " ; do - - see above tab.
Total	561.0	Mill #Cu

*1964-1971 Calculated heads are higher than actual grade of mill feed, since considerable cu is recovered by leaching from oxide ore dumps, not reported as ore produced.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	1.829	17.3	9.5	90	10.5	.53	5,070	Pit
1969	1.919	21.3	11.1	90	12.4	.62	5,330	Pit
1968	1.173	15.3	13.0	90	14.5	.72	3,260	Pit
1967	.935	15.5	16.6	90	18.5	.92	---	Combined U.G. & O.P.
1966	.551	13.0	23.6	90	26.3	1.31	1,530	U.G.
1965	---Not reported---17 Mill #Cu projected for production est.							
1964	.953	25.0	26.2	90	29.1	1.46	2,640	U.G.
1963	.639	20.2	31.7	90	35.2	1.76	1,770	U.G.
1962	.075	4.5						Start-up U.G.
1961								
1960								
Total 1962-70		149.1						

Production Summary

1905-1954	64.6	Mill #Cu; Graton-Sales, Vol. 2
1962-1970	149.1	" " ; U.S. Bureau of Mines - Min. Yearbooks
Total	213.7	Mill #Cu

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes Actual Heads
1971								
1970	4.970	47.5	9.6	90	10.6	.53	13,750	.52
1969	4.644	39.8	8.6	90	9.6	.48	12,850	
1968	3.359	34.6	10.3	90	11.5	.57	9,330	
1967	2.430	25.8	10.6	90	11.8	.59	6,750	
1966	4.354	49.8	11.5	90	12.7	.64	12,080	
1965	3.200	40.4	12.6	90	14.1	.70	8,900	
1964	3.164	42.9	13.6	90	15.1	.75	8,770	
1963	3.149	43.7	13.8	90	15.4	.77	8,750	
1962	3.151	34.9	11.1	90	12.3	.62	8,750	
1961	3.137	34.7	11.1	90	12.3	.62	8,700	
1960	3.058	33.1	10.8	90	12.1	.60	8,500	
Total 1960-70		427.0						

Production Summary

1954-1955	67.6 Mill #Cu	; Parsons
1956-1959	170.9 " "	; U.S. Bureau of Mines - Min. Yearbooks*
1960-1970	427.0 " "	; do - - see above tab.
Total	665.5 Mill #Cu	

*Note: Source of data for 1969-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	.829	63.2	77.0	90	85.5	4.26	2,300	
1969	.783	58.6	75.0	90	83.3	4.15	2,200	
1968	.623	45.2	72.5	90	80.5	4.04	1,750	
1967	.386	29.0	75.2	90	83.5	4.17		Strike
1966	.721	54.0	75.0	90	83.3	4.15	2,000	
1965	.766	62.0	81.0	90	90.0	4.50	2,100	
1964	.749	64.1	85.5	90	95.0	4.75	2,100	
1963	.715	66.2	92.5	90	103.8	5.15	2,000	
1962	.618	61.8	100.0	90	111.0	5.55	1,700	
1961	.595	61.0	102.5	90	114.0	5.70	1,500	
1960	.510	51.2	100.0	90	103.8	5.15	1,400	
1959	.373	39.2	105.0	90	117.0	5.83	1,000	
1958	.499	58.6	117.0	90	131.0	6.53	1,400	
1957	.630	69.4	109.0	90	121.0	6.04	1,750	
1956	.632	62.0	98.3	90	109.0	5.45	1,750	
1955	.546	56.5	103.5	90	115.0	5.75	1,500	
1954	.663	63.0	95.0	90	105.5	5.28	1,850	
1953	---	58.7	---	90	---	---	---	
1952	.541	54.9	10.1	90	112.0	5.50	1,500	
1951	---	54.5	---	90	---	---	---	
1950	---	26.7	---	90	---	---	---	
1949	---	19.7	---	90	---	---	---	
Total 1949-70		**1,179.5**						

Production Summary

1880-1948	4.972	Bill #Cu; Ariz. Bureau of Mines Bull. 156
1949-1970	1.180	" " ; U.S. Bureau of Mines - Min. Yearbooks
Total	6.152	Bill #Cu

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	5.510	41.1	7.5	88	8.5	.42	15,300	
1969	5.490	41.3	7.5	88	8.5	.43	15,250	
1968	5.480	48.8	8.9	88	10.1	.51	15,200	
1967	4.980	47.8	9.6	88	10.9	.55	13,820	
1966	4.210	46.7	11.1	88	12.6	.62	11,680	
1965	4.230	43.4	10.3	88	11.7	.58	11,720	
1964	4.290	45.1	10.5	88	11.9	.60	11,920	
1963	4.360	46.8	10.8	88	12.2	.61	12,100	
1962	4.250	45.9	10.8	88	12.3	.61	11,810	
1961	4.260	withheld - - - - - - - - - - - - - - - - - -					11,820	
1960	4.370	withheld - - - - - - - - - - - - - - - - - -					12,100	
Total 1962-70		406.9						

Production Summary

1959-1961	145.8	Mill #Cu; JEK estimate
1962-1970	406.9	" " ; U.S. Bureau of Mines - Min. Yearbooks*
Total	552.7	Mill #Cu

*Note: Source of data for 1960-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	9.376	81.2	8.7	80	10.8	.54	26,000	
1969	8.855	93.8	10.6	80	13.3	.66	24,600	
1968	6.167	69.7	11.3	80	14.1	.71		Strike
1967	4.014	54.3	13.5	80	16.9	.85		Strike
1966	6.447	97.8	15.2	80	19.0	.95	17,900	
1965	5.799	106.9	18.4	80	23.1	1.15	16,100	
1964	5.837	97.8	16.8	80	20.9	1.05	16,200	
1963	5.487	93.9	17.1	80	21.4	1.07	15,300	
1962	5.552	104.6	18.9	80	23.5	1.18	15,400	
1961	4.847	78.3	16.2	80	20.2	1.01	13,450	
1960	5.315	80.8	15.2	80	19.0	.95	14,800	
Total 1960-70		959.1						

Production Summary

1915-1962	3.250	Bill #Cu; Wilson Volume*
1963-1970	.695	" " ; U.S. Bureau of Mines - Min. Yearbooks+
Total	3.945	Bill #Cu

* Note: By calculation; 180.9 mill tons ore grading 1.123% Cu (1915-62). Assume 80% rec, calculated production is 3.250 bill #cu. Parsons record to 1955 plus estimate projection closely checks that figure.

\+ Note: Source of data for 1969-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	4.850	52.0	10.7	80	13.4	.67	13,000	
1969	5.550	58.5	10.6	80	13.3	.66	15,000	
1968	4.715	49.4	10.2	80	12.8	.65		Strike
1967	3.176	39.4	12.8	80	15.9	.80		Strike
1966	6.107	69.2	11.3	80	14.1	.71	17,000	
1965	5.661	71.2	12.6	80	15.8	.79	15,500	
1964	6.001	83.0	13.8	80	17.2	.87	16,500	
1963	5.347	76.5	14.3	80	17.9	.89	15,000	
1962	5.374	83.5	15.6	80	19.5	.97	15,000	
1961	4.928	79.1	16.1	80	20.1	1.00	13,500	
1960	4.245	66.5	15.6	80	19.5	.97	12,000	
1959	3.170	51.5	16.8	80	21.0	1.05	9,000	
1958	4.027	69.0	17.1	80	21.4	1.08	11,000	
1957	4.441	77.6	17.5	80	21.8	1.09	12,350	
1956	5.069	80.0	15.8	80	19.7	.98	14,000	
1955	4.432	59.8	13.5	80	16.9	.85	12,000	
1954	---	17.0	---	---	---	---	---	
Total 1954-70		1,083.2						

Production Summary

1954-1955	.077	Bill #Cu; Parsons
1956-1970	1.006	" " ; U.S. Bureau of Mines - Min. Yearbooks*
Total	1.083	Bill #Cu

*Note: Source of data for 1969-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MAGMA
(Superior)

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	.443	34.6	78.0	90	86.5	4.33	1,230	
1969	.443	35.2	79.8	90	88.7	4.43	1,230	
1968	.334	29.4	88.2	90	97.9	4.88		Strike
1967	.220	19.1	86.8	90	96.5	4.83		Strike
1966	.432	39.3	91.0	90	101.0	5.05	1,195	
1965	.440	38.9	88.4	90	98.3	4.91	1,220	
1964	.378	34.1	90.7	90	100.5	5.03	1,100	
1963	.310	28.3	91.3	90	101.2	5.07	862	
1962	.338	29.8	88.3	90	98.0	4.89	938	
1961	.411	41.5	101.1	90	112.5	5.63	1,140	
1960	.387	37.8	97.7	90	108.6	5.43	1,075	
Total 1960-70		368.0						

Production Summary

1911-1964	1.460	Bill #Cu; Graton-Sales, Vol. 2.
1964-1970	.231	" " ; U.S. Bureau of Mines - Min. Yearbooks
Sub total	1.691	Bill #Cu; Magma only
	.002	" " ; L S and A
Total	1.693	Bill #Cu

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	5.952	46.7	7.9	85	9.2	.46	16,500	
1969	6.031	51.2	8.5	85	10.0	.50	16,700	
1968	6.233	57.4	9.2	85	10.9	.54	17.300	
1967	5.632	54.3	9.7	85	11.4	.57	15,600	
1966	5.379	51.1	9.5	85	11.2	.56	14,950	
1965	4.914	38.1	7.8	85	9.1	.46	13,600	
1964	.387	2.7	7.0	85	8.2	.41		Start-up
1963								
1962								
1961								
1960								
Total 1964-70		301.5						

Production Summary

1964-1970 301.5 Mill #Cu; U.S. Bureau of Mines - Min. Yearbooks*

*Note: Source of data for 1969-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971	7.040*	81.2	11.5	93	12.4	.62	22,300	Strike 1½ mo.
1970	8.040	92.7	11.5	93	12.4	.62	22,300	
1969	7.940	97.3	12.3	93	13.2	.66	22,100	
1968	6.010	78.3	13.0	93	14.0	.70	16,700	Strike
1967	4.600	73.5	16.0	93	17.2	.86	12,780	Strike
1966	5.970	95.9	16.1	93	17.3	.86	16,550	
1965	6.650	112.5	18.8	93	21.0	1.01	18,450	
1964	7.560	107.6	14.2	93	15.3	.77	21,000	
1963	7.320	100.9	14.9	93	16.0	.80	20,300	
1962	6.280	82.8	13.2	93	14.2	.71	17,450	
1961	2.200	withheld (Est. 27.8)	---	93	---	---	---	Start-up
1960				93				
Total 1961-70		869.3						

* Estimate - Total tons reduced for strike loss.

Production Summary

1961	27.8	Mill #Cu; JEK estimate
1962	82.8	" " ; Asarco News
1963-1970	758.7	" " ; U. S. Bureau Mines - Min. Yearbooks
Total	869.3	Mill #Cu

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	19.172	241.9	12.6	82	15.4	.77	53,000	
1969	19.271	250.9	13.0	82	15.9	.79	54,000	
1968	15.474	213.8	13.8	82	16.8	.84		Strike
1967	11.052	164.2	14.9	82	18.2	.91		Strike
1966	19.325	282.2	14.6	82	17.8	.89	54,000	
1965	19.089	255.1	13.4	82	16.3	.81	53,000	
1964	18.632	258.8	13.9	82	16.6	.85	51,800	
1963	17.141	242.4	14.2	82	17.3	.86	47,600	
1962	16.983	242.7	14.3	82	17.5	.86	47,200	
1961	16.286	222.9	13.7	82	16.7	.84	45,200	
1960	14.500	211.3	14.6	82	17.8	.89	40,300	
Total 1960-70		2,586.2						

Production Summary

1872-1932	1.766	Bill #Cu; Wilson Vol. (Morenci & Metcalf)
1937-1963	4.949	" " ; " " (Morenci Open Pit)
1964-1970	1.667	" " ; U.S. Bureau of Mines - Min. Yearbooks+
Total	8.382	Bill #Cu

+Note: Source of data for 1969-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %*	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	3.833	13.3	3.5	40	8.7	.44	10,650	
1969	4.060	7.2	1.8	40	4.5	.22	12,500	Ore waste (?) Start-up
1968								
1967								
1966								
1965								
1964								
1963								
1962								
1961								
1960								

Total 1969-70

* Dump leaching.

Production Summary

1969-1970 20.5 Mill #Cu; Ariz. Bureau of Min . Resources

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971	14.600	129.0	8.9	93	9.5	.48	40,600	No strike loss
1970	14.600	132.5	9.1	93	9.8	.49	40,600	
1969	14.100	131.2	9.3	93	10.0	.50	39,100	
1968	13.000	123.0	9.5	93	10.2	.51	36,100	
1967	9.900	93.0	9.4	93	10.1	.51	27,500	
1966	6.020	78.6	13.7	93	14.7	.74	16,700	
1965	2.650	36.0	13.6	93	14.6	.73	7,350	
1964	2.850	60.0	21.1	93	22.7	1.13	7,930	
1963	1.990	46.0	23.1	93	24.9	1.24	5,530	
1962	1.180	withheld	---	---	---	---	3,280	
1961	1.390	withheld	---	---	---	---	3,860	
1960	1.330	withheld	---	---	---	---	3,700	
Total	1963-70	700.3						

Production Summary

1955-1962	253.0	Mill #Cu; JEK estimate
1963-1970	700.3	" " ; U.S. Bureau of Mines - Min. Yearbooks
Total	953.3	Mill #Cu

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971	11.600*	166.8	14.4	80	18.0	.90	35,000	Strike 1 mo.
1970	12.650	179.6	14.2	80	17.7	.89	35,100	
1969	11.650	151.6	13.0	80	16.3	.81	33,300	
1968	6.750	116.1	17.2	80	21.5	1.08		Strike
1967	4.950	93.3	18.8	80	23.5	1.18		Strike
1966	8.760	141.6	15.9	80	19.9	1.00	24,300	
1965	8.600	144.3	16.8	80	20.9	1.05	23,900	
1964	6.890	116.5	16.9	80	21.1	1.06	19,150	
1963	7.120	125.9	17.7	80	22.1	1.11	19,750	
1962	7.700	132.9	17.3	80	21.5	1.08	21,400	
1961	7.430	128.7	19.5	80	24.3	1.22	20,600	
1960	6.530	117.6	18.0	80	22.5	1.13	18,100	
Total 1960-70		1,448.1						

* 11 month operation, by projection from 1970

Production Summary

1905-1955	2.360	Bill #Cu;	Parsons
1956	.084	" " ;	By projection - JEK
1957-1959	.258	" " ;	U.S. Bureau of Mines - Min. Yearbooks
1960-1970	1.448	" " ;	do - - See above tab.+
Total	4.150	Bill #Cu	

+Note: Source of data for 1969-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes Actual Feed
1971								
1970	15.470	190.0	12.3	88	14.0	.70	42,900	
1969	15.280	191.4	12.6	88	14.3	.71	42,400	
1968	11.370	144.1	12.7	88	14.4	.72	Strike	.70
1967	7.890	107.9	13.7	88	15.6	.78	Strike	.76
1966	14.390	202.8	14.3	88	16.2	.81	40,000	
1965	13.500	187.5	13.9	88	15.8	.79	37,500	
1964	12.440	185.2	14.9	88	16.9	.85	34,600	
1963	12.560	177.1	14.1	88	16.1	.80	34,900	
1962	12.570	168.4	13.4	88	15.3	.76	34,900	
1961	12.530	165.2	13.2	88	15.0	.75	34,800	
1960	12.260	163.5	13.4	88	15.2	.76	34,000	
Total 1960-70		1,883.1						

Production Summary

1956-1959	.447	Bill #Cu; U. S. Bureau of Mines - Min. Yearbooks
1960-1970	1.883	" " ; do - - See above tab.
Total	2.330	Bill #Cu

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	14.384	67.0	4.7	88	5.3	.27		
1969	1.034	---	---	88	---	---		Start-up
1968								
1967								
1966								
1965								
1964								
1963								
1962								
1961								
1960								
Total 1969-70		67.0						

Production Summary

1969-1970 67.0 Mill #Cu; Ariz. Bureau of Min. Resources

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd
1971	3.800*	46.2	12.1	80	15.2	.76	10,500
1970	3.788	38.4	10.1	80	12.6	.63	10,500
1969	3.874	40.0	10.4	80	12.9	.65	10,750
1968	3.923	50.0	12.8	80	16.0	.80	10,900
1967	3.812	45.9	12.0	80	15.1	.75	10,620
1966	3.546	48.8	13.7	80	17.2	.86	9,850
1965	3.185	43.0	13.5	80	16.8	.84	8,850
1964	3.033	48.3	15.1	80	18.9	.95	8,430
1963	2.948	47.2	16.0	80	20.0	1.00	8,200
1962	2.761	withheld	---	---	---	---	7,670
1961	2.686	withheld	---	---	---	---	7,450
1960	2.723	withheld	---	---	---	---	7,550
Total 1963-70		361.6					

* by projection

Production Summary

1954-1955	68.8	Mill #Cu; Parsons
1956-1958	78.5	" " ; U.S. Bureau of Mines - Min. Yearbooks
1959-1962	185.0	" " ; JEK estimate
1963-1970	361.6	" " ; U.S. Bureau of Mines - Min. Yearbooks+
Total	693.9	Mill #Cu

+Note: Source of data for 1969-70 is Arizona Bureau of Mineral Resources, which lists precipitate copper production separately. U.S. Bureau of Mines combines both precipitate and concentrate production.

MINE PRODUCTION AND CALCULATIONS

Year	Mill Tons Ore	Rec Cu Mill #	Calc Rec #Cu/T	Assum. Milling Rec %	Calc Heads #Cu/T	Calc Heads %Cu	Calc Tpd	Notes
1971								
1970	8.763	175.8	20.1	93	21.6	1.08	24,300	
1969	3.015	22.3	7.4	93	8.0	.40	8,400	Start-up
1968								
1967								
1966								
1965								
1964								
1963								
1962								
1961								
1960								
Total 1969-70		198.1						

Production Summary

1969-1970 198.1 Mill #Cu; Ariz. Bureau of Min. Resources

DN

JEK w77

INTER-OFFICE MEMORANDUM

J. E. K.

JUL 18 1972

To Joseph J. Durek
At Oakland, 2026 KB

Date July 5, 1972

From John E. Kinnison
At Tucson

Copies to

Subject Arizona Copper Production and Reserves

(DRAFT-Typed in Oakland)

The enclosed data, on which I have been working on and off since March, was ready to send out finally - Saturday. On reviewing the cover letter prior to mailing, I was unhappy to some extent with the brevity and emphasis (or lack of). Brigitta has left for a week of vacation, so I am now adding these additional comments in longhand. The following is principally for your benefit, and amounts to largely amplification on the source and quality of data.

PRODUCTION

The basic source for porphyry copper production, is of course Parsons - to 1955. From that point I have used largely the U.S. Bureau of Mines and Minerals Yearbooks. In some instances data by mine did not exist for some mines, some years. In these cases projection was made back or forward, or both. Allowance for strike shutdown was given, and for change in plant capacity. For instance, the early years of Pima were not listed, and I allowed for full depletion of the original high-grade reserve in the central core up to 1962, and the remaining years taken from Minerals Yearbooks; Silverbell required estimates from 1958-1962 using slight increase in mill capacity and minor decline in grade. And so forth.

For the non-porphyry deposits, additional effort was required; particularly at Bisbee. Fortunately, I was able to find a reliable district total through 1948, and the old Sacramento production was published in Parsons. In any event, I was able to sort out the underground production and have listed this all under Copper Queen - a surprisingly large figure - 6.152 Bill. #Cu - equal to any respectable openpit.

The problem, as I'm sure you realize, is that articles about a district are often vague regarding production (yours on Morenci and Hammers' on Magma are refreshingly complete). I tried the Arizona Bureau of Mines and Dept. of Mineral Resources, but could get relatively little help for these agencies.

The point of all this commentary is that production figures are not generally available, and yet are probably useful in understanding the relative magnitude of various deposits. I believe the figures listed herein are accurate within any limits of practical use.

RESERVES

The figures given are (with the exception of Inspiration) better than simple guesses. In each case there existed either (1) direct information, (2) second-hand but specific and probably reliable (to a point) type of information; or (3) published reserves. In many cases it has been possible to roughly check the probable validity of stated reserves by general knowledge of - say - area drilled and other factors. The Metcalf reserve listed for instance, is secondhand but in 1960 after some quick reconnaissance, Courtright and I estimated approximately the same figure, based on the areal extent of promising leached capping and a few solicated comments from Phelps Dodge.

I might add that any revisions you can suggest, based on your own information, will be appreciated -- particulary if any gross errors are seen. Possibly the most "shaky" reserve at an operating mine is Inspiration, in the Live Oak-Thornton area. The reserve given is purely guess, based on the rather large quantity of leached capping with lim.-after chalcocite which has been dumped west of Miami in the last few years. Another very unsure reserve is that for Lonestar-I have three different tonnages and grades from different sources, with the grade being the most divergent; but all of which are higher grade/lower tonnage than the original announcement of about .4% Cu.

In summary, the reserves given are, I hope, generally realistic; in a number of instances, however, there is admittedly a possiblity for error.

EXPLORATION

One premise which invites consideration is that exploration might be established on the basis of neighboring reserves or resources. This may not be the best approach, but is certainly worth consideration and it appears that other companies are using this as a principal means of area selection.

The two outstanding areas are Morenci-Safford and Ray-Miami, with Pima-Rosemont running a close third.

By going a step further than mineral "centers" to mineral "zones", the following observations are immediately possible:

1. Morenci-Safford and Ray-Miami (together with Santa Rita-Tyrone which is not tabulated) suggests a copper belt parallel the much-discussed Texas Lineament. There is, however, nothing (or very little) on the ground to suggest intervening centers.

2. The mineral belt following through part of its length the general course of the San Pedro, from Bisbee north through Magma and finally to Jerome, contains more known copper than the Silver Bell zone lying parallel and to the west.

The San Pedro zone contains:

Bisbee	7.9
Ray-Miami	35.7
San-Manuel-Copper Creek	16.1
Total Resource	59.7 Bill #Cu

Compared to the Silver Bell zone:

Cerbat	.9
Pima-Rosemont	26.6
Sacaton-Poston	5.0
Silver Bell	1.8
Total Resource	34.3 Bill #Cu

The Poston Butt deposit, in the tabulation above, should really be deleted to give a better, more restricted comparison.

The S. W. trending zone from Miami to Sacton, and extended S. W. to Ajo, yields:

Ajo	6.4
Ray-Miami	35.7
Sacaton-Poston	5.0
Slate-Vekol	7.5
Total Resource	54.6 Bill #Cu

I will not pursue this line of argument more at this time - I really only bring it up to stimulate discussion. Perhaps we can both comment on such ideas during personal conferences in the future.

(Indeed, one can argue the opposite proposition; that as a "center" or "zone" begins, through continued discovery, to exceed even our best expectations, the chance for continued discoveries actually must decline; to zero at some point - and that less productive "zones" or "centers" which are geologically "strong" offer better targets.)

PRICE OF COPPER

Not being a financial expert, I do not wish to argue anything specific under this heading.

Even a bystander, however, can note that if my reserve figures are even roughly accurate, that there is more copper in reserve at operating properties than all past production.

This would make me very nervous about investing in low-grade, or marginal operations, unless payback were very quick-in which case, really, the word marginal would not apply.

FINAL COMMENTS

The total reserve, as listed on Attachment A, pg. 2, does not correlate (by about 1 Bill. #) with the total given on pg. 3 of Attachment E. In compiling Attachment A, I intended to list neither Courtland (an unsignificant reserve) nor Johnson Camp (geographically isolated-as is Courtland also; Johnson (or Dragoon) is properly omitted, but Courtland was included, accounting for the .1 Bill. # difference in totals.

In the course of the compilations, I worked out an approximate mill feed grade and daily tonnage for the operating properties, from 1960-70. These indicate the general decline in grade at many properties (among other things). The sheets are not ready yet for distribution, but I will try and have these checked and typed in the near future, as I believe the data may be of general interest.

I see in the most recent Paydirt a reserve of measured openpit ore of .275 Bill. # recoverable Cu; slightly over my figure of .229 Bill. #Cu.

Please have patience with my poor handwriting. I felt that the data had been refined over and over, to the point of diminishing returns, and wanted it and these other remarks transmitted without further delay.

JEK:la

DN

INTER-OFFICE MEMORANDUM

TO J. J. Durek
AT Oakland, California

DATE June 30, 1972

FROM John E. Kinnison
AT Tucson, Arizona

COPIES TO J. J. Durek (2 extra w/o map)
File
Blue

SUBJECT Arizona Copper Resources; Production and Reserves

INTRODUCTION

I have reviewed past copper production, using various sources, and compiled production data tabulated on the attached sheets. I believe these figures are reasonably accurate, and only minimal gaps have been estimated.

Reserves as tabulated have been carefully screened, and although some of the figures are from second-hand private sources, I am reasonably confident that no great errors are incorporated. Reserves which stem from published data are undoubtedly understated in some cases. A few deposits, such as Poston Butte, may eventually be determined to be exaggerated, even though I have applied a reduction for unusual losses. The total copper (in lbs.) figures are based directly on tonnage vs. grade without reduction for normal milling loss. All heap leach reserves, however, have been reduced due to above-normal processing loss. An estimated reduction has also been applied to reported tonnages which appear to be "rough estimates," not worked out according to a mining plan, and which may suffer loss to a block caving system.

DESCRIPTION OF ATTACHMENTS

Attachment A is a summary based on geographic location, and is of interest to the extent that the major centers of mineralization in Arizona are indicated. I will not comment further at this time; however, I hope that this and like compilations may assist our thoughts on exploration. A general geologic map is also enclosed, which shows the location of all deposits. For convenience I also enclose a previous memo to you (4-15-72), in which I list all mines and prospects, with or without known reserves.

Attachment B is a simple reference list indicating ownership of the deposits herein tabulated.

Attachment C is a straight forward summary of operating properties' production and reserves (including some which are mined out). I should note that in addition to those deposits of the "porphyry copper" type, I have tabulated two major veins (Magma and Old Dominion) and the pre-Cambrian Jerome district.

Attachment D is a detailed break-down of reserves in four classifications:

High-grade (+ .6% Cu) at operating mines;
Low-grade (- .6% Cu) at operating mines;
High-grade at non-operating properties; and
Low-grade at non-operating properties.

Such a classification is given since it casts some insight on the probable availability of reserves, which in turn may ultimately have an impact on the price of copper under any given level of projected consumption. Clearly, the bulk of reserves are at currently-operating properties, and grade $\geq$ .6% Cu. Much low-grade ($<$ .6%) is also available at operating properties, and is either on-stream or currently yielding copper (Att. D, page 2).

Of the non-operating properties, in both high and low-grade categories, some deposits are under development, whereas others will probably remain marginal. Separate evaluation of each deposit is necessary--but if operating or development costs are apt to be excessive, or if the grade is low, competition from reserves at existing mines may serve to keep a damper on the price of copper sufficient to make marginal operations hazardous.

Attachment E consists of basic data for each deposit for which I projected reserves. Individual break down is given by tonnage and grade, and the amount of special reduction applied--if any--is shown. The total reserve in bill. lbs. of Cu is given for each deposit or division thereof, together with brief comments on the deposits.

JEK/bl

ARIZONA MAJOR COPPER RESOURCES

District	Deposit		Production Through 1970 Bill.lbs. Cu	Estimated Reserves Bill.lbs.Cu	Total Bill.lbs.Cu
Ajo	Ajo		3.586	2.800	6.386
Bagdad	Bagdad		.561	3.593	4.154
Bisbee	Copper Queen		6.152	.200	
	Lavender		1.083	.060	
	Sacramento		.437		
		Total	7.672	.260	7.932
Bradshaw	Copper Basin			.560	
	Pine Flat			.200	
	Jerome		3.617		
		Total	3.617	.760	4.377
Cerbat	Mineral Park		.302	.592	.894
Morenci-Safford	Lonestar			6.545	
	Metcalf			8.000	
	Morenci		8.832	6.400	
	Safford			8.100	
	Sanchez			.388	
	San Juan			.150	
		Total	8.832	29.583	38.415
Pima-Rosemont	Esperanza		.533	.510	
	Helvetia			.480	
	Mission-Pima		1.827	7.300	
	Palo Verde			1.826	
	Rosemont			3.360	
	San Xavier			1.060	
	Sierrita		.067	2.800	
	Twin Buttes		.198	6.600	
		Total	2.625	23.936	26.561
Ray-Miami	Bluebird		.020	.468	
	Cactus			.200	
	Castle Dome		.257		
	Chilito			.416	
	Christmas		.214	.229	
	Copper Cities		.665	.495	
	Diamond-H			.110	
	Inspiration/Red Hill		3.950	1.300	
	Magma		1.693	1.163	
	Miami		2.500		
	Miami East			2.525	
	Ox Hide		.021	.066	
	Pinto Valley			3.150	
	Ray		4.150	12.100	
		Total	13.450	22.222	35.692

District	Deposit		Production Through 1970 Bill.lbs. Cu	Estimated Reserves Bill.lbs.Cu	Total Bill.lbs.Cu
Sacaton-Poston Butte	Blackwater			.800	
	Poston Butte			3.500	
	Sacaton			.730	
		Total		5.030	5.030
San Manuel-Copper Creek	Kalamazoo			8.136	
	San Manuel		2.330	5.600	
	Old Reliable			.024	
		Total	2.330	13.760	16.090
Silver Bell	Silver Bell		.694	1.120	1.814
Slate-Vekol	Lakeshore			6.608	
	Reward			.900	
		Total		7.508	7.508
Courtland	Turquoise			.100	.100
		GRAND TOTAL	43.689	111.264	154.953

SOME ARIZONA COPPER DEPOSITS' OWNERSHIP

Mine or Deposit	Company
Ajo	Phelps Dodge Corporation
Bagdad	Bagdad Copper Corporation
Blackwater	Duval Corporation
Bluebird	Ranchers Exploration and Development Corp.
Cactus	Cities Service Minerals Corporation (Miami Copper)
Chilito	Kennecott Copper Corporation
Christmas	Inspiration Consolidated Copper Company
Copper Basin	Phelps Dodge Corporation
Copper Cities	Cities Service Minerals Corporation (Miami Copper)
Copper Creek	Newmont Exploration Ltd.
Copper Queen	Phelps Dodge Corporation
Diamond-H	Cities Service Minerals Corporation (Miami Copper)
Dragoon (or Johnson Camp)	Cyprus Mines Corporation - Superior Oil Company
Esperanza	Duval Corporation
Inspiration	Inspiration Consolidated Copper Company
Kalamazoo	Newmont Exploration Ltd.
Lakeshore	Hecla Mining Company
Lavender	Phelps Dodge Corporation
Lonestar	Kennecott Copper Corporation
Magma	Magma Copper Company
Metcalf	Phelps Dodge Corporation
Miami	Cities Service Minerals Corporation (Miami Copper)
Mineral Park	Duval Corporation
Mission	American Smelting and Refining Company
Morenci	Phelps Dodge Corporation
Old Reliable	Ranchers Exploration and Development Corp.

Mine or Deposit	Company
Ox Hide	Inspiration Consolidated Copper Company
Eisenhower (Palo Verde)	Anaconda Company
Helvetia (Peach or Elgin deposit)	Anaconda Company
Pima	Pima Mining Company
Pine Flat	?
Pinto Valley	Cities Service Minerals Corporation (Miami Copper)
Poston Butte	Continental Oil Company
Ray	Kennecott Copper Corporation
Red Mountain	Kerr McGee Corporation
Reward	Newmont Exploration Ltd. - Superior Oil Company
Rosemont	Anaconda Company
Sacaton	American Smelting and Refining Company
Safford	Phelps Dodge Corporation
Sanchez	Inspiration Consolidated Copper Company
San Juan	Producers Mining Corporation
San Manuel	San Manuel Copper Company
San Xavier	American Smelting and Refining Company
Sierrita	Duval Corporation
Silver Bell	American Smelting and Refining Company
Turquoise	Union Oil Company of California
Twin Buttes	Anaconda Company

S U M M A R Y

OPERATING ARIZONA COPPER PROPERTIES
PRODUCTION AND RESERVES

Mine	Starting Date	Production Through 1970 Bill.lbs. Cu	Estimated Reserves	Total
Ajo	1905	3.586	2.800	6.386
Bagdad	1938	.561	3.593	4.154
Bisbee: Copper Queen*	1880	6.152	.200	6.352
Lavender	1954	1.083	.060	1.143
Sacramento	1923	.437	Mined out 1931	.437
Bluebird	1968?	.020	.468	.488
Castle Dome	1943	.257	Mined out 1953	.257
Christmas	1905	.214	.229	.443
Copper Cities - Diamond H	1954	.665	.605	1.270
Esperanza	1959	.553	.510	1.063
Inspiration	1915	3.950	1.300	5.250
Jerome (United Verde and U.V.X.)	1888	3.617	Mined out 1953	3.617
Magma	1911	1.693	1.163	2.856
Miami	1910	2.500	Mined out 1958	2.500
Mineral Park	1964	.302	.592	.894
Mission	1961	.874	4.200	5.074
Morenci-Metcalf	1872	8.832	14.400	23.232
Old Dominion	1881	.850	Mined Out 1931	.850
Ox Hide	1969	.021	.066	.087
Pima	1955	.953	2.700	3.653
Ray	1905	4.150	12.100	16.250
San Manuel-Kalamazoo	1956	2.330	13.736	16.066
Sierrita	1969	.067	2.898	2.965
Silver Bell	1954	.694	1.120	1.814
Twin Buttes	1969	.198	6.600	6.798
	TOTAL	44.559	69.340	113.899

*Includes all underground production from Bisbee district.

6-30-72

CLASSIFICATION
ARIZONA COPPER RESERVES

HIGH-GRADE RESERVES AT OPERATING MINES

Mine or Deposit	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Ajo	175	.8%Cu	2.800
Bagdad	50	.6	.600
Copper Queen	-	-	.200
Inspiration, Live Oak	50	.7	.700
Red Hill	50	.6	.600
Lakeshore	472	.7	6.608
Lavender	-	-	.060
Magma	10.2	5.7	1.163
Metcalf	500	.8	8.000
Miami East	110	1.35	*2.525
Mission, Tactite	40	.75	.600
Argillite	50	.6	.600
Morenci	400	.8	6.400
Ray, Sulphide	500	.85	8.500
Silicate	200	.9	3.600
Sacaton	48	.76	.730
San Manuel, Original	400	.7	5.600
Kalamazoo	565	.72	8.136
Silver Bell	80	.7	1.120
Twin Buttes	550	.6	6.600
	TOTAL		65.142

* Includes reduction for unusual losses, as shown by master list.

6-30-72

LOW GRADE RESERVES AT OPERATING MINES

Mine or Deposit	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Bagdad, Low Grade, Phase 1	215	.51%Cu	2.193
Low Grade, Phase 2	100?	.4	.800
Bluebird	75	.52	* .468
Christmas	22	.52	.229
Copper Cities	45	.55	.495
Diamond H	10	.55	.110
Esperanza	50	.51	.510
Mineral Park	58	.51	.592
Mission, Low Grade	300	.5	3.000
Old Reliable	4	.5	* .024
Ox Hide	10	.55	* .066
Pima	300	.45	2.700
San Xavier North	51	.51	.520
	TOTAL		11.707

* Includes reduction for unusual losses, as shown by master list.

HIGH GRADE AT NON-OPERATING PROPERTIES

Mine or Deposit	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Copper Basin	50	.7%Cu	.560
Mission, North Extension[1]	20	1.0	.400
Helvetia (Peach or Elgin deposit)	30	.8	.480
Reward	75	.6	.900
Rosemont	280	.6	3.360
Safford (P.D.)	450	.9	8.100
San Xavier (Tract II)[1]	30	.9	.540
	TOTAL		14.340

[1] Classified with non-operating properties due to geometric relationship with, and present status of, Anaconda's Palo Verde deposit (non-operating low-grade class)

LOW GRADE AT NON-OPERATING PROPERTIES

Mine or Deposit	Reserves		
	Ore Mill Tons	Grade	Available Cu Bill. lbs.
Blackwater	200	.4%Cu	* .800
Cactus	20	.5	.200
Chilito	65	.4	* .416
Dragoon (or Johnson Camp)	100	.5	1.000
Lonestar	700	.55	*6.545
Palo Verde (Eisenhower)	163	.56	1.826
Pine Flat	25	.4	.200
Pinto Valley	350	.45	3.150
Poston Butte	500	.5	*3.500
Sanchez	75	.37	* .388
San Juan	15	.5	.150
Turquoise	10	.5	.100
	TOTAL		18.275

* Includes reduction for unusual losses, as shown by master list.

ESTIMATED ARIZONA COPPER RESERVES

DATA SHEETS

Mine or Deposit	Reduc-**tion	Reserves: Ore Mill Tons	Grade	Copper*** Bill lbs.	Comments
Ajo		175	.8%Cu	2.800	Operating pit, pri sulph.
Bagdad		50	.6	.600	Operating pit, pri sulph & oxide leach.
Low-grade Phase 1		215	.51	2.193	Primary available to pit.
Phase 2		100?	.4	.800	Primary available to pit.
Blackwater	50%	200	.4	.800	Marginal or sub-marginal oxide deposit. Tonnage questioned.
Bluebird	40%	75	.52	.468	Published. Operating pit-leach.
Cactus		20	.5	.200	Sub-marginal deposit, chalcocite, available to pit.
Chilito	20%	65	.4	.416	Sub-marginal
Christmas		22	.52	.229	Operating pit, pri sulph in tactite.
Low-grade		*850	.4	*--	Tonnage highly questionable.
Copper Basin	20%	50	.7	.560	Slightly enriched - available to pit.
Copper Cities		45	.55	.495	Operating pit, pri sulph and some chalcocite.
Copper Creek		?	.55	--	Deep pri sulph.
Copper Queen		-	-	.200	Operating underground, 4-yr. proj. 72-75, end of life.
Diamond-H		10	.55	.110	Operating pit, adjoins Copper Cities
Dragoon (or Johnson Camp)		100	.5	1.000	Pri sulph in tactite
Esperanza		50	.51	.510	Tonnage/grade questioned. Recent production .42% Cu.
Inspiration, Live Oak		50	.7	.700	Live Oak - thornton pit areas, tonnage questioned.
Red Hill		50	.6	.600	Adjacent to Live Oak pit, planned new pit expansion.
Kalamazoo		565	.72	8.136	Eventual block cave.
Lakeshore		472	.7	6.608	Oxide, sulph, avail to open pit. High-grade tactite, U.G. mine
Lavender		-	-	.060	End of mine 1972.

* Too questionable to include in totals
** Reduction due to estimated unusual losses
*** Includes % reduction as shown

6-30-72

Mine or Deposit	Reduction**	Reserves Ore Mill Tons	Grade	Copper*** Bill lbs.	Comments
Lonestar	15%	700	.55	6.545	Grade questionable--either up or down. Mixed oxide-sulph in part Cc enriched.
Magma		10.2	5.7	1.163	Operating underground, 2000 tpd. New reserves permit increase in capacity to 3,000 tpd in 1974. Pri sulph.
Metcalf		500	.8	8.000	Potential pit and block cave, Cc ore.
Miami East	15%	110	1.35	2.525	Deep, block cave potential. Faulted segment of old Miami Cc ore body.
Mineral Park		58	.51	.592	Operating pit, Cc ore, enrichment weak
Mission, Tactite		40	.75	.600	Operating pit, pri sulph in tactite and argillite. Low-grade reserve is JEK guess.
Argillite		50	.6	.600	
Low-grade		300	.5	3.000	
North extension		20/410	1.0	.400/4.6	
Morenci		400	.8	6.400	Operating pit, Cc
Old Reliable	40%	4	.5	.024	Planned in-place leach of Bx pipe in Copper Creek dist.
Ox Hide	40%	10	.55	.066	Operating pit, heap leach.
Palo Verde (Eisenhower)		163	.56	1.826	Adjacent to Mission. Potential pit.
Helvetia (Peach or Elgin deposit)		30	.8	.480	Potential pit when cheap acid is available. ½ reserve oxide in limy host. ½ pri sulph.
Pima		300	.45	2.700	Operating pit. Reserve mostly in argill
Pine Flat		25	.4	.200	Sub-marginal. Available to pit
Pinto Valley		350	.45	3.150	Published, open pit deferred in 1970; pri sulph.
Poston Butte	30%	500	.5	3.500	700 feet overburden, heavy water inflow Part oxide.
Ray, Sulphide		500	.85	8.500	Operating pit, chalcocite blanket.
Silicate		200	.9	3.600	Operating pit, leach.
Red Mountain		unknown	.3-.7	-	Deep pri sulph.

** Reduction due to estimated unusual losses
*** Includes % reduction as shown

6-30-72

Mine or Deposit	Reduction**	Reserves Ore Mill Tons	Grade	Copper *** Bill.lbs.	Comments
Reward		75	.6	.900	(Unconfirmed 100 mill tons). Avail. to open pit. Pri sulph in tactite and diabase
Rosemont		280	.6	3.360	Pri sulph in alt. sediments (?)
Sacaton		48	.76	.730	Chalcocite ore available to pit and block cave. 15-20 mill pit reserve, early benches will ave. 1.4% Cu.
Safford (P.D.)		450	.9	8.100	Pri sulph in andesite and porph. Potential block cave.
Sanchez	30%	75	.37	.388	Published. Available to pit. Oxide in shear? zone in andesite
San Juan		15	.5	.150	Leach (?)
San Manuel		400	.7	5.600	Operating block cave, 174 mill tons prod. through 1970
San Xavier North		51	.51	.520	Potential open pit. Upper benches include nucleus of 10 mill tons leach @ .75% Cu and 12 mill tons Cc @ .75% Cu
San Xavier (Tract II)		30	.9	.540	Available to pit, pri sulph in tactite
Sierrita		400	.35	2.800	
Silver Bell		80	.7	1.120	Source quoted grade at .8% Cu, believed to be high.
Turquoise		10	.5	.100	Sub-marginal.
Twin Buttes		550	.6	6.600	Operating pit. Total reserves may include ½ as block cave. 1970 prod. + 1% Cu. Pri sulph in tactite.
		TOTAL		112.264 Bill. lbs. Copper	

** Reduction due to estimated unusual losses
*** Includes % reduction as shown

6-30-72

DN

INTER-OFFICE MEMORANDUM

TO J. J. Durek
AT Oakland, California

* DATE April 15, 1972

FROM John E. Kinnison
AT Tucson, Arizona

COPIES TO File
Blue

SUBJECT Known Porphyry Copper Deposits, Southwestern United States

---

According to your request relayed by Mrs. Ludgate, concerning the subject heading, I forward the following. You had requested only the total number of porphyry copper type deposits of which I had knowledge, but inasmuch as I had already started a tabulation and classification by individual deposit, I took the time to sort through my note files to prepare Attachments A through F.

A summary of these attachments produces the following tabulation and total:

ARIZONA DEPOSITS

Productive Deposits	18
Potentially Productive Deposits	12
Potentially Productive Deposits, marginal	6
Sub-marginal Deposits	21
Untested Prospects	3
Sub-total	60
Att. E, Deposits not listed above, outcome uncertain	3
Total	63

The breakdown which I have summarized above and detailed on the individual attachments, may be used in a general way to indicate the odds of finding a commercial deposit once a zone of porphyry copper type alteration/mineralization of sufficient size (say, in excess of one-half mile diameter) has been found. If the productive deposits and the potentially productive deposits are combined for a total of 30, and if the marginal deposits and untested prospects are combined with the sub-marginal deposits for a total of 30, it is evident that the gambling odds are about 50-50.

From the standpoint of analysis by you, or that which Tom O'Neill is making, you may prefer to eliminate both the Bluebird and Ox Hide, as well as Christmas. Even though, the gambling odds would not be materially changed. Although some small or non-typical zones of alteration and mineralization may have been eliminated from my tabulation, I do not believe that any known prospects or deposits of material significance are unlisted, with the exception of Northern Mohave County where my information is meager.

*Revised 6-30-72

Attachment F lists five deposits in New Mexico. Although these are all of which I am currently aware, I do not admit to familiarity in New Mexico to the same degree of confidence that I have in Arizona. I have not attempted to list anything in Sonora.

The favorable gambling odds above cited, once a sizeable zone of porphyry copper mineralization has been found has nothing to do, of course, with the odds of finding a presently unknown or unexposed deposit. Also, the search for buried deposits--particularly on pediments--raises the problem of preservation versus distruction of Tertiary chalcocite blankets, and this variable is often an unpredictable but exceedingly important element for consideration.

JEK/bl
Attachs.
*Revised 6-30-72

ATTACHMENT A

PRODUCTIVE DEPOSITS

MAJOR	MINOR
Ajo (New Cornelia)	Bagdad
Bisbee (Lavender, Sacramento, Copper Queen)	[1]Bluebird
Miami - Inspiration	Castle Dome (Mined out)
Mission - Pima	[2]Christmas
Morenci	Copper Cities - Diamond H
Ray	Esperanza
San Manuel	Mineral Park
Sierrita	[1]Ox Hide
Twin Buttes	Silver Bell

Notes [1]Strictly speaking, these exotic deposits are not porphyry copper deposits, but they represent significant copper occurrences in a porphyry district.

[2]Christmas is here categorized as a "porphyry copper" in the sense that it represents a hydrothermal system in a porphyry environment, somewhat analogous to Mission.

ATTACHMENT B

POTENTIALLY PRODUCTIVE DEPOSITS

MAJOR	MINOR
Kalamazoo	Reward
[1]Lakeshore	[1]Sacaton
[1]Metcalf	[1]San Xavier North
[2]Miami East	[1]Old Reliable (Copper Creek District)
[3]Pinto Valley	
[2,3]Poston Butte	
Rosemont	
[2]Safford (P.D.)	

MARGINAL

[4]Blackwater

Chilito

Dragoon (Johnson Camp)

Helvetia

Lone Star

[2]Sanchez

Notes:

[1]Currently under development.

[2]Still in exploration/evaluation stage.

[3]Classified as "potentially productive" due to announced company plans. Under different ownership, probably would be considered "marginal" at this time.

[4]Except for a low-grade oxide tonnage, this deposit is essentially "pyritic."

ATTACHMENT C

SUB-MARGINAL

Exploration to date indicates these deposits are either too small, low-grade, or spotty to be commercial.

DEPOSIT	DRILLED BY
Cactus	Miami Copper
Copper Basin	Phelps Dodge Corporation
Copper Mountain	Phelps Dodge, New Jersey Zinc, Asarco
[2]Four Metals	Noranda
Glen Oaks	Phelps Dodge, Norandex, Sierra Mining
*Greenback	Pinal Mining Co., El Paso Gas
*Greenwood Peak	Asarco
*Kelvin (Area)	Con Coppermines, Occidental, Tipperary
Lane Mountain	Utah Construction
*Madera (Morgan)	Miami Copper, Consolidated Uranium, E + E Corporation
*Pioneer (Red Hills)	Duval Sulphur (?). Kaiser Cement, and others
Pine Flat	Dave Lowell, others
*Rock House	American Onex, Jay Fuller
Saginaw Hill	Calumet and Arizona, Ventures Ltd., Bear Creek, Anaconda
San Juan	Tuab, Bear Creek
Santa Cruz	Asarco
Sheep Mountain	Phelps Dodge
[2]Sunnyside	Asarco
[2]Three R	Con Coppermines
*Turquoise	Asarco, Bear Creek, Superior Oil, and others
*White Tank	Cominco, Kaiser Exploration and Mining Company
*Willcox	Asarco, Bear Creek

Notes: * Essentially pyritic, primary sulphides generally $<$.1% Cu, enrichment negligible or absent.

[2] Small breccia pipes with limited reserves, Patagonia area. Other pipes are present in the district but not listed separately.

ATTACHMENT D

UNTESTED PROSPECTS

Border Pipe (South of Patagonia)	Mineralized breccia pipe ±500 feet in diameter. Outcrops indicate original disseminated pyrite with minor enrichment. Deposit too small to warrant drilling.
Lost Horse	Possible fringe zone, two miles long by less than 400 feet wide as exposed, but may extend under flanking alluvium. The area is in a gunnery range withdrawn from mining.
Tyndall District (Santa Rita Mountains)	Zone of strong pervasive quartz-sericite-pyrite alteration several square miles in extent. General character of leached outcrops, plus occasional sulphides reached by old workings, indicate little more than traces of either primary or secondary copper.

ATTACHMENT E

DEPOSITS UNDER ACTIVE EXPLORATION,

OUTCOME UNCERTAIN

[1]Copper Basin.....	Phelps Dodge
[2]Copper Creek.....	Newmont, Humble
[1]Pine Flat.....	?
[2]Red Mountain.....	Kerr-McGee
[3]Van Dyke.....	Occidental (Miami town site)

Notes: [1]Listed also under "sub-marginal."

[2] Both deposits, on basis of all but most recent deep drilling, would have been listed as sub-marginal. Reported deep ore-grade intercepts render the final outcome uncertain.

[3] I have no reliable information on this drilling program.

ATTACHMENT F

SOUTHERN NEW MEXICO

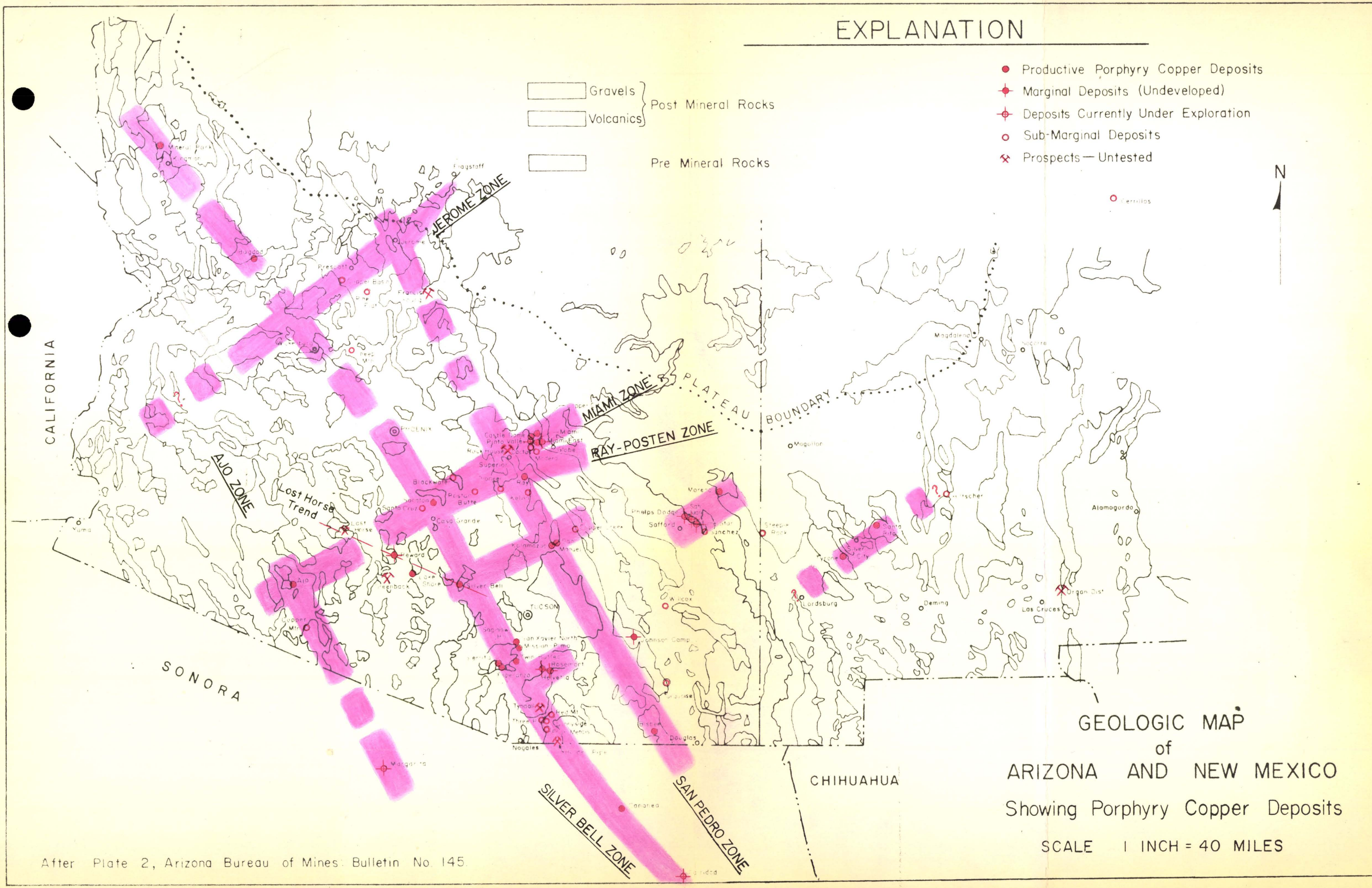
1. Tyrone

2. Santa Rita (Chino)

3. Small altered zone near Silver City, owned by U.S. Smelting and Refining. In 1960 it had not been drilled, but the dumps from caved adits indicated strong chalcocite enrichment.

4. A spotty kaolinized zone southwest of Lordsburg, capping suggests spotty pyrite with questionable limonite/copper sulphides.

5. Organ district. Strong alteration, but very low copper content. Drilled by Duval (?).



GEOLOGIC MAP of ARIZONA AND NEW MEXICO

Showing Porphyry Copper Deposits

SCALE 1 INCH = 40 MILES

After Plate 2, Arizona Bureau of Mines Bulletin No. 145

EXPLANATION

- Gravels
- Volcanics
- } Post Mineral Rocks
- Pre Mineral Rocks

- Productive Porphyry Copper Deposits
- Marginal Deposits (Undeveloped)
- Deposits Currently Under Exploration
- Sub-Marginal Deposits
- Prospects — Untested

N

CALIFORNIA

SONORA

CHIHUAHUA

PLATEAU BOUNDARY

Mineral Park
Kingman
Flagstaff
Cerrillos
Bagdad
Jerome
Prescott
Copper Basin
Pine
Flat
Francis
Young
Wickenburg
Sheep
Mtn
Magdalena
Socorro
Copper Cities
PHOENIX
Castle Dome
Pinto Valley
Miami
Miami East
Rock House
Cactus
Globe
Madera
Superior
Pioneer
Ray
Kelvin
Blackwater
Saxton
Santa Cruz
Poston
Butte
Casa Grande
Morenci
Hilltscher
Yuma
Lost
Horse
Phelps Dodge
Safford
San
Juan
Long Star
Sanchez
Steeple
Rock
Santa
Rita
Alamogordo
Copper Creek
Kalamazoo
San
Manuel
Tyrone
Silver
City
Reward
Ajo
Lake
Shore
Greenback
Silver Bell
Willcox
Lordsburg
Deming
Organ Dist
Las Cruces
TUCSON
Copper
Mtn
Saginaw
Hill
San Xavier North
Mission-Pima
Johnson Camp
Sierrita
Twin Buttes
Rosemont
Esperanza
Helvetia
Turquoise
Tyndall
Red Mt
Three R
Sunnyside
Four Metals
Bisbee
Douglas
Nogales
Border Pipe
Margarita
Cananea
Carridad

GEOLOGIC MAP
of
ARIZONA AND NEW MEXICO
Showing Porphyry Copper Deposits

SCALE 1 INCH = 40 MILES

After Plate 2, Arizona Bureau of Mines Bulletin No. 145.

To J. J. Durek 7/5/72
From J. E. Runnisen

Re: Arizona Copper production and Reserves

Joe —

The enclosed data, on which I have been working on and off since March, was ready to send out - finally - saturday. On reviewing the cover letter prior to mailing, I was unhappy to some extent with the brevity and emphasis (or lack of). Brigitte has left for a week of vacation, so I am now adding these additional comments in long hand. The following is principally for your benefit, and amounts to largely amplification on the source and quality of data.

PRODUCTION

The basic source for porphyry copper production, is of course Parsons - to 1955. From that point I have used largely the U.S. Bur Mines Minerals resources Yearbooks. In some instances data by mine did not exist for some mines, some years. In these cases projection was made back or forward, or both. Allowance for strikes shutdowns was given, and for change in plant capacity. For instance, the early years of Pima were not listed - and I allowed for full depletion of the original hi-grade reserve in the central core up to 1962, and ~~estimated~~ the remaining years taken from Min Yearbooks; Silverbell required estimation from 58-62 using slight increase in mill capacity and minor decline in grade. And so forth —

For the non-porphyry deposits, additional effort was required; particularly at Bisbee. Fortunately, I was able to find a reliable district total through 1948, and the old Sacramento production was published in Parsons. In any event, I was able to sort out the underground production and have listed this all under Copper Queen - a surprisingly large figure - 6.152 B.11 #Cu -- equal to any respectable open pit.

The problem, as I'm sure you realize, is that ~~most~~ articles about a district are often vague regarding production (Cyprus on Morenci and Hanmer's on ~~and~~ Magma are refreshingly complete). I tried the Horz Bur Mines and Dept Mer Resources, but could get relatively little help for these agencys.

The point of all this commentary is that production figures are not generally available, and yet are probably useful in understanding the relative magnitude of various deposits. I believe the figures listed herein are accurate within any limits of practical use.

RESERVES

The figures given are (with the exception of Inspiration) better than simple guesses. In each case there existed either ① direct information, ② second-hand but specific and probably reliable - (to a point) ~~the~~ type of information; or ③ published reserves. In many cases it has been possible to roughly check the probable validity of stated reserves by general knowledge of - say - area drilled and other factors. The Metcalf reserve listed for instance, is second-hand -- but in 1960 after some quick reconnaissance, Courtright and I estimated approximately the same figure, based on the areal extent of promising leached capping and a few solicited comments from P.D..

I might add that any revisions you can suggest, based on your own information, will be appreciated -- particularly if any gross errors are seen. Possibly the most "shaky" reserve of any operating mine is Inspiration, in the Live Oak - Thornton area. The reserve given is purely guess, based on the rather large quantity of leached capping with lime-often Chalcocite which has been dumped ~~on~~ west of Miami in the last few years. Another very unsure reserve is that for Lonestar -- I have three different tonnages and grades from different sources, with the grade being the most divergent; but all of which are higher grade/lower tonnage than

In summary, the reserves given are, I hope, generally realistic; In a number of instances, however, there is admittedly a possibility for error.

Exploration

One premise which invites consideration is that exploration might be established on the basis of neighboring Reserves or resources. This may not be the best approach, but is certainly worth consideration -- and it appears that other companies are using this as a principal means of area selection.

The two outstanding areas are Morenci - Safford and Ray - Miami, with Pima - Rosemont running a close third.

By going a step further than mineral "Centers" to Mineral "zones", the following observations are immediately possible:

1. Morenci - Safford and Ray - Miami (together with Santa Rita - Tyrone which is not tabulated) suggests a copper belt parallel the much-discussed Texas Lineaments. There is, however, nothing (or very little) on the ground to suggest intervening Centers.

2. The Mineral belt following the general Course of the San Pedro, from Bisbee north through Magma and finally to Jerome, contains through part of its length more known copper than the Silver Bell zone lying parallel and to the west.

The San Pedro Zone contains:

Bisbee	7.9	
Ray Miami	35.7	
San-Manuel-Copper Creek	16.1	
Total Resource	59.7	B.11 # Cu

Compared to the Silver Bell Zone:

Cerbat	±9	
Pima - Rosemont	26.6	
Sacaton - Poston	5.0	
Silver Bell	1.8	
Total Resource	34.3	B.11 # Cu

The Poston Butte deposit, in the tabulation above, should really be deleted to give a better, more restricted comparsion.

The S.W. trending zone from Miami to Sacton, and extended SW to Ajo, yields:

Ajo	6.4	
Ray-Miami	35.7	
Sacaton-Poston	5.0	
Slate-Vekol	7.5	
Total Resource	54.6	B.11 # Cu

I will not pursue this line of argument more at this time -- I really only bring it up to stimulate discussion. Perhaps we can both comment on such ideas during personal conferences in the future.

(Indeed, one can argue the opposite proposition; that as a "center" or "zone" begins, through continued discovery, to exceed even our best expectations, the chance for continued discoveries actually must decline; to zero at some point -- and that less productive "zones" or "centers" which are geologically "strong" offer better targets.)

Price of Copper

Not being a financial expert, I do not wish to argue anything specific under this heading.

Even a bystander, however, can note that if my reserve figures are even roughly accurate, that there is more copper in reserve at operating properties than all past production. This would make me very nervous about investing in low-grade, or marginal operations, unless pay back were very quick -- in which case, really, the word marginal would not apply.

Johnny 7/5/72

P.S. —

Some final comments:

The total reserve as listed on Att A, pg 2, does not correlate (by about 1 B.11 #) with the total given on pg 3 of Att E. In compiling Att A I intended to list neither Courtland (an insignificant reserve) nor Johnson Camp (geographically isolated – as is Courtland also); Johnson (nr Dragoon) is properly omitted, by Courtland was included, accounting for the 1 B.11 # difference in totals.

In the course of the compilations, I worked out an approximate mill feed grade and daily tonnage for the operating properties, from 1960-70. These indicate the general decline in grade at many properties (among other things). The sheets are not ready yet for distribution, but I will try and have these checked and typed in the near future, as I believe the data may be of general interest.

I see in the most recent psych. a reserve recoverable of measured open pit ore of .275 B.11 # Cu; slightly over my figure of .229 B.11 # Cu.

Please have patience with my poor handwriting. I felt that the data had been revised over and over, to the point of diminishing returns, and wanted it and these other remarks transmitted without further delay