



CONTACT INFORMATION

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

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possesses outstanding opportunities for solitude or a primitive and unconfined type of recreation are entitled to considerable deference.

7. Federal Land Policy and Management Act of 1976: Inventory and Identification--
Federal Land Policy and Management Act of 1976: Wilderness--Wilderness Act

While the Bureau of Land Management may inventory and identify areas of the public lands of less than 5,000 acres as having wilderness characteristics, it may not properly designate such areas as wilderness study areas under sec. 603(a) of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1782(a) (1976), because that section only mandates review of roadless areas of 5,000 acres or more and roadless islands of the public lands. However, such areas may be managed under the general management authority of sec. 302, 43 U.S.C. § 1732 (1976), in a manner consistent with wilderness objectives, and such areas may also be recommended for wilderness designation.

APPEARANCES: Robert B. Crist, Graham M. Clark, Jr., Esq., Tucson, Arizona, for ASARCO, Inc.; Jerry L. Haggard, Esq., Phoenix, Arizona, for Western Nuclear, Inc., and Energy Fuels Exploration Co., Phelps Dodge Corporation, and Cyprus Bagdad Copper Co.; Clinton J. Hansen, Esq., Phoenix, Arizona, for Arizona Mining Association; Dale Goble, Esq., Office of the Solicitor, Washington, D.C., for the Bureau of Land Management.

OPINION BY ADMINISTRATIVE JUDGE STUEBING

ASARCO, Inc., Western Nuclear, Inc., and Energy Fuels Exploration Company, Phelps Dodge Corporation, Arizona Mining Association, and Cyprus Bagdad Copper Company appeal from decisions of the Arizona State Director, Bureau of Land Management (BLM), dated March 12, 1981, denying in substantial part their protests of the designation of lands within Arizona as wilderness study areas (WSA's). A list of those lands designated as WSA's appeared in the Federal Register on November 7, 1980, at 45 FR 74066.

The State Director's action establishing WSA's was taken pursuant to section 603(a) of the Federal Land Policy and Management Act of 1976 (FLPMA), 43 U.S.C. § 1782 (1976). That section directs the Secretary to review those roadless areas of 5,000 acres or more and roadless islands of the public lands which were identified during the inventory required by section 201(a)

of the Act as having wilderness characteristics described in the Wilderness Act of September 3, 1964, 16 U.S.C. § 1131(c) (1976). Following review of an area or island, the Secretary shall from time to time report to the President his recommendation as to the suitability or unsuitability of each such area or island for preservation as wilderness.

The wilderness characteristics alluded to in section 603(a) are defined in section 2(c) of the Wilderness Act, 16 U.S.C. § 1131(c) (1976):

A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this chapter an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

The review process undertaken by the State Office pursuant to section 603(a) has been divided into three phases by BLM: Inventory, study, and reporting. The State Director's announcement on November 7, 1980, of those areas designated as WSA's marks the end of the inventory phase of the review process and the beginning of the study phase.

Although appellants do not each appeal the identical WSA designations, the arguments advanced by each on appeal are of sufficient similarity to permit our consolidation of these five cases. 1/ These arguments are:

1. The "wilderness-only" inventory conducted by BLM violates the statutory mandate of FLPMA for a comprehensive multi-resource inventory and is contrary to national policy.
2. BLM's practice of eliminating nonwilderness corridors (cherrystems) from an inventory unit is contrary to section 603(a).
3. Vehicle routes satisfying BLM's "road" definition exist within the WSA's and disqualify such areas from further study.
4. The WSA's contain significant imprints of man and do not otherwise possess wilderness characteristics.

1/ The WSA's on appeal are set forth in the Appendix.

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3. Vehicle routes satisfying BLM's "road" definition exist within the WSA's and disqualify such areas from further study.
4. The WSA's contain significant imprints of man and do not otherwise possess wilderness characteristics.

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5. The management restrictions set forth in the Department's Interim Management Plan Policy do not comply with section 603, congressional intent, or national policy.

We shall address each argument in order.

[1] The "wilderness-only" inventory mentioned by appellants refers to the inventory undertaken by BLM to identify those roadless areas of the public lands of 5,000 acres or more possessing wilderness characteristics. Appellants charge that BLM acted contrary to section 201 of FLPMA by limiting its inventory to wilderness values. That section directs the Secretary to "prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values." 43 U.S.C. § 1711 (1976). Appellants interpret section 201(a) to require a multi-resource inventory prior to any wilderness review of the same lands. The result of BLM's "wilderness-only" inventory, in appellants' view, has been to designate lands as WSA's in ignorance of the resources therein and to lock up these lands for an unlimited period of time under BLM's Interim Management Policy.

Counsel for BLM maintains that the Secretary acted within his discretion in limiting his initial inventory efforts to wilderness values. This conclusion was a reasonable one, counsel argues, because a multi-resource inventory of the public lands would require several years, during which time all lands would remain under the nonimpairment standard of section 603(c). This standard would remain in effect until the lands were determined to lack wilderness characteristics or were released from WSA status. In counsel's view, therefore, the Secretary's action limiting the inventory initially to wilderness values relieved as much land as possible from the restrictions of section 603(c) in as short a time as possible. By counsel's estimate, the Secretary's policy has allowed some 149,368,000 acres (86 percent of the total) to be released to full, multiple use management.

Appellants' argument echoes that of the Cotter Corporation in Utah v. Andrus, 486 F. Supp. 995 (D. Utah 1979)^a. Therein at 1,003, Judge Anderson addressed the merits of this argument:

Cotter contends that BLM must take all potential values into account when it designates an area as a WSA. The statute, however, envisions a dynamic process, not a static one-time-only decision. FLPMA is addressed in part to solving the problem of the lack of a comprehensive plan for the use, preservation and disposal of public lands. The purpose of the inventory and the wilderness review is to enable BLM to ascertain the character of the lands within its jurisdiction, and the best use to which particular portions of land can be put—given such things as wilderness characteristics, mineral values, and the nation's needs for recreation, energy, etc. BLM is entitled to address this problem one step at a time. [Citations omitted; emphasis in original.]

* * * BLM is not required to immediately balance the mineral values against the wilderness values of a particular piece of land prior to designating the land a WSA. BLM may, consistent

a) GFS(MIN) JD-2(1979)

with FLPMA, look first at potential wilderness characteristics and then proceed to study the area for all its potential uses prior to formulating its final recommendations to the Executive.
[Emphasis added.]

In Petroleum, Inc., 61 IBLA 139 (1982)^b this Board reached a result consistent with that of Judge Anderson. Therein at 142, we noted that the concern of appellant that the Secretary have comprehensive and balanced information regarding the various values of the WSA will be met during the study phase of the review process. During this phase, BLM will consider all values, resources, and uses of the lands considered for wilderness preservation. This same statement is equally appropriate in the instant appeals. No argument presented by appellants in their statement of reasons compels a different result.

[2] Appellants' second argument on appeal charges that BLM has designated lands as WSA's that are not roadless. The focus of this argument is BLM's cherrystemming practice whereby BLM designates as nonwilderness corridors (cherrystems) lands occupied by roads or other intrusions that would seemingly disqualify a parcel from wilderness consideration. The boundaries of an inventory unit containing a cherrystem are drawn around an intrusion by BLM so as to exclude it from the area being considered for wilderness values.

In National Outdoor Coalition, 59 IBLA 291, 296 (1981)^c we held that BLM did not act contrary to law or any established Department policy in recognizing nonwilderness corridors occupied by roads or other manmade intrusions. Though the boundaries of a WSA "containing" a nonwilderness corridor might be irregular as a result of such corridors, we agreed with BLM that section 603(a) did not specify any particular shape for an area that may eventually be recommended for wilderness preservation. This decision has been followed in several subsequent cases, none of which are materially different from the cases on appeal. See, e.g., State of Nevada, 62 IBLA 153 (1982)^d and C & K Petroleum Co., 59 IBLA 301 (1981)^e. The State Director's response approving the practice of cherrystemming is, accordingly, affirmed.

[3] Appellants express considerable opposition to BLM's characterization of certain vehicle routes within the WSA's as ways rather than roads. The opposition raised by appellants calls for a close examination of the definition of a "road" used by BLM in its field work. That definition, set forth in H.R. Rep. No. 1163, 94th Cong., 2d Sess. 17 (1976), also appears in BLM's Wilderness Inventory Handbook (WIH) at 5: "The word 'roadless' refers to the absence of roads which have been improved and maintained by mechanical means to insure relatively regular and continuous use. A way maintained solely by the passage of vehicles does not constitute a road."

Appellants rely upon Organic Act Directive (OAD) 78-61, Change 2 (June 28, 1979), for the proposition that a route qualifies as a "road" so long as the route was improved at one time with tools to insure relatively regular and continuous use. Such an interpretation, we feel, is misleading. OAD 78-61 does nothing to remove the requirement that a vehicle route, once improved by mechanical means, must receive maintenance by mechanical means as needed in order to qualify as a road. What the OAD does say, however, is

- b) GFS(MISC) 31(1982), GFS(O&G) 47(1982)
- c) GFS(MIN) 6(1982), GFS(MISC) 2(1982)
- d) GFS(MISC) 58(1982)
- e) GFS(MISC) 3(1982)

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that a route, having been mechanically improved, may be regarded as a road if mechanical maintenance has not yet been necessary. Improvements and relatively regular and continuous use would be an indication that the road would be maintained if the need were to arise. OAD at 4. Appellants do not establish error in BLM's methods by pointing to WSA's where evidence of the use of tools is found. Similarly, appellants do not establish error by alleging mechanical improvement and mechanical maintenance in the past if mechanical maintenance has not been made for some time. The contention that a route is in fact a road must be supported by proof of mechanical improvement and mechanical maintenance, inter alia. See Conoco, Inc., 61 IBLA 23, 30 (1981).^f If mechanical maintenance is unnecessary because of the stability of the soil or other reasons, that fact must be alleged and proved. No such allegation appears in appellants' statements of reasons. See Sierra Club, 62 IBLA 367, 369-70 (1982).^g

The "road" definition that BLM uses in its field work applies also to routes of travel within a wash. Appellants' argument that a route located within a wash subject to annual runoffs should be presumed to be improved finds no support in FLPMA, the WIH, or the OAD's. The further contention that BLM's requirement of mechanical maintenance is artificial or irrelevant because nonmechanically maintained routes may be equally visible or well-travelled overlooks the fact that BLM may eliminate such routes as substantially noticeable imprints of man.

[4] Appellants' fourth argument on appeal is the contention that the WSA's contain significant intrusions of man and otherwise lack wilderness characteristics. Though these allegations are repeated for virtually every WSA on appeal, appellants' statements of reasons do not point to specific intrusions or inholdings which appellants believe that State Director overlooked or improperly considered in his protest response. In the absence of specific allegations of error, our review of the record, consisting of some 16 cartons of documents, is necessarily limited to the issues of law or policy advanced by appellants.

Appellants' allegations of intrusions or imprints of man within the WSA's do not by themselves establish error in the State Director's protest response. In setting forth the definition of wilderness, quoted above, Congress did not require that a wilderness area be free of all imprints of man. Instead, Congress required that an area generally appear to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. Indeed, in H.R. Rep. No. 95-540, 94th Cong., 2d Sess. 6 (1977), a report prepared to accompany H.R. 3454, 2/ there are listed several examples of intrusions which may be allowed in a designated wilderness area. Among these are trails, trail signs, bridges, fire towers, firebreaks, fire suppression facilities, pit toilets, fisheries enhancement facilities, fire rings, hitching posts, snow gauges, water quantity and quality measuring devices, and other scientific devices. Based on this guidance, BLM has set forth in its WIH examples of intrusions found on the

2/ This bill was later enacted as the Endangered American Wilderness Act, 16 U.S.C. § 1132 (Supp. II 1978).

^f) GFS(MISC) 27(1982), GFS(O&G) 36(1982)

^g) GFS(MISC) 72(1982)

public lands which, it finds, may be present within a WSA. These additional items include research monitoring markers and devices, wildlife enhancement facilities, radio repeater sites, air quality monitoring devices, fencing, and spring development.

As there is apparently no question that the lands contain imprints of man, appellants' objections to such imprints reduce to a disagreement with BLM as to whether such imprints are substantially noticeable. This question, of course, calls for a highly subjective determination by BLM. In Conoco, Inc., supra, we held that BLM's subjective judgment as to an area's naturalness qualities was entitled to considerable deference by this Board. We believe a similar holding is appropriate in the instant appeals. Inventory case files assembled by BLM evidence its firsthand knowledge of the lands at issue. In addition, BLM has received the benefit of numerous comments from individuals and groups of wide ranging interests. BLM's expertise and familiarity with the units on the ground entitle it, we believe, to our considerable deference in such subjective determinations. Appellants' views to the contrary, while not unreasonable, do not undermine this deference. The request by appellants for appointment of an Administrative Law Judge to further inquire into these issues is denied.

Whether BLM may consider during the inventory imprints of man outside WSA boundaries is a related issue raised by appellants. Sights and sounds of man's imprint, whether located just beyond the perimeter of a WSA or in an inholding within, are generally considered during the study phase of wilderness review. Such sights and sounds technically emanate from land outside the WSA and are treated by BLM as so occurring. OAD 78-61, Change 2 at 3. BLM's practice is to assess the imprints of man outside unit boundaries during the inventory stage only in situations where the imprint is adjacent to the unit and its impact is so extremely imposing that it cannot be ignored, and if not considered, reasonable application of inventory guidelines would be questioned. OAD 78-61, Change 3 at 4. On the basis of appellants' submissions on appeal, we perceive no abuse of this policy by BLM.

[5] Appellants further maintain that BLM incorrectly considered the rehabilitation potential of impacted lands in designating such lands as WSA's. Though this charge is made as to all units on appeal, our examination of the case files indicates that it is applicable to only a limited number of units.

The WIH and OAD 78-61, Change 3, appear to be inconsistent with one another on the issue of rehabilitation. At page 14, the WIH provides support for the rehabilitation of a substantially noticeable impact:

An inventory unit or portion of an inventory unit in which the imprint of man's work is substantially noticeable, but which otherwise contains wilderness characteristics, may be further considered for designation as a Wilderness Study Area when it is reasonable to expect the imprint of man's work to return or be returned to a substantially unnoticeable level either by natural processes or by hand labor. An example could be an abandoned railroad bed. [Emphasis in original.]

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This support appears to have been withdrawn, however, by the subsequent OAD:

h. Rehabilitation potential. Page 14 of the WIH identified the possibility of considering certain areas in which existing imprints of man could be rehabilitated through either natural processes or hand labor. Consideration may be given to rehabilitation potential only under the following conditions.

(1) An inventory unit must qualify as having wilderness characteristics without considering rehabilitation potential. In other words, rehabilitation potential should not be the basis for concluding that wilderness values exist in a unit. The intent is not to create wilderness where it does not exist.

(2) Rehabilitation potential should be considered only for those imprints of man that exist within a unit but are not so significant as to automatically disqualify the unit or portion of a unit.

(3) Rehabilitation potential should be considered only in rare and extreme cases.

(4) For rehabilitation potential to enter into the decision, it must be documented that rehabilitation through hand tools and/or natural processes is feasible in light of the magnitude of the area and technical, physical, scientific, and budgetary factors. It must also be documented that either enough is known about rehabilitation potential of a given situation to reasonably predict its success or that natural rehabilitation has been established to the point where rehabilitation is certain. [Emphasis in original.]

This subsequent OAD expresses the current BLM policy on the subject. Our examination of the files shows that BLM frequently considered the rehabilitation potential of manmade imprints that it found to be substantially unnoticeable. No error occurs in these situations, we believe, because such lands were found to possess wilderness characteristics independent of whatever rehabilitation may occur. In unit AZ-050-023A/B, however, BLM's narrative summary openly acknowledges that past mining operations have left a "substantially noticeable impact on an area covering approximately 80 acres." Despite such impact, this 80-acre area was allowed to remain in the WSA because of its favorable rehabilitation potential. In unit AZ-020-028/029, mining imprints described as "significant" by BLM were allowed to remain in the WSA for a similar reason. We hereby remand the case files of these two units to BLM to reconsider its actions in the light of OAD 78-61, Change 3. If BLM shall find that such impacts are not so significant as to be automatically disqualifying, it shall supplement the narrative summaries appropriately setting forth the reasons for its conclusions. If BLM shall find that such impacts are so significant as to be automatically disqualifying, it

shall modify the boundaries of the unit to exclude such impacted lands. ^{3/} Assuming that such modifications do not reduce the acreage of the WSA's to less than 5,000 acres, infra, these WSA's, as modified, may be further studied for wilderness preservation.

[6] Though appellants have heretofore focused on the naturalness characteristics of the WSA's, they also find error in BLM's application of the outstanding opportunity criterion. In designating each of the units on appeal as a WSA, BLM was required to find that each unit possessed outstanding opportunities for either solitude or a primitive and unconfined type of recreation. 16 U.S.C. § 1131(c) (1976). Appellants contend that BLM misapplied this standard in reliance on OAD 78-61, Change 3. This directive requires BLM to avoid comparisons of units in assessing whether outstanding opportunities for solitude or a primitive and unconfined type of recreation exist. In appellants' view, comparisons of the WSA's with other lands, whether administered by BLM or not, is necessary, so that only lands with truly outstanding opportunities are designated as WSA's.

We agree with appellants that comparisons are necessary, but find no error in BLM's inventory process. We reach this conclusion, because there is implicit in the inventory process a comparison by virtue of the fact that BLM is required to identify lands with outstanding opportunities. The WIH, authored by BLM, defines the term "outstanding" in this way: "Standing out among others of its kind; conspicuous, prominent; 2. superior to others of its kind; distinguished; excellent." WIH at 13, 15. There is no indication in the OAD's that this definition was intended to be modified.

In Committee for Idaho's High Desert, 62 IBLA 319, 326 (1982),^h the concurring opinion stated: "In order to attribute 'outstanding' opportunities, values, or characteristics to land, that land must be compared with other lands, as the term 'outstanding' is necessarily comparative in its concept." (Emphasis in original.) Commenting on this same issue, the Board held in Sierra Club, 61 IBLA 329, 334 (1982):ⁱ "The ultimate question is not whether BLM employees flawlessly follow every direction contained in the WIH; rather, the real question is whether or not the BLM decision correctly applies the statutory criteria." We believe BLM's construction of the outstanding opportunity criterion, as set forth in its definition of the term "outstanding," to be a reasonable one and hold that the statutory criteria have been correctly applied.

^{3/} Three recent decisions of this Board have discussed rehabilitation potential to some extent without reference to OAD 78-61, Change 3. They are Don Coops, 61 IBLA 300 (1982);^j City of Colorado Springs, 61 IBLA 124 (1982);^k and Tri-County Cattlemen's Association, 60 IBLA 305 (1981).^l Insofar as any of these cases need to be distinguished, it does not appear that in any of them did appellants establish that the wilderness criterion of naturalness was lacking or that the imprint of man's work was so significant as to require automatic disqualification of the units, or portions thereof. Absent such a showing, BLM's consideration of their rehabilitation potential was not improper.

h) GFS(MISC) 69(1982)

i) GFS(MISC) 42(1982)

j) GFS(MISC) 40(1982)

k) GFS(MISC) 30(1982)

l) GFS(MISC) 23(1982)

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[6] Though appellants have heretofore focused on the naturalness characteristics of the WSA's, they also find error in BLM's application of the outstanding opportunity criterion. In designating each of the units on appeal as a WSA, BLM was required to find that each unit possessed outstanding opportunities for either solitude or a primitive and unconfined type of recreation. 16 U.S.C. § 1131(c) (1976). Appellants contend that BLM misapplied this standard in reliance on OAD 78-61, Change 3. This directive requires BLM to avoid comparisons of units in assessing whether outstanding opportunities for solitude or a primitive and unconfined type of recreation exist. In appellants' view, comparisons of the WSA's with other lands, whether administered by BLM or not, is necessary, so that only lands with truly outstanding opportunities are designated as WSA's.

We agree with appellants that comparisons are necessary, but find no error in BLM's inventory process. We reach this conclusion, because there is implicit in the inventory process a comparison by virtue of the fact that BLM is required to identify lands with outstanding opportunities. The WIH, authored by BLM, defines the term "outstanding" in this way: "Standing out among others of its kind; conspicuous, prominent; 2. superior to others of its kind; distinguished; excellent." WIH at 13, 15. There is no indication in the OAD's that this definition was intended to be modified.

In Committee for Idaho's High Desert, 62 IBLA 319, 326 (1982),^h the concurring opinion stated: "In order to attribute 'outstanding' opportunities, values, or characteristics to land, that land must be compared with other lands, as the term 'outstanding' is necessarily comparative in its concept." (Emphasis in original.) Commenting on this same issue, the Board held in Sierra Club, 61 IBLA 329, 334 (1982):ⁱ "The ultimate question is not whether BLM employees flawlessly follow every direction contained in the WIH; rather, the real question is whether or not the BLM decision correctly applies the statutory criteria." We believe BLM's construction of the outstanding opportunity criterion, as set forth in its definition of the term "outstanding," to be a reasonable one and hold that the statutory criteria have been correctly applied.

^{3/} Three recent decisions of this Board have discussed rehabilitation potential to some extent without reference to OAD 78-61, Change 3. They are Don Coops, 61 IBLA 300 (1982); City of Colorado Springs, 61 IBLA 124 (1982);^k and Tri-County Cattlemen's Association, 60 IBLA 305 (1981).^l Insofar as any of these cases need to be distinguished, it does not appear that in any of them did appellants establish that the wilderness criterion of naturalness was lacking or that the imprint of man's work was so significant as to require automatic disqualification of the units, or portions thereof. Absent such a showing, BLM's consideration of their rehabilitation potential was not improper.

h) GFS(MISC) 69(1982)

i) GFS(MISC) 42(1982)

j) GFS(MISC) 40(1982)

k) GFS(MISC) 30(1982)

l) GFS(MISC) 23(1982)

Appellants' remaining comments on the outstanding opportunity criterion are very general and amount to little more than simple disagreement with BLM's determination that the WSA's do in fact possess such opportunities. As we stated above in our discussion of naturalness characteristics, BLM's determination of the presence of outstanding opportunities calls for a highly subjective judgment on its part. Because of its expertise gained from its firsthand knowledge of the lands and the comments of interested persons, we believe that BLM's judgment is entitled to considerable deference. By this statement, we do not mean to imply that BLM's determination will be immune from review. To the contrary, BLM's documentation for its judgment will be carefully studied, as will the documentation of an appellant. An appellant will, however, have a particularly heavy burden to support a reversal of BLM's subjective conclusions. We cannot say that appellants have met this burden on the issue of the units' outstanding opportunities for solitude or a primitive and unconfined type of recreation. Conoco, Inc., supra at 28.

Appellants' final argument on appeal is the contention that the management restrictions set forth in the Interim Management Policy (IMP) do not comply with section 603, congressional intent, or national policy. While appellants' argument may be of interest in the future, they allege no facts which would evidence an ongoing controversy and thus allow the Board to consider this argument in a concrete, factual setting. Moreover, the right to protest the State Director's WSA's designations was granted to provide a forum for those persons objecting to BLM's finding that the WSA's possessed the requisite size, naturalness, and outstanding opportunities. Appellants' arguments are outside the scope of this grant and must await a future adverse application of the IMP to a proposed action of appellants.

[7] Our examination of the inventory files indicates that units whose area is less than 5,000 acres have been designated as WSA's. ^{4/} The Secretary's authority to review roadless areas for wilderness characteristics under section 603(a) is, however, limited to roadless areas of 5,000 acres or more and roadless islands of the public lands. 43 U.S.C. § 1782 (1976). Although we acknowledge that section 2(c) of the Wilderness Act of 1964, supra, requires a wilderness area to have "at least five thousand acres or [be] of sufficient size as to make practicable its preservation and use in an unimpaired condition," the Secretary's review authority under section 603(a) is not coextensive with this language from section 2(c). Our holding to this effect is set forth in Tri-County Cattlemen's Association, supra.

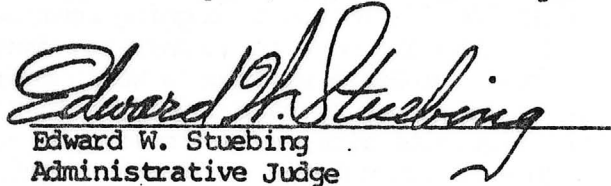
In Tri-County, this Board examined in some detail the legislative history of section 603 and found that the authority to designate an inventory unit as a WSA is derived from section 603(a). That section directs the Secretary to review only those areas of 5,000 acres or more. Thus, we concluded that section 603(a) established a minimum acreage requirement for WSA's. Id. at 312.

^{4/} Those units under appeal whose area is less than 5,000 acres are: AZ-010-006B, AZ-010-006C, AZ-010-006D, AZ-010-096A, AZ-010-099; AZ-020-007, AZ-020-014, AZ-020-021, AZ-020-068, AZ-020-084A, AZ-020-197, AZ-020-203B; AZ-040-076, AZ-040-077; AZ-050-005B, AZ-050-023A, AZ-050-031, and AZ-050-033.


The impact of Tri-County on the instant case is to reverse the State Director's WSA designation pursuant to section 603(a) of any parcel under 5,000 acres in area. This holding is made despite the fact that these parcels may be contiguous with proposed wilderness lands of other Interior agencies or the subject of strong public support. As Tri-County points out, however, BLM has the authority to pursue wilderness review of these areas under other provisions of FLPMA, specifically, 43 U.S.C. §§ 1712 and 1732 (1976). The nonimpairment standard set forth in section 603(c) would not apply to such an area under 5,000 acres. See also Don Coops, 61 IBLA 300, 305-06 (1982),^m and Save the Glades Committee, 54 IBLA 215 (1981),ⁿ

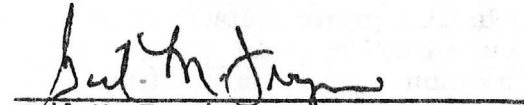
To summarize our multiple holdings in these cases, the State Director's decisions with respect to those WSA's under 5,000 acres in area are reversed; case files AZ-020-028/029 and AZ-050-023A/B are remanded for action consistent herewith; and the State Director's decisions for the remainder of the units on appeal are affirmed.

Therefore, pursuant to the authority delegated to the Board of Land Appeals by the Secretary of the Interior, 43 CFR 4.1, the decisions of the State Director are reversed in part, remanded in part, and affirmed in part.


Edward W. Stuebing
Administrative Judge

We concur:


Anne Poindexter Lewis
Administrative Judge


Gail M. Frazier
Administrative Judge


^m) GFS(MISC) 40(1982)

ⁿ) GFS(MISC) 36(1981)


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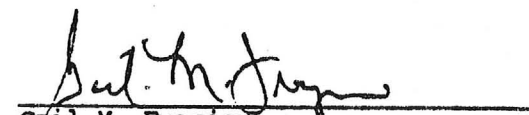
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Edward W. Stuebing
Administrative Judge

We concur:


Anne Poindexter Lewis
Administrative Judge


Gail M. Frazier
Administrative Judge

^m) GFS(MISC) 40(1982)

ⁿ) GFS(MISC) 36(1981)

APPENDIX

IBLA 81-802 - ASARCO, Inc.*

AZ-020-071	AZ-020-187
AZ-020-075	AZ-020-194
AZ-020-100	AZ-020-197

IBLA 81-804 - Western Nuclear, Inc., and Energy Fuels Exploration Company.

AZ-010-031	AZ-010-097
AZ-010-033A	AZ-010-104A
AZ-010-034	AZ-010-104B
AZ-010-093	AZ-010-105A**
AZ-010-096A	AZ-010-109**
AZ-010-096C	AZ-010-111
AZ-010-096D	AZ-010-112**

IBLA 81-805 - Phelps Dodge Corporation

AZ-040-014	AZ-040-048
AZ-040-016	AZ-040-060
AZ-040-022/023/024A	AZ-040-065
AZ-040-022/023/024B	AZ-040-076
	AZ-040-077

IBLA 81-806 - Arizona Mining Association

AZ-010-008A/19	AZ-010-096C
AZ-010-008B	AZ-010-096D
AZ-010-009	AZ-010-097
AZ-010-031	AZ-010-099
AZ-010-033A	AZ-010-104A
AZ-010-034A	AZ-010-104B

* Though ASARCO's statement of reasons includes a discussion of unit AZ-040-001A, there is no mention of this unit in either its protest or notice of appeal. This unit, therefore, is not considered in this appeal.

** The appeals of Western Nuclear, Inc., and Energy Fuels Corporation as to units AZ-010-105A, AZ-010-109, AZ-010-112 are hereby dismissed for appellants' failure to timely submit their protest. By an announcement appearing in the Federal Register, 45 FR 11919 (Feb. 22, 1980), the Acting State Director specified that all protests of accelerated inventory units, such as these, must be filed no later than Mar. 26, 1980. Appellants' protest of these units is dated Dec. 30, 1980, well after the deadline. Had appellants appealed the WSA designation of unit AZ-010-119, as appears to have been their intention, a similar dismissal for untimeliness would be in order.

IBLA 81-806 - Arizona Mining Association (continued)

AZ-010-041	AZ-010-106A***
AZ-010-050	AZ-010-106B***
AZ-010-051	AZ-010-106C***
AZ-010-052	AZ-010-106D***
AZ-010-091	AZ-010-111
AZ-010-093	AZ-010-132
AZ-010-096A	AZ-010-136
AZ-020-001A	AZ-020-119
AZ-020-007	AZ-020-125
AZ-020-008	AZ-020-126A
AZ-020-009	AZ-020-136
AZ-020-010	AZ-020-138
AZ-020-012/042	AZ-020-142/144
AZ-020-014	AZ-020-157
AZ-020-015	AZ-020-160
AZ-020-021	AZ-020-163
AZ-020-024	AZ-020-164
AZ-020-028/029	AZ-020-172
AZ-020-068	AZ-020-176
AZ-020-071	AZ-020-187
AZ-020-075	AZ-020-194
AZ-020-083	AZ-020-197
AZ-020-084A	AZ-020-202
AZ-020-099	AZ-020-203B
AZ-020-100	AZ-020-204
	AZ-020-205
AZ-040-001A	AZ-050-005B
AZ-040-008	AZ-050-007C/5-48/2-52
	AZ-050-012
AZ-040-014	AZ-050-013
AZ-040-016	AZ-050-014A/B
AZ-040-022/023/024A	AZ-050-015A
AZ-040-022/023/024B	AZ-050-017
AZ-040-048	AZ-050-023A
AZ-040-060	AZ-050-023B
AZ-040-065	AZ-050-031
AZ-040-076	AZ-050-033
AZ-040-077	AZ-050-034

IBLA 81-807 - Cyprus Bagdad Copper Co.

AZ-020-068	AZ-050-012
AZ-020-071	AZ-050-013

*** An amended notice of appeal has been filed by the Arizona Mining Association to substitute units AZ-010-006A, AZ-010-006B, AZ-010-006C, and AZ-010-006D for units AZ-010-106A, AZ-010-106B, AZ-010-106C, and AZ-010-106D on appeal. Because this amended notice merely corrects what appears to be clerical errors, we will permit this substitution to be made.

IBLA 81-807 - Cyprus Bagdad Copper Co. (continued)

AZ-020-075
AZ-020-204
AZ-020-205

AZ-050-014
AZ-050-017
AZ-050-050****
AZ-050-076/5-48/5-52****

**** These units appear to be the product of further clerical errors; units AZ-050-015 and AZ-050-007C/5-48/2-52 were undoubtedly intended.

April 26, 1977

Mr. R. J. Bonnis, Mine Manager
Cyprus Bagdad Copper Company
P. O. Box 245
Bagdad, Arizona 86321

Dear Mr. Bonnis:

The Department of Mineral Resources is compiling data for its annual report on the copper industry, A PROFILE OF ARIZONA'S PRIMARY COPPER INDUSTRY FOR 1976 VOLUME I. We would appreciate having your 1976 production figures for: (1) tons of ore mined (2) pounds of recoverable copper and (3) pounds of recoverable molybdenum. Please insert the data in the space provided on the attached tabulation sheet.

Similar requests are being sent to all Arizona copper producers and a copy of the completed 1976 tabulations will be returned to you.

Thank you very much.

Sincerely,

Glenn A. Miller
Mineral Resources Specialist

Enclosures

GAM/bh

File: Pink-Reading, Yellow "C", File Cyprus Bagdad Copper Co.
Copper Report, GAM file

Bagdad (F)

OK MB

BAGDAD
4 of 8

PART B

CONCENTRATE UPGRADING
at
CYPRUS BAGDAD COPPER CORPORATION
by
Patrick Finton
Metallurgist

For Presentation at the
Arizona Conference of AIME
December 5, 1988

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INTRODUCTION

The Bagdad Concentrator has produced a by-product, molybdenum concentrate, since the mid 1950's. Through the years, the molybdenum separation process has undergone many changes. The initial separation process utilized a Nokes depression scheme. In the mid 60's, the process was modified to include steaming of the feed material. By 1974, safety considerations required that Nokes be replaced as the primary copper depressing reagent. The plant was then converted to thioglycollic acid (TGA) without any detrimental metallurgical results.

For the most of 1984, the concentrator was idle due to the extremely depressed copper prices. When the concentrator was restarted in October 1984, it was discovered that the concentrate steaming vessels had severely deteriorated during the shutdown. Because the TGA process required steaming, and it was imperative that the plant operate, the molybdenum plant was immediately converted to a sodium hydrosulfide circuit. The change proved to be very successful, and we are currently on a hydrosulfide circuit.

One of the start-up conditions in 1984 was that the molybdenum concentrate produced would have a maximum copper content of 0.5% Cu. After several months of working with the new reagent circuit, a concentrate grade containing 0.7% Cu could be routinely achieved. This was considerably better than the initial results, but the molybdenum concentrate still did not meet the 0.5% Cu requirement.

By March 1985, one of the molybdenum plant operators convinced management that the grade problem might be caused by a middling fraction in the final cleaning stages. It was decided that the 2nd cleaner tailing should be cleaned separately from the new advancing 1st cleaner concentrate. After the flowsheet in Figure 1 was initiated, the molybdenum plant was able to consistently make an acceptable molybdenum concentrate. The

problem with this circuit was that a significant amount of molybdenum was in the south 1st cleaner and south 2nd cleaner cells. Because of the larger cleaner circuit load, it generally took a circuit adjustment four (4) to six (6) hours to effect the final concentrate grade.

Column Cells

Although the molybdenum plant was consistently making a good concentrate grade, it was decided in late 1985 to try a column flotation test. After considering numerous cell options, a decision was made to build a three foot (3') diameter "test" cell in the molybdenum cleaner area. The cleaner area was selected because it allowed the column cell to be tested as a scavenger, 1st cleaner or final cleaner. With the cell in the cleaner area, the maximum cell height was 32 feet 3 inches. The column cell diameter selection was considerably less scientific, a three foot diameter piece of pipe was available in the "good" scrap pile.

The column cell was initially piped in as a parallel scavenger cell. The molybdenum content in the plant tailings immediately shot up when the column cell was started and did not come down until the test was abandoned six (6) hours later.

The column cell was repiped so that it was between the 1st cleaner tailing and scavenger feed and operated as a prescavenger cell. This gave much better plant results. For the next several months, the column cell operating parameters were changed, and the results observed. The data in Table A represents the normal conditions of the column cell while it was operated as a prescavenger. The lowest tailing was 2.69% Mo which was unacceptably high. The cell's tailing could be manipulated slightly as the change in feed rate indicates, but the most pronounced change in the cell was caused by changes in the feed to the cell. A number of different variables were changed: air rate, wash water rate, froth level, feed rate, frother addition and NaHS additions. All without any success. Although the cell

would not perform up to reported successes, the real puzzling thing was that the cell could not be deliberately sabotaged. It simply ran the way it wanted to, not good and not bad.

When Cyprus bought Sierrita, we were able to buy more than just the plant, we also got information. As part of the transition group, I talked to Sierrita personnel about their column cells and how they liked them. I was shown some retention time tests that they had done on their 40 foot cells. These tests showed that there was a tremendous amount of short circuiting that was occurring within the cells. This was completely contrary to the idea that the material was going through the column cell in a plug flow fashion. This also explained why I could not get the Bagdad column cell to tail out, and why the cell was so feed dependent.

In May 1986, the column cell was repiped as a cleaner cell. The column cell was then operated in parallel with the moly south 1st cleaner cells. The feed was split approximately evenly between the conventional flotation cells and the column cell. Table B shows some of the typical results of this testing.

In November 1986, the "test" column cell was operated as an additional cleaning stage between the north 1st cleaner and the north 2nd cleaner. This eliminated the need for the south 1st and 2nd cleaners. Figure 2 shows the normal operating flowsheet at that time.

By the end of 1987, consideration was given to the possibility of eliminating the north 2nd cleaners with the addition of a second column cell. Test work indicated that approximately 70% of the time the existing column cell was producing an acceptable final concentrate. Figure 3 shows a typical concentrate profile in the cleaner section when the column cell was and was not operating. It was decided that a final acceptable molybdenum concentrate could be produced using a column-to-column cleaning stage. On February 1, 1988, a second column cell was put into service in a

column-to-column arrangement. This arrangement has proven to be very effective in moly cleaning. The main problem with the cells is that the operators have a tendency to pull the column cells too hard. With the old conventional 2nd cleaner cells, an operator had to work to speed up the cells. With the column cells, all he had to do is turn a knob on the air addition and the cell speeded up. With standard flotation cells, an operational change may take four (4) hours before it impacts the final concentrate. The column cells react much quicker.

Another effect of using column cells, as is shown in Table C, is that the overall plant recovery may be improved. The Bagdad column cells have been taken out of the molybdenum circuit three (3) times to do copper flotation testing. The results in Table C show that the molybdenum plant recovery usually dropped when the cells were not in use. I feel that this is in agreement with my visual observations. Without the column cell's cleaning action, the operators had to crowd the 1st and 2nd cleaners. In doing so, there was a greater tailings load going to the scavenger cells and a correspondingly higher scavenger tailing loss.

Magnetic Separator

In March 1987, Cyprus Bagdad started looking at the possibility of using a Wet High Intensity Magnetic Separator (WHIMS) to remove copper from our molybdenum concentrate. Table D shows the preliminary laboratory test results. Better than 50% of the copper could be removed from the molybdenum concentrate while only 2% of the moly was rejected.

The next step was to plant test a pilot model. A model CF-5MM magnetic separator was used for the field test work in August. Again, Table E, about half of the copper was rejected, but this time approximately 15% of the molybdenum was also removed. The molybdenum rejection was acceptable since this tailing was to be returned to a previous cleaning stage.

In early 1988, a magnetic separator was purchased and installed in the molybdenum plant. From a metallurgical standpoint, the machine performed as anticipated with significant copper reduction in the molybdenum concentrate. Figure 4 is a graph of the actual plant Inscan copper values when the magnetic separator is utilized.

As with most new pieces of equipment, a few operations problems have developed. We have known for several years that we were concentrating plastic in the molybdenum concentrate. The amount of plastic had not been significant enough to present a grade or operational problem. With the production magnetic separator, the plastic plugged the grid sectors and stopped the slurry flow. Upon closer examination of the foreign material, it was determined that there were two (2) types of "plastic". One type of plastic appeared to be from the plastic bags used to line the wet blast holes in the pit. This plastic could be scalped out of the circuit with a DSM or vibrating screen. The second "plastic" consisted of single strands that looked like the bristles from a nylon brush. At this time, we have not positively identified the material or how to keep it out of the magnetic separator. The manufacturer is working on redesigning the separator grids so that they minimize plugging and/or can be periodically cleaned.

Today our moly plant flowsheet, Figure 5, has been substantially simplified. The use of column cells and the magnetic separator has definitely improved the moly plant performance.

COLUMN CELLS IN THE COPPER-MOLY PLANT

With our successful use of column cells in the moly plant, it was decided to test the column cell as a final Cu-Mo concentrate cleaner to see if our concentrate grade could be improved. In November 1987, the moly column cell was repiped as a copper 3rd cleaner for an eight (8) day test. The test showed that the percent copper in the copper-moly concentrate could be improved by a minimum of 3% Cu, Table F. The problems were that copper

recovery was only 50% and molybdenum was actually being depressed in the column cell.

In January 1988, a second test run was made. This time both the wash water and column cell feed tonnage were reduced. Figures 6 and 7 show the effects of these changes. When the wash water was increased, the copper concentrate grade improved, but the moly recovery dropped. As the feed rate to the column cell was reduced, the copper recovery dropped.

While at the AIME Annual Meeting in Phoenix in January 1988, a number of column cell speakers talked about the fact that column cells have a maximum production capacity. In the two (2) previous tests, I had observed that copper recovery was dependent upon the column cell feed rate. In relooking at the data, Table G, it appeared that our particular column cell had a concentrate production capacity of about 0.34 ton/hr/ft².

A third copper column cell test was performed in April and May 1988. In the two (2) previous tests, a sock sparging system had been used to supply the dispersed column cell air. This test run would be used to confirm the cell capacity and to see if a new air sparging system would improve the cell production. The test run was broken into three (3) periods with two (2) different sparger systems. Testing again confirmed that the cell production capacity was about 0.34 ton/hr/ft², Table H.

Although column cells are being sized according to their concentrate production capacity, it may be that in copper-moly circuits, the cells will have to be sized according to their moly recovery. Bagdad has observed on several tests that moly recovery can be very sensitive to the cell feed and air rates. Only after the bulk of the copper minerals have floated will the moly be recovered. This is exhibited in Table I where good moly recoveries were achieved when the cell was being worked to its best cleaning capacity as opposed to its production capacity.

Conclusions

In upgrading concentrates at the Bagdad Concentrator, the following observations have been made:

1. Column cells have proven to be very effective at upgrading Bagdad's moly concentrate.
2. It is possible with a series arrangement of column cells to improve and simplify a moly plant cleaner circuit.
3. Once material handling problems have been solved with the magnetic separator, approximately half of the copper in the moly concentrate will be removed.
4. The size of a column cell in a bulk cleaning operation may depend upon the flotation rate of the slowest mineral.

FIGURE 1

MOLY PLANT FLOWSHEET - 1985

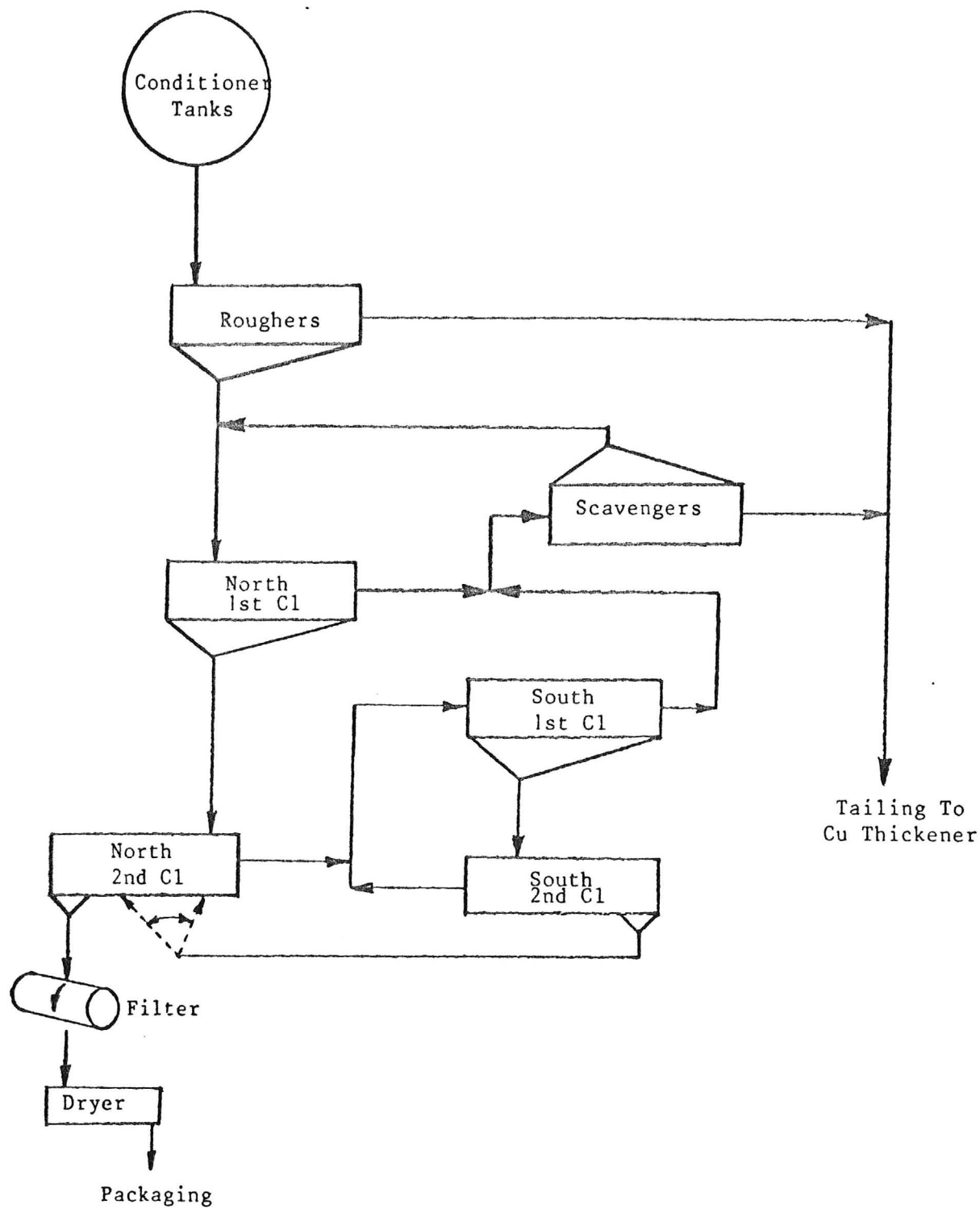


FIGURE 2

MOLY PLANT FLOWSHEET - 1987

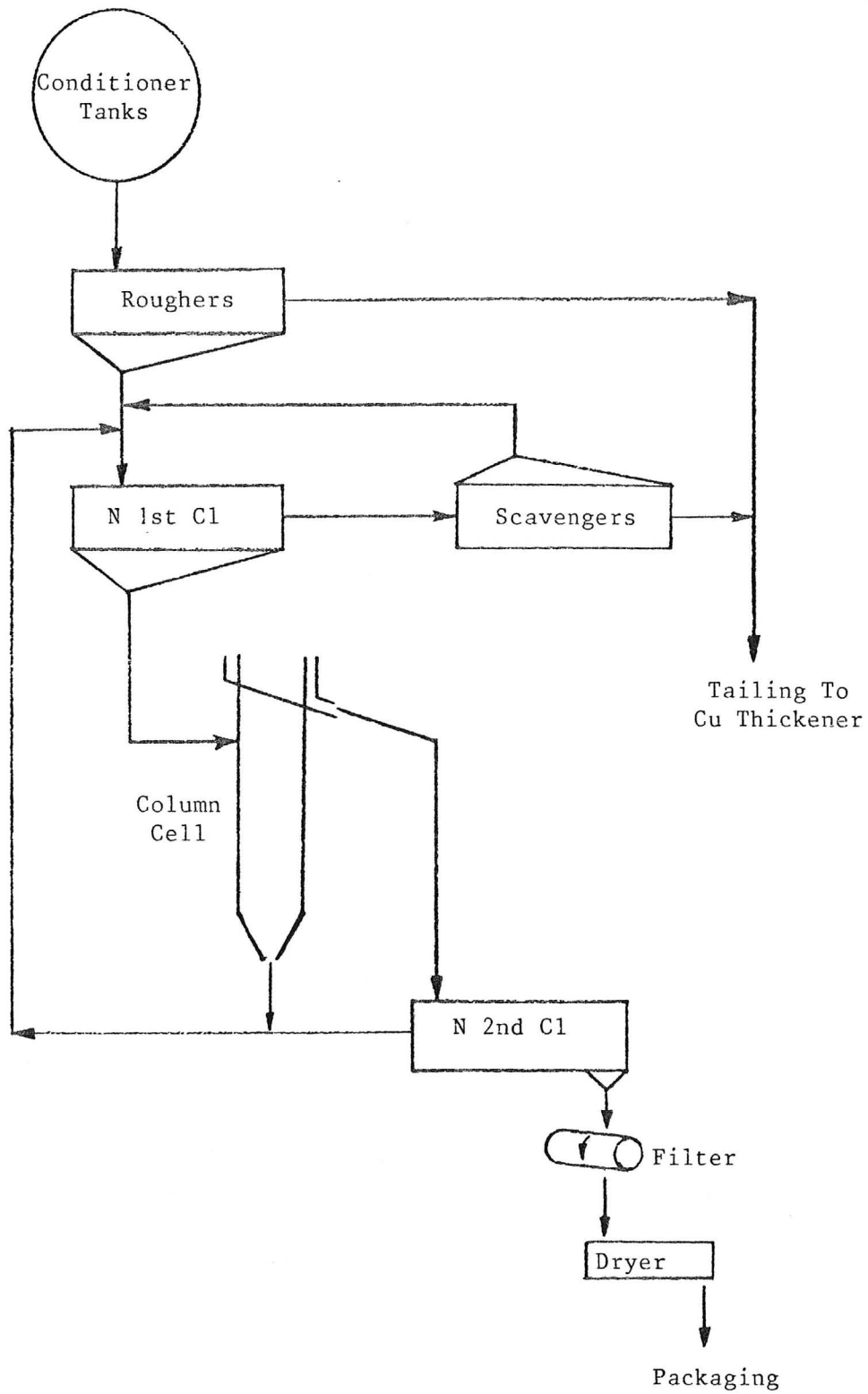


FIGURE 3

MOLY PLANT PROFILES ON NOVEMBER 6, 1987

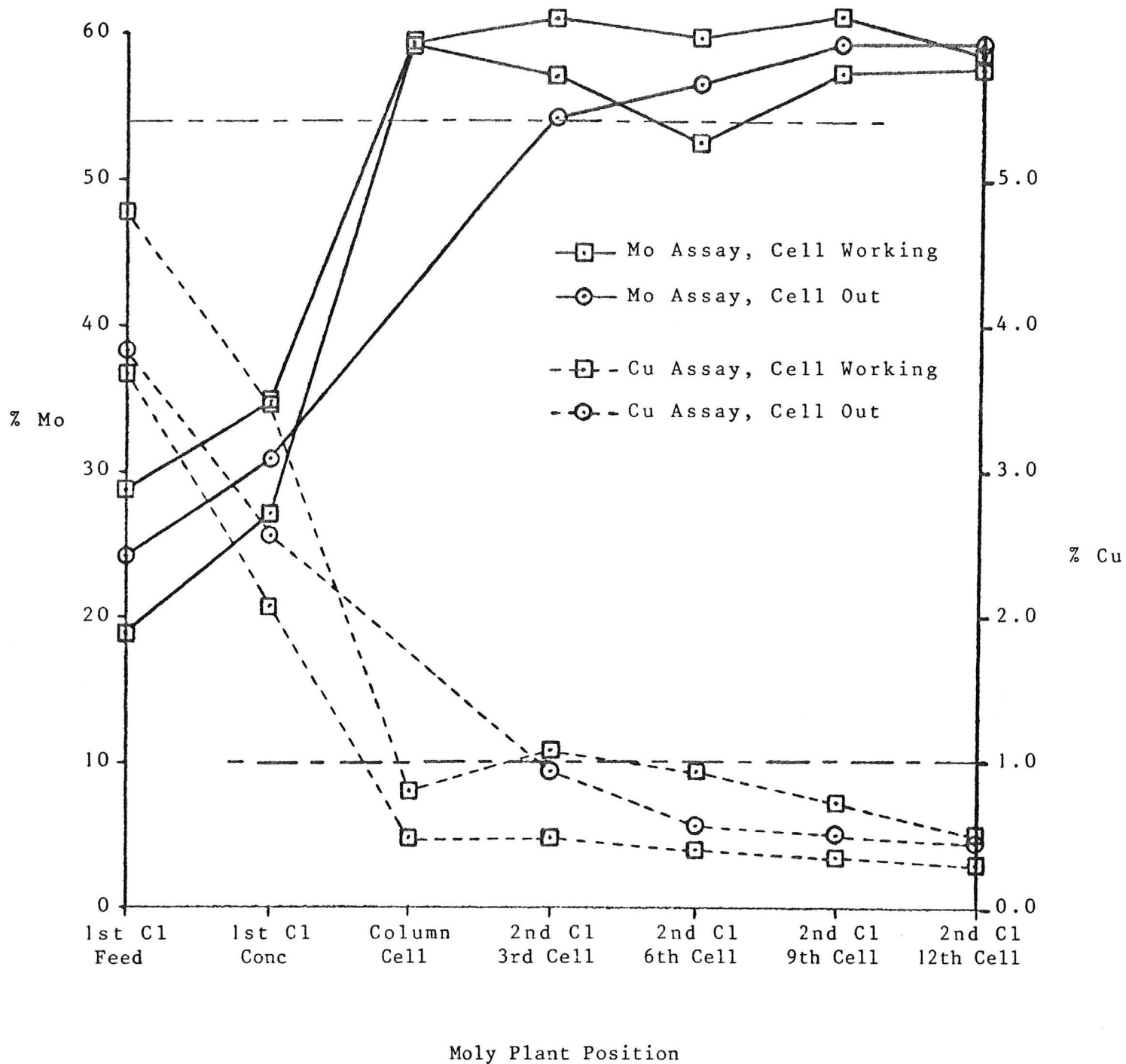


Figure 4

PERCENT COPPER IN MOLY CONC

Effect of Usage of Magnetic Separator

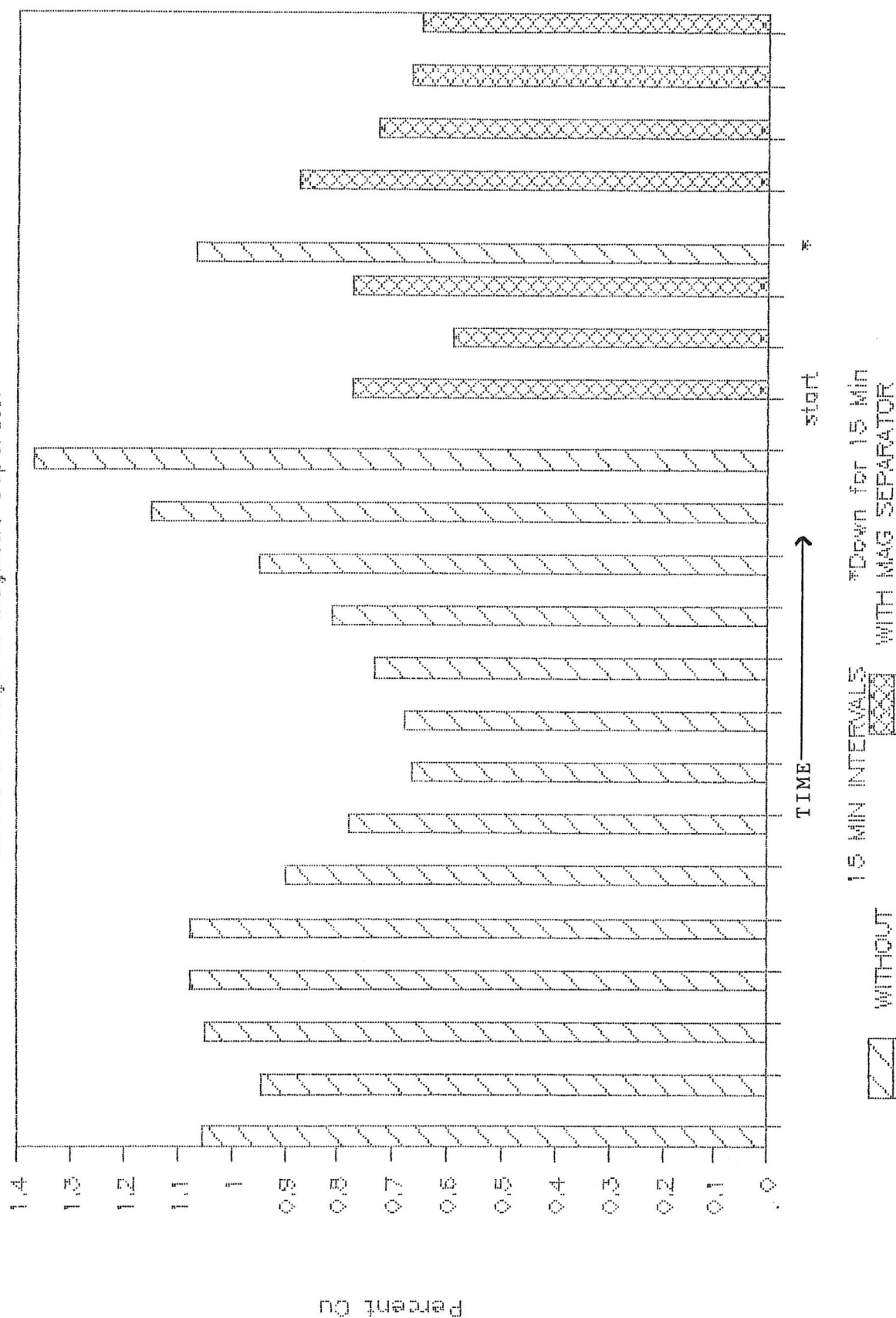


FIGURE 5

CURRENT FLOWSHEET

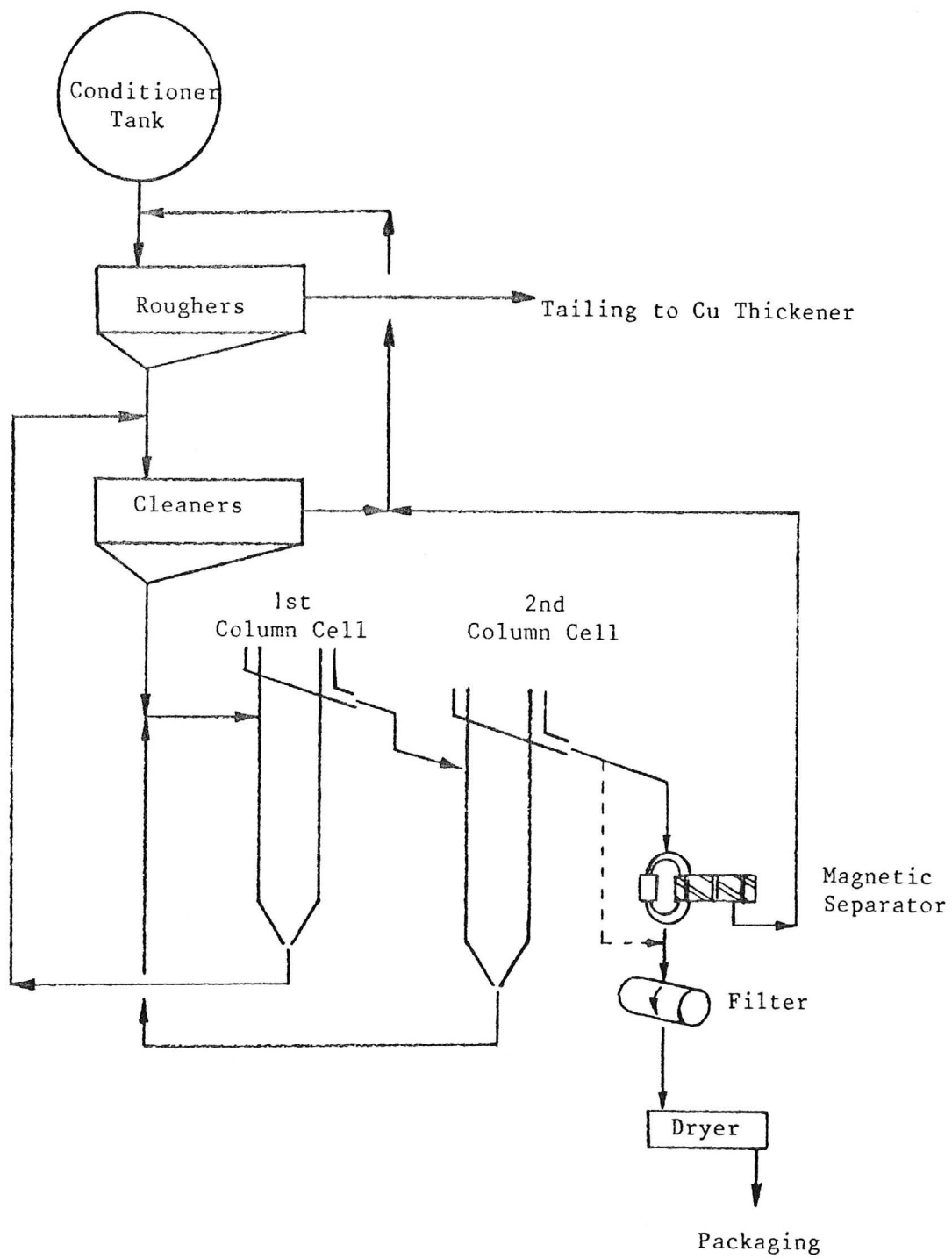


FIGURE 6

EFFECTS OF WASH WATER RATE

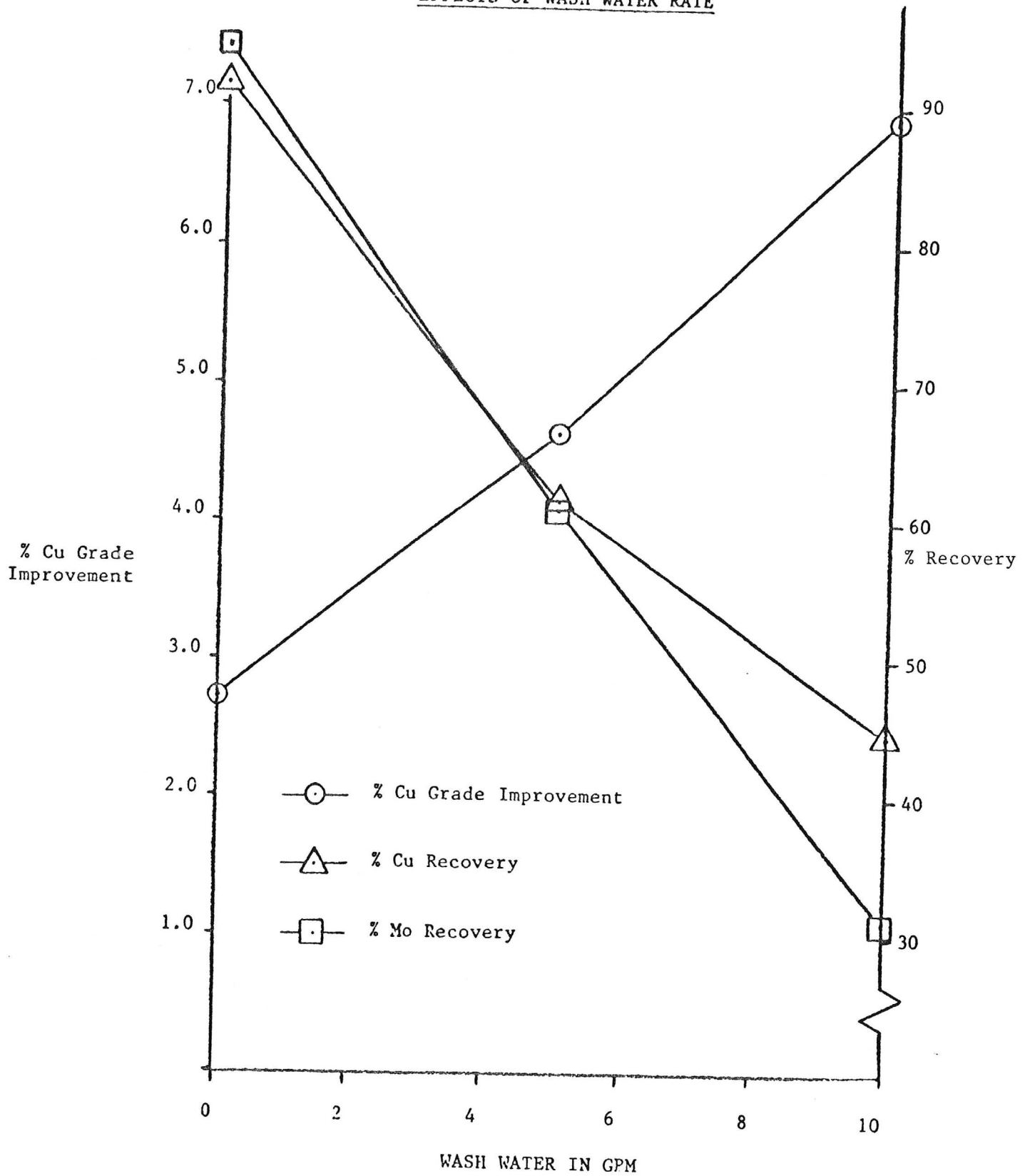
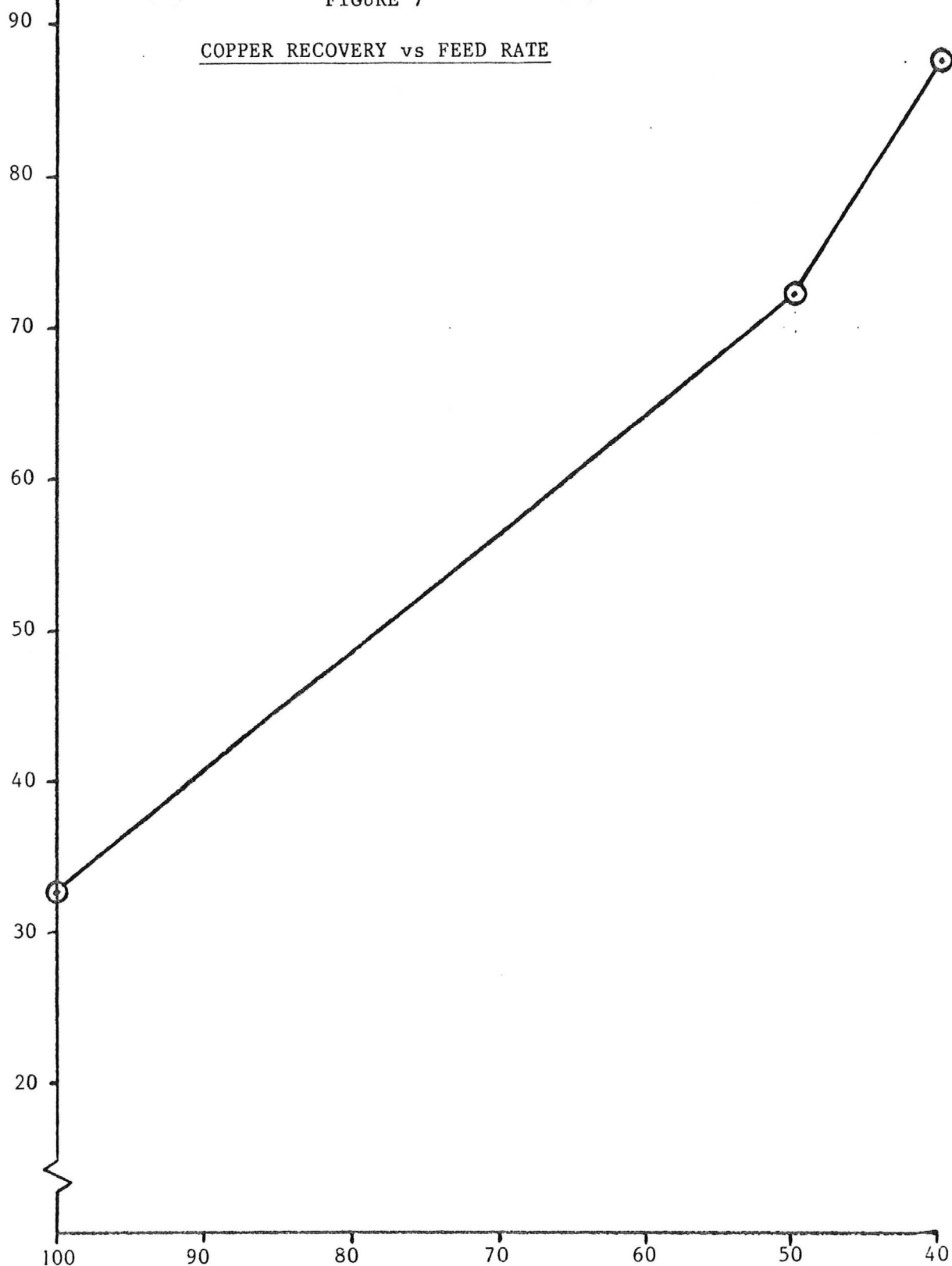


FIGURE 7

COPPER RECOVERY vs FEED RATE

% Cu Recovery



COLUMN CELL FEED RATE
as a % of 2nd Cleaner Concentrate

TABLE A
COLUMN CELL AS A PRESCAVENGER

Time	Feed Rate	Feed Percent			Tailings %			Concentrate %		Recovery		Ratio of Concentration
	%	Cu	Mo	Insol	Cu	Mo	Cu	Mo	Insol	Cu	Mo	
9:30	100	11.14	8.63	35.02	14.20	5.61	6.67	18.5	39.64	24.33	50.28	4.25
11:00	50	11.76	7.67	34.79	14.98	4.75	6.82	15.5	39.01	22.88	55.01	3.66
12:30	29	13.26	6.28	37.35	20.08	2.95	7.14	13.9	40.90	28.38	67.33	3.29
1:30	21	13.80	6.43	35.16	19.77	2.69	7.45	13.7	40.42	26.16	72.44	2.94
2:30	100	12.47	7.82	31.17	16.94	4.56	6.43	17.4	35.53	21.93	56.46	3.95

Sampling was done on March 21, 1986

TABLE B
COLUMN CELL AS A CLEANER

Test	Feed %		Tailing %		Copper		Concentrate %		Insol		Moly Recovery	
	Cu	Mo	COL	1st CL	COL	1st CL	COL	1st CL	COL	1st CL	COL	1st CL
1	12.7	16.06	8.20	6.81	3.27	5.10	44.0	38.0	8.86	17.03	60.17	70.19
2	10.8	16.69	6.43	8.87	2.13	2.59	51.1	43.8	8.43	12.39	70.45	58.73
3	7.94	20.76	4.32	9.49	2.60	3.38	48.5	42.9	9.00	11.92	86.94	69.69

Sampling was done on July 2, and 3, 1986

TABLE C

MOLY PLANT OPERATION WITH AND WITHOUT THE COLUMN CELL

<u>Period</u>	<u>Column Cell</u>	<u>Plant Feed Grade % Mo</u>	<u>Final Concentrate % Cu % Mo</u>	<u>Plant Molybdenum Recovery</u>
11/07 - 11/14/87	Using	1.091	0.71 54.69	90.61
11/16 - 11/23/87	Not Using	0.949	0.92 55.14	82.39
11/25 - 12/02/87	Using	0.886	0.66 55.54	85.82
12/29 - 01/09/88	Using	0.901	0.98 54.93	81.91
01/11 - 01/22/88	Not Using	0.840	0.83 55.02	85.06
01/24 - 02/04/88	Using	1.123	0.66 55.46	91.28
03/11 - 04/09/88	Using	1.028	0.80 55.49	89.04
04/11 - 05/10/88	Not Using	1.011	0.61 54.94	88.05
05/12 - 06/10/88	Using	1.106	0.60 55.65	90.74

Average Recovery When Column Cell In Use 88.23 %

Average When Cell Not In Use 85.17 %

TABLE D

MAGNETIC SEPARATOR LABORATORY RESULTS

Magnetic Field Strength (Gauss)	Product	Weight	Percent			Percent Distribution		
			Cu	Fe	Mo	Cu	Fe	Mo
6,000	Mag	4.9	22.2	19.7	15.6	45.0	42.0	1.5
	Non-Mag	95.1	1.4	1.4	52.9	55.0	58.0	98.5
	Feed	100.0	2.4	2.3	51.1			
8,000	Mag	6.0	23.0	19.6	15.4	62.0	55.6	1.8
	Non-Mag	94.0	0.9	1.0	53.6	38.0	44.4	98.2
	Feed	100.0	2.2	2.1	51.4			
8,000	Mag 1	6.8	21.4	19.7	12.8	62.7	56.9	1.7
	Mag 2	1.6	19.8	17.7	18.9	13.6	12.0	0.6
	Non-Mag	91.6	0.6	0.8	54.0	23.7	31.1	97.7
	Feed	100.0	2.3	2.4	50.6			
12,000	Mag	6.3	23.0	19.6	15.7	63.2	56.9	1.9
	Non-Mag	93.7	0.9	1.0	53.9	36.8	43.1	98.1
	Feed	100.0	2.3	2.2	51.4			
20,000	Mag	7.6	23.0	19.2	15.8	75.9	66.4	2.3
	Non-Mag	92.4	0.6	0.8	54.2	24.1	33.6	97.7
	Feed	100.0	2.3	2.2	51.2			

TABLE E
MAGNETIC SEPARATOR PLANT TEST RESULTS

Test	Product	Weight	Percent			Percent Distribution		
			Mo	Cu	Fe	Mo	Cu	Fe
1	Feed	100.0	57.2	0.41	1.25	100.0	100.0	100.0
	Non-Mag	85.2	57.6	0.26	1.11	85.7	54.0	75.7
	Mag	8.4	55.0	1.10	2.10	8.0	22.4	14.0
	Mid	6.4	56.3	1.50	2.00	6.2	23.6	10.3
2	Feed	100.0	56.8	0.30	0.81	100.0	100.0	100.0
	Non-Mag	88.9	58.0	0.20	0.68	90.8	59.3	74.6
	Mag	10.2	52.0	1.10	1.80	9.1	37.3	22.6
	Mid	0.9	54.2	1.10	2.40	0.1	3.4	2.7
3	Feed	100.0	56.5	0.47	1.31	100.0	100.0	100.0
	Non-Mag	76.4	56.8	0.25	1.07	76.9	40.6	62.4
	Mag	22.5	55.5	1.20	2.10	22.1	57.5	36.1
	Mid	1.1	55.6	0.80	1.80	1.0	1.9	1.5
4	Feed	100.0	56.1	0.90	1.70	100.0	100.0	100.0
	Non-Mag	68.5	56.4	0.40	0.98	68.8	30.4	39.5
	Mag	15.2	52.1	2.40	4.30	14.1	40.5	38.4
	Mid	16.4	54.7	1.60	2.30	17.1	29.1	22.1
5	Feed	100.0	55.7	0.90	1.70	100.0	100.0	100.0
	Non-Mag	88.3	56.1	0.43	1.03	89.0	42.2	53.5
	Mag	5.7	46.2	3.90	7.90	4.7	24.7	26.5
	Mid	6.0	46.6	5.00	5.70	6.3	33.1	20.0
6	Feed	100.0	52.2	1.00	2.00	100.0	100.0	100.0
	Non-Mag	54.6	55.6	0.49	1.15	58.1	26.8	31.4
	Mag	35.1	51.8	1.50	3.00	34.8	52.6	52.6
	Mid	10.3	48.9	2.00	3.10	7.1	20.6	16.0
7	Feed	100.0	51.4	1.50	2.70	100.0	100.0	100.0
	Non-Mag	78.5	53.8	0.59	1.42	82.1	30.9	41.3
	Mag	20.5	44.4	4.90	7.50	17.7	67.0	57.0
	Mid	1.0	47.0	3.10	4.60	0.2	2.1	1.8

TABLE F
COPPER ASSAYS FOR THE FIRST TEST RUN

<u>Test Time</u>		<u>% Cu Feed</u>	<u>% Cu Conc</u>	<u>% Cu Tailing</u>	<u>% Cu Recovery</u>	<u>% Cu* Improvement</u>
Nov 16	10 am	29.70	36.74	30.30	-----	7.04
	12:45	30.22	36.95	31.92	-----	6.73
	3 pm	31.61	38.65	31.93	-----	7.04
Nov 17	10:30	37.97	49.91	38.13	-----	11.94
	1:30	42.16	56.11	41.08	9.56	13.95
	3 pm	43.71	59.83	43.40	2.58	16.12
Nov 18	1:15	44.24	48.30	39.42	59.26	4.06
Nov 19	8 am	40.56	46.60	37.70	36.92	6.04
	10 am	40.72	45.97	38.33	35.32	5.25
	11:30	40.24	47.08	38.01	28.77	6.84
	1:30	38.81	46.12	36.26	30.73	7.31
	3 pm	43.26	51.06	40.24	32.94	7.80
Nov 20	8:30	38.10	43.40	35.68	35.71	5.30
	10 am	38.42	43.56	31.02	66.91	5.14
	11:30	39.54	44.20	31.34	71.28	4.66
	1:30	41.33	44.57	28.68	85.85	3.24
	3 pm	43.02	46.42	29.30	86.47	3.40
Nov 21	1 pm	32.11	39.98	22.98	66.87	7.87
	2:30	35.10	41.56	24.08	74.65	6.46
Nov 22	10 am	33.74	42.95	21.01	73.86	9.21
	11:30	34.99	45.30	23.12	69.29	10.31

Minimum % Cu Improvement 3.24%
Maximum % Cu Improvement 16.12%
Average % Cu Improvement 7.41%

* % Cu Improvement = % Cu in Concentrate - % Cu in Feed

TABLE G
COLUMN CELL CONCENTRATE PRODUCTION

<u>Date</u>	<u>Cell Feed Ton/Hr</u>	<u>Cu Recovery</u>	<u>Concentrate Ton/Hr</u>	<u>Cell Capacity Ton/Hr/ft²</u>
Nov 16	7.54	-----	-----	-----
17	6.31	6.07	0.38	0.05
18	8.55	59.26	5.07	0.72
19	6.52	32.94	2.15	0.30
20	3.39	77.63	2.63	0.37
21	3.72	70.76	2.63	0.37
22	4.74	71.58	3.39	0.48
Jan 12	2.76	72.77	2.01	0.28
13	2.88	69.02	1.99	0.28
15	4.17	25.62	1.07	0.15
19	4.23	14.26	0.60	0.08
20	3.62	71.40	2.58	0.36
21	4.38	93.65	4.10	0.58
22	3.21	97.64	3.13	0.44
Average				0.34

TABLE H
THIRD COPPER COLUMN CELL TEST RUN

<u>Period</u>	<u>Average Results*</u>			<u>Optimum** Cell Production Ton/Hr/Ft²</u>
	<u>% Cu Improvement</u>	<u>% Cu Recovery</u>	<u>% Mo Recovery</u>	
1	6.65	56.13	35.49	0.279
2	5.30	65.77	36.02	0.317
3	5.42	63.76	45.68	0.332

* Average results include sampling times when the cell was not operated at its peak efficiency.

** The Optimum Cell Production was calculated in each period using the period's regression formula and the conditions of 42% of the 2nd cleaner feed and an air rate of 30 scfm.

TABLE I

Mo Assays - Third Period

<u>Date/Time</u>		<u>% of Feed</u>	<u>Air SCFM</u>	<u>% Mo Feed</u>	<u>% Mo Conc</u>	<u>% Mo Tailing</u>	<u>% Mo Recovery</u>	<u>Cell Prod Ton/Hr/Ft²</u>
5/08/88	2:30	100	30	1.52	0.86	1.41	(11.32)	----
	3:30	100	30	1.27	0.77	1.29	2.33	0.02
5/09/88	10 a.m.	42	10	1.25	0.62	1.39	9.02	0.08
	11 a.m.	42	15	1.07	0.69	1.59	37.26	0.27
	1 p.m.	42	20	1.23	0.78	1.78	34.88	0.25
	2 p.m.	42	25	1.44	1.24	1.42	(9.57)	0.37
	4 p.m.	42	30	1.69	1.53	0.29	102.21	0.37
5/10/88	10 a.m.	25	30	0.85	0.84	0.20	100.37	0.28
	11 a.m.	33	30	0.75	0.68	1.20	78.46	0.41
	12 noon	42	30	0.73	0.58	1.06	54.62	0.41
	1 p.m.	50	30	0.78	0.58	0.96	35.22	0.34
	2 p.m.	58	30	0.81	0.77	1.12	84.20	0.74
	2:45	58	30	0.74	0.60	1.02	54.05	0.55
	3:45	58	30	0.82	0.65	1.09	48.64	0.51
Average				1.07	0.80	1.13	45.68	0.35

**AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM**

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. 1251 et seq., the "Act),

Cypress Bagdad Copper Corporation
P.O. Box 245
Bagdad, Arizona 86321

is authorized to discharge from wastewater control facilities (Discharge Serial Numbers 001 - 006)

to receiving waters listed on page 2 of this permit,

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein, and in the attached 12 pages of EPA Region 9 "Standard Federal NPDES Permit Conditions," dated January 29, 1988.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,
(five years after effective date).

Signed this day of

For the Regional Administrator

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Director, Water Management Division

DRAFT

A. DISCHARGE POINTS AND RECEIVING WATERS

<u>Discharge Serial No.</u>	<u>Location and Receiving Water</u>
001:	Copper Creek, tributary to Boulder Creek Latitude: 34 ⁰ 36' 23" N Longitude: 113 ⁰ 13' 55" W
002:	Mulholland Wash, tributary to Boulder Creek Latitude: 34 ⁰ 35' 53" N Longitude: 113 ⁰ 15' 25" W
003:	Mulholland Wash, tributary to Boulder Creek Latitude: 34 ⁰ 35' 52" N Longitude: 113 ⁰ 15' 23" W
004:	Copper Creek, tributary to Boulder Creek Latitude: 34 ⁰ 36' 23" N Longitude: 113 ⁰ 13' 55" W
005:	Mulholland Wash, tributary to Boulder Creek Latitude: 34 ⁰ 35' 42" N Longitude: 113 ⁰ 15' 37" W
006:	Mammoth Wash, tributary to Burro Creek Latitude: 34 ⁰ 35' 17" N Longitude: 113 ⁰ 17' 22" W

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B. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Effluent limits (discharge prohibitions) for Discharge Serial Numbers 001 - 006.
 - a. Beginning with the effective date of this permit, the permittee shall not discharge wastewater to receiving waters except overflow from facilities as defined in b. below.
 - b. "Facilities" are the waste control facilities designed, constructed and maintained to contain or recycle the volume of water that is the sum of all the following:
 - 1) The volume of water applied by the operator to an active leach area.
 - 2) The volume of runoff resulting from rain falling directly on the total leach and tailing area.
 - 3) The volume of runoff resulting from rain falling directly on leachate holding facilities.
 - 4) The volume of runoff resulting from 3.0 inches of rain falling on areas draining into leachate catchment and recycle facilities, tailings piles, and holding facilities.
 - 5) The volume of runoff resulting from 3.0 inches of rain falling directly on the pit.
 - 6) The volume of runoff resulting from 3.0 inches of rain falling on areas that drain into the pit.
 - c. Containment shall include catchment and pump-back facilities to recycle runoff into process water circuits or onto leach dumps and percolation ponds where the runoff and process water so contained is treated by neutralization, and settling.
2. Discharges resulting from a rainfall event in excess of that described in condition A.1.b. above shall be monitored and limited as listed below. All metals limits are for total recoverable metals as specified in Methods for Chemical Analysis of Water and Wastes (EPA 600/4-79-020) method 4.1.4. Results shall be reported as total metal.

PARAMETER	DAILY MAXIMUM mg/l	MONITORING	
		frequency	sample type
Suspended Solids	***	once/day	composite
Arsenic (as As)	0.05	once/day	composite
Copper (as Cu)	0.05	once/day	composite
Lead (as Pb)	0.05	once/day	composite
Manganese (as Mn)	10.0	once/day	composite

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Mercury (as Hg)	0.0002	once/day	composite
Silver (as Ag)	0.05	once/day	composite
Zinc (as Zn)	0.5	once/day	composite
Ammonia (as un-ionized NH ₃)	0.02	once/day	composite
Cyanides (as cyanide ion and complexes)	0.02	once/day	composite
Sulfides	0.10	once/day	composite
pH	not less than 6.5 nor greater than 9.0 Standard Units. The discharge shall not cause the pH of the receiving water to change more than 0.5 Standard Units.		once/day composite

***Monitoring and reporting required. No limit set at this time.

Any flow will be monitored continuously, the remainder of the items are monitored once per day. No limits are set on flow at this time, however, the flow will be the minimum needed to protect the integrity of the containment facilities during a flood event.

3. For the purposes of this permit, the gauge station used to monitor rainfall shall be that operated by the National Weather Service at

Bagdad, Arizona

The permittee may establish a gauge station at the facility, in which case rainfall shall be recorded on a daily basis. A National Weather Service Standard Rain Gauge shall be used.

4. Not later than 10 days after any discharge from the permittee's facility to the waters of the United States, the permittee shall submit to the Regional Administrator and State Agency the following information:
 - a. the description and cause of the discharge;
 - b. The date, time and duration of the discharge;
 - c. actions taken to reduce, eliminate or prevent recurrence of the discharge; and
 - d. the rainfall, in inches per day for each day which contributed to or caused the discharge.

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5. In addition, the discharge will meet the following general requirements:
- a. The discharge shall not cause changes in the taste, color or odor of the receiving water nor shall it cause detectable off-flavor in the flesh of fish.
 - b. The discharge shall not result in floating debris, oil, grease, scum and other floating materials which result in unsightly conditions in the receiving water or produce a deposit on a shoreline or bank bordering such waters or which adversely affect the ecosystem.
 - c. There shall be no discharge of substances that will settle to form sludge or bottom deposits which result in unsightly, putrescent or odorous conditions in the receiving water or which adversely affect the ecosystem.
 - d. There shall be no discharge of substances in concentrations which produce undesirable aquatic life or result in the dominance of nuisance species.
 - e. Effluent samples shall be taken downstream from any additions from the treatment works, and prior to mixing with the receiving waters.
 - f. There shall be no discharge of toxic substances that violate water quality standards for the State of Arizona, including those in A.C.R. R9-21-205.
 - g. The discharge shall not:
 - 1) lower the dissolved oxygen concentration of the receiving water to less than 1 mg/l;
 - 2) raise the natural ambient water temperature of the receiving water more than 3 degrees celsius; or
 - 3) cause the turbidity of the receiving water to exceed 50 nephelometric turbidity units.

C. REPORTING AND MONITORING

1. Reporting of Monitoring Results

Monitoring results obtained during the month shall be submitted on forms to be supplied by the Regional Administrator, to the extent that the information reported may be entered on the forms. The results of all monitoring required by this permit shall be submitted in such a format as to allow direct comparison with the limitations and requirements of the permit. Unless otherwise specified, discharge flows shall be reported in terms of the average flow over each monthly period and the maximum daily flow over that monthly period. Each monthly report is due by the 28th of the following month, i.e. January report is due by February 28. Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

Water Management Division
Attention W-4
Environmental Protection Agency
215 Fremont Street
San Francisco, CA 94105

Arizona Dept. of Envir. Quality
Office of Water Quality
Water Permits/UST Compliance Unit
2005 North Central Avenue
Phoenix, AZ 85004

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2. Twenty-Four Hour Reporting of Noncompliance

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances to the following persons or their offices:

Mr. Steve Fuller, USEPA
(415) 974-8314

Mr. John Rampe, ADEQ
(602) 257-2333

If the permittee is unsuccessful in contacting the persons above, he shall report by 9 a.m. on the first business day following the noncompliance. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including dates and times, and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. Intermittent Discharge Monitoring

If the discharge is intermittent rather than continuous, then on the first day of each such intermittent discharge, the permittee shall monitor and record data for all the characteristics listed in the monitoring requirements, after which the frequencies of analysis listed in the monitoring requirements shall apply for the duration of each such intermittent discharge. In no event shall the permittee be required to monitor and record data more often than twice the frequencies listed in the monitoring requirements.

4. Monitoring Modification

Monitoring, analytical, and reporting requirements may be modified by the Regional Administrator upon due notice.

D. DEFINITIONS

1. The "monthly or weekly average" discharge means the total discharge by weight during a calendar monthly or weekly period, respectively, divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the monthly or weekly average discharge shall be determined by the summation of all the measured discharges by weight divided by the number of days during the monthly or weekly period when the measurements were made.
2. A "discrete" sample means any individual sample collected in less than 15 minutes. A "discrete" sample for enteric virus means any individual sample collected in less than 3 hours.
3. The "daily maximum" discharge means the total discharge by weight during any calendar day.

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4. The "monthly or weekly average" concentration, other than for fecal or total coliform bacteria, means the arithmetic mean of measurements made during a calendar monthly or weekly period, respectively. The "monthly or weekly average" concentration for fecal or total coliform bacteria means the geometric mean of measurements made during a monthly or weekly period, respectively. The geometric mean is the n th root of the product of n numbers.
5. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.
6. A "composite sample" means, for flow rate measurements, the arithmetic mean of no fewer than 8 individual measurements taken at equal intervals for 24 hours or for the duration of discharge, whichever is shorter. A composite sample means, for other than flow rate measurement, a combination of 8 individual portions obtained at equal time intervals for 24 hour(s) or for the duration of the discharge, whichever is shorter. The volume of each individual portion shall be directly proportional to the discharge flow rate at the time of sampling. The sampling period shall coincide with the period of maximum discharge flow.

EPA Region 9 - Standard Federal NPDES Permit Conditions

(Updated as of January 29, 1988)

1) Duty to Reapply [40 CFR 122.21(d)]

- The permittee shall submit a new application 180 days before the existing permit expires.

2) Applications [40 CFR 122.22]

(a) All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

(i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principle business function, or any other person who performs similar policy- or decision-making functions for the corporation, or

(ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes: (i) The chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of EPA).

(b) All reports required by permits and other information requested by the Director shall be signed by a person described in paragraph (a) of this Section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph (a) of this section;

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) and,

(3) The written authorization is submitted to the Director.

(c) Changes to authorization. If an authorization under paragraph (b) of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph (b) of this section must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

(d) Certification. Any person signing a document under paragraph (a) or (b) of this section shall make the following certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

3) Duty to comply [40 CFR 122.41(a)]

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

(1) The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

(2) The Clean Water Act provides that:

(A) Any person who causes a violation of any condition in this permit is subject to a civil penalty not to exceed \$25,000 per day of each violation. Any person who negligently causes a violation of any condition in this permit is subject to a fine of not less than \$2,500 nor more than \$25,000 per day of violation, or by imprisonment for not more than one year, or both for a first conviction. For a second conviction, such a person is subject to a fine of not more than \$50,000 per day of violation, or by imprisonment for not more than two years, or both. [Updated pursuant to the Water Quality Act of 1987]

(B) Any person who knowingly causes violation of any condition of this permit is subject to a fine of not less than \$5,000 nor more than \$50,000 per day of violation, or by imprisonment for not more than three years, or by both for a first conviction. For a second conviction, such a person is subject to a fine of not more than \$100,000 per day of violation, or by imprisonment of not more than six years, or both. [Updated pursuant to the Water Quality Act of 1987]

(C) Any person who knowingly causes a violation of any condition of this permit and, by so doing, knows at that time that he thereby places another in imminent danger of death or serious bodily injury shall be subject to a fine of not more than \$250,000, or imprisonment of not more than 15 years, or both. A person who is an organization and violates this provision shall be subject to a fine of not more than \$1,000,000 for a first conviction. For a second conviction under this provision, the maximum fine and imprisonment shall be doubled. [Updated pursuant to the Water Quality Act of 1987]

4) Need to halt or reduce activity not a defense [40 CFR 122.41(c)]

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

5) Duty to mitigate [40 CFR 122.41(d)]

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

6) Proper operation and maintenance [40 CFR 122.41(e)]

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

7) Permit actions [40 CFR 122.41(f)]

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

8) Property rights [40 CFR 122.41(g)]

This permit does not convey any property rights of any sort, or any exclusive privilege.

9) Duty to provide information [40 CFR 122.41(h)]

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Director upon request, copies of records required to be kept by this permit.

10) Inspection and entry [40 CFR 122.41(i)]

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

(1) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

(2) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

(3) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

(4) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

11) Monitoring and records [40 CFR 122.41(j)]

(1) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(2) The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

(3) Records of monitoring information shall include:

(i) The date, exact place, and time of sampling or measurements;

(ii) The individual(s) who performed the sampling or measurements;

(iii) The date(s) analyses were performed;

(iv) The individual(s) who performed the analyses;

(v) The analytical techniques or methods used; and

(vi) The results of such analyses.

(4) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

(5) The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained in this permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than two years per violation, or by both for a first conviction. For a second conviction, such a person is subject to a fine of not more than \$20,000 per day of violation, or imprisonment for not more than four years, or both. [Updated pursuant to the Water Quality Act of 1987]

12) Signatory requirement [40 CFR 122.41(k)]

(1) All applications, reports, or information submitted to the Director shall be signed and certified. (See 40 CFR 122.22)

(2) The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than two years per violation, or

by both for a first conviction. For a second conviction, such a person is subject to a fine of not more than \$20,000 per day of violation, or imprisonment of not more than four years, or both. [Updated pursuant to the Water Quality Act of 1987]

13) Reporting requirements [40 CFR 122.41(l)]

(1) Planned changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

(i) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b); or

(ii) The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR 122.42(a)(1).

(2) Anticipated noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(3) Transfers. This permit is not transferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act (CWA). (See 40 CFR 122.61; in some cases, modification or revocation and reissuance is mandatory.)

(4) Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(i) Monitoring results must be reported on a Discharge Monitoring Report (DMR).

(ii) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR Part 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

(iii) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Director in the permit.

(5) Compliance schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(6) Twenty-four hour reporting.

(i) The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or

planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(ii) The following shall be included as information which must be reported within 24 hours under this paragraph.

(A) Any unanticipated bypass which exceeds any effluent limitation in the permit. (See 40 CFR 122.41(g).)

(B) Any upset which exceeds any effluent limitation in the permit.

(C) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in the permit to be reported within 24 hours. (See 40 CFR 122.44(g).)

(iii) The Director may waive the written report on a case-by case basis for reports under paragraph (6)(ii) of this section if the oral report has been received within 24 hours.

(7) Other noncompliance. The permittee shall report all instances of noncompliance not reported under paragraphs (4), (5), and (6) of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (6) of this section.

(8) Other information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

14) Bypass [40 CFR 122.41(m)]

(1) Definitions

(i) "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

(ii) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

(2) Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs (3) and (4) of this section.

(3) Notice-

(i) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, of possible at least ten days before the date of the bypass.

(ii) Unanticipated bypass. If the permittee shall submit notice of an unanticipated bypass as required in paragraph (a)(6) of section 13) (24-hour notice).

(4) Prohibition of bypass.

(i) Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

(A) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(B) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(C) The permittee submitted notices as required under paragraph (3) of this section.

(ii) The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph (4)(i) of this section.

15) Upset [40 CFR 122.41(n)]

(1) Definition.

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

(2) Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph (3) of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

(3) Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(i) An upset occurred and that the permittee can identify the cause(s) of the upset;

(ii) The permitted facility was at the time being properly operated; and

(iii) The permittee submitted notice of the upset as required in paragraph 13)(6)(ii)(B)(24-hour notice).

(iv) The permittee complied with any remedial measures required under 40 CFR 122.41(d).

(4) Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

16) Existing manufacturing, commercial, mining, and silvicultural dischargers [40 CFR 122.42(a)]

In addition to the reporting requirements under 40 CFR 122.41(l), all existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe:

(1) That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

(i) One hundred micrograms per liter (100 ug/l);

(ii) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

(iii) Five times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

(iv) The level established by the Director in accordance with 40 CFR 122.44(f).

(2) That any activity has occurred or will occur which would result in any discharge, on a nonroutine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

(i) Five hundred micrograms per liter (500 ug/l);

(ii) One milligram per liter (1 mg/l) for antimony;

(iii) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7);

(iv) The level established by the Director in accordance with 40 CFR 122.44(f).

17) Publicly owned treatment works [40 CFR 122.42(b)]

This section applies only to publicly owned treatment works as defined at 40 CFR 122.2.

(1) All POTW's must provide adequate notice to the Director of the following:

(i) Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of CWA if it were directly discharging those pollutants; and

(ii) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

(iii) For purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(2) [The following condition has been established by Region 9 to enforce applicable requirements of the Resource Conservation and Recovery Act] Publicly owned treatment works may not receive hazardous waste by truck, rail, or dedicated pipe except as provided under 40 CFR 270. Hazardous wastes are defined at 40 CFR 261 and include any mixture containing any waste listed under 40 CFR 261.31 - 261.33. The Domestic Sewage Exclusion (40 CFR 261.4) applies only to wastes mixed with domestic sewage in a sewer leading to a publicly owned treatment works and not to mixtures of hazardous wastes and sewage or septage delivered to the treatment plant by truck.

18) Reopener clause [40 CFR 122.44(c)]

This permit shall be modified or revoked and reissued to incorporate an applicable effluent standard or limitation under sections 301(b)(2)(C), and (D), 304(b)(2) and 307(a)(2) which is promulgated or approved after the permit is issued if that effluent standard or limitation is more stringent than any effluent limitation in the permit, or controls a pollutant not limited in the permit.

19) Privately owned treatment works [The following conditions were established by Region 9 to enforce applicable requirements of the Resource Conservation and Recovery Act and 40 CFR 122.44(m)]

This section applies only to privately owned treatment works as defined at 40 CFR 122.2.

(1) Materials authorized to be disposed of into the privately owned treatment works and collection system are typical domestic sewage. Unauthorized materials are hazardous waste (as defined at 40 CFR Part 261), motor oil, gasoline, paints, varnishes, solvents, pesticides, fertilizers, industrial wastes, or other materials not generally associated with toilet flushing or personal hygiene, laundry, or food preparation, unless specifically listed under "Authorized Non-domestic Sewer Dischargers" elsewhere in this permit.

(2) It is the permittee's responsibility to inform users of the privately owned treatment works and collection system of the prohibition against unauthorized materials and to ensure compliance with the prohibition. The permittee must have the authority and capability to sample all discharges to the collection system, including any from septic haulers or other unsewered dischargers, and shall take and analyze such samples for conventional, toxic, or hazardous pollutants when instructed by the permitting authority or by an EPA, State or Tribal inspector. The permittee must provide adequate security to prevent unauthorized discharges to the collection system.

(3) Should a user of the privately owned treatment works desire authorization to discharge non-domestic wastes, the permittee shall submit a request for permit modification and an application, pursuant to 40 CFR 122.44(m), describing the proposed discharge. The application shall, to the extent possible, be submitted using EPA Forms 1 and 2C, unless another format is requested by the permitting authority. If the privately owned treatment works or collection system user is different from the permittee, and the permittee agrees to allow the non-domestic discharge, the user shall submit the application and the permittee shall submit the permit modification request. The application and request for modification shall be submitted at least 6 months before authorization to discharge non-domestic wastes to the privately owned treatment works or collection system is desired.

20) Transfers by modification [40 CFR 122.61(a)]

Except as provided in section 21), a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued (under 40 CFR 122.62(b)(2)), or a minor modification made (under 40 CFR 122.63(d)), to identify the new permittee and incorporate such other requirements as may be necessary under CWA.

21) Automatic transfers [40 CFR 122.61(b)]

As an alternative to transfers under section 20), any NPDES permit may be automatically transferred to a new permittee if:

(1) The current permittee notifies the Director at least 30 days in advance of the proposed transfer date in paragraph (2) of this section;

(2) The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

(3) The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify or revoke and reissue the permit. A modification under this subparagraph may also be a minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in the paragraph (2) of this section.

22) Minor modification of permits [40 CFR 122.63]

Upon the consent of the permittee, the Director may modify a permit to make the corrections or allowances for changes in the permitted activity listed in this section, without following the procedures of 40 CFR Part 124. Any permit modification not processed as a minor modification under this section must be made for cause and with 40 CFR Part 124 draft permit and public notice as required in 40 CFR 122.62. Minor modifications may only:

(1) Correct typographical errors;

(2) Require more frequent monitoring or reporting by the permittee;

(3) Change an interim compliance date in a schedule of compliance, provided the new date is not more than 120 days after the date specified in the existing permit and does not interfere with attainment of the final compliance date requirement; or

(4) Allow for a change in ownership or operational control of a facility where the Director determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittees has been submitted to the Director.

(5)(i) Change the construction schedule for a discharger which is a new source. No such change shall affect a discharger's obligation prior to discharge under 40 CFR 122.29.

(ii) Delete a point source outfall when the discharge from that outfall is terminated

and does not result in discharge of pollutants from other outfalls except in accordance with the permit limits.

(6) When the permit becomes final and effective on or after March 9, 1982, conform to changes respecting 40 CFR 122.41(e), (l), (m)(4)(i)(B), (n)(3)(i), and 122.42(a) issued September 26, 1984.

(7) Incorporate conditions of a POTW pretreatment program that has been approved in accordance with the procedures in 40 CFR 403.11 as enforceable conditions of the POTW's permit.

23) Termination of permits [40 CFR 122.64]

The following are causes for terminating a permit during its term, or for denying a permit renewal application:

- (1) Noncompliance by the permittee with any condition of the permit;
- (2) The permittee's failure in the application or during the permit issuance process to disclose fully all relevant facts, or the permittee's misrepresentation of any relevant facts at any time;
- (3) A determination that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination; or
- (4) A change in any condition that requires either a temporary or a permanent reduction or elimination of any discharge controlled by the permit (for example, plant closure or termination of discharge by connection to a POTW).

24) Availability of Reports [Pursuant to Clean Water Act Section 308]

Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Regional Administrator. As required by the Act, permit applications, permits, and effluent data shall not be considered confidential.

25) Removed Substances [Pursuant to Clean Water Act Section 301]

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

26) Severability [Pursuant to Clean Water Act Section 512]

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and remainder of this permit, shall not be affected thereby.

27) Civil and Criminal Liability [Pursuant to Clean Water Act Section 309]

Except as provided in permit conditions on "Bypass" (Section 14) and "Upset" (Section 15), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

28) Oil and Hazardous Substance Liability [Pursuant to Clean Water Act Section 311]

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act.

29) State or Tribal Law [Pursuant to Clean Water Act Section 510]

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the operator from any responsibilities, liabilities, or penalties established pursuant to any applicable State or Tribal law or regulation under authority preserved by Section 510 of the Clean Water Act.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

**215 Fremont Street
San Francisco, Ca. 94105**

July 5, 1988

Supplemental Fact Sheet

**Cyprus Bagdad Copper Company
NPDES Permit No. AZ0022268**

This Fact Sheet is a supplement to the Fact Sheet previously prepared by the Arizona Department of Environmental Quality on May 2, 1988. This supplement addresses changes made by EPA to the draft permit prior to public notice. Facility background information will not be repeated in this supplement.

EPA's proposed effluent limits for this facility are derived from the effluent limitations for the Ore Mining and Dressing Point Source Category at 40 CFR Part 440 Subpart J. Best Available Technology (BAT) for controlling such discharges has been defined as no discharge. 40 CFR 440.131(c) provides for exemption from the no discharge requirement during storm flows if the facility is designed, constructed and maintained to contain the runoff from a 10-year 24-hour precipitation event and all process and mine drainage waters. The facility must also take all reasonable steps to minimize such overflow, and comply with permit notification requirements. However, this exemption from BAT requirements does not exempt the discharge from water quality based effluent limits required to protect Arizona Water Quality Standards. Such limits have been set for the following parameters: Arsenic, Copper, Lead, Manganese, Mercury, Silver, Zinc, Ammonia, Cyanides, Sulfides, and pH. Monitoring is also required for flow and Suspended Solids, but no limits are set.

Water Quality Standards for the waters impacted by this discharge are discussed in the previous fact sheet.

MAY 02 1988

III. Additional Information

Additional information relating to this proposed permit may be obtained at either of the following locations:

Jon Hangartner (W-5-1)
U. S. Environmental Protection Agency
Region 9
215 Fremont Street
San Francisco, California 94105
(415) 974-8336

Wayne H. Palsma - Room 202
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004
(602) 257-2270

MAY 02 1988

Fact Sheet - NPDES Permit No. AZ0022268

Cyprus Bagdad Copper Corporation
Post Office Box 245
Bagdad, Arizona 86321

I. Background

The Cyprus Bagdad Copper Corporation located at terminus of State Route 96 in Yavapai County has applied for a new National Pollutant Discharge Elimination System (NPDES) permit to allow the discharge of process wastewater and stormwater runoff from their copper mine. The new permit will supercede their current permit, which will expire June 30, 1988. The conditions of the existing permit will continue in force until the effective date of the new permit. The proposed permit is drafted pursuant to Section 402 of the Clean Water Act. They have six discharge points; two to Copper Creek, three to Mulholland Wash and one to Mammoth Wash in the Colorado River Main Stem Basin.

II. Nature of Discharge - Standards - Limitations

The proposed permits cover the six possible discharge points from the Cyprus Copper Mine. The waste control facilities consist of holding facilities, catchment and pumpback facilities. The waste control facilities have the capability of containing all process wastewater and stormwater runoff from a storm greater than a 10 year, 24 hour precipitation event. In addition to containment, the proposed permit allows the discharge of treated water. The limits for this discharge are contained in Appendix 2. The containment requirements are listed in Appendix 1.

In order to protect the beneficial uses of surface waters, the State of Arizona has adopted water quality standards for various streams, depending on the protection required. This facility discharges to washes tributary to either Boulder Creek or Burro Creek in the Colorado Main Stem Basin. Boulder Creek has protected uses of Aquatic and Wildlife, Agriculture Irrigation and Agriculture Livestock Watering; while, Burro Creek has protected uses of Aquatic and Wildlife, Incidental Human Contact and Agriculture Livestock Watering (R9-21-Appendix A). The corresponding criteria for pollutants of concern are listed in R9-21-Appendix B.

MAY 02 1988

Appendix 1

1. During the effective life of this permit, the permittee shall not discharge stormwater runoff and/or process wastewater to receiving waters, except as listed below:

- a. Storm water runoff and/or process wastewater overflow may be discharged from waste control facilities without being subject to the limitations in I.B.1.c. of this permit only if these facilities are designed, constructed and maintained to contain or recycle the volume of water that is the sum of all the following:
 - (1) The volume of water applied by the operator to an active leach area.
 - (2) The volume of runoff resulting from rain falling directly on the total leach and tailings area.
 - (3) The volume of runoff resulting from rain falling directly on leachate holding facilities.
 - (4) The volume of runoff resulting from 3 inches of rain falling on areas draining into leachate catchment and recycle facilities, tailings piles, and holding facilities.
 - (5) The volume of runoff resulting from 3 inches of rain falling directly on the pit.
 - (6) The volume of runoff resulting from 3 inches of rain falling on areas that drain into the pit.

ALL discharges, however, shall be monitored according to the requirements of I.B.1.c.

- b. Containment shall include catchment and pump-back facilities to recycle runoff into process water circuits or onto leach dumps and percolation ponds where the runoff and process water so contained is treated by neutralization, settling and percolation.

MAY 02 1988

Appendix 2

1. Trace substances shall be limited and monitored as specified below. All metals limits below are for total recoverable metals as specified in Methods for Chemical Analysis of Water and Wastes (EPA 600/4-79-020) method 4.1.4. Results shall be reported as total metal.

Discharge Points 001,002, 003, 004, 005, and 006

<u>Effluent characteristics</u>	<u>Daily Maximum</u>	<u>Monitoring</u>	
		<u>Frequency</u>	<u>Sample Type</u>
	**	Daily	Composite
Flow		Daily	Composite
Arsenic (as As)	0.050 mg/l	Daily	Composite
Copper (as Cu)	0.050 mg/l	Daily	Composite
Lead* (as Pb)	0.050 mg/l	Daily	Composite
Manganese (as Mn)	10.000 mg/l	Daily	Composite
Mercury* (as Hg)	0.0002 mg/l	Daily	Composite
Silver (as Ag)	0.050 mg/l	Daily	Composite
Zinc (as Zn)	0.500 mg/l	Daily	Composite
Ammonia (as un-ionized NH ₃)	0.020 mg/l	Daily	Composite
Cyanides* (as cyanide ion and complexes)	0.020 mg/l	Daily	Composite
Sulfides	0.100 mg/l	Daily	Composite
Suspended Solids	30 mg/l	Daily	Composite
Settleable Solids	2 ml/l	Daily	Composite
pH	Not less than 6.5 standards units nor greater than 9.0 standards units. The discharge shall not cause the pH of the receiving water to change more than 0.5 standard units.		

* The allowable limit for this is set at less than the current minimum level of detection. Compliance requires concentrations be less than but not equal to the number listed.

** Monitoring and reporting required. No limit set at this time.

WHP:mm



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

Certified Mail: 007796749

12 JUL 1988

William J. Lampard
Vice President
Cyprus Bagdad Copper Corp.
P.O. Box 245
Bagdad, AZ 86321

Dear Mr. Lampard:

Enclosed is a copy of the draft permit, statement of basis and public notice of our proposed action on your application for a National Pollutant Discharge Elimination System (NPDES) permit for:

Cyprus Bagdad Copper Corp.
Bagdad, Arizona
NPDES Permit No. AZ0022268

The public comment period is from July 13, 1988 to August, 13, 1988. Comments on the proposed action, or a request for a public hearing pursuant to 40 CFR 124.12, may be submitted to this office within 30 days following the date of this public notice.

If the Regional Administrator finds a significant degree of public interest exists with respect to the proposed permit, a public hearing shall be held. If no hearing is held, we expect to forward the permit containing the final determinations of the Regional Administrator shortly after the close of the 30-day comment period.

If you have any questions regarding the draft permit, please call Jon Hangartner of my staff at (415) 974-8299.

Sincerely,

Kenneth D. Greenberg, Chief
Permits Issuance Section

Enclosure

cc: D.R. Russell, Environ. Coordinator, Cyprus Bagdad
Copper Co.

Bagdad (F) on
MJB 11

Cyprus Bagdad Copper Corp.
Page 2

cc: (cont'd)

- ADEQ, Water Permits Unit
- ADEQ, Northern Regional Office
- U.S. Fish and Wildlife, Ecological Services
- AZ Game and Fish Dept.
- AZ Dept. of Commerce
- Northern AZ Council of Govs.
- Yavapai County Health Dept.
- State Land Dept.
- Department of Water Resources

13 JUL 1988

JOINT NOTICE OF PROPOSED ACTION

by the

U.S. Environmental Protection
Agency
Region 9 (W-5-1)
215. Fremont Street
San Francisco, CA 94105
Telephone: (415) 974-8299

Arizona Department of
Environmental Quality
2005 N. Central Avenue
Phoenix, AZ 85004
Telephone: (602) 257-2270

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

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

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

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

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

Cypress Bagdad Copper Corporation
P.O. Box 245
Bagdad, Arizona 86321

NPDES Permit No. AZ0022268

The applicant is the operator of the Cypress Copper Mine located in Yavapai County. The discharge consists of process wastewater and stormwater runoff from the copper mine. The proposed permit covers six possible discharge points from the mine's waste control facilities at the following locations: Discharge Serial No. 001 - Latitude 34°36'23"N, Longitude 113°13'55"W, discharging to Copper Creek, tributary to Boulder Creek, Discharge Serial No. 002 - Latitude 34°35'53"N, Longitude 113°15'25"W, discharging to Mulholland Wash, tributary to Boulder Creek, Discharge Serial No. 003 - Latitude 34°35'52"N, Longitude 113°15'23"W, discharging to Mulholland Wash, tributary to Boulder Creek, Discharge Serial No. 004 - Latitude 34°36'23"N, Longitude 113°13'55"W, discharging to Copper Creek, tributary to Boulder Creek, Discharge Serial No. 005 - Latitude 34°35'42"N, Longitude 113°15'37"W, discharging to Mulholland Wash, tributary to Boulder Creek, and Discharge Serial No. 006 - Latitude

34°35'17"N, Longitude 113°17'22"W, discharging to Mammoth Wash, tributary to Burro Creek. Boulder Creek has protected uses of Aquatic and Wildlife, Agriculture Irrigation, and Agriculture Livestock Watering. Burro Creek has protected uses of Aquatic and Wildlife, Incidental Human Contact, and Agriculture Livestock Watering. The proposed permit is based on Best Available Technology for the Ore Mining and Dressing Point Source Category, and allows no discharge from this facility except overflow from wastewater control facilities in the event of a precipitation event greater than a 10-year 24-hour storm. If such discharge occurs, the permit contains water quality based effluent limitations for Arsenic, Copper, Lead, Manganese, Mercury, Silver, Zinc, Ammonia, Cyanides, Sulfides, and pH. Monitoring is also required for flow and Suspended Solids.

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

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

The ADMINISTRATIVE RECORD for the DRAFT PERMIT, which includes the APPLICATION, DRAFT PERMIT, STATEMENT OF BASIS, and all data sent by the applicant may be viewed Monday through Friday from 9:00 A.M. until 4:00 P.M. at the EPA address below. A copy of these documents may be obtained by calling or writing to the addresses below:

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

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

Telephone: (415)974-8299

Telephone: (602)257-2270

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

All comments or objections submitted within thirty (30) days from the date of this notice will be considered in the formulation of the final determinations regarding the application. If the response to this notice indicates a significant degree of public desire for a public hearing, the Regional Administrator shall hold one in accordance with 40 CFR 124.12. A public notice of such hearing will be issued at least thirty (30) days prior to the hearing. A request for a public hearing shall be in writing and shall state the nature of the issues proposed to be raised in the hearing.

If this DRAFT PERMIT becomes final, and there are no appeals, discharge from and operation of the identified facility may proceed or continue, subject to the conditions of the permit and other applicable permit and legal requirements.

A final decision to set the conditions and to issue the FINAL PERMIT, or to deny the APPLICATION for the permit, shall be made after all comments have been considered. Notice of the final decision shall be sent to each person who has sent or delivered written comments or requested notice of the final permit decision. The decision will become effective 30 days from the date of issuance unless:

1. a later effective date is specified in the decision; or
2. an evidentiary hearing is requested pursuant to 40 CFR 124.74. Any person may send or deliver, in writing, a request for an evidentiary hearing. Requests for an evidentiary hearing must state each legal or factual question alleged to be at issue, and its relevance to the permit decision. If the request is sent or delivered by a person other than the applicant, the person will simultaneously send a copy of the request to the applicant. A request for an evidentiary hearing must be sent or delivered to Patrick Chan at the address shown above within 33 days following the mailing of the final decision. If an evidentiary hearing is granted, applicable provisions of the permit will be stayed pending the outcome of the hearing; or
3. there are not comments requesting a change to the DRAFT PERMIT, in which case the final decision shall become effective immediately upon issuance.

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

Date: 13 JUL 1988

GEOLOGY OF THE BAGDAD MINE *K*

GEOLOGIC SUMMARY

11-83

The Bagdad open pit mine is developed within and adjacent to a composite quartz monzonite stock of Late Cretaceous age, located approximately 100 miles northwest of Phoenix, Arizona. Copper and molybdenum sulfide ore is presently being mined at a rate of 56 - 58,000 tons per day by the Cyprus Bagdad Copper Company, a subsidiary of AMOCO Minerals Company. Reserves exceed 400 million tons of sulfide ore averaging .46% Cu and about .02% Mo.

In many respects, the Bagdad orebody is similar to other Arizona Cu-Mo porphyry systems of Laramide age. A well defined ore zone occurs within an extensive stockwork of small veins and veinlets consisting predominantly of quartz, pyrite, chalcopyrite, and molybdenite. Calcite is a common gangue mineral and locally magnetite is conspicuous. Sphalerite, tetrahedrite, and galena are minor minerals generally occurring in relatively late or peripheral quartz veins, where they are frequently associated with higher than average silver values. Nearly monomineralic fracture fillings of pyrite, chalcopyrite, and molybdenite occur widely throughout the ore shell. There is a general tendency for molybdenite to increase with depth.

Conspicuous, widely disseminated indigenous chalcopyrite is restricted to a relatively late intrusion of porphyritic quartz monzonite (PQM) and a finer grained, quartz monzonite porphyry (QMP). For the purposes of geologic block modelling, these two rock types are considered cogenetic textural varieties, and have been treated as a single modelling unit. At the present mining elevations, the PQM forms a large, irregular, dike-like body trending east-northeast across the central part of the composite stock and associated ore shell. Several lines of evidence indicate that the PQM was intruded into a subvolcanic environment and represents the upper part of a much larger Cu-Mo enriched body of quartz monzonite that energized and introduced copper and molybdenum to a complex hydrothermal system developed in the strongly fractured rocks above and adjacent to the PQM. Supporting this genetic model is the symmetrical arrangement of the ore shell and pyritic halo around the elongate body of porphyritic quartz monzonite.

Predating the PQM are two largely equigranular, medium-grained facies of the composite stock. The oldest of these intrusive units is a relatively biotitic, strongly potassically altered granodiorite. This granodioritic facies of the Bagdad stock has been informally designated QM₁. Probably because of its relatively high initial iron content and closely spaced fractures, the granodioritic facies commonly acted as an especially favorable host for copper mineralization.

The predominant rock type within the composite stock is a medium-grained, nearly equigranular to weakly seriate-porphyrific quartz monzonite (QM₂) that may largely postdate the more biotitic QM₁. Contacts between QM₁ and QM₂ are generally obscure, and it appears likely that at least locally the granodioritic QM₁ may be a border facies grading inward to QM₂. The Laramide stock intruded a complex Precambrian terrain that commonly is strongly mineralized for several hundred feet away from the outward dipping intrusive contacts.

The youngest igneous rock recognized as part of the Laramide intrusive system is represented by dikes and probably plug-like bodies of granite porphyry (GRP). Although the GRP is somewhat similar to some varieties of conspicuously porphyritic, quartz phenocrystic QMP, the granite porphyry is essentially unmineralized, except for rare quartz-pyrite-sphalerite-galena veins, and appears to postdate the main stage of Cu-Mo mineralization. Pyrite is widely developed in the GRP, where it is associated with strong to pervasive phyllic - argillic alteration probably representing the waning stages of the hydrothermal system.

Rock alteration studies within and adjacent to the Bagdad stock indicate that Cu-Mo mineralization generally is associated with a zone characterized by overprinting of moderate to strong potassic alteration (defined by secondary biotite and K-feldspar) by a later superimposed phyllic alteration (defined by sericite). The shift from widespread potassic alteration to later phyllic alteration probably reflects an inward collapse of temperature gradients during the declining stages of the hydrothermal system. Within the ore shell, Cu and Mo mineralization occurred during both the potassic and phyllic alteration phases, with the phyllic alteration generally diminishing in the deeper parts of the orebody. A strongly developed quartz-sericite-pyrite alteration halo surrounds the ore shell, dipping steeply away from the pit, and helping to define the geometry of the higher-grade portion of the orebody as an elliptical truncated cone increasing in diameter with depth.

Limited fluid inclusion studies of quartz in veins associated with mainstage Cu-Mo mineralization and phyllic alteration (Nash and Cunningham, 1974) indicate ore deposition from hydrothermal solutions of moderate to high salinity (8 to 35% NaCl equivalent) at temperatures ranging from 225° to 375° C. The presently exposed portion of the ore shell apparently formed at a depth of approximately 6,000 feet. Geological evidence and physical-chemical constraints indicated by fluid inclusion data suggest that the Bagdad Cu-Mo hydrothermal system developed beneath a Late Cretaceous volcanic center in response to multiple intrusive pulses of granodioritic to granitic magma. Mineralization appears to be spatially and temporarily associated with the intrusion of the porphyritic quartz monzonite (PQM), probably resulting from a complex interaction between magma-derived heat and metal-enriched hydrothermal fluids, and groundwater. Widespread breccia piping and the occurrence of largely vapor filled fluid inclusions indicate localized venting and boiling of this major hydrothermal system.

DESCRIPTION OF GEOLOGIC MODELLING UNITS

Eight lithologic units are represented on the generalized geologic map used in this report. For simplicity of block modelling, these units commonly include two or more diverse lithologies.

Dumps and Tailings

Mine dumps and old mill tailings occur widely in the mine area. Because large tonnages of these unconsolidated materials will have to be relocated in order to significantly expand the pit, they constitute an important modelling unit.

Sanders Basalt

A succession of Late Miocene(?) olivine basalt flows, up to 100 or more feet thick, cap Sanders and Copper Creek Mesas east and north of the pit. Separating this basalt from the underlying Gila Conglomerate is a conspicuous, white rhyolite tuff approximately 30 feet thick.

Gila Conglomerate

Middle to Late Miocene terrestrial sediments consisting largely of weakly to moderately consolidated, alluvial fan and stream gravel, pebbly arkosic sandstone, with numerous interbeds and channel fillings of rhyolitic tuff and poorly sorted tuffaceous sandstone and mudstone. The Gila Conglomerate was deposited on an erosion surface with substantial topographic relief so that, in the mine area, the thickness of this formation varies from less than 100 feet to approximately 1,000 feet.

Porphyritic Quartz Monzonite (PQM)

The PQM, together with its finer-grained equivalent QMP, represents an extremely important modelling unit. Even though this relatively late intrusive rock generally contains significant disseminated chalcopyrite, the abundance of this indigenous sulfide is highly variable and this rock largely coincides with low-grade ore and a central core of low-grade sulfide mineralization. Disseminated pyrite is ubiquitous within the PQM, but its abundance relative to chalcopyrite varies greatly; molybdenite commonly occurs as sparsely disseminated grains.

Texturally, the PQM ranges from distinctly porphyritic to seriate-porphyritic, with all gradations to finer-grained, conspicuously porphyritic QMP. Generally the PQM is light gray, but approaches white in varieties with less than 5 percent biotite.

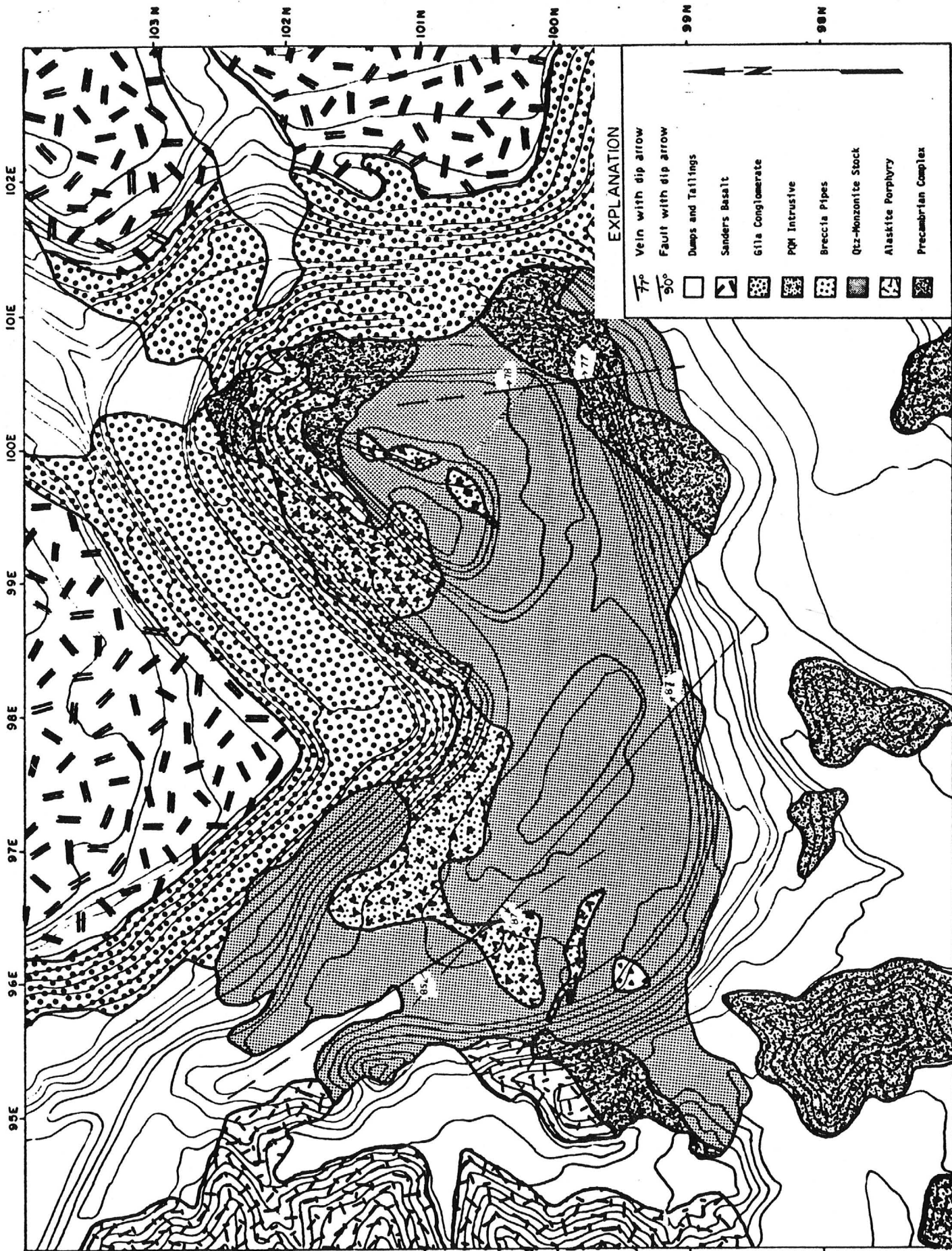
A distinctive phenocryst population usually consists of 3-8% biotite (1-5 mm), 10-20% rounded quartz "eyes" (1.5-6 mm), 30-35% sodic plagioclase (2-10 mm), and 3-10% euhedral orthoclase (3-12 mm). These phenocrysts occur as an open mesh with a fine-grained interstitial groundmass of quartz and potassium feldspar.

Breccia Pipes

Weakly to strongly mineralized breccias are widely occurring in the mine area. The two largest, presumably pipelike bodies of breccia are shown on the generalized geologic map. These breccias consist largely of a highly mixed assortment of closely packed, angular to subrounded fragments of Precambrian rock types in a strongly altered matrix of finer-grained breccia and comminuted rock. These breccias are unsorted, with fragments ranging in size from a few millimeters to more than a meter. Potassic alteration is strong to pervasive with crosscutting veinlets, alteration rims, and interstitial fillings of fine to coarsely crystalline biotite, K-feldspar, and quartz, commonly assuming an aplitic to pegmatitic aspect, with intergrown or disseminated chalcopyrite, pyrite, and minor molybdenite. Most of the sulfide mineralization occurs in quartz veinlets than crosscut both the fragments and matrix, indicating that the breccias formed prior to the culmination of the main stage of Cu-Mo mineralization. The age of the breccias is bracketed by the occurrence of rare Laramide quartz monzonite fragments and numerous crosscutting dikes and irregular stringers of PQM and QMP. A poorly defined spatial association between the breccias and the PQM suggests a genetic relationship.

Quartz Monzonite (QM)

Because vague or gradational contacts are common between the granodioritic facies of the Laramide quartz monzonite (QM₁) and the more widespread less biotitic quartz monzonite (QM₂), these two rock types have not been adequately delineated in the pit or subsurface. For this reason they have been combined to form a single modelling unit (QM). Both compositional and textural varieties are medium-grained, weakly seriate-porphyrific to hypidiomorphic-granular rocks. Biotite in the QM₁ occurs largely or entirely as leafy secondary biotite, commonly forming prismatic aggregates that may be pseudomorphs after hornblende. In the QM₂ biotite forms characteristic booklike phenocrysts or aggregates. Potassium feldspar is significantly more abundant in the QM₂, where it is largely intergrown with quartz to form a fine-grained interstitial mosaic. Sparse quartz eyes (1-2 mm) are commonly present in the QM₂, locally becoming conspicuous. Disseminated indigenous chalcopyrite has not been recognized in either variety of the QM.



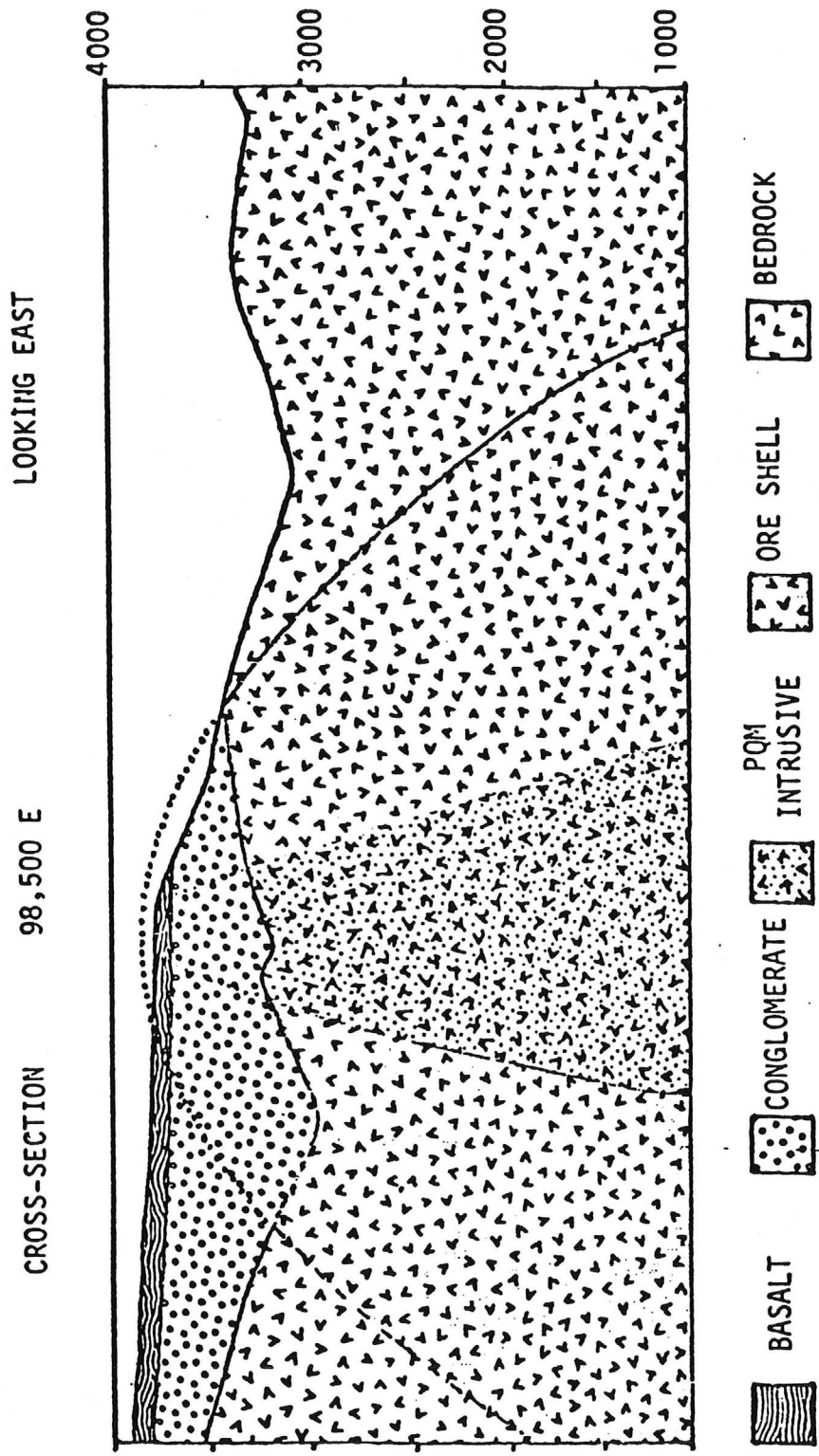
IDEALIZED GEOLOGIC MAP

Alaskite Porphyry (alp)

This leucocratic Precambrian rock is in contact with the composite stock along most of its western margin. This distinctive rock is composed almost entirely of quartz and feldspar. Irregular quartz phenocrysts (1-4 mm) are conspicuous, and along with twinned albite phenocrysts (1-3 mm) are set in a fine- to very fine-grained micrographic to myrmekitic ground-mass of interlocking quartz and potassium feldspar with some albite. This granophyric intrusive rock is essentially devoid of mafic minerals, and the extremely low initial iron content probably explains why it is an extremely poor host for copper mineralization.

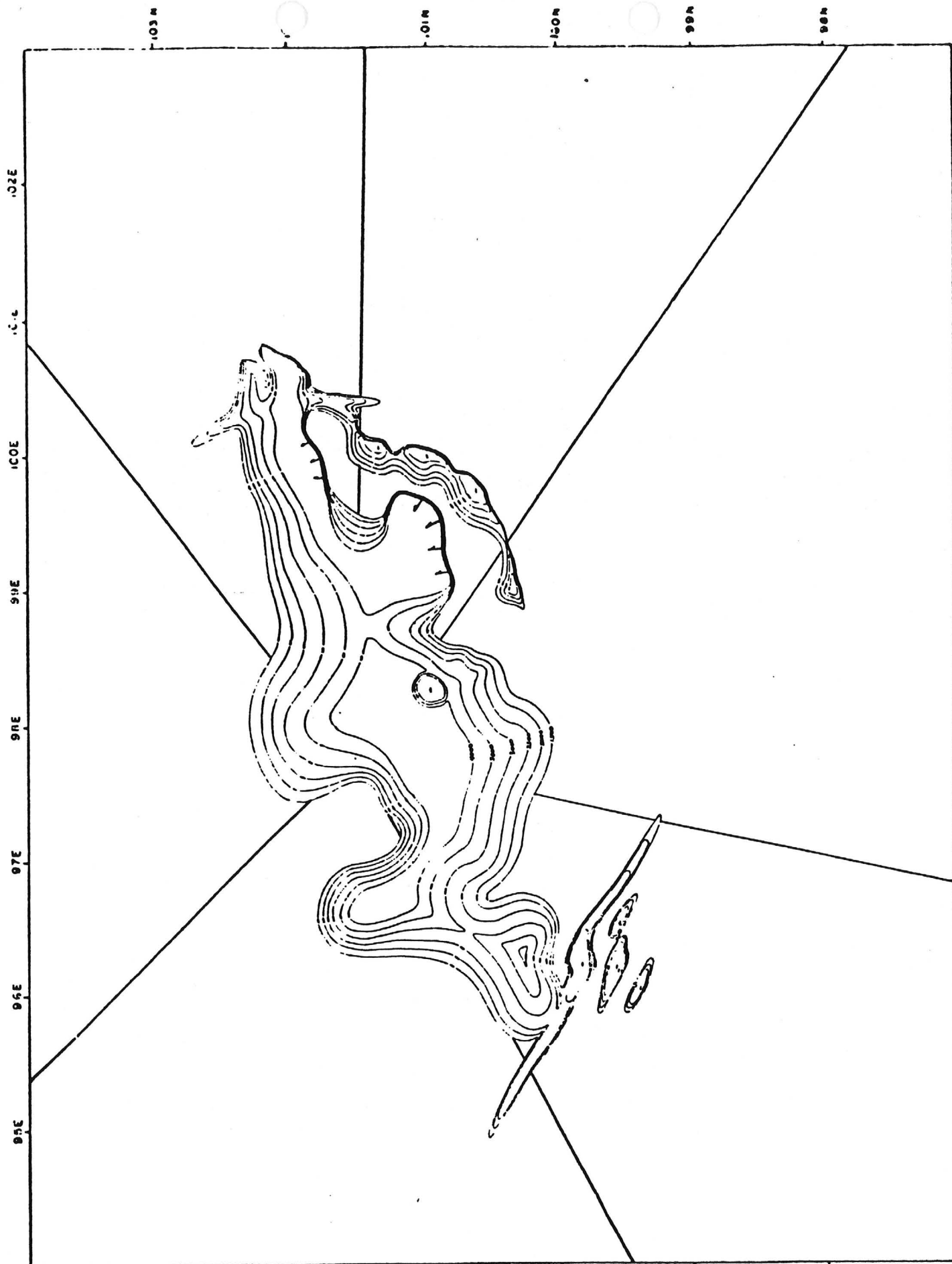
Precambrian Complex

Because of the structural complexity of the Precambrian terrain adjacent to the Laramide composite stock, these intimately mixed and highly diverse rocks have been included in a single modelling unit. This complex consists predominantly of three metamorphosed Precambrian formations (Bridle Volcanics, Butte Falls Tuff, and Hillside Mica Schist) intruded by a wide assortment of igneous rocks ranging in composition from gabbro to granite, including pegmatite and aplite. Generally within the ore shell relatively high-iron rocks (Bridle Volcanics, gabbro, and quartz diorite) have acted as exceptionally favorable hosts for copper mineralization. Conversely, molybdenite mineralization seems to be independent of the host's initial iron content, and may in fact be localized in silicic rocks low in iron. Future block modelling should be revised to differentiate the more mafic Precambrian rocks as a separate modelling unit.



SECTION SHOWING RELATIONSHIP BETWEEN PQM AND ORE SHELL
 WEATHERING ZONES HAVE BEEN OMITTED FROM SECTION

SCALE: 1 IN = 1000 FT

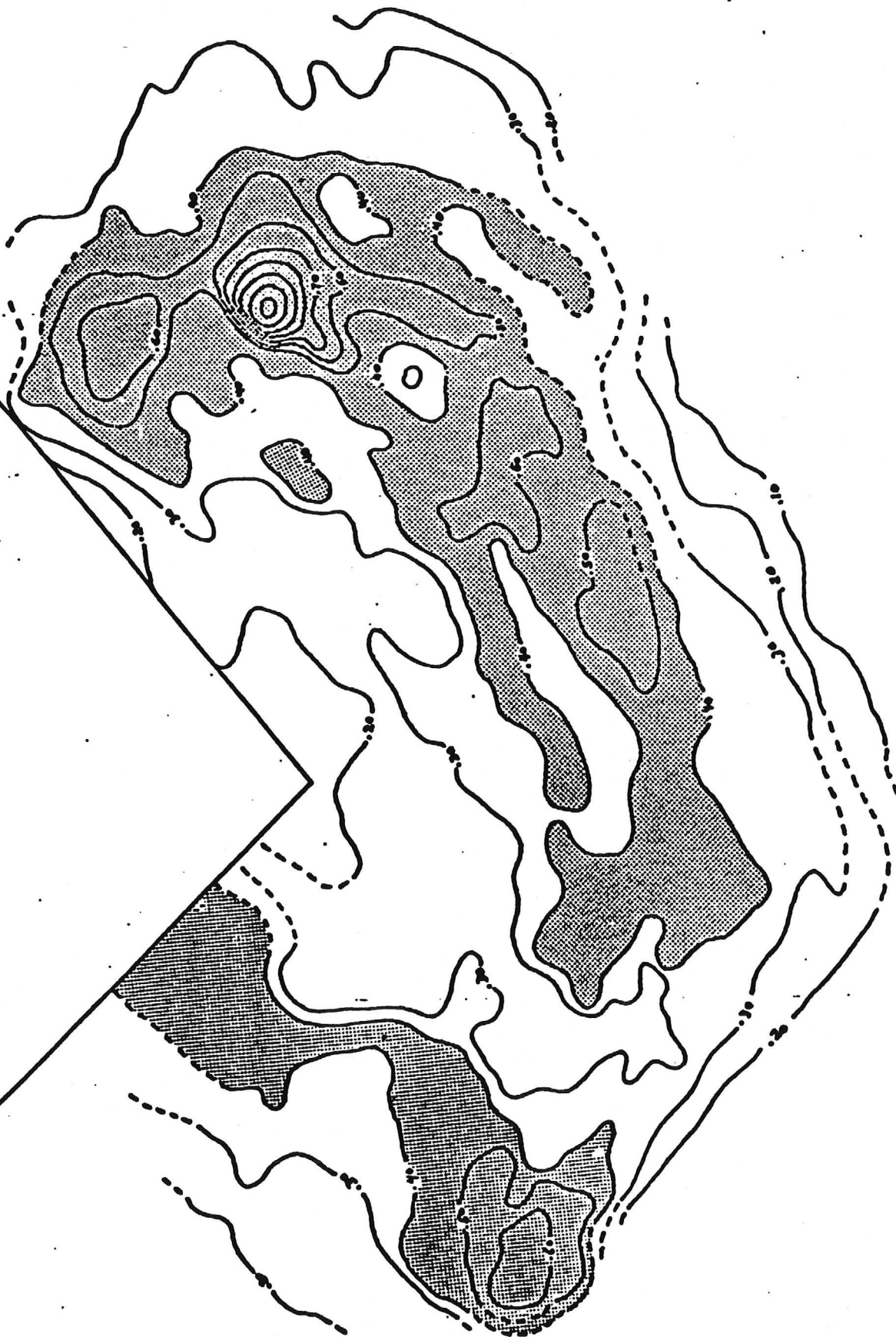


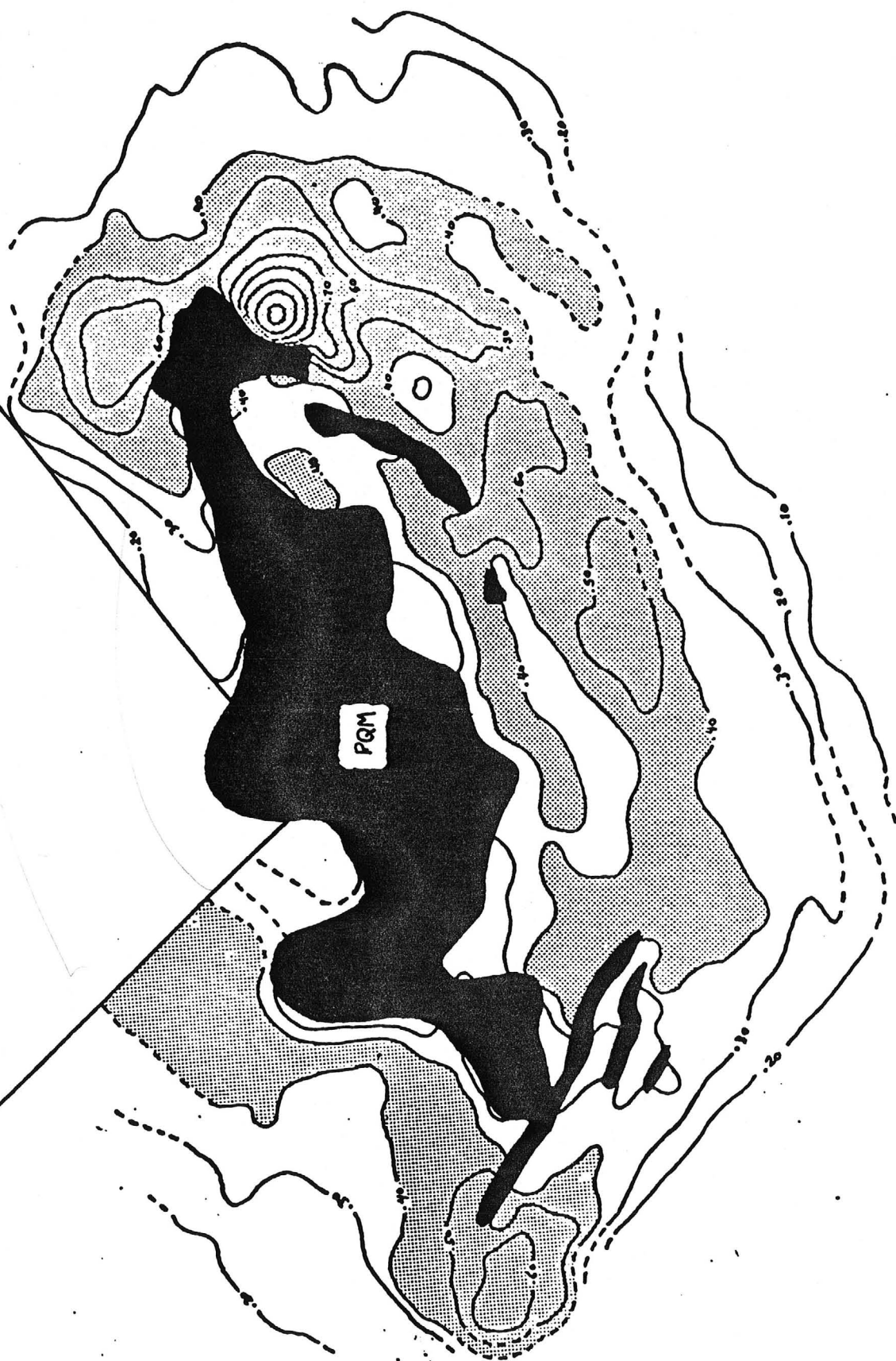
DOM INTRUSIVE CONTOUR

250' CONTOUR INTERVAL

Scale: 1" = 1000'

2000 ELEVATION





A.I.M.E. - ARIZONA CONFERENCE

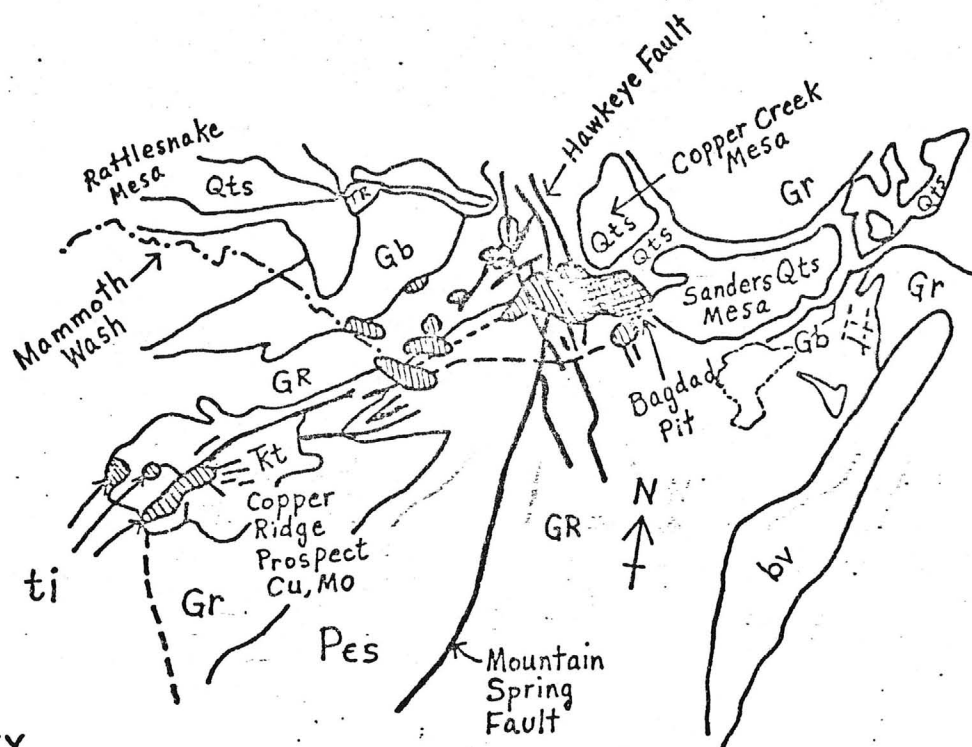
MINING GEOLOGY DIVISION
SPRING MEETING 1978
APRIL 22, 1978

*Calculate then 12
File in
Cyprus Bagdad
mine file
Make Subject Card
Bagdad Area geology*

P R O G R A M

8:00 a.m. - 9:00 a.m.	REGISTRATION	
9:00 a.m. - 12:00 Noon	TECHNICAL SESSION	
	Welcome Address	Robert J. Bonnis
	1. Bruce Mine - A Case for Metamorphic Remobilization of Precambrian Massive Sulfide	Robert L. Clayton
	2. Geology of Cyprus Bagdad Mine	P. K. Medhi James Sterling Frank Nelson
	3. Ore Estimation at Cyprus Bagdad Mine	John E. Nelson George Rudy
	4. Engineering Geology at Cyprus Bagdad Mine	Wayne L. Jacobsen
	5. Cyprus Bagdad Mine Today	Mark Gillo
12:00 Noon - 1:30 p.m.	LUNCH AT THE COPPER KETTLE	
1:30 p.m. - 4:30 p.m.	TOUR OF CYPRUS BAGDAD OPEN-PIT MINE	
5:30 p.m. - 6:30 p.m.	HAPPY HOUR AT THE COPPER KETTLE	
6:30 p.m. - 7:30 p.m.	DINNER	
7:30 p.m. - 7:45 p.m.	GUEST SPEAKER R. C. Bogart General Manager Cyprus Bagdad	
7:45 p.m. - 8:00 p.m.	AMATEUR MAGICIAN Armando Gonzales	

GENERALIZED GEOLOGIC MAP OF THE BAGDAD AREA



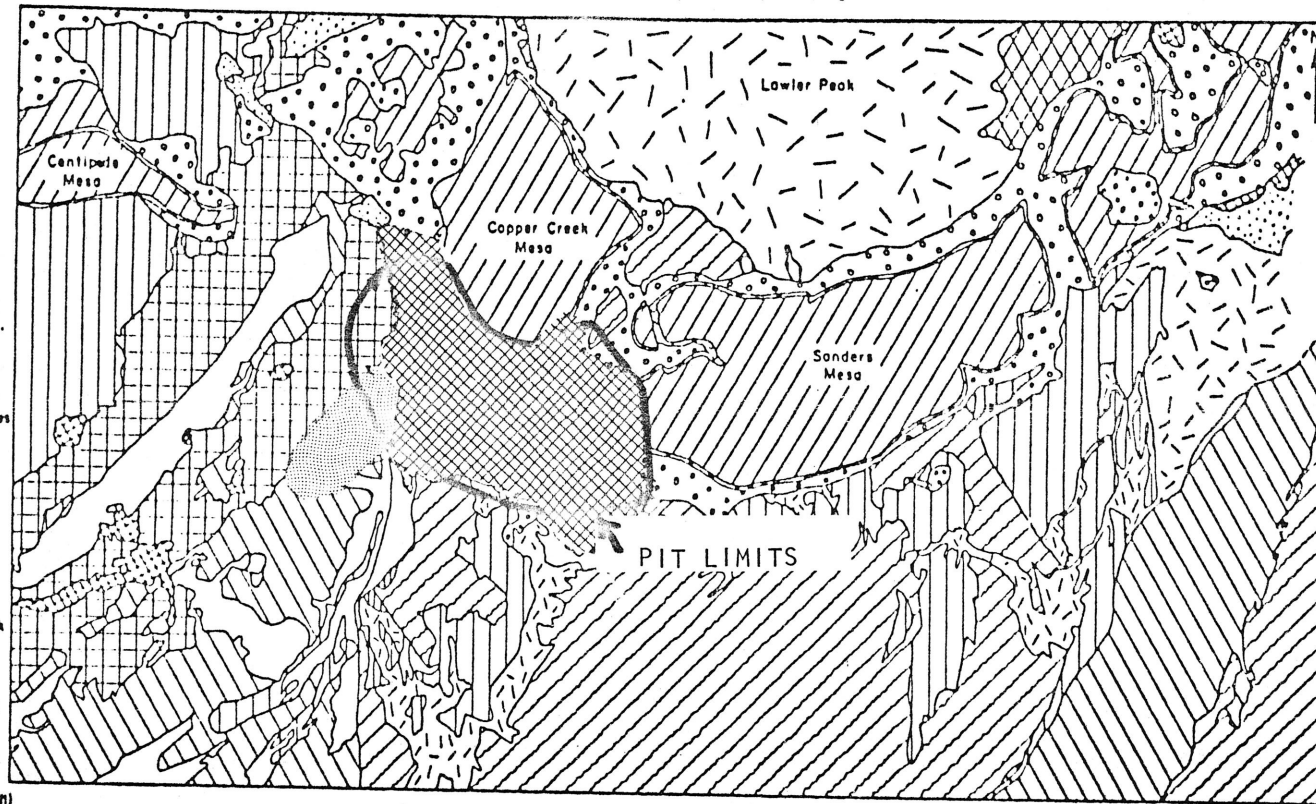
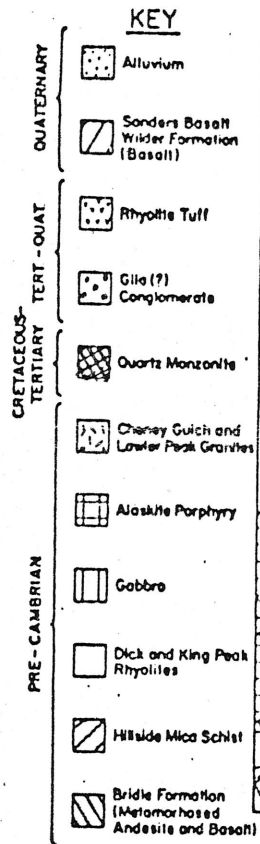
KEY

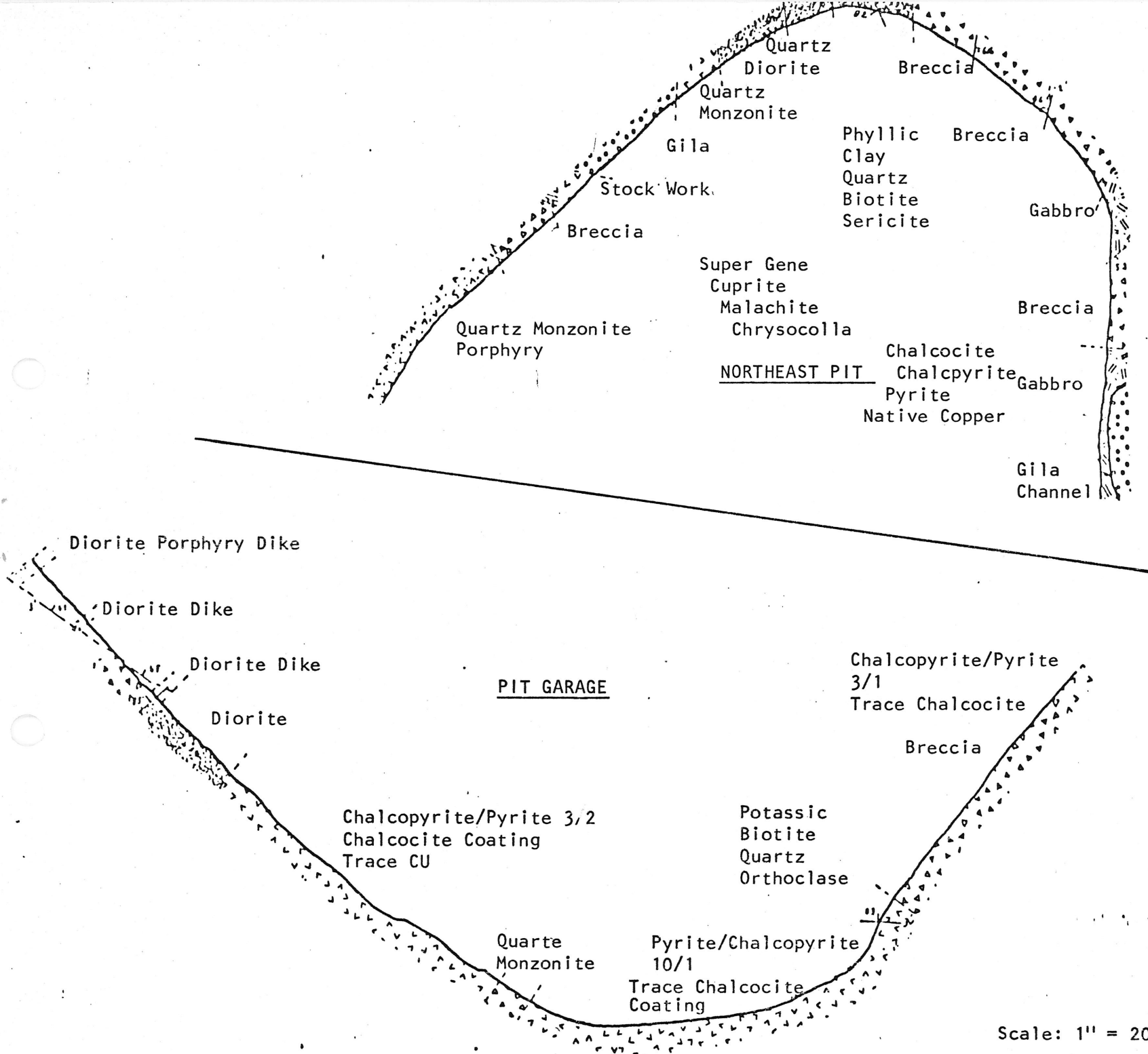
Qts Quaternary-Tertiary Alluvium and Basalt	Gb Precambrian Gabbro-Anorthoxite
TI Tertiary-Cretaceous Intrusives, Dikes, Stocks of Monzonite, Diorite or Rhyolite	Gr Precambrian Granites
Kt Tertiary-Cretaceous Welded Tuff	br Bridle Formation Precambrian Meta-Andesites and Basalts
Pes Precambrian Shists	

SCALE 1:120,000

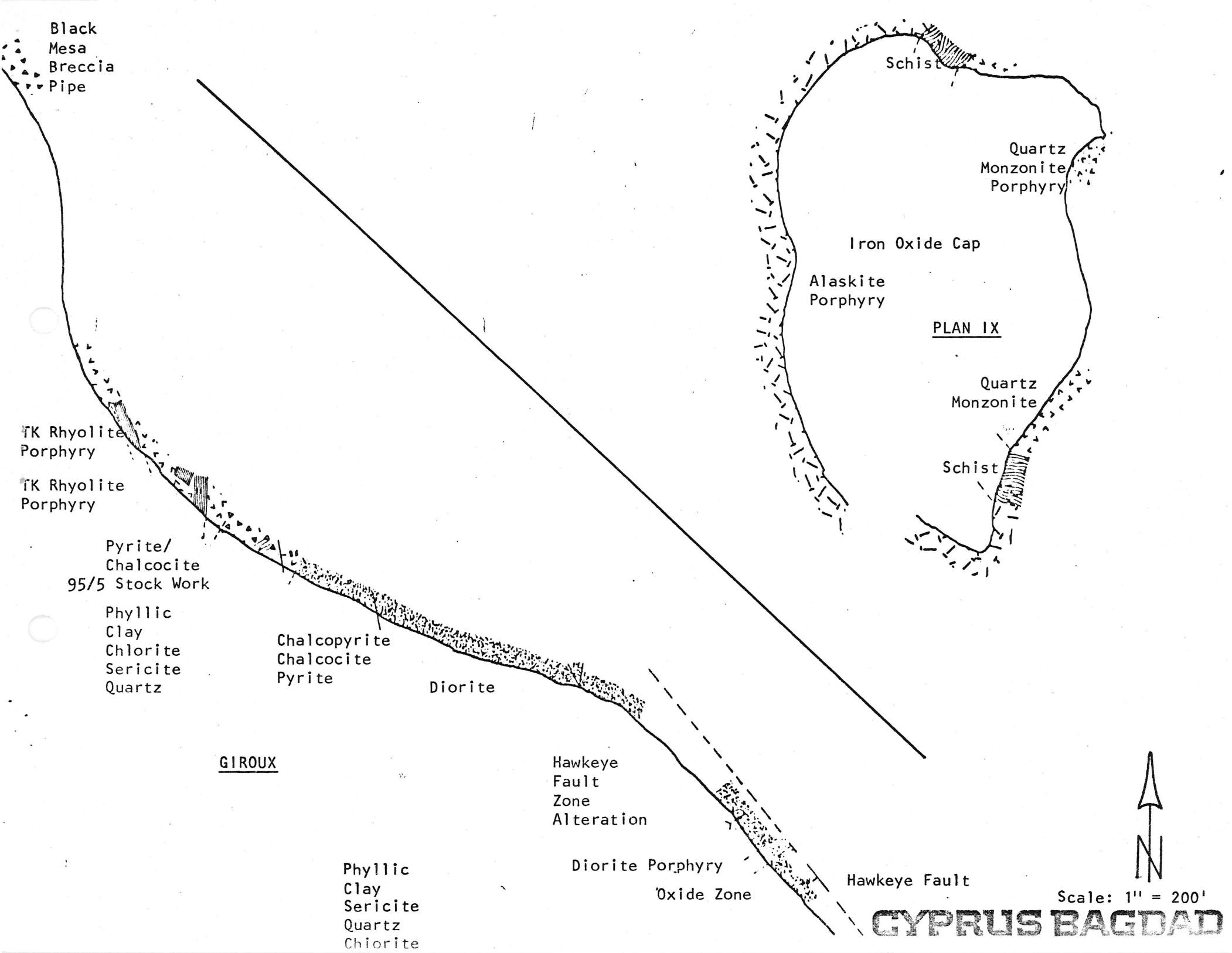
PKM

Generalized geological map of Bagdad





CYPRUS BAGDAD



BAGDAD "77"

PREPARED FOR THE ARIZONA CONFERENCE A.I.M.E. DECEMBER 1977 MEETING
TUCSON, ARIZONA

BY: R. J. BONNIS
J. E. NELSON

CYPRUS BAGDAD COPPER COMPANY
BAGDAD, ARIZONA

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BAGDAD "77"

PREPARED FOR THE ARIZONA CONFERENCE A.I.M.E. DECEMBER 1977 MEETING
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1.0 INTRODUCTION

THIS PROGRAM IS TO INTRODUCE THOSE WHO ARE NOT FAMILIAR WITH BAGDAD TO THE ACTIVITIES CARRIED ON BY THE CYPRUS BAGDAD COPPER COMPANY AT BAGDAD, ARIZONA. THIS TEXT IS A BRIEF DESCRIPTION OF THE OPEN PIT OPERATION OF THE CYPRUS BAGDAD COPPER COMPANY.

2.0 LOCATION

THE CYPRUS BAGDAD COPPER COMPANY'S OPEN PIT COPPER MINING OPERATION IS LOCATED IN THE EUREKA MINING DISTRICT IN THE WEST CENTRAL SECTION OF THE STATE OF ARIZONA, YAVAPAI COUNTY. NEARBY COMMUNITIES ARE PRESCOTT, ARIZONA, TO THE EAST APPROXIMATELY 70 MILES BY ROAD, AND WICKENBURG, ARIZONA, ABOUT THE SAME DISTANCE TO THE SOUTHEAST. IT IS SERVED BY A HARD-SURFACED ROAD FROM BOTH OF THESE COMMUNITIES. A RAILROAD SIDING IS LOCATED 23 MILES TO THE EAST AT THE TOWN OF HILLSIDE, ARIZONA. BAGDAD HAS A POPULATION OF ABOUT 3,500.

3.0 CLIMATOLOGY

BAGDAD IS LOCATED IN THE SEMI-DESERT AREA OF ARIZONA, AT AN AVERAGE ELEVATION OF APPROXIMATELY 3,300 FEET. THE ELEVATION OF THE AIRPORT IS APPROXIMATELY 4,000 FEET AND THE BOTTOM OF THE PIT 2,800 FEET. THE ANNUAL RAINFALL AVERAGE IS 13.83 INCHES. THE AVERAGE AMBIENT TEMPERATURE IS 62 DEGREES, WITH HIGHS OF 105 DEGREES TO LOWS OF 10 DEGREES ABOVE ZERO. THE PREVAILING WINDS ARE FROM THE SOUTHWEST. THE GENERAL FLORA AND FAUNA OF THE AREA ARE TYPICAL OF THE BASIN REGION OF ARIZONA, CONSISTING OF MANY SPECIES OF CACTI, CEDAR, MESQUITE AND OAK BRUSH. A VARIETY OF WILDLIFE ABOUNDS IN THE SURROUNDING HILLS.

4.0 BRIEF HISTORY

THE BAGDAD MINING CLAIMS WERE DISCOVERED IN 1882 AND PATENTED IN 1889 BY MR. JOHN LAWLER. SUCCESSOR OWNERS AND COMPANIES WERE: GIROUX SYNDICATE, COPPER CREEK DEVELOPMENT COMPANY, ARIZONA NEVADA COPPER COMPANY, BAGDAD COPPER COMPANY, ARIZONA BAGDAD COPPER COMPANY, AND FINALLY IN 1927, BAGDAD COPPER CORPORATION.

5.0 MERGER

IN JUNE, 1973, CYPRUS MINES CORPORATION AND BAGDAD COPPER CORPORATION MERGED. IN JANUARY, 1974, IT BECAME THE CYPRUS BAGDAD COPPER COMPANY.

EXPLORATION DRILLING TO PROVE THE BAGDAD ORE BODY WAS STARTED AS EARLY AS 1919. THE FIRST METALLURGICAL TESTING WAS BY A 50-TON PILOT PLANT IN THE LATE 20's. THIS WAS FOLLOWED BY A 200-TON MILL IN THE EARLY 30's. AS PART OF THE WORLD WAR II WAR EFFORT, A 2,500 TON PER DAY MILL WAS CONSTRUCTED UNDER AN RFC LOAN.

IN 1944, MR. JOHN C. LINCOLN, OF LINCOLN ELECTRIC COMPANY, ACQUIRED CONTROLLING INTEREST OF BAGDAD COPPER CORPORATION. SHORTLY AFTER THIS DATE, IN 1945, UNDER THE DIRECTION OF MR. LINCOLN, THE MINE WAS CONVERTED FROM AN UNDERGROUND BLOCK CAVING TO AN OPEN PIT OPERATION.

UPON BECOMING AN OPEN PIT OPERATION, THE MILL CAPACITY WAS INCREASED TO 4,000 TONS IN 1949, 5,000 TONS IN 1957, AND TO 6,000 TONS IN 1963.

IN MAY 1974, THE DECISION WAS MADE TO EXPAND BAGDAD'S PRODUCTION AGAIN, BUT THIS TIME FROM THE 6,000 TON PER DAY CONCENTRATOR TO A NEW ONE WITH A CAPACITY OF 40,000 TONS PER DAY.

THE OLD CONCENTRATOR WAS SHUT DOWN IN JULY OF 1977, AND THE SHAKEDOWN OF THE NEW CONCENTRATOR BEGAN. IT IS EXPECTED TO REACH ITS 40,000 TON PER DAY DESIGN CAPACITY SOME TIME BEFORE THE END OF 1977.

A LEACH-PRECIPITATION SYSTEM, TOGETHER WITH A CONTACT SULPHURIC ACID PLANT, WAS INSTALLED IN 1961. THIS PROCESSING WAS INITIATED TO TAKE ADVANTAGE OF THE COPPER IN THE OXIDE ORE STOCKPILED IN THE ADJACENT CANYONS WHILE STRIPPING THE SULPHIDE ORE BODY. IN 1970, A SOLVENT EXTRACTION- ELECTROWINNING PROCESS WAS BUILT AND COMMISSIONED TO REPLACE THE FORMER IRON CEMENTATION SYSTEM. ALL COPPER RECOVERED FROM THE OXIDE DUMPS IS NOW PRODUCED IN THE FORM OF CATHODE COPPER.

IN 1966, A JOINT VENTURE BETWEEN BAGDAD COPPER CORPORATION AND CHEMETALS COMPANY, CALLED ARIZONA CHEMCOPPER COMPANY, WAS FORMED AND A PLANT WAS CONSTRUCTED TO REFINE PRECIPITATE COPPER PRODUCED BY THE LEACHING SYSTEM INTO FRICTION AND MOULDING GRADE COPPER POWDER. THIS PLANT USED HYDROGEN-REDUCTION IN AN ACID CIRCUIT AS THE PROCESS, AND WAS THE ONLY ONE OF ITS KIND.

THE JOINT VENTURE OPERATED THIS PLANT FOR A PERIOD OF TIME, AND IT WAS FINALLY PURCHASED BY BAGDAD.

THE OPERATION'S PRODUCTION WAS FROM PURCHASED COPPER PRECIPITATES AND, DUE TO THE SCARCITY OF PRECIPS, IT WAS CLOSED.

6.0 PIT GEOLOGY

ALONG A CROSS SECTION TAKEN IN THE PIT, THE FOLLOWING GEOLOGICAL UNITS CAN BE OBSERVED:

THE MESA CAPPINGS ARE COMPOSED OF BLACK COLORED BASALT FLOWS WHICH HAVE ERUPTED FROM VENTS SEEN N-W OF THE PIT (NEXT TO BOULDER CREEK). BELOW THE BASALT, IT IS EASY TO RECOGNIZE A WHITE UNIT OF TUFFACEOUS ASH DEPOSITED IN RIVER CHANNELS AND LAKES.

UNDER THE WHITE TUFF LIES A LAYER OF BEIGE COLORED CONGLOMERATE (10,000 - 100,000 YEARS OLD) DEPOSITED IN OLD RIVER CHANNELS AND COMPOSED OF BASALT BOULDERS AND CEMENTED FRAGMENTS.

ALL THE ROCKS MENTIONED ABOVE MUST BE REMOVED BEFORE THE ROCK CONTAINING THE COPPER CAN BE REACHED. THIS ROCK IS CALLED QUARTZ MONZONITE, WHICH IS VERY SIMILAR IN CHARACTER TO A GRANITE AND IS APPROXIMATELY 72 MILLION YEARS OLD.

COPPER SULFIDE (CuFeS_2) AND MOLYBDENUM SULFIDE (MoS_2) MINERALIZATION WAS INTRODUCED INTO THIS ROCK BY HOT WATERS ORIGINATING IN THE INTERIOR OF THE EARTH.

THE COPPER OXIDES FORMED AT A LATER DATE BY LEACHING AND OXIDATION OF THE CuFeS_2 . THE LEACHING WAS DONE BY GROUND WATER, RIVERS, AND RAIN. THE MAJOR OXIDE MINERALS IN THE PIT ARE CHRYSO-COLLA, COMMONLY ASSOCIATED WITH QUARTZ CRYSTALS, MALACHITE, AND AZURITE. NO TURQUOISE EXISTS IN THE MINE, DUE TO A LACK OF PHOSPHOR AND ALUMINUM.

THE ORE BODY (303,000,000 TONS AT .49% TOTAL Cu AND .03% OXIDE Cu - FEBRUARY, 1973) CONTAINS ABOUT HALF A PER CENT COPPER, 0.03 PER CENT MOLYBDENUM, 30 ppm LEAD, 60 ppm ZINC, ONE OUNCE PER TON OF CONCENTRATE SILVER AND 5 ppm URANIUM. THIS MINE IS NOT CREDITED FOR ANY GOLD RECOVERY.

7.0 PLANNING AND ENGINEERING

THE BAGDAD GEOLOGY DEPARTMENT HAD PROVEN A RESERVE OF 303 MILLION TONS, AND THIS WAS THEN TURNED OVER TO THE ENGINEERS TO SEE IF A FEASIBLE MINING PLAN COULD BE DEVELOPED. AN IN-HOUSE STUDY REVEALED THAT THIS 303 MILLION TONS COULD BE MINED WITH A PROFIT; AND WITH THIS IN HAND, BAGDAD WENT OUT TO LOOK FOR SOME CAPITAL TO EXPAND.

AFTER THE MERGER, IN JUNE OF 1973, FORMAL STUDIES COMMENCED; AND IN MAY OF 1974, THE CAPITAL EXPENDITURE REQUIRED FOR THE EXPANSION WAS AUTHORIZED.

DURING OCTOBER 1974, A JOINT VENTURE COMPOSED OF FLUOR UTAH INC. OF SAN MATEO, CALIFORNIA AND HOLMES & NARVER INC. OF ANAHEIM, CALIFORNIA WAS SELECTED TO PERFORM THE DESIGN, ENGINEERING AND PROCUREMENT OF PERMANENT FACILITIES. A CONTRACT WAS ISSUED TO BROWN & ROOT OF HOUSTON, TEXAS AND CONSTRUCTION OF THE NEW 40,000 TON PER DAY CONCENTRATOR COMMENCED SEPTEMBER 1, 1975. THE MINE SITE FACILITIES AND PRE-PRODUCTION STRIPPING WERE UNDERTAKEN BY BAGDAD PERSONNEL.

8.0 EXPANSION

8.1 TOWNSITE

WITH THE INCREASED TONNAGE, A CORRESPONDING INCREASE IN EMPLOYMENT HAS TAKEN PLACE. BAGDAD AT 6,000 TONS PER DAY EMPLOYED 525 PEOPLE; BUT AT 40,000 TONS PER DAY, THE COMPANY EMPLOYS 750 PEOPLE.

CYPRUS BAGDAD OWNS AND OPERATES THE TOWNSITE. IN OTHER WORDS, IT IS A COMPANY TOWN. RENTS ARE NOMINAL. TOP RENT IS \$35.00 PER MONTH, WITH ELECTRICITY AND WATER FURNISHED. DURING THE PAST SEVERAL YEARS, THE COMPANY HAS INSTITUTED AN UPGRADING PROGRAM TO IMPROVE THE QUALITY OF HOUSING. AS PART OF THE EXPANSION PROJECT, 354 MODERN BLOCK CONDOMINIUMS WERE CONSTRUCTED. A NEW MODERN 259 UNIT MOBILE HOME PARK WAS CONSTRUCTED FOR EMPLOYEES WHO OWN THEIR OWN TRAILERS; ALSO, IT IS UTILIZED BY RETIRED EMPLOYEES.

COMPANY OWNED AND MAINTAINED FACILITIES INCLUDE A CENTRAL SEWAGE TREATMENT PLANT, AN ELECTRIC POWER DISTRIBUTION SYSTEM, AND ALL STREETS, MOST OF WHICH WILL BE PAVED BY THE END OF THE YEAR. THE TOWN IS PIPED FOR BUTANE AND THERE IS A NATURAL GAS LINE TO THE MINE PLANT SITES.

BAGDAD OWNS AND OPERATES A STORE ON A NON-PROFIT BASIS AS AN EMPLOYEE FRINGE BENEFIT.

CYPRUS BAGDAD COPPER COMPANY OWNS AND OPERATES AN 11-BED HOSPITAL, WHICH IS STAFFED BY THREE DOCTORS AND A 24-HOUR NURSING STAFF. IT IS WELL MAINTAINED AND EQUIPPED. THERE IS AN EMERGENCY OPERATING ROOM, DELIVERY ROOM, AN OPERATING ROOM, X-RAY LABORATORY, CHEMICAL LABORATORY, VARIOUS TREATMENT ROOMS, OFFICE, KITCHEN, WARDS, AND PRIVATE ROOMS.

USES HAVE BEEN FOR MAJOR OPERATIONS, EMERGENCY TREATMENT AND CONVALESCENCE.

AMBULANCE SERVICE IS ALSO PROVIDED BY A WELL MAINTAINED AMBULANCE. WHEN NECESSARY, THE COMPANY AIRCRAFT IS AVAILABLE TO TRANSPORT PATIENTS TO PHOENIX FOR SPECIALIZED SERVICES.

THIS COMMUNITY OF BAGDAD HAS TWO MODERN AND ATTRACTIVE SCHOOL PLANTS. GRADES KINDERGARTEN THROUGH EIGHTH ARE HOUSED IN THE DAVID C. LINCOLN ELEMENTARY SCHOOL, COMPLETED IN 1976. GRADES NINE THROUGH TWELVE ARE HOUSED IN TWO ATTRACTIVE RED BRICK BUILDINGS, SCHEDULED FOR RENOVATION DURING 1977. A LARGE GYMNASIUM, A MULTI-PURPOSE BUILDING, AN AUDITORIUM, ATHLETIC FIELDS, AND A COMMUNITY SWIMMING POOL ENHANCE THE EXTRACURRICULAR PROGRAMS.

THE FOLLOWING SERVICES ARE PROVIDED BY OUTSIDE INDIVIDUALS: SERVICE STATION, GARBAGE COLLECTION, BANK, BEAUTY SALON, BARBER SHOP, HOBBY SHOP, LAUNDROMAT, MOTION PICTURE THEATRES (BOTH DRIVE-IN AND INDOOR). THERE ARE ALSO A POST OFFICE, LIBRARY, MOUNTAIN BELL TELEPHONE SERVICES, A JAIL, TWO FULL TIME DEPUTIES. AN AUTO SUPPLY STORE IS OWNED AND MAINTAINED BY THE COMPANY. BAGDAD ALSO BOASTS A WEEKLY NEWSPAPER, THREE RESTAURANTS, TWO BARS AND ELEVEN CHURCHES.

8.2 MINING AND THE PIT

THE MINING METHOD USED IN THE CYPRUS BAGDAD MINE IS THE MULTIPLE BENCH, OPEN PIT SYSTEM.

THE BENCH HEIGHT IS 40 FEET, AND THE MINIMUM MINING WIDTH IS 100 FEET. MINING STARTS BY DRILLING MULTIPLE ROWS OF 9-INCH ROTARY DRILL HOLES, 47 FEET DEEP. THESE ARE ON A 20-FOOT BY 20-FOOT SPACING, BOTH IN GILA AND QUARTZ MONZONITE.

THESE HOLES ARE THEN LOADED WITH AMMONIUM NITRATE FUEL OIL BLASTING AGENT TIED TOGETHER WITH DETONATING CORD. IN WET GROUND, A PUMP TRUCK AND PLASTIC LINERS ARE USED; OR IF THE HOLE CAN'T BE PUMPED OUT, A SLURRY OR TRITEX BOMBS ARE USED. A MINIMUM OF 30 FEET OF BACKBREAK CAN BE EXPECTED WHEN MULTIPLE ROWS ARE SHOT SIMULTANEOUSLY. BAGDAD'S EXPERIENCE HAS BEEN THAT IF DELAYS ARE USED, ONLY 10 TO 15 FEET OF BACKBREAK CAN BE EXPECTED. SOMETIMES AS MUCH AS 60 FEET BACKBREAK WILL APPEAR ON A SIMULTANEOUS SHOT; SO BY NOT USING DELAYS, 20 TO 50 FEET OF "FREE" MUCK ARE OBTAINED WITH THE SAME NUMBER OF HOLES AND SAME AMOUNT OF POWDER. IN SPECIAL CASES, DELAYS ARE PLACED BETWEEN THE ROWS (SEE FIGURE #1) TO REDUCE VIBRATION AND POSSIBLE SUBSEQUENT DAMAGE TO THE PIT SLOPES.

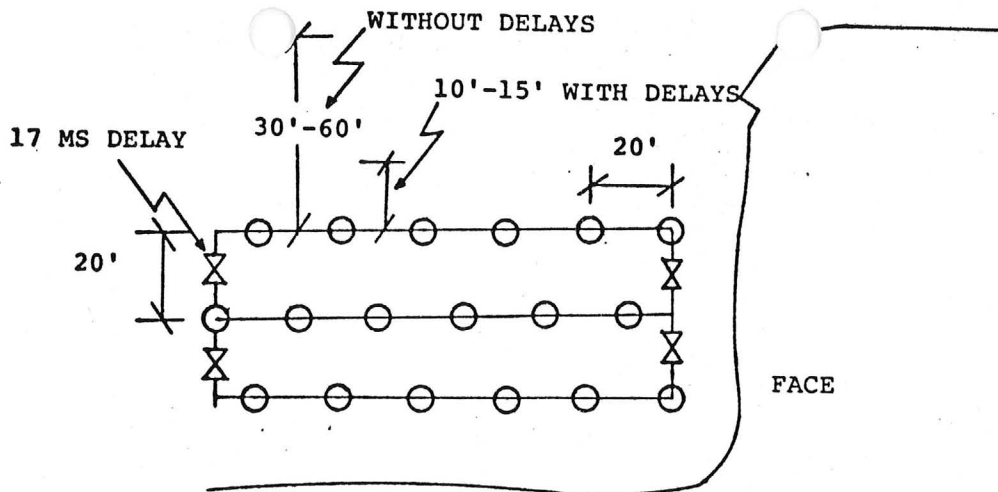


FIGURE #1

SECONDARY BLASTING IS RARE, BUT IF A BOULDER DOES APPEAR, IT IS DRILLED WITH AN AIR TRACK DRILL OR A JACKHAMMER, LOADED WITH STICK POWDER, AND SHOT. THIS OPERATION TAKES PLACE AT THE WORKING FACE.

MUCH CARE IS TAKEN WITH THE BLASTING AS IT IS BAGDAD'S PHILOSOPHY TO USE THE SHOVELS TO LOAD AND NOT TO DIG. HARD TOES OR EXCESSIVELY COARSE MUCK NOT ONLY TEAR UP THE EQUIPMENT, BUT ALSO SLOW THE LOADING CYCLE.

AFTER THE MUCK HAS BEEN BROKEN, IT IS LOADED INTO 170-TON TRUCKS BY A 20-YARD SHOVEL. DOUBLE SET UPS ARE MAINTAINED AS OFTEN AS POSSIBLE. TRUCKS THAT ARE BACKING UNDER THE SHOVEL ARE SPOTTED BY THE SHOVEL OPERATOR WITH THE DIPPER WHEN THE TRUCK IS BACKING BLIND, WHILE THE TRUCKS ON THE OTHER SIDE CAN SPOT THEMSELVES. BAGDAD USES THE CABLE BRIDGE SYSTEM RATHER THAN THE DRIVE-OVER SYSTEM BECAUSE IT FACILITATES BETTER ROAD MAINTENANCE AND A FASTER CYCLE TIME, AND THE TRUCKS DON'T HAVE TO SLOW DOWN FOR THE "BUMP".

THE ROAD MAINTENANCE PROGRAM IS AN INTEGRAL PART OF BAGDAD'S MINING OPERATION. IT NOT ONLY REDUCES TIRE COSTS (BAGDAD'S TIRE LOSS DUE TO ROCK CUTS IS LESS THAN 5%, AND THE PROJECTED RUNOUT TIRE LIFE IS IN EXCESS OF 5,000 HOURS FOR OUR 36.00 x 51 TIRE SIZE), BUT IT ALSO DECREASES THE CYCLE TIME BY ALLOWING FASTER SPEEDS. SMOOTH ROADS ALSO DECREASE MAINTENANCE ON THE HAULAGE FLEET BY REDUCING PROBLEMS INHERENT IN ROUGH ROAD DRIVING, i.e. FRAME, SUSPENSION, AND TIRE OVERLOADING PROBLEMS. THE ROADS ARE MAINTAINED WITH A FLEET OF FOUR SCRAPERS, FOUR CAT 16 BLADES, ONE CAT 12 BLADE, AND ONE CHAMPION 80-T BLADE. THE CHAMPION 80-T IS THE WORLD'S LARGEST MOTOR GRADER WITH 700 BPH AND A WORKING WEIGHT OF 180,000 POUNDS. THIS IS A PROTOTYPE, AND BAGDAD IS RENTING IT.

GRADES ARE MAINTAINED AT THE SHOVELS BY THE USE OF A LASER. THIS ELIMINATES HARD TOES AND WATER PROBLEMS, AS CORRECT GRADES ARE MAINTAINED, EVEN AT NIGHT. THE LASER ALLOWS A SHOVEL OPERATOR TO

HOLD GRADE BECAUSE IT IS ALWAYS ON THE JOB, AND AT NIGHT THE OPERATOR CAN SEE A RED LINE ON THE WORKING FACE. IT ALSO ALLOWS THE ENGINEERING CREW MORE TIME TO DO OTHER JOBS.

HAULING IS DONE WITH TWENTY-TWO 170-TON TRUCKS AND THREE 60-TON TRUCKS. THE 60-TON TRUCKS ARE USED ONLY FOR BACKUP OR WHEN A LEVEL IS TOO SMALL TO ACCOMMODATE A LARGE SHOVEL OR TURCK, i.e. WHEN STARTING A LEVEL OR BUILDING A ROAD.

8.3 MUCK MOVING

THE NAME OF THE GAME IS "MUCK MOVING". BAGDAD FEELS ITS MOST IMPORTANT ASSET IS ITS PERSONNEL, AND BAGDAD IS VERY MUCH PEOPLE ORIENTED.

THE EXPANSION PROGRAM HAS INCREASED THE TOTAL EMPLOYMENT AT BAGDAD FROM ABOUT 500 TO 750 EMPLOYEES, AND THE PIT DEPARTMENT HAS ONLY INCREASED FROM 210 TO 297. THE MINIMUM WORK FORCE FOR THE EXPANDED OPERATION WAS BUILT UP AT A RATE WHICH PERMITTED STRIPPING TO PROGRESS WITHOUT PEAKING AND A CONSEQUENT DECLINE IN MANPOWER OR EQUIPMENT REQUIREMENTS.

THE ORE REQUIREMENTS HAVE JUMPED 700%, BUT OUR EMPLOYMENT HAS ONLY INCREASED 50%. THE INCREASED PRODUCTIVITY PER MAN HAS BEEN ACCOMPLISHED BY INTRODUCING NEW AND LARGER EQUIPMENT. THE FIGURES IN THE FOLLOWING GRAPHS INDICATE A LARGE INCREASE IN PRODUCTIVITY WITH THE INTRODUCTION OF 170-TON TRUCKS, i.e. TONS/DRIVER SHIFT.

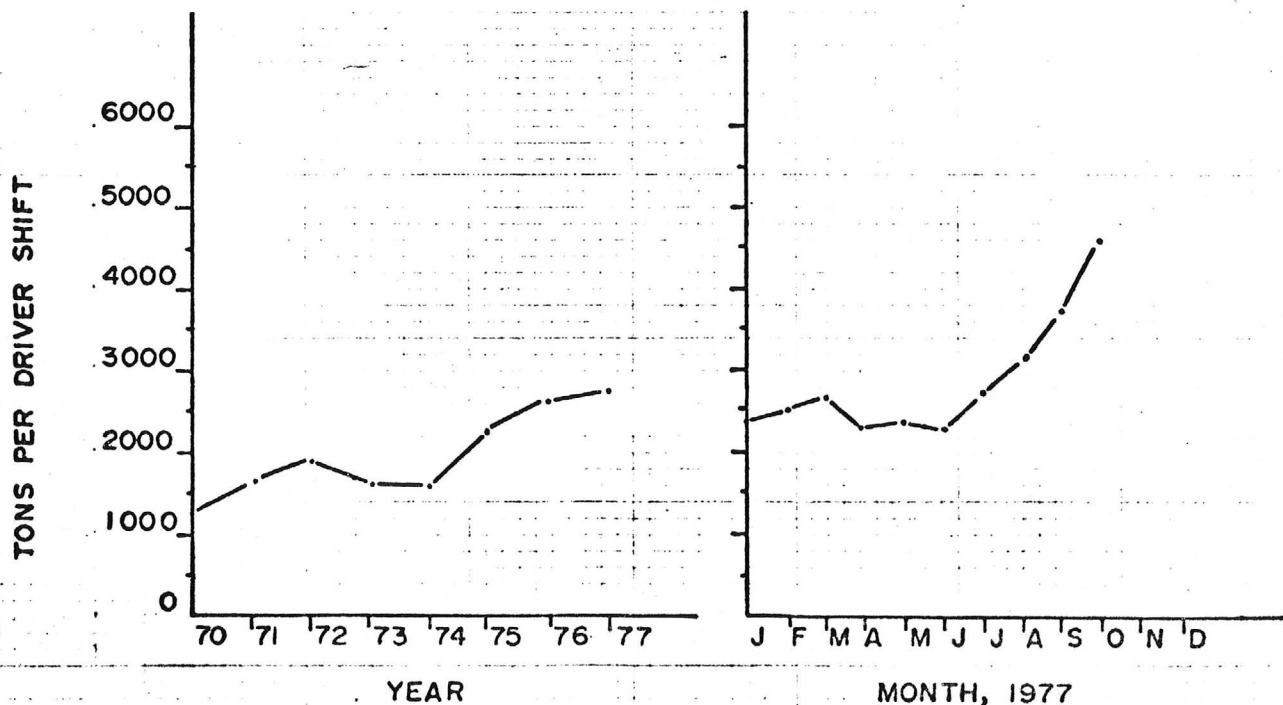


FIGURE #2

BAGDAD PLANS ITS HAUL ROADS 120 FEET WIDE WITH A STRADDLE BERM IN THE CENTER OF THE ROAD. THIS BERM NOT ONLY GIVES A RUNAWAY TRUCK AN OUT, BUT SEPARATES THE TWO LANES OF TRAFFIC IN WET WEATHER. THE MAXIMUM GRADE PLANNED ON THE HAUL ROADS IS 8%.

IN ORDER TO MAXIMIZE EQUIPMENT AVAILABILITY AND MANPOWER UTILIZATION, BAGDAD ONLY OPERATES TWO SHIFTS PER DAY, WITH ONE HOUR BETWEEN SHIFTS. THIS SYSTEM ALLOWS MAINTENANCE OF ANY PIECE OF EQUIPMENT ON THE THIRD SHIFT AND ALLOWS THE BACK UP FLEET TO BE VERY SMALL, AS ROUTINE MAINTENANCE IS DONE ON THE THIRD SHIFT OR BETWEEN SHIFTS. THIS SYSTEM ALSO ELIMINATES THE NEED FOR A SHUTDOWN TO BLAST, AS ALL BLASTING CAN BE DONE BETWEEN, BEFORE, OR AFTER SHIFT. THIS TWO SHIFT PER DAY SYSTEM ENHANCES OUR ROAD MAINTENANCE PROGRAM, AS HAUL ROADS CAN BE BLADED WITHOUT INTERRUPTING TRAFFIC. IT ALSO ELIMINATES THIRD SHIFT SUPERVISION AND THE ACCIDENT PRONE GRAVEYARD SHIFT.

ANOTHER FEATURE BAGDAD HAS ADOPTED IS THE USE OF "PIT STOPS". A PIT STOP IS A PORTABLE SLED WITH FUEL, AIR, HOIST OIL, TREATED WATER, AND LUBRICANTS ON BOARD. THESE ARE NORMALLY PLACED ON THE DUMPS AND AT THE CRUSHER. THESE ARE RELATIVELY INEXPENSIVE TO BUILD (\$40,000) AND SAVE MANY HOURS IN TRANSPORT TIME AND FUEL TIME. THESE PIT STOPS ARE EQUIPPED WITH QUICK CONNECT FITTINGS AND CAN PUMP 300 GALLONS PER MINUTE OF FUEL. THE LOCATION OF THESE STOPS ALSO ALLOWS THE TRUCKS TO CYCLE FASTER AND GIVES THEM MORE TIME TO HAUL, AS SOME TRUCKS ARE LEFT LOADED ON THE ONE HOUR SHIFT CHANGE AND WILL GO TO DUMP UPON SHIFT START AS THE REST OF THE FLEET WILL GO TO A SHOVEL TO BE LOADED. THE PIT STOPS BEING AT THE DUMP POINT, THERE IS NO LOST TRANSPORT TIME.

THE CONFIGURATION OF THE BAGDAD PIT NORMALLY DICTATES THAT TRUCKS HAUL TO ONE DUMP FROM A PARTICULAR SHOVEL. IN RARE CASES, ONE DUMP IS ADEQUATE FOR TWO SHOVELS; BUT THE USUAL CASE IS ONE SHOVEL, ONE DUMP. THIS SITUATION LENDS ITSELF TO THE USE OF A SCHEDULE BOARD, A BOARD THAT IS PUT UP AT THE START OF A SHIFT AND TELLS EACH DRIVER WHICH SHOVEL HE IS TO HAUL FROM THAT SHIFT. THE DRIVERS THEN OPERATE ON AN HONOR SYSTEM AS THEY KEEP THE SHOVEL COVERED.

SPOTTERS ARE USED AT BAGDAD FOR THREE REASONS: ON HIGH DUMPS THE OUTSIDE EDGE OF A DUMP TENDS TO SETTLE, AND THE SPOTTER WILL NOT ALLOW A TRUCK TO BACK INTO ONE OF THESE LOW SPOTS, ESPECIALLY AT NIGHT. THE SECOND REASON IS TO KEEP TRACK OF THE LOADS AND TYPE OF MATERIAL EACH SHOVEL PRODUCES, AS WELL AS THE NUMBER OF LOADS EACH TRUCK HAULS PER SHIFT. THE THIRD REASON IS TO KEEP ROCKS FROM UNDER THE TRUCKS, BOTH BY BACKING THEM INTO CLEAN SPOTS AND REMOVING FALLEN ROCKS FROM THE DUMPING PROCESS.

THE MAINTENANCE PROGRAM ON THE EQUIPMENT IS VERY EXTENSIVE. THE 20 YARD SHOVELS ARE EQUIPPED WITH AN AUTOMATIC LUBE SYSTEM, BUT BAGDAD STILL MAINTAINS AN OILER. THIS OILER WILL CLEAN AND CHECK THE SHOVEL DAILY. HE ALSO RELIEVES THE OPERATOR, THUS ALLOWING THE OPERATOR A BREATHER WHILE HE LEARNS THE CORRECT TECHNIQUES TO OPERATE A SHOVEL. THE TRUCKS ARE ALSO SERVICED REGULARLY - OIL AND LUBRICANTS ARE CHANGED ACCORDING TO TACH HOURS AND THE OIL IS ANALYZED FOR METALS. WE ARE CURRENTLY CHANGING THE CRANKCASE OIL EVERY 200 TACH HOURS ON THE 170 TON TRUCKS.

9.0 SLOPE STABILITY AND MONITORING

THE SLOPE ANGLE IS VERY CRITICAL IN OPEN PIT MINING. CURRENTLY BAGDAD EMPLOYS A SLOPE STABILITY MAN TO ANALYZE THE VARIOUS AREAS OF THE PIT AND TO MAKE RECOMMENDATIONS.

CURRENTLY IN ONE AREA WE ARE EXPERIMENTING WITH A 57° SLOPE BETWEEN HAUL ROADS. THIS AREA IS IN A GILA CONGLOMERATE, IS PRE-SPLIT AND HAS BEEN STANDING FOR TWO YEARS WITH NO INSTABILITY. WHEN WE REACH ROCK WE WILL FLATTEN THE SLOPE TO 45° .

EACH AREA OF THE PIT HAS TO BE LOOKED AT INDIVIDUALLY, AS TO ROCK TYPE, WATER LEVEL, AND MOST IMPORTANTLY FAULTING AND FRACTURING. IT APPEARS NOW THAT IN SOME AREAS OF THE PIT WE WILL BE LIMITED TO A 50° SLOPE AS SOME STRUCTURE IS DAYLIGHTED AT THIS ANGLE.

SLOPE STABILITY IS AN ONGOING JOB AS THERE ARE OVER 35 MONITORING DEVICES WITHIN THE PIT. SLOPE MOVEMENT IS DETECTED BY A INFRARED DISTANCE METER LOCATED 3000-4000 FEET AWAY FROM THE SLOPE. THE DISTANCE METER CAN DETECT MOVEMENTS IN THE ORDER OF .001 FEET AT 10,000 FEET. THE RATE AT WHICH A SLOPE INSTABILITY MOVES DICTATES THE FREQUENCY OF THE MEASUREMENTS. SLOPE STABILITY MONITORING HELPS ESTABLISH SAFE WORKING CONDITIONS BY PROVIDING OPERATING PERSONNEL WITH AN EARLY WARNING OF SLOPE INSTABILITY.

10.0 THE CONCENTRATOR

DESIGN CONCEPTS - PROCESS TECHNIQUES AND GENERAL CONCENTRATOR LAYOUT ARE SIMILAR TO OTHER WELL ESTABLISHED PLANTS IN ARIZONA HANDLING HIGH TONNAGE, LOW-GRADE PORPHYRY ORES. AN EFFORT HAS BEEN MADE TO USE LARGE CAPACITY PROCESSING UNITS WHICH HAVE ALREADY PROVEN THEIR RELIABILITY IN OTHER OPERATIONS. THE USE OF LARGE WELL PROVEN EQUIPMENT WITH ADEQUATE INSTRUMENTATION FOR MONITORING AND CONTROL WILL ALLOW A HIGH TONNAGE OPERATION WITH A MINIMUM OF OPERATING PERSONNEL.

THE CONCENTRATOR IS DESIGNED TO PROCESS 40,000 TONS OF ORE PER DAY, CONTAINING .55% TOTAL COPPER. PRODUCTION IS ESTIMATED TO BE 650 TONS PER DAY OF 28-30% COPPER CONCENTRATE AND 12,500 POUNDS PER DAY OF 55% MOLYBDENUM CONCENTRATE.

THE PRIMARY CRUSHER IS PLANNED TO OPERATE TWO SHIFTS PER DAY, SEVEN DAYS PER WEEK. THE CRUSHER IS A 60 x 89 ALLIS CHALMERS GYRATORY CRUSHER WITH THE OPEN SIDE SET AT 8.5 INCHES. THE CRUSHER IS DRIVEN BY A 500 HP INDUCTION MOTOR. MAXIMUM CRUSHER CAPACITY IS 3595 TPH.

THE CRUSHED ORE DROPS INTO A 450-T SURGE BIN AND IS THEN DRAWN OUT BY A FLUID-POWERED 84" x 20'-LONG APRON FEEDER.

THE ORE IS THEN CONVEYED AND ELEVATED ABOUT 6400 FT. AND 1020 FT. RESPECTIVELY ON A SERIES OF FIVE 54" AND 60" WIDE STEEL CHORD CONVEYOR BELTS, THE FINAL OF WHICH IS A RADIAL STACKER DELIVERING TO A 55,000 T (LIVE) ORE STOCKPILE AT THE CONCENTRATOR. THE MAXIMUM BELT SLOPE IS 14 DEGREES AND THE TOTAL CONNECTED POWER ON THE CONVEYING SYSTEM IS 6500 HP.

THE MILL IS COMPRISED OF THREE PARALLEL AND SEPARATELY OPERABLE LINES. THE NOMINAL DESIGN THROUGHPUT IS 600 TPH PER LINE.

THE 8.5 INCH ORE IS RECLAIMED AND FEEDS DIRECTLY INTO A 32'Ø x 13'-LONG KOPPERS CASCADE MILL ALONG WITH RECLAIM WATER AND MILK OF LIME.

THIS MILL IS DESIGNED TO OPERATE AUTOGENOUSLY, TURNING AT 73% OF CRITICAL SPEED AND DRIVEN BY TWO 4000 HP WOUND ROTOR MOTORS.

THE AUTOGENOUS MILL DISCHARGES INTO A DOUBLE-DECK SCREEN AND THE PLUS HALF-INCH OVERSIZE IS RETURNED TO A SHORthead CRUSHER AND ITS 3/8-INCH PRODUCT RETURNS TO THE COARSE ORE FEED OF THE AUTOGENOUS MILL. THE MATERIAL PASSING THE SCREEN IS CYCLONED AND THE OVERFLOW WITH 50% PASSING 200-MESH CONSTITUTES FEED TO FLOTATION. THE UNDERFLOW IS THE FEED TO THE SECONDARY GRINDING CIRCUIT (A 15.5'Ø x 22'-LONG KOPPERS OVERFLOW BALL MILL OPERATING AT 66.5% OF CRITICAL SPEED.

CYCLONE OVERFLOW IS THEN COMBINED AND GRAVITATES VIA A FEED SAMPLER TO A 4-POINT DISTRIBUTOR AND INTO 4 @ 15-CELL LINES OF 500 CU. FT. FLOTATION CELLS. CELLS ARE COMPARTMENTED IN FIVE 3-CELL UNITS PER LINE.

THE ROUGHER TAILS ARE THEN SAMPLED AND FLOW BY GRAVITY TO THE TAILINGS POND.

THE ROUGHER FROTH IS CYCLONED AND THE UNDERFLOW IS REGROUND IN A 10'Ø x 15' BALL MILL AND THE OVERFLOW IS CLEANER FEED. THIS IS CLEANED TWICE AND SENT TO THE MOLY CIRCUIT. THE CLEANER TAILS ARE SCAVENGED

AND THE FROTH IS REGROUND AND THE TAILS GO TO THE TAILINGS POND.

THE COPPER-MOLY CONCENTRATE IS THICKENED, CONDITIONED AND SENT TO THE MOLY ROUGHER CELLS. THE ROUGHER FROTH IS THEN CYCLONED AND REGROUND IF NECESSARY, THEN IT IS SENT TO THE CLEANERS. THE FINAL CONCENTRATE IS THEN FILTERED AND DRIED.

THE COPPER CONCENTRATE IS FILTERED, DRIED AND LOADED INTO TRUCKS FOR A 25 MILE TRIP TO THE NEAREST RAILROAD SIDING AT HILLSIDE, ARIZONA.

THE CONCENTRATOR IS SERVED BY A 5300-GPM, 12-WELL SYSTEM LOCATED IN THE BIG SANDY VALLEY NORTH OF WIKIEUP.

SINGLE POINT MAINLINE PUMPING THROUGH A 24"Ø x 31 MILE LONG PIPELINE UTILIZES (5) 6 x 4 - 5 STAGE BINGHAM PUMPS DRIVEN BY 1000 HP RELIANCE MOTORS.

11.0 CONCLUSION

THE FOUR PRIMARY REASONS FOR BAGDAD'S SUCCESS IN MEETING ITS GOAL OF "MOVING MUCK" ARE:

1. PERSONAL RELATIONS "OPEN DOOR POLICY".
2. EXCELLENT PREVENTIVE MAINTENANCE PROGRAM.
3. EXCELLENT HAUL ROAD MAINTENANCE.
4. USING SHOVELS TO LOAD, NOT TO DIG.

mine file

BAGDAD "77"

PREPARED FOR THE ARIZONA CONFERENCE A.I.M.E. DECEMBER 1977 MEETING
TUCSON, ARIZONA

BY: R. J. BONNIS
J. E. NELSON

CYPRUS BAGDAD COPPER COMPANY
BAGDAD, ARIZONA

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BAGDAD "77"

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1.0 INTRODUCTION

THIS PROGRAM IS TO INTRODUCE THOSE WHO ARE NOT FAMILIAR WITH BAGDAD TO THE ACTIVITIES CARRIED ON BY THE CYPRUS BAGDAD COPPER COMPANY AT BAGDAD, ARIZONA. THIS TEXT IS A BRIEF DESCRIPTION OF THE OPEN PIT OPERATION OF THE CYPRUS BAGDAD COPPER COMPANY.

2.0 LOCATION

THE CYPRUS BAGDAD COPPER COMPANY'S OPEN PIT COPPER MINING OPERATION IS LOCATED IN THE EUREKA MINING DISTRICT IN THE WEST CENTRAL SECTION OF THE STATE OF ARIZONA, YAVAPAI COUNTY. NEARBY COMMUNITIES ARE PRESCOTT, ARIZONA, TO THE EAST APPROXIMATELY 70 MILES BY ROAD, AND WICKENBURG, ARIZONA, ABOUT THE SAME DISTANCE TO THE SOUTHEAST. IT IS SERVED BY A HARD-SURFACED ROAD FROM BOTH OF THESE COMMUNITIES. A RAILROAD SIDING IS LOCATED 23 MILES TO THE EAST AT THE TOWN OF HILLSIDE, ARIZONA. BAGDAD HAS A POPULATION OF ABOUT 3,500.

3.0 CLIMATOLOGY

BAGDAD IS LOCATED IN THE SEMI-DESERT AREA OF ARIZONA, AT AN AVERAGE ELEVATION OF APPROXIMATELY 3,300 FEET. THE ELEVATION OF THE AIRPORT IS APPROXIMATELY 4,000 FEET AND THE BOTTOM OF THE PIT 2,800 FEET. THE ANNUAL RAINFALL AVERAGE IS 13.83 INCHES. THE AVERAGE AMBIENT TEMPERATURE IS 62 DEGREES, WITH HIGHS OF 105 DEGREES TO LOWS OF 10 DEGREES ABOVE ZERO. THE PREVAILING WINDS ARE FROM THE SOUTHWEST. THE GENERAL FLORA AND FAUNA OF THE AREA ARE TYPICAL OF THE BASIN REGION OF ARIZONA, CONSISTING OF MANY SPECIES OF CACTI, CEDAR, MESQUITE AND OAK BRUSH. A VARIETY OF WILDLIFE ABOUNDS IN THE SURROUNDING HILLS.

4.0 BRIEF HISTORY

THE BAGDAD MINING CLAIMS WERE DISCOVERED IN 1882 AND PATENTED IN 1889 BY MR. JOHN LAWLER. SUCCESSOR OWNERS AND COMPANIES WERE: GIROUX SYNDICATE, COPPER CREEK DEVELOPMENT COMPANY, ARIZONA NEVADA COPPER COMPANY, BAGDAD COPPER COMPANY, ARIZONA BAGDAD COPPER COMPANY, AND FINALLY IN 1927, BAGDAD COPPER CORPORATION.

5.0 MERGER

IN JUNE, 1973, CYPRUS MINES CORPORATION AND BAGDAD COPPER CORPORATION MERGED. IN JANUARY, 1974, IT BECAME THE CYPRUS BAGDAD COPPER COMPANY.

EXPLORATORY DRILLING TO PROVE THE BAGDAD ORE BODY WAS STARTED AS EARLY AS 1919. THE FIRST METALLURGICAL TESTING WAS BY A 50-TON PILOT PLANT IN THE LATE 20's. THIS WAS FOLLOWED BY A 200-TON MILL IN THE EARLY 30's. AS PART OF THE WORLD WAR II WAR EFFORT, A 2,500 TON PER DAY MILL WAS CONSTRUCTED UNDER AN RFC LOAN.

IN 1944, MR. JOHN C. LINCOLN, OF LINCOLN ELECTRIC COMPANY, ACQUIRED CONTROLLING INTEREST OF BAGDAD COPPER CORPORATION. SHORTLY AFTER THIS DATE, IN 1945, UNDER THE DIRECTION OF MR. LINCOLN, THE MINE WAS CONVERTED FROM AN UNDERGROUND BLOCK CAVING TO AN OPEN PIT OPERATION.

UPON BECOMING AN OPEN PIT OPERATION, THE MILL CAPACITY WAS INCREASED TO 4,000 TONS IN 1949, 5,000 TONS IN 1957, AND TO 6,000 TONS IN 1963.

IN MAY 1974, THE DECISION WAS MADE TO EXPAND BAGDAD'S PRODUCTION AGAIN, BUT THIS TIME FROM THE 6,000 TON PER DAY CONCENTRATOR TO A NEW ONE WITH A CAPACITY OF 40,000 TONS PER DAY.

THE OLD CONCENTRATOR WAS SHUT DOWN IN JULY OF 1977, AND THE SHAKEDOWN OF THE NEW CONCENTRATOR BEGAN. IT IS EXPECTED TO REACH ITS 40,000 TON PER DAY DESIGN CAPACITY SOME TIME BEFORE THE END OF 1977.

A LEACH-PRECIPI-TATION SYSTEM, TOGETHER WITH A CONTACT SULPHURIC ACID PLANT, WAS INSTALLED IN 1961. THIS PROCESSING WAS INITIATED TO TAKE ADVANTAGE OF THE COPPER IN THE OXIDE ORE STOCKPILED IN THE ADJACENT CANYONS WHILE STRIPPING THE SULPHIDE ORE BODY. IN 1970, A SOLVENT EXTRACTION- ELECTROWINNING PROCESS WAS BUILT AND COMMISSIONED TO REPLACE THE FORMER IRON CEMENTATION SYSTEM. ALL COPPER RECOVERED FROM THE OXIDE DUMPS IS NOW PRODUCED IN THE FORM OF CATHODE COPPER.

IN 1966, A JOINT VENTURE BETWEEN BAGDAD COPPER CORPORATION AND CHEMETALS COMPANY, CALLED ARIZONA CHEMCOPPER COMPANY, WAS FORMED AND A PLANT WAS CONSTRUCTED TO REFINE PRECIPITATE COPPER PRODUCED BY THE LEACHING SYSTEM INTO FRICTION AND MOULDING GRADE COPPER POWDER. THIS PLANT USED HYDROGEN-REDUCTION IN AN ACID CIRCUIT AS THE PROCESS, AND WAS THE ONLY ONE OF ITS KIND.

THE JOINT VENTURE OPERATED THIS PLANT FOR A PERIOD OF TIME, AND IT WAS FINALLY PURCHASED BY BAGDAD.

THE OPERATION'S PRODUCTION WAS FROM PURCHASED COPPER PRECIPITATES AND, DUE TO THE SCARCITY OF PRECIPS, IT WAS CLOSED.

6.0 PIT GEOLOGY

ALONG A CROSS SECTION TAKEN IN THE PIT, THE FOLLOWING GEOLOGICAL UNITS CAN BE OBSERVED:

THE MESA CAPPINGS ARE COMPOSED OF BLACK COLORED BASALT FLOWS WHICH HAVE ERUPTED FROM VENTS SEEN N-W OF THE PIT (NEXT TO BOULDER CREEK). BELOW THE BASALT, IT IS EASY TO RECOGNIZE A WHITE UNIT OF TUFFACEOUS ASH DEPOSITED IN RIVER CHANNELS AND LAKES.

UNDER THE WHITE TUFF LIES A LAYER OF BEIGE COLORED CONGLOMERATE (10,000 - 100,000 YEARS OLD) DEPOSITED IN OLD RIVER CHANNELS AND COMPOSED OF BASALT BOULDERS AND CEMENTED FRAGMENTS.

ALL THE ROCKS MENTIONED ABOVE MUST BE REMOVED BEFORE THE ROCK CONTAINING THE COPPER CAN BE REACHED. THIS ROCK IS CALLED QUARTZ MONZONITE, WHICH IS VERY SIMILAR IN CHARACTER TO A GRANITE AND IS APPROXIMATELY 72 MILLION YEARS OLD.

COPPER SULFIDE (CuFeS_2) AND MOLYBDENUM SULFIDE (MoS_2) MINERALIZATION WAS INTRODUCED INTO THIS ROCK BY HOT WATERS ORIGINATING IN THE INTERIOR OF THE EARTH.

THE COPPER OXIDES FORMED AT A LATER DATE BY LEACHING AND OXIDATION OF THE CuFeS_2 . THE LEACHING WAS DONE BY GROUND WATER, RIVERS, AND RAIN. THE MAJOR OXIDE MINERALS IN THE PIT ARE CHRYSOCOLLA, COMMONLY ASSOCIATED WITH QUARTZ CRYSTALS, MALACHITE, AND AZURITE. NO TURQUOISE EXISTS IN THE MINE, DUE TO A LACK OF PHOSPHOR AND ALUMINUM.

THE ORE BODY (303,000,000 TONS AT .49% TOTAL Cu AND .03% OXIDE Cu - FEBRUARY, 1973) CONTAINS ABOUT HALF A PER CENT COPPER, 0.03 PER CENT MOLYBDENUM, 30 ppm LEAD, 60 ppm ZINC, ONE OUNCE PER TON OF CONCENTRATE SILVER AND 5 ppm URANIUM. THIS MINE IS NOT CREDITED FOR ANY GOLD RECOVERY.

7.0 PLANNING AND ENGINEERING

THE BAGDAD GEOLOGY DEPARTMENT HAD PROVEN A RESERVE OF 303 MILLION TONS, AND THIS WAS THEN TURNED OVER TO THE ENGINEERS TO SEE IF A FEASIBLE MINING PLAN COULD BE DEVELOPED. AN IN-HOUSE STUDY REVEALED THAT THIS 303 MILLION TONS COULD BE MINED WITH A PROFIT; AND WITH THIS IN HAND, BAGDAD WENT OUT TO LOOK FOR SOME CAPITAL TO EXPAND.

AFTER THE MERGER, IN JUNE OF 1973, FORMAL STUDIES COMMENCED; AND IN MAY OF 1974, THE CAPITAL EXPENDITURE REQUIRED FOR THE EXPANSION WAS AUTHORIZED.

DURING OCTOBER 1974, A JOINT VENTURE COMPOSED OF FLUOR UTAH INC. OF SAN MATEO, CALIFORNIA AND HOLMES & NARVER INC. OF ANAHEIM, CALIFORNIA WAS SELECTED TO PERFORM THE DESIGN, ENGINEERING AND PROCUREMENT OF PERMANENT FACILITIES. A CONTRACT WAS ISSUED TO BROWN & ROOT OF HOUSTON, TEXAS AND CONSTRUCTION OF THE NEW 40,000 TON PER DAY CONCENTRATOR COMMENCED SEPTEMBER 1, 1975. THE MINE SITE FACILITIES AND PRE-PRODUCTION STRIPPING WERE UNDERTAKEN BY BAGDAD PERSONNEL.

8.0 EXPANSION

8.1 TOWNSITE

WITH THE INCREASED TONNAGE, A CORRESPONDING INCREASE IN EMPLOYMENT HAS TAKEN PLACE. BAGDAD AT 6,000 TONS PER DAY EMPLOYED 525 PEOPLE; BUT AT 40,000 TONS PER DAY, THE COMPANY EMPLOYS 750 PEOPLE.

CYPRUS BAGDAD OWNS AND OPERATES THE TOWNSITE. IN OTHER WORDS, IT IS A COMPANY TOWN. RENTS ARE NOMINAL. TOP RENT IS \$35.00 PER MONTH, WITH ELECTRICITY AND WATER FURNISHED. DURING THE PAST SEVERAL YEARS, THE COMPANY HAS INSTITUTED AN UPGRADING PROGRAM TO IMPROVE THE QUALITY OF HOUSING. AS PART OF THE EXPANSION PROJECT, 354 MODERN BLOCK CONDOMINIUMS WERE CONSTRUCTED. A NEW MODERN 259 UNIT MOBILE HOME PARK WAS CONSTRUCTED FOR EMPLOYEES WHO OWN THEIR OWN TRAILERS; ALSO, IT IS UTILIZED BY RETIRED EMPLOYEES.

COMPANY OWNED AND MAINTAINED FACILITIES INCLUDE A CENTRAL SEWAGE TREATMENT PLANT, AN ELECTRIC POWER DISTRIBUTION SYSTEM, AND ALL STREETS, MOST OF WHICH WILL BE PAVED BY THE END OF THE YEAR. THE TOWN IS PIPED FOR BUTANE AND THERE IS A NATURAL GAS LINE TO THE MINE PLANT SITES.

BAGDAD OWNS AND OPERATES A STORE ON A NON-PROFIT BASIS AS AN EMPLOYEE FRINGE BENEFIT.

CYPRUS BAGDAD COPPER COMPANY OWNS AND OPERATES AN 11-BED HOSPITAL, WHICH IS STAFFED BY THREE DOCTORS AND A 24-HOUR NURSING STAFF. IT IS WELL MAINTAINED AND EQUIPPED. THERE IS AN EMERGENCY OPERATING ROOM, DELIVERY ROOM, AN OPERATING ROOM, X-RAY LABORATORY, CHEMICAL LABORATORY, VARIOUS TREATMENT ROOMS, OFFICE, KITCHEN, WARDS, AND PRIVATE ROOMS.

USES HAVE BEEN FOR MAJOR OPERATIONS, EMERGENCY TREATMENT AND CONVALESCENCE.

AMBULANCE SERVICE IS ALSO PROVIDED BY A WELL MAINTAINED AMBULANCE. WHEN NECESSARY, THE COMPANY AIRCRAFT IS AVAILABLE TO TRANSPORT PATIENTS TO PHOENIX FOR SPECIALIZED SERVICES.

THIS COMMUNITY OF BAGDAD HAS TWO MODERN AND ATTRACTIVE SCHOOL PLANTS. GRADES KINDERGARTEN THROUGH EIGHTH ARE HOUSED IN THE DAVID C. LINCOLN ELEMENTARY SCHOOL, COMPLETED IN 1976. GRADES NINE THROUGH TWELVE ARE HOUSED IN TWO ATTRACTIVE RED BRICK BUILDINGS, SCHEDULED FOR RENOVATION DURING 1977. A LARGE GYMNASIUM, A MULTI-PURPOSE BUILDING, AN AUDITORIUM, ATHLETIC FIELDS, AND A COMMUNITY SWIMMING POOL ENHANCE THE EXTRACURRICULAR PROGRAMS.

THE FOLLOWING SERVICES ARE PROVIDED BY OUTSIDE INDIVIDUALS: SERVICE STATION, GARBAGE COLLECTION, BANK, BEAUTY SALON, BARBER SHOP, HOBBY SHOP, LAUNDROMAT, MOTION PICTURE THEATRES (BOTH DRIVE-IN AND INDOOR). THERE ARE ALSO A POST OFFICE, LIBRARY, MOUNTAIN BELL TELEPHONE SERVICES, A JAIL, TWO FULL TIME DEPUTIES. AN AUTO SUPPLY STORE IS OWNED AND MAINTAINED BY THE COMPANY. BAGDAD ALSO BOASTS A WEEKLY NEWSPAPER, THREE RESTAURANTS, TWO BARS AND ELEVEN CHURCHES.

8.2 MINING AND THE PIT

THE MINING METHOD USED IN THE CYPRUS BAGDAD MINE IS THE MULTIPLE BENCH, OPEN PIT SYSTEM.

THE BENCH HEIGHT IS 40 FEET, AND THE MINIMUM MINING WIDTH IS 100 FEET. MINING STARTS BY DRILLING MULTIPLE ROWS OF 9-INCH ROTARY DRILL HOLES, 47 FEET DEEP. THESE ARE ON A 20-FOOT BY 20-FOOT SPACING, BOTH IN GILA AND QUARTZ MONZONITE.

THESE HOLES ARE THEN LOADED WITH AMMONIUM NITRATE FUEL OIL BLASTING AGENT TIED TOGETHER WITH DETONATING CORD. IN WET GROUND, A PUMP TRUCK AND PLASTIC LINERS ARE USED; OR IF THE HOLE CAN'T BE PUMPED OUT, A SLURRY OR TRITEX BOMBS ARE USED. A MINIMUM OF 30 FEET OF BACKBREAK CAN BE EXPECTED WHEN MULTIPLE ROWS ARE SHOT SIMULTANEOUSLY. BAGDAD'S EXPERIENCE HAS BEEN THAT IF DELAYS ARE USED, ONLY 10 TO 15 FEET OF BACKBREAK CAN BE EXPECTED. SOMETIMES AS MUCH AS 60 FEET BACKBREAK WILL APPEAR ON A SIMULTANEOUS SHOT; SO BY NOT USING DELAYS, 20 TO 50 FEET OF "FREE" MUCK ARE OBTAINED WITH THE SAME NUMBER OF HOLES AND SAME AMOUNT OF POWDER. IN SPECIAL CASES, DELAYS ARE PLACED BETWEEN THE ROWS (SEE FIGURE #1) TO REDUCE VIBRATION AND POSSIBLE SUBSEQUENT DAMAGE TO THE PIT SLOPES.

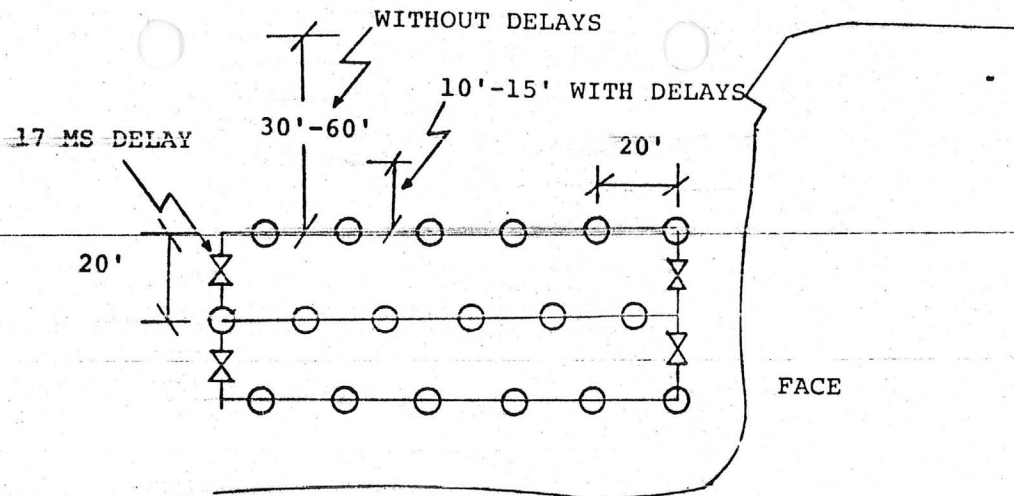


FIGURE #1

SECONDARY BLASTING IS RARE, BUT IF A BOULDER DOES APPEAR, IT IS DRILLED WITH AN AIR TRACK DRILL OR A JACKHAMMER, LOADED WITH STICK POWDER, AND SHOT. THIS OPERATION TAKES PLACE AT THE WORKING FACE.

MUCH CARE IS TAKEN WITH THE BLASTING AS IT IS BAGDAD'S PHILOSOPHY TO USE THE SHOVELS TO LOAD AND NOT TO DIG. HARD TOES OR EXCESSIVELY COARSE MUCK NOT ONLY TEAR UP THE EQUIPMENT, BUT ALSO SLOW THE LOADING CYCLE.

AFTER THE MUCK HAS BEEN BROKEN, IT IS LOADED INTO 170-TON TRUCKS BY A 20-YARD SHOVEL. DOUBLE SET UPS ARE MAINTAINED AS OFTEN AS POSSIBLE. TRUCKS THAT ARE BACKING UNDER THE SHOVEL ARE SPOTTED BY THE SHOVEL OPERATOR WITH THE DIPPER WHEN THE TRUCK IS BACKING BLIND, WHILE THE TRUCKS ON THE OTHER SIDE CAN SPOT THEMSELVES. BAGDAD USES THE CABLE BRIDGE SYSTEM RATHER THAN THE DRIVE-OVER SYSTEM BECAUSE IT FACILITATES BETTER ROAD MAINTENANCE AND A FASTER CYCLE TIME, AND THE TRUCKS DON'T HAVE TO SLOW DOWN FOR THE "BUMP".

THE ROAD MAINTENANCE PROGRAM IS AN INTEGRAL PART OF BAGDAD'S MINING OPERATION. IT NOT ONLY REDUCES TIRE COSTS (BAGDAD'S TIRE LOSS DUE TO ROCK CUTS IS LESS THAN 5%, AND THE PROJECTED RUNOUT TIRE LIFE IS IN EXCESS OF 5,000 HOURS FOR OUR 36.00 x 51 TIRE SIZE), BUT IT ALSO DECREASES THE CYCLE TIME BY ALLOWING FASTER SPEEDS. SMOOTH ROADS ALSO DECREASE MAINTENANCE ON THE HAULAGE FLEET BY REDUCING PROBLEMS INHERENT IN ROUGH ROAD DRIVING, i.e. FRAME, SUSPENSION, AND TIRE OVERLOADING PROBLEMS. THE ROADS ARE MAINTAINED WITH A FLEET OF FOUR SCRAPERS, FOUR CAT 16 BLADES, ONE CAT 12 BLADE, AND ONE CHAMPION 80-T BLADE. THE CHAMPION 80-T IS THE WORLD'S LARGEST MOTOR GRADER WITH 700 BPH AND A WORKING WEIGHT OF 180,000 POUNDS. THIS IS A PROTOTYPE, AND BAGDAD IS RENTING IT.

GRADES ARE MAINTAINED AT THE SHOVELS BY THE USE OF A LASER. THIS ELIMINATES HARD TOES AND WATER PROBLEMS, AS CORRECT GRADES ARE MAINTAINED, EVEN AT NIGHT. THE LASER ALLOWS A SHOVEL OPERATOR TO

HOLD GRA BECAUSE IT IS ALWAYS ON THE J AND AT NIGHT THE OPERATOR CAN SEE A RED LINE ON THE WORKING FACE. IT ALSO ALLOWS THE ENGINEERING CREW MORE TIME TO DO OTHER JOBS.

HAULING IS DONE WITH TWENTY-TWO 170-TON TRUCKS AND THREE 60-TON TRUCKS. THE 60-TON TRUCKS ARE USED ONLY FOR BACKUP OR WHEN A LEVEL IS TOO SMALL TO ACCOMMODATE A LARGE SHOVEL OR TURCK, i.e. WHEN STARTING A LEVEL OR BUILDING A ROAD.

8.3 MUCK MOVING

THE NAME OF THE GAME IS "MUCK MOVING". BAGDAD FEELS ITS MOST IMPORTANT ASSET IS ITS PERSONNEL, AND BAGDAD IS VERY MUCH PEOPLE ORIENTED.

THE EXPANSION PROGRAM HAS INCREASED THE TOTAL EMPLOYMENT AT BAGDAD FROM ABOUT 500 TO 750 EMPLOYEES, AND THE PIT DEPARTMENT HAS ONLY INCREASED FROM 210 TO 297. THE MINIMUM WORK FORCE FOR THE EXPANDED OPERATION WAS BUILT UP AT A RATE WHICH PERMITTED STRIPPING TO PROGRESS WITHOUT PEAKING AND A CONSEQUENT DECLINE IN MANPOWER OR EQUIPMENT REQUIREMENTS.

THE ORE REQUIREMENTS HAVE JUMPED 700%, BUT OUR EMPLOYMENT HAS ONLY INCREASED 50%. THE INCREASED PRODUCTIVITY PER MAN HAS BEEN ACCOMPLISHED BY INTRODUCING NEW AND LARGER EQUIPMENT. THE FIGURES IN THE FOLLOWING GRAPHS INDICATE A LARGE INCREASE IN PRODUCTIVITY WITH THE INTRODUCTION OF 170-TON TRUCKS, i.e. TONS/DRIVER SHIFT.

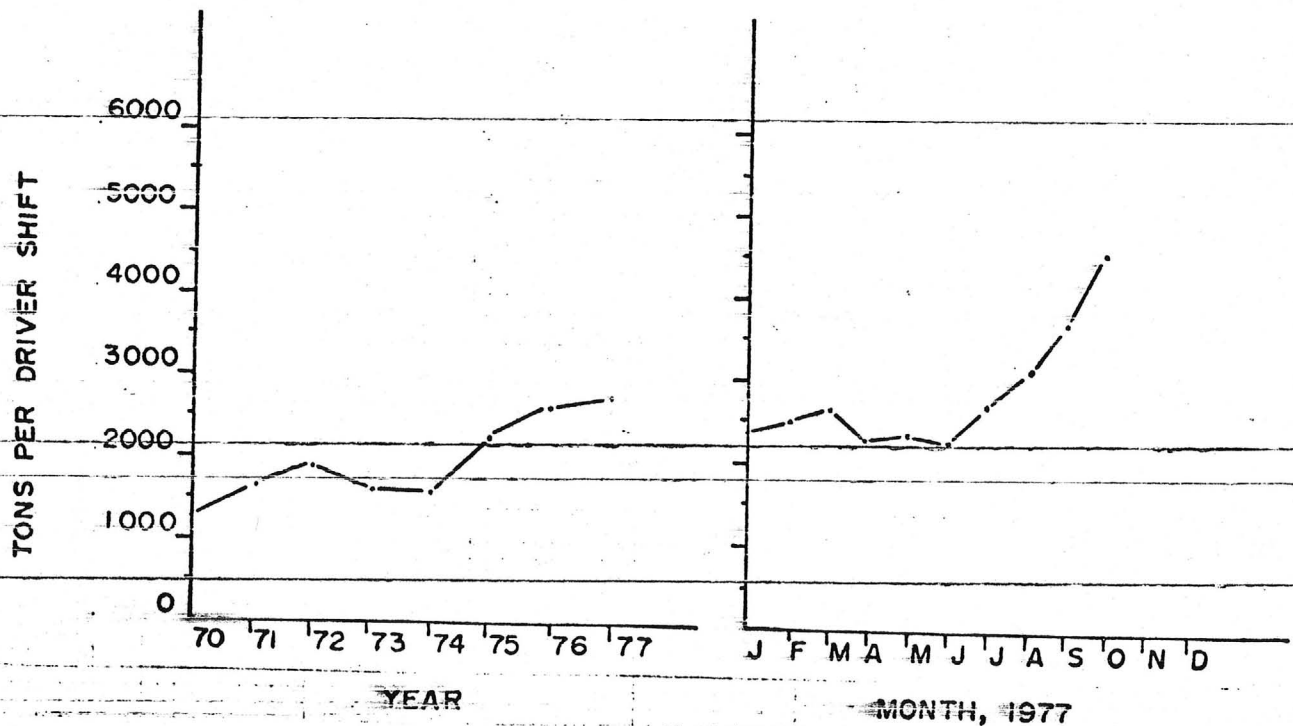


FIGURE #2

BAGDAD PLANS ITS HAUL ROADS 120 FEET WIDE WITH A STRADDLE BERM IN THE CENTER OF THE ROAD. THIS BERM NOT ONLY GIVES A RUNAWAY TRUCK AN OUT, BUT SEPARATES THE TWO LANES OF TRAFFIC IN WET WEATHER. THE MAXIMUM GRADE PLANNED ON THE HAUL ROADS IS 8%.

IN ORDER TO MAXIMIZE EQUIPMENT AVAILABILITY AND MANPOWER UTILIZATION, BAGDAD ONLY OPERATES TWO SHIFTS PER DAY, WITH ONE HOUR BETWEEN SHIFTS. THIS SYSTEM ALLOWS MAINTENANCE OF ANY PIECE OF EQUIPMENT ON THE THIRD SHIFT AND ALLOWS THE BACK UP FLEET TO BE VERY SMALL, AS ROUTINE MAINTENANCE IS DONE ON THE THIRD SHIFT OR BETWEEN SHIFTS. THIS SYSTEM ALSO ELIMINATES THE NEED FOR A SHUTDOWN TO BLAST, AS ALL BLASTING CAN BE DONE BETWEEN, BEFORE, OR AFTER SHIFT. THIS TWO SHIFT PER DAY SYSTEM ENHANCES OUR ROAD MAINTENANCE PROGRAM, AS HAUL ROADS CAN BE BLADED WITHOUT INTERRUPTING TRAFFIC. IT ALSO ELIMINATES THIRD SHIFT SUPERVISION AND THE ACCIDENT PRONE GRAVEYARD SHIFT.

ANOTHER FEATURE BAGDAD HAS ADOPTED IS THE USE OF "PIT STOPS". A PIT STOP IS A PORTABLE SLED WITH FUEL, AIR, HOIST OIL, TREATED WATER, AND LUBRICANTS ON BOARD. THESE ARE NORMALLY PLACED ON THE DUMPS AND AT THE CRUSHER. THESE ARE RELATIVELY INEXPENSIVE TO BUILD (\$40,000) AND SAVE MANY HOURS IN TRANSPORT TIME AND FUEL TIME. THESE PIT STOPS ARE EQUIPPED WITH QUICK CONNECT FITTINGS AND CAN PUMP 300 GALLONS PER MINUTE OF FUEL. THE LOCATION OF THESE STOPS ALSO ALLOWS THE TRUCKS TO CYCLE FASTER AND GIVES THEM MORE TIME TO HAUL, AS SOME TRUCKS ARE LEFT LOADED ON THE ONE HOUR SHIFT CHANGE AND WILL GO TO DUMP UPON SHIFT START AS THE REST OF THE FLEET WILL GO TO A SHOVEL TO BE LOADED. THE PIT STOPS BEING AT THE DUMP POINT, THERE IS NO LOST TRANSPORT TIME.

THE CONFIGURATION OF THE BAGDAD PIT NORMALLY DICTATES THAT TRUCKS HAUL TO ONE DUMP FROM A PARTICULAR SHOVEL. IN RARE CASES, ONE DUMP IS ADEQUATE FOR TWO SHOVELS; BUT THE USUAL CASE IS ONE SHOVEL, ONE DUMP. THIS SITUATION LENDS ITSELF TO THE USE OF A SCHEDULE BOARD, A BOARD THAT IS PUT UP AT THE START OF A SHIFT AND TELLS EACH DRIVER WHICH SHOVEL HE IS TO HAUL FROM THAT SHIFT. THE DRIVERS THEN OPERATE ON AN HONOR SYSTEM AS THEY KEEP THE SHOVEL COVERED.

SPOTTERS ARE USED AT BAGDAD FOR THREE REASONS: ON HIGH DUMPS THE OUTSIDE EDGE OF A DUMP TENDS TO SETTLE, AND THE SPOTTER WILL NOT ALLOW A TRUCK TO BACK INTO ONE OF THESE LOW SPOTS, ESPECIALLY AT NIGHT. THE SECOND REASON IS TO KEEP TRACK OF THE LOADS AND TYPE OF MATERIAL EACH SHOVEL PRODUCES, AS WELL AS THE NUMBER OF LOADS EACH TRUCK HAULS PER SHIFT. THE THIRD REASON IS TO KEEP ROCKS FROM UNDER THE TRUCKS, BOTH BY BACKING THEM INTO CLEAN SPOTS AND REMOVING FALLEN ROCKS FROM THE DUMPING PROCESS.

THE MAINTENANCE PROGRAM ON THE EQUIPMENT IS VERY EXTENSIVE. THE 20 YARD SHOVELS ARE EQUIPPED WITH AN AUTOMATIC LUBE SYSTEM, BUT BAGDAD STILL MAINTAINS AN OILER. THIS OILER WILL CLEAN AND CHECK THE SHOVEL DAILY. HE ALSO RELIEVES THE OPERATOR, THUS ALLOWING THE OPERATOR A BREATHING WHILE HE LEARNS THE CORRECT TECHNIQUES TO OPERATE A SHOVEL. THE TRUCKS ARE ALSO SERVICED REGULARLY - OIL AND LUBRICANTS ARE CHANGED ACCORDING TO TACH HOURS AND THE OIL IS ANALYZED FOR METALS. WE ARE CURRENTLY CHANGING THE CRANKCASE OIL EVERY 200 TACH HOURS ON THE 170 TON TRUCKS.

9.0 SLOPE STABILITY AND MONITORING

THE SLOPE ANGLE IS VERY CRITICAL IN OPEN PIT MINING. CURRENTLY BAGDAD EMPLOYS A SLOPE STABILITY MAN TO ANALYZE THE VARIOUS AREAS OF THE PIT AND TO MAKE RECOMMENDATIONS.

CURRENTLY IN ONE AREA WE ARE EXPERIMENTING WITH A 57° SLOPE BETWEEN HAUL ROADS. THIS AREA IS IN A GILA CONGLOMERATE, IS PRE-SPLIT AND HAS BEEN STANDING FOR TWO YEARS WITH NO INSTABILITY. WHEN WE REACH ROCK WE WILL FLATTEN THE SLOPE TO 45°.

EACH AREA OF THE PIT HAS TO BE LOOKED AT INDIVIDUALLY, AS TO ROCK TYPE, WATER LEVEL, AND MOST IMPORTANTLY FAULTING AND FRACTURING. IT APPEARS NOW THAT IN SOME AREAS OF THE PIT WE WILL BE LIMITED TO A 50° SLOPE AS SOME STRUCTURE IS DAYLIGHTED AT THIS ANGLE.

SLOPE STABILITY IS AN ONGOING JOB AS THERE ARE OVER 35 MONITORING DEVICES WITHIN THE PIT. SLOPE MOVEMENT IS DETECTED BY A INFRARED DISTANCE METER LOCATED 3000-4000 FEET AWAY FROM THE SLOPE. THE DISTANCE METER CAN DETECT MOVEMENTS IN THE ORDER OF .001 FEET AT 10,000 FEET. THE RATE AT WHICH A SLOPE INSTABILITY MOVES DICTATES THE FREQUENCY OF THE MEASUREMENTS. SLOPE STABILITY MONITORING HELPS ESTABLISH SAFE WORKING CONDITIONS BY PROVIDING OPERATING PERSONNEL WITH AN EARLY WARNING OF SLOPE INSTABILITY.

10.0 THE CONCENTRATOR

DESIGN CONCEPTS - PROCESS TECHNIQUES AND GENERAL CONCENTRATOR LAYOUT ARE SIMILAR TO OTHER WELL ESTABLISHED PLANTS IN ARIZONA HANDLING HIGH TONNAGE, LOW-GRADE PORPHYRY ORES. AN EFFORT HAS BEEN MADE TO USE LARGE CAPACITY PROCESSING UNITS WHICH HAVE ALREADY PROVEN THEIR RELIABILITY IN OTHER OPERATIONS. THE USE OF LARGE WELL PROVEN EQUIPMENT WITH ADEQUATE INSTRUMENTATION FOR MONITORING AND CONTROL WILL ALLOW A HIGH TONNAGE OPERATION WITH A MINIMUM OF OPERATING PERSONNEL.

THE CONCENTRATOR IS DESIGNED TO PROCESS 40,000 TONS OF ORE PER DAY, CONTAINING .55% TOTAL COPPER. PRODUCTION IS ESTIMATED TO BE 650 TONS PER DAY OF 28-30% COPPER CONCENTRATE AND 12,500 POUNDS PER DAY OF 55% MOLYBDENUM CONCENTRATE.

THE PRIMARY CRUSHER IS PLANNED TO OPERATE TWO SHIFTS PER DAY, SEVEN DAYS PER WEEK. THE CRUSHER IS A 60 x 89 ALLIS CHALMERS' GYRATORY CRUSHER WITH THE OPEN SIDE SET AT 8.5 INCHES. THE CRUSHER IS DRIVEN BY A 500 HP INDUCTION MOTOR. MAXIMUM CRUSHER CAPACITY IS 3595 TPH.

THE CRUSHED ORE DROPS INTO A 450-T SURGE BIN AND IS THEN DRAWN OUT BY A FLUID-POWERED 84" x 20'-LONG APRON FEEDER.

THE ORE IS THEN CONVEYED AND ELEVATED ABOUT 6400 FT. AND 1020 FT. RESPECTIVELY ON A SERIES OF FIVE 54" AND 60" WIDE STEEL CHORD CONVEYOR BELTS, THE FINAL OF WHICH IS A RADIAL STACKER DELIVERING TO A 55,000 T (LIVE) ORE STOCKPILE AT THE CONCENTRATOR. THE MAXIMUM BELT SLOPE IS 14 DEGREES AND THE TOTAL CONNECTED POWER ON THE CONVEYING SYSTEM IS 6500 HP.

THE MILL IS COMPRISED OF THREE PARALLEL AND SEPARATELY OPERABLE LINES. THE NOMINAL DESIGN THROUGHPUT IS 600 TPH PER LINE.

THE 8.5 INCH ORE IS RECLAIMED AND FEEDS DIRECTLY INTO A 32'Ø x 13'-LONG KOPPERS CASCADE MILL ALONG WITH RECLAIM WATER AND MILK OF LIME.

THIS MILL IS DESIGNED TO OPERATE AUTOGENOUSLY, TURNING AT 73% OF CRITICAL SPEED AND DRIVEN BY TWO 4000 HP WOUND ROTOR MOTORS.

THE AUTOGENOUS MILL DISCHARGES INTO A DOUBLE-DECK SCREEN AND THE PLUS HALF-INCH OVERSIZE IS RETURNED TO A SHORthead CRUSHER AND ITS 3/8-INCH PRODUCT RETURNS TO THE COARSE ORE FEED OF THE AUTOGENOUS MILL. THE MATERIAL PASSING THE SCREEN IS CYCLONED AND THE OVERFLOW WITH 50% PASSING 200-MESH CONSTITUTES FEED TO FLOTATION. THE UNDERFLOW IS THE FEED TO THE SECONDARY GRINDING CIRCUIT (A 15.5'Ø x 22'-LONG KOPPERS OVERFLOW BALL MILL OPERATING AT 66.5% OF CRITICAL SPEED.

CYCLONE OVERFLOW IS THEN COMBINED AND GRAVITATES VIA A FEED SAMPLER TO A 4-POINT DISTRIBUTOR AND INTO 4 @ 15-CELL LINES OF 500 CU. FT. FLOTATION CELLS. CELLS ARE COMPARTMENTED IN FIVE 3-CELL UNITS PER LINE.

THE ROUGHER TAILS ARE THEN SAMPLED AND FLOW BY GRAVITY TO THE TAILINGS POND.

THE ROUGHER FROTH IS CYCLONED AND THE UNDERFLOW IS REGROUND IN A 10'Ø x 15' BALL MILL AND THE OVERFLOW IS CLEANER FEED. THIS IS CLEANED TWICE AND SENT TO THE MOLY CIRCUIT. THE CLEANER TAILS ARE SCAVENGED

AND THE FROTH IS REGROUND AND THE TAILS GO TO THE TAILINGS POND.

THE COPPER-MOLY CONCENTRATE IS THICKENED, CONDITIONED AND SENT TO THE MOLY ROUGHER CELLS. THE ROUGHER FROTH IS THEN CYCLONED AND REGROUND IF NECESSARY, THEN IT IS SENT TO THE CLEANERS. THE FINAL CONCENTRATE IS THEN FILTERED AND DRIED.

THE COPPER CONCENTRATE IS FILTERED, DRIED AND LOADED INTO TRUCKS FOR A 25 MILE TRIP TO THE NEAREST RAILROAD SIDING AT HILLSIDE, ARIZONA.

THE CONCENTRATOR IS SERVED BY A 5300-GPM, 12-WELL SYSTEM LOCATED IN THE BIG SANDY VALLEY NORTH OF WIKIEUP.

SINGLE POINT MAINLINE PUMPING THROUGH A 24"Ø x 31 MILE LONG PIPELINE UTILIZES (5) 6 x 4 - 5 STAGE BINGHAM PUMPS DRIVEN BY 1000 HP RELIANCE MOTORS.

11.0 CONCLUSION

THE FOUR PRIMARY REASONS FOR BAGDAD'S SUCCESS IN MEETING ITS GOAL OF "MOVING MUCK" ARE:

1. PERSONAL RELATIONS "OPEN DOOR POLICY".
2. EXCELLENT PREVENTIVE MAINTENANCE PROGRAM.
3. EXCELLENT HAUL ROAD MAINTENANCE.
4. USING SHOVELS TO LOAD, NOT TO DIG.