

Editor's Note: appeal filed, sub nom. National Credit Union Administration Board, et al. v. Babbitt, Civ.No. S-00-1676 GEB JFM (E.D. Calif. Aug. 3, 2000), transferred to Fresno, new Civil No. 00-6772, settled, dismissed with prejudice, (March 15, 2002)

UNITED STATES
v.
J. GARY FEEZOR ET AL.

IBLA 88-178

Decided August 4, 1994

Appeal from a decision by Administrative Law Judge John R. Rampton, Jr., dismissing, in part, a contest complaint against the Copper Lode Nos. 1, 2, 3, 5, 7, 13, and 14 mining claims. IBLA 79-407 (On Remand).

Appeal reviewed de novo; decision below reversed.

1. Administrativ Authority: Generally--Administrative Procedure:
Administrative Law Judges--Administrative Procedure: Hearings--
Rules of Practice: Hearings

Except to the extent expressly delineated in its decision or order, when the Board of Land Appeals remands a case to the Hearings Division for the taking of additional evidence, the Administrative Law Judge to whom the matter is assigned has full authority to admit such evidence as is deemed relevant and probative and to enter such rulings as judged appropriate.

2. Mining Claims: Determination of Validity--Mining Claims:
Discovery: Generally

A discovery within the meaning of the mining laws exists where the evidence is such that a person of ordinary prudence would be justified in the further expenditure of labor and means, with a reasonable prospect of a success in developing a paying mine. Determining that a prudent individual would be justified in attempting to develop a paying mine necessarily involves consideration of whether or not a mineral deposit has been exposed within the limits of a claim and, if so, whether the evidence is such that an individual would be justified in concluding that the mineral exposed exists in sufficient quantity and quality so as to make expectations of its profitable extraction reasonable under the facts of record.

3. Mining Claims: Discovery: Geologic Inference

Assuming that an exposure of a mineral deposit has been shown to exist, recourse to geologic inference to show

the continuation of values beyond the area of the physical exposure is dependent upon a determination that the demonstrated values have been relatively consistent and are likely to continue given the geologic nature of the deposition.

4. Administrative Procedure: Burden of Proof--Mining Claims:
Determination of Validity--Rules of Practice: Hearings

Once the Government has presented a prima facie case as to the invalidity of a challenged mining claim, the burden of overcoming this showing, by a preponderance of the evidence, devolves upon the claimant as the proponent of the claim's validity. A claimant may be deemed to have preponderated even in the face of directly conflicting evidence where the fact-finder determines that evidence presented by the claimant is more credible than that submitted by the Government.

5. Administrative Procedure: Administrative Review--Rules of Practice:
Appeals: Generally

While the Board of Land Appeals generally accords substantial deference to the findings of an Administrative Law Judge with respect to conflicting evidence, such deference is not absolute, since the Board, in the exercise of its delegated plenary authority, may undertake a de novo review of the entire record and make findings of fact thereon as fully and finally as might the Secretary of the Interior.

6. Mining Claims: Discovery: Geologic Inference

Recourse to geologic inference to project values beyond the area of surface exposures may not be permitted where the evidence fails to establish that the surface sampling has derived results which are "basically equivalent" with results derived from drilling and where geologic mapping does not independently establish the basic equivalency of surface and subsurface mineralization.

7. Mining Claims: Determination of Validity--Mining Claims:
Discovery: Generally

A discovery exists only where the evidence establishes that mineralization is present in sufficient quantity and quality so as to render its profitable extraction reasonably likely. Where the evidence fails to establish sufficient quantity of adequate quality mineralization in an exposure, such an exposure does not

constitute a valuable mineral deposit within the meaning of the mining laws.

8. Mining Claims: Determination of Validity--Mining Claims:
Discovery: Generally

There is a clear distinction between "exploration" and "development" as these terms relate to discovery under the mining laws. Prior to the "discovery" of a valuable mineral deposit, mining activities such as attempting to locate a deposit and the subsequent mapping and drilling of the deposit to determine the extent and grade of the mineralization disclosed constitute acts of exploration. Evidence which is sufficient to justify further exploration expenditures does not necessarily constitute evidence which would justify embarking upon the development of a claim.

9. Mining Claims: Determination of Validity--Mining Claims:
Discovery: Generally

Where no evidence is presented to establish that a mineral deposit present on one claim extends into an adjacent claim, the latter claim cannot be deemed valid even if the evidence establishes that the mineral deposit located on the first claim is a valuable mineral deposit under the mining laws.

10. Mining Claims: Determination of Validity--Mining Claims:
Discovery: Generally

The standard for determining whether a discovery of a valuable mineral deposit has been made is not whether expenditures for further exploration or for further analysis might be justified. Rather, a finding of discovery requires that the evidence be sufficient to justify, as a present matter, the expenditures necessary to develop a paying mine with a reasonable prospect of success.

11. Mining Claims: Determination of Validity--Mining Claims:
Discovery: Generally

Where the Board, in the course of a de novo review of the record of a mining contest, determines that various cost factors in an economic analysis of a proposed development plan have either been ignored or significantly understated with the result that the claimant's assertion that there is a reasonable prospect of success in developing the deposit is no longer sustainable on the record developed, the claims embracing such deposit are properly declared null and void.

APPEARANCES: Leo N. Smith, Esq., Tucson, Arizona, for appellees; John W. Burke, Esq., Office of the Field Solicitor, San Francisco, California, for the National Park Service.

OPINION BY ADMINISTRATIVE JUDGE BURSKI

The National Park Service (NPS) has appealed from that part of the decision of Administrative Law Judge John R. Rampton, Jr., dated November 30, 1987, which dismissed a contest complaint filed on its behalf by the Bureau of Land Management against the Copper Lode Nos. 1, 2, 3, 5, 7, 13, and 14 mining claims. For reasons set forth below, we reverse.

Judge Rampton's decision in this matter was a continuation of extended proceedings involving the subject claims. The seven claims at issue herein were originally part of a block of 32 claims which had been located between 1965 and 1969 in protracted secs. 32 and 33, T. 28 N., R. 3 E., and protracted sec. 5, T. 27 N., R. 3 E., San Bernardino Meridian, Inyo County, California, within the Death Valley National Monument. At the time that these claims were located, lands within the Death Valley National Monument were open to mineral entry. However, pursuant to the provisions of the Mining in the Parks Act, 90 Stat. 1342, 16 U.S.C. § 1901 (1988), these lands were closed to further mineral entry and location on September 28, 1976.

On January 11, 1978, following the recordation of these claims pursuant to section 8 of the Mining in the Parks Act, 16 U.S.C. § 1907 (1988), the Bureau of Land Management, at the request of NPS, issued a contest complaint alleging that the claims were invalid because "[t]here are not presently disclosed within the boundaries of the mining claims minerals of a variety subject to the mining laws, sufficient in quantity, quality, and value to constitute a discovery." In late May and early June of that year, a hearing was held before Administrative Law Judge E. Kendall Clarke. Subsequent thereto, Judge Clarke issued his decision finding all of the subject claims null and void because none was supported by a discovery of a valuable mineral deposit.

In his decision, Judge Clarke noted that, of the original 32 claims involved in the contest complaint, only the validity of 11 claims remained in issue (1979 Decision at 2). These claims were the Copper Lode Nos. 1, 2, 3, 5, 7, 8, 9, 10, 13, 14, and 28. With respect to these claims, Judge Clarke held that there were insufficient showings as to the quantity and quality of copper ore within the claim limits and rejected contestees' attempts to use geologic inference to project a copper ore body delineated by drilling conducted on some claims onto various other claims which had not been drilled, declaring that "[u]nder the mining laws of the United States geological inference may not be used to establish the existence of a valuable mineral deposit" (1979 Decision at 10). Accordingly, he held all 11 claims null and void. Contestees duly appealed Judge Clarke's decision to this Board.

In our original decision, reported as United States v. Feezor, 74 IBLA 56, 90 I.D. 262 (1983), the Board affirmed Judge Clarke's conclusion as

to the invalidity of the claims but substantially modified the basis therefor. Thus, the Board rejected any blanket proscription on the use of geologic inference to establish the existence of a "valuable mineral deposit." Rather, the Board held:

[G]eologic inference, standing alone, is insufficient to establish the existence of a valuable mineral deposit where it is necessary to infer continuity of values at depth where such values have not yet been disclosed. In other words, while geologic inference is, in fact, applicable, isolated and erratic high values are simply incapable of giving rise to an inference that better values exist someplace on the claim. In essence, and in practice, geologic inference is primarily applicable as a basis upon which to show continuity of values. Thus, where values have been high and relatively consistent, geologic inference can be used to infer sufficient quantity of similar quality mineralization beyond the actual exposed areas, such that a prudent man would be justified in expending labor and means with a reasonable prospect of success in developing a paying mine.

Id. at 78-79, 90 I.D. at 274-75.

Having established the legal framework in which the factual record would be analyzed, the Board then turned to the question of what inferences could properly be drawn from the record established before Judge Clarke. Contestees had asserted that there were three separate areas within the claim group which showed varying evidence of containing a valuable mineral deposit of copper. These were generally denominated as the South Body (Area A), the North Body (Area B), and the Middle Body (Area C). The great bulk of both the geologic studies and the testimonial evidence was directed to Area A and, to a lesser extent, Area B.

We noted that all parties were essentially in agreement that the drilling program conducted by Richard E. Mieritz between 1969 and 1971, had delineated a copper deposit containing approximately 400,000 tons of 0.50-percent copper in Area A in a hilltop area located within the boundaries of the Copper Lode Nos. 1 and 2. 1/ All parties agreed, however, that this deposit could not be economically mined since it would not justify the capital investment necessary to extract it. See 1978 Tr. 51, 63, 177, 291, 417-18. 2/

Other sampling had been conducted by Occidental Minerals Corporation (OXY) in 1975. This sampling had consisted of various chip and channel

1/ Additional drilling by Tom Beard in 1968 and Norandex, Inc., in 1970, had generally obtained results consistent with the Mieritz drilling.

2/ While it was undisputed at the 1978 hearing that this deposit could not, by itself, be successfully developed, contestees altered their viewpoint at the subsequent hearings. This issue is examined infra in the text of this opinion.

samples taken from surface outcroppings. Some of these surface samples had been taken beyond the limits of the Mieritz drilling program and, as we noted in our original decision, a major source of controversy was the extent to which the results of the OXY sampling could be used to establish the existence of a valuable mineral deposit outside of the limits clearly delineated by the Mieritz drill holes, *i.e.*, the hilltop portion of Area A. The Board concluded that the answer to this question turned on whether the assay results obtained from the OXY surface samples within the hilltop portion of Area A could be correlated to the results obtained from the assays of the Mieritz drill holes.

In determining whether the results of the surface sampling correlated with that of the drill holes, this Board reviewed the numerous maps which had been submitted by the parties. Particular reliance was placed on a map found at subexhibit 5 of exhibit 4, which the Board termed the "Mieritz" map, based on its conclusion that the "Mieritz" map had, indeed, been prepared by Richard Mieritz. Utilizing this map to establish the location of drill hole H-61, which had shown minimal values throughout its 60-foot depth, the Board noted that chip samples 53 and 108 showed significant copper values beyond the area delineated by the drilling program. We concluded, therefore, that "the chip samples taken in the instant case do not give results sufficiently reliable so as to permit estimates of values at depth on the sole basis of favorable surface showings." *Id.* at 89, 90 I.D. at 281. ^{3/} Thus, the Board determined that the record failed to establish a basis for concluding that the disclosure of high copper values through OXY's surface sampling was indicative of high values at depth.

The Board also rejected the use of geologic inference, independent of the results of the OXY samples, to establish any additional extension of the ore body disclosed by Mieritz' drilling within Area A. The Board noted that the mineralized zone was virtually bracketed by holes which showed merely waste values and, advertent to the topography of the area, "in which the drill holes showing value are higher in elevation than those in the southeast which show waste," concluded that there was no factual basis for geologically projecting the defined body in Area A beyond the areas delimited by the drill holes. *Id.* Insofar as Areas B and C were concerned, the Board noted that, with respect to Area B, "the scattered drilling which was done there gave absolutely no indication that values continue at depth," and with respect to Area C that "there was virtually no showing, whatsoever, that mineralization in a vein structure even existed." *Id.* at 92, 90 I.D. at 281-82. Accordingly, the Board affirmed

^{3/} While the examination of the relationship between drill hole H-61 and chip samples 53 and 108 was a critical component of the Board's conclusion on this point, it was not the only relevant factor considered. Thus, the Board noted that its conclusions were fortified by the fact that the chip samples taken from the North body (Area B) showed significant values whereas of the five holes drilled by Mieritz only one showed any copper values (0.41-percent copper at a depth of 10 feet). Thus, the Board noted that "a number of surface samples show values for which there is absolutely no reason to presume continuance at depth." *Id.* at 90, 90 I.D. at 281.

Judge Clarke's findings that all of the subject claims were unsupported by a discovery of a valuable mineral deposit and, accordingly, null and void.

Subsequent to the issuance of that decision, however, contestees filed a petition seeking to have the Board reconsider the result reached therein. Critical to this petition was contestees' argument that, contrary to the assumption of the Board, the map found at subexhibit 5 of exhibit 4 had not been prepared by Mieritz but rather had been adapted from the original Mieritz map by Robert D. O'Brien, a Government mining engineer, priarily by adding claim corners onto the original Mieritz map. Since the location of the claim corners was critical in determining the physical relationship between the drill holes and the OXY sampling sites, this allegation, if true, would significantly undermine the Board's reliance on subexhibit 5 of exhibit 4 as the basis for resolving the conflict between the Government's exhibit 6 and the contestees' exhibit G as to the location of the Mieritz drill holes. Accordingly, the Board reexamined its reliance on subexhibit 5 of exhibit 4.

In its decision reported as United States v. Feezor (On Reconsideration), 81 IBLA 94 (1984), the Board, after reexamining the exhibit in question, was forced to conclude that contestees' argument might be well-based. While the Board noted that a review of subexhibit 5 of exhibit 4 did not fully resolve all of the questions as to that map's origins, it agreed that the unresolved questions surrounding the preparation of that exhibit deprived it of the controlling weight which the Board had earlier accorded to it.

On the other hand, the Board rejected contestees' suggestion that it utilize exhibit G to determine the correlation of the surface sampling to the drill holes. Exhibit G was a map prepared by James B. Fletcher, a mining engineer employed by contestees, assertedly using topographic controls to locate the Mieritz drill holes and the OXY chip samples. Noting that, in their petition, contestees had argued that "topography is the only common reference point," the Board pointed out that the OXY map (Exh. C and Subexh. 6 of Exh. 4) did not show topographic relief. The Board concluded, therefore, that it could not rely on exhibit G and declared that the Board had "no alternative but to remand this case to the Hearings Division for a further fact-finding hearing." Id. at 98. The Board then proceeded to delineate the scope of this hearing.

While recognizing that the major focus of the hearing would be the attempted correlation of the surface sampling sites and drill holes in Area A, the Board also noted that, if contestees were successful in establishing such a correlation, this might well have an effect on Area B. Thus, the Board stated that

[w]hile we do retain considerable doubt as to the ability of appellants to show the existence of a valuable mineral deposit in that area, we feel that appellants should be afforded an opportunity to attempt to show the validity of the claims in this area

in the context of further examination of the reliability of the surface sampling program.

Id. at 99. Turning to Area C, however, the Board noted that the paucity of sampling in that area would not justify the conclusion that the discovery of a valuable mineral deposit had been disclosed therein, even if contestees were able to establish that the OXY surface sampling correlated to values at depth. Therefore, the Board reaffirmed its original holding of invalidity with respect to the Copper Lode Nos. 10 and 28.

Pursuant to this analysis, the Board set aside its earlier finding of invalidity of the Copper Lode Nos. 1, 2, 3, 5, 7, 8, 9, 13, and 14, and remanded the case to the Hearings Division. The Board expressly noted that

[t]he Administrative Law Judge shall have full authority, consistent with the legal rulings of the Board in our original decision, both to determine whether or not the surface sampling has been shown to be consistent with the results of the drill hole program and also whether a discovery has been shown to exist within the limits of the various claims, both at the time of the withdrawal in 1976, and at the present time. Id.

On remand, the already convoluted history of this case became more so. Judge Clarke duly set the matter for a hearing commencing on June 5, 1985. At that time, contestees' attorney objected to the consideration of the Government's economic report prepared by David Paul Oradei (which, with appendix, totalled approximately 600 pages, see Exhs. 25 and 26) on the ground that he had obtained the report only in the preceding week and had not had sufficient opportunity to review the document. See 1985 Prehearing Tr. 6-7. ^{4/} While Judge Clarke ultimately admitted the report, he felt compelled to grant contestees an additional hearing so that they would have an adequate opportunity in which to analyze and, if they desired, rebut the various conclusions reached in the report (1985 Tr. 305-06). This decision was to have critical impact on the subsequent course of events.

Be that as it may, the initial 2 days of hearing in 1985 progressed along lines fairly predictable from the prior proceedings. Thus, contestees presented testimony from Harvey W. Smith, a consulting mining engineer and registered mineral surveyor, who had worked on establishing the claim locations for contestees in 1973 to 1975. Smith noted that he had resurveyed the claims in February 1985 (1985 Tr. 16). Based on his surveying results,

^{4/} The hearings on remand were held on June 5 and 6, 1985, in Las Vegas, Nevada, on Sept. 26, 1985, in San Francisco, California, on Jan. 27 through 31, 1986, and on Feb. 7, 1986, in Las Vegas, and on Mar. 25, 1986, in Phoenix, Arizona. The hearing transcripts for the 1985 Las Vegas hearings and the hearing in San Francisco were numbered consecutively. The 1986 Las Vegas and Phoenix hearings were also numbered consecutively starting with page one. References in this decision to the transcript will therefore be preceded by the year of the transcript to minimize confusion.

he prepared various overlays purportedly showing the location of the Copper Lode No. 2, the location of certain of the Mieritz test holes, and the location of the OXY chip samples. See Exhs. P-1, P-2, and P-3. 5/ Utilizing these exhibits as well as Mieritz' map (Subexh. 3 of Exh. F), Smith then prepared exhibit Q which consisted of a composite of P-1, P-2, P-3, and the Mieritz map (1985 Tr. 22). It is important to note that, in correlating the map of the OXY samples (which had no topographic features) with the other maps, Smith used chip samples 50, 51, and 70, which, he had been informed by Fletcher, were along the line of the road, as the tie-in for that map (1985 Tr. 46-53), thus ultimately basing the location of the chips samples on the basis of the road.

William C. Oates, a mining engineering technician, testified on behalf of NPS with respect to his examination of the mining claims. He noted that there was a close correlation between Smith's placement of the Mieritz drill holes and his own location of those holes (1985 Tr. 65). Oates testified, however, that he was unable to correlate the OXY grid system to the location of the drill holes since there were no common points between the various maps and the OXY map also failed to provide any topographic reference points by which such a correlation might be made (1985 Tr. 71-72).

Robert T. Mitcham, a Government mining engineer who had testified at the 1978 hearing, also addressed the problem of correlation of the OXY samples to the Mieritz samples. Mitcham noted that there were three OXY maps now in the record (Exhs. C, G, and 22) that varied in their location of the chip sample grid with respect to the claim group boundaries by as much as 60 to 80 feet, which he attributed to the effects of xeroxing and the piecing together of small segments (1985 Tr. 102). In determining the placement of the chip sample grid vis-a-vis the claim boundaries and the Mieritz drill holes, Mitcham used the OXY map designated as exhibit C, which showed the chip samples in relation to the outer periphery of the claim group, and measured 1,800 feet (i.e., the width of three claims) west of a corner on the periphery (designated as A on Exh. 22), thereby locating the west sideline of Copper Lode No. 2 in relation to the chip samples. See Exh. 21. 6/ Using various overlays, Mitcham argued that drill holes 19, 34, and 56, which showed essentially waste values and, thus, defined the deposit in an easterly direction, were located west of OXY chip samples 107, 108, and 53 which had shown high values (1985 Tr. 123-24, 135, 144-45).

5/ At the 1985 hearings, all exhibits were numbered consecutively to those received in the 1978 hearing, but were given the prefix "II" to distinguish them from the earlier exhibits. This practice was subsequently abandoned at the 1986 hearings. For purposes of consistency, the prefix "II" has been dropped throughout this decision.

6/ Mitcham also testified that, in preparing exhibit 6 for the original hearing, he did not have access to the OXY map introduced as exhibit C, but rather had based exhibit 6 on the copy of the OXY map designated as subexhibit 6 of exhibit 4 (1985 Tr. 99-100). A comparison of exhibit 6 with exhibit 21 shows that, as depicted on exhibit 21, the grid has moved approximately 80 feet east in relationship to the west sideline of the Copper Lode No. 2, consistent with Mitcham's testimony (1985 Tr. 102).

Thus, Mitcham reiterated his original conclusion that favorable surface sampling could not be correlated to values at depth. In response to an inquiry from contestees' counsel, Mitcham admitted that, other than drill holes 19, 34, and 56, and OXY chips samples 107, 108, and 53, he had made no effort to correlate any of the drill holes with the surface sampling (1985 Tr. 183).

Contestees then presented the testimony of James D. Fletcher, who had prepared exhibit G for the original hearing, to challenge the placement of the chip samples in relation to the claim lines. While Fletcher had not been on the claims during the OXY sampling, he had visited the site immediately after the surface sampling and the OXY engineers and geologists had pointed out a number of the sample sites to him (1985 Tr. 228-30). Fletcher testified that, according to the OXY personnel, the string of chip samples designated 44 to 55 had been taken along the bank of a road, generally referred to as the upper road. Fletcher used this location as the control point for the chip samples resulting in a location of the chip samples substantially to the southwest of the placement of these sample sites in Government's exhibit 21. See Exh. P-3. Fletcher noted, however, that the chip samples were not taken along 50-foot lengths but rather, within each 50-foot interval, samples would be taken at various places and these samples would be consolidated into a single sample for each interval (1985 Tr. 214).

Harvey Smith then testified, enlarging on Fletcher's criticism of the location of the OXY chip sample grid in relation to the west sideline of Copper Lode No. 2, as shown on exhibit 21. He argued that the Government's reliance on the OXY map (Exh. 22), which had served as a basis for the location of the grid, was misplaced, because, in his view, this map was clearly a sketch map and not the finished product (1985 Tr. 249). Ultimately, Smith admitted that, while he would rely on the actual sample locations, he would not put much faith in the OXY grid as depicted on the various maps (1985 Tr. 254).

The Government then presented the testimony of Oradei, a mining engineer in the employ of NPS, who had prepared an economic analysis (Exhs. 25 and 26) based, in large part, on various assumptions contained in Fletcher's economic analysis report which had been admitted into the original hearing as exhibit A. He did, however, alter a number of Fletcher's economic assumptions, particularly with respect to the use of multiple access roads (which, Oradei noted, would not be permitted in the Park), reclamation costs and powerline costs (1985 Tr. 265-69, 285). Oradei's conclusions were that, regardless of which reserve estimate was used, the property was not economically viable, even accepting all of Fletcher's assumptions other than the reclamation and powerline costs (1985 Tr. 282-83).

At this point in the hearing, the Government moved to have Oradei's report (Exhs. 25 and 26) admitted into evidence. After an extensive voir dire with respect to various elements utilized in Oradei's computer runs, contestees objected to its admission, particularly challenging the foundational basis for the computation of inflation used in the report. Following an unrecorded conference between the parties and Judge Clarke, it was

determined to continue the hearing until September 26, 1985, to permit contestees an opportunity to study the Oradei report before commencing their cross-examination. Judge Clarke noted that, in addition to cross-examining Oradei, "contestees may wish to call witnesses of their own concerning economic analysis, which will be the only subject that we'll have at this continued hearing * * *" (1985 Tr. 304-05). Pursuant to this understanding, the hearing was adjourned.

Following the close of the hearing on June 6, 1985, and prior to the scheduled hearing date of September 26, 1985, however, an internal reorganization of the Hearings Division, Office of Hearings and Appeals, resulted in the closure of the Sacramento hearings office, to which Judge Clarke had been assigned. The case file was transmitted to the Salt Lake City office where it was assigned to Administrative Law Judge John R. Rampton, Jr., who subsequently presided at the September 26 hearing.

At the outset of the September 26 hearing, the Government objected to the proposed admission of a report which contestees had obtained from the mining consulting firm of Pincock, Allen & Holt (referred to as the PAH Report), analyzing the economics of an open pit heap leaching process with a crystallization plant producing copper sulfate (CuSO_4) as its end product. Counsel for the Government noted that, not only did this report purport to show the economic viability of the claims based on both differing mining methods and a different end product than theretofore advanced, ^{7/} but the Government had only received a copy of the report the week of the hearing (1985 Tr. 313-17). On these grounds, the Government sought an order barring admission of the PAH Report.

In response to these arguments, contestees contended that, while they did not oppose a further continuation to permit the Government to analyze their report and present further testimony in respect thereto, they did not agree that the changes in method of extraction and the end product sold provided any basis for excluding the report. Thus, contestees contended that though they had elected to present one method of development at the initial hearing, they were not thereafter disbarred from presenting alternative extraction methods at subsequent hearings which might prove more remunerative (1985 Tr. 324-35).

While Judge Rampton agreed that the Government should be afforded another hearing at which it could present evidence relating to the new development analysis presented by contestees, he rejected the Government's motion to totally bar consideration of the newly-proposed extraction method. Judge Rampton did note, however, that, in order to permit consideration of the open-pit method, contestees would be required to show either that the planned methodology was in existence on the date of withdrawal or that the claims were, at that time, supported by a discovery of a valuable mineral

^{7/} As counsel for the Government noted, the hearing had previously proceeded on an analysis of a proposal for an in situ leaching copper cementation process which would obtain impure copper as the end product (1985 Tr. 315). See Exh. A.

deposit utilizing production techniques then in use (1985 Tr. 326-30). Accordingly, proceedings on September 26, 1985, were limited to completion of Oradei's testimony relating to the preparation of exhibits 25 and 26.

In recounting the basis for his conclusions as to the unprofitability of mining the deposit disclosed using either the Government's or the contestees' reserve calculations, Oradei noted that he had used the Consumer Price Index for Urban Consumers (CPIU), which had been the subject of some criticism at the previous hearing, to adjust for inflation only for those items not specifically listed in the Mining Cost Service (1985 Tr. 345). Oradei did admit that under the regulations existing prior to the adoption of the Mining in the Parks Act, supra, he would not have added reclamation costs in determining whether mining was or was not economic (1985 Tr. 388).

Following the conclusion of Oradei's testimony, disagreement again arose between counsel, this time concerning testimony contestees wished to elicit from Slusher, who had participated in the OXY surface sampling program for the Copper Lode claims. The following colloquy is illustrative of the point of contention:

JUDGE RAMPTON: Let me understand that the two questions that were left open were -- the correlation of the drill holes with the surface sampling so that you could determine whether or not there could be any extension of the chip sampling in depth using some geologic inference -- whether it was perfectly acceptable because they were close enough and there was correlation you could extend the values found on the surface to depth. That was one purpose of the remand.

And all that testimony has been received on that?

MR. SMITH: Well, let me put it this way, Your Honor. I think there were a couple or three questions that were actually remanded. One included whether -- assuming that the use of the chip sampling in determining the reserves was applicable to another area which was not discussed at all at the last hearing -- area B to the north of the property.

The testimony at the last hearing, I think -- correct me if I am wrong, Mr. Burke, -- was related exclusively to the results of surveying performed both by the Park Service and by surveys for the contestants.

But the question of the validity of the use of a sampling method -- and particularly the use of samples in computing ore reserves in the north area -- were not addressed at the last hearing.

MR. BURKE: Well --

JUDGE RAMPTON: You mean, in general?

MR. SMITH: That is correct.

JUDGE RAMPTON: And do you intend to present evidence as to why and you have a witness who will testify as to that particular method as to why you can project that?

MR. SMITH: Well, first of all, after nine years later we have a witness that did the chip sampling which was not available at all of the earlier hearings. The purpose of putting Mr. Slusher on the stand was to -- again -- have him in his own words describe what has been attacked repeatedly and repeatedly by the National Park Service as --

JUDGE RAMPTON: As not being valid sampling techniques?

MR. SMITH: Right. [8/] To have him describe the technique--to have him describe his, and the company for which he worked, analysis of those samples, and the use of those samples, and the reserves that they initially came up with.

JUDGE RAMPTON: That is you next witness?

MR. BURKE: You Honor, I am going to object to this. This is a 100 percent surprise on the part of Mr. Smith. It is my understanding that we wrapped up everything except for the economic analysis in the last report and that this hearing was totally dedicated to cross-examining our witnesses, Exhibit No. II-25 and II-26, and rebutting it if necessary.

And I believe that this is an improper expansion of this hearing.

MR. SMITH: Well, I am sorry. Your scope of what this hearing was to be certainly wasn't limited to my cross-examination and your rebuttal. Now, if you could tell me that the reserves and the calculations of the reserves don't relate to economics, I think you are flying in the face of Mr. Oradei's testimony which clearly illustrates that the small reserves that the National Park Service is asserting as a reserve figure is not economic.

(1985 Tr. 426-28).

8/ In point of fact, while the Government had, indeed, attempted to challenge the technique by which the OXY samples were taken, this Board had already ruled in its initial decision that such a challenge was barred by a joint stipulation to which the parties had agreed. See United States v. Feezor, supra at 60-66, 90 I.D. at 264-67.

The disagreement between counsel as to the scope of the matters subject to further testimony continued. Counsel for the Government ultimately summarized his views:

MR. BURKE: Mr. Smith put on his witnesses first. That whole issue of what was where was supposedly addressed at that Las Vegas hearing. We put on our minerals examiner who testified about the economic report.

Judge Clarke decided that it was appropriate to put the hearing in abeyance so Mr. Smith had appropriate time to take a look and respond to that economic report. He was supposed to have given me by the 1st of September his list of witnesses and exhibits that were to go into evidence.

I get a preliminary report less than a week before the hearing. And I get the other report three days before the hearing. So, for me to cross-examine whoever he puts on on that minerals report to preserve the testimony is I feel highly detrimental to the Park Service.

Secondly, this new line of testimony from Mr. Slusher I feel is purely outside the purpose of this continuation.

(1985 Tr. 436-37).

Counsel for the contestants responded:

MR. SMITH: If I was offering evidence that I sent Mr. Slusher out there with a tape measure or an aerial photograph and had him line up these grids, yes, I would absolutely be precluded and that is not the nature of his testimony.

The nature of his testimony is how he took the samples, what he did with the sample results, how he analyzed the sample results, the reserves that were computed, and his opinion as to the economics of the deposit as of the pre-withdrawal period.

(1985 Tr. 437).

Following an additional exchange between Judge Rampton and counsel for contestees as to whether Slusher would have been called in June had that hearing not been continued, the parties went off the record. After the off-the-record discussion, Judge Rampton reconvened the hearing. Judge Rampton noted the continuing objection by the Government to Slusher's testimony and agreed that the hearing should be continued. He noted that the parties had indicated that they might be able to achieve an agreement on the time, place, date, and scope of the hearing and he gave them until October 4, 1985, to notify him of the results of their negotiations (1985 Tr. 438-40). Pursuant to this understanding, Judge Rampton then recessed the hearing.

On October 15, 1985, Judge Rampton issued a prehearing order. It is obvious from this order that a number of disagreements still separated the parties respecting the scope of any future hearing. Thus, Judge Rampton directed the contestees to file a plan of survey in support of a proposal to make an on the ground survey of the claims as well as a separate motion to permit Slusher's testimony. The Government was afforded the opportunity to file responses thereto. Contestees were also directed to submit a revised mining plan of operations on or before December 30, 1985, at which date the parties were also required to exchange a list of witnesses. Finally, Judge Rampton notified the parties that the hearing would be reconvened in Las Vegas, Nevada, on January 27, 1986.

Pursuant to this order, contestees filed a "Memorandum Regarding Additional Field Work By Contestees" on October 17, 1985. In this memorandum, contestees sought permission to engage in a geological and engineering study involving the marking on the ground of control and elevation points, construction of a base map from aerial surveys, and the use of such maps to refine and revise a proposed mining plan, pit design, minesite facilities and haulage and utility routes. In addition, contestees sought permission to conduct a surface sampling program in conjunction with their geological and engineering work arguing that, under this Board's decision in United States v. Foresyth, 15 IBLA 43 (1974), such work was permitted even though the land was withdrawn since, they contended, it would merely be corroborative of a pre-existing discovery. Finally, contestees sought an order compelling NPS to permit contestees to observe any additional field work conducted by NPS.

In response, the Government, by memorandum filed on October 25, 1985, strongly objected to all of contestees' requests. The Government argued that, since contestees had been afforded an opportunity to cross-examine Oradei, the record should now be closed pursuant to Judge Clarke's directive at the end of the 1985 Las Vegas hearings. The Government contended that "[c]ontestees are now seeking exploratory evidence and are expanding the scope of the remand by trying to develop and introduce evidence which was not in existence at the time of the original hearing under the representation that they are only updating pre-existing evidence" (Memorandum at 3). The Government argued that contestees' reliance on United States v. Foresyth, supra, in support of its proposed sampling program was misplaced since this was not an attempt to prove a pre-existing discovery but was actually an attempt to make a discovery. The Government also objected to contestees' request that the Government be required to notify contestees of any additional field work which it conducted on the claims, noting that, as the responsible management agency for the land involved in the contest, NPS was not required to notify anyone of its intention to carry out its land management functions.

By order dated October 31, 1985, Judge Rampton approved contestees' request to conduct a geological and engineering study of the area as proposed but rejected its request to conduct further sampling. In making this latter ruling, Judge Rampton noted that additional sampling of the same sites already sampled would be redundant of the earlier sampling programs and sampling of new sites would constitute an attempt to make a discovery

after the land had been withdrawn. Judge Rampton expressly ruled that at the reconvened hearing contestees could present evidence as to the possible economic feasibility of mining the claims by open pit leaching aimed at copper sulfate production. ^{9/} Thereafter, by order dated December 24, 1985, Judge Rampton permitted the testimony of Slusher, except so far as it might be redundant with respect to the question of the reliability of the sampling techniques utilized by OXY, which had been previously stipulated to.

The hearing reconvened on January 27, 1986. Contestees called Gordon McLain, a licensed mineral surveyor, as their first witness in the reconvened hearing. McLain testified that, through the use of horizontal and vertical ground controls in conjunction with aerial photography, he had prepared a topographic map of the claims. The underlying topographic lines shown on exhibit BB were the results of this effort (1986 Tr. 8). While on the claims, McLain also attempted to reestablish the boundary lines of the various claims. See Exh. CC. This was accomplished by using four primary control points tied into the location notices (1986 Tr. 39). As surveyed by McLain, the sidelines of the Copper Lode No. 8, as located on the ground, were shorter than the 1,500 feet called for in the notice of location, while the sidelines of the Copper Lode No. 9, which abutted the Copper Lode No. 8 along its north endline, extended beyond the statutory limit of 1,500 feet. McLain testified that he shortened the Copper Lode No. 9 in his survey by moving the north endline of the claim southward to conform the claim to the statutory maximum (1986 Tr. 20).

Contestees next called Thomas A. Clary, an exploration geologist who had also testified at the initial hearing. Clary testified that, in September and December of 1985, he had visited the property in order to map it. He explained that he and Slusher had prepared a topographic base map (Exh. FF), using McLain's topographic lines on exhibit BB and adding geologic features as disclosed by their examination of the property (1986 Tr. 49-53). Clary testified that, using the geologic features shown on exhibit FF, he and Slusher constructed a three-dimensional model showing topography and geology (Exh. EE), which would graphically demonstrate the geologic features depicted on exhibit FF. ^{10/}

^{9/} No ruling was made on contestees' request that NPS be required to allow the contestees to observe any additional field work which NPS chose to conduct.

^{10/} While exhibit EE was ultimately admitted into evidence (1986 Tr. 416), it was not transmitted to the Board. Subsequent to the filing of the appeal herein, Judge Rampton, by order dated Jan. 4, 1988, informed the parties that, unless one of them objected, exhibit EE (which measured 4 feet by 8 feet by 1-1/2 feet) would not be transmitted to the Board both because of its bulk and because of the fact that Judge Rampton found that the primary information shown thereon was duplicative of information contained in more manageable exhibits. Contestees concurred in Judge Rampton's decision and the Government filed no objection. Accordingly, by order dated July 8, 1988, Judge Rampton ordered the exhibit returned to the contestees.

The geology as shown on exhibit FF was also added to exhibit BB by both color and numerical coding. As testified by Clary, purple (1) depicted the older rocks, lying beneath an angular unconformity; red (2) was identified as the marker rock and consisted of a dolomitic bed containing calcium and magnesium carbonates lying on top of the unconformity; skin color (3) was the altered host rock (quartzite); green (4) was the copper ore zone within the host rock; brown (5) was the younger rocks which served to localize the mineralization between red and brown segments; orange (6) represented younger rocks within the brown; light yellow (7) showed covered ground where there were no traces of outcroppings; and dark yellow (8) showed stream sediments (1986 Tr. 74-77). Clary also testified as to the preparation of various cross-sections (Exhs. GG-1 to GG-5) taken along lines depicted on exhibit FF and which, by using results from the various drill holes, attempted to show the relationship of the geology of the deposit to the mineralization shown by the drill holes (1986 Tr. 88).

Gary Slusher was the next witness called by contestees. Slusher, who possessed a degree in industrial engineering and had taken 2 years postgraduate studies in geology, was employed by OXY as an exploration geologist and had participated in the 1975 OXY surface sampling program of the Copper Lode claims (1986 Tr. 117). Slusher noted that two types of samples were taken by OXY in 1975: general sampling across the property and specific sampling of the area of known visible outcrops (1986 Tr. 124). Consistent with Fletcher's testimony, Slusher stated that OXY samples 44 to 55 were taken along the upper road and, using the road as the terminal point for the east-west grid line, he located the chip samples as shown on exhibit BB (1986 Tr. 153-54).

Slusher noted, however, that had the topographic base map existed in 1975, he would not have transferred the chip samples onto that map

because they had already been used for the purpose for which they had been collected * * * to establish a correlation of the results that you obtain in the surface sampling, and that was available from the drilling that had been done on the property * * * on an average basis, not a chip sample to correlate to a drill hole, but on an average for the representative of the whole area.

(1986 Tr. 156-57). See also 1986 Tr. 124.

Slusher recalled that his original reserve estimate was on the order of 20 to 30 million tons of material containing copper ore (1986 Tr. 158). While Slusher first stated that 4 million tons would be in a "proven" category (1986 Tr. 159), he subsequently declared that only 400,000 tons would be in a "proven" category (1986 Tr. 168). Because the claims in issue at the 1986 hearing did not contain the entire mineral formation, Slusher lowered his estimate of total reserves within the Copper Lode claims to 15-16 million tons in his more recent calculations (1986 Tr. 165). This reserve figure was a single figure for all of the claims and was not broken down by mineralized areas (1986 Tr. 168). In Slusher's opinion the only "proven" areas were those on the hill where Mieritz had done the bulk of

his drilling. ^{11/} Of the remaining reserves, Slusher estimated that approximately 75 percent would be classified as "probable" with the remaining 25 percent deemed "possible" (1986 Tr. 168-70). Slusher admitted, however, that David Holmns, the geologist at OXY to whom he reported, had recommended that the deposit not be developed because of insufficient reserves and that OXY had subsequently relinquished its lease (1986 Tr. 171).

Slusher explained the underlying theoretical basis of his reserve estimate in a colloquy with Judge Rampton:

JUDGE RAMPTON: All right. Then what you are doing is taking the assay results, finding out exactly what type of copper deposit you have in these various surface sampling comparing it to the assays received from the drill corings.

THE WITNESS [SLUSHER]: Right.

JUDGE RAMPTON: And seeing what correlation there is between the type of deposit you have at the surface that can be seen, as what lies underneath, is that correct?

THE WITNESS: Right. And based on this sampling, if I was sampling other areas that reflected the same type of geology as in area A, I could expect that same correlation or feature at depth.

JUDGE RAMPTON: So you can tie in, in your opinion, if there has been drilling in area A, and then you move after you have --after you have sampled area A, you move on to B, even though there has been no drilling in that area, you can project and correlate what you feel is beneath the surface, is that correct?

THE WITNESS: That's right. And if I sampled --

JUDGE RAMPTON: Because that is a bed of ore that goes through this entire area with some faulting.

THE WITNESS: Correct.

JUDGE RAMPTON: But this gives you the geologic information to project the bed with its various faults and dips; is that correct?

^{11/} Mieritz, in the report on the results of his drilling, stated that his drilling program had developed 324,000 tons of 0.77-percent oxide copper ore, with extensions being possible northward, northeasterly and mainly southeasterly toward a second known area of mineralization (Exh. 2 at 4-5). Fletcher, in his report, had estimated total "probable" reserves of 3,180,000-tons at 0.60-percent copper in Areas A and B, and "possible" reserves of 1,030,000-tons of 0.30-percent copper in Area C (Exh. A at 1).

THE WITNESS: Right. And you have -- you are also noting the geology. In a small area like this, you know, the formation we're talking about is relatively uniform across the whole area.

(1986 Tr. 183-85).

Slusher then turned to an explication of the various cross-sections which he had prepared (Exhs. GG-1 to GG-5). He noted that a two-lined representation of drilling on the GG exhibits meant that the assay reports were above the cut-off level used (0.20 percent), 12/ whereas a single line indicated that drilling continued into an area of copper oxide with values below the cut-off limits (1986 Tr. 202). Slusher admitted that Mieritz had used a higher cut-off grade than Slusher did in his calculations (1986 Tr. 203). 13/

All of the cross-sections posited the existence of two mineralized zones, one denominated as zone 4 and the other as zone 4-A. An analysis of these cross-sections showed that a number of mineralized zones were depicted across fault lines or shear zones on the basis of surface outcroppings without any sampling (see, e.g., Exh. GG-1, zone 4 east of the shear zone; Exh. GG-5, zone 4 east of first fault line and shear zone), and were also shown beneath the surface in areas with minimal, if any, drill hole results (see, e.g., Exh. GG-1, zone 4 east of the fault line). Two cross-sections (Exhs. GG-2 and GG-3) mapped surface outcroppings denominated as zone 4 or 4-A where no drill results or other sampling were available and projected subsurface continuations of these zones past fault lines into areas which had also not been drilled. 14/ While Slusher suggested that

12/ While Slusher variously testified that the cut-off used was 0.20 percent or 0.30 percent (1986 Tr. 202), an analysis of exhibit GG-1 clearly shows that the cut-off was 0.20 percent. Thus H-3, which was drilled to a depth of 40 feet and which showed values for each 10-foot interval of 0.28 percent, 0.25 percent, 0.28 percent, and 0.35 percent, respectively, was included within the ore zone throughout its entire length.

13/ Mieritz had, in fact, used a 0.40-percent cut-off grade. See Exh. 2 at 6.

14/ Slusher did argue that, with respect to the extension of zone 4 and zone 4-A on exhibit GG-3, Norandex drill hole CL-1 provided support for the projections beyond the fault line, even though it was not shown on the cross-section (1986 Tr. 233-34). It is, however, difficult to give much weight to this assertion. The Norandex CL-1 drill hole is located approximately 400 feet due south of the K-L cross-section line depicted on exhibit GG-3. The Mieritz report noted that this hole was drilled to a depth of 758.7 feet at a -45° directed towards the ore body. Mieritz reported that the only favorable showings were at depths of 505 to 515 feet with 0.90-percent copper and 580 to 600 feet with 0.65-percent copper content, and that "other values from 500 to 745 feet ranged from isolated values of 0.42 to nil" (Exh. 2 at 5). See also Exh. 1. Indeed, the assay results corroborate Mieritz' statement even using the 0.20-percent cut-off grade utilized by contestees. See Exh. 4, Subexh. 3. Yet, despite the fact that the CL-1 hole showed values only for a distance of 10 and 20 feet,

displacement along the fault lines would be relatively small, in the order of a few hundred feet (1986 Tr. 252-53), he had also testified earlier that shear or fault zones, such as shown on exhibits GG-1 and GG-2, generally exhibited a lack of geologic controls which made subsurface projections more problematic (1986 Tr. 144-46). Subsurface continuations of zones 4 and 4-A, however, were projected across shear zones as well as simple faults on exhibit GG-2.

In response to questioning from Government counsel, Slusher explained how he ascribed mineralized values to the areas in which there was no sampling:

Q. [By Burke] In other words, you are telling me that on Exhibit GG-2, you cannot tell me what percentage or the grade of mineralization is in the areas that have been identified as either four or 4-A; is that correct?

A. [By Slusher] No, because no sampling has been done. The grade that I would apply to it would be the average that I'm applying to that. And then I would classify that based on indicated or inferred class. But as far as taking samples in the subsurface, I haven't.

Q. Okay. Then in summary, let's make this very simple. You have given me a very long-winded answer for your last sentence. I want to make sure that this is clear.

You have not assigned a grade level to any of the areas that are not colored in, is that correct?

A. No, that's not correct.

Q. What grade level have you assigned to those areas?

A. Well, in projecting reserves through there I take an average of point six.

Q. What data do you base that on?

fn. 14 (continued)

commencing at depths of 505 and 580 feet, respectively, exhibit GG-3 projected both zones 4 and 4-A as continuing past the fault and showed zone 4-A as extending approximately 35 feet in width, terminating above the 150-foot level, and showed zone 4 as extending 75 feet in width, stopping at the 300-foot level. Even assuming that the angle of penetration of the CL-1 well avoided the generation of bed boundary errors and resulted in an accurate measurement of the true width of the mineralized zones, it is virtually impossible to argue that the results obtained therefrom corroborate the projections made past the fault line as shown on exhibit GG-3.

A. It's based to the data that we accumulated in drilling and other sampling.

(1986 Tr. 224-25).

Later in the hearing, 15/ Clary was recalled and he expanded on the principles that guided him and Slusher in making their subsurface extrapolations. Thus, he noted they had determined that the principles of superposition, original horizontality, and lateral continuity were all applicable to the copper deposit they were analyzing (1986 Tr. 396-400). 16/ Clary testified that, applying these principles, he and Slusher had concluded that there were approximately 24 million tons of inferred reserves within the limits of the claims (1986 Tr. 392), in addition to the 2.5 million tons of measured and indicated reserves which Fletcher had attributed to Area A and the additional 700,000 tons of such reserves which Fletcher had attributed to Area B. Clary noted, however, that the PAH studies did not include computations based on their estimate of inferred reserves but rather was limited to the reserves as estimated by Fletcher (1986 Tr. 388-89).

The Government called two witnesses to challenge the geological extrapolations contestees were positing. Martin Miller, a graduate student in geology, specializing in faulting, testified concerning his examination of the geology of the claims. Miller noted that his assessment of the faulting in the area differed in a number of respects from those of contestees' witnesses. Most importantly, Miller stated that he had discovered a fault, which he referred to as fault 3, immediately southeast of the main mineralized body in Area A (1986 Tr. 624), which, in effect, resulted in a bracketing of that ore body (1986 Tr. 631). While he agreed with Clary and Slusher that beds 3 and 5 had been deposited in a water medium, he made the point that these had been moving waters, with the result that "you cannot follow an individual bed for very far" (1986 Tr. 642). In his view, the mineralization on the claims was sporadic and discontinuous, particularly in Area B (1986 Tr. 648-49, 657). Moreover, he also challenged the existence of fault 5 at the site where contestees had mapped it (1986 Tr. 635). Another

15/ Immediately after Slusher completed his testimony, contestees called two individuals who had worked on the PAH study. Their testimony related not to the geology of the area but to the economics of development. After their testimony, Clary was recalled and testified further concerning the geology of the claim area. In order to keep at least a minimum of logical development of the issues, we will discuss Clary's testimony as it relates to the geology at this point and thereafter proceed to review the other testimony relating to geology even though it was given later at the hearing. Then, having presented the geological issues, we will turn to the economic questions addressed at the hearing.

16/ Clary defined superposition as a principle of sedimentary deposition which notes that beds are laid down sequentially with the oldest being on the bottom and the youngest on the top. Original horizontality assumes that sediments which are deposited in a water medium will be laid down horizontally. Lateral continuity states that beds being laid down in a basin will not terminate until they reach the edge of the basin.

NPS volunteer, Mark Savoca, who had degrees in anthropology and geology, corroborated Miller's assertions as to the discontinuous nature of the deposition (1986 Tr. 675).

Contestees also presented the PAH Report, a new economic analysis of the Copper Lode claims based on the production of copper sulfate. The first witness called was Ken Edmiston, a metallurgical engineer working primarily in hydrometallurgy and mineral processing. Edmiston testified that he was the project manager for the preparation of the PAH Report. This report consisted of three separate documents. The main volume analyzed profitability of deposits containing 3,200,000 tons of 0.60-percent copper and 2,500,000 tons of 0.55-percent copper, assuming various economic models dependent upon whether or not treatment of the ore occurred on-site or off-site, and at varying prices and rates of recovery. See Exh. KK. Another document (Exh. HH) summarized these results. Finally, a third document analyzed profitability assuming a 400,000-ton deposit of 0.53-percent copper content (Exh. LL).

In discussing the various inputs, Edmiston noted that the reserve figures utilized were those provided by contestees which, in turn, were based on Fletcher's estimates. Edmiston also noted that the production parameters established by contestees involved case scenarios of 10 million and 20 million pounds of copper sulfate per annum (1986 Tr. 259-60). Given these parameters, PAH then proceeded to design a mine and plant and analyze its profitability. See Exh. KK at 1.0. Assuming a copper sulfate price of \$0.30 per pound, the PAH Report concluded that: "[F]or mining 3,200,000 tons of 0.6 percent copper, the DCF-ROI [17] is 22.9 percent for a plant located at the mine and 15.6 percent for a plant located offsite. For mining 2,500,000 tons of 0.55 percent copper, the DCF-ROI is 21.1 percent onsite and 13.2 percent offsite" (Exh. KK at 2.0).

Edmiston was extensively examined both as to the nature of the report which PAH had provided contestees as well as the bases for its estimates of various cost factors used in the economic models. Edmiston noted that, with respect to capital costs, since they had performed studies for other clients utilizing the same operations, they had utilized the costs that had been developed therein (1986 Tr. 272). While the operating costs would be more site specific, Edmiston also stated that, to the extent that prior studies by PAH had developed relevant cost data, they were utilized (1986 Tr. 273).

Under cross-examination, Edmiston admitted that there was very little metallurgical data available on the Copper Lode deposit and that they had

17/ Discounted cash flow/return on investment. This term is used interchangeably in the PAH Report with discounted cash flow/rate of return (DCFROR) (see 1986 Tr. 261), which latter term will be used in the text of this opinion. It is computed as the rate of return where the net present value (NPV) of the annual cash flow equals zero. See Exh. KK, Appendix I at 4.

primarily relied on test data from Mountain States to determine that the deposit was amenable of heap leaching (1986 Tr. 294). With respect to the construction of the heap leach pads, PAH used costs developed for a client in Nevada, noting that the major cost factor, other than construction, was for the purchase of liners (1986 Tr. 295-97). PAH also computed the cost of constructing three ponds (a pregnant liquor pond, a barren solution pond, and an evaporation pond) designed to contain a total volume of 2.5 million gallons (1986 Tr. 298-99). No specific sites for the ponds, however, were selected, though Edmiston averred that he believed the costs allowed would be sufficient to cover most eventualities (1986 Tr. 299-300). Provision was also made for a 9.2-mile road, a water system along the road, a solvent extraction plant, a crystallization plant, ancillary equipment and various environmental costs (annualized at \$80,000). The first year's capital costs (after adding an additional 15-percent contingency fund) under Case 1, for example, were computed to be \$3,631,000. See Exh. KK, Table 9.1. Total reclamation of the site was estimated to cost \$239,000 (Exh. KK, Table 8.1), relying heavily on earlier NPS estimates. 18/ See Exh. KK at 8.0 to 8.6.

Most of the above costs were generally downsized for the 400,000-ton reserve scenario, which Edmiston characterized as "what we can almost call a pilot plant" (1986 Tr. 310). It was expressly noted that used equipment would be utilized. See Exh. LL at 3.2. Total capital expenditures, including the 15-percent contingency allocation, were estimated to be \$1,411,000. Total reclamation costs at the end of the 5-year period needed to totally mine the deposit was estimated to be \$50,000. See Exh. LL at 3.3.

Both scenarios were premised on a plan to air-dry the copper sulfate on-site after the crystals had been washed (1986 Tr. 328). In response to a question from Judge Rampton as to the problem of winds in the area, Edmiston responded that "[w]e would have plastic barriers down low, but we would have to allow for movement of air on the top in order to dry down to a pentahydrate product, or to where we could bag it" (1986 Tr. 328-29). He admitted, however, that he had made no computations with respect to the length of time needed to air-dry three-quarter inch copper sulfate crystals. Id.

Jim Fretz, a financial analyst and mineral economist who participated in the PAH study then testified. He stated that he had taken the capital and operating expenses developed by Edmiston and other members of the study team and entered them into the cash flow model to obtain the economic analysis. As such, he was responsible for the on-site processing and off-site

18/ These NPS estimates, however, had been generated with respect to Fletcher's plan of production by means of in situ heap leaching with an aim towards the production of cementation copper as opposed to contestees' new plans for open-pit extraction and production of copper sulfate. See, e.g., Exh. 25 at 30 ("This is an extremely conservative estimate for an operation which proposes in-situ leaching with an on-site plant").

processing computer output. See Exh. KK at 11 and 12. He noted that the computer model automatically applied depreciation schedules, investment tax credits and depletion allowances (1986 Tr. 337-38).

In response to contestees' testimony and exhibits relating to development of the claims for copper sulfate production, the Government presented the testimony of Robert Shoemaker, an expert in metallurgy, who was also a former past president of the Society of Mining and Engineers of the American Institute of Mining and Metallurgy. Shoemaker noted that mineralogy is the study of minerals themselves and how they are associated with each other, while metallurgy is concerned with the extraction of a desired metal or mineral product from the ore and is, itself, dependent on the mineralogy of the particular ore in question. Thus, he stated, "[I]f the mineralogy does not permit the separation of the desired material, whether it be a concentrate or a pregnant solution containing the desired metal, then no type of metallurgy can correct that problem" (1986 Tr. 468). After first pointing out that the samples which were assayed had been crushed to a very fine rock and that any amenability to leaching which these samples showed would not necessarily apply to coarse rocks since the larger the ore particle the longer leaching takes (1986 Tr. 465-66, 474-75), and also noting that the assay reports were silent as to the nature of any gangue or waste minerals associated with the copper-bearing metals (1986 Tr. 469), Shoemaker concluded that there was simply insufficient testing to permit any economic predictions of success at the present time (1986 Tr. 471).

Shoemaker was also strongly critical of contestees' proposal to air-dry the copper sulfate crystals. Noting that the area is susceptible to strong winds, Shoemaker argued that the copper crystals would be contaminated by dirt and dust. Furthermore, he contended that exposure to the sun could turn copper sulfate pentahydrate white, whereas normally it is sold as a deep blue crystal (1986 Tr. 477). He stated that he knew of no producer who air-dried copper sulfate which, he testified, is normally heated with warm air in mechanical dryers to avoid the loss of the waters of hydration (1986 Tr. 479).

Shoemaker advanced numerous other criticisms of the PAH study. Thus, Shoemaker noted that Mountain States had predicted acid consumption to be 28 pounds per ton of ore, based on three test runs. See Exh. KK at 6.2. However, Shoemaker testified that, in his view, it would be virtually impossible to keep some of the offsetting dolomite formations from mixing with the ore. Since both calcium and magnesium carbonate are acid consumptive, this would dramatically increase net acid consumption (1986 Tr. 481). Shoemaker was similarly critical of the 80-percent recovery rate used as the base rate throughout the study, arguing that, in view of the limited studies actually performed, it was impossible to assume a recovery rate at that level (1986 Tr. 483).

Shoemaker also challenged the size and costs of contestees' leaching pad. First, he asserted that the proposed pad (600 by 1,000 feet) would be of insufficient size to hold the amount of ore presupposed in the report. See 1986 Tr. 497-99. Additionally, he noted that Edmiston had testified,

with reference to the leach pad designed for the 400,000-ton reserve scenario, that he had used a figure of \$1.80 per square foot in deriving the costs (see 1986 Tr. 312). Yet, a number of the case scenarios in the main PAH Report allocated only \$100,000 of the first year's capital costs for initial leach pad construction even though a pad of the size proposed (600' by 1,000') should, priced at \$1.80 per square foot, cost more than \$1 million. See Exh. KK, Table 9.1. Moreover, this \$100,000 figure was carried through in the annual operating costs, since the report recognized that it would be necessary to construct a new pad every year. See Exh. KK at 6.11. Thus, Shoemaker essentially argued, the costs associated with leach pad construction were severely understated both with respect to initial capital expenditures as well as annual operating costs. ^{19/}

Shoemaker also took issue with certain assumptions with respect to the amount of water which would be needed for leaching and other operations. He disagreed with the number and size of the ponds proposed, arguing that in his view at least six ponds were needed (1986 Tr. 514-15). Further, he contended that, in light of evaporation in the desert atmosphere, at least 25 truck loads of water per day would be needed as opposed to the two estimated in the report (1986 Tr. 521). He suggested that the cost of water would be approximately \$466,000 annually just for the heap leaching operation, far surpassing the \$40,000 per year budgeted for water for all purposes in the study (1986 Tr. 522).

In a similar vein, he criticized numerous facets of the cost computation as either too low or for failing to consider some cost factors at all. In the former category he included the staffing of the plant, which he deemed inadequate, and the amount of money allocated to environmental compliance. He estimated increased annual costs attributable to these items of \$150,000 and \$120,000, respectively (1986 Tr. 541-42, 560).

^{19/} In fact, a comparison of Table 6.2 of exhibit KK, which contains the capital cost estimates under various case scenarios involving production of either 10,000,000 or 20,000,000 pounds annually of copper sulfate, with Table 3.1 of exhibit LL, which posits annual production of 3,392,000 pounds of copper sulfate, shows a number of irreconcilable problems. Thus, exhibit LL estimates initial pad expenditures of \$176,000 for a pad of approximately 100,000 square feet, while exhibit KK has a whole range of initial pad costs running from \$88,000 (Case 9) to \$200,000 (Cases 4, 5, and 6) for a pad which is six times the size of that presupposed in exhibit LL. Indeed, even excluding those cases dealing with annual production of 20,000,000 pounds of copper sulfate for which pad costs are estimated to be \$200,000, the initial costs of pad construction set forth in exhibit LL, Table 9.1, varies from \$88,000 to \$133,000. Since initial pad costs do not include the costs of solution distribution piping and pumps, which theoretically might vary under each case scenario, it is difficult to see why these initial expenditures should vary among the differing case scenarios since each involves construction of the same size pad. Further confusion is added by the fact that, for every case scenario other than Cases 4, 5, and 6, the annual replacement costs for pads (a new one is scheduled to be constructed every year), which is carried as an operating expenditure, is \$80,000.

In the category of costs totally omitted he included a concrete pad for drying the crystals (1986 Tr. 536), the costs of paper bags which, given a production rate of 10 million pounds per year, he estimated would amount to \$58,000 (1986 Tr. 542-43), provision for a working capital fund (1986 Tr. 555-56), and the cost of preparation of a feasibility study (1986 Tr. 558). He also noted that since copper sulfate was largely used in the animal feed supplement market as a fungicide and an algicide, it was necessary for producers to obtain EPA registration, which could take up to 2 years, during which time contestees' market would be limited to plating and the copper flotation industry (1986 Tr. 547-48). Finally, he challenged the study's reliance on the price of copper sulfate as shown in the Chemical Marketing Reporter (Exh. MM), which was approximately 46 cents per pound, as the price which would be generally obtainable, noting that copper sulfate was widely discounted and was presently selling within the range of 30 to 35 cents per pound (1986 Tr. 553-54).

In concluding his direct testimony, Shoemaker characterized the PAH Report as "highly unprofessional" and stated that, in his opinion, "no prudent man would invest in a project of this sort on this analysis" (1986 Tr. 567).

The Government then recalled Oradei to testify concerning the PAH Report. Oradei also was highly critical of the report. After first describing a number of arithmetical errors appearing in various tables in the report (see 1986 Tr. 574-79), all of which had the effect of erroneously inflating DCFROR, he challenged the report's reliance on earlier NPS estimates of reclamation costs, pointing out that the NPS estimate had been directed to an in situ mining plan and not the open pit plan contemplated by the report. He noted that, elsewhere in Death Valley, reclamation costs associated with open pit operations were in the range of \$200,000 to \$500,000 (1986 Tr. 580-81). In any event, Oradei noted that merely correcting for the deficiencies outlined by Shoemaker would add annual costs of \$1,146,045 to the project, resulting in a negative cash flow even without correcting contestees' reclamation estimates or anything else (1986 Tr. 582). He also attacked the study's estimates of haulage costs as unrealistically low considering the nature of the haul required, arguing that 30 cents per ton/mile, rather than the 14 cents per ton/mile used, would be more realistic (1986 Tr. 588-90). He concluded that "[m]y professional opinion is that these reports would be dismissed out of hand by any competent engineer" (1986 Tr. 604).

Contestees commenced their cross-examination of the Government's witnesses with Shoemaker. 20/ Shoemaker reiterated his testimony that, in his experience, 15 percent is the minimum evaporation loss that can be expected in a heap leaching operation (1986 Tr. 721). He also stated

20/ Prior to the commencement of contestees' cross-examination of Shoemaker, the Government presented testimony from Mitcham challenging the location of the claim boundaries by McLain. See generally 1986 Tr. 679-707. In particular, Mitcham was critical of the plotting on the north end of the claim group, i.e., Copper Lode Nos. 5, 7, 8, and 9.

that he believed that the haulage costs were particularly out-of-line (1986 Tr. 747-48). At one point, in response to a question as to factors which he deemed unprofessional in the PAH Report, Shoemaker expanded on his criticisms:

A. [BY SHOEMAKER]: There was absolutely no back-up data given.

Q. [BY SMITH]: Okay. What are we -- when you say back-up data, what are we talking about?

A. Equipment lists, equipment sizes, both mobile and process equipment, power required by all of the equipment.

Q. Do you mean on a piece by piece basis or a total?

A. That's right.

Q. Okay.

A. Piece by piece and total.

Q. You say there was no total power indicated in the report?

A. I believe there was a power figure given. The total figure given for the generator. But if there was, there was no individual powers given for any individual motors.

There was no electrical single line diagram, which is necessary to determine the proper cost of the switch gear. There were no plans and sections, drawings which showed plans and sections of the buildings, the placement of equipment in the buildings, the type of buildings that were necessary to withstand high winds there are in the area. There was no general arrangement drawings. No plot plan -- no metallurgical calculations.

The report was based on inadequate sampling, and inadequate, completely inadequate metallurgical testing.

Q. All of which are considerations in pursuing the development, I would assume, of any mining operation?

A. They are necessary to even project a feasibility study.

Q. So what you are talking about are the types of items that you would normally expect to be contained in a professionally prepared feasibility study?

A. That is correct, engineering study, feasibility study.

(1986 Tr. 753-54).

Contestees also cross-examined Oradei as to the basis for his objections to the PAH Report. Oradei declared: "What I deem to be

unprofessional is that the report purports in the end to provide a determination of profitability, or at least economic indication of a mining project, but does not base that upon a specific mining project, or upon site specific knowledge of the project" (1986 Tr. 780).

In light of the substantial criticisms which had been leveled at the PAH Report, contestees recalled Edmiston. Initially, he noted that the PAH Report was not intended as a feasibility study but rather was merely an "order of magnitude" study, which is the lowest possible level of analysis of a project (1986 Tr. 911). He reviewed, in detail, a number of the criticisms which had been leveled at the report by Shoemaker and Oradei. He noted, for example, that correcting the computation mistakes identified by Oradei, would result in adding \$150,000 to capital costs in Case 2 and \$40,000 to the capital costs in the other case scenarios and an additional \$40,000 to operating costs in all of the case scenarios (1986 Tr. 917). He stated that he had recomputed the DCFROR for the base case and that these changes decreased the discounted cash flow by 1 percent and that, in his view, the accumulative effect of the errors would not significantly affect the economic viability of the project (1986 Tr. 918-19). Furthermore, he asserted that, even considering the other factors mentioned by Shoemaker and Oradei, "[t]he discounted cash flow is still a high enough number it would warrant continued examination of the property" (1986 Tr. 920).

With respect to the construction of the leach pads, Edmiston noted that they intended to utilize the mining of the deposit to construct the pad under a phased approach using the waste rock as fill in constructing the pads and utilizing mined-out areas for pad placement (1986 Tr. 928-29). He stated that, after each pad had been used for leaching, they would neutralize the acid and prepare the site for reclamation and move onto another pad (1986 Tr. 931-32). Noting that the pad size now envisioned (700,000+ square feet) was greater than that originally analyzed (600,000 square feet), Edmiston stated that they had recomputed the costs, in what he described as a sensitivity analysis, by adding 20 percent to the operating costs and, after accounting for all of the pad costs within the first 8 years of the life of the mine, ended up increasing annual operating costs for the initial 8 years by \$64,000 annually for a total \$144,000 per year. 21/

Edmiston also declared that the evaporation rate used in the study (7 percent) had been obtained from a sprinkling company and that their own survey had shown rates between 5 and 10 percent (1986 Tr. 921, 923-24). He also argued that, contrary to Shoemaker's assertions that three separated pads were necessary, the single pad approach envisioned in the study could work, explaining that "we feel the little bit of commingling of solution

21/ Edmiston did not, however, attempt to reconcile the original figures used for annual construction of a 600,000 square-foot pad (\$80,000) with the amount per square foot used to determine pad construction costs in exhibit LL. Application of the rate of expenditure assumed in exhibit LL would result in an annual expenditure of \$1,232,000 for a 600,000 square-foot pad. See note 19, supra and accompanying text.

from one pad to the next is going to be very minimal as far as affecting head grades coming out of this," arguing that "the capital savings more than offset that problem" (1986 Tr. 937).

With respect to a number of the items which Shoemaker and Oradei had identified as costs which were unaccounted for, Edmiston sought to justify their omission by arguing that the contestees had informed PAH that they had a "surplus" of equipment from other projects which they would utilize ^{22/} and, therefore, these items would not have to be purchased (1986 Tr. 939). Edmiston also stated that they had modified their sensitivity analysis to include the operating costs of a dryer (\$30,000 per year) and decided to allocate \$120,000 out of the contingency fund and unspecified plant savings for the capital costs related to obtaining the equipment (1986 Tr. 939-40).

Edmiston also reiterated his view that long haul costs (under the off-site processing scenario) would average approximately 14 cents per ton/mile, even though the figure the PAH Report used for the short haul on-site costs worked out to 64 cents per ton/mile. ^{See} 1986 Tr. 946; Exh. 39 at 8. Edmiston asserted that the long haul figure was based on an estimate from Brimhall Sand and Gravel (Brimhall) of 12 cents per ton/mile for hauling the ore and file reports indicating 8-1/2 cents per ton/mile in Arizona (1986 Tr. at 968). ^{23/} Edmiston also defended the report's

^{22/} These items were identified as "a 580 backhoe, a three-cubic-yard loader, three-ton forklift, 10-ton truck, two pickups, some water tanks and welders and miscellaneous tools" (1986 Tr. 939). The propriety of excluding such expenditures in determining the economic costs of production are examined infra in this decision.

^{23/} Edmiston conducted a lengthy attack on computations which Oradei had made with respect to road construction costs and his estimate of haulage costs, focussing particularly on the haulage costs of \$1.4897 per cubic yard/mile which, Edmiston asserted, Oradei had used in formulating his estimate. ^{See} 1986 Tr. 942-48. In this regard, it must be noted that the construction costs, themselves, were largely dependent on haulage costs since the cost of hauling fill was the largest single component of road construction costs and was estimated by Oradei to aggregate more than \$358,000, viz., slightly more than 77 percent of the total projected road construction costs. ^{See} Exh. 39 at 4. Edmiston actually admitted, however, that use of a 30-cents a ton/mile haulage cost figure, as had earlier been suggested by Oradei in his testimony (see 1986 Tr. 588-90), would result in total road construction costs very close to the price which contestees had been quoted by Brimhall, in effect acknowledging that Oradei's estimate of haulage costs of 30 cents a ton/mile was consistent with the haulage costs necessarily subsumed in the Brimhall road construction estimate. Thus, while Edmiston may have succeeded in raising substantial doubts as to Oradei's construction estimate (but see 1986 Tr. 1057 and Exh. 39 at 5), his testimony actually provided independent support for Oradei's assertion that haulage costs would aggregate 30 cents a ton/mile. Moreover, Edmiston's reliance on the Brimhall estimate as showing road construction costs was, itself, somewhat undercut by subsequent testimony

reliance on the price of copper sulfate as shown in the Chemical Marketing Reporter (46 cents per pound), arguing that he had obtained price quotations from various producers ranging from 40 to 48 cents per pound FOB (1986 Tr. 952-53).

Edmiston did, however, make various additions in the sensitivity analyses to account for some of the criticisms leveled against the PAH Report by Shoemaker and Oradei. Thus, he added \$120,000 to capital costs to cover permitting expenses, \$3,000 to operating costs to cover the cost of a \$500,000 reclamation bond, \$780,000 to cover 4 months working capital costs, \$150,000 for a future feasibility study, \$60,000 for additional miscellaneous, and \$50,000 for additional contingency (1986 Tr. 955-58). He later summarized the various changes as follows:

A. Let's see in the capital, added 120 thousand dollars of environmental. 150 thousand dollar feasibility study. Four months of working capital, which of course would vary within any particular case, but for the base case is right around 780 thousand dollars. 20 thousand dollars on the pads, and 50 thousand dollars contingency.

I think that that's the -- I'll stop there and add in the operating costs and tell you what package that represented when we talked about cash flows.

Of the operating costs, we increased the pad costs up to 144 thousand dollars a year for the first eight years. We added 30 thousand dollars in for a dryer. Three thousand dollars for the bond. 60 thousand dollars in miscellaneous.

Now that represented the group where we marked on Exhibit HH a discounted cash flow of 31.1 on the on-site, so that you can come back to the number.

Then we talked about another set that was on top of that where we added 20 percent more capital and 20 percent more operating on top of that number, for approximately an additional 1.1 million dollars of capital costs and approximately 500 thousand dollars of operating costs.

And then that had a discounted cash flow on the on-site case of 40 cents at 18 and-a-half. So you go back and tie that to that cash flow.

(1986 Tr. 1012-13).

fn. 23 (continued)

from Clary to the effect that, in obtaining this estimate from Brimhall, contestees had accessed the claim down what was referred to as the Lee's Camp road rather than the access road which contestees intended to use. See 1986 Tr. 873-76, 1019-21; Exh. KK at 5.3.

While essentially admitting that a number of the criticisms made by Shoemaker and Oradei were well-based, Edmiston defended the quality of the original PAH Report, noting that an order of magnitude study normally has a level of confidence of plus or minus 35 percent (1986 Tr. 982). Edmiston asserted that even after the sensitivity analysis had addressed all points raised by Shoemaker and Oradei which he deemed to be at least arguable, the base case scenario DCFROR remained positive. ^{24/} No costs, however, were allocated to the equipment which contestees already possessed and which they intended to use in developing the claims.

Edmiston also testified as to new computations which had been made with respect to the 400,000-ton reserve scenario. Edmiston stated that, while analysis of two amended cases had been commenced before the last hearing, it had not been completed. He noted that, with respect to capital costs, these amended cases had added costs of \$100,000 for a feasibility study, \$255,000 for four months working capital, \$120,000 in additional environmental costs, and \$20,000 additional in the water system. Insofar as operating costs were concerned, an additional \$24,000 was added to miscellaneous costs and an additional \$28,000 to water costs. With these additions, the DCFROR for 1986 at 45 cents per pound CuSO₄ was 10.4 percent and the DCFROR for 1976 was 37 percent (1986 Tr. 1017-18).

As the final two witnesses, the Government recalled Oradei and Shoemaker. Oradei discussed various problems with the proposed road construction relating to excessive grade (between 10 and 14 percent over half of a mile) as well as the unlikelihood that NPS would allow any widening of the existing road (1986 Tr. 1034-35). He also stated that, in his opinion, NPS would not permit the blocking of the road which would result from the proposed location of the leaching pads (1986 Tr. 1040). Shoemaker was equally critical of construction of the leach pads on fill, noting that he had never heard of a leach pad constructed on 65 feet of fill, as proposed, and that he did not believe the State of California, or any other state, would allow such an operation (1986 Tr. 1061-63). He declared that the pad construction plan "is so preliminary and it is based on so many assumptions, that I cannot see that it has any chance of success" (1986 Tr. 1069). He noted that, in his view, given the lack of information available with respect to the nature of the mineralization and its susceptibility to leaching operations, as well as the questionable assumptions of the PAH Report, "a prudent man would not spend any more money on this, or invest in a leaching operation of this size, even if it wasn't within a National Park boundary" (1986 Tr. 1076). With Shoemaker's testimony, the protracted hearings

^{24/} Originally, Edmiston stated that for the base case (3-40-A), which presupposed a selling price of 40 cents per pound and total reserves of 3,200,000 tons of 0.60-percent copper with an estimated recovery rate of 80 percent and with on-site milling, the DCFROR was 31.1 percent. At 46 cents per pound CuSO₄, the DCFROR was 41.1 percent. With respect to off-site processing, the DCFROR was 26.7 percent at 40 cents per pound CuSO₄, and 37.8 percent at 46 cents per pound CuSO₄ (1986 Tr. 960-62).

See Exh. HH. Subsequently, when these figures were further amended to account for an additional 20 percent for capital and operating costs, the DCFROR was 18.5 percent for the on-site base case scenario (1986 Tr. 1014).

came to a close. As might be expected, the parties subsequently submitted substantial briefs in support of their opposing views. 25/

In a lengthy and detailed decision, Judge Rampton exhaustively reviewed the evidence adduced at the various hearings. After briefly recounting the case's history prior to the remand, including this Board's determination in United States v. Feezor, supra, that "demonstrated" reserves could properly be included in determinations of a claim's validity, he initially turned to an examination of the question of the reserve base.

As Judge Rampton noted, there were essentially three separate estimates of "demonstrated" reserves. First, there was the 400,000-ton estimate which the Government conceded existed within the hilltop portion of Area A, which Mieritz' drilling program had clearly defined. Second, there was the 3.2 million-ton estimate made by Fletcher in 1978, which consisted of 2.48 million tons in Area A and 700,000 tons in Area B. 26/ And, third, there was the 11 to 12 million-ton estimate made by Slusher, a figure representing the approximately 75 percent of Slusher's total reserve estimate (15 to 16 million tons) which he had contended were properly classified as "demonstrated" reserves. Recognizing both that this last estimate was based on data which the Government strongly contested and, further, that all of the contestees' economic analyses were predicated on reserve figures of 3.2 million tons or less, Judge Rampton determined that it was unnecessary to ascertain the reliability of the Slusher estimate. Rather, he decided that the critical conflict which needed to be resolved was that between the Government estimate of 400,000 tons and Fletcher's estimate of 3.2 million tons (Decision at 12). Resolution of this conflict, Judge Rampton continued, was dependent upon volumetric determinations of the mineralized zone based on both surface and subsurface data and the projections which could properly be made therefrom. And it was on these latter points, Judge Rampton noted, that the parties took vastly differing views.

Starting with the base figure of 400,000 tons which all parties agreed had been delineated on the hilltop portion of Area A, Judge Rampton noted that the initial disagreement between Mieritz' interpretation, on the one hand, and that of the Government's mining engineer, O'Brien, on the other, related to the extent to which the results of the drilling program could

25/ In their opening brief before Judge Rampton, contestees admitted that the Copper Lode No. 9 was invalid. See Posthearing Opening Brief at 21. Thus, that claim is not involved herein.

26/ As Judge Rampton noted in his decision, Fletcher's original total reserve figure was 4.2 million tons. See Exh. I. This figure included, however, 1.03 million tons in Area C. Since the Board had already determined that the two claims which embraced Area C (Copper Lode Nos. 10 and 28) were null and void, Judge Rampton subtracted the tonnage allocated to that area in determining the total tonnage claimed by Fletcher. See Decision at 12 n.6.

be projected, with O'Brien challenging the Mieritz projections vertically beyond the bottom of the drill holes and laterally beyond the area actually drilled. O'Brien's disagreement became considerably stronger with respect to Fletcher's projection of a southeast extension of the values disclosed in the hilltop portion of Area A. Pointing out that contestees supported the validity of these projections not only with the drilling data obtained by Beard and Norandex but on the basis of its geologic mapping, Judge Rampton turned to the question of the validity of the geologic mapping (Exhs. BB and GG-1 to GG-5) upon which contestees placed so much weight.

While recognizing that the Government witnesses had criticized the mapping as failing to properly depict a number of faults in the area, Judge Rampton generally discounted the importance of this conflict since, in his view, volumetric calculations would not be significantly affected regardless of which view was adopted. Thus, Judge Rampton noted that, while Miller's testimony as to the existence of fault 3 had a "more intuitive appeal," the Government had failed to establish how its existence would ultimately affect reserve calculations (Decision at 19). Similarly, he noted that if, in fact, the Government was correct in its assertion that there was no fault where contestees had located fault 5, this would, paradoxically, actually expand the deposit east of the point at which contestees said it terminated (Decision at 21-22). 27/

Judge Rampton noted that Miller had criticized the subsurface mapping for its failure to accurately show the "pervasive yet mild" deformation throughout the area. He concluded, however, that there was no essential difference between the notation which Miller would have placed on exhibit GG-1 and the dashed lines and question marks which Clary and Slusher had used since "both impart a certain sense of uncertainty about the actual contact between the two beds, which uncertainty is not, a prima facie obstruction to the use of such projections in the calculation of 'indicated' reserves" (Decision at 25).

Judge Rampton adverted to the Government's criticism of the failure of contestees' geologic maps (Exhs. BB and FF) to display specific strike/dip

27/ Judge Rampton did recognize, however, that positioning fault 5 further east, as the Government contended it should be, would raise a challenge to contestees' assertion as to the existence of a zone 4A, since such a location of the fault would result in the exposure of a considerable section of host rock. Assuming the Government's location of the fault was correct, zone 4A should be found outcropping to the east of Area B. The Government's witness Miller argued, however, that there was no evidence of zone 4A east of Area B. Thus, acceptance of the Government's location for this fault would undermine contestees' assertion that zone 4A existed, as well as serve to raise doubts as to the correctness of contestees' continuous layer theory of mineral deposition. See Decision at 22-23.

symbols. While agreeing that this made comparisons with the Government's map (Exh. 35) more difficult, 28/ he noted that contestees did list numerical dip values for six locations in exhibit I (Decision at 29). Thus, he concluded that, while comparisons were more arduous, they were not impossible (Decision at 30).

Judge Rampton then turned to a review of what had been a central issue in earlier considerations of these claims, the relative location of the chip samples vis-a-vis the Mieritz drill holes. As noted above, Slusher, who had taken the chip samples while employed by OXY but who had not testified at the initial hearing, was present and did testify as to the taking of these samples.

In reviewing Slusher's testimony, Judge Rampton pointed out that Slusher expressly disclaimed any effort to relate individual chip samples to specific drill holes, since he was not interested in individual hole to sample comparisons. Instead, Slusher stated that he keyed his sampling to an aerial photograph and, therefore, "his entire grid pattern was strictly tied to field orientation based upon aerially visible features" (Decision at 32). Based on his recollection, Slusher testified that, with the exception of exhibit BB, all of the exhibits failed to correctly position the hilltop sample grid pattern with the topography. As Judge Rampton noted, Slusher asserted that he had re-created the position of the sample grid on exhibit BB, which, Slusher estimated, was accurate to within 10 feet of the original location of the sample sites (Decision at 32-33).

Having set forth the relevant testimony, Judge Rampton expressly found "Exhibit BB represents the best evidence of the location of the chip sample grid," and declared all prior overlays and positionings "superseded" thereby (Decision at 33). Inasmuch as all of the chip sample sites were shown by this exhibit to be within the known deposit delineated by the Mieritz drilling, Judge Rampton further found that "the concerns expressed by the Board are resolved in claimants' favor" (Decision at 33).

Judge Rampton then reviewed the testimony of contestees' experts (Slusher and Fletcher) that there was a demonstrable correlation between average value of the surface samples and the weighted average of the positive intercepts of the Mieritz drilling. 29/ As he related, "[I]t is the figures 0.563 percent (drill holes) and 0.5094 percent (chip samples) that Slusher asserts are 'basically equivalent' and validate the proposed procedure for using chip samples collected throughout another mineralized exposure as a substitute for drill hole techniques" (Decision at 34).

28/ Judge Rampton pointed out that the importance of the comparison of the various values lay in the Government's assertion "that claimants have used dip angles that are too steep in order to calculate thicker beds at depth, and to 'avoid' predicting mineralization within a barren drill hole (drilled by Mieritz) in Area B" (Decision at 29).

29/ The figures which Judge Rampton utilized were found in exhibits 7 and 8 which had been prepared by Mitcham. While exhibit 8 contained the

In its brief after the hearing, the Government had strenuously objected to the approach which Slusher and Fletcher had utilized (comparison of the average value of the chip samples and the drill hole results) to support their conclusion that the chip samples were favorably correlated to the drill hole results, arguing that "the similarity in the samplings resulted from the large number of samples averaged and from being partially coincidental" (Posthearing Response I at 6). Arguing that if, indeed, there was a correlation between surface sampling and the drill hole results through the entire length of the drill hole, such a correlation should be even more pronounced in the initial 10-foot interval of the drill holes, the Government submitted a "Data Comparison of Sampling in Grid Area" located in Area A, which compared the values derived from the first 10 feet of each drill hole with the nearest chip sample. Id. at 7-9. The Government argued that:

The highly variable results seen in the tabulation in comparing (1) grade of a chip sample to average grade of the nearest drill hole, (2) between the grade of a chip sample and the grade of the first 10 feet in that drill hole and (3) between the average grade of the drill hole and the first 10 feet is indicative of the lack of correlation between the surface sampling and the drill hole sampling.

Id. at 6.

Moreover, the Government challenged the entire theoretical basis for contestees' correlation argument, contending that "[a]verages, especially in low grade material, such as the mineralization on these claims, converge towards a sameness as more samples are included." Id. at 10. In fact, the Government suggested, contestees had based their original argument before the Board on the propriety of using geologic inference not on the comparisons of averages but rather on the comparison of individual or a limited number of samples. 30/ And, the Government further argued, even if one assumed that contestees had shown a correlation between the average surface sample in the grid area and the average drill hole results, use of such a correlation in other areas would, itself, be dependent upon the existence of surface sampling similar to the grid pattern followed by OXY so that a representative value could be obtained. Otherwise, the Government noted

fn. 29 (continued)

calculated average grade of virtually all of the chip samples, exhibit 7 utilized only the 39 drill holes above a cut-off grade of 0.19-percent copper.

30/ Support for this latter assertion can be gleaned from contestees' original pleading before the Board. Thus, in their initial statement of reasons for appeal, filed on June 19, 1979, contestees had argued that drill hole H-61 was located well to the north of the chip sample grid. See 1979 SOR at 18-19. The location of a single drill hole, however, would not have been of particular significance if, as is now contended, it is the average of the values which should be compared to determine whether a correlation exists. See also 1978 Tr. 192-93.

that "[a] correlation factor gained by comparing total averages of both surface sampling and drill hole results would be of little value in evaluating a few surface samples or inferring a mineral reserve." Id. at 11.

Judge Rampton adverted to these arguments in his decision. He rejected them, however, for a number of reasons. At the outset, he noted that, "presumably" the Government had utilized its own exhibits in determining what was the nearest drill hole to the various chip samples in order to derive the information shown on its "Data Comparison." Since he had already determined that exhibit BB was controlling, the Government's determination of which drill holes were nearest to specific chip samples was necessarily suspect. Further, he complained that the Government had provided no reason why the comparison of a 50-foot composite chip sample should be specifically comparable to either the average values obtained from a 30 to 80 foot drill hole some distance away or to the initial 10-foot interval of that drill hole. Finally, he argued that this was precisely the type of comparison (individual drill hole to individual chip sample) which both Slusher and Mitcham had criticized. See Decision at 35-36. 31/

The decision below also recognized that a number of the Government's witnesses, particularly Gould, had attacked the reliability of surface sampling because of the possibility that the effects of weathering could cause the surface outcrop to become "enriched" or, alternatively, "leached out," in effect creating surface "caps" which would not necessarily be indicative of values at depth. While admitting that this was certainly a possibility, Judge Rampton described this as "a working hypothesis which can be overcome by actual measurements" (Decision at 36). In this regard, he noted that while both Slusher and Clary had admitted that there were leached out areas on the claims, "the samples were taken from within the remaining 'positive' or 'enriched' (green) areas, not from within the leached out areas," and "that no leach 'cap' as envisioned by Gould, exists on top of these particular mineralized areas" (Decision at 37). 32/ Based on these assertions, Judge Rampton concluded:

It is found that claimants' evidence indicates that leach cap concerns are of minor importance in this case. Further, it

31/ Judge Rampton also rejected the assertion that, even assuming the validity of the value-averaging approach advocated by contestees, it could only be applied to other areas in which surface sampling similar to that undertaken by OXY had occurred, characterizing this argument as "only a restatement of the issue" (Decision at 35).

32/ While, indeed, no leach cap may have been encountered, this does not necessarily establish the reliability of surface samples as an indicator of values at depth. Thus, contestees' experts admitted that leaching had, in fact, occurred (see, e.g., 1986 Tr. 135-36) and that they had conducted their surface sampling only from "enriched" areas in the host rock. It is difficult to see how an "enriched" area of the host rock should be less suspect than a leached-out area, particularly where there is no indication that the leached-out area was excluded from volumetric computations.

is found that each non-hilltop mineral exposure has been sampled a sufficient number of times at locations adequately spaced over the entire surface expanse to allow a valid surface average to be calculated. Thus, it is found that the data supporting each proposed projection of quality is valid (reasonable) and adequate in quantity.

(Decision at 37-38).

After briefly reviewing the relevancy of the Beard and Norandex drilling results, Judge Rampton turned to evaluating all of the evidence in the record with respect to geology and reserve estimates. Initially, he concluded:

Based upon their testimony and exhibits, it is found that claimants have established, by a preponderance of the evidence, that the rock within Copper Lode claims 1, 2, 3, 5, 7, 13, and 14 contains at least 3.2 million tons of "demonstrated" mineral reserves; subclassified into 400,000 tons of "measured" and at least 2.8 million tons of "indicated" reserves. It is found that claimants' "indicated" required calculations are computed partly from specific measurements and partly from valid projections, as the Government's witness, Gould, actually admitted.

(Decision at 40-41).

Continuing further, after expressly finding that "[t]he chip samples were taken from the mineralized zones, and enough samples were taken from all geographic points within each zone to allow a representative average of surface quality values to be calculated," Judge Rampton then held that:

It is found that claimants' proposed extensions of average surface assay values, as determined from Slusher's chip samples * * * and surface mapping data, down the dip of the mineralized zones, as a substitute for drilling, is reasonable and valid. Such projections are the type specifically envisioned in the definition of "indicated" reserves. This "quality" projection is validated by the comparison between the chip samples and Mieritz data upon the hilltop. It is found that the claimants have demonstrated, by a preponderance of the evidence, that it is reasonable to assume a total average surface assay value in any non-hilltop area will be "basically equivalent" to any total average which might be obtained from subsurface values in that area, based upon the known similarity of mineralization over the entire extent of the claims and the demonstrated equivalence of total surface and subsurface averages within the hilltop zone. Therefore, it is reasonable to project all surface "features," i.e., geometry and assay values to depth.

(Decision at 41).

However, with respect to the Copper Lode No. 8, Judge Rampton noted that

[b]ecause claimants have not shown that the Area C mineralization is of a quality to be above the cut-off grade, it is found that computations of reserves in Area C cannot be considered "indicated" and claim 8 is declared void for lack of an exposure of demonstrated valuable mineralization within its boundaries.

(Decision at 42). At this point, having determined the issues relating to reserve quantities generally in contestees' favor, he turned to an analysis of the economics of development as of 1986.

In his review of the evidentiary record as it related to the question of the economic feasibility of development, Judge Rampton emphasized a number of points. Thus, while he recognized that the PAH Report was only an order of magnitude study rather than a feasibility analysis, he noted that Edmiston had justified this by noting that its purpose was merely "to determine whether [claimants] should proceed to put more funds in to study the project" (Decision at 43). Generally agreeing with contestees' argument on this point, Judge Rampton concluded that while there may be a succession of analyses from order of magnitude to prefeasibility, to feasibility, to basic engineering, detailed engineering and construction, "[i]t is apparent that positive results from any such reexamination may cause a prudent person to expend further time and money in the expectation of developing a profitable mine" (Decision at 44 (emphasis in original)). Thus, the fact that the PAH Report was only an order of magnitude study did not adversely affect the weight which he accorded to it.

Judge Rampton recounted, in some detail, the various criticisms which both Shoemaker and Oradei had levelled at the report, including Oradei's objection that the NPS figures for reclamation which had been used in the report had been premised on in situ mining techniques rather than open pit mining and Shoemaker's critique of the sufficiency of the metallurgical tests conducted and estimates of water consumption likely to occur (Decision at 50-62). ^{33/} Turning to contestees' response to these charges, Judge Rampton pointed out that Edmiston had flatly disagreed with Shoemaker's estimate of water consumption and had further asserted, in response to Shoemaker's suggestion, that there was an insufficient area within the claim to construct the leach pads, that contestees would conduct their operations by using mined-out areas and waste rock (Decision at 62-63). ^{34/}

^{33/} Since this testimony has already been set forth earlier in this decision, it will not be repeated.

^{34/} The decision subsequently noted that, in rebuttal, Shoemaker had challenged this proposal, opining that the State of California would never agree to permit pad construction on fill because of erosive problems relating to precipitation events and that, even if it did permit such a pad, it would have to be built to structural specifications which would require nearly total compaction for which no costs had been allocated. See Decision at 66-67.

Judge Rampton also related Edmiston's testimony concerning alterations in the PAH Report which had been made to respond to certain of the criticisms which had been raised. Thus, he noted that Edmiston had added in the operational costs of a dryer, ^{35/} provided funding for a feasibility study as well as working capital, and made a number of other changes which Edmiston deemed warranted. As Judge Rampton related "[a]ltogether, in response to the NPS concerns, PAH added 1.12 million dollars to the original cost figures, and \$200,000 to the yearly operating cost figures" (Decision at 66).

Having reviewed the evidence as to profitability in 1986, Judge Rampton then proceeded to make certain findings. As an initial matter, he discussed the question as to the reliability of the PAH Report. In summarizing the views of Shoemaker and Oradei, he noted:

[I]n essence, the Government alleges that a discovery cannot be demonstrated by anything less than a study of the economics of a particular operation at a high enough level of accuracy to attract a "prudent" outside investor, presumably what claimants refer to as a "bankable" document or feasibility study. Presumably Oradei would accept nothing less than a full-fledged proposal of operations, sufficient to allow for a considered NPS ye or nay. [Footnote omitted.]

(Decision at 68-69). But, as Judge Rampton went on to note, even the Government's witnesses recognized that a prudent operator would continually analyze the economic viability of a project throughout development, concluding that "the Government witnesses admit that a prudent man may, in fact, invest in a project at an early stage, then later abandon the project if more detailed studies indicate the project has become non-economical" (Decision at 69). While recognizing that, based on the evidence adduced at the hearing, "no findings can be made that the claimants are assured of a successful operation," Judge Rampton pointed out that "the law does not require a guaranteed success to validate a mining claim[;] * * * the law requires only that the claimants would be prudent in expending time, money and effort with a reasonable expectation of success" (Decision at 70).

In determining whether or not the evidence was sufficient to establish the required showing, Judge Rampton noted that, even with all of the changes to the PAH Report which contestees had accepted and the inclusion of an additional 20 percent added to all costs, the DCFROR was positive, although he admitted that the error cushion was smaller than originally shown in the PAH Report. Id.

^{35/} Judge Rampton noted that Edmiston did not, however, earmark any capital expenditures for the purchase of a dryer (estimated to cost \$120,000) because, he suggested, this could be paid for from plant cost savings (Decision at 63). Actually, as noted above in the text, Edmiston had testified that the purchase prices were taken from some unspecified savings in the plant and from the contingency funds (1986 Tr. 940).

Judge Rampton recognized that the Governmental concerns expressed at the hearing were sufficient to indicate that on-site processing was probably impractical. However, he continued:

[S]uch concerns do not render on-site processing totally impossible. Nor do the stated concerns affect off-site processing locations at all, because those locations, though not currently secured, are much, much less rugged than the on-site topography (see Exh. 5A to 5H, O and K). Therefore, claimants' off-site processing plans may be very practicable, as originally noted by Gould (78 Tr. 91), and, in fact, could result in cost savings for pipelines, power lines and the like.

(Decision at 70).

Insofar as the access road was concerned, Judge Rampton generally rejected the Government's concerns as "too insubstantial to be given much weight," and, accordingly, accepted the price quotation provided by Brimhall as the most reasonable cost estimate (Decision at 71). Judge Rampton noted, however, that the information in the PAH Report might prove inadequate to meet Federal and State permitting requirements and that the development of additional information might, in fact, "cause the claimants to reevaluate the economics of working the deposit, and perhaps even abandon their plans." Nevertheless, he concluded:

It is found that the PAH report is competently prepared, based on adequate foundational data, and considers all appropriate factors related to a leaching operation. It is found that claimants have demonstrated, by a preponderance of the evidence, by virtue of the DCFROR results in Exhibit KK, as modified, that the prudent man would expend further time and money upon the Copper Lode deposit in the reasonable expectation of developing a profitable mine. It is therefore found that claimants have demonstrated the discovery of a valuable mineral deposit (of at least 3.2 million tons of copper ore) within the boundaries of claims 1, 2, 3, 5, 7, 13, and 14 at the time of the 1986 hearings.

Id.

Additionally, insofar as the analysis of the scaled-down mining of the 400,000-ton core deposit (see Exh. LL) was concerned, Judge Rampton also found that contestees had demonstrated a discovery of a valuable mineral deposit as of 1986 with respect to the mining of this limited deposit (Decision at 71-72).

Noting that the land embraced by the claims had been withdrawn from the operation of the mining laws in 1976, Judge Rampton next turned to an analysis of whether contestees had established that a discovery of a valuable mineral deposit existed as of that date. He noted that, in attempting to make such a showing, contestees had concentrated on showing that a discovery had existed with respect to the hilltop deposit, both by indexing backwards the costs of production and the estimated returns and by reaffirming the validity of Fletcher's original conclusions set forth in exhibit A.

With respect to the former approach, Judge Rampton noted:

Because Exhibit LL has been found to be valid with respect to profitability at the time of second hearing in 1986, and because the Government submitted no evidence contradicting the back indexing of 1985 costs to 1976 level * * *, it is found that the claimants have demonstrated, by a preponderance of the evidence, that the prudent man could reasonably have expected to develop a profitable heap leach operation upon the hilltop deposit in 1976. Claimants have, therefore, demonstrated that a discovery existed on September 28, 1976, with respect to the hilltop deposit (claims 1 and 2).

(Decision at 73).

Furthermore, assuming the existence of a 3.2 million ton reserve, Judge Rampton expressly held that exhibit A, the original Fletcher report, was, itself, sufficient to support a finding that the in situ mining plan originally proposed which had envisioned copper as the end product had a reasonable prospect of success and, "in the absence of any valid objections, will be sufficient to demonstrate a discovery." Id. at 73. He then proceeded to conduct an extensive analysis of Oradei's (and other Government witnesses') criticism of this report (see Decision at 74-79), ultimately, concluding that the contestees had preponderated on the question of whether or not there was a reasonable prospect of success in developing a paying mine under the in situ mining plan aimed at production of copper (Decision at 79).

Finally, having determined that the claimants had shown that a discovery existed within the Copper Lode Nos. 1, 2, 3, 5, 7, 13, and 14, Judge Rampton explored the issue of the proper boundaries of the claims. As he noted, this question chiefly concerned Copper Lode Nos. 5 and 7. He pointed out that the parties generally agreed as to the southern endline of Nos. 5 and 8, which two claims also shared a common sideline, with the Copper Lode No. 5 abutting the Copper Lode No. 8 to the west. The Copper Lode No. 7, located north of the Copper Lode No. 5, shared a common endline with that claim. The key point in controversy was the west sideline of both the Copper Lode Nos. 5 and 7. Depending upon whether the Government's or contestees' location of this sideline was utilized, an area allegedly containing approximately 37,000 tons of ore within Area B would be either excluded or included within the claim boundaries (Decision at 80-81).

Following a detailed review of the internal inconsistencies of the various maps submitted at the hearings, Judge Rampton concluded that the McLain location (Exh. CC) should be considered controlling since it was based on the discovery monument for the Copper Lode No. 9 (Decision at 86). In so doing, he rejected a map drawn by Mitcham (Exh. 36), which, he noted, would place the discovery monument for the Copper Lode No. 9 within the Copper Lode No. 8. 36/

36/ Judge Rampton had earlier rejected the Government's assertion that this discovery monument had been washed by floods from its original situs,

In his summation of the decision, Judge Rampton reiterated his conclusion that the claimants had demonstrated a discovery on the Copper Lode Nos. 1, 2, 3, 5, 7, 13, and 14, but had failed to make a similar showing with respect to claim 8 and had conceded the lack of discovery with respect to the Copper Lode No. 9. Subsidiary thereto, Judge Rampton noted that, independent of the foregoing analysis, the contestees had established that a discovery existed even if limited to the 400,000-ton deposit delineated on the Copper Lode Nos. 1 and 2 as of the date of the withdrawal and of the hearing. Accordingly, he declined to declare these claims null and void as requested by NPS. Finally, consistent with his analysis, he held that actual claim boundaries of Copper Lode Nos. 1, 2, 3, 13 and 14 were as they were agreed to by the parties, whereas the location of the Copper Lode Nos. 5 and 7 was as shown on exhibit CC. From these determinations, NPS has brought the instant appeal.

In its brief on appeal, NPS vigorously assails the entire thrust of Judge Rampton's analysis. While the substance of its concerns will be directly addressed below, they may be broadly encapsulized into four categories. Thus, NPS argues that Judge Rampton erred in permitting the expansion of the scope of the hearing to include the introduction of exhibits related to geologic mapping and consideration of open-pit mining and copper sulfate production, all of which, it is contended, were completely beyond the scope of this Board's initial remand. Second, NPS attacks Judge Rampton's conclusion that contestees had established a correlation between the OXY chip sampling data and the Mieritz drilling results in Area A and further contends that, even assuming arguendo that such a correlation was established for the hilltop area, there was clearly an insufficient evidentiary basis upon which to project these results southeasterly in Area A beyond the hilltop and anyplace in Area B. Third, NPS disagrees with Judge Rampton's economic analysis both with respect to 1986 and as of the withdrawal of the land from mineral entry (Sept. 28, 1976). Finally, NPS urges the Board to reject Judge Rampton's reliance on the McLain positioning of the claim boundaries, arguing that it is manifestly against the weight of the evidence. To the extent necessary to resolve the matters involved herein, we will consider these points seriatim.

[1] As an initial matter, we believe it fair to state that the hearing on remand far exceeded both in scope and duration anything which this Board contemplated when it originally remanded the matter to the Hearings Division. Our intent in referring the matter to the Hearings Division was simply to provide contestees with a further opportunity of establishing a correlation between the results shown in the surface sampling program and those obtained by the Mieritz drill holes such as would justify the use of geologic inference in areas beyond the 400,000-ton deposit clearly delineated on the hilltop area. We did not expect that contestees would develop and submit the extensive geologic mapping which was admitted into the 1986 hearings. And we certainly did not apprehend that contestees would attempt

fn. 36 (continued)

noting that "there was absolutely no testimony in the record to support such an assertion" (Decision at 83).

to revise both the mining method which they intended to pursue and the end product which they sought to market.

Nor do we think that there is much doubt that contestees attempted, successfully, to expand the hearing to encompass questions clearly beyond the scope intended by Judge Clarke when he recessed the hearing on June 6, 1985, for the expressed purpose of providing contestees with an opportunity to review the Government's economic analyses prior to cross-examining Oradei. ^{37/} Indeed, we believe that there is a substantial likelihood that Judge Clarke would have rejected contestees' attempts to alter its proposed development plans and to introduce newly developed evidence relating to geologic interpretations, and a further likelihood that this Board would have sustained his actions in doing so.

Be that as it may, however, the question before the Board is not whether contestees' proffer of evidence was properly rejected, the question is whether Judge Rampton abused his discretion in permitting the submission of the geologic interpretations and the economic analyses of open-pit mining and copper sulfate production. And, with respect to this question, the answer is clearly in the negative.

As we noted above, in our order of remand this Board expressly provided that "[t]he Administrative Law Judge shall have full authority * * * to determine * * * whether a discovery has been shown to exist within the limits of the various claims, both at the time of the withdrawal in 1976 and at the present time." This is merely consistent with a considerable body of precedents which recognize the broad authority bestowed upon an Administrative Law Judge in the conduct of a hearing. See, e.g., United States v. Pittsburgh Pacific Co., 68 IBLA 342, 345-47, 89 I.D. 586, 588-89 (1982); United States v. Taylor, 19 IBLA 9, 21-22, 82 I.D. 68, 72-73 (1975); United States v. King, A-30867 (Feb. 28, 1968). While such discretion is clearly circumscribed both by the mandates of law (see Sunshine Mining Co. v. State of Idaho, 114 IBLA 317 (1990)) and any express limitations which this Board has deemed appropriate to impose in referring the matter to the Hearings Division (see Tetlin Native Corp., 86 IBLA 325 (1985); Tanalian, Inc., 75 IBLA 316 (1983)), decisions of an Administrative Law Judge allowing

^{37/} Any review of the controversy which surrounded Oradei's economic analysis (Exhs. 25 and 26) shows that Judge Clarke's reference to the fact that "contestees may wish to call witnesses of their own concerning economic analysis," was merely recognition that, in their attempt to rebut Oradei's analysis, contestees would be allowed to present their own expert testimony. It would be feckless to suggest that Judge Clarke expected that at the reconvened hearing contestees would present a new plan for mining the property by open-pit methods aimed at copper sulphate production, which scenario, not coincidentally, would have the effect not of rebutting Oradei's testimony but rather of rendering his entire economic analysis irrelevant.

the introduction of evidence which he deems relevant and probative are generally left to his or her good judgment. ^{38/}

In any event, while counsel for the Government did strenuously object to the admission of the geologic interpretations and the new cost analyses relating to open-pit mining for copper sulfate production, counsel did not avail himself of the remedy of seeking an interlocutory appeal to this Board as provided by 43 CFR 4.28. See United States v. Pittsburgh Pacific Co., *supra*. Given the fact that all of the documents and testimony has now been received into evidence, this Board deems it appropriate to consider, as did Judge Rampton, the impact of this evidence on the questions pending before it.

However, before embarking upon what will prove to be an extended foray into the evidentiary record in order to resolve questions such as the efficacy of the OXY chip sampling program, the correctness of contestees' geologic analysis, and the determination of what values, if any, should be accorded to outcrops and deposits located in various parts of the claims, we believe it is useful to briefly outline the legal principles which will provide the framework for our review. Initially we note that, while it has long been recognized that a valid mining claim represents "property in the fullest sense of the word" (Forbes v. Gracey, 94 U.S. 762, 767 (1876)), it has also been repeatedly held that, for a mining claim to be "valid," it must, *inter alia*, be supported by the discovery of a valuable mineral deposit. See, e.g., Cameron v. United States, 252 U.S. 450, 459 (1920); Barrows v. Hickel, 447 F.2d 80, 82 (9th Cir. 1971).

[2] Traditionally, a discovery has been said to exist where the evidence is such that a prudent individual would be justified in the further expenditure of his labor and means with a reasonable prospect of success in developing a paying mine. Chrisman v. Miller, 197 U.S. 313 (1905); Castle v. Womble, 19 L.D. 455, 457 (1894). This "prudent man" test has been refined to require a showing that the mineral disclosed is "presently marketable at a profit," which simply means that the mining claimant "must show that as a present fact, considering historic price and cost factors and assuming that they will continue, there is a reasonable likelihood of success that a paying mine can be developed." In re Pacific Coast Molybdenum, 75 IBLA 16, 29, 90 I.D. 352, 360 (1983).

Determining that a prudent individual would be justified in attempting to develop a paying mine necessarily involves consideration of whether or not a mineral deposit has been exposed within the limits of a claim and, if

^{38/} Indeed, while the Board has occasionally reversed a determination of an Administrative Law Judge to exclude evidence (see, e.g., Midland Livestock Co., 10 IBLA 389, 401 n.7 (1973)), we have been unable to locate a single decision in which the Board has overruled the admission of evidence, except where the consideration of that evidence would violate specific rules of evidence deemed applicable to administrative proceedings, as in Holland Livestock Ranch, 52 IBLA 326, 351-58, 88 I.D. 275, 289-92 (1981).

so, whether the evidence is such that an individual would be justified in concluding that the mineral exposed exists in sufficient quantity and quality so as to make expectations of its profitable extraction reasonable under the facts of record. See, e.g., Chrisman v. Miller, *supra* at 322; Thomas v. Morton, 408 F. Supp. 1361, 1371-72 (D. Ariz. 1976), *aff'd*, 552 F.2d 871 (9th Cir. 1977); Converse v. Udall, 399 F.2d 616, 620-21 (9th Cir. 1968), *cert. denied*, 393 U.S. 1025 (1969). Moreover, where the land embraced by a mining claim has been withdrawn from location and entry under the mining laws, as in the instant case, the evidence must show that a discovery existed both at the time of the withdrawal and at the present time. Cameron v. United States, *supra*; Clear Gravel Enterprises v. Keil, 505 F.2d 180 (9th Cir. 1974).

[3] The sine qua non of a discovery of a valuable mineral deposit is, of course, the exposure of a mineral deposit. See generally United States v. White, 118 IBLA 266, 98 I.D. 129 (1991). Once an exposure of a mineral deposit within the limits of a mining claim has been shown to exist, and demonstrated values have been high and relatively consistent, geologic inference may be used to show continuity of values beyond the area of the physical exposure and establish that the exposed mineral deposit is "valuable" within the meaning of the mining laws. See United States v. Whittaker, 95 IBLA 271, 282 (1987); United States v. Feezor, *supra* at 79, 90 I.D. at 274-75. As will be seen, resolution of the instant appeal turns on the determination of whether or not values have been shown to be both high and relatively consistent and, if so, to what extent reasonable inferences based on the geology of the area support the extension of mineralization beyond the actual exposures.

We turn now to the question which was the original causative factor in leading this Board to remand this matter for further evidence, viz., is there a correlation between the OXY chip sampling and the results obtained by the Mieritz drilling program and, if so, to what extent, if any, does this correlation permit conclusions to be drawn as to the existence of reserves in areas which were not the subject of drilling but on which certain positive surface sampling results have been obtained? In order to even approach this question, however, it is necessary, as Judge Rampton recognized, to first determine the relative location of the OXY chip samples vis-à-vis the Mieritz drill holes.

As our earlier recitation of the factual background of this appeal indicates, while the position of the various chip samples relative to each other and the relationship of the Mieritz drill holes to each other had not, at least until the 1986 hearings, generally been in dispute (see United States v. Feezor, *supra* at 87-90, 90 I.D. at 280-81), determination of the physical correlation of the chip samples to the drill holes as well as location of both of these sampling programs within individual claim boundaries has proved to be a more problematic exercise. Leaving aside for the moment any attempt to correlate the sampling results to individual

claims, 39/ we will first focus on the question of whether or not it is possible, on the basis of the evidentiary record developed at the various hearings, to establish the location of both the OXY chip samples and the Mieritz drill holes as they relate to topographic features in evidence in the area. If both can, indeed, be so located they can also, necessarily, be positioned in relationship to each other.

Insofar as the correlation of the Mieritz drill holes to each other is concerned, we think it obvious that the Mieritz map (see Exh. 2, Map No. 5) would generally be accorded controlling weight in the absence of any evidence that it did not correctly depict the relationship of the various drill holes to one another. In point of fact, contestees' witness Harvey Smith testified that he surveyed some of the Mieritz drill holes in the field and then drew them onto a map (Exh. P-2) which, when compared to the Mieritz map (Exh. Q), showed that the drill holes which he had recovered during his survey and the drill holes as shown on the Mieritz map were "all in the same relative position" (1985 Tr. 27). The Government's witness, William Oates, testified that its map of the Mieritz drill-hole pattern (Exh. 20) correlated closely to contestees' exhibit P-2 (1985 Tr. 65). Significantly, since exhibit Q and Map No. 5 of exhibit 2 both show the location of roads in relation to the drill holes, and Map No. 5 does, itself, contain topographic elevations, it is possible to arrive at a location of the drill holes based on existing topography and other surface features. Based on all of the testimony provided on this question, we conclude that the location of the Mieritz drill holes is best shown on exhibit Q. 40/

Turning to the question of the location of the OXY chip samples, as we noted in our decision on the petition for reconsideration, the OXY maps

39/ In retrospect, given the fact that the outer boundaries of the claims are still the subject of substantial controversy, it seems clear that any attempt to correlate either the drill holes or the OXY chip samples on the basis of their relationship to specific claims as these claims were shown on various maps must fail. The present disagreements merely underline the inability of determining what claim boundaries were used by those individuals who drew the earlier maps. To the extent that the boundaries are themselves under dispute, they cannot serve as a reliable baseline for determining the relationship of the drill holes and the chip samples. Moreover, ultimate resolution of the claims' boundaries would not affect this problem since the critical question would be not what are the boundaries of the claims but, rather, what did the drafters of the various maps think the boundaries of the claims were when they prepared the maps.

40/ We have determined to rely on exhibit Q for the placement of the Mieritz drill holes even though we recognize that subsequent testimony in the 1985 hearings indicated that there was not a complete correlation between the relative placement of the drill holes as shown on Map 5 of exhibit 2 and exhibit Q. See generally 1985 Tr. 161-70. While virtually nothing in this record can be said to be totally free from doubt, we believe that exhibit Q does provide the best depiction of the location of the Mieritz drill holes since it is premised on an actual survey in the field, though admittedly all of the holes were not recovered.

failed to show any topographic relief. See Exh. C and Subexh. 6 of Exh. 4. Nor did they indicate the relative location of any other physical feature, such as the roads which traverse the area, which might otherwise provide a basis for orienting the samples to the topographic maps. Thus, all attempts to relate these samples to topography were, at least until Slusher testified, highly speculative. Indeed, while Smith had depicted the situs of the chip samples on exhibit P-3 based on information provided to Fletcher by the OXY engineers and geologists that chip samples 50, 51, and 70 had been taken along the "upper" road (1985 Tr. 51), even he subsequently admitted that, insofar as the grid pattern was concerned, he would not want to stake very much reputation on its placement (1985 Tr. 254).

In this regard, the testimony of Slusher was important as it represented the only direct, non-hearsay account of the OXY chip sampling program such as would permit positioning of the samples based on the topography of the hilltop. 41/ Not only did Slusher claim that exhibit BB correctly positioned the chip samples in relation to physical features, he flatly asserted that none of the other maps (presumably including contestees' exhibit P-3) correctly noted the location of the OXY sampling. See 1986 Tr. 125. Judge Rampton, for his part, accepted this testimony and accordingly found that exhibit BB superceded all other mappings of the sites. NPS strongly assails this finding and, we believe, further analysis casts considerable doubt on the reliability of Slusher's reconstruction of the OXY sampling pattern.

As depicted on exhibit BB, 42/ Slusher's positioning of the chip sample sites contradicts not only the Fletcher/Smith locations, as shown

41/ By contrast, while Fletcher testified that he visited the area immediately after the OXY chip sampling and was shown the sampling sites by the OXY geologists and was further informed that, except for the sampling along the "upper" or south road, the grid had been laid out on a true North-South axis (1985 Tr. 228-30), this was classic hearsay since it was offered for the truth of the matters therein asserted and, as such, while admissible in the hearing (see Holland Livestock Ranch, supra at 290), would have limited weight in determining the situs of the individual chip samples. While he could offer direct testimony as to those sampling areas he had actually viewed and did testify that the map which he and Smith prepared (Exh. P-3) was based on his recollection of these matters as well as existing bulldozed areas still visible on the upper road (1985 Tr. 207), he would be unable to provide direct testimony as to the location of the grid over the hilltop area. Moreover, his placement of the grid would have necessarily been premised on the OXY maps which, Slusher subsequently asserted, inaccurately depicted the grid's relationship to the area's topography (1986 Tr. 125).

42/ We note, parenthetically, that while Judge Rampton declared exhibit BB to represent "the best evidence of the location of the chip sample grid," the fact of the matter is that given the small scale of that exhibit and the fact that none of the chip samples or drill hole samples are identified by number thereon, any analysis of the relationship of the chip samples to the drill holes is possible only after a lengthy and laborious examination of

on exhibit P-3, but significantly alters the relative relationship of the samples to each other as shown on the OXY sampling map, itself. See Exh. C and Subexh. 6 of Exh. 4. Thus, the original OXY maps show two lines of chip samples, designated as samples 34 to 36 and 37 to 39, respectively, which run in an east/west direction, as being crossed or intersected by four lines of samples running in a north/south direction. Paradoxically, the two east/west lines of samples both assayed at far below the cut-off point (0.200 percent) 43/ yet all but one of the north/south lines of samples which crossed or intersected the east/west line show values above the cut-off point, in many cases, substantially so. 44/ In exhibit BB, however, these two east/west lines of samples are not intersected by any of the north/south lines, which now terminate either at the line formed by samples 27 to 33 or 50 feet south of this line. In effect, the four north/south lines have been moved 100 feet north of where they are shown on the OXY map. This has the result of erasing the obvious contradiction between north/south lines showing high values while the crossing east/west lines show waste. But, while this reestablishes a measure of consistency in the south part of the grid, this is achieved only by creating significant alterations throughout the entire grid system.

Slusher had premised his criticism of the OXY map on his recollection that he had constructed the grid pattern on the basis of the samples taken along the road. 45/ See, e.g., 1986 Tr. 125, 151-55. Indeed, he expressly testified that the north/south lines did not cross the road (1986 Tr. 155). In order to fit both this parameter as well as Slusher's recollection of the 69 and 70 sample line, exhibit BB depicts a sampling pattern at significant odds with the one previously examined by this Board and analyzed by both parties' experts.

To take but a few examples, in the south area of the grid, the OXY map showed sample 22 bracketed by sample 77 to the west and sample 84 to the east. In exhibit BB, sample 22 is now bracketed by sample 76 to the west and sample 86 to the east. Furthermore, not only are the two sample lines 34 to 36 and 37 to 39 almost 150 feet from the grid rather than being intersected by the north/south grid lines, but the four lines of north/south samples which are shown as intersecting these east/west lines on the OXY maps no longer all terminate at the same line. Rather two of them (the 75

fn. 42 (continued)

the exhibit. Moreover, while Judge Rampton asserted that "[t]he actual configuration * * * of the hilltop sample grid has never been in dispute" (Decision at 32), in point of fact, the grid pattern rendered on exhibit BB differs in significant ways from all previous depictions of the OXY sampling program, including that contained in the OXY maps, as we explain below.

43/ Thus, sample sites 34 to 36 average 0.002-percent copper while sample sites 37 to 39 averaged none.

44/ These sample sites were 75-76, 86-87, 88-89, and 100-101. These surface sampling sites average 1.320, 0.238, 0.343, and 0.625 percent, respectively. Sample site 100 was the only one of these to be below the cut-off point.

45/ This is the line of sample sites designated Nos. 44 through 55.

to 80 and the 81 to 87 lines) extend 50 feet further south than the other two lines. ^{46/} Moreover, it also seems clear that all of the east/west sample lines on exhibit BB are shown to be approximately 50 feet further south in relationship to the road than on the Fletcher/Smith maps and, in fact, closely approximate the east/west lines (in relationship to the road) as shown on NPS exhibit 21. Compare Exh. BB with Exhs. P-3 and 21.

Notwithstanding the foregoing discrepancies, Judge Rampton found that exhibit BB superceded all other maps. In this regard, however, we note that the variations between exhibit BB and the other maps would not likely have been viewed as particularly significant by Judge Rampton since he accepted Slusher's theory that it was the relationship of the average of the chip samples to the average of the drill hole samples which was important in determining the reliability of projections based solely on chip sampling. We review this contention in detail below. For our present purposes, we will accept, with some misgivings, the grid as shown on exhibit BB as representing the actual grid pattern of the OXY samples since we must agree with Judge Rampton that, on this question at least, Slusher was clearly in the best position to testify as to the situs of those samples.

As we have noted a number of times, at the remanded hearing the contestees took the view that it was not the specific relationships of chip samples to drill holes which were important but the fact that the average of the chip samples closely approximated the average of the drill hole samples on the hilltop area which was critical in establishing the reliability of the surface chip samples to determine value at depth. This was, however, most decidedly not the basis upon which the Board had remanded the case for a further hearing. ^{47/} On the contrary, this Board clearly directed its attention to the relationship of specific drill holes to specific chip samples and it was its ultimate inability to establish a

^{46/} The reason this is so is unclear. The north/south lines are numbered boustrophedonically from west to east. Using the road as a base, sample line 71 to 74 proceeds southward approximately 200 feet. For some unexplained reason, however, according to exhibit BB sample line 75 does not start due east of the termination of sample 74, but rather commences 50 feet east and 50 feet south of that point. Sample line 81 to 87 runs from the road to an ending point due east of the end point of sample 75, but sample 88 commences 50 feet east and 50 feet north of that point. While use of a road as a base point would explain the lack of parallel ending points in the north part of the grid, no similar justification would explain the absence of parallelism at the south end of the grid. There appears to be no topographic or other reason for this pattern and its only justification seems to reside in a desire not to contradict Slusher's recollection that the north/south lines of samples did not cross the road. Moreover, the new placement of sample lines 34 to 36 and 37 to 39, virtually outside the grid pattern, cannot be explained either by topography or anything else.

^{47/} Nor can it be said that contestees' present position is completely consistent with past arguments which they have made on this question. See note 30, supra.

common ground for correlating the OXY chip sample map with the Mieritz drill hole map which ultimately prevented the Board from deciding this appeal in 1984. Thus, our decision on reconsideration expressly noted that "the focus of the hearing will be the attempted correlation of surface sampling sites and drill holes in Area A." 81 IBLA at 99. And it is obvious that, if the Board had contemplated that the correlation between the drill holes and surface sampling would consist merely of a comparison of averages, no remand would have been needed since the averages were already available.

We are thus faced with a situation in which not only did the scope of the hearing on remand far transcend anything which this Board expected when a further hearing was ordered, but the very ratio decidendi for ordering the hearing was rejected by the contestees and ignored by the Administrative Law Judge. We have, accordingly, reviewed de novo the record as it relates to comparisons of specific drill hole and chip sample sites.

While there are admittedly a number of areas in which the surface sampling corresponds to the drill hole results, there are also a number of areas in which no such correlation can be seen. Thus, four grid squares in the northern part of the grid 48/ show an average sample value of 0.153-percent copper, below the 0.200-percent cut-off grade. Indeed, of the 12 samples which circumscribe this area, only 3 are individually above the cut-off grade. 49/ Yet the fact of the matter is that this block of samples is located in the center of the area of high values as delineated by the Mieritz drill holes. On the other hand, while Mieritz drill hole 50 averaged only 0.100 percent through its 40-foot depth, chip sample 101, immediately east of this drill hole, assayed at 1.239-percent copper. Any analysis of the grid pattern disclosed on exhibit BB must ineluctably lead to the conclusion that no reliance can be placed on individual samples as a clear predictor of value at depth.

Contestees, however, have expressly eschewed reliance on any individual sample to individual drill hole relationship. Rather, they now argue that it is the comparison of the average of the chip samples to the average of the drill hole results which establishes the correlation upon which they seek to rely as a predictor of values beyond the hilltop area. See, e.g., 1986 Tr. 156-57, 183-85. Thus, they contend that if a correlation can be shown between the average surface value and the average drill hole value within the hilltop area, surface samples taken in other geologically similar areas should be sufficient, by themselves, to serve as a forecaster of values which would be encountered at depth. This theorization, of course, requires the establishment of two separate predicates. First, there must

48/ Each of these squares are bracketed by a set of four chip samples. The four squares mentioned in the text are those formed by chip samples 58, 60, 93, and 97, chip samples 52, 61, 81, and 93, chip samples 40, 58, 92, and 98, and chip samples 41, 57, 82, and 92.

49/ These are samples 41, 57, and 61, which show values of 0.485 percent, 0.409 percent, and 0.365 percent, respectively.

be shown to be surface/subsurface correlation in values. Second, it must be established that the areas are, in fact, geologically similar.

Not only does NPS challenge both of these predicates, it more fundamentally assails the utility of the underlying theory. Thus, it argues that, for purposes of statistical analysis, the averaging of values over a wide area ultimately results in the derivation of meaningless figures. NPS notes that the drill holes themselves did not all penetrate to the same depth and asserts that those that went beyond 40 feet exhibited a marked decrease in favorable showings 50/ (SOR at 25-26). Noting this, NPS asserts that the combination of shallow drill holes with deeper drill holes distorted the average value derived for the Mieritz drilling. 51/

In our view, however, the statistical comparison utilized by Judge Rampton suffers from an even more fundamental flaw. As noted above, Judge Rampton accepted Slusher's comparison of the results of exhibit 7 (which posited an average drill hole value of 0.563-percent copper) with those of exhibit 8 (which derived an average chip sample value of 0.5094-percent copper) as support for the proposition that the results of the sampling program were "basically equivalent" (Decision at 34). The problem, however, is that, while Slusher and Judge Rampton purported to compare the average value of the drill hole samples with the average value of the chip samples on the hilltop area, what they actually compared was the average value of all of the chip samples on the hilltop area with the average value of the favorable drill hole results on the hilltop. As any analysis of exhibit 7 makes abundantly clear, not only was that exhibit limited only to favorable drill holes, it was further limited to only those intervals in favorable drill holes as were vertically above intervals below the cut-off grade.

Thus, for example, exhibit 7 shows a 50-foot intercept for drill hole 1, even though that hole went a distance of 80 feet, and a 30-foot intercept for drill hole 14, even though that hole was drilled to a depth of 100 feet. Similarly, exhibit 7 omitted various drill holes on the hilltop area but which had unfavorable showings. 52/ A number of these were, in fact, clearly within areas in which chip samples were taken, such as drill holes 17, 21, 25, and 50. On the other hand, the only chip samples which were excluded from exhibit 8 were those taken west of the road (9, 10, 26, and 27), three chip samples taken along the lower road (64, 65, and 66),

50/ There are a total of 51 drill holes in Area A which went to a depth of 40 or more feet. The average 10-foot interval value for 30 feet and below is 0.350-percent copper. The average 10-foot interval value for 40 feet and below is 0.315-percent copper.

51/ In this regard, we note that the average 10-foot interval value for those drill holes which did not penetrate beyond 40 feet was 0.355-percent copper.

52/ The following Mieritz drill holes were completely omitted: 16, 17, 17A, 18, 18A, 21, 22, 23, 25, 26, 26A, 33, 34, 35, 36, 37, 38, 39, 50, 51, 52, 53, 56, and 61.

and two chip samples (67 and 68) taken even further north. 53/ Since the average derived for the chip samples, unlike the drill hole results, included both positive and negative samples, the fact that the average value of the surface samples might be said to correlate to the average value of only the good drill hole results actually would indicate that surface sampling derives results which are higher than those disclosed by drilling. An analysis of the data developed from both the Mieritz drilling and the OXY chip sampling program shows precisely this relationship.

To compute the values shown on exhibit 7, each individual drill hole well was first divided into 10-foot intercepts and only those 10-foot segments which were above the cut-off point were included in calculating average grade. 54/ The average grade of each segment was then multiplied by the number of feet in those intercepts which had been used to ascertain the average grade, deriving a figure denominated as "Intercept x Grade." To ascertain the average copper content for the deposit, the "Intercept x Grade" figure for each of the 39 holes was added together and this sum was divided by a figure (1910) which represented the total length of 10-foot intercepts being analyzed. The end result of the computation was the derivation of an average of 0.563-percent copper which, as noted above, was deemed to be "basically equivalent" with the figure of 0.5094-percent copper derived from the surface sampling of the hilltop.

However, if one computes an average grade for all of the relevant drill holes and compares that figure to the average grade of all the relevant surface samples, there is no equivalency. 55/ Thus, the average grade per drill hole, with each drill hole being treated as a single unit regardless of depth, is 0.383-percent copper. The average grade for comparable surface samples is 0.543-percent copper. Far from deriving equivalent values, the average value of the surface samples is more than 41 percent higher than the average value disclosed by each drill hole. And, if each individual 10-foot intercept of all of these drill holes is used to calculate the average

53/ It should also be noted that no chip samples were taken for numbers 8, 11, 25, and 28, presumably because these would have been on the road base.

54/ Admittedly, exhibit 7, even as amended at the initial hearing (see 1978 Tr. 163-65), excluded two drill holes (Nos. 17 and 33) which should have been included since the average grade of both holes was above 0.200-percent copper. This appears to have been in error. Their inclusion, however, would have resulted in a lower total grade for the deposit since the average value of the positive 10-foot intercepts of these two holes was 0.290-percent copper, only slightly more than half the value derived from the other drill hole segments utilized in exhibit 7.

55/ In making these calculations, those drill holes and surface samples which were clearly off the hilltop area have been excluded. With respect to the Mieritz sampling, we have excluded drill holes 35, 36, 37, 38, and 39. Insofar as the OXY surface sampling program is concerned, we have omitted, in addition to those sites excluded from exhibit 8 (i.e. 9, 10, 26, 27, 64, 65, 66, 67, and 68), sample sites 34, 35, 36, 37, 38, and 39, since, as depicted on exhibit BB, these sites are no longer within the hilltop area.

grade, the result is even lower, 0.375-percent copper, 56/ which makes the disparity in values even greater, approaching 45 percent. These values are clearly not basically equivalent. We must conclude from our de novo review of the evidence that contestees have simply failed to establish a basis for any reliance upon surface sampling, by itself, as a predictor of values at depth.

To the extent, therefore, that contestees relied upon the "basically equivalent" results of the OXY chip samples and Mieritz drill holes as justification for a straight projection of surface values to depth, the foregoing analysis fatally undermines the essential premise of their theory. However, we note that Slusher has also testified that one purpose of establishing the grid sampling pattern over the hilltop area was to derive a "correction" factor which would be used in analyzing surface sample results in other areas. See 1986 Tr. 124. No correction factor was used because of the presumed "basically equivalent" nature of the surface and subsurface averages. The figures derived above indicate that, assuming that a correlation could be established between surface and subsurface values, 57/ a correction factor of 30 percent should be applied to the chip sample results (see note 66, infra). Application of such a correction factor would, as indicated below, have a significant effect on the interpretation of surface sampling results in areas outside of the Area A hilltop.

Contestees, however, also suggest that the geologic mapping which they submitted at the hearing on remand may, itself, be sufficient to establish values at depth and that, since surface sampling has shown some indications of value, i.e., an exposure, these indications coupled with the geologic mapping are sufficient to show the existence of ore bodies beyond the areas delineated by the Mieritz drilling program. NPS, for its part, vigorously assails both the details of the geologic mapping submitted by contestees as well as its efficacy as a predictor of values beyond the hilltop area. It is to these questions which we now turn.

56/ This figure may be derived by first calculating the "Intercept x Grade" value of both those drill holes (other than 35, 36, 37, 38, and 39) excluded from exhibit 7, as well as the omitted segments of drill holes which were included. This figure (125.9) is then added to the total "Intercept x Grade" value shown on the exhibit (1075.41) to derive a new total of 1,201.31. Since 129 10-foot segments are being included in this calculation, a total of 1,290 is next added to the "Intercept in Feet" figure (1,910), resulting in a total of 3,200. This latter figure is then divided into the new "Intercept x Grade" total to arrive at an average 10-foot interval value of 0.375-percent copper.

57/ Application of any correction factor, of course, would be dependent upon a showing that the surface and subsurface values were, in fact, in a complementary relationship. In other words, the fact that surface values in the hilltop area assayed approximately 40 percent higher than the values at depth is of no utility in projecting values at depth in other areas unless it is also established that this relationship, itself, is derived from the nature of the deposit and not from accidental factors.

Contestees base the primary thrust of their argument on the assertion that the sedimentary deposition evidenced in the area, which contestees contend was laid down in a large marine basin (1986 Tr. 397), would result in initial continuous horizontal beds subject to subsequent deformation by faulting and erosion. Noting that the sedimentary copper which is found within the host rock would have been subject to the same principles (1986 Tr. 400-401), contestees argue that there is a geologic basis for assuming continuity in mineralization over a wide geographic area.

While not disputing the sedimentary nature of the deposition, NPS' experts disagree with contestees' assertion that the deposition was similar to a large marine basin, contending instead that bed 3 (the host rock) clearly showed signs that it was deposited in "moving waters" and that the suggested environment was more akin "to a tidal flat" (1986 Tr. 641-45). The importance of this assertion is that if the mineralization was also laid down by moving waters, its lateral continuity would be compromised. Thus, the Government's witness Miller noted that "while you can map layer three as a continuous unit, you cannot follow an individual bed very far" (1986 Tr. 642). It was clearly the view of the NPS witnesses that the mineralization was, in fact, spotty and sporadic within bed 3. See, e.g., 1986 Tr. 653, 657, 674.

In his decision, Judge Rampton essentially agreed with contestees' interpretation of the geology and mode of deposition. Thus, he expressly held that:

It is found that the claimants have demonstrated, by a preponderance of the evidence, that it is reasonable to assume a total average surface assay value in any non-hilltop area will be "basically equivalent" to any total average which might be obtained from subsurface values in that area, based upon the known similarity of mineralization over the entire extent of the claims and the demonstrated equivalence of total surface and subsurface averages within the hilltop zone. Therefore, it is reasonable to project all surface "features," i.e., geometry and assay values to depth.

(Decision at 41). This conclusion explicitly assumes that the principle of lateral continuity applies to the mineralization and necessarily represents a rejection of the geological interpretations posited by NPS' witnesses.

[4] On appeal to this Board, NPS vigorously challenges this factual finding, contending that it, as well as other findings adverse to NPS' position, was the result of a misapplication of the burden of proof which required NPS to affirmatively establish error in contestees' assertions rather than requiring contestees to affirmatively establish the correctness of their own assertions. See SOR at 7, 17-29. While it is, of course, axiomatic that, once the Government establishes a prima facie case as to a claim's invalidity, the burden of preponderation devolves on the claimant (see, e.g., Lara v. Secretary of the Interior, 820 F.2d 1535, 1540 (9th Cir. 1987); United States v. Springer, 491 F.2d 239, 242 (9th Cir.), cert. denied 419 U.S. 834 (1974); Foster v. Seaton, 271 F.2d 836 (D.C. Cir. 1959)), we

do not believe that Judge Rampton's decision was the product of a misapplication of this principle.

Certainly, a review of Judge Rampton's decision illuminates the fact that he consistently accepted the geologic interpretations advanced by contestees' witnesses even where they were in direct conflict with testimony presented by witnesses for NPS. NPS' implicit suggestion that this could be possible only if the Judge were misapplying the burden of proof is, we believe, itself premised on a misapprehension of the nature of "preponderation" in the context of adjudicatory practice.

As has been noted:

To establish the preponderance of the evidence means to prove that something is more likely so than not so; in other words, the "preponderance of the evidence" means such evidence, when considered and compared with that opposed to it, has more convincing force and produces in your minds belief that what is sought to be proved is more likely to be true than not true.

South-East Coal Co. v. Consolidation Coal Co., 434 F.2d 767, 778 (6th Cir. 1970). Accord Winston L. Thornton, 106 IBLA 15, 19-20 (1988); Thunderbird Oil Corp., 91 IBLA 195, 201 (1986), aff'd sub nom. Planet Corp. v. Hodel, CV No. 86-679 BB (D. N.M. May 6, 1987).

Thus, the fact that one party to a hearing presents testimony from a duly qualified expert critical of an interpretation of data advanced by an expert for the other party does not mean that the second party, even if possessed of the ultimate burden of proof, can never be said to have "preponderated" on the validity of the questioned interpretation. On the contrary, the fact-finder could easily find that, while the testimony submitted on behalf of the first party was probative, the testimony of the expert for the second party was more credible and established the validity of the challenged interpretation by a preponderance of the evidence. Our review of Judge Rampton's decision shows not that it was driven by any misapplication of the burden of persuasion but rather that it was clearly the product of his determination that, in numerous areas of conflicting analysis, the evidence submitted on behalf of contestees was simply more compelling. That being said, however, we are constrained to note that our de novo review of the record, at least insofar as matters related to geological extrapolations are concerned, compels us to conclusions differing in many key aspects from those propounded by Judge Rampton.

[5] We recognize that the Board has long noted that substantial deference is accorded to findings of Administrative Law Judges on conflicting evidence, based on the reality that the trier of fact has a unique opportunity to observe the various witnesses and judge the weight to be accorded their testimony. See, e.g., Holland Livestock Ranch, 52 IBLA 326, 350, 88 I.D. 275, 289 (1981), rev'd on other grounds, 714 F.2d 90 (9th Cir. 1983); United States v. Chartrand, 11 IBLA 194, 212, 80 I.D. 408, 417-18 (1973). But, we have also cautioned that this deference is not absolute, particularly where the Judge's determination of credibility is not premised

on demeanor evidence. See Bureau of Land Management v. Ericsson, 88 IBLA 248, 262-64 (1985) (separate opinion). More particularly, with reference to expert opinion, we have cautioned, in denying a request for a fact-finding hearing, that:

Where, as in the instant case, what is involved is not a judgment as to the veracity or believability of a witness's testimony, but rather the consistency of a party's ultimate conclusions with the facts of record, little weight would be accorded to an administrative law judge's determination beyond that which it would command by the force of its analysis and the clarity of its exposition.

Thunderbird Oil Corp., IBLA 84-455, Order of June 6, 1986, at 2. See also New England Coalition on Nuclear Pollution v. NRC, 582 F.2d 87, 99-100 (1st Cir. 1978).

Examination of Judge Rampton's decision gives not the slightest hint that his factual determinations were animated by any doubts as to the veracity of the NPS witnesses. Nor is there any indication therein that the demeanor of these witnesses had any impact on his ultimate conclusions. Rather, it seems clear that such credibility findings as are inherent in his ultimate conclusions were premised on his determination that the substantive analysis of contestees' witnesses was more in accord with the facts of record than the contrary analysis provided by the witnesses for the Government. While Judge Rampton's conclusions on these questions are certainly deserving of respectful consideration by this Board, they are not preclusive of the exercise of the Board's delegated plenary authority, which includes the authority to undertake a de novo review of the entire record and make findings of fact thereon as fully and finally as might the Secretary himself. See Schade v. Andrus, 638 F.2d 122, 124-25 (9th Cir. 1981); United States v. Dunbar Stone Co., 56 IBLA 61, 67-68 (1981), aff'd, Civ. No. 81-1271 PHX EHC (D. Ariz. Feb. 27, 1984), aff'd, Civ. No. 84-1915 (9th Cir. Jan. 24, 1985), cert. denied, 472 U.S. 1028 (1985).

[6] Our review of the record developed below convinces us that contestees have failed to establish that the principle of lateral continuity is applicable to the mineralized copper zones outcropping on the surface of the claims, particularly with respect to continuity of values. A number of separate factors impels us to this conclusion.

First of all, while water is clearly indicated as the medium of deposition, we do not believe that the evidence establishes that the sedimentary deposition occurred in a marine basin. Thus, both contestees' experts and those of NPS noted the ripple marks evident in bed 3, the host formation. See 1986 Tr. 398 (Clary), 641 (Miller). As Miller testified, these ripple marks are consistent with deposition within moving waters, either tidal or fluvial, which would result in significantly less lateral continuity than would be expected had the deposition occurred in a marine basin environment.

Second, we note that Clary and Slusher had consistently argued that, based on their geologic analysis, two distinct mineralized zones (which they denominated as zone 4 and zone 4A) were traceable throughout the host

formation (bed 3). NPS' experts, for their part, disputed this assertion, contending that the evidence showed, at best, only a single zone of mineralization throughout bed 3 and that the evidence upon which contestees premised their theory of two zones of mineralization actually underscored the fact that the mineralization which did occur within the host rock was spotty and discontinuous. We believe that when all of the evidence tendered on this point is scrutinized, the conclusion is simply inescapable that contestees have failed to establish the existence of two separate mineralized zones within bed 3 which can fairly be said to be traceable any lateral distance beyond the southeastern extension of Area A.

Contestees' experts drew support for their two-bed mineralization theory from a number of factors. Thus, they noted the two apparent zones of mineralization in the southeastern extension of Area A (shown on Exh. BB as D-E and F-G). Significantly, however, other than this single manifestation, 58/ the existence of two discrete mineralized zones was not otherwise evidenced on the surface. See 1986 Tr. 218-23. Admittedly, Slusher attempted to buttress contestees' theory by pointing to subsurface indications of mineralization. Thus, exhibit GG-1 (cross section E-F) showed the TB-3 drill hole as penetrating 80 feet through zone 4A and then bottoming at the 200-foot level in zone 4. It seems clear to us, however, that insofar as the TB-3 hole is concerned, it provides no support for the existence of two discrete areas of mineralization within bed 3.

Slusher premised the existence of zone 4, as shown on GG-1, on a single assay from the TB-3 which, Slusher claimed, showed increased values at the bottom of the hole. The assay results of this drill hole are found in exhibit 4, subexhibit 3. A close reading of the assay report shows that Slusher had misinterpreted the document. Mieritz had reported that TB-3 was drilled to a depth of 200 feet. See Exh. 2 at 4. The assay results indicated "nil" copper for the 195- to 200-foot interval. The number (0.26 percent) upon which Slusher apparently relied (see 1986 Tr. 369) appears immediately below the entry for the 195-200-foot interval. See Exh. 4, Subexh. 3; Exh. F, Appendix. There is no sample depth given for this last entry, though the notation "#4255" does appear. If, however, one adds the individual sample results and divides by 41, the total number of individual samples assayed, the answer derived is 0.2651 percent. It seems obvious that the assay entry upon which Slusher relied to predicate his assertion that zone 4 existed in this area was not an indication of bottom-hole values but merely the average of the samples taken throughout the 200-foot depth of the hole. 59/

Thus, save for the two areas of mineralization southeast of the hilltop in Area A, there is simply no evidence of two discrete mineralized zones within bed 3. And, even with respect to the southeast area, the NPS

58/ Exhibit GG-3, which is cross-section K-L, merely shows a different aspect of the same surface areas.

59/ While Slusher also referenced the Norandex CL-1 drill hole, we have already discussed why it is difficult to place much reliance on this hole. See note 14, supra.

witnesses challenged the conclusions of contestees' experts. Miller, for example, asserted that zone 4A as delineated on GG-1 was not confined to a single horizon but rather crossed various bedding planes (1986 Tr. 655-56). Moreover, he complained that significant areas southeast of Area A, which had been delineated on exhibit BB as mineralized zones, were actually float. Similarly, the Miller/Savoca contention that fault 5 veered to the northeast before encountering the G-H cross-section line would, if correct, substantially undermine the two-zone theory since, as they suggested, under contestees' scenario zone 4A should then have been, but is not, manifested east of the Area B mineralization. 60/

While we recognize that this matter is not totally free from doubt, it seems to us that contestees have failed to establish that two identifiable zones of mineralization, each exhibiting lateral continuity, exist within the host formation. Thus, the two areas of surface mineralization shown southeast of the hilltop portion of Area A actually lend credence to the NPS view that the mineralization is erratic and discontinuous, at least insofar as the significant distances projected by contestees are concerned.

The third factor which militates against ascribing continuity of mineral values throughout the host rock is the simple fact that, after noting that green was mapped based on visible showings of copper on the surface, Slusher expressly admitted that "the uniformity of the copper content at each location along there is not meant to be implied by that color [green]" (1986 Tr. 185-86). But, to the extent that continuity of values along the surface is disclaimed, it is difficult to ascertain a basis for the assumed continuity of values underneath the surface. Certainly no general principle of lateral continuity would admit of one while denying the other. 61/ Absent horizontal continuity of values along the surface exposure of the bedding plane, there is no reason to assume vertical continuity of values

60/ As noted above, Judge Rampton did not attempt to resolve most of these geologic questions because, having determined to limit his consideration to the question whether Fletcher's 3,200,000-ton reserve estimate was supported by the record, he apparently assumed it was unnecessary. The problem with this approach, however, is that to the extent that Fletcher's estimate was premised on the same geologic predicates delineated by Clary and Slusher, any evidence which weakened their reliance on the lateral continuity of the mineralization necessarily undermined as well the factual underpinnings of Fletcher's estimate, since the only critical difference between his computations and those of Slusher and Clary lay in the extent of the subsurface extrapolations of mineralization and all three relied on the principle of lateral continuity to support the use of surface sampling in areas without drill holes as a predictor of values at depth. See generally 1978 Tr. 380-81; Exh. A.

61/ While the varying surface effects of leaching or enrichment could readily explain the inability to project values laterally along the surface outcrops, to admit of this justification is to simultaneously undermine contestees' essential theory that surface values can be projected at depth down the dip of the exposures.

from surface outcrops to depth merely because contestees invoke the principle of lateral continuity.

In summary, then, we find that the evidence does not establish that a marine basin was the medium of deposition, nor does the evidence provide an adequate basis for concluding that the mineral deposition has occurred in such a manner as to result in continuity of values over any extended geographic range. Contestees have simply failed to establish that the separate mineralized areas within the claims can be expected, based on their geologic origins, to exhibit equivalent or comparable values either on the surface or at depth. We must conclude, therefore, that the geologic mapping adds no independent evidentiary weight to contestees' ultimate assertion that values obtained by surface sampling can be assumed to be a reliable predictor of those values which would be encountered at depth.

Thus, we have concluded that the values disclosed by surface sampling have not been shown to be "basically equivalent" to those derived from testing at depth and further that the geologic mapping does not independently sustain the basic equivalency of surface and subsurface mineralization. It follows, therefore, that the validity of those claims embracing Area B and the southeastern extension to Area A must be established, if they are to be established by all, by the actual evidence of record and not by advertence to general principles of lateral continuity to eliminate any evidentiary lacunae. And, when this evidence is examined, we think the conclusion is inescapable that contestees have failed to establish that these claims contain a valuable mineral deposit within the meaning of the mining laws.

Insofar as the claims embracing Area B are concerned, *i.e.*, the Copper Lode Nos. 5 and 7, the evidence clearly fails to establish the disclosure of a valuable mineral deposit. In remanding this appeal to the Hearings Division, we had noted that "[w]hile we do retain considerable doubt as to the ability of appellants to show the existence of a valuable mineral deposit in Area B, particularly in view of the Mieritz drilling in that area, we feel that appellants should be afforded an opportunity to attempt to show the validity of the claims in this area in the context of further examination of the reliability of the surface sampling program." 81 IBLA at 99. The record developed at the subsequent hearings, far from alleviating our prior concerns, actually convincingly establishes that contestees have not exposed a valuable mineral deposit within Area B.

As indicated above, the results of the Mieritz drilling program, which was admittedly far less structured in Area B than it was in the hilltop portion of Area A, gave scant indication as to the possible existence of a valuable mineral deposit. Mieritz drilled a total of five holes in Area B of which four (A1 through A4) were ultimately re-located on the ground. See 1986 Tr. 112-13, 407-09; Exh. FF. Insofar as these drill holes were concerned, only one (A4) had any positive intervals and this consisted of the initial 10-foot interval of a 30-foot hole which showed 0.41-percent

copper. ^{62/} Not only were all of the other intervals below cut-off grade, the average interval grade for all of the holes drilled on Area B was slightly less than 0.06-percent copper.

Contestees' experts discounted the results of the Mieritz drilling in Area B on the ground that the various drill holes had failed to intercept any of the mineralized horizon. See, e.g., Exhs. A and BB. ^{63/} Thus, total reliance was placed on the results of the chip sampling as a predictor of value at depth and the assumed lateral continuity of mineralization. For the reasons delineated above, such reliance was, in our view, misplaced. In any event, even assuming arguendo the correctness of contestees' assumptions, it would be impossible to agree that the evidence shows the disclosure of a valuable mineral deposit in Area B.

[7] In his decision, Judge Rampton rejected the Government's argument that, even if a "basic equivalency" had been established between the Mieritz drilling and the surface grid pattern on the hilltop portion of Area A, these results could not be transferred to Area B because the OXY sampling in that area was not in a grid pattern but was generally random. Judge Rampton declared that "enough samples were taken from all geographic points within each [mineralized] zone to allow a representative average of surface quality values to be calculated" (Decision at 41). The basis for this assertion, however, is not apparent in the record.

The hilltop portion of Area A over which OXY ran its grid pattern encompassed approximately two and a half acres. In this area, OXY took a total of 89 chip samples. ^{64/} The mineralized portion referred to as Area B aggregates approximately one and a half acres. In this area, a maximum of 22 chip samples were taken in the mineralized zone. ^{65/} Thus, while the

^{62/} Thus, the first 10-foot interval assayed at 0.41-percent copper, while the subsequent two intervals showed 0.09- and 0.13-percent copper, respectively.

^{63/} In his report prepared in 1977, Fletcher noted that several holes had been drilled in Area B, but asserted that they "were collared below the mineralization and were blank" (Exh. A at 7). It is, however, difficult to understand the basis for Fletcher's assertion since the location of the Area B drill holes was not shown on any map until exhibit FF was introduced in the 1986 hearing. We also note that one of the NPS challenges to the Clary/Slusher geologic mapping was premised on an assertion that in Area B contestees' experts exaggerated the true angle of dip to avoid having drill hole A1 (which was essentially barren) intersect the mineralized area shown on exhibit GG-4. See Posthearing Response I at 13-14.

^{64/} This figure excludes all chip samples which we deemed not to be within the hilltop area. See note 55, supra.

^{65/} The various OXY maps show a total of 25 chip samples in the general vicinity of Area B, numbered 127 through 151. Three of these, 127, 128, and 150, do not appear to have been taken within the mineralized zone indicated on exhibit BB, even though presumably they were taken on some

acreage involved in Area B was more than half the size of the grid portion of Area A, only one quarter of the number of samples taken in Area A were taken in Area B.

Even if one accepts the general theories of contestees, the fact that a correlation has been established between "representative" surface values and the values which can be expected to be encountered at depth does not mean that single or random sampling gives rise to any inferences of subsurface value. It is only the "representative" sample which can be said to have any predictive value. Indeed, contestees expressly repudiated any reliance on individual surface samples as indicative of subsurface values. Instead, as noted above, they contend it is the average that is important. But, equally important in such an analysis is the nature and number of the samples which go into making the "average." Thus, as the number of samples relative to the area being sampled decreases, the reliability of any average derived therefrom decreases as well, since the possibility that anomalous samples will contaminate the average operates inversely to the number of samples taken. In other words, as the number of samples goes down, the likelihood of distortion goes up. Thus, as an initial consideration, the predictive reliability of the "average" value of the samples taken in Area B is, necessarily, significantly lower than the reliability of the "average" value of the samples taken in the hilltop portion of Area A, even assuming the correctness of contestees' theory.

Furthermore, an examination of the individual samples taken within Area B reinforces the possibility that the "average" was contaminated. The average assay value of the 22 chip samples was 0.350-percent copper. If, however, the two highest samples are discarded (Nos. 131 and 134), the average value declines to 0.197-percent copper, under the cut-off grade even if it is assumed, as contestees did, that no correction factor need be applied to the surface samples. Indeed, merely excluding the highest sample (No. 131), which is, in fact, 59 percent higher than the second highest sample, results in an average assay value of 0.257-percent copper. Applying as correction factor of 30 percent 66/ which, as explained above, would

fn. 65 (continued)

area which had a surficial indication of value. While the exclusion of these three samples lowers the total number of samples, it has the corollary effect of raising the average value of the remaining samples, since these three samples averaged 0.004-percent copper.

66/ As indicated above, the average chip sample values were between 41 and 44 percent greater than the average values derived from the drill holes, depending on the method of computation. In order to calculate the correction factor which should be applied to other surface samples, however, it is necessary to determine the percentage by which the surface samples overstated the values disclosed at depth. Using the single drilling unit approach, the surface values overstated the subsurface values by 0.160 percent or approximately 29.5 percent (0.160 divided by 0.543) and using the 10-foot interval approach the surface values overstated the subsurface values by 0.168 percent or approximately 31 percent (0.168 divided by

be necessary even if the correlation theory were accepted as established, results in a corrected "average" subsurface value of 0.180 percent copper, also below the cut-off grade.

More importantly, examination of the figures used by Fletcher in computing his estimate of reserves in Area B shows that he did not use an average of the chip samples to derive his estimate of reserves, he used an average of the "positive" chip samples. Fletcher asserted that Area B contained 700,000 tons of 0.770-percent copper. In point of fact, however, as noted above, the "average" grade of the 22 chip samples was 0.350-percent copper, less than half the figure used by Fletcher. This discrepancy cannot be explained by the fact that Fletcher's total was weighted for areas of influence.

Fletcher had computed four reserve blocks in Area B. He computed, accordingly, a separate grade for each block, varying from 1.30-percent copper to 0.50-percent copper. Examination of the four blocks with respect to the samples taken within each conclusively shows that he did not utilize all of the surface samples within each block. Thus, for Block I Fletcher derived a value of 1.30-percent copper. This block embraced two lines of four samples each (Nos. 129 to 132, and 133 to 136). The average of these eight samples is not 1.30 percent, but rather 0.508 percent. Even if one excludes the two westernmost samples on the theory that, since they showed virtually no copper, they were outside the area of mineralization (see Exh. I), the average of the remaining six samples is only 0.675-percent copper. The only way to approximate Fletcher's figure of 1.30-percent copper is to limit consideration to only the three samples which assayed above the cut-off point.

The same approach is manifested with respect to the other three blocks in Area B. Thus, for Block II, Fletcher used a figure of 0.50-percent copper, even though the average of the four samples located therein was 0.244 percent. For Block III, 0.70-percent copper was shown, even though the average for the six samples in this block was 0.350-percent copper. And, for Block IV, Fletcher applied an average of 0.55-percent copper in determining reserves, even though the average of the four samples was 0.147-percent copper. Indeed, the computations with respect to Block IV underline the problem with Fletcher's analysis. The only sample in Block IV above 0.012 percent was No. 148, which assayed at 0.560 percent. In effect, Fletcher posited the existence of 80,000 tons of 0.55-percent copper on a single surface chip sample and ignored three other samples which showed virtually no copper at all. Whatever the utility of contestees' theory that the average value of surface samples may be taken (with or without the application of a correction factor) as a predictor of value at depth, it clearly has no applicability in Area B where, in effect, various values

fn. 66 (continued)

0.543). Accordingly, we deem the application of a 30-percent correction factor to the average surface sample value appropriate when considering the evidentiary record in light of the assumption that a surface/subsurface correlation of values has been established.

are presumed to exist at depth based solely on the existence of individual positive surface samples and not on an average derived from a representative group of samples.

[8] We do not mean to suggest that the surface sampling done in Area B, which yielded a number of positive results, is of no value. Certainly, a reasonable individual could conclude therefrom that further exploration of the area was warranted. But there is, as we have noted in a number of cases, a fundamental difference between evidence which would justify a prudent individual in the continued exploration of a prospect and that which would justify the commencement of work to develop that prospect into a paying mine.

In United States v. White, *supra*, we quoted the varying definitions of "prospecting," "exploration" and "development" from Peele's Mining Engineers' Handbook 10-03 (3d ed. 1941):

Peele defines prospecting as "the search for minerals," exploration as "the work of exploring a mineral deposit when found * * * undertaken to gain knowledge of the size, shape, position, characteristics, and value of the deposit," and "development" as "the driving of openings to and in a proved deposit, for mining and handling the product economically."

Id. at 319-20, 98 I.D. at 157. Certainly, the OXY chip sampling program could be classified as "exploration" within the meaning of this definition. But, while admittedly there are no bright lines delineating the passage from prospecting to exploration on to development, performance of some exploration work does not, ipso facto, mean that the work has progressed sufficiently to proceed to "development" of the claims. On the contrary, it is only upon an evaluation of the results of exploration that a determination can be made to abandon the prospect, continue exploration activities, or proceed to development. And, in this regard, as we expressly noted in United States v. White, *supra*, evidence which is sufficient to justify further exploration expenditures does not necessarily constitute evidence which would justify embarking upon the vastly more expensive venture of attempting to develop the prospect.

That some copper mineralization exists in various parts of these claims, including Area B, is obvious from mere visual examination. Doubtless it was these surface expressions of possible value which originally led to the location of claims over the deposit. Determination that the claims embrace a valuable mineral deposit within the meaning of the mining laws, however, requires more than mere visual confirmation that some mineralization exists. Rather, the mineralization must be present in sufficient quantity and sufficient quality so as to reasonably justify the belief that its extraction is economically feasible. To determine whether such was the case with respect to these claims, two separate exploratory programs were undertaken. The first, conducted by Mieritz in 1969, while primarily directed to the mineralization within Area A, also included the drilling of five holes within Area B. Only a single 10-foot segment above 0.130-percent copper was encountered in these five holes. Mieritz, in his subsequent report, noted

that Area B constituted a possible future target which "could, if properly explored by drilling, add a substantial ore reserve to the property" (Exh. 2 at 7). Clearly, he did not view his activities as having ended the exploratory phase with respect to Area B.

In 1975, OXY obtained an option on the claims and conducted extensive surface sampling, again concentrating primarily on the hilltop part of Area A, but also encompassing other possible mineralized areas, including Area B. Of the 25 surface samples taken in Area B, only 9 showed values above 0.200-percent copper, while the average value of the 25 samples was 0.308-percent copper, actually below the cut-off grade which Mieritz had utilized (0.400-percent copper) and scarcely above the 0.300-percent copper cut-off which Fletcher subsequently used (see Exh. A at 1) in computing reserves. Thereafter, OXY dropped its option on these claims.

The foregoing is the sum total of the exploration work undertaken with respect to Area B. Contestees, of course, have argued that, on the basis of the OXY chip samples on the hilltop portion of Area A, they have established that a "basic equivalency" has been shown to exist between average surface values in a mineralized area and the values which would be encountered at depth. But, as we have noted above, (1) the evidence simply fails to establish that a complementary relationship between representative values obtained from surface sampling and those encountered at depth exists; (2) even if such relationship be assumed, the evidence does not support the assertion that the values are "basically equivalent"; (3) even if a complementary relationship of basic equivalency be assumed, the surface sampling program conducted in Area B was not designed to obtain values sufficiently representative as to predicate assumptions of value at depth; and (4) even if the surface sampling program in Area B was designed to obtain representative surface values, these were not the values used in making the projections relied upon to establish the value of the deposit. In short, our analysis of the evidentiary record fails to disclose any support for the conclusion that the evidence is sufficient to warrant commencing the development of a mine in Area B. We think it clear that a reasonably prudent person would require further exploration work before hazarding the substantial investment necessary to develop this prospect.

While it is, as courts have long noted, a common practice to locate mining claims upon the first indication of mineral potential, a mining claim is valid, as against the United States, only upon the discovery of a valuable mineral deposit. See, e.g., Best v. Humboldt Placer Mining Co., 371 U.S. 334, 336 (1963); Lara v. Secretary of the Interior, supra at 1542; Skaw v. United States, 13 Cl. Ct. 7, 28 (1987). Evidence of mineralization which merely justifies further exploration to determine whether sufficient minerals exist to warrant an attempt to develop a valuable mine does not constitute a discovery of a valuable mineral deposit. See, e.g., Chrisman v. Miller, supra at 322-23; Barton v. Morton, 498 F.2d 288, 290 (9th Cir. 1974); United States v. White, supra at 312-13, 98 I.D. at 153-54. Contestees have simply failed to establish that the surface mineralization evident within Area B exists in sufficient quantity or quality to justify the commencement of development activities with respect to the Copper Lode Nos. 5 and 7. Thus, those claims are not now and were not on September 28, 1976,

when the lands were withdrawn from mineral entry and location, supported by a discovery of a valuable mineral deposit. It must follow, therefore, that those claims are properly declared null and void and Judge Rampton's decision dismissing the contest as to these two claims is hereby reversed.

Turning now to the non-hilltop portion of Area A, an analysis of the record developed at the hearing shows that the considerations to which we adverted in our discussion of Area B are of equal applicability insofar as the surface mineralization in the non-hilltop portion of Area A is concerned. As noted earlier in our review of the evidence, there are two discrete areas of mineralization at issue in that area. As delineated on exhibit BB, these may be referred to as the D-E and the F-G deposits.

In computing his estimate of reserves, Fletcher had divided Area A into four separate blocks. Block I was totally within the hilltop area. Block II included some small amounts of the eastern area of the hilltop and continued east to approximately chip samples 152 and 153. Block III abutted Block II on the southeast, trending in a southeasterly direction and encompassing the northern portion of the D-E and F-G deposits, while Block IV was located directly south of Block III and included the southern half of the D-E and F-G exposures, terminating just north of a line of chip samples (Nos. 170 to 173). See generally Exhs. A and I.

Fletcher prepared differing estimates of grade and volume for these four blocks. Thus, for Block I he estimated 330,000 tons at 0.80-percent copper, for Block II, 800,000 tons at 0.55-percent copper, for Block III, 830,000 tons at 0.50-percent copper, and for Block IV, 520,000 tons at 0.45-percent copper. Leaving aside, for the moment, the estimates of volume, it is clear that the estimates of grade in Area A were based, just as they were in Area B, solely on the favorable assays and ignored any assay result below the cut-off grade.

We have discussed above our reasons for rejecting contestees' assertion that the chip sampling on the hilltop area showed results which were "basically equivalent" with those obtained from the Mieritz drill holes. As we pointed out, one of the fallacies of the analysis was that the average value derived from exhibit 7 (the drill holes) was not comparable to the average value derived in exhibit 8 for the surface chip sampling program. Our purpose here is not to repeat that analysis, but rather to focus on the fact that the values which contestees argued were comparable were 0.563-percent copper for the drill holes and 0.5094-percent copper for the chip samples. In computing the average value of the hilltop deposit, however, Fletcher used neither 0.563-percent copper nor 0.5094-percent copper; rather, he employed a figure of 0.800-percent copper for Block I and 0.550-percent copper for Block II, with an average value for the two blocks of 0.623-percent copper.

It should be noted that no assays other than the Mieritz drill hole results and the OXY chip samples over the grid area were utilized in making these projections. See Exh. I. In effect, relying solely on interpretations of the hilltop sampling, which had led Mieritz (using a

0.400-percent cut-off and only the drill hole results) to estimate a reserve of 323,670 tons at 0.772-percent copper (see Exh. 2 at 6), ^{67/} Fletcher, using a 0.300-percent copper cut-off, projected reserves of 1,130,000 tons of 0.623-percent copper. In other words, using the data developed by the chip sampling program, which data was deemed to be corroborative of the drilling results (see 1986 Tr. 156), contestees posited a nearly four-fold increase in the amount of mineralization projected. While some of this increase might be explained by Fletcher's utilization of the lower cut-off figure which would result in both an increase in volume with a reciprocal decline in average copper content, the fact of the matter is that the average grade which Fletcher derived declined approximately 20 percent from the Mieritz estimate, while the increase in estimated reserves was nearly 250 percent. This latter increase simply cannot be explained as the result of the use of a 0.300-percent cut-off figure.

The only conceivable explanation for the substantial increase in reserves lies in Fletcher's projection that the values would continue for a depth of 125 feet (1978 Tr. 390-91), a projection which necessarily ignores the fact that the eastern and southeastern perimeter of the hilltop was virtually bracketed with drill holes which showed minimal, if any, value and which were also topographically located below those drill holes showing value. See, e.g., drill holes Nos. 16, 17, 17A, 18, 21, 22, 34, 50, 51, 52, 53, 56. The effect of Fletcher's approach was to derive a value, 0.623-percent copper, which was greater than either the average value of the favorable drill holes or the average value of the chip samples on the hilltop and then simply apply this value down dip a distance of 125 feet, even though a number of drill holes provided positive evidence that such an extension was not warranted.

Analysis of the grades assigned to Blocks III and IV, on the other hand, shows that the figures utilized therein reflect reliance on only the favorable assay results from surface sampling to determine value. While Fletcher used an average figure of 0.50-percent copper for Block III, the average of the all of the chip samples located in that Block was actually

^{67/} Fletcher testified at the initial hearing that, using 0.30-percent copper as the cut-off grade, he computed the hilltop deposit as delineated by the Mieritz drilling to consist of 300,000 tons at 0.67-percent copper, a figure which he felt was comparable to the estimates of Gould and O'Brien based on the Mieritz report, and which he deemed also comparable to the values which he obtained when he computed an average value for the OXY chip samples in the hilltop area using the same cut-off. See 1978 Tr. 380, 389-90. Eliminating those drill holes which showed less than 0.300-percent copper on exhibit 7 (Nos. 2, 3, 8, and 12), results in an average value for each 10-foot intercept of approximately 0.583-percent copper. However, the 51 chip samples in the hilltop area above 0.300-percent copper (Nos. 2, 3, 5-7, 12, 13, 16-19, 21, 24, 29, 41-51, 53, 54, 57, 59, 61, 69-72, 74-79, 84, 88, 91, 96, 101-08) actually average 0.834-percent copper, an average close to the figure which Fletcher used for Block I.

0.326-percent copper. 68/ Only two of the nine samples assayed above the 0.300-percent cut-off. Yet, with over 75 percent of the chip samples showing values below his cut-off grade, and the total average barely exceeding his own cut-off limit, Fletcher assigned a value of 0.50-percent copper to this block which had an estimated reserve volume of 830,000 tons.

Similarly, with respect to Block IV, while Fletcher assigned a value of 0.45-percent copper to this reserve, the average value of the eight chip samples was 0.412-percent copper. 69/ While the average value of all the surface samples in Block IV is admittedly closer to the value Fletcher used than is evident elsewhere in his computations, the boundary of Block IV was also constructed in such a way as to exclude one sample to the west (No. 165) and seven samples immediately south of Block IV (Nos. 164, 170-173, 176, 177) which had assayed at an average of 0.065-percent copper. 70/

In any event, as we noted above, even assuming that contestees had established a surface/subsurface correlation, such a correlation only has validity if "representative" surface values were used to predict value at depth. As shown on exhibit BB, the area of surface mineralization for the D-E deposit approximates 1-3/4 acres while the area of surface mineralization for the F-G deposit totals slightly more than 1 acre. Exhibit BB shows seven sample sites as located within the D-E deposit while only five sites are found in the F-G deposit. 71/ Comparison of the number of samples located within both of these deposits with the number of samples taken in the hilltop portion of Area A fatally undermines any assertion that a representative sample was derived from which a valid projection of values at depth could be made.

Nor does any of the drilling done by either Beard or Norandex alter this analysis. While drill holes TB-1 and TB-2 were in the general vicinity of this area, no assay results are available for these two drill holes. The TB-3 drill hole is located in the southern portion of the F-G deposit. The assays from this 200-foot drill hole showed the initial 80 feet as containing 0.470-percent copper, with the remainder of the hole evidencing copper oxide though not of a particularly high percentage. The TB-4 hole was located immediately southwest of the D-E deposit. Its initial 35 feet

68/ There were nine chip samples located within Block III; Nos. 155-159, 174, 175, 180, 181.

69/ The eight chip samples within Block IV are Nos. 160-163, 166-169.

70/ Inclusion of these samples with those utilized to derive an average for Block IV would have resulted in an average value of 0.210-percent copper, well below the cut-off value used by Fletcher.

71/ Exhibit BB shows sample sites Nos. 157-163 as within D-E, while site Nos. 166, 167, 169, 174, and 180 are shown as within F-G. These sample site groupings do not directly correspond to those used in Block III and Block IV because Fletcher, in delineating these two blocks, divided both the D-E and F-G deposits (which trend generally north/south) roughly in half between the two blocks. Also, sample site No. 168 was excluded from the mineralized area of F-G since exhibit BB shows an area of alluvial cover where that sample was taken.

assayed at 0.33-percent copper, while the remaining 75 to 80 feet showed no value greater than 0.06-percent copper. Finally, the TB-5 hole was located approximately 300 feet south of the western boundary of the F-G deposit. It had been drilled to the depth of 200 feet and showed an average value of 0.33-percent copper through its initial 80 feet and 0.07-percent copper through the remaining 120 feet.

There were also two Norandex drill holes in this general area. The CL-4 was drilled at approximately the same site as the TB-5. Drilled to a depth of 299 feet, the only mineral showing was a 25-foot interval from 125 to 150 feet, which averaged 0.12-percent copper. See Exh. 11. The CL-5 hole was located at the eastern edge of the F-G mineralization. Two areas of mineralization were encountered in this drill hole. The first, extending 40 feet from the 10- to 50-foot level, averaged 0.310-percent copper, while the second, approximately 30 feet in length commencing at the 125-foot level, averaged 0.489-percent copper.

While the TB-3 and the CL-5 (and, to a lesser extent, the TB-4 and TB-5) certainly provide some favorable evidence of mineral value, the question, as noted above, is whether these results would justify a prudent person in commencing development of a valuable mine or would merely justify such an individual in continuing exploration of a potential prospect. In this regard, we believe it is important to remember that both the TB holes, which were drilled in 1968 before Mieritz conducted his drilling program, and the Norandex holes, which were drilled shortly after Mieritz' field work had been completed, were evaluated in Mieritz' report. After reviewing the data developed by Beard and Norandex, Mieritz concluded that "[a]ll in all, the early 1968 drilling and the most recent 1970 drilling have not improved the 'ore reserve' position of year 1969, namely because their target of these programs was 'large category goals' and for the moment, this property is not in that category" (Exh. 2 at 6). 72/

The only data developed subsequent to Mieritz' analysis was the OXY chip sampling. 73/ We already have discussed in detail the limited nature of this sampling in the area delimited as Blocks III and IV of Area A. We do not believe that the addition of the information developed by the chip sampling program would convince a person of ordinary prudence that sufficient exploration has occurred to justify commencement of the development of a paying mine with any reasonable prospect of success. Rather, prior

72/ Moreover, it is worth noting that Norandex had concluded, based on its five holes, all of which had intersected copper mineralization that "assays indicated the width and grade of the copper diminished in all directions from the main showing." The report continued: "Consequently, the project was terminated in October, 1970." See Exh. 1.

73/ Admittedly, contestees also submitted geologic and topographic mapping the lack of which Mieritz had noted in his report. See Exh. 2 at 6. We have dealt with the effect of the geologic mapping above and will not repeat that discussion herein, though the conclusions are, of course, applicable throughout our analysis of the evidentiary record.

to the commitment of the resources inherent in such a venture, a reasonably prudent individual would conclude, as did Mieritz in his report, that "[f]urther exploration by drilling - air track is satisfactory - is necessary" (Exh. 2 at 6).

[9] In any event, even assuming arguendo that contestees had established the reliability of the surface sampling as a predictor of value at depth and, indeed, even accepting Fletcher's conclusions as to the quality and the quantity of the mineralization present in Blocks III and IV of Area A, it would still be impossible to accept Judge Rampton's determination that contestees had preponderated on the issue of discovery with respect to the Copper Lode Nos. 13 and 14.

As depicted on exhibits BB and CC, 74/ the D-E deposit is primarily located in the southern third of the Copper Lode No. 2, while the F-G deposit is generally located in the southwestern corner of the Copper Lode No. 3. These exhibits indicate that a small sliver of the D-E deposit invades the northeastern corner of the Copper Lode No. 13, while an equally small fraction of the F-G deposit encroaches into the northwest corner of the Copper Lode No. 14. South of these two small intrusions, it is undisputed that the only surface manifestation of copper values consist of isolated float or leached outcroppings. See, e.g., 1986 Tr. 77, 135-36, 652-53. Not one of the nine surface samples taken within these claims (Nos. 164, 170-173, 176-179) assayed above Fletcher's cut-off and the average value disclosed was 0.069-percent copper. The majority of these sample sites are within 50 feet of the northern endlines of these two claims and effectively contain any southern extension of the D-E and F-G deposits, assuming the validity of contestees' surface/subsurface correlation theory. 75/ While three drill holes are apparently located on these claims, one of these (TB-4) is located at the northern limits of the Copper Lode No. 13, north of the negative chip sample line, while the other two drill holes (TB-5 and CL-4), which exhibits BB and CC show as straddling

74/ Exhibit CC is an overlay of exhibit BB which provides a tracing of the claims based on contestees' location of the claim boundaries. As noted supra, Judge Rampton had concluded that this exhibit should control the location of the claims (Decision at 86). We would point out that contestees' exhibit C located most of the negative samples significantly north of the Copper Lode Nos. 13 and 14. And, while contestees' exhibit G, prepared by Fletcher, showed the negative line of samples immediately south of the northern endlines of these two claims, application of a standard zone of influence approach (see United States v. Collord, 128 IBLA 266 (1994)) would have placed all of the D-E and F-G deposits in the Copper Lode Nos. 2 and 3, with no part impinging upon the Copper Lode Nos. 13 and 14.

75/ Moreover, the southernmost chip sample included within the D-E deposit (No. 163), itself, assayed at only 0.245-percent copper, below Fletcher's own cut-off point. Indeed, if the adjacent sample (No. 165) were considered, the average of these two samples would be 0.145-percent copper. Thus, the depiction of the southern limits of the D-E deposit on exhibits BB and CC could be seen as an unwarranted extension of the deposit, contrary to the parameters guiding Fletcher's own analysis.

the common sideline of the two claims, evidenced minimal, if any values.

In his analysis of the results of these latter two holes, Mieritz observed: "Hole CL-4 * * * showed no copper mineralization of any significance. This hole was drilled in the same area as hole T.B. 5, (vertical) which basically was also a negative hole mineral-wise, except for the first 80 feet which averaged 0.33% copper with a single high assay of 0.54%" (Exh. 2 at 6).

The foregoing is the sum total of all evidence presented to establish the existence of a discovery of a valuable mineral deposit on the Copper Lode Nos. 13 and 14. Even were we to accept all of the theoretical predicates supporting contestees' position, which we do not, it would be impossible to concur with Judge Rampton's dismissal of the contest against these two claims. Accordingly, we must reverse his decision as to these two claims and hereby declare the Copper Lode Nos. 13 and 14 null and void since they are not supported by the existence of a discovery of a valuable mineral deposit.

This brings us to the consideration of the Copper Lode No. 3, which, according to exhibits BB and CC, contains most of the F-G deposit. Our discussion of the Copper Lode Nos. 13 and 14 assumed, arguendo, the correctness of contestees' various theories which underpin their ultimate conclusions. In point of fact, however, for reasons which we have detailed above, we have concluded that there are fundamental flaws which critically undermine both the theory of surface/subsurface correlation and its application to areas outside of the hilltop portion of Area A. Thus, we find, with respect to the Copper Lode No. 3, that contestees have failed to establish: (1) that the values obtained from a representative surface sample can be correlated to values occurring at depth; (2) assuming arguendo that a correlation could be established, that the values from a representative surface sample would be "basically equivalent" to those obtained at depth; or (3) that the limited surface sampling undertaken on the F-G deposit could serve as a basis for deriving a "representative" sample of that area. 76/ While the evidence thus far obtained might justify a prudent individual in making further expenditures to explore the nature and the extent of the deposit, it would not justify a prudent individual in proceeding to the development of a valuable mine, with a reasonable prospect of success. It therefore follows that the Copper Lode No. 3 is not now, and was not in 1976, supported by a discovery of a valuable mineral deposit, within the meaning of the mining laws, and that it is properly declared null and void for that reason. Judge Rampton's decision to the contrary is hereby reversed.

76/ Furthermore, even if one assumed that the five OXY samples which exhibits BB and CC show as having been taken within F-G (see note 71, supra) were sufficient to constitute a representative sample, the average value derived was only 0.345-percent copper. Application of a 30 percent correction factor, which we deem would be required even had contestees established the validity of their surface/subsurface correlation theory (see notes 57 and 66, supra), results in an average value at depth of 0.242-percent copper, below the cut-off figure which Fletcher used to compute reserves.

The D-E deposit is shown as located within the Copper Lode No. 2. While our discussion of the deficiencies of contestees' projections of the F-G deposit applies with equal force to the D-E deposit, ^{77/} these deficiencies do not necessarily compel the conclusion that this claim is null and void since the Copper Lode No. 2 shares the hilltop deposit with the Copper Lode No. 1 and, therein, contestees have clearly established the existence of considerable reserves of copper. Thus, the ultimate validity of this claim will be dependent upon whether contestees have established that there is a reasonable likelihood of success in developing a paying mine on that deposit. The importance of our foregoing analysis with respect to the Copper Lode No. 2 resides in the fact that the validity of that claim will be solely determined by the reserves delineated on the hilltop and these reserves cannot be supplemented by any additional reserves claimed to have been delineated in Blocks III or IV by Fletcher.

There remains for consideration, therefore, only the hilltop deposit delineated by the Mieritz drilling program. While the various experts ascribed differing volumes and grades to the core deposit, ^{78/} there was no disputing that the exposures on the hilltop area showed a significant deposit of copper. The question, however, was whether or not a reasonable likelihood exists that this deposit can be mined, removed, and marketed at a profit at the present time and in 1976 when the land was removed from location and entry under the mining law.

In his decision, Judge Rampton recognized the relative consistency of the various interpretations of the Mieritz drilling results and, accordingly, separately considered whether the core deposit (for which he relied upon the Government's estimate of approximately 400,000 tons of "demonstrated" reserves) could, itself, be said to constitute a discovery of a valuable mineral deposit (Decision at 12). Judge Rampton concluded that contestees had established a reasonable likelihood of success in producing copper sulfate via open-pit mining and heap leaching even if reserves were

^{77/} Not only do the same general considerations discussed in the text with respect to the F-G deposit apply, but, just as application of a 30 percent correction factor to the sample average obtained for the F-G deposit lowered it below Fletcher's cut-off grade (see note 76, *supra*), so, too, does application of the 30-percent correction factor to the sample average for the D-E deposit (0.417-percent copper) result in an average value (0.292-percent copper) below the cut-off utilized by Fletcher in determining reserves.

^{78/} Mieritz had estimated a deposit of 323,670 tons of 0.772-percent copper, using a 0.400-percent cut-off (Exh. 2 at 6); Fletcher had estimated reserves of +/- 300,000 tons at 0.67-percent copper using a 0.300-percent cut-off (Exh. A at 6); O'Brien had estimated 442,500 tons at 0.447-percent copper (Exh. 4 at 5); Gould estimated 445,858 tons at 0.496-percent copper (1978 Tr. 50); and Mitcham estimated 403,077 tons at 0.563-percent copper (1978 Tr. 173). As can generally be seen from the foregoing, there is an inverse relationship between volume and grade so that, as a higher cut-off grade is used, the average grade increases but the total volume declines.

limited to a 400,000 ton deposit (Decision at 73). This conclusion was largely premised on Judge Rampton's general acceptance of the PAH analysis, particularly exhibits KK and LL. We will turn, therefore, from consideration of the geologic questions presented by this case to an examination of the economics of development of a small-scale mine aimed at the production of copper sulfate through open-pit mining and heap leaching. 79/

At the outset of the discussion on the economics of development, it must be recognized that the overwhelming majority of the evidence developed at the hearing was concerned with the economics of developing a deposit aggregating either 3.2 million or 2.5 million tons of copper ore, 80/ and relatively little emphasis was accorded the development of a 400,000-ton deposit, which is now the focus of our concern. Compare Exh. KK with Exh. LL. However, while the more detailed analysis conducted with respect to the assumed larger deposit is no longer of direct significance, it is relevant to the extent that, as Edmiston testified, many of the cost factors utilized in exhibit LL were merely downsized from exhibit KK. See 1986 Tr. 310-26. Thus, to a certain extent, it will be necessary to advert to the testimony and evidentiary submissions relating to exhibit KK, as well as to exhibit LL.

Conceptually, NPS attacked contestees' economic analysis along two broad lines. The first of these was a general attack on the sufficiency of the data necessary to even make an informed judgment as to the economic

79/ While Judge Rampton also found that Fletcher's original report (Exh. A) was sufficient, assuming a 3.2 million-ton reserve, to establish a reasonable likelihood of success in embarking upon an in situ mining venture to produce copper (Decision at 79), no similar finding was made with respect to production of copper from a 400,000-ton reserve. Indeed, in light of Fletcher's declaration that he would not recommend development of the claim if its reserves were as limited as the Government contended (see 1978 Tr. 418), it would be impossible to sustain a determination that contestees had established a discovery of a valuable mineral deposit assuming copper production from a 400,000-ton deposit. Insofar as his ruling as to the sufficiency of the Fletcher report is concerned, we are constrained to note that Judge Rampton actually sustained an objection to Shoemaker's testimony relating to that report on the ground that "the viability of the process, the in situ process" was no longer a matter of concern. See 1986 Tr. 461. In any event, even though the economics of development of the 3.2 million-ton deposit are no longer germane to resolution of this appeal (since we have affirmatively found that the evidence does not establish the existence of such a deposit), we do wish to note that, in our view, Oradei's economic analysis of copper production as originally proposed by the claimants (Exhs. 25 and 26) substantially undercut any basis for relying on Fletcher's conclusions as presented in exhibit A.

80/ The 3.2 million-ton estimate assumed the development of both Area A and Area B, whereas the 2.5 million-ton estimate examined the development of only Area A. Both of these estimates, of course, presupposed the existence of tonnage which, for reasons explained above, we do not believe to be supported by the record.

viability of development. The second related to specific elements of cost which, the Government witnesses asserted, were either ignored or understated in the PAH Report. In our view, the evidence sustains both of these critiques.

[10] NPS experts repeatedly assailed the PAH analysis as being premised on assumptions for which there was inadequate evidence. Included in these criticisms was Shoemaker's discussion of the lack of sufficient information regarding both mineralogy and metallurgy to determine the susceptibility of the deposit to leaching as proposed by contestees. See generally 1986 Tr. 466 et passim. Similarly, both Shoemaker and Oradei attacked the PAH Report on the ground that there was simply a lack of specificity as to the mode and processes of development as would permit the exercise of an informed judgment in determining whether or not to proceed with the project.

While Judge Rampton adverted to these concerns in his decision, he largely discounted them. He recognized that the PAH study did not constitute a feasibility study and agreed that "based on the data available, no finding can be made that the claimants are assured of a successful operation," but noted that the law did not require a guarantee of success, merely a reasonable likelihood of one (Decision at 69-70). In this regard, Judge Rampton's findings reflect his earlier determination that:

The concept that any potential investment project should undergo various progressively more accurate viability analyses is probably universal within the mining industry, as well as other industries. The concept reflects, of course, the natural desire to avoid the unnecessary expenditure of large sums of money. That is, if a "cheap" quick look at a project is sufficient to determine that a project is not worthwhile, an expensive exhaustive examination would not be necessary. Conversely, if a quick look indicates that a project shows promise, a more detailed look may be warranted. There may be many such analyses; order of magnitude, prefeasibility, feasibility, basic engineering, detailed engineering, and construction, or as few as two; preliminary and final. The analyses may not even be formally set out or labeled. In all cases, however (as all witnesses in this matter agree), the developer will reexamine the project at various times to determine if continued development, with concomitant expenditures of more money, remains an economically viable thing to do. It is apparent that positive results from any such reexamination may cause a prudent person to expend further time and money in the expectation of developing a profitable mine. [Emphasis supplied; citations to record omitted.]

(Decision at 44). While there is much which is clearly correct in this analysis, we believe that the last sentence contains a fundamental misapplication of the law of discovery.

In essence, the standard propounded by Judge Rampton in the above-quoted analysis substitutes the prudent expenditure of funds to develop

a feasibility study with the reasonable likelihood of success in developing a paying mine. To say that sufficient information exists such that a prudent person would be justified in expending \$150,000 in a feasibility study is not the same as saying that sufficient information exists so that a prudent individual would be justified in expending the \$3,010,000 originally estimated to constitute the capital costs in exhibit KK. The standard for discovery is not whether expenditures for further exploration or for further analysis might be justified. A finding of discovery requires that the evidence be sufficient to warrant the expenditures necessary to develop a paying mine with a reasonable prospect of success. Therefore, regardless of the nature of the PAH study, the real question is whether or not it provides the necessary evidence which would permit the conclusion that a prudent person would be justified in the further expenditures necessary to develop a paying mine with a reasonable prospect of success. And, to the extent that this study provides an inadequate framework to permit such a determination, it must be concluded that it cannot serve as a basis upon which a reasonable person could justify an attempt to develop a paying mine.

Thus, when Shoemaker testified that there had been inadequate testing to determine whether the deposit was even susceptible to large-scale leaching, 81/ this testimony, if found credible, would be sufficient, in and of itself, to fatally undermine contestees' assertion of discovery. The fact that subsequent studies might prove that the deposit was amenable to heap leaching is ultimately irrelevant. Contestees, as proponents of their claims' validity, bear the ultimate burden of establishing the existence of a discovery (Foster v. Seaton, supra) and, to the extent that critical information is presently lacking, contestees properly suffer the consequences.

It is difficult to read Shoemaker's testimony relating to mineralogy and metallurgy without coming to the conclusion that contestees have simply failed to establish an essential predicate to their claims' validity, i.e., whether, and to what extent, the deposit will prove amenable to heap leaching. This deficiency is, we would suggest, sufficient in itself to invalidate any assertion that there is a reasonable prospect of success in developing a paying mine. But, even if this were not so, even if it were assumed that adequate mineralogical and metallurgic studies had been performed, examination of the specific cost factors properly deemed applicable makes it impossible to sustain the conclusion that a discovery exists with respect to the core deposit.

[11] As our earlier review of the evidence indicated, the NPS witnesses detailed numerous instances in which, in their view, the original PAH Reports either omitted costs properly considered (e.g., working capital, feasibility studies) or significantly understated those that were included (e.g., water consumption rates and resultant costs, reclamation costs). Subsequent to their critique, contestees presented revised figures to remedy

81/ And, in this regard, we note that one of the two studies upon which contestees relied itself recommended mineralogical studies of a more representative group of samples. See Exh. 3.

some of these omissions (working capital and feasibility studies) while at the same time rejecting other changes advanced by NPS' experts (increased water costs). Insofar as the core deposit was concerned, they agreed to 82/ various changes with respect to exhibit LL. See 1986 Tr. 1017-18. With respect to capital costs, Edmiston added a total of \$395,000. This figure consisted of \$100,000 for a feasibility study, \$255,000 for 4 months working capital, \$120,000 in additional funds allocated to environmental costs, and \$20,000 in additional water costs. An additional \$52,000 was allocated to operating costs, consisting of a \$24,000 increase in miscellaneous costs and a \$28,000 increase in water costs. Edmiston claimed that the resultant 1985 DCFROR was 10.4 percent. 83/

Leaving aside the question whether a DCFROR of 10.4 percent would be sufficient to justify the expenditures of funds for development where the underlying study has a plus or minus accuracy of 35 percent, we believe that, even as revised, exhibit LL fails to include costs which are clearly involved. We noted above that, as originally proposed, contestees had planned to air-dry the copper sulfate on-site, thereby avoiding the expenditure for a dryer (1986 Tr. 328-29). Following substantial criticism by Shoemaker as to the feasibility of such a venture, contestees modified the proposal to include a dryer and allocated \$30,000 annually as operating costs in exhibit KK. No money, however, was allocated to cover the estimated cost of the dryer (\$120,000). This was justified on the ground that half of the cost would come from unspecified plant savings and the other half could be taken from contingency funds (1986 Tr. 940-41). Even accepting that half of the funds would come from other plant savings, 84/ use of \$60,000 of the contingency fund for funding the other half is, we would suggest, totally improper.

82/ We are well aware that contestees asserted that they accepted some of these revisions, not because they conceded that their original assumptions were erroneous, but rather to conduct a sensitivity analysis of the effect of various of the modifications which the NPS witnesses had argued were necessary. See, e.g., 1986 Tr. 939. In point of fact, however, Judge Rampton's findings as to discovery were clearly premised on consideration of these changes. See Decision at 71 ("It is found that claimants have demonstrated, by virtue of the DCFROR results in exhibit KK, as modified, that the prudent man would expend further time and money upon the Copper Lode deposit in the reasonable expectation of developing a profitable mine").

83/ In actuality, the resultant 1985 DCFROR would be approximately 7 percent. Apparently, in computing the new DCFROR contestees added the increased capital costs but overlooked the increase in operating costs.

84/ With respect to anticipated plant savings, it is difficult to see exactly how the switch from air-drying to use of a dryer results in any significant capital savings since one of main criticisms which Shoemaker leveled at the original PAH study was that it failed to make provisions for pads or other facilities to be used in air-drying the copper sulfate. See 1986 Tr. 536.

The entire purpose in providing for contingency funds in determining capital outlays is to guard against unforeseen contingencies which might fatally cripple profitability. But, once having determined to modify the underlying analysis in a manner which increases capital costs, one cannot simultaneously argue that this is an unforeseen contingency. Having decided to purchase a dryer (a decision clearly occasioned by the substantial criticism of contestees' air-dry proposal), the cost associated therewith is a capital cost no different than the provision of 4-months' working capital or any other element requiring an initial capital outlay which contestees have now seen fit to include in their project. The correct approach requires not only the addition of the costs of a dryer to the projected capital costs as a line item, it requires as well a proportional increase in contingency funds to provide the necessary cushion against the unexpected as it relates to the purchase and operation of the dryer.

In addition, it is also clear that while contestees added a total of \$395,000 in capital costs to exhibit LL, no pro rata increase was made to the contingency funds. 85/ Merely apportioning half of the dryer's costs to capital expenditures and providing for a proportionate increase in contingency costs to reflect the various changes from the original estimate results in the addition of a total of \$128,250 to capital outlays. Furthermore, no provision was made in exhibit LL for the operating expenses of the dryer which, accepting contestees' estimate of \$30,000 per annum with production of 10 million pounds of copper sulfate, should aggregate in excess of \$10,000 per year. Factoring in these changes results in a 1985 DCFROR of 3.6 percent, a DCFROR hardly sufficient to attract needed capital in a venture as inherently risky as mining.

Moreover, the foregoing analysis must, itself, be deemed to be excessively optimistic. First of all, it accepts a reclamation expenditure of only \$50,000 for open-pit mining in the middle of Death Valley National Monument. There is, in actuality, no basis for this estimate since it is premised on exhibit KK (see Exh. LL at 3.3), which in turn based its estimate on Oradei's reclamation cost analysis. See Exh. KK at 8; Exh. 25 at 28-30. But, as was expressly noted in Oradei's cost analysis, Oradei's estimate was "an extremely conservative estimate for an operation which proposes in-situ leaching with an on-site plant" (Exh. 25 at 30). It has no necessary bearing on the costs of reclamation of an open-pit mine as, indeed, Oradei expressly testified. See 1986 Tr. 579-80. Oradei's subsequent statement that other open-pit operations (which did not include on-site processing) were bonded for reclamation purposes at between \$200,000 to \$500,000 (1986 Tr. 581) is the only direct evidence, anyplace in the record, as to the possible costs of reclamation of an open-pit mine. There is simply no evidentiary basis on which to accept contestees' assertion that the cost of reclamation would be \$50,000.

85/ Both exhibit KK and exhibit LL based the amount allocated to contingency funds on 15 percent of total expected capital outlays. See Exh. KK at Table 6.2; Exh. LL at Table 3.1.

Second, the cost estimates clearly excluded outlays for equipment which contestees intended to utilize. In explaining the failure to provide outlays for various items of mobile equipment, Edmiston noted that contestees had informed him that they "had a surplus of equipment from another job, project or plant or operation that had gone out of commission * * * [a]nd that it was his intent that we utilize the equipment" (1986 Tr. 939). Accordingly, no costs were allocated for these items which, according to Edmiston, included "a 580 backhoe, a three-cubic-yard loader, three-ton forklift, 10-ton truck, two pickups, some water tanks and welders and miscellaneous tools." *Id.* This approach, however, proceeds on a fundamentally flawed basis.

To suggest that, because an individual happens to already have on hand various equipment which will be used in mining, such equipment is essentially "free" is no different than arguing that, because an individual happens to have large amounts of cash which are not being invested, use of the cash in an enterprise is also without cost. Regardless of whether or not either the equipment or the cash is being presently put to beneficial use, both are possessed of a present opportunity value which might be expressed with respect to equipment as its rental value and with respect to cash as its interest value. Utilization of either presently unused equipment or presently uninvested capital represents consumption of the opportunity value attributable to both, and this lost opportunity value is properly assessed against any income in determining the net profitability of an enterprise. The failure of the PAH Report to factor in these costs in its analysis necessarily resulted in an overstatement of any possible return.

Third, while exhibit KK presented both on-site and off-site scenarios, it is clear that exhibit LL proceeded from an assumption that development would occur on-site. Judge Rampton in his decision, however, expressly concluded that "on-site processing is probably impractical" (Decision at 70). Admittedly, he also noted that the evidence did not "render on-site processing totally impossible," but it is difficult to determine the relevance of this observation unless one assumes that the Government bears the burden of establishing the invalidity of a mining claim beyond any possibility, and thus must establish that a proposal is "totally impossible." In point of fact, as noted above, it is contestees who bear the affirmative obligation of establishing a reasonable "likelihood" of success. The fact that something may not be "totally impossible" scarcely establishes that it is reasonably likely.

Moreover, after Shoemaker had flatly testified that there was no site large enough on any of the claims to hold the leaching pads called for in exhibit KK (1986 Tr. 513), Edmiston responded that it had always ^{86/} been contestees' intent to construct their pads on fill material and noted that

^{86/} While contestees may well have always intended to construct their pad on fill, Edmiston's testimony was the first indication of this fact.

the pad would be commenced from a saddle area northeast of the hilltop deposit. See 1986 Tr. 929-30. Leaving aside the substantial questions attendant to contestees' plan to place the pad on fill (but see 1986 Tr. 1060-63), we must point out that the site identified by Edmiston is located on the Copper Lode No. 3 mining claim. Since that claim has already been declared null and void, contestees will not be able to construct any pad facilities thereon. Even allowing for the fact that a smaller initial pad would be needed, it is difficult to see where on the two claims which embrace the hilltop area such a pad could be sited. There is simply no realistic likelihood that on-site processing of the hilltop deposit will be feasible, and the added transportation costs inherent in off-site processing would further negatively affect profitability. 87/

The cumulative impact of all the foregoing is that the record, far from supporting contestees' assertions as to the existence of a discovery on the hilltop deposit, actually establishes the opposite, i.e., a prudent individual would not be presently justified in the further expenditure of labor and means with a reasonable likelihood of success in developing a paying mine. The fact that the evidence might be adjudged sufficient to impel a prudent individual to commit further capital to study whether or not development is feasible is not, as noted above, the equivalent of evidence sufficient to say, as a present fact, that a prudent individual would be justified in committing further capital to the development of the claim.

This is underlined not only by the failure of other entities such as OXY to proceed with development efforts but by contestees' own failure to commission a feasibility study or even to conduct more detailed testing of the deposit's amenability to leaching. We recognize that the cost of such additional studies is not insignificant. But since contestees themselves admit that such studies would be prerequisite to actual development, these are costs which a prudent individual should be willing to absorb, particularly where, as here, the levels of expected outlays for development are themselves much more substantial. Judge Rampton's determination that a prudent individual would proceed with the development of the hilltop deposit cannot be sustained based on the evidence adduced below. Accordingly, we find that the Copper Lode Nos. 1 and 2 are null and void for lack of a present discovery of a valuable mineral deposit within the meaning of the mining laws.

87/ Included in such impacts would be the increased truck traffic which would be necessary for off-site processing and which would substantially increase road costs. Exhibit LL had estimated these costs at only \$100,000. See Exh. LL at Table 3.1. By contrast, the scenarios examined in exhibit KK, including those involving on-site processing, estimated road construction costs to be \$320,000 (Exh. KK at Table 6.2), i.e., \$220,000 more than estimated in exhibit LL. The amount of road traffic necessitated by off-site processing of the hilltop deposit is greater than the road traffic which would result with on-site processing under exhibit KK and upgrading the road to the level indicated as necessary in exhibit KK would further negatively affect the economic feasibility of development.

In light of the foregoing, we will not further burden an already lengthy decision with an examination of the proper boundaries of the claims, particularly with respect to the location of the west sideline of the Copper Lode Nos. 5 and 7. Since we have determined that none of the claims exhibit a present discovery of a valuable mineral deposit, it is unnecessary to decide this matter.

In summary, we find: (1) that the record fails to establish any consistent relationship between the individual Mieritz drill holes and OXY chip samples which would warrant reliance upon individual chip samples, without more, as predictors of values at depth; (2) that the evidence fails to establish any direct correlation between the average value of the chip samples and the average value of the drill holes; (3) that insofar as the geologic mapping is concerned, the evidence fails to establish that the principle of lateral continuity is applicable to the mineralized copper zones outcropping on the surface of the claims, particularly with respect to continuity of values at depth; (4) that the evidence fails to establish the existence of a valuable mineral deposit within Area B; (5) that the evidence also fails to establish the existence of a valuable mineral deposit within the non-hilltop portions of Area A; and (6) that the evidence fails to establish that there is a reasonable likelihood of success that a paying mine could be developed on the hilltop portion of Area A. Contestees, as the proponents of validity of these claims, bore the burden of preponderating with respect to each of the elements listed above and their failure to do so requires that we find these claims invalid.

Therefore, pursuant to the authority delegated to the Board of Land Appeals by the Secretary of the Interior, 43 CFR 4.1, the decision appealed from is reversed and the Copper Lode Nos. 1, 2, 3, 5, 7, 13, and 14 are hereby declared null and void for lack of a discovery of a valuable mineral deposit within the meaning of the mining laws.

James L. Burski
Administrative Judge

I concur:

Gail M. Frazier
Administrative Judge