UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Mining Division
Region IV

September 18, 1952

Memorandum

To: Field Team, Region IV

From: Acting Chief, Mining Division, Region IV

Subject: ~~Final~~ Field Report, DMA Docket 2085, (Asbestos) Metate Asbestos Corporation, Gila County, Arizona

Enclosed are nine copies of the final engineering report on DMA 2085 by L. A. Stewart of the Bureau of Mines.

The examining engineer recommends exploration work in the amount of $3050 to prove or disprove the existence of ore bearing limestone blocks within a distance of 100 feet from an operating mine.

We concur in this recommendation.

W. H. King
W. H. King

Enclosures

MINING DIVISION
REGION IV

August 27, 1952

Memorandum

Register

To : W. D. King, Acting Chief, Mining Div., Region IV

From : Chief, Arizona-New Mexico Branch, Mining Div., Region IV

Subject : Report on MMA Docket 2005, Metate Asbestos Corp., Gila County, Ariz.

We are returning the above report to you with a revised section on Summary, Conclusions and Recommendations by Lincoln A. Stewart of the Bureau of Mines. Stewart still believes that this property should be granted Government assistance for exploratory work as he revisited the mine last week (August 21 and 23), so again recommends a loan.

As I wrote you in my letter of July 1, A. F. Shride and Jules Macnalior of the Geological Survey visited this property in December 1951 and mapped the mine. L. A. Stewart of the Bureau of Mines accompanied Shride to the property in February 1952 and examined the property. The examiners had difficulty in arranging a proposal for exploration work on the property that was agreeable to all parties but a final agreement was thought to have been reached early in April, so Stewart submitted his report to the Denver office on April 14. At that time we understood that Shride agreed to the section on Summary, Conclusions and Recommendations that accompanied Stewart's report.

About that time Shride was busy with work for the coming convention in Tucson of the Geological Society of America, so he did not complete his report and submit it to Denver until June 12. In the meantime he had revisited the Metate property and found that conditions had changed very much since Stewart's and his visit in February. Shride then recommended denial of a loan although Stewart had recommended a loan in April and at that time thought that Shride concurred with this recommendation. // Note

On August 21 and 23, Stewart again visited the Metate Asbestos Corp. mine and after this examination he still thinks that Metate should be granted a small loan. However, if the loan application is held up

cc W. D. King (6)
A. F. Shride
MMA-2005
JF

WMStorms:frj

much longer, the applicant will have advanced the workings to such a degree that the present proposal may have to be modified.

As the need for Arizona asbestos seems to be great, I would recommend that the loan for the presently proposed exploration work be granted.

Stewart's original report is being returned.

Walter R. Storms

Walter R. Storms, Chief
Arizona-New Mexico Branch
Mining Division, Region IV

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION
WASHINGTON 25, D. C.

200 New Customhouse
Denver 2, Colorado

June 16, 1952

Memorandum

To: DMA Field Team, Region IV

From: A. N. Koschmann

Subject: DMA Project 2006, "Chanley" Amosite Line, Mutate Asbestos Corporation, Gila County, Arizona (Amosite)

Enclosed are the original and 4 copies of the geologic report by A. F. Bride of the U. S. Geological Survey covering the above project.

It has been recommended that the loan be denied.

A copy of the brochure is enclosed.

A. N. Koschmann
A. N. Koschmann
Supervising Geologist
Colorado-Wyoming

Enclosures (10)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

[illegible] Box 213, University Station
Tucson, Arizona

June 12, 1952

Memorandum

To: A. [illegible] Lindemann, Denver, Colorado

From: A. F. Shride, Tucson, Arizona

Subject: Geologic Report, UPA 2005, "Shanley" Apache Mine, Metate Asbestos Corporation, Gila County, Arizona (Asbestos)

Enclosed are the original and 8 copies of the above report by A. F. Shride of the Geological Survey.

Because the conclusions and recommendations of this report are at variance with those of the engineering report which recommends exploration, the enclosed report is longer than is usually necessary. I would like to direct your attention particularly to pages 10, 11, and 12 of the geologic report.

Enclosed is a copy of the original brochure.

A. F. Shride
Acting District Supervisor
Arizona-New Mexico

Enclosures 10

UNITED STATES
DEPARTMENT OF THE INTERIOR
OSCAR L. CHAPMAN, SECRETARY

DEFENSE MINERALS EXPLORATION ADMINISTRATION

REPORT OF EXAMINATION BY FIELD TEAM
REGION IV

DMA-2005X, Metato Asbestos Corp.

Gila County, Arizona

Revised

Lincoln A. Stewart, Mining Engineer
U. S. Bureau of Mines

August 1952

REVISED SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

By Lincoln A. Stewart 1/

The Engineering report, Metate Asbestos Corp., Gila County, Ariz., was submitted to Denver April 10, 1952 following an investigation of the property by the examining team on February 12. Submitted with this report was the Summary, Conclusions and Recommendations, which the Geological Survey member had read. No objection to the recommendation was offered at that time.

The writer freely admits optimism in the recommendation of the application and is still of the opinion that denial recommendations, based on failure to predicate full repayment of loans for asbestos explorations, are an inadequate approach to the encouragement and stimulation of intensive search for new deposits or for extensions of known deposits. wrong

Two asbestos consultants to the Government 2/ have indicated that everything possible must be done to get more production from Arizona.

Shride submitted the Geologic report on June 12, after having revisited the mine. In that report, possibilities of exploration at the presently operating mine (No. 2) are discussed. On page 9, under heading <u>West of Dike</u> it is stated "Immediately west of the N. 70° E. diabase dike, asbestos is exposed in three places. If the limestone "feathers out" to the northwest, as diagrammed on figures 6A and 6C, as seems most likely, there is little potential of asbestos northwest of the dike. If, however, the limestone is

1/ Mining Engineer, U. S. Bureau of Mines, Tucson, Ariz.
2/ Dr. Oliver Bowles and Jesse M. Weaver.

continuous for some distance, as shown in the alternative figures 6B and 6D, this is a very likely area for asbestos. If exploration is done in this deposit, drifting on the northwest side of the dike along the strike of the beds would be worthwhile to find out whether or not the limestone west of the dike is continuous for at least a few tens of feet."

This is the part of the program mentioned on page 16 of the Engineering report: "There is a further possibility of the existence of a similar deposit on the north side of the main dike because of the fact that the formations dip more steeply on the north side of the dike, the driving of an exploratory crosscut to that side should be held in abeyance until considerable depth has been attained in the primary exploration incline. Thus any ore found could be mined much more cheaply b y overhand stoping from a drift along the strike". 200 feet of Crosscutting and drifting was tentatively set up for this phase.

Quoting again from the Geologic report, page 10 under heading <u>In Irregular "Bulge" at Southwest End of Workings</u>, it is stated: "Where the "bulge" was first encountered, one round was shot in the diabase. This exposed a continuation of the ore-bearing bed. It seems likely, however, that this is a "sliver" of limestone (as illustrated on figure 6B) that will not be continuous. It would be worthwhile to drift 10 to 20 feet to prove the nature of this limestone block. If the limestone underlies the entire diabase "bulge", very probably it will contain minable widths of asbestos ore".

This location was to be the primary exploration incline of the program, the first phase of which was the rehabilitation of the original incline to this point, to be followed by 200 feet of inclined drifting. The Engineering report states: "At the bottom of the incline a round has been blasted through this crosscutting dike and fiber is showing below the dike. There also is a possibility that a deposit will be found westward from this point. If the cross dike is merely an offshoot from the main east-west dike, geologic conditions would be favorable for a continuation of the deposit down dip along the south side of the main dike".

At the time the Engineering report was written the crosscutting diabase feature that swung the ore to the southwest was interpreted as a dike. Further mining allowed the geologist to interpret the diabase irregularity as a "bulge". On page 11 of the Geologic report it is stated: "The two possible extensions of the deposit earlier discussed (northwest of the dike and below the diabase "bulge") are geologically unlikely areas for the discovery of asbestos".

For a period of more than 4 months since the Engineering report and recommendations were made, the Metate Asbestos Corp. has continued stoping down dip on the deposit. Although the switch-back from the incline to the adit entry is still in use, the company has widened the upper part of the workings and shifted the track to conform with the alignment of the stope. This method of hoisting

the ore seems adequate for their rate of production. The face of the stope is now 60 feet beyond the point shown on figure 3 of Engineering Report (see figure 3A, this report). The ventilating raise to surface, suggested in the original recommendation, has been driven.

It is obvious that the original proposal is not now entirely valid and the applicant is aware of this fact. However, the need to explore the two possibilities remains, as there is a chance of mineralization to the northwest of the mine, if the limestone beds persist down dip. For this reason, the applicant has suggested that the exploration now consist of 100 feet of drifting northwest from some point near the bottom of the stope. To cover the possibility that the limestone beds to be sought may be at different elevations and dips due to tilting, the applicant further suggests that 20 feet of raising be included, plus a total of 100 feet of long-hole drilling (possibly 5 holes of 20 feet each) to take the place of sinking a winze.

An all inclusive unit bid has been offered for this work as follows:

100 feet of drifting at $22.50 per foot	$2,250
20 feet of raising at $15.00 per foot	300
100 feet of long-hole drilling at $5.00 per foot	500
Total	$3,050

The two possibilities of limestone remnants have been previously mentioned as lying under the diabase bulge and west of the N. 70° E. diabase dike. The geologic report suggests the possibility of these

two limestone blocks "feathering out" and thus being "geologically unlikely areas for the discovery of asbestos". The only place opened under the bulge "exposed a continuation of the ore-bearing bed". The report also states "if the limestone underlies the entire diabase "bulge", very probably it will contain minable widths of asbestos ore".

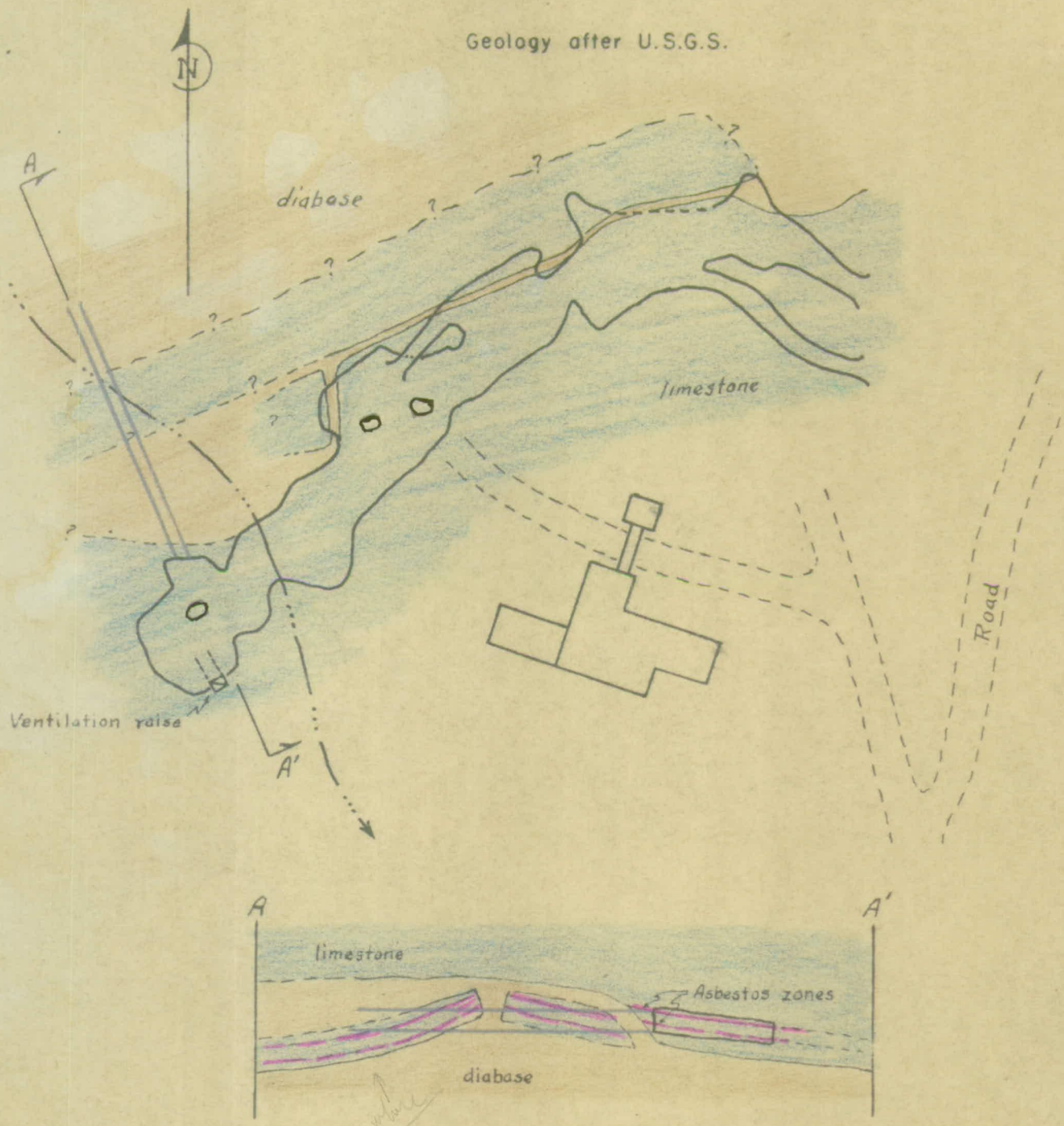
Of the limestone west of the N. 70° E. diabase sill, the geologic report states "asbestos is exposed in three places", and that if exploration is done west of the dike "drifting - - - would be worthwhile to find out whether or not the limestone - - - is continuous - - -".

The possibility of proving or disproving the existence of two potentially ore-bearing limestone blocks within a distance of less than 100 feet from an operating mine at a maximum cost of $3,050 seems to the writer to be a rich well worth taking. The time to do this exploration at a minimum cost is while the mine is in operation. When the present deposit is bottomed, the company plans to conduct a retreating operation of pulling pillars and widening stope areas to recover all possible ore. Owing to the blocky condition of the roof under the gulch, the mine certainly will cave soon thereafter and the chance of relatively inexpensive exploration then will be lost.

The unit bid prices are considered reasonable. The exploratory operations will be conducted on evening or night shift. Long-hole drilling will be done with a jackhammer; applicant will have to rent or buy jointed drill steel. The unit footages are maximum figures considered sufficient to explore the potentialities. Applicant states that if fiber is found it will take over from there.

In view of the low cost of exploring the two possible nearby extensions of the deposit, the writer recommends that the Metate Asbestos Corp. be granted a loan of $3,050 to perform the above exploratory work. Two months should be allowed for the work. It could be started within 10 or 15 days from date of notification to proceed.

The applicant recently has discovered two outcropping asbestos ledges about 150 feet apart on the northernmost claim (Apache No. 2) of the group, less than one-half mile from the mine. These ledges contain fiber similar to that exposed in the outcrop of the main mine. In the near future the applicant expects to make an application for a relatively modest exploratory loan to strip the outcrop and, if showings justify, to explore by an inclined drift. The applicant would like to have this forthcoming program considered as another possible phase of exploration under the present DMA docket No. 2005, in order to obviate the necessity of presenting an entirely new application. However, if this request will in any way jeopardize the granting of the presently recommended loan, the applicant states that this suggestion be disregarded.



Section A - A'.

Postulated cross section. See Fig. 6B, Geologic Report.

Scale 1" = 50'

Proposed drift

DMA 2005

Mine as of 8/23/52.

Fig. 3A - Revised plan, Metate mine, showing proposed work.

"SHANDY" APACHE MINE
MATTE ASBESTOS CORPORATION
GILA COUNTY, ARIZONA
ZONA 2005

ASBESTOS

Geology

By
A. F. Shride
Geologist, U. S. Geological Survey

"SHANLEY" APACHE MINE
PRIVATE ASBESTOS CORPORATION
GILA COUNTY, ARIZONA
ZNA 2005

ASBESTOS

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SUMMARY AND CONCLUSIONS

An ore shoot 20 to 25 feet wide, of unpredictable but probably not great length, containing perhaps 65 to 80 tons of all lengths of low-iron chrysotile asbestos per hundred feet of length is available for exploration in the area under consideration. This ore contains a large content - perhaps 50 percent - of harsh but nonetheless spinning quality asbestos. Due to the probable exorbitant costs of exploration, per ton of optimistically expectable asbestos, an exploration program of the magnitude proposed, even though the amount of money involved is small ($25,000), does not seem justified.

Because some spinning length asbestos is expectable financial aid in some form may be worthwhile. Unfortunately, none of the Defense Minerals Exploration Administration or Defense Materials Procurement Agency programs seem designed to furnish the financial aid required.

INTRODUCTION

The Metate Asbestos Corporation has requested an exploration loan on the Apache asbestos deposits which are approximately 12 miles airline east-northeast of Globe, Arizona. The deposits are readily accessible from Globe by 15.5 miles of paved, gravel, and dirt road adequate except when wet. As more than one "Apache" asbestos mine exists in the district this mine is here designated the "Shanley" Apache Mine. W. G. Shanley originally developed this area in the 1920's.

The chrysotile asbestos deposits of Gila County, Arizona are genetically related to the intrusion of small dikes and extensive sills of diabase into the pre-Cambrian Pascal limestone. Chrysotile occurs as cross-fiber veins in serpentine zones that approximately parallel the bedding of the limestone. The localization of the asbestos deposits was influenced by favorable limestone beds, proximity of diabase to these beds, small-scale folds, and minor bedding-plane and thrust faults.

GEOLOGY OF THE APACHE DEPOSITS

The minable asbestos-serpentine zones on the Apache claims are at the top and bottom of a 4 feet thick competent limestone bed that is approximately 40 feet below the top of the lower member of the Pascal limestone. This stratigraphic unit is the most productive of asbestos throughout the asbestos district. A diabase sill, in general concordant, underlies the limestone; the contact between the diabase and the limestone is 8 to 15 feet stratigraphically below the lower asbestos zone in the asbestos-bearing areas. To the west of the asbestos-bearing areas this sill cuts up across the limestone most favorable to asbestos localization; therefore, asbestos cannot be expected beneath the western part of the Apache group of claims.

The pre-Cambrian rocks and the diabase sills in this area dip 15-30 degrees to the southwest. This dip is the result of post-diabase deformation and therefore is not significant in localizing the asbestos deposits; however, the attitude of the beds does cause a problem in mine development because the deposits must be developed in a down-dip direction.

The main area under consideration in this application can be visualized as underlain by a thin "slab" of southwestward dipping limestone; the asbestos deposits, which parallel the bedding of the limestone are 8 to 15 feet above a thick diabase sill. Approximately halfway between the northernmost mine and the southernmost mine (see fig. 4), the limestone "slab" and the underlying sill are offset by a vertical easterly-trending fault. The northern block is the downthrown block; the throw is on the order of 15-20 feet. On opposite sides of the fault the underlying diabase sill is intruded at slightly different stratigraphic horizons. For purposes of description, hereafter, the northernmost mine arbitrarily will be referred to as the No. 1 mine and the southernmost as the No. 2 mine. North of the fault to the vicinity of the No. 1 mine the limestone-diabase contact is approximately 10 feet below the upper asbestos zone. South of the fault for a distance of approximately 150 feet - to the vicinity of the No. 2 mine - the concordant contact of the diabase and limestone is 2 feet stratigraphically above the upper asbestos zone. Thus in this 150 foot interval there can be no asbestos. In the vicinity of the No. 2 mine the diabase cuts down across the limestone at a high angle and resumes concordancy approximately 10

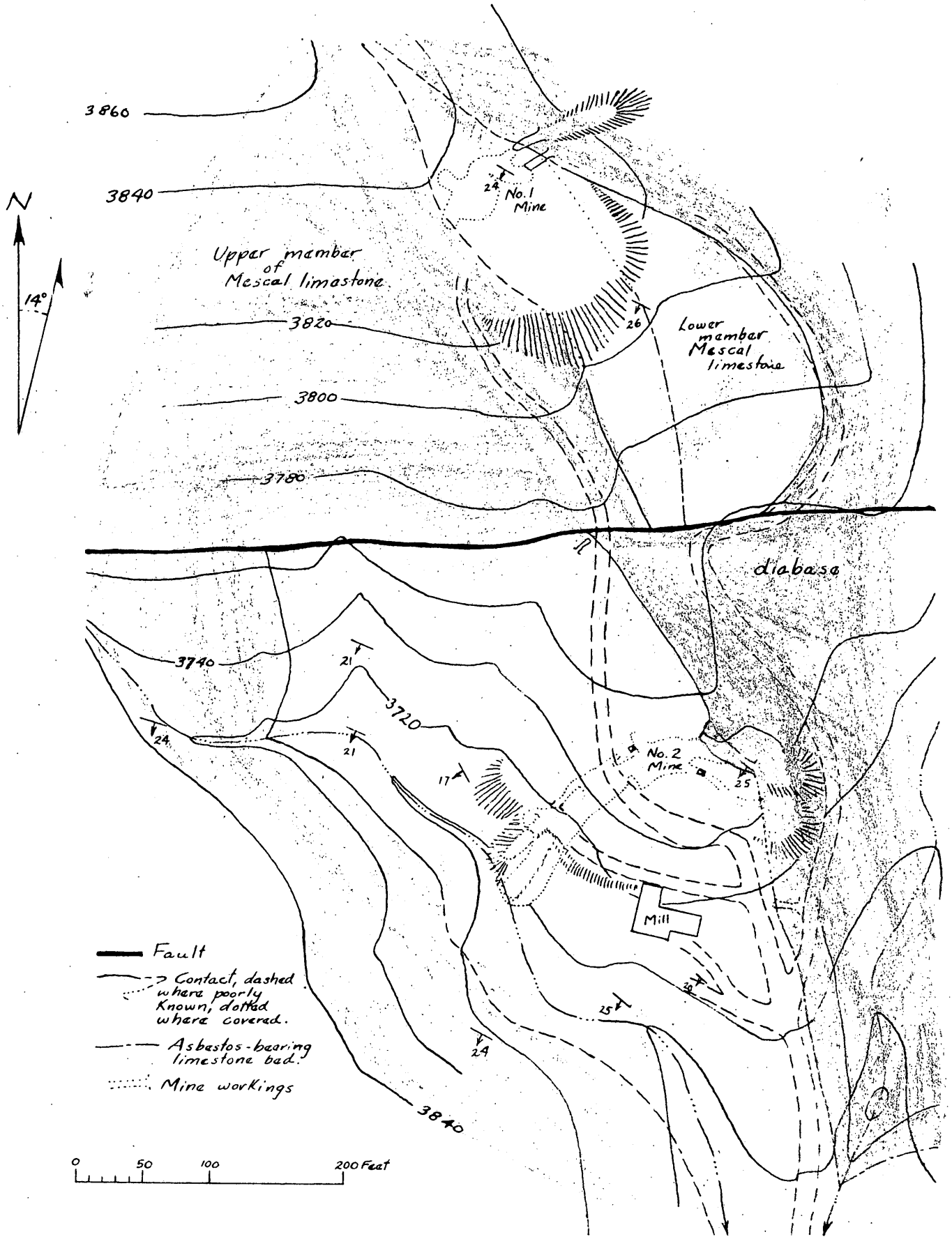

FIGURE 4.-SKETCH GEOLOGIC MAP, "SHANLEY" APACHE MINE

DMA-2005

feet below the upper asbestos zone. The strike of the discordant portion of the limestone-diabase contact can be generalized as N. 70° E.

The most significant factor that determined the extent of the asbestos mineralization in Arizona was the degree and lateral extent of bedding-plane and thrust faulting. Because in many places there was bedding-plane adjustment only immediately adjacent to discordant diabase intrusions, many deposits of the district have little lateral extent away from the diabase-limestone contacts. The deposits on the Apache claims are excellent examples of deposits that cannot be expected to have much extent away from the diabase. Such deposits are likely to be more or less continuous along the discordant contacts of limestone with diabase; however, owing to the vagaries of diabase intrusion the continuity of the deposits along the contacts cannot be predicted readily.

No. 1 Asbestos Deposit

The No. 1 deposit obviously rakes southwest. There are poor prologic criteria to suggest a northeast-trending discordant diabase contact immediately north of the present mine workings. Other than this possible diabase discordancy, there is no suggestion as to the reason for localization of the asbestos in this area. The No. 1 deposit has been exploited by a small stope (see fig. 4). Present mine focus on one harsh fiber veins, totaling 2 to 3 inches in thickness, in a serpentine zone averaging 10 inches in thickness. This zone is at the bottom of the 4 foot favorable limestone bed. In the vicinity of the No. 1 mine, fiber is exposed in the upper zone (at the top of the favorable bed) in only one small area, and nowhere does the upper zone appear to contain sizable quantities of asbestos.

The fiber of the No. 1 deposit is within a few feet of the topographic surface and is moderately weathered and therefore weak. If the zones parallel, the asbestos of both zones is likely to be weathered for some distance. For this reason and because the ore zone contains less asbestos per unit of stope area than the No. 2 deposit, exploration or exploitation of the No. 1 deposit is not as desirable as for the No. 2 deposit.

No. 2 Asbestos Deposit

Most of the minable asbestos of the No. 2 deposit occurs in a shear 20 to 25 feet wide that parallels a N. 70° E. diabase dike. The ore zones are on the southeast side of the dike. The dip of the beds and the asbestos zones in this area is 20° - 22° in a S. 30° - 45° E. direction. An upper 10 to 15 inch thick serpentine zone, at the top of the favorable limestone bed, contains harsh fiber veins totaling 2 to 8 inches in thickness; the average cumulative thickness of the veins is visually estimated to be 4 to 5 inches. A serpentine zone 4 feet stratigraphically below the upper zone contains minable quantities of asbestos only sporadically.

As previously noted, north of the No. 2 mine, the sill has cut up across the beds and in consequence, along the outcrop between the fiber outcrop and the east-trending fault, at a stratigraphic horizon 2 feet above the favorable beds for asbestos development. The line along which the discordancy occurs is probably the N. 70° E. dike. It seems likely that the limestone that is known from three or more in the mine workings to border the dike on the northwest side is merely a narrow sliver of limestone that probably "feathers out" into the diabase to the northwest

(fig. 6A, 6C). Alternative geologic possibilities to show the possible relations of the limestone to the diabase are shown on figures 6B and 6D.

Recent development in the southwestern part of the mine workings in the No. 2 deposit has exposed an irregularity or "bulge" in the underlying diabase sill adjacent to the N. 70° E. dike described above. Exposures of the "bulge" are few and the feature may alternatively be interpreted as a local thin discordant sill offshoot of the main sill - such seems unlikely, however. For alternative interpretations of this feature, see figures 6A and 6B. The local irregularity in the sill at the southwestern end of the present workings was particularly favorable for the development of a considerable local concentration of asbestos, because in the vicinity of such features, the limestone was well fractured and prepared for mineralization. Such features also cause difficulty in geologic interpretation, because past experience in the Gila County District has shown that the degree of asbestos mineralization beyond such structures is not predictable. For some deposits away from such structures and parallel to dikes, such as the N. 70° E. dike of the No. 2 area, the asbestos-bearing serpentine zone may abruptly pinch out. In other places the zone may continue parallel to such dikes. Mining along the zone in the vicinity of the diabase "bulge" is likely to be profitable as long as this feature persists. It should be noted that all asbestos mined to date from the No. 2 deposit is between the above described irregularity and a like "bulge" where the asbestos zone crops out at the surface (see map, fig. 5). Unless such irregularities occur at intervals along the southeast extension of the deposit, it is likely that the asbestos content of the fiber zones will be too little to warrant mining.

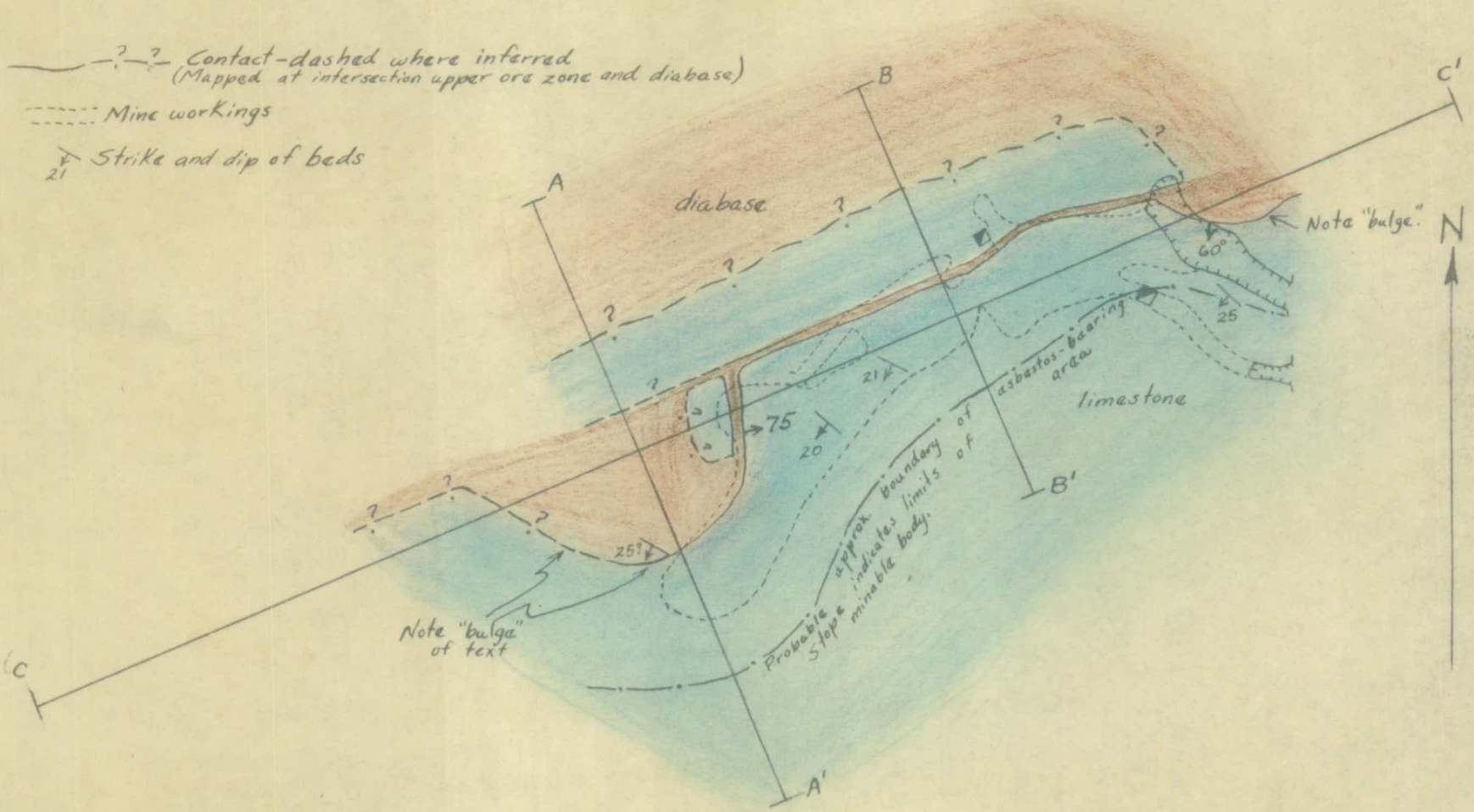

FIGURE 5.— GEOLOGIC MAP, NO. 2 MINE, "SHANLEY" APACHE MINE

0 50 100 150 Feet

DMA-2005

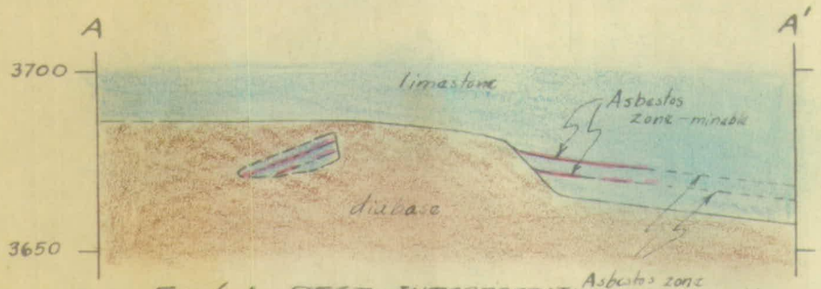

FIG. 6 A - BEST INTERPRETATION OF SECTION A-A'

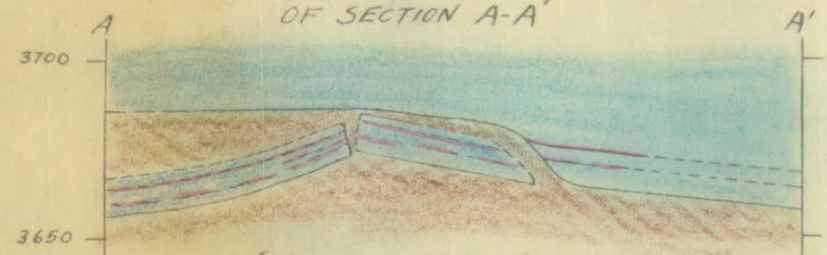

FIG. 6 B. - POSSIBLE BUT IMPROBABLE INTERPRETATION OF SECTION A-A'

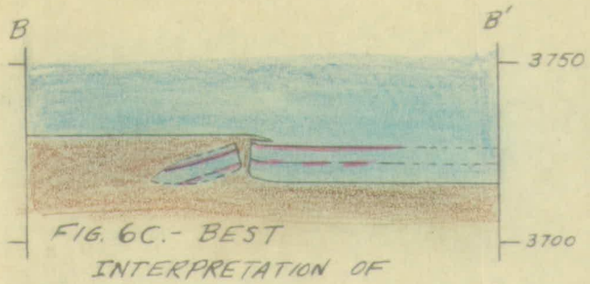

FIG. 6C. - BEST INTERPRETATION OF SECTION B-B'

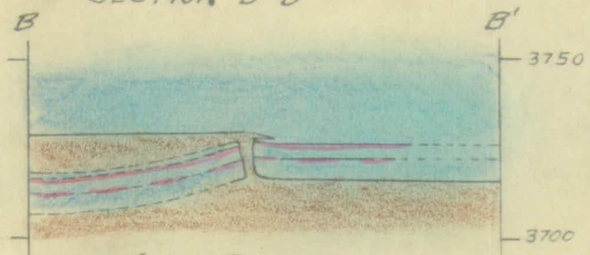

FIG 6D. - POSSIBLE BUT IMPROBABLE SECTION B-B'

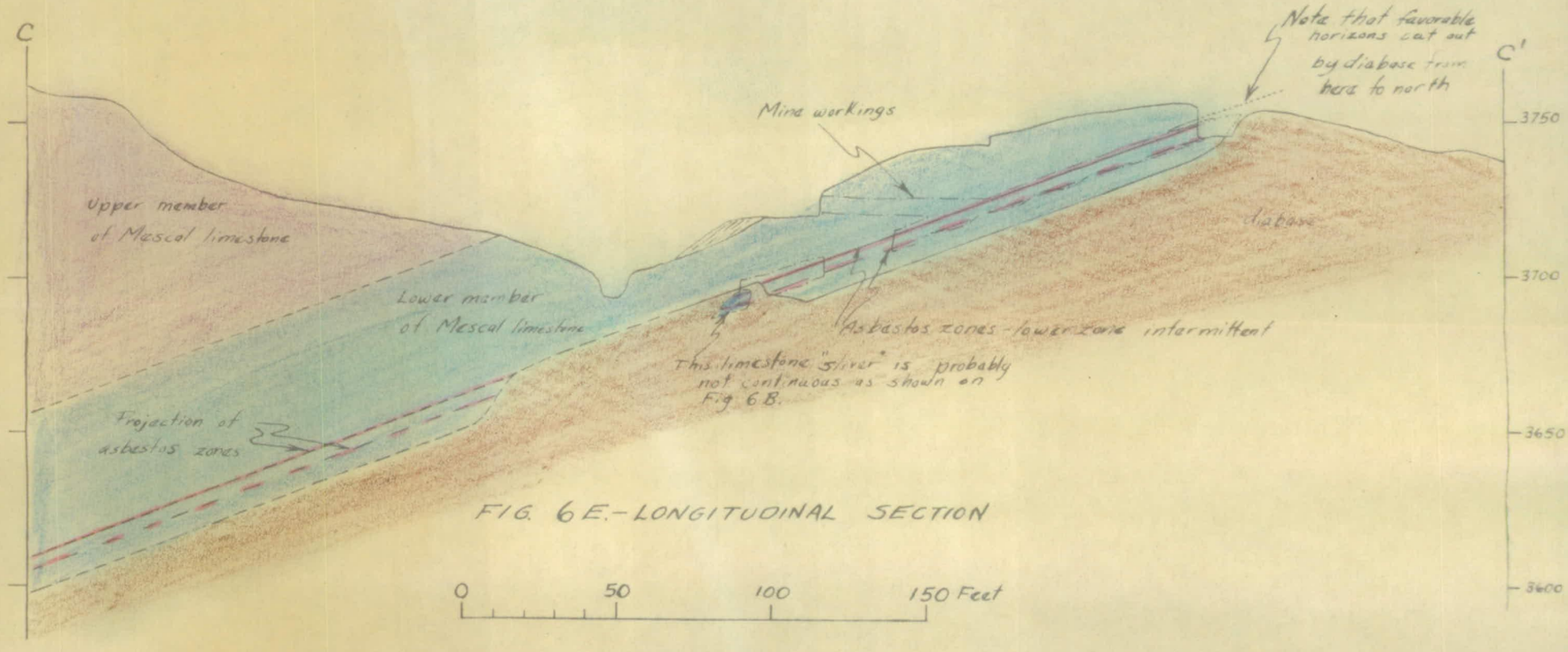

FIG. 6 E. - LONGITUDINAL SECTION

FIGURE 6. - SECTIONS THROUGH NO. 2 DEPOSIT "SHANLEY" APACHE MINE (ASBESTOS)

DMA-2005

Although the fiber is harsh, it is of fairly good tensile strength and is being blended with Shabani fiber, by one of the larger domestic fabricators, to produce electrical grade rovings and textiles. Therefore, the fiber should be considered as of strategic quality, although due to rigid specifications as to flexibility, the Emergency Procurement Service might not consider purchase of the asbestos for the stockpile. Much of the fiber produced from this deposit has been weak due to weathering. Fiber that may be exposed downdip, beyond the line of the creek bed (see fig. 6), can be expected to be of better strength because it will probably be below the zone of weathering.

RESERVES

The asbestos of the No. 1 deposit is of inferior quality and there is little point in estimating reserves for this report. At the present no exploration is contemplated in the No. 1 area.

In the No. 2 area, at present a minable width of asbestos veins can be predicted only in the area bordering the southeast side of the dike. This ore shoot is 20 to 25 feet wide. Experience in the district has shown, that for this type of deposit, it is not reasonable to anticipate asbestos reserves more than 50 feet along the trend of the ore shoot. The upper zone mined to date has included asbestos veins averaging about 4 inches in cumulative thickness. The lower zone, which contains recoverable amounts of asbestos only locally, probably has furnished an equivalent of about 25 percent of the amount of asbestos that has been produced from the upper zone. From the above data 33 to 40 tons of all grades of asbestos are inferred. Deposits of this type are so unpredictable that it does not seem reasonable to term any of this ore as "indicated." This asbestos

might be included in 66 to 80 tons of mill rock. There is little basis from past production figures for estimating the ratio of spinning lengths of fiber to short fiber. However, the veins of the Apache claims contain an unusual amount of spinning lengths of fiber; as a guess, perhaps 40-60 percent of the fiber is recoverable as spinning length fiber.

REVIEW OF ORIGINAL EXPLORATION PROPOSAL

The applicant's original exploration proposal requested funds for two inclined adits, each approximately 500 feet in length.

One adit was to be started in the vicinity of the No. 1 mine and to be driven southward to the vicinity of the No. 2 deposit on the expectation that the asbestos is persistent between the two areas. This plan is not plausible because:

(1) The drifts would not follow the rake of either ore shoot.

(2) The east-west fault that is approximately halfway between the two ore bodies offsets the ore horizon to make the plan untenable.

(3) North of the No. 2 ore body the favorable limestone bed is known, from surface, exposures, to be missing due to dilution by the diabase sill.

The other adit was intended to explore an asbestos zone that crops out approximately 1000 feet northwest of the No. 1 mine. At this exposure 1½ to 2 inches of harsh to semi-harsh asbestos in a weakly serpentinized zone 8 to 12 inches thick occurs 18 inches below a diabase sill in a narrow "sliver" of limestone that is bounded above and below and on both sides by diabase. At the stratigraphic horizon of the asbestos the limestone sliver is limited by diabase to a width of 30 feet. Although the exposures are so poor that strike of the contacts between diabase and limestone cannot be determined with certainty, the best judgment that can

be made is that the contacts are parallel and strike about N. 45° E. If this appraisal of the structure is correct, the proposed inclined adit would explore a limestone block only 30 feet in width. The obvious geologic contacts (stratigraphy and proximity to diabase) are very favorable, yet the limestone that crops out is poorly superdolomitized and contains little asbestos. In consideration of the above facts, exploration is not justified in this area.

In view of the above appraisals, the applicant was asked to prepare a less pretentious exploration proposal more commensurate with the potential of the No. 2 ore body, where a thick (2-8 inch total of asbestos veins) but narrow ore shoot was exposed. The exploration proposal set forth in the engineering report resulted from this request.

EXPLORATION POSSIBILITIES

West of Dike, No. 2 Mine

Immediately west of the N. 70° E. diabase dike, asbestos is exposed in three places. If the limestone "feathers out" to the northwest, as diagrammed on figures 6A and 6C, one as seems most likely, there is little potential of asbestos northwest of the dike. If, however, the limestone is continuous for some distance, as shown in the alternative figures 6B and 6D, this is a very likely area for asbestos. If exploration is done in this deposit, drifting on the northwest side of the dike along the strike of the beds would be worthwhile to find out whether or not the limestone west of the dike is continuous for at least a few tens of feet.

In Irregular "Bulge" at Southwest End of Workings, No. 2 Mine

Where the "bulge" was first encountered, one round was shot in the diabase. This exposed a continuation of the ore-bearing bed. It seems likely, however, that this is a "sliver" of limestone (as illustrated on

figure 6E) that will not be continuous. It would be worthwhile to drift 10 to 20 feet to prove the nature of this limestone block. If the limestone underlies the entire diabase "bulge," very probably it will contain mirable widths of asbestos ore.

Southeast Along the Zone at Present Being Exploited, No. 2 Mine

Asbestos-serpentine zones containing approximately the same amounts and type of fiber as at present being mined can be expected to exist downdip on the southeast side of the dike and the irregular "bulge" in the underlying sill as long as the favorable geologic conditions persist. It is impossible to predict the persistence of the favorable structural conditions, except by comparison with other deposits in the district. Deposits of the Apache type (elongate, narrow bodies localized along a discordant diabase contact where there was pre-mineral fracturing of the limestone) persist in very few places more than 100 to 300 feet, and in many places are persistent only a few tens of feet along the long axis of the deposits.

Downdip from the present face of the No. 2 mine, 65 to 80 tons of asbestos of all grades might be developed per 100 feet of drifting, if favorable geologic structure persists. On the basis of 1951 production records, furnished by the applicant, this fiber might be expected to have an average value on the order of $350 per ton. Therefore, the value of the asbestos that might be discovered per hundred feet of drifting, might be on the order of $25,000. To repay the cost of the revised exploration program furnished by the applicant, would require approximately $500,000 worth of asbestos, or 20 times the value of fiber that is reasonably expectable per hundred feet of drifting. As previously stated, few

deposits of the subject type have lengths of more than 100 to 300 feet. Obviously only a small percentage of the loan can be repaid if fiber is found only in this area. The two possible extensions of the deposit earlier discussed (northwest of the dike and below the diabase "bulge") are geologically unlikely areas for the discovery of asbestos.

If a remote geologic possibility that an appreciable part of an exploration loan will be repaid is a requisite to granting that loan, it must be recommended that the subject loan be denied.

If the revised exploration program is carried out, the maximum length that might be explored along the trend of the ore shoot now exposed might be on the order of 300 feet. If favorable geologic conditions persist along the trend of the ore shoot for 300 feet beyond the present face, a remote geologic probability, the Government would be "subsidizing," by granting the exploration loan, the development work at the rate of $80 -$100 per ton of all grades of asbestos that might be optimistically hoped would be discovered. This assumes that asbestos in comparable quantities to that at present exposed would exist throughout the 300 feet length.

Optimistically it might be hoped that 100 to 150 tons of harsh fiber that may be suitable for spinning would be developed by such exploration work. It would be a more reasonable geologic "bet," that not more than 50 tons of spinning grades would be expectable. If only 50 tons were discovered this production might be said to have been "subsidized" at the rate of $400 per ton of strategic fiber produced. (On one 13 ton shipment of spinning grades of asbestos, the applicant received an average of $735 per ton). Granted of an exploration loan on the basis of the above geologic potential does not seem warranted.

It is certain that some strategic quality asbestos will be recovered beyond the mine face now exposed. If the need for strategic asbestos is so critical that the unfavorable odds outlined in previous paragraphs can be overlooked, granted of an exploration loan can be recommended. The exploration plan to follow the ore body is feasible from a purely geologic viewpoint. Flexibility of direction and planning should be allowed in making a contract for such a program. A preferable way of aiding the operators of this property would be some method of advancing, month by month as long as necessary, funds in small amounts against production so that operating capital would be available. Insufficient reserves (35 to 40 tons inferred) exist to warrant a production loan.