224 New Customhouse
Denver, Colorado

June 21, 1951

Memorandum

To: Landon Strobel, Executive Secretary, Defense Minerals Administration

From: DMA Field Team, Region IV

Subject: DMA Docket 244, American Asbestos Cement Corp., Gila County, Arizona

We are attaching the report of the field geologists and engineers on the American Asbestos Cement Corporation, Docket DMA 244. We also attach three copies of a confidential letter.

The field team recommends that no funds be granted this company until competent technical supervision is provided and that any exploration funds granted be in two steps: (1) a relatively small sum for geologic reconnaissance by a competent geologist; and (2) a larger drilling program be authorized if the geologic reconnaissance appears to warrant it.

JHE/cl
copy to DMA files
Koschmann
Allsman
Anderson
Storms

J. H. East, Jr.

A. H. Koschmann

Attachments
One copy by air mail
Two copies by regular mail
Original brochure
Confidential letter, dated June 18, 1951 (filed in Mr. East's desk)

Dma

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

200 New Customhouse
Denver 2, Colorado

June 20, 1951

Memorandum

To: DMA Field Team, Region IV

From: A. H. Koschmann

Subject: DMA Docket #244, American Asbestos Cement Corporation Report, Gila County, Arizona

Enclosed are the original and 7 copies of the above geologic report by A. F. Shride.

A. H. Koschmann

A. H. Koschmann
Supervising Geologist
Colorado-Wyoming

Enclosures

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Mining Division
Region IV

224 NEW CUSTOMHOUSE
DENVER 2, COLORADO

June 18, 1951

Memorandum

To: DMA Field Team, Region IV

From: Chief, Mining Division

Subject: DMA Docket 244 (1093X), American Asbestos Cement Corp., Gila County, Ariz.

The Summary, Conclusions and Recommendations and Engineer's Report on the above project has been reviewed. I concur with the examiner's recommendations Stage 1 and Stage 2 under Alternate II, which would provide approximately $7,000 for reconnaissance and detailed geologic mapping. I also agree that Stage 3, Alternate II should be dependent upon the other work and should follow, provided it is determined that it has merit.

There are a number of items that I disagree with in the exploration program as follows:

1. The arrangement for rental of diamond drill equipment is too high and probably can be done much cheaper on a footage contract.

2. Two shifts should be used on the diamond drill to save equipment.

3. It is unlikely that the bulldozer will be required full time for 18 months. 3 months probably would be adequate.

4. The ~~wage~~ wagon drill idea should be abandoned as it requires too much additional equipment, manpower and housing. The 8,000 feet probably can be diamond drilled in 18 months on 2 shifts.

Based upon Bureau of Mines experience and using one core drill 2 shifts a day, it is my estimate that costs should be about as follows:

8,000 feet	18 months	
Core drilling	18 months @ $2,500	$45,000
Bulldozing	3 months @ $2,600	7,800
Trucking	18 months @ $500	9,000
Housing		10,000

Equipment	$1,500
Administration and geological - 18 months @ $1,700	30,600
Total	$103,900

Cost per foot, including geology would be $13, which is still allowing a lot for contingencies and bad ground.

I recommend that a contract on a matching fund basis be entered for $107,000, of which $7,000 is for reconnaissance and geologic mapping, before any exploration is started and that the $100,000 be made available with an understanding with the applicant that it is contingent upon results of the mapping and may be withdrawn entirely or in part if at any time it becomes evident that further exploration is futile.

P. T. Allsman

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

June 18, 1951
Registered Mail
Return Receipt Requested

Memorandum

To: Mr. A. H. Koschmann, Denver, Colorado

From: Mr. A. F. Shride, Tucson, Arizona

Subject: DMA Docket #244, American Asbestos Cement Corporation Report, Gila County, Arizona

Enclosed are the original and 7 copies of the above geologic report by A. F. Shride.

C. A. Anderson reviewed and approved a rough draft of the general part of the report and concurred with the conclusions and recommendations as stated verbally to him.

I wish to reemphasize that Government participation in a drilling program should not be considered as practical until concrete geologic data has been collected and evaluated.

A. F. Shride

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

Enclosures 8

JUN 1951
RECEIVED
U.S. Geological Survey
Minerals Leasing Branch
Denver

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

SOUTHWEST EXPERIMENT STATION
Box 4097
UNIVERSITY STATION

MINING DIVISION
REGION IV

TUCSON, ARIZONA

June 7, 1951

Memorandum

To : Paul T. Allsman, Denver, Colorado

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

Subject : ~~Final Report~~, DMA Docket 244, American Asbestos Cement Corp., Gila County, Ariz.

Enclosed are original and 7 copies of the above report, including the section on Summary, Conclusions and Recommendations by L. A. Stewart of the Bureau of Mines and A. F. Shride of the Geological Survey, and the section on Engineeringby Stewart.

This report has my approval.

Walter R. Storms

Walter R. Storms

CC P. T. Allsman (7)
C. A. Anderson
DMA 244
DF

UNITED STATES

DEPARTMENT OF THE INTERIOR
OSCAR L. CHAPMAN, SECRETARY

DEFENSE MINERALS ADMINISTRATION

REPORT OF EXAMINATION BY FIELD TEAM
REGION IV

DM-244, American Asbestos Cement Corporation (Asbestos)

Gila County, Ariz.

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

Andrew F. Shride, Geologist
U. S. Geological Survey

June 1951

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

By Lincoln A. Stewart[1] and A. F. Shride[2]

On December 21, 1950, Frank J. Gammache, vice-president of the American Asbestos Cement Corp., made application to the National Security Resources Board for Government assistance to increase production of strategic grades of chrysotile asbestos by development and exploration of the corporation's property in Gila County, Ariz. This application, Docket No. 244, was in the amount of $1,059,000 to increase production from 5 tons of crude fiber daily to 200 tons per day.

After several delays requested by the applicant, Lincoln A. Stewart, engineer for the Bureau of Mines, and A. F. Shride, geologist for the Geological Survey, spent the week of April 9-13 examining portions of the property and conferring with Ammon R. Smith, president, and Gammache. A second and more detailed investigation was made during the week of May 1-5. Gammache returned to the property from Washington, D. C. during this period and stated that the development application could be considered void, and that it was to be superseded by an exploratory loan application. Messrs. Smith and Gammache came to the Bureau's Tucson office on May 14, gave the writers a copy of the new application which, we were told, was already docketed as No. 1093X.

It has been considered expeditious to report on this new application as an amended Docket No. 244 rather than await receipt of Docket No. 1093X through regular channels.

1/ Mining Engineer, Bureau of Mines, Mining Division, Arizona-New Mexico Branch, Tucson, Arizona.
2/ Geologist, Geological Survey, Tucson, Arizona

Fiber was first shipped in 1921 from the claims under consideration in this project. Considerable prospecting, and some mining has been done on these properties. Little mining has been done since the 1920's. No record of production is available, but total fiber production in the 1920's was probably on the order of 400-600 tons of chrysotile asbestos, most of which was of spinning grade. The Gila Asbestos Co. leased the claims in 1949, built a mill, and produced fiber, the amount of which is unknown to the writers, before selling its rights to the American Asbestos Cement Corp. early in 1951. The applicant renegotiated a lease-option with the owners of the claims and started mining early in February, 1951.

Production during the tenure of the American Asbestos Cement Corp. has been at the rate of 1 to 2 tons of asbestos daily; approximately 40 percent of this production was of strategic grade.

The chrysotile asbestos deposits of Gila County, Ariz. are along bedding-plane or, rarely, thrust faults in the lower member of the pre-Cambrian Mescal limestone, and are related genetically and spatially to intrusions of diabase. The asbestos veins are roughly parallel to bedding in the limestone and are in a thin zone (generally 6-18 inches) of serpentine. Most deposits are flat-lying. The deposits are usually elliptical in plan and seldom very large. Typical minable lenses may include 50 to 2,500 tons of mill rock that contain 10 to 400 tons of fiber. A few deposits are larger.

The chrysotile of Arizona, if soft and unweathered, is of high tensile strength and low in admixed magnetite content - therefore of high quality for strategic purposes. Compared with other chrysotile deposits of the world, the Arizona deposits, though small, contain a relatively high percentage of spinning grades of fiber.

Important geologic factors which must be considered in appraising a deposit for exploration are in approximate order of significance: (1) bedding-plane and/or thrust faults, (2) favorable stratigraphic units, (3) proximity to diabase sills and dikes, (4) small-scale folds and high-angle faults. Unless the above factors are considered the finding of ore will be largely a matter of luck. The Government should not participate in any exploration program that does not include adequate geologic examination.

At the present time the American Asbestos Cement Corp. is mining asbestos at only one locality. In addition, at their own expense, they are diamond drilling exploratory holes in the immediate vicinity of the mine.

After several conferences with Smith and Cammache, basically it has been agreed to decrease the magnitude of their proposal to a drilling program to be preceded and accompanied by geologic investigations.

The writers have set up two alternative exploration programs. Alternative I proposes that geologic work be started and, before completion, be followed by a drilling program at the earliest possible date. This is a modification of the corporation's proposal and the one which they favor.

Alternative II proposes that geologic work on all obviously potential areas be completed before a drilling program is started and that the final decision on the drilling project be postponed until geologic work (stages 1 and 2 below) indicates the possible magnitude of such a project. The writers recommend this latter alternative in the following stages:

Stage 1 Reconnaissance geologic work.

Stage 2 Detailed mapping of all obviously potential areas to define areas for exploration.

Stage 3 Drilling program. It is possible that the geologic work will indicate that no drilling should be done. Conversely, it is also possible that geologic work will indicate that it will be expeditious to use several drill rigs.

The preliminary geologic work is estimated at a cost of $6,850. If followed by a drilling program the maximum cost could be $203,780, or if the use of 2 or 3 drill rigs is justified the cost would be respectively $136,040 or $119,850.

The writers recommend that approximately $7,000 be allotted to cover the Government's participation in the expense of preliminary geologic work that is the first phase of this asbestos exploratory project.

It is further recommended that a decision be made at the Washington level as to means and necessity at this time of allocating money to cover a possible later drilling program, the magnitude of which cannot be determined at present, but is estimated to cost a maximum of $200,000.

AMERICAN ASBESTOS CEMENT CORPORATION PROJECT
GILA COUNTY, ARIZONA

Geology

Geology

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

AMERICAN ASBESTOS CEMENT CORPORATION PROJECT
GILA COUNTY, ARIZONA

CONTENTS

	Page
General Geology	1
Lithology	1
Structure	2
Asbestos Deposits	3
Occurrence	3
Localization of Asbestos Deposits	5
Descriptions of Individual Deposits	8
American Asbestos Cement Corporation Mine No. 1	9
American Asbestos Cement Corporation Mine No. 2	10
Voeberg Claims	13
Smith Claim	15
Wilson Fraction No. 1 Deposit	16
Terry Mine	16
Home Mine	16
Buckhorn Mine	17
Other Deposits	19
Conclusions	19

ILLUSTRATIONS

	To Follow Page
Figure 2. Idealized cross-sections showing relation of asbestos-serpentine zones to diabase intrusions and folds in limestone.	7

GENERAL GEOLOGY

The chrysotile asbestos deposits of central Arizona are in the Mescal limestone, one of the upper formations of the pre-Cambrian Apache group, and are associated with intrusions of diabase. Stratigraphy, small-scale structures, and igneous intrusions are important factors in localizing the deposits which are the result of metamorphism of limestone near the diabase intrusions.

Lithology

The Mescal limestone is the only formation of the Apache group pertinent to this discussion, therefore the other formations of the group will not be described in this report. The Mescal limestone can be divided in most areas in Gila County into two very distinctive members, an upper (or algal), massive member and a lower, generally thin-bedded member. The algal member over most of Gila County is composed of massive thick limestone beds totaling 60-140 feet in thickness. This member contains concentric, saucer-shaped structures which probably represent algal growths. In the area considered in this report, the algal member is not as thick-bedded and massive as is usual in the region, and some beds do not contain algal structures. However, the algal member is distinctive enough so that the contact between the upper and lower members can be readily determined in diamond-drill core.

The lower member of the Mescal limestone is composed of flat-bedded, thin- to thick-bedded gray limestones and subordinate calcareous shales, and is 150 to 190 feet thick in the asbestos district. In the subject area the lower member is roughly estimated to be about 150 feet thick. In the asbestos-bearing region dolomitic

limestone and cherty limestones are rare. However, one prominent chert-bearing bed was noted in the subject area. With one possible exception cherty beds would not cause difficulty in diamond-drilling.

The diabase is predominately in the form of sills a few inches to several hundred feet thick; dikes are comparatively rare and nowhere more than a few feet wide. Some sills extend several miles laterally. In general, the diabase was intruded along bedding planes in the limestones and the sills are concordant, but locally the sills are discordant. The diabase pushed the beds apart; there was no assimilation of the limestone.

Structure

The rocks of the region are in general flat-lying, but flat-lying blocks of the sedimentary formations are displaced hundreds of feet vertically by the thicker diabase sills. Equivalent stratigraphic units may be at different elevations within an area of a few acres.

Large scale faults and folds are rare in the district and have no significance in the area of this report, therefore structural features hereafter described are small scale structures which are significant to asbestos emplacement. Locally there are small folds and faults in the limestone. The small faults are of two types: (1) bedding-plane and thrust faults, and (2) vertical or near-vertical strike-slip faults. The bedding-plane and thrust faults in a few localities have horizontal displacements of several tens of feet, but in general the displacements are not more than a few inches. The faults are not readily discernible, especially on weathered outcrops. Bedding-plane faulting was distributed and absorbed among

the thinner-bedded and shaly limestones, but was concentrated along a few bedding planes in the more massive limestones. In some places vertical strike-slip faults parallel the crests of folds; in many places the vertical faults are associated with thrust faults. Movement on the high-angle faults is almost entirely horizontal, and displacement in most places is not more than a few inches. Most of the small folds in the limestone are only a few tens of feet wide, and typical folds have a height of 5 to 15 feet.

It will serve the purposes of this report, without considering the evidence, to note that folding and faulting of the limestones were a result of displacement by diabase intrusion, and that late sills and dikes in many places follow faults opened concomitantly with intrusion. Folds are most common along the contacts with discordant diabase sills, along dikes, or above irregularities in diabase-limestone contacts (see Figs. 2a, 2b). Unless there are well defined lines of weakness along which the diabase was intruded, the direction, the degree of folding, or extent of folds along their length cannot be accurately predicted, because irregularities are common along cross-cutting diabase-limestone contacts.

ASBESTOS DEPOSITS

Occurrence

The chrysotile occurs as veins of cross-fiber in zones of serpentine which have replaced the Mescal limestone along thrust and bedding-plane faults. As bedding-plane faulting greatly predominates over thrust faulting, the asbestos-bearing serpentine zones usually occur at certain stratigraphic horizons in any particular area,

the favorable horizons may be at different stratigraphic positions in different areas. The average minable asbestos-serpentine zones are 6-18 inches thick. Two zones 5-6 feet apart can be mined from the same stope in many of the Arizona deposits. The typical asbestos deposit is roughly elliptical in plan, and is elongated along a fold or zone of strike-slip faulting. The typical asbestos deposit of the Arizona fields has an areal extent of from 1,000 to 20,000 square feet. Such lenses may include 50 to 2,500 tons of mill rock that contain 10 to 400 tons of fiber. A few deposits are larger; one deposit in Gila County has been stoped over an area averaging 200 feet wide and 900 feet long.

Individual asbestos veins roughly parallel the bedding in the limestone and range from a knife edge to 10 inches in thickness. Most veins are less than 1 inch thick. Individual veins usually contain 1 to 20 or more partings, which cause the asbestos to separate into fibers shorter than the vein width on milling. A serpentine zone may contain one to several tens of veins of asbestos.

Small quantities of magnetite can be found in association with most of the Arizona chrysotile deposits. Only rarely is magnetite found in the asbestos zones. On milling very little of the fiber is contaminated by magnetite. Therefore Arizona chrysotile asbestos is particularily suitable for high-temperature electrical insulation products.

Harsh and soft fiber may exist in the same deposit; rarely both types of fiber are found in one vein. It has been found that if several exposures contain harsh fiber, most of the deposit is likely

to be of harsh fiber. With this exception no geologic characteristics have been found that would aid in predicting whether a deposit or parts of a deposit contain harsh fiber. Harsh and soft fiber are usually distributed in one deposit in such a manner that soft fiber can be selectively mined.

At shallow depths much of the asbestos may be weathered and weakened so that much of the fiber is not of commercial value. In the subject area several of the deposits examined were badly weathered and the asbestos of substandard quality even though capped by 30 to 60 feet of limestone and diabase. This will probably be true for an appreciable percentage of other deposits in the area. Deposits in which present exposures show that the asbestos-serpentine zones have been channel-ways for ground water should be explored only if it is a reasonable prediction that part of the deposit may not be affected by weathering.

Localization of Asbestos Deposits

In order to outline exploration procedure it is necessary to state briefly the factors controlling asbestos deposition. Four factors are of prime importance: (1) faulting, (2) competency of the limestone beds (certain stratigraphic units are the most favorable), (3) folding, and (4) the emplacement of diabase intrusions.

Pre-mineral bedding-plane faulting occurred throughout the Mescal limestone formation, if circumstances were favorable for faulting, but displacements, and therefore shattering of the limestones, were greatest between the thicker, purer, most competent beds of the lower member of the Mescal limestone. Bedding-plane displacements were distributed in small increments among the shaly and thinner-bedded limestones of the Mescal, and there was little attendant shattering of the adjacent limestones.

The pre-mineral, near-vertical strike-slip faulting common in several of the Arizona asbestos deposits, except for rare examples, had little influence in localizing appreciable quantities of asbestos. Mapping of the larger Arizona asbestos deposits has shown that strike-slip faults are related genetically to bedding-plane faults. Bedding-plane faults in the Mescal limestone are difficult to recognize, and if recognized are difficult to date as pre-mineral faults. However, the pre-mineral strike-slip faults are readily recognized and can generally be assumed to reflect pre-mineral bedding-plane faulting. Areas in which bedding-plane faulting can be distinguished are particularily favorable for exploration, assuming that other factors are favorable.

Because pre-mineral shattering was quantitatively more widespread in the more competent beds, and therefore significant in the localization of serpentine and asbestos, a consideration of the stratigraphic controls is necessary in any exploration program in the Arizona asbestos field. Previous geologic work has shown that certain stratigraphic units are more favorable than others for asbestos deposits and that certain units rarely or never contain minable quantities of asbestos. For the area under consideration it will be sufficient to emphasize only two points in connection with stratigraphic controls: (1) In Gila County minable quantities of asbestos have been found in the algal member in only 4 places known to the writer and then only under special circumstances which our reconnaissance indicates are not applicable to the area under consideration. Therefore, in the area controlled by the American Asbestos Cement Corporation, the algal member should be considered as a unit barren of minable asbestos. (2) In the lower member only

asbestos zones that are associated with the purer, thicker limestones need be considered for exploration. These are the only zones likely to be persistent enough to warrant exploration. To the best of present knowledge, only the thicker beds in the top 60 feet of the lower member need be considered as potentially asbestos-bearing on the American Asbestos Cement Corporation property; most of the fiber horizons are within the top 30 feet of the member.

Folds are favorable to asbestos formation because the limestone beds were most shattered and susceptible to mineralization in the vicinity of folds. Most folds in the Gila County asbestos district are genetically related to discordant intrusions of diabase. All the folds seen in the area under consideration are related to diabase intrusions. Only the portions of this area which do show disruption of the normal flat structure by diabase intrusion should be considered as favorable for exploration (see Fig. 2).

Most of the Arizona asbestos deposits are along folds related to a single discordant diabase intrusion (Figs. 2a and 2b). Unless there was widespread bedding-plane or thrust faulting associated with such intrusions, the deposits are likely to be small. In a few places there are several discordant diabase-limestone contacts within an area of 1 or 2 acres (see Fig. 2c). In such areas diabase intrusion caused much thrust and bedding-plane faulting, and much folding. The largest deposits of the district are in such multi-structure environments. Any area that includes several discordant diabase contacts, and evident folding as a result of diabase intrusion should be given generous consideration as a potential area for exploration.

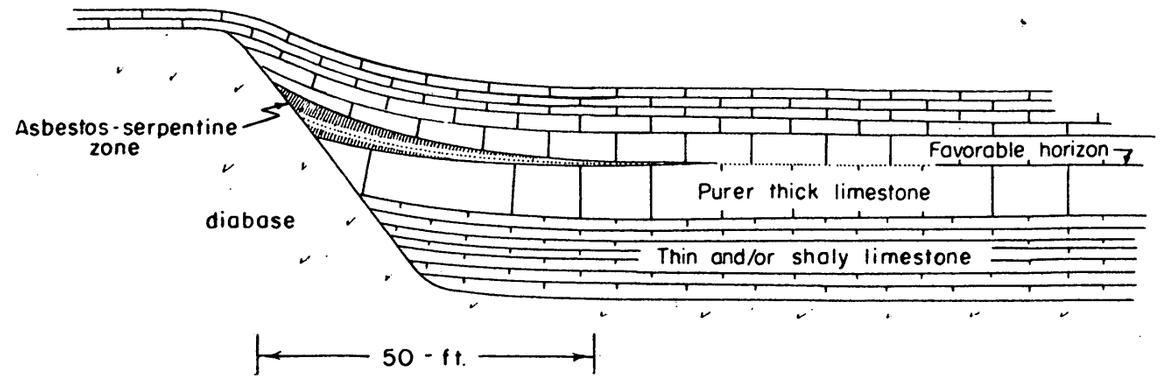


Fig. 2a - Asbestos-serpentine zone along bedding plane which was opened as result of discordant diabase intrusion. This is most common occurrence for asbestos deposits in Gila County, Arizona. Unless bedding faulting is widespread this type of deposit is usually small. Expectable production of asbestos might be 10-200 tons of all grades of asbestos.

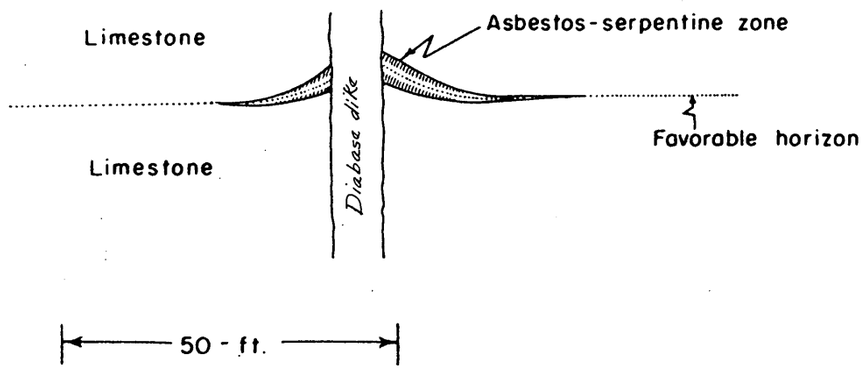


Fig. 2b - Asbestos-serpentine zone in limestones locally disrupted by a diabase dike. If this is the only diabase-limestone structure in the vicinity and a diabase sill is some distance from the favorable horizon, even though much bedding-plane faulting is evident, the deposit is usually smaller than for the Fig. 1a occurrence.

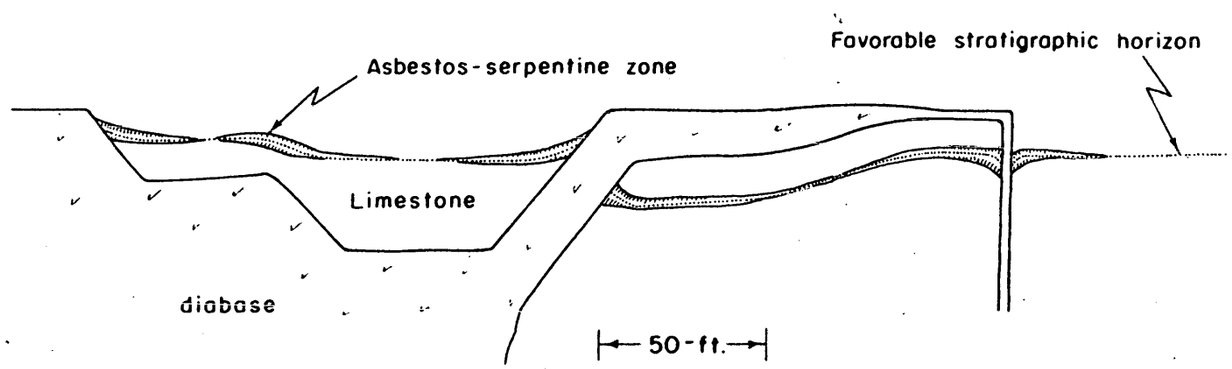


Fig. 2c - Cross-section showing several discordant diabase-limestone contacts within a small area. Bedding-plane and small-scale thrust faulting commonly caused much fracturing of competent limestone beds in such areas and the environment was favorable for the emplacement of asbestos deposits containing several hundred tons of chrysotile. Such deposits in most localities include a large percentage of spinning grades of chrysotile.

Note:- Thicknesses of asbestos-serpentine zones are greatly exaggerated to show their relation to controlling factors.

D.M.A. 244

Figure 2.- Idealized cross-sections showing relation of asbestos-serpentine zones to diabase intrusions and folds in limestone.

Without going into the theory of origin of the deposits it can be stated dogmatically that conditions were most favorable for the formation of asbestos where concordant diabase sills are within a few feet or few tens of feet at most of the favorable limestone beds. Conditions for asbestos formation were especially favorable adjacent to the contact where diabase cuts discordantly across the favorable beds. Only favorable beds that are close to concordant sills or are truncated by discordant sills should be explored.

In summary, exploration is likely to be successful only where the proper combination of structure, stratigraphy, and diabase emplacement exist. Individual Arizona asbestos deposits are generally of small extent and individual targets for exploration are small. The deposits are likely to occur any place where diabase and favorable horizons in the Mescal limestone are in close proximity. In the area under consideration diabase and the favorable horizons are in general in close proximity, therefore only the structure and stratigraphy need be considered in outlining an exploration program.

DESCRIPTIONS OF INDIVIDUAL ASBESTOS DEPOSITS

The writer briefly examined the deposits noted in the following descriptions. All areas described below are readily accessible with the exception of the Vesberg mesa area and the Ben Stage claims.

Descriptions of asbestos-bearing zones which include thicknesses of asbestos veins in inches refer to cumulative vein thicknesses. For example, the statement "2 inches of fiber in the zone" means that the cumulative thickness of all asbestos veins in the serpentine zone totals 2 inches. This fiber may be in 1 vein or 20 veins; for the purposes of this report no distinction is made.

American Asbestos Cement Corporation Mine No. 1

The American Asbestos Cement Corporation Mine No. 1 exposes two fiber zones; the favorable horizons are 13 and 17 feet below the base of the algal member. The horizons are cut off to the southwest by a crosscutting diabase sill ; for brevity this contact is noted as a "roll" hereafter. (The relations are like those shown in figure 1a.) The contact between the sill and limestone is irregular but strikes in a general N. 25 W. direction. Northeast of the diabase "roll" that cuts off the fiber horizon, the sill is concordant and the diabase-limestone contact is 7 feet below the lower fiber horizon. Approximately 400 feet northeast of the "roll" which bounds the deposit to the No. 1 deposit the diabase sill cuts down through the limestone to a lower stratigraphic level.

The applicant, at the time of application, assumed that this asbestos deposit is continuous underneath the entire mass on which the mine is located. The "roll" which bounds the deposit to the southwest crosscuts up across the lower member to the base of the algal member before becoming concordant. The sill is in contact with the algal member between the No. 1 mine and the No. 2 mine which is approximately 5/8 of a mile west of the No. 1 mine. Therefore, there is no chance finding minable asbestos between the No. 1 and No. 2 mines.

To the southeast, along the axis of the deposit, six diamond drill holes have adequately established that the deposit pinches out at some point less than 75 feet from the present mine face. On the northeast edge of the deposit, as exposed in the mine faces, the fiber content of the ore zones has decreased to the quantity commonly considered cut-off content in the Arizona district.

Surface outcrops also show that the serpentine zone pinches out completely to the northeast (away from the "roll" that bounds the asbestos deposit on the southwest). It is certain that this deposit is of limited extent.

The fiber is slightly harsh but of good strength; therefore it is of borderline quality for stockpiling. Because of poor methods of mining and milling the fiber is not well cleaned, or graded. The last 29 tons of No. 1 and No. 2 grades produced from this mine was rejected by the General Services Administration because the fiber did not meet stockpile specifications.

Past production from the No. 1 mine is estimated from stope outlines to have been on the order of 200-300 tons of all grades of asbestos. Remaining reserves are obviously small, therefore a more detailed description of this deposit is not warranted. The writer estimates reserves at 100 to 200 short tons of fiber, of which 30 to 40 percent is No. 1 and No. 2 grades (Canadian classification). It should be noted that these are the only blocked out reserves seen during our examination; therefore the original request for a development loan of $1,059,000 was not valid.

American Asbestos Cement Corporation Mine No. 2

Workings of the American Asbestos Cement Corporation mine No. 2 are around the periphery of a small mesa that is about 5/8 of a mile west of the No. 1 mine. The No. 2 mesa, which averages 450 feet in diameter at the level of the fiber horizons, is capped by 50-60 feet of limestone, and is underlain by a thick sill of diabase. The diabase sill, which is in contact with the algal member between the No. 1 and No. 2 mines, cuts down across the algal member and the

lower limestone member at the south edge of the mesa. Some 10-15 feet below the lowest fiber horizon the sill becomes concordant and is concordant to the north under the remainder of the mesa. Along the discordant portion of the sill on the south side of the mesa a thin sill branches for the main sill and separates a 25-foot thick wedge of limestone from the main limestone mass. This branching sill pinches out approximately half way through the mesa. One of the best portions of the asbestos deposit is in the wedge of limestone between the branching sill and the lower main sill. From the northeast corner of the mesa a 3 to 4-foot diabase dike strikes S. 20° - 25° W. The greatest quantities of asbestos are exposed adjacent to this dike.

Three asbestos-serpentine zones exist in the No. 2 area. The two bottom zones are at the same stratigraphic horizons as those of the No. 1 mine, namely 13 and 17 feet stratigraphically below the base of the algal member. A third zone is stratigraphically approximately 6 feet below the base of the algal member.

Three benches and two adits, one 20 feet long and one 104 feet long expose the asbestos zones in the limestone wedge at the south end of the mesa. The 104-feet adit and a bench at the portal of the adit (on the southeast corner of the mesa) expose ½ to 2 inches of good quality soft fiber in the bottom zone. In the same area the middle zone contains a ¼ to ½ inch total width of fiber. At the outcrop the top zone contains little fiber, but a raise and small stope 60 feet from the portal of the 104-feet adit exposes veins totaling ½ to 3 inches of soft asbestos. Two benches and a 20-foot adit on the southwest side of the mesa expose ½ to 1½ inches of soft fiber. The two upper zones are not present on this side of the mesa.

It is obvious that the benches and adits on the southeast and southwest sides of the mesa expose the best parts of asbestos-serpentine lenses genetically related to the deformation of the limestone "wedged off" between the two diabase sills. The asbestos-serpentine zones become discontinuous 20 to 60 feet away, laterally, from the main sill.

An adit and stopes that parallel the S. 20° - 25° W. dike in the northeastern part of the mesa are in part unsafe for examination. Examination of the accessible workings indicates that minable quantities of asbestos may exist for distance of 10-25 feet on either side of the dike. Apparently only the lower zone contains minable quantities of asbestos. Adjacent to the dike 2½ to 7 inches of asbestos is exposed in pillars; ten to twenty-five feet away from the dike most faces expose less than 2 inches of asbestos. Most of the fiber is badly weathered and of poor quality. The workings are reported to follow the dike for approximately 150 feet; it is also reported that the workings furtherest from the portal exposed asbestos so badly decomposed as to be worthless. A vertical fault zone exposed on the surface near the west edge of the mesa has been a watercourse; therefore the report that much of the fiber near the west end of the workings is decomposed is likely true.

On the east side of the mesa narrow veins of fiber are exposed in trenches and outcrops between the workings described above; however, the fiber in these exposures is in too small quantities to be minable. On the well exposed north and west sides of the mesa only occasional traces of asbestos can be found.

In summary, the asbestos deposit of the No. 2 mesa has been adequately explored in the most favorable areas. Most of the minable

fiber has been recovered. The asbestos deposit is controlled by local deformation and there is no geologic reason to expect that diamond drill exploration would result in appreciable extension of the known deposit. Perhaps a few tens of tons of fiber remained to be mined in this area. No further geologic work on exploration can be recommended for this area.

(Note: Since the field examination was made, it has been reported that a stripping operation has been started on the No. 2 mesa. In the writer's opinion this operation is almost certain to fail. The unsuccessful expenditure of money on this stripping may affect the ability of the Corporation to participate in an exploration program.)

Vosberg Claims

Approximately 3/4 of a mile W.N.W. of the No. 2 mesa is a small southwest-trending mesa (the Vosberg mesa) approximately 1200 feet long and 200-400 feet wide. This mesa is capped by 60-90 feet of Mescal limestone which rests, concordantly in most places, on a thick diabase sill.

In one place on the east side of the mesa a small "roll" of diabase like that shown in figure 2a cuts across the favorable horizons, which apparently are the same as at the No. 1 and No. 2 mines. Underneath most of the mesa the diabase sill is concordant and about 4 feet below the bottom fiber zone. Adjacent to this cross-cutting diabase-limestone contact are 2 zones, 30 inches apart, which contain small amounts of asbestos. The top zone as exposed in an 85-foot adit which approximately parallels the "roll" contains 1-1½ inches of harsh fiber at the portal

of the adit, but at the face of the adit there is only partly serpentinized limestone. The bottom zone contains ½-3/4 of an inch of semi-harsh to soft fiber for the length of the adit. Away from the "roll" the quantity of asbestos decreases. In the interval 40-150 feet south of the "roll" the top zone includes traces to 3/4 of an inch of harsh fiber; the bottom zone contains traces to 1½ inches of soft to semi-harsh fiber. Traces of fiber were seen in both zones for a distance of approximately 800 feet along the outcrop south and west of the "roll."

The Veeberg mesa is regarded by the applicant as one of the most likely areas for diamond drill exploration. The above described deposit is the only one seen on the mesa. The dumps of the two inaccessible shafts, one near each end of the mesa, show no mineralized material worth consideration. Although the stratigraphy is favorable and diabase is close to the favorable horizons, there is almost no folding of the beds except near the one "roll" and bedding-plane faulting was almost nil. This area is not worthy of any consideration for an exploration program, the past exploration by one 85-foot adit and two 20 foot adits has probably exposed the best part of the deposit.

Southwest of the No. 2 mine ½ mile and apparently also on the Veeberg group of claims are numerous short adits around the edge of a steep-sided mesa. Some of these adits expose 3-5 inches of excellent quality soft fiber but almost without exception the fiber veins pinch down to non-minable widths into the mesa. From a hurried reconnaissance study, it appears that these deposits may be genetically related to a discordant diabase "roll" which paralleled the present edge of the mesa but has been eroded away. The present deposits are probably the remnants of a once more extensive deposit related to this "roll."

Perhaps several tons of fiber could be "gouged" from the existing exposures but there seems no reason to plan an exploration program for this area.

Smith Claim

An estimated 2 miles south and perhaps slightly east of the No. 1 mine fiber is exposed 3 to 5 feet below the top of a diabase capped mesa (i.e. apparently just below a concordant contact between limestone and diabase). The outcrops are obscured by diabase soil and the few pits and trenches do not expose enough of the fiber zone to determine its continuity.

The stratigraphic horizon at which the asbestos is emplaced could not be determined in the reconnaissance investigation. To determine the stratigraphic position, it would be necessary to study the Mescal formation some distance away (perhaps ½ mile to the west where well exposed) and trace key beds wherever possible to the Smith claim. It seems likely from the few outcrops seen that this deposit is in a locally flat-bedded portion of the algal member. No minable veins of asbestos are exposed by the present trenches and pits.

Before this area could be considered as favorable for exploration, it would be necessary to prove by careful geologic work that the horizon is in the lower member of the Mescal. Further trenching should also be done to better expose the fiber horizon. The applicant is attracted by this area because there is only a few feet of overburden and therefore in the applicant's opinion the area is likely for a stripping operation. The writers of this report seriously doubt the feasibility of stripping methods of mining in an area like this one because of the difficulty in keeping the ore clean. It should also be pointed out that much of the fiber may be so weathered as to be valueless.

Wilson Fraction No. 1 deposit

An estimated 3/4 of a mile south of the No. 1 mine is a small asbestos deposit on the Wilson Fraction No. 1. This deposit is a local zone at the base of the algal limestone and against a discordant diabase-limestone contact like that shown in figure 2a. There is little bedding-plane faulting. This deposit has been adequately explored by the present short adits; no minable asbestos remains. There is no reason to expect that minable quantities of asbestos could be developed in the immediate vicinity by an exploration program.

Tony Mine

Approximately 5/8 of a mile south of the No. 1 mine is the Tony mine which exposes a fiber zone just below the base of the algal member. In every exposure examined the fiber zone has obviously been a channel for ground water and the fiber is badly decomposed. The lateral extent of the deposit is also limited by a discordant diabase sill. Therefore, further consideration of this deposit is probably not warranted.

Home Mine

Five adits and several thousand square feet of stopes expose a deposit known as the Home deposit, which is approximately ½ mile southeast of the No. 1 mine. This mine is in a small limestone capped mesa which is underlain by diabase. On the north side of the mesa a discordant sill cuts off the favorable horizons. Two or possibly three 1-2 foot wide dikes strike N. 60°-70° W. through the best part of the deposit. There is considerable pre-mineral

bedding-plane faulting in the Home area. Present mine faces expose veins totaling 1-3 inches of soft or semi-harsh asbestos in a serpentine zone 8-12 inches thick. In the late 1920's mining was apparently stopped in this deposit because not enough of spinning grades of fiber were produced. At that time only spinning grades were recovered and sold.

Except where near the portals of the adits, surface exposures of the favorable limestones are poor. No fiber was seen around the periphery of the mesa. It would seem worthwhile to map this mesa in some detail to determine whether or not enough area remains between the stopes and the east edge of the mesa to serve as a target for an exploration program. It is likely that very little of this deposit remains unexplored. The Home deposit is not being considered by the applicant for early exploration, probably because the applicant does not fully realize the nature of the deposit.

Buckhorn Mine

The Buckhorn mine is about 2 miles southwest of the No. 1 mine, along the south edge of a flat-topped mesa which is readily accessible by a road that traverses the mesa between the American Asbestos Cement Corporation mill and the No. 1 mine.

Asbestos is exposed almost continuously along approximately 1,800 feet of outcrop. The underlying diabase sill is 6 inches to 4 feet below the fiber horizon which is approximately 60 feet stratigraphically below the algal member. The total thickness of limestone overlying this fiber horizon probably averages about 90 feet. The deposit is exposed by several (possibly 15) adits and by extensive stopes. A large part of the stoped area is not accessible due to

backfill. Only a few of the most accessible mine faces were examined by the writer. All of the adit and stope faces examined contain veins totaling 1 to 3 inches of fiber, most of which is soft and of good tensile strength. Obviously, during past operations much No. 1 and No. 2 grade chrysotile was recovered. However, only a small percentage of the fiber at present exposed is of spinning length.

The ore controls are not readily apparent for this deposit. There is much evidence of pre-mineral bedding-plane faulting in the stoped areas. Reconnaissance on the north and east sides of the mesa suggests that the diabase sill, which is essentially concordant beneath the presently explored part of the deposit, cuts up across the favorable horizon somewhere north of the present mine faces. Detailed mapping would be required to determine the position of the line along which the discordance occurs. If it were found that a large area remains undeveloped between the present mine faces and the intersection of the favorable horizon and the discordant portion of the sill, that area probably would be a very likely one for diamond drill exploration. This area would seem especially favorable if it is found that pre-mineral bedding-plane faulting is prominent in most of the mine faces.

The American Asbestos Cement Corporation officials apparently are giving the Buckhorn area low priority in their exploration planning. The writer considers this area to have greater promise than any other area visited during this examination. The area is readily accessible for diamond drilling. If geologic mapping results in suggesting a target area for a drilling program 3 to 6 holes, each about 90 feet deep, should be sufficient to determine whether or not new development

is warranted. If the deposit is large, a greater number of holes will be necessary to outline the deposit. The deposit is readily accessible for development. Water supply would be expensive for a drilling program; the deposit is 3½-4 miles from present water supplies. If mining operations are started, a water supply might be developed on Wilson Creek, the canyon of which bounds the Buckhorn mesa on the south.

Other Deposits

The above descriptions include all the noteworthy deposits seen during our examinations. The applicant is very enthusiastic about deposits reported on the Ben Stago group of claims, which are on the south side of Wilson Creek and approximately 1 mile south of the Buckhorn mine. These claims are at present accessible only by trail. As none of the officials of the Corporation had seen the claims or know the geography of the Ben Stago area, the writer did not examine that area. There is little known factual basis for the applicant's optimism about exploration potentialities in the Ben Stago area.

There are several other areas included in the holdings of the applicant. Nothing is known about these areas. The applicant does not know even the location of deposits; therefore an examination does not seem worthwhile at this time.

CONCLUSIONS

Two of the areas examined, the Home and Buckhorn areas, may be potential sites for diamond drill exploration. Geologic work, which essentially should consist of determining simple geometric relations, should be done before these areas are given consideration in an exploration program. The applicant at present is not considering seriously exploration work in either of these 2 areas.

None of the other deposits examined warrant consideration in exploration planning either because the deposit has been fully exploited already, or is already adequately explored, or the geologic evidence suggests that the possibility of finding new ore bodies is very unlikely.

In the general area of several square miles under consideration for diamond drill exploration, it is likely from geologic considerations that asbestos deposits exist that will warrant diamond drilling. The applicant knows the area only poorly and cannot at this time point out potentially favorable areas for the consideration of the examining team. Therefore, preliminary geologic work is advisable before exploration by diamond-drilling is considered.

If geologic work is successful in delineating areas for exploration, the asbestos deposits that might be found would probably be small. Individual minable deposits might yield quantities of asbestos on the order of 50-500 tons for each deposit. An appreciable percentage of the fiber would be of spinning length. It can be reasonably expected that geologic work would result in discovering as few as 2 areas or as many as 10 areas that would warrant exploration. Almost without exception Arizona chrysotile is of low iron content; therefore the fiber that might be found would be of strategic quality.

The spacing of drill holes in any exploration program for Arizona asbestos will depend on the configuration of the deposit. In plan most deposits are elongate. The first 2 or 3 diamond-drill holes should be laid out to find the axis of elongation. Succeeding holes, if necessary, should be staggered from a precise grid system to outline the probable width and length of the area that might be mined.

It may not be possible to conform to a grid system in planning drilling programs. In planning the diamond-drill hole layout the first few holes for any one deposit should not be less than 100-150 feet apart. Once the maximum probable extent of the deposit is known, the remaining holes might be placed at 50-60 feet intervals to sample the ore zone and determine feasibility of mining. Such sampling should indicate the total tonnage of asbestos that might be expected; it will not constitute sufficient sampling to estimate tonnage by grades.

After detailed geologic work, the depth to the ore horizon will usually be predictable within a 5- to 10-foot limit of error. After one or at the most two holes are drilled, it will be possible to predict for additional holes the depth to the ore horizon within 1- or 2-foot limit of error. For maximum efficiency in drilling the driller at all times should be kept informed of the depth at which he may expect to penetrate the ore zones.

Further conclusions based on geologic data are included in the engineering section of this report.

DM-244

American Asbestos Cement Corporation
(Asbestos)

Gila County, Arizona

Engineering Report

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

Engineering

DMR-244, American Asbestos Cement Corporation (Asbestos)

Gila County, Arizona

CONTENTS

Engineering Report	Page
Introduction	1
Acknowledgments	3
Location, topography and climate	4
History and production	5
Ownership and extent	6
Description of deposits	6
Present status of development and exploration	7
Applicant's proposed exploration project	8
Applicant's estimated cost of project	9
Proposed financing	9
Discussion of estimated costs	10
Conclusions and recommendations	16

ILLUSTRATIONS

Figure	Following Page
1 Location map	4

Exhibit "D" Property Map ---------- Appendix 10

INTRODUCTION

A request for examination of the property of the American Asbestos Cement Corp. in Gila County, Ariz., DMA Docket No. 244, was received from the Defense Minerals Administration Field Team Region IV, on Jan. 15, 1951. The proposal was to increase production by strip mining and increased mill capacity, and to explore by diamond drilling. On Jan. 31 word was received from Geo. Hill of Phoenix, attorney for the corporation, to delay the investigation until a later notification, as his principals wished to diamond drill and do certain other work to check probable ore extensions prior to an examination. A tentative date of March 26 was made, but this was later changed by Hill to April 9.

During the week of April 9, Lincoln A. Stewart, engineer of the Bureau of Mines and Andrew F. Shride, geologist of the Geological Survey, examined the mine, drilling procedures, the area in general, and conferred with Ammon R. Smith and Frank J. Gammache, president, and vice president of the corporation, respectively.

At that time the company had no map of the producing mine although they had been diamond drilling for extensions of that ore deposit. Six random diamond drill holes already had been completed in the immediate area ahead of the mine workings but none of the holes had cut more than traces of fiber.

The authors suggested that the owners secure a surveyor's transit so the company engineer could map the mine and accurately locate the completed diamond drill holes with reference to the mine workings, and make a topographic map of the immediate area. Detailed cost estimates were requested for the proposed stripping program, as well as costs of the current diamond drilling. It was agreed that

these data would be available in 2 weeks time when a more detailed examination was to be made. The fallacy of expecting that the favorable strata would continue to be asbestos bearing indefinitely under whole mesas was explained to the owners.

The application for a development loan under Docket No. 244 was loosely set up for a sum of $1,059,000 to increase production from 5 tons of crude fiber daily to 200 tons per day. This was to be done by means of stripping 50 to 60 feet of overburden on various mesas to expose narrow serpentine-fiber zones which then would be mined in quarry faces. A mill costing $375,000 was included in the proposal.

On the second visit to the property early in May, Stewart and Shride were accompanied by William T. Griswold of the Bureau of Mines and Joe Kensfick of the Geological Survey. By this date 3 more holes had been drilled, none of which had cut commercial fiber. Gammache then said that development Docket No. 244 could be considered void and that an exploratory loan was being requested. Consequently, this report is based primarily on the exploratory application.

Several of the areas proposed for exploration work by the applicant have not been seen by officials of the American Asbestos Cement Corp., nor by any of the staff of the corporation. Exploration proposals for these areas are based on hearsay information of dubious value. The writers examined only those areas considered most favorable by the corporation at the time of examination. Had the writers investigated all areas recommended by the corporation for exploration, undoubtedly much unfavorable territory would have been covered that should have been examined and rejected previously by the corporation.

All available information indicates that spinning grades of chrysotile asbestos are in short supply and that the need for this strategic fiber is acute. It will be noted later in this report that the examining team has proposed modification of the applicant's exploratory program to a program which could accomplish similar results at a lesser cost. This team does not wish to appear pragmatical but is basing the recommendations on its knowledge of the habit and peculiarity of the occurrence of asbestos deposits in Arizona. From 1929 to 1931 Stewart was chief mining engineer for the Johns Manville asbestos mines in Arizona. During World War II Stewart and Shride were associated for 2 years in the Arizona asbestos district, doing field and exploratory work for the Government. During 1946, Shride mapped in detail a large number of the deposits that had not been mapped during the asbestos project work. One of the examiners has been closely associated with the mining of asbestos for a period of nearly 5 years and both have followed the progress of the Arizona asbestos industry more or less continuously for the past 10 years.

ACKNOWLEDGMENTS

Information and data on wagon drilling were furnished by John H. Soule' of the Bureau of Mines Silver City, New Mexico Field Office, and by J. E. Douglas of the Joy Manufacturing Co.

Acknowledgment is made to the officials of the American Asbestos Cement Corp. for their assistance in the field work and their courteous treatment to Government personnel assigned to the investigation of this project.

LOCATION, TOPOGRAPHY, AND CLIMATE

The American Asbestos Cement Corp.'s property is located in northern Gila County near the headwaters of Cherry Creek, within the Tonto National Forest (fig. 1). This area locally is known as the Sierra Anoha asbestos district. Access from Young is by about 15 miles of unimproved road that fords Cherry Creek 13 times. Young is 69 road miles north of Globe on the well-graded Globe-Young-Holbrook road. Globe, on the Southern Pacific railroad, is the shipping point for the Gila County asbestos area.

In the area of interest to this report, Cherry Creek and its tributaries have carved the region with many steep-sided canyons, but have left intervening mesas that have an altitude of 5,000 to 5,700 feet. The outcrops of potentially asbestos-bearing limestone strata are found around the edges of these mesas.

The average yearly precipitation is between 20 and 25 inches. The greater portion of this occurs during July, August, and the first part of September, with a lesser period of precipitation from November to February. The remainder of the months are normally dry. Summer thundershowers frequently make travel over dirt roads difficult for several days. Roads over 5,500 feet in elevation may be blocked by snow for a week or 10 days between December and March.

Summer temperatures usually are not great enough to lower human efficiency, except on south slopes or in the sunny portions of narrow canyons. Winter temperatures may reach 10° to 20° below freezing.

Scrub oak and juniper trees occur scattered over the area embraced by the property and yellow pine abounds on the higher elevations about 10 miles to the north.

The water supply is adequate for domestic use, and for the exploration and mining program. It must be hauled to the latter operational sites. It should be noted that the 2 present water supply sources (Cherry and Walnut Creeks) are subject to contamination. The applicant should make certain that the water is safe at all times for human consumption.

HISTORY AND PRODUCTION

The asbestos claims now controlled by the American Asbestos Cement Corp. originally were located between 1916 and 1918 by G. F. Wilson and associates. Fiber first was shipped in 1921. The property has been leased at various times, considerable prospecting has been done, and several small mills have been constructed. During the 1920's a few scattered areas were mined to the then commercial limits. No record of production is available, but it is probable that the total production during the 1920's was on the order of 400 to 600 tons of fiber.

The Gila Asbestos Co. leased these claims in November, 1949, built a mill, and made some production to the Government stock pile. This production is not known to the writer but the General Services Administration should have the record. About the end of 1950, the American Asbestos Cement Corp. bought the Gila Asbestos Co. and renegotiated a lease-option agreement with the owners. Early in February operations were started at the No. 1 mine. Production to April 14 is shown indirectly on Exhibit "F" (Appendix, p. 12). An analysis of these figures indicates that, during the 2 month period of February 15 to April 15, the production was on the order of 1 to 2 tons of asbestos fiber daily, of which approximately 40 percent was strategic grade.

OWNERSHIP AND EXTENT

The applicant has a lease and option on 74 unpatented mining claims, in 7 non-contiguous groups. These claims are spread over an area of about 12 square miles, as shown by the property map furnished by the applicant, Exhibit "D" in the appendix of this report.

DESCRIPTION OF DEPOSITS

Arizona asbestos is found invariably in veins within bands of serpentine. The veins vary in thickness from a fraction of an inch to several inches, and roughly parallel the borders of the enclosing serpentine. This serpentine is usually from 4 to 18 inches in thickness. The serpentine band is enclosed in limestone strata that is essentially flat lying.

Asbestos zones usually outcrop in steep cliff faces. The mines are opened by adits on the ore horizon, and mining is conducted either by modified room-and-pillar methods, or by longwall stoping with backfill.

Development work in asbestos mines cannot be planned as definitely as in the mining of most other minerals, as the veins pinch and swell irregularly and are erratic in size and distribution. Experience over the entire Arizona asbestos district has shown that the various commercial deposits that have been mined are relatively small.

In most of the larger mines, the serpentine-fiber band is carried at the top of the drift, and the stopes are developed by progressively widening the opening. The barren limestone below the ore zone is removed by undercut drilling and blasting. About 40 percent of the waste can be placed in the backfill, the remainder trammed to the dump. The material of the serpentine fiber zone is broken down by light blasts, all limestone fragments are rejected, and the remainder

is removed to the mill. At the No. 1 mine of the American Asbestos Cement Corp. the fiber zone is carried on the floor instead of at the top of the stopes.

Owing to the necessity for making the stopes high enough for men to work and also to the relative thinness of the asbestos-bearing zone, the ratio of commercial fiber recovered to rock removed is on the order of 1 ton to 75 tons. Therefore, mining costs are high.

PRESENT STATUS OF DEVELOPMENT AND EXPLORATION

At present, development work is being conducted by the American Asbestos Cement Corporation at only one location, the No. 1 mine. Early in March, at their own expense, the corporation rented a diamond drill and started drilling exploratory holes in the vicinity of the mine. In the following 2 months, 9 holes had been drilled, none of which showed commercial fiber. Hole No. 10 was drilled 12 feet ahead of a productive mine face solely to determine whether the existence of commercial fiber could be recognized under normal drilling conditions. The drilling of hole No. 10 clearly demonstrated that a commercial zone can be cored, at least in part, and that sludge return alone is adequate for determining whether or not a minable zone of fiber exists.

This drilling has been done under a rental contract with the Joy Manufacturing Co., using a Joy (Sullivan) No. 12 gasoline-engine-powered diamond drill. The contract specifies that rent shall be paid at the rate of $25 per day for every day except Sunday and legal holidays (unless worked), and includes elapsed time from Michigan City, Ind., and return to the nearest carrier, with a minimum rental of $1,000. The driller-foreman gets $15.00 per day and, by verbal agreement, the helper gets $10.00 per day. The corporation agrees to

furnish living expenses for drill operator and helper, or furnish board and lodging. Joy Manufacturing Co. is to be reimbursed for any and all expenditures in carrying out the contract, including all loss, breakage and/or depreciation of diamonds, supplies, repairs, and renewals of drilling outfit and equipment, and the American Asbestos Cement Corp. agrees to pay for all special equipment.

The corporation estimates that they already have spent approximately $15,000 in diamond drilling, building access roads, and developing a water supply for the drilling program.

APPLICANT'S PROPOSED EXPLORATION PROJECT

On May 9, Gammache returned to the property from Washington, D. C. and stated that the corporation had made application for an exploration project. On May 14, Messrs. Smith and Gammache came to the Bureau of Mines Tucson office, gave the authors a copy of the application, and produced a letter of acknowledgment, dated May 4, from Landon Strobel, executive secretary for the Defense Minerals Administration, stating that the application, received April 30, 1951, had been assigned Docket No. 1093X. The writers have deemed it expeditious to report on this application as an amended Docket No. 244, rather than to await receipt of the new Docket No. 1093X through regular channels. Copy of the application is appended to this report with all exhibits except "A" (Option and Lease of Mining Property), which is identical to Exhibit "D" of original Docket No. 244.

According to this application, the corporation contemplates core drilling and other exploratory steps which will continue for a period not longer than one year. It is requested that Government aid be granted to explore the following area (Exhibit "D", appendix):

"(a) Wilson group; Continuation of the expansion of the present exploration claims, 14 in number; (b) Vesberg group consisting of 18 claims; (c) the Cherry Creek group consisting of 11 claims; (d) Buckhorn group consisting of 11 claims; and (f) the exploration of areas contiguous to the Wilson, Vesberg and Buckhorn groups. It seems most desirable that two core drilling units should be assigned to the first two areas listed above, and one unit each to the next two areas listed, delaying exploration on the remaining areas until a later date."

APPLICANT'S ESTIMATED COST OF PROJECT

The above exploration program would require operation of 6 drilling units at an estimated cost of $104,020, each for a 1-year operation, plus $51,000 for administration, auditing, engineering, and geological services, plus $23,500 for compressors and pneumatic drills, plus $20,000 for temporary housing for 32 men. The total exploratory project thus would cost $718,620 for a 1-year operation project as estimated by the applicant. Owing to the obvious impracticability of such an expansive project and the apparent reluctance of the applicant to bear its pro-rata share in the over-all program, the examiners have modified the proposal to a more economical and technically feasible program discussed later in this report.

PROPOSED FINANCING

The application is vague in its statement as to the corporation's participation in the estimated cost of the exploration. The applicant states "It is suggested, in conformity with the release of the Defense Minerals Administration of February 10, wherein it was proposed by the Government that in certain instances the Government would provide 100%

financing, that no contribution should be required of this applicant.[1] In the event the administration does not consider that the critical shortage of asbestos (spinning grade) warrants the waiver of the 10% contribution feature, this corporation can presently undertake only limited exploration projects. * * * * * * The total cost of one core drilling project would be $178,512 annually. The Corporation is prepared to bear its 10% pro-rata cost of such a project, or $17,851.20 but feels that a total of five additional projects should be undertaken. The annual cost per additional core drilling unit would be $104,019.96." (Appendix, p. 2).

However, in the discussion of the proposal at the Bureau of Mines office on May 18, Smith agreed in principle to the examining team's suggested modifications and stated he was willing to spend up to $20,000 as his pro-rata share in a 10-90 matching proposal. He will be credited, of course, with a fair rental figure for use of any corporation equipment.

DISCUSSION OF ESTIMATED COSTS

No specific drilling program, showing the location of drilling sites and the number of holes in each area, can be set up at this time. The claims in 7 non-contiguous groups are spread over an area of approximately 3 by 4 miles. Exhibit "D", furnished by the applicant, is misleading inasmuch as the shape and position of the various groups are generalized. The actual boundaries of the groups have not been definitely located. Therefore, it is impossible in the comments on some of the deposits to apply a name to the deposit or prospect under discussion.

1/ Apparently the applicant refers to the press release dated February 20, 1951, which states "However, in exceptional cases involving the most strategic and critical metals and minerals the Secretary may depart from the matching principle in whole or in part if he finds that such action is necessary to accomplish the objectives of the program."

The locale, extent, and number of possible asbestos-bearing areas can only be estimated from the past experience of the examining team in the Arizona asbestos field. Therefore, any current planning can be expressed only in general terms. Cost estimates can be made only by assuming that a certain percentage of the areas to be investigated by geologic means will be favorable for drilling.

Assuming that geologic work has indicated that there are 10 possible areas, that it will take an average of 10 holes to prove each area, and that the holes will average 80 feet in depth, then 8,000 feet of drilling will be required. This estimate of footage is liberal. Drilling at the rate of 20 feet per day, 400 drilling days will be required, or 15½ months elapsed time. Moving, breakdowns, inclement weather, etc. would probably extend this time to 18 months for 1 drill.

The writer's estimated cost figures for diamond drill explorations primarily are based on the applicant's present Joy contract and the rental price of the water truck, which is rented from the Isbell Construction Co. The 1,000-gallon auxiliary water tank is rented from a local individual at $30 per month. Calculations indicate that this figure is comparable to the cost and installation of a new tank of the same capacity prorated over a one-year operation.

As the above equipment is presently in use on the property, it would appear advisable to continue with this arrangement. Rental of the applicant's Jeep or pickup truck and bulldozer seems advisable. We are advised that the present D-4 bulldozer tractor is to be replaced by a D-7 or 8 size which the applicant will rent to the Government at $10 per hour with operator, gas, and oil. A wagon drill and attendant compressor should be purchased. Discussions with John H. Soule[2/]

2/ Mining Engineer, Bureau of Mines, Silver City, N. Mex. Field Office, author of RI 3984, Drilling and Sampling with a Wagon Drill, 1947.

and a representative of the Joy Manufacturing Co. have indicated that a light 3½-inch wagon drill will do the required work when used with a 315 c.f.m. compressor. At the altitude of the work (6,000 feet) a 210 c.f.m. compressor would be inadequate.

The wagon drill will be used to expedite the diamond drilling. Conditions for this type of drilling are ideal. The holes will be vertical, bit wear will be moderate, and the limestone and diabase are neither hard nor abrasive, and most important, the rocks will contain no moisture that would impede drilling.

It should be possible to drill 30 to 40 feet in a few hours at a cost of approximately $1.00 per foot. Beyond approximately 40 feet, the efficiency of wagon drilling rapidly falls off, with consequent increase in cost and time. No water is required for this drilling. Diamond drilling will follow down these holes and core through the fiber zone.

The bulldozer will construct necessary access roads, clear drilling sites and move the core drill rig and compressor. The wagon drill can be moved with a Jeep or pickup truck.

The terrain is such that little or no rock work will be necessary for road construction, but a jackhammer is included in the proposal for this work should it be needed.

Estimated monthly costs for various phases of the exploratory program are as follows, using rounded figures:

Administration and geologic work:

Pro-rata administration	$ 300
Auditing, reports, etc.	100
Geologist or engineer @ $450 per month	450
Helper to above @ $300 per month	300
Rental of Jeep @ $ 85 per month	85
Miscellaneous expenses, gas, oil, etc.	300
Payroll taxes	165
Total	$1,700

Core drilling, 26 working days, one unit:

Rental of diamond drill and drilling equipment	$ 650
Labor	
Driller @ $15 per day and overtime	500
Helper @ $10 per day and overtime	300
Board and lodging of driller and helper @ $5 per day each	260
Supplies and replacements of diamond bits, rods, etc.	400
Rental of driller's pick-up truck	65
Account Joy Manufacturing Co. contract	$2,175
Rental of water truck and driver @ $3.50 per hour, 10-hour day	910
Rental of auxiliary 1,000 gallon water tank	30
	$ 940
Miscellaneous expenses, gas, oil, etc.	100
Payroll taxes	120
	$3,335
Contingency	365
Total	$3,700

Operation of wagon drill, 10 hours per day, 15 days per month:[1]

Drill operator @ $1.50 per hour for 10 hour day	$ 225
Helper @ $1.35 per hour for 10 hour day	203
Miscellaneous expenses, gas and oil for compressor, etc.	200
Payroll taxes	62
	690
Contingency	70
Total	$ 760

Rental of dozer and pick-up truck, 10 hours per day, 26 days per month:

Rental of D-8 dozer with operator @ $10 per hour	$2,600
Rental of pick-up truck @ $85 per month	85
Truck driver @ $1.25 per hour for 10-hour day[2]	362.50
Miscellaneous expenses, gas and oil, etc.	100
	$3,147.50
Contingency	252.50
Total	$3,400.00

1/ It is thought that wagon drilling in advance of 1 or even 2 diamond drill rigs could be accomplished with an average working time of 15 days per month.

2/ Calculated @ 20 days regular pay, 6 days at time and a half.

Purchase of new equipment, and housing:

315 c.f.m. compressor, mounted, 4 wheels	$ 7,200
Light wagon drill, 3½ in. machine	1,550
Drill steel, bits, air hose, etc.	550
Surveying equipment	1,000
Temporary housing	10,000
Jackhammer, 55 pound class	350
Drill steel, bits, air hose	100
Total	$20,750

Operation of each additional core drilling unit per month @ 26 working days:

Rental of diamond drill and drilling equipment	$ 650
Labor	
Driller @ $15 per day and overtime	500
Helper @ $10 per day and overtime	300
Board and lodging of above @ $5 per day each	260
Supplies and replacements of bits, rods, etc.	400
Rental of 1000-gal. water tank	30
Miscellaneous expenses, gas, oil, etc.	150
Payroll taxes	110
	$ 2,400
Contingency	200
Total	$ 2,600

Note: Services of dozer, pick-up trucks, and water truck available from first unit.

CONCLUSIONS AND RECOMMENDATIONS 5/

Owing to the acute shortage of strategic grades of chrysotile asbestos and the geologic probability of finding chrysotile in the subject area, any reasonable exploration program should be considered. On the basis of reconnaissance examination of only a part of the area under consideration for exploration and from past experience in the Arizona asbestos field, the examiners believe that an exploration program by drilling in the area proposed by the American Asbestos Cement Corp. may be feasible. A drilling proposal can be recommended only if it is to be preceded by adequate geologic work. The gross geologic features that were favorable to the formation of asbestos are present in several of the areas visited, and probably are present in some of the areas not examined. More geologic work must be done to determine the existence or lack of the minor geologic structures so significant in controlling asbestos deposition. Three areas have been studied in detail by the examining team. In these immediate areas further exploration is not warranted. Two other areas (the Home and Buckhorn mine areas), studied in less detail, show enough promise that detailed geologic work is warranted. More geologic work must be done to see whether or not the geometric relations of diabase to limestone are such that the target for an exploration program is large enough to be feasible. For example, in the Home mine area, a discordant diabase sill cuts out the favorable horizon. Reconnaissance suggests that on plotting this diabase-limestone contact and the present mine faces,

5/ This section prepared by Lincoln A. Stewart and Andrew F. Shride

it would be found that too small a block of ground exists to warrant drilling. Such geometric relations very likely exist at other places on the claims.

The applicant proposes to hire geologic and engineering staffs from funds of which the Government would contribute 90 percent. To date no geologic work and essentially no engineering work have been done by the corporation. Exploration to date has been on a n unsound basis. Exploration being done and to be done by the corporation at its own expense in the next few months is to be on a "wildcat" basis.

Although there is a possibility of finding additional minable asbestos in the area controlled by the applicant, the examiners are reluctant to recommend Government participation in any exploration program unless the American Asbestos Cement Corp. will seek and follow competent advice. Supervision by the present field staff of the corporation is not advisable if reasonable returns for the exploration funds spent are to be expected.

The engineering and/or geologic examinations to be made are not defined by the applicant, mainly because the principals of the corporation do not have a background knowledge of the asbestos industry or of the mining of this commodity, and do not know their properties well enough to appraise their needs. A geologist or an engineer (with some knowledge of geology) plus an assistant would be sufficient technical staffing for the exploration program. The geologist or engineer should have a background in the asbestos industry.

The writers have set up two alternative exploration programs, each with possible modifications. Alternative I proposes that geologic

work be started and, before completion, be followed by a drilling program at the earliest possible date. Modification Ia proposes the use of one drill rig; Modification Ib proposes a two rig program.

Alternative II proposes that geologic work on all obviously potential areas be completed before a drilling program is started and that the final decision on a drilling project be postponed until geologic work indicates the possible magnitude of such a project. Alternative I has been discussed in detail with the president and vice-president of the American Asbestos Cement Corp. and, in principle, is agreeable to them. Obviously, the applicant is not sympathetic to Alternative II, but is willing to participate in it. The writers have set forth in the following pages both Alternatives for the information of the Denver and Washington Defense Minerals Administration offices. Because of the sketchy information available at this time only Alternative II can be recommended. Each program is broken down to suitable chronological stages.

Alternative I

(Geologic work to be done; a drilling program to be started if possible in advance of completion of the geologic work.)

Stage 1. Quick reconnaissance by the corporation's geologist or engineer to determine the most likely areas for detailed work. The geologist or engineer should be allowed, during the early part of this stage, a minimum of a week or 10 days to visit well developed and exposed deposits elsewhere in Gila County and to familiarize himself with the habits of Arizona chrysotile deposits. Stage 1 might take 3 to 6 weeks to complete.

Stage 2. Detailed mapping of areas determined to be the most likely prospects during the reconnaissance stage of examination. Probably the potentially productive areas delimited by reconnaissance work would be small; therefore little time would be required for detailed mapping of each area. This stage should include surface and underground mapping to determine controlling geologic structures and thereby the probable extension of known deposits or inferrable position of possible "geologic" ore bodies. The detailed mapping of any particular area should be stopped if it is found at any time during the mapping that ore bodies are geologically improbable.

Without doubt a relatively small expenditure of money for geologic work can save considerable drilling expense. Unless an outstanding possibility for drill exploration is discovered early in Stage 2 no drilling should be done until Stage 2 is completed. This recommendation is at

variance with that outlined by the applicant. The corporation would start a "wildcat" drilling program at the beginning of Stage 1. We recommend, if such "wildcatting" is done, that the Government not participate in that part of the program, -- only by luck would such a program result in finding ore.

Detailed mapping of any one area would require 1 to 10 days. The examining team would estimate from past experience and on the basis of their reconnaissance examinations that between 5 and 10 areas might come under consideration for detailed examination. Stage 2 would take 1½ to 3 months to complete.

Stage 3. Drilling. The corporation proposes to use wagon drills for preliminary drilling to determine whether favorable limestone beds are present and whether appreciable chrysotile is present. Except for a relatively small portion of the areas to be explored, the depth of sediments that overlie the favorable beds is likely to be on the order of 30 to 120 feet and average 60 to 80 feet.

In order to lower exploration costs, the writers suggest that wagon drilling be employed to bore the first 30 to 40 feet of each hole, to be followed by core drilling, AX size with use of an M-Series core barrel through the ore zone.

During Stage 3 detailed mapping would be continued on the areas that had been considered from Stage 1 reconnaissance to have only moderate promise.

Alternative Ia

Assuming that it will take 3 months for the geologist to acquaint himself with the area involved and to find favorable sites in advance of the drilling operation, and that 1 diamond drill will be used 18 months, the cost of the over-all exploration is estimated as follows:

Diamond drilling	$3700 x 18	$ 66,600
Wagon drilling	760 x 18	13,680
Dozer and pick-up	3400 x 18	61,200
Administration, geologist, etc.	1700 x 21	35,700
		$177,180
Cost of new equipment and housing		20,750
Total		$197,930

Alternative Ib

Assuming that sufficient favorable areas are found so that the operation of a second rig is advisable, 4 months after the first rig has begun to work, the cost of over-all exploration would be:

Diamond drilling, rig No. 1	$3700 x 11	$ 40,700
Diamond drilling, rig No. 2	2600 x 7	18,200
Wagon drilling	760 x 11	8,360
Dozer and pick-up	3400 x 11	37,400
Administration, etc.	1700 x 14	23,800
		$128,460
New equipment and housing		20,750
Total		$149,210

Alternative II

(Geologic investigation to be completed before a drilling program is planned and recommended.)

The writers prefer this Alternative I to that proposed by the applicant and recommend that Alternative not be considered, but that Alternative II be the basis of any negotiations for an exploration contract.

Stage 1. Reconnaissance. Reconnaissance requiring 3 to 6 weeks as under Stage 1, Alternative I.

Stage 2. Detailed mapping of all obviously potential areas to be completed before a final plan for a drilling program is made. After the drilling program (Stage 3) begins, the only geologic work to be done would be that work necessary to direct the drilling program and detailed mapping deemed advisable on these areas of relatively poor potential that have not previously been mapped.

Stage 3. Drilling program. A drilling program would not be outlined under the Alternative II plan until geologic work had been completed. It is possible that the geologic work would indicate that no drilling should be done. In that case this Alternative will have cost only $6,850. It also is possible that it would be expeditious to use several drill rigs. In such an event the over-all exploration program would cost much less than that outlined under Alternative I, and the program would be completed in less time.

If, after geologic study, it appears feasible to follow with a drilling program, Government personnel should

have an opportunity to review the proposed drilling project. If it is possible to "ear mark" funds for a following possible drilling exploration project, it would not be necessary to renegotiate a new contract. Tentative cost estimates for Alternative II, including a drilling program, are outlined below for comparison with the cost estimates of Alternative I.

The estimated monthly cost of the geologic work is as follows:

Administration and reports	$ 25
Geologist @ $450 per month	450
Helper @ $300 per month	300
Rental of jeep @ $ 85 per month	85
Payroll taxes	108
Miscellaneous expenses, gas, oil, etc.	100
	$1,068
Contingency	232
	$1,300
Surveying equipment	1,000
Total	$2,300

Note that no new housing is required for this stage.

For the 4½ month period the cost would be

$$4.5 \times \$1300 + \$1000 = \$6,850$$

In case an exploratory program is found advisable after the geologic study, the over-all cost per month can be figured from the same basic data as Alternative I.

It is possible that with the geologic data available, more than one diamond drill rig could be moved in simultaneously, with a consequent lowering of exploration cost.

Assuming, as before, that 18 drill rig months will be required, and that the geologist will continue as before, the cost of 1 rig will be $196,930.[6]

With 2 rigs starting simultaneously, the cost will be

Diamond drill No. 1	$3700 x 9	$ 33,300
Diamond drill No. 2	2600 x 9	23,400
Wagon drilling	760 x 9	6,840
Dozer and pick-up	3400 x 9	30,600
Administration, geology, etc.	1700 x 9	15,300
		$109,440 [6]
New equipment and housing		19,750
Total		$129,190

If 3 diamond drill rigs could be used to complete the exploration in 6 months, the cost would be reduced to approximately $113,000.

Resume of Costs of Writers' Proposals

Alternative I

(a) With 1 drill rig	$197,930
(b) With 2 drill rigs	149,210

Alternative II

Preliminary geologic work	6,850
Followed by 1 drill rig $196,930 + 6,850	203,780
Followed by 2 drill rigs $129,190 + 6,850	136,040
Followed by 3 drill rigs $113,000 + 6,850	119,850

Recommendations

Because of the lack of information now available, the writers consider Alternative II to be the most practicable for Government participation.

6/ Surveying equipment ($1,000) was supplied previously in this alternative.

Therefore, it is recommended that approximately $7,000 be allotted to cover the Government's participation in the expense of preliminary geologic work that is the first phase of this asbestos exploratory project.

It is further recommended that a decision be made at the Washington level as to means and necessity at this time of allocating money to cover a possible later drilling program, the magnitude of which cannot be determined at present, but is estimated at a maximum of $200,000.

APPENDIX

Application o f American Asbestos Cement Corp. for

Exploratory Lease

Dr. James Boyd
The Administrator
Defense Minerals Administration
U.S.Department of Interior
Washington, D. C.

Dear Doctor Boyd:

This letter is prepared to accompany form MF-103 Application for Aid for Exploration Projects Pursuant to Mineral Order 5, Under Defense Production Act of 1950, dated April 30, 1951. The answers to all questions contained in attached form MF-103 are given below:

1. The American Asbestos Cement Corporation is a Corporation, organized under the laws of Pennsylvania.

2. President-Treasurer Ammon R. Smith; Vice-Presidents Vernon R. Smith and Frank J. Gammache; Secretary Hon. McClean Stock, all of York, Pennsylvania. The Officers listed above own all stock of the corporation.

3. (a) This corporation was organized on January 1950, being the successor to a partnership which was established by the same parties in 1948 for the purpose of importing asbestos-cement products from Italy. It early became evident to the partners that the world shortage of asbestos required the adoption of measures designed to expand that supply. Accordingly, our Chief Engineer, Mr. Gammache, was ordered to Arizona to investigate and report on asbestos deposits there. After a thorough survey of the area, the corporation took out an option on the claims held by the Gila Asbestos Company in the Florine Mining District of Gila County, Arizona. A list of these claims and the options and lease of the mining property are more fully described hereinafter. On February 5, 1951 the corporation exercised its option and purchased outright the Gila Asbestos Company.

(b) The project will be under the direct supervision of Frank J. Gammache, a Professional Engineer registered in the State of Pennsylvania. A former employee of the Bureau of Mines, Mr. Gammache's accomplishments in the engineering field are well known. For a fuller reference on Mr. Gammache, see Army records re his supervision of Ruhr, Saar and Bavarian coal Mining Districts (Army

Publication issued by Garmisch Recreation Center, 1947, Military Post, Garmisch, Germany)? also Milton Pearce, now employed by the Corporation, former engineer for the Johns Manville Corporation, of their property known as the Chrysotile Mining Property, Gila, Arizona, and Mr. Carl Trischka, who was Chief Geologist at Chrysotile during the later 1920's and until his recent retirement was Chief Geologist for the Phelps-Dodge Corporation at their Bisbee operations.

4. Concerning ownership of property (Questions 5,6 & 7.) see Exhibit A entitled "Option and the Lease of Mining Property".

5. With respect to question 8, there is attached as Exhibit B a current financial statement of the Corporation.

6. Answering question 9, applicant desires to point out that the corporation, at its own expense, has gone ahead with the development of its asbestos deposits in Arizona, the first such activity ever to be taken by private interests. This activity so far has required the expenditure of more than $15,000. and consists of core drilling, surveys, and mapping. Moreover, the government has made only token exploration, none of which was in the area covered by this application. This Corporation believes the present critical world situation warrants exploration projects of a scope which this Corporation is unable financially to aid at the present time. It is suggested, in conformity with the release of the Defense Minerals Administration of February 10, wherein it was proposed by the government that in certain instances the government would provide 100% financing, that no contribution should be required of this applicant. In the event the administration does not consider that the critical shortage of asbestos (spinning grade) warrants the waiver of the 10% contribution feature, this corporation can presently undertake only limited exploration projects.

It is estimated that an exploration project in one area would involve the expenditure over a one year period of $178,516. The cost of Administration, auditing, engineering, geology and access road development, etc. would be the same for the exploration of one core drilling unit as for several units. The total cost of one core drilling project would be $178,516 annually. The Corporation is prepared to bear its 10% pro-rata cost of such a project, or $17,851.20 but feels that a total of five additional projects should be undertaken. The annual cost per additional core drilling unit would be $104,019.96. See Exhibits C1, C2, C3 and C4 for complete explanation of estimates.

7. Answering question 10 there is attached a claim map of Young, Arizona, American Asbestos Cement Corporation (Exhibit D). It should be emphasized that none of the project aid requested will apply to the going operations at Mine No. 1 and the Mill. The

Corporation desires that preferential treatment in the granting of aid to the various areas be as follows:

(a) Wilson group; Continuation of the expansion of the present exploration claims, 14 in number, (b) Vosburg group consisting of 18 claims; (c) the Cherry Creek group consisting of 11 claims; (d) Buckhorn group consisting of 11 claims; (e) the Ranstage group, also consisting of 11 claims; and (f) the exploration of areas contiguous to the Wilson, Vosburg and Buckhorn groups. It seems most desirable that two core drilling units should be assigned to the first two areas listed above, and one unit each to the next two areas listed, delaying exploration on the remaining areas until a later date.

8. The answer to question 11 may be found in Exhibit A.

9. The answer to question 12 is partially contained in Exhibit B. Access to the area by county dirt roads useable the year round. The closest railroad is the Southern Pacific at Globe, Arizona, 85 miles distant from the mill. The Corporation maintains a warehouse with truck and railroad facilities at Globe, Arizona.

10. With respect to water supply it is unfortunate that the only known remaining supply of long fiber spinning asbestos is in an area where water is so critically short. It should be pointed out, however, that the corporation has developed a supply of water, as pointed out in footnote to Exhibit C. Additional drilling may be required if the present drought continues. The Corporation generates all of its own power by deisel or gasoline fuel, and that power is sufficient to carry on the exploration program.

11. With respect to useable facilities, see Exhibit E.

12. With respect to shipping and milling, the present facilities of the Corporation are being utalized. The Corporation, at its own expense, has planned for the early expansion of the present mill. Shipping of ore and finished products is by truck.

13. Answering question 16, (a) Mine No. 1, shown on Exhibit D, has been in operation since May, 1950. It is understood there were several very small, hand operated exploration projects on some of these claims, but no history is available regarding them. The product from Mine #1 has been sold to the United States Government for the stock piling program, both by the former owners and this Corporation. The Strategic Minerals Division, Bureau of Federal Supply, has full records regarding government purchases of this most critical mineral from Mines No. 1 and No. 2.

(b) While this Corporation has not sufficient information to answer this question, it is our considered opinion that the Arizona area, as a source of long fiber asbestos, has been

too long neglected. The reliance on Canadian and Souther Rhodesian output has delayed the development of domestic sources and makes essential an all out effort now to place the United States on a self-sufficient basis.

(e) So far as is known there are no reports either by the government or private sources to answer this question. That makes more imperative the approval of these exploration projects.

14. In answer to question 17, see Exhibit F.

15. No data available to answer question 18. This is confirmed by the personal inspection of Mr. Andrew F. Shride, Acting District Supervisor, U. S. Geological Survey, Arizona-New Mexico, University Station, Tucson, Arizona; and Mr. Lincoln Stewart, United States Bureau of Mines, same address.

16. In response to question 19, it is desired to point out that because of the demand of government and private industry for fiber being produced at Mines No. 1 and 2, the Corporation is investing as much capital as possible for mill and mine expansion, including new machinery. If this capital is div erted to exploration projects, the government stock piling program and those private contractors producing critical items for the defense effort will suffer accordingly. The government only recently agreed to reimburse this Corporation, in advance, to the extent of 75% for fibre produced and in its warehouse. This concession will enable the Corporation to finance increased production of critical fibre and should point the way to further concessions in connection with the present application.

17. In answer to question 20, asbestos fibre (spinning grade).

18. In answer to question 21, the application has made it clear that the Corporation contemplates core drilling and other exploratory steps which will continue for a period not longer than one year.

19. Question 22, must be answered in the same manner as question 18.

20. With request to requirements and cost (question 23), the required data may be found in the exhibits made a part hereof. The same statement applies to question 24.

The Corporation, of course, understands the necessity for keeping complete figures regarding the operation of any projects authorized under this operation.

Washington Counsel for this Corporation is Harry J. Maginnis, Esquire Room 1018, King Building, Metropolitan 2447, Washington, D. C., who will hand-deliver this application.

Mr. Maginnis may be consulted at any time regarding this application and will render every possible assistance to the government in its processing.

AMOS E. SMITH
President-Treasurer

Exhibit "A"

Executed Option and Lease of Mining Property

Identical with Exhibit "D" of Docket No. 244

AMERICAN ASBESTOS CEMENT CORPORATION

BALANCE SHEET

Exhibit "B"

APRIL 30, 1951

ASSETS

Current Assets

Cash in Bank	$ 5,177.34	
Inventory of Pipe (at landed cost) (Note 1)	53,733.21	
Advance to Employees	1,166.02	
Total Current Assets		$ 60,076.57

Property, Plant and Equipment	Cost	Accumulated Depreciation	Net Value	
Sundry Equipment	$ 233.20	$ 16.51	$ 216.69	
Autos	2,097.87	371.50	1,726.37	
	$2,331.07	$388.01	$1,943.06	
Cost of Mine Buildings and Equipment			86,129.50	88,072.56

Other Assets

Cost of Pipe Contracts Acquired	$4,819.13	
Development Expenses - Asbestos Pipe and Mining Property (Note 2)	50,744.34	
Prepayments	127.53	54,891.00
Total Assets		$ 203,040.13

Exhibit "B" Cont'd

Exhibit "B" Cont'd

LIABILITIES

Current Liabilities

Notes Payable	$93,445.40	
Accounts Payable	3,867.66	
Accrued Payroll Taxes	122.38	
Employees Income Tax Withheld	290.80	
Total Current Liabilities		$ 97,726.44

Advances

Officers	$37,882.97	
Austin R. Smith Auto Company	33,431.72	71,313.69

Capital

Common Stock Authorized-500 shares @ $100.00 par	$50,000.00	
Common Stock Unissued - 160 shares	16,000.00	
Issued and Outstanding		34,000.00
Total Liabilities and Capital Stock		$203,040.13

Note 1 - Inventory figure does not include Asbestos Fibre on Hand at mine in warehouse or in process at a reported sales value on April 13th of $51,388.50. Additional production April 13th to 30th estimated at $15,000.00.

Note 2 - Represents capitalization of costs since incorporation with respect to import of pipe and cost incurred at mine.

AMERICAN ASBESTOS CEMENT CORP. Ex C-1

Estimated cost exploration of Asbestos on Property of A.A.C.C. Florina Mining District Gila County, Arizona.

		Cost per Mo.
1	Administration	$ 600.00
	Auditing, reports etc.	450.00
	Expenses	300.00
2	Legal Fees	500.00
3	Engineer	500.00
	Engineer Aide	400.00
	Expense of above	200.00
	Supplies & Equipment	300.00
4	Geologist	500.00
	Geologist Aid	200.00
	Expense of above	150.00
	Supplies & Equipment	150.00
	Cost	4250.00

Estimated Cost of Core Drilling per unit, per month, @ 26 working days

Rental of drill and equipment @ $25.00 day	$ 650.00
Labor	
Driller @ $25.00 day	650.00
Helper @ 15.00 day	390.00
Board and lodging @ $10.00 day	260.00
One water truck and driver @ $3.50 hour, 10 hour day	910.00
Rental auxiliary 1,000 gal. water tank (one each per drilling unit) @ $30.00 month	30.00
Payroll, taxes, per unit	170.30
Supplies (diamond drills, steel rods, etc.	400.00
Construction of Access roads and movement of drill units 1 - D-6 Bulldozer @ $10.00 hour, including operator	2,600.00
1 - Model #12 caterpiller grader, @ $7.00 hour, including operator	1,820.00
Total -	$ 7,880.30
10% contingency	788.03
	$ 8,668.33

Additional Requirements.

1	Temporary Housing 2 - 6 room Units @ $16,000.00 ea. each unit 16 men	$ 20,000.00
2	2 Compressors @ $ 5,800.00 ea. 4 - J 30 Jackhammers @ $350.00 ea. 2 Wagon Drills @ $1500.00 ea. Supplies, hose etc.	17,600.00 1,400.00 3,000.00 1,500.00 23,500.00

The above compressors, Jackhammers will be needed to replace four portable compressors now in use at # 1 mine to continuous-present operation.

Summary of Costs per month.

Administration, Engineering etc.		4,250.00
Core Drilling etc., per unit		8,668.00
		12,918.00
Additional requirements 23,500.00	23,500.00 ÷ 12	1,958.00
		14,876.00

Development Expense to April 14, 1951.

Costs

Joy Mfg. Company, Feb. 23 thru Mar. 24	$ 1866.04	
Joy Mfg. Company, Mar. 25 thru Apr. 9	600.80	estimate
Labor	1315.00	
Payroll, taxes	188.30	
Care horse	197.39	
Supplies	296.37	
Rental - motor truck and driver	1330.00	
Rental - 1,000 gal. tank, per month	30.00	
Total -	5823.10	

Footage Drilled

No. 1 Hole	70 feet
No. 2 "	83 "
No. 3 "	91 "
No. 4 "	84 "
No. 5 "	79 "
No. 6 "	66 "
Total footage	473 "

Cost per foot $12.31

The above represents over one week's delay in moving drill rig from Globe to the mines (106 miles) inclement weather for two weeks and hauling water 6.5 miles. The water haul has been reduced to 2.1 miles by construction of a small dam. At the present time the drill crew is averaging thirty feet per ten hour shift.

EXHIBIT "F"

The following lists of equipment and facilities of the American Asbestos Cement Corporation will be made available to the exploration Program.

	Per Month	Per Year
4 Ingersoll Rand air Compressors, 105 c.f.m. with jackhammers, etc. Each $3,575.00 per year		$14,300.00
2 Jeeps with drivers @ $125.00 each per month	$250.00	3,000.00
2 Pickup trucks with drivers @ $125.00 each per month	250.00	3,000.00
1 D-4 Caterpiller bulldozer with operator @ $8 per hour, 10 hour day, 26 days per month	2,080.00	

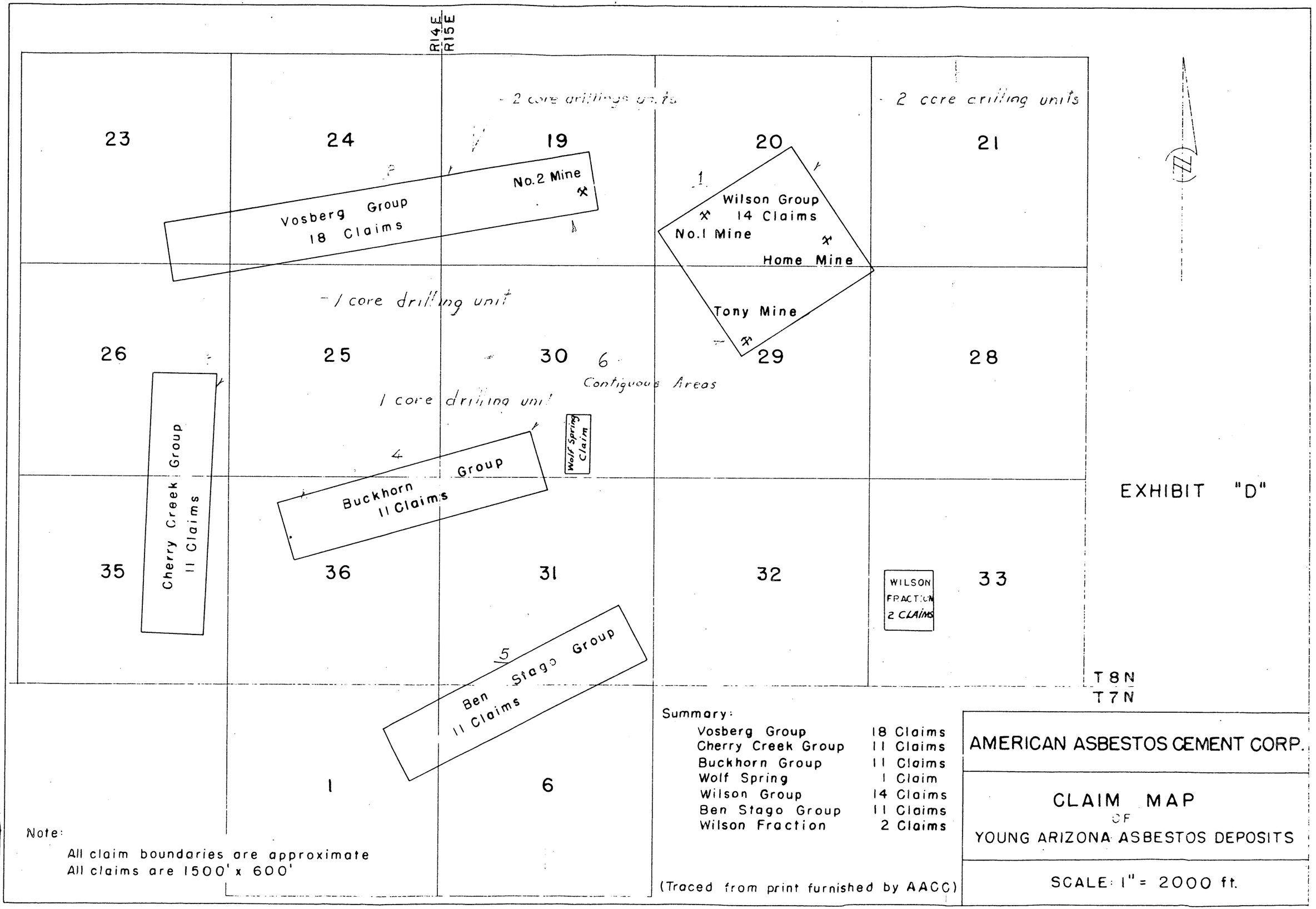
In addition to the above the Corporation will make available to the project without cost its facilities on the property i.e. shops, tool, commissary, existing temporary housing, etc.

EXHIBIT "F"

AMERICAN ASBESTOS CEMENT CORP.
115 W. Oak St., Globe, Arizona.

Operation Statement April 14, 1951

Production			
Sales Western Chemical Co.		2798.75	
Value inventory on hand 4-14-51			
18.55 tons # 1 Crude @ 1500.00 ton	27825.00		
11.05 " # 2 " @ 800.00 "	8840.00		
4.00 " # 3 " @ 300.00 "	1200.00		
3.75 " # 4a " @ 60.00 "	225.00		
37.1 " # 4 " @ 35.00 "	1298.50		
Total Inventory finished		39588.50	
Value ore in process			
24 tons @ 500.00 ton		12000.00	
Total			54179.25
Costs			
Mining Supplies	2600.87		
Labor	7462.79		
Payroll taxes	1068.67		
Total mining		11132.33	
Milling			
Supplies	474.08		
Labor	1779.55		
Payroll taxes	254.83		
Total Milling		2508.46	
Trucking & Warehouse			
Truck expense	429.85		
Truck hire	820.13		
Unloading	306.50		
Warehouse rent	60.00		
Warehouse repairs	149.46		
Total Trucking & Warehouse		1159.94	
General Expense			
Automobile expense	121.37		
Sales Tax	48.44		
Telephone & telegraph	154.05		
Freight	111.06		
Office Supplies & expense	142.42		
Travel expense F.J.G.	350.00		
Total General		927.34	
Royalty		3786.50	
Fiber purchased from Gila		6787.50	[illegible]
Total Cost			26622.07
Value over cost			27557.18



Note:
All claim boundaries are approximate
All claims are 1500' x 600'

Summary:

Vosberg Group	18 Claims
Cherry Creek Group	11 Claims
Buckhorn Group	11 Claims
Wolf Spring	1 Claim
Wilson Group	14 Claims
Ben Stago Group	11 Claims
Wilson Fraction	2 Claims

(Traced from print furnished by AACC)

AMERICAN ASBESTOS CEMENT CORP.

CLAIM MAP
OF
YOUNG ARIZONA ASBESTOS DEPOSITS

SCALE: 1" = 2000 ft.

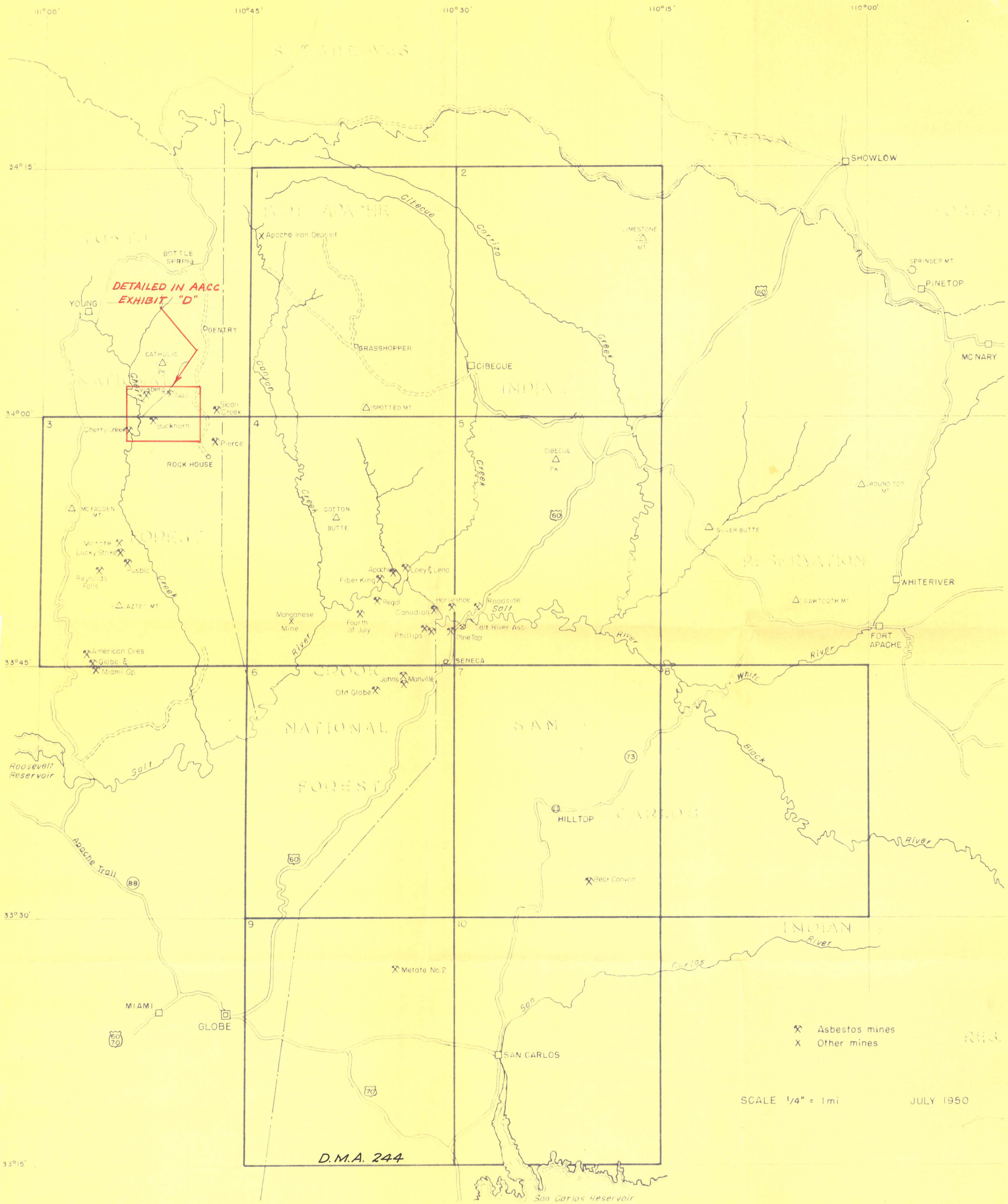


Figure 1. - Location map, Asbestos Deposits, Gila County, Arizona. (index map of aerial photo sheets)