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DMEA ~~DMA~~ Docket No. 2486

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To:	Code 700, Rm. 4640	Date	4-15-52
To:	Op. Com	Date	9-7-52
To:	Mr. Krause R-4640	Date	7-22-52
To:	Oper Com	Date	Mar 2-53
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MME Form 7
(2/63)

OFFICIAL FILE COPY

Date	Surname	Code
9/28	Johnson	120
		110
		220

September 28, 1966

Memorandum

To: The File

From: Assistant Chief, Office of Minerals Exploration

Subject: Office visit
Mr. A. H. Scott, President
Magnet Cove Titanium (Rutile) & Columbium Corp.
Little Rock, Arkansas
(DMEA-2486 (Columbium))

Mr. Scott visited Mr. Frank E. Johnson and me on September 26, 1966, regarding possible financial assistance from the Government to drill additional holes on his company's property in the Magnet Cove area, Arkansas. Prior to this visit, Mr. Scott had written requesting an appointment and had sent copies of correspondence to and from the offices of Senators Edward B. Long and John Stennis, comments on discussions with Mr. William N. Lawrence, Office of Emergency Planning, and Senator John McClelland, and newspaper reports on the increasing demand for titanium by major aircraft manufacturers.

Following lengthy introductory remarks about the titanium situation, Mr. Scott asked if the Office of Minerals Exploration is authorized to explore anywhere in the United States without instructions from other Government agencies. When assured that OME operates independently of other agencies, he asked if additional drilling on his property could be undertaken with OME assistance. He was informed that the drilling completed by the U. S. Bureau of Mines in 1948 had indicated the presence of a considerable tonnage of low-grade rutile columbium-bearing material and that additional drilling would be close-spaced and more in the development stage than exploration and, therefore, not eligible for assistance under OME regulations. This statement was accepted without much question and he left the office shortly thereafter.

Since the early 1950's, Mr. Scott has made frequent inquiries of various Government agencies for assistance to develop his property. The principal technical problem is to develop a feasible method to treat this material, and Mr. Scott has been informed of this on many occasions. An application for assistance under the DMEA program (DMEA-2486) was denied in 1952 because the metallurgical problem superseded the need for finding additional reserves.

Harold Kirkemo

Harold Kirkemo

cc: Director's Reading File
Division File
Economic Geology File
OME File
OME Reading File
Mr. Kirkemo

HKirkemo/gla 9-28-66

23263

8/30/66

DMEA - application denied
(Graph no. 2 [illegible])
USBM [illegible] [illegible]
individual [illegible] [illegible] of
low grade [illegible], Ti-bearing
material. Reserve - a multibillion?
[illegible]. Tito made-reserved Ti
but not in form of [illegible].
(Unless Ti recovered as [illegible] - not
[illegible])

JEP

A. H. Scott
357 Rivercliff
Little Rock, Arkansas

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O. E. E.
RECEIVED
AUG 26 1966
INITIALS | CODE
JEJ | 110
J | 120

August 23, 1966

Mr. Frank Johnson, Chief Titanium
U. S. Department of Interior, Geological Survey
Office of Minerals Exploration
Washington, D. C.

Dear Mr. Johnson:

The enclosed statements are numerous and my personal statement is rather lengthy and comprehensive. However, I did my best to present just facts as I found them pertaining to the current production of Rutile in the United States and Australia and the anticipated production of Rutile in Sierra Leone.

I do hope that your tight, busy schedule will permit you to analyze and study these statements as I am convinced that our Government must go all out to find likely deposits of Rutile by core-drilling and blocking out on an extensive basis.

Sincerely yours,

C. H. Scott

C. H. Scott

S/d
encl.

May Wm. N. Lawrence, Chief Stockpile & Requirements, tell Senator McClellan and me that we should discuss Titanium Rutile with you. We shall contact you after Sept 6th.

I have placed these same enclosures on Mr. Moore's desk. C. H. S.

MAGNET COVE TITANIUM (RUTILE) & COLUMBIUM CORP.
357 Rivercliff -- 2000 Magnolia Ave.
Little Rock, Arkansas

August 17, 1966

Sen. Edward B. Long
Senate Office Bldg.
Washington, D. C.

Re: 335 planes shot from the air to date over Vietnam -- Mr. McNamara indicates a 580-plane loss this year at a cost of approximately $1,200,000,000.

My dear Sen. Long:

Mr. Daniel B. Miles, your Administrative Assistant, was most courteous to me during my recent visit to your office in permitting me to discuss a sensitive and precious ore (rutile) that must be available at all times in the production of airplanes and spacecraft by manufacturers located in your Congressional District. The healthy economy of your District could be strangled and deflated to a great degree if any of the large plants were closed down for any length of time because of shortage of any strategic ore used by them.

The enclosed statement is rather comprehensive and long; however, I am confident you will be well-compensated in studying and analyzing the facts contained in this overall appraisal of the raw ore (rutile) and the finished titanium metal used in the production of airplanes, spacecraft and military equipment.

Submarine warfare could be a reality within 2 to 4 years -- not likely, but possible. Russia could supply numerous submarines to North Vietnam by some kind of lend-lease arrangement or an outright sale. It is Russia's hardware in North Vietnam presently and many of her Technical and Air Force personnel and experts are not only advising the North Vietnamese soldiers but are actually operating their own installed equipment in shooting down our planes and pilots.

I do hope your tight, busy schedule will permit you to write the suggested personalities outlined in the statement if you come to the conclusion your District must be protected at all times against the shortage of rutile that would occur if and when we become involved in submarine warfare.

Cong. Wilbur Mills has a fine grasp of titanium and its impact in our military and peacetime economy. He knows of my activities.

Any courtesy you can extend in meeting this request will be greatly appreciated.

Sincerely yours,

C. H. Scott, President

CHS/mdw
Enclosures

RICHARD B. RUSSELL, GA., CHAIRMAN
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WILLIAM H. DARDEN, CHIEF OF STAFF
CHARLES B. KIRBOW, CHIEF CLERK

United States Senate

COMMITTEE ON ARMED SERVICES

June 3, 1966

Mr. C. H. Scott, President
Magnet Cove Titanium (Rutile)
& Columbium Corp.
427 Hall Building
Little Rock, Arkansas

Dear Mr. Scott:

I certainly appreciate your good letter of May 25, and the detailed information which you imparted to me on the importance of titanium in our military preparedness program and the production situation at the present time.

I certainly agree that this appears to be a very serious problem and I will look into it just as soon as I can. As soon as I have some more detailed information, I will let you hear from me again.

Thanks again for your interest in providing me with this information. It was good to hear from you.

With best wishes, I am

Sincerely,

John Stennis

John Stennis
United States Senator

RICHARD B. RUSSELL, GA., CHAIRMAN
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JOHN G. TOWER, TEX.

WILLIAM H. DARDEN, CHIEF OF STAFF
CHARLES B. KIRBOW, CHIEF CLERK

United States Senate

COMMITTEE ON ARMED SERVICES

June 1, 1966

Mr. C. H. Scott, President
Magnet Cove Titanium and Columbium Corporation
427 Hall Building
Little Rock, Arkansas

Dear Mr. Scott:

Senator Russell has asked that I acknowledge and thank you for your letter of May 26, 1966, in regard to developing a large deposit of titanium (rutile) in this country, thus lessening our dependence on imports of this strategic and critical material.

The Senator is appreciative of having your comments on this matter and is calling your views to the attention of the appropriate officials of the Department of Defense and the Office of Emergency Planning.

Sincerely yours,

Charles B. Kirbow

Charles B. Kirbow
Chief Clerk

McNamara Sees 580-plane Loss This Year in War

WASHINGTON (AP)—Defense Secretary Robert S. McNamara estimates that the United States in the current fiscal year will lose 580 attack aircraft—worth $1.2 billion—in the Vietnam air war.

McNamara has assured senators, however, that the pending $58-billion defense fund bill includes provisions for more than enough replacement planes.

Testifying in secret before the Senate Appropriations Committee on August 1, McNamara said:

"Attack aircraft losses will run around 580 probably. Those airplanes are worth roughly $2 million apiece. So that is about $1.2 billion I would think in terms of aircraft losses per year at the present rate."

McNamara's report on aircraft losses is included in a censored transcript of his testimony on the big annual defense bill.

Senator Milton R. Young (Rep., N.D.), noting recent heavy aircraft losses in Vietnam, asked McNamara:

"Are we keeping abreast of these losses in new production?"

McNamara replied that estimates on aircraft losses for the fiscal year 1966, which ended June 30, ran below estimates.

He said that loss estimates on attack aircraft, including combat and noncombat, had been projected at 448 but actually were 406, or 42 less.

"We lost 271 helicopters," he continued. "We planned to lose 352, so the losses were 81 fewer than projected."

Increased Losses Result From Rise in Attacks

Increased raids during the current fiscal year over North and South Vietnam could result in larger losses, the secretary said, adding that "we are buying airplanes on a schedule that will more than offset that loss rate."

The week of August 7 tended to bear out McNamara's prediction of heavier losses when 15 attack planes were shot down, the largest one-week toll of the war. This brought the announced total of warplane losses in the North to 336.

"With all the sorties we have over North Vietnam, what do we find to destroy up there?" Young asked. "They don't have much industry up there, do they?"

"No, the industry is very small," McNamara replied. "About 15 per cent of their economy might be thought of as industrial. The other 85 per cent is agricultural * * *. They have one rather small steel plant and they have a cement plant of fairly good size. They have a few other industrial plants. But it is a very, very small industrial economy.

"Our attacks in North Vietnam are directed principally against the lines of communication, over which they are moving men and equipment into South Vietnam * * *."

McDonnell Wins F4 Contract For $439 Million

St. Louis Firm to Build Five Different Models of Plane For Navy, Air Force Use

Grumman Gets a Navy Award

By a WALL STREET JOURNAL *Staff Reporter*

WASHINGTON—McDonnell Aircraft Corp. received a $439 million contract for five different models of the F4 plane for the Navy and Air Force.

The St. Louis concern had previously received $424 million in F4 contracts.

The F4, known as the Phantom, is a two-seat tactical-strike plane and all-weather interceptor. Powered by two General Electric Co. tourbojets, it has a top speed of 1,500 miles an hour. A reconnaissance version also is built. Used extensively in the Vietnam war, the plane is equipped with Sparrow radar homing missiles and Sidewinder infrared homing missiles for interception of enemy aircraft. The F4 can also carry 13,000 pounds of bombs externally.

Other defense contracts:

Grumman Aircraft Engineering Corp., Bethpage, N.Y., a $12.4 million award from the Navy for research and development work on EA6B aircraft.

McDONNELL AIRCRAFT CORPORATION NOW HAS TWO CONTRACTS FOR A TOTAL OF MORE THAN 850 MILLION DOLLARS TO PRODUCE THE PHANTOM F-4, ALSO OTHER COMPANIES WHICH ARE PRODUCING APOLLO, MINUTEMAN, F-111, PROPOSED 2,000 MILE PER HOUR SUPERSONIC PLANE, A-7, C-5 CARGO, ENGINES BY PRATT-WHITNEY AND GENERAL ELECTRIC AND DIFFERENT TYPES OF HELICOPTERS COMBINED, CONSUME LARGE TONNAGE OF TITANIUM METAL AND 95% OF THE ORE (RUTILE) MUST BE IMPORTED FROM AUSTRALIA. OUR NATION MUST PROTECT ITSELF AGAINST ANY POSSIBILITY OF THIS PRECIOUS AND ESSENTIAL ORE BEING CUT OFF BY SUBMARINE WARFARE BY GENERATING AN AGRESSIVE AND INTENSE EXPLORATION PROGRAM BY THE U. S. GEOLOGICAL SURVEY AND THE U. S. BUREAU OF MINES TO PINPOINT, CORE DRILL AND BLOCK OUT MANY OF THE PRECIOUS ORES SO ESSENTIAL IN THE DEVELOPMENT OF OUR CURRENT MILITARY PREPAREDNESS PROGRAM AS WELL AS THE FUTURE. THE U. S. GEOLOGICAL SURVEY AND THE U. S. BUREAU OF MINES HAVE BEEN GREATLY HANDICAPPED BY THE LACK OF AMPLE APPROPRIATION BY CONGRESS TO DO THE CREDITABLE JOB THEY ARE CAPABLE OF DOING. THEY NEED MORE MANPOWER AND BETTER EQUIPMENT FOR METALLURGICAL RESEARCH IN ORDER TO KEEP PACE WITH OUR EXPANDING PEACETIME AND MILITARY ECONOMY. I TRUST YOU CAN FEEL JUSTIFIED IN CONTACTING THE PERSONALITIES SUGGESTED IN MY STATEMENT

WE HAVE BEEN VERY LIBERAL WITH OUR TAX DOLLARS IN ASSISTING OVER 100 NATIONS, HOWEVER MOST OF THEM HAVE FORGOTTEN WHAT RECIPROCITY MEANS WHEN WE ARE IN NEED OF MANPOWER AND MONEY FROM MANY OF THESE NATIONS. WE SHOULD DIVERT A SMALL FRACTION OF THIS ANNUAL AID TO CREATE A SAFETY VALVE FOR OUR NATION IN FINDING ANY AND ALL STRATEGIC MINERALS SORELY NEEDED DURING PEACE OR WAR. THIS PROPOSAL IS A MUST AND ESSENTIAL.

C H Scott

ECONOMIC AND MILITARY AID [illegible]ING THE PAST 21 YEARS FOR A TOTAL OF 21 BI[illegible]IONS OF DOLLARS WAS PROPOSED BY PRESIDENTS TRUMAN, EISENHOWER, KENNEDY AND JOHNSON AND PASSED BY CONGRESS. NO CRITICISM, HOWEVER, A VERY GENEROUS NATION FOR PEOPLE THROUGHOUT THE WORLD.

WHERE U.S. AID BILLIONS HAVE GONE

Economic and military aid, mid-1945 to mid-1966, **millions of dollars**

EUROPE	$47,350
France	$9,410
Britain	9,085
Italy	6,150
West Germany	4,995
Yugoslavia	2,830
Netherlands	2,500
Belgium	2,000
Spain	1,970
Norway	1,290
Austria	1,198†
Denmark	950
Poland	550
Portugal	530
Czechoslovakia	193
Soviet Union	186
Ireland	147
Finland	135
West Berlin	132
Sweden	109
Iceland	78
Hungary	32
Albania	20
East Germany	1
Regional aid, not allocated by country	$2,859

FAR EAST	[illegible]
Korea	$6,650
China (Formosa)	4,900
Japan	4,030
Vietnam	2,650†
Philippines	1,940
Indo-China*	1,535
Indonesia	870
Thailand	475†
Laos	460†
Cambodia	340
Ryukyu Islands	340
Burma	115
Hong Kong	42
Malaysia	40
Regional aid, not allocated by country	$3,213

NEAR EAST AND SOUTH ASIA	[illegible]
India	$6,400†
Turkey	5,050
Greece	3,800
Pakistan	3,200†
Iran	1,650
United Arab Republic	1,230
Israel	1,150
Jordan	550
Afghanistan	340
Saudi Arabia	145
Iraq	105
Nepal	100†
Ceylon	95
Lebanon	90
Syria	83
Yemen	45
Cyprus	20
Regional aid, not allocated by country	$1,247

[illegible]	[illegible]
Brazil	$3,075
Chile	1,260
Mexico	1,200
Colombia	765
Argentina	725
Peru	675
Bolivia	440
Venezuela	440
Dominican Republic	300
Ecuador	280
Guatemala	220
Panama	180
Costa Rica	150
Nicaragua	130
El Salvador	120
Uruguay	120
Haiti	105
Paraguay	100
Honduras	80
Cuba	52
Trinidad and Tobago	47
Jamaica	45
Canada	36
Guyana	20
Surinam	6
British Honduras	4
Regional aid, not allocated by country	$1,111

AFRICA	$3,600
Morocco	$550
Tunisia	520
Congo (former Belgian)	350
Ethiopia	$270
Liberia	270
Libya	225
Nigeria	195
Algeria	180
Ghana	170
South Africa	154
Sudan	95
Guinea	90
Somali Republic	55
Tanzania	50
Kenya	45
Sierra Leone	33
Zambia	31
Cameroon	30
Ivory Coast	30
Senegal	23
Uganda	20
Mali	18
Malagasy Republic	15
Malawi	11
Niger	11
Togo	11
Dahomey	10
Burundi	8
Gabon	7
Rhodesia	7
Chad	6
Upper Volta	6
Central African Republic	4
Congo (former French)	3
Mauritania	3
Rwanda	2
Regional aid, not allocated by country	$92

[illegible]	[illegible]
Australia	$150
New Zealand	22
Regional aid, not allocated by country	$128

Aid not allocated by regions	$6,164

GRAND TOTAL U.S. FOREIGN AID	$122,000

†Excluding military aid.

*Aid to Indo-China area before it was split into North and South Vietnam, Cambodia and Laos.

Source: Agency for International Development

335 PLANES SHOT FROM THE AIR TO DATE OVER NORTH AND SOUTH VIETNAM --- MR. MCNAMARA INDICATES A 580-PLANE LOSS THIS YEAR AT A COST OF APPROXIMATELY $1,200,000,000. 24 MONTHS AGO, NO ONE, NOT EVEN IN GOVERNMENT, COULD ANTICIPATE THIS STAGGERING LOSS IN PLANES AND PILOTS, BUT IT HAS OCCURRED.

The escalation of our present ugly and unpredictable war in South and North Vietnam to the same degree during the next 24 months as we have seen its growth of harshness, destruction and death during the past 24 months, could involve us in submarine warfare with North Vietnam, China, Albanis and even with Russia or any other ally during the next 2 to 4 years -- not likely, but possible.

Our Secretary of Defense, Mr. Robert McNamara, recently made a statement before the Foreign Relations Committee that neither he nor anyone else in Government, and especially speaking of the Pentagon, could anticipate the tremendous impact that the B-52 would have on our current bombing of different strategic and important installations in North and South Vietnam, nor were they able to evaluate the favorable participation of our helicopters in supplying combat troops and delivering military supplies to most unexpected areas and also to rescue and fly our wounded to safety. No one in or out of business can anticipate what can happen today or in the future pertaining to the escalation of the war.

Titanium (rutile) is consumed in large quantities by manufacturers of air and space craft that are producing the Gemini Series, Phantom F-4 and F-4C, the Apollo, the Minuteman, the projected C5-A, the F-111, the proposed 2,000 mph supersonic plane, and the anticipated A-7, which is about 1 1/2 years from production, different makes of helicopters, and engines produced by Pratt-Whitney Corp., subsidiary of United Aircraft Co., General Electric, and Allison, a subsidiary of General Motors. Under no circumstances can the current production of these strategic and must airplanes and spacecraft, which consume a large tonnage of Titanium (rutile), be cut off because of inability to import the raw ore (rutile) from Australia.

95% of world production of Titanium (rutile) is produced in Australia and if this supply should be cut off by enemy submarine warfare, our country would be placed in the same position as we were during the Second War when Germany's ruthless and slashing submarine attacks sank hundreds of boats conveying raw strategic materials, and especially the heavy toll the submarines took in sinking 350 boats of Alcoa that were importing bauxite from Dutch and English possessions. Please bear in mind that Australia produced 215,000 tons, approximately, of rutile in 1965 versus our 6,000 tons.

The loss of this bauxite, which was being partly consumed in producing airplanes from aluminum, forced the Government to build a pilot plant at Bauxite, Arkansas in order to upgrade low grade bauxite and to find new deposits to make up for the loss sustained in the sinking of the ships conveying bauxite to our country. We should find new deposits of Rutile immediately, wherever the U. S. Geological Survey knows of likely deposits.

During March, 1964, Mr. Amkeny, Director, U. S. Bureau of Mines, stated: "The only large potential sources of Rutile in the United States, except those in Florida and Virginia, is the deposit at Magnet Cove, Arkansas." Virginia and Florida produced 11,500 tons of Rutile in 1963, 8,001 tons in 1964, 6,000 tons in 1965, and will not exceed 5,000 tons in 1966. Australia will produce approximately 235,000 tons this year versus our 5,000. This current record in the production of Rutile in Florida and Virginia indicates that future production will be very limited unless new deposits are found. It is necessary to locate any large, unexplored deposits of Rutile which will enable us to meet any emergency because of unexpected submarine warfare. These facts can be substantiated by Mr. John Stamper, Chief of Titanium, U.S. Bureau of Mines.

There is no present urgency nor is there any anxiety on the part of Government or corporations now consuming Rutile in the production of Titanium metal, Titanium pigment or welding rod coating. However, this most favorable and easy supply of Rutile can become dangerously tight and actually short before 1970 and, of course, if we become involved in devastating submarine warfare, it would place our nation in a very precarious position because of having insufficient reserve of Rutile in this country. This must not happen.

Ilmenite (titanium) is in abundance; approximately 2,500,000 tons were produced in 1965 in several countries; 1,000,000 tons were produced in the United States. Ilmenite contains 45- to -50% iron and is currently priced at $23 to $26 per ton. It is principally used in the production of titanium pigment by the sulphate process.

Rutile is a purer form of Titanium. 95% of world production of Rutile is in Australia. Approximately 215,000 tons of Rutile was produced in Australia in 1965 versus our 6,000 tons. Rutile is quoted at $104 to $125 per ton. Rutile was principally used to make titanium metal and was consumed in the welding rod coating industry until 1962, when DuPont, American Potash & Chemical, American Cynamide, Cabot (1/3 Ruberoid), and Pittsburgh Plate Glass Co. started to consume large tonnage of Rutile in making titanium pigment by the chloride process. It has been stated that National Lead Co. will begin to consume Rutile in producing titanium pigment by the chloride process.

Different groups using Rutile for Titanium pigment, Titanium metal and welding rod coating estimate that it will take approximately 450,000 tons of Rutile annually by 1970. Pittsburgh Plate Glass Co., which owns 80%, and an English company owning 20%, will help to meet this tremendous tonnage in the production of Rutile from a deposit located in Sierra Leone. The company hopes to produce 100,000 tons of Rutile in 1967 and 200,000 tons in 1968, and thereafter. Australia hopes to level off its production of Rutile to 300,000 tons annually, beginning in 1970.

Approximately 23,000 tons of Titanium ore (Rutile) was consumed last year in our military preparedness program and an anticipated 39,000 tons needed per year by 1970. However, if our war is escalated to the extent of filling the skies over Vietnam with these airplanes, such the Phantom F-4 which consumes large quantities of titanium metal (Rutile), a total of approximately 1,800,000 pounds will be consumed by McDonnell Aircraft Co. alone in 1967. Other new uses in our military hardware can swell this consumption to 50,000 tons of Titanium ore by 1970 and our peacetime economy in the production of titanium pigment by the chloride process will consume 450,000 tons, more or less, by 1970.

Titanium metal will become cheaper as the companies are able to refine the Kroll process; in fact, the trade is hopeful that a new process will be developed whereby Titanium metal could be produced at a lower cost, making it more competitive with steel and aluminum, which would increase its consumption by thousands of tons annually. Titanium metal is now accepted by many companies regardless of the price tag because the metal is one-half as heavy as steel alloys, extremely strong and resistent to heat and fatigue.

It is possible and most likely that by 1970 there will be a shortage of 20,000 to 40,000 tons of Rutile in meeting the military and peacetime economy demand. A real crisis could develop and our country could be placed in a very dangerous position if the supply of our Rutile from Australia and Sierra Leone (which will begin production of Rutile in 1967) should be sunk by a sudden and explosive submarine attack by any enemy during the next 2 to 4 years. This will not likely happen; however, no one in or out of Government can anticipate what actually will occur by a sudden escalation of the war.

We suggest that you encourage Mr. McNamara, Secretary of Defense, who is very conscious-minded about our current and anticipated losses of aircraft in Vietnam and is alert to the necessity of having an ample supply of any and all strategic minerals consumed in our military preparedness program, to stress with Mr. Farris Bryant, Director of the Office of Emergency Planning, and with Mr. Joe Califano, Special Assistant to President Johnson, and who concentrates in working with the Office of Emergency Planning pertaining to stockpiles and requirements of all strategic minerals, the importance of approving any proposed drilling and blocking out program of Titanium (Rutile) wherever designated or pinpointed by the U.S. Geological Survey as soon as possible. We suggest also that you send a copy of the letter to Mr. McNamara to Mr. Farris Bryant, Mr. Joe Califano, Mr. Cordell Moore, Assistant Secretary, Department of Interior, and Director of Mineral Resources, and to Mr. Frank Johnson, Chief of Titanium, U. S. Geological Survey.

The economy of your Congressional District is tied up in the continuous production of airplanes and spacecraft. It is absolutely essential for these corporations to have strategic minerals available at all times.

Mr. Mittendorf

IN REPLY REFER TO:

G-MD-CNM

2486

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

APR 7 1955

Mr. C. H. Scott
C. H. Scott and Associates
514 Boyle Building
Little Rock, Arkansas

My dear Mr. Scott:

I was pleased to read, in your letter of March 29, that you expect to do large-scale diamond drilling in the Magnet Cove area.

We commonly follow the progress of privately-conducted exploration in districts we are studying and use information gained through the exploration as one basis of our interpretation of the local geology. As you no doubt realize, the amount of privately financed exploratory work that is being done vastly exceeds the amount we can observe in detail. The attention we can give to a specific operation is governed by the availability of personnel and funds at the time the work is to be done, as well as the kind and amount of information pertaining to our projects which we might obtain from the work.

A diamond drilling program, of the scope you describe in sections 17 and 18, might very well uncover data of geologic interest to us. I do not believe, however, that a geologist would be available full time to observe the progress of your drilling from start to finish, although it may be feasible for one of our men to study your drill core and take selected samples for chemical, mineralogical, or other study. Under the statutory limitations under which we work, we cannot designate sites for drilling or make analyses for the parties carrying out the exploration.

Sphene, like the other titanium minerals, may contain small amounts of columbium. The sphene in section 17 may be expected to contain a somewhat smaller proportion of columbium than the perofskite at the Mo-Ti prospect. A single specimen of the perofskite was analyzed and found to contain 0.56 percent columbium.

I have not investigated the possible metallurgical problems involved in extracting titanium or columbium from sphene, so I am referring your letter to the Bureau of Mines for reply to that question.

Sincerely yours,

Thomas B. Nolan

Assistant Director

General comments about C. H. Scott letter

Deep drilling in the Magnet Cove Titanium Co. property in Section 18 may turn up some geologic information that would be interesting to us. I don't see the incentive for Scott to do the work though as the main question is the value of the material that has already been pretty well blocked out and not the amount of such material present. Carbonatite occurs in this area; the drilling may give us information about that rock and the relations between it, the rutile mineralization, and the igneous country rock of the area. This igneous rock may be at least in part an agglomerate as C. S. Ross says he has found shards in it. Drilling might help in straightening out the nature and origin of this rock.

As is indicated on the map, much of Section 17 is underlain by jacupirangite, which contains perofskite and, in places, as much as 25% of sphene. The sphene contains about 0.22 % Nb, and the perofskite 0.56%. The sphene figure has not been published. Both in this area and farther south in the Cove rutile veins are most common near contacts. Drilling at such places would provide information about the nature and configuration of the contact; drilling in the inner parts of the jacupirangite body probably would yield little information of geologic interest.

It [illegible] keep track of the drilling that might be done in the Cove and to have any samples necessary for our studies analyzed. It might be hard, however, to keep away from consulting work, spotting holes and making assays for Mr. Scott.

(Holly Griffitts)

C. H. SCOTT AND ASSOCIATES
TELEPHONE FRANKLIN 4-8400
914 BOYLE BUILDING
LITTLE ROCK, ARKANSAS

March 29, 1955

U. S. G. S. RECEIVED MAR 31 CORRESPONDENCE & CONTRACTS

Mr. Thomas S. Nolan
Acting Director
United States Dept. of Interior
Geological Survey
Washington, D. C.

My dear Mr. Nolan:

First, I want to thank you for your most sympathetic attitude pertaining to our problems in the Magnet Cove area during the conference Monday of last week.

I was impressed and pleased with your statement to Dr. Felix Wormser that he knew of your feeling pertaining to more research on all strategic minerals, not only in developing processes to separate them, but to refine them and to upgrade them.

Personally, I think we have been spending pennies where we should have been spending dollars.

The Government would be justified in spending 25 million dollars a year in upgrading Manganese alone in Minnesota, South Dakota, Arkansas, Arizona and a few other soft spots. We should not be placed in a position of having to import 90% of our Manganese, which is so essential, in our steel industry.

A group of us in Little Rock and surrounding territory have joined together in a company to do a thorough job of core drilling in the Magnet Cove area.

1. To find how deep Rutile might be found on the Magnet Cove Titanium's property in Section 18.

2. To spend at least $100,000 to $150,000 in core drilling and sampling for Columbium, Titanium (Rutile) Thorium and Uranium in Section 17, as well as finding out the quantity of Sphene that has been found by the U. S. Geological Survey on property obtained by me in Section 17.

Is it feasible and is it the policy of the U. S. Geological Survey to have an observer while the core drilling is going on, with the privilege of looking at all of the samples and having them analyzed in the U. S. Geological Survey's laboratory? I thought because of the money and the work that have been spent and done on this area that you would like to keep close record of what we might find in our extensive core drilling program.

I understood from the discussion in our meeting of last week that Sphene contained approximately 40% of Titanium, and am just wondering if the U. S. Geological Survey thinks that the Titanium in this Sphene contains Columbium. Too, what do you think some of the metallurgical problems are to overcome before the Titanium could be separated from the Sphene.

Any courtesy that you can extend in meeting my request as soon as your busy, tight schedule will permit will be greatly appreciated.

Sincerely yours,

C. H. Scott

C. H. Scott

"Industry Prospe[illegible] Arkansas

Arkansas RESOURCES AND DEVELOPMENT COMMISSION

STATE CAPITOL LITTLE ROCK

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JAN 19 1954

January 18, 1954

Mr. C. O. Mittendorf
Defense Minerals Exploration Administration
Washington 25, D. C.

Dear Mr. Mittendorf:

Unfortunately we have lost the letter which you mailed us either the latter part of November or the first part of December and which dealt with our application Docket No. DMEA-2486 (columbium). We would appreciate it very much if you could furnish us with a copy of this letter to complete our files. We are enclosing a self-addressed stamped envelope in which to mail the copy if it is available.

Yours very truly,

Arthur M. Emmerling
Executive Director

by Norman F. Williams
Norman F. Williams

NFW:kh

FILE COPY
SURNAME:

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

DEC 4 - 1953

Mr. Arthur M. Emmerling, Director
Arkansas Resources and Development Commission
State Capitol
Little Rock, Arkansas

Re: Docket DMEA-2486 (Columbium)
Magnet Cove Property
Hot Spring County, Arkansas

Dear Mr. Emmerling:

Reference is made to your letter of November 19, 1953, in which you express concern over the period of time required to process your application. You also requested information regarding the status of the subject application, the metallurgical research work being done on the ore, and advice as to when you may expect some determination of the metallurgical research.

To begin, I must agree that the subject application has been held in an inactive status for an excessive period of time while we were awaiting definitive results of metallurgical research which has been, and is now being conducted by Government agencies and private concerns.

I also wish to point out that the determination of the metallurgical feasibility to recover columbium from the Magnet Cove and similar ores is not the responsibility of the Defense Minerals Exploration Administration, since separate funds have been allocated for that purpose by the Defense Materials Procurement Agency to the U.S. Bureau of Mines.

This agency is, of course, deeply interested in the results of current research work and frequently checks on the progress being made. It is our understanding that metallurgical investigations are still in the experimental stage and that no commercially feasible process has been developed; also, that it cannot be predicted at what future date successful results might be attained.

In view of the excessive period of time that this application has been held in an inactive status, and in light of your expressed desire that the application be approved or rejected, we deem it advisable for purposes of good administration to deny your application as submitted. In this connection a substantial part of the proposed drilling included in your application would normally be denied as it is considered to be essentially development work and could not be approved as exploration in any event.

If and when future metallurgical research indicates an economically feasible process has been developed, you may then submit a new application, in which case you should furnish any additional data that you have.

I wish to thank you for your interest in the Defense Minerals Exploration program and for bringing your property to our attention.

Sincerely yours,

C. O. Mittendorf (fw)

Administrator

FLKnouse/CCMittendorf/fw/esf
12-4-53
cc to: Adm. Reading File
Docket
Messrs. R.F.Griffith, Rm. 3641-A
D.M.Larrabee, Rm. G-232, GSA
Ellis
Knouse
DMEA Field Team, Region VI (2)

12-4-53

DMEA DOCKET

Larrabee*
Wather*
Gottley*

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

DEC - 1 1953

11/24 - Forbes
Dmea - 2486

Dear Mr. Flemming:

This is with further reference to your letter dated November 5 and to my acknowledgment of November 6 which advised you that I would investigate the results of recent metallurgical research on titanium- and columbium-bearing ores located in Hot Springs County, Arkansas, and also give you my reactions on the propriety of approving Government funds for additional exploratory work on the Magnet Cove property controlled by Mr. C. H. Scott, of Denver, Colorado.

As you are aware, the DMEA considered Mr. Scott's initial request for an exploration contract early in 1952 and reached the conclusion that no further exploration work was warranted until technologic investigation demonstrated that the economic recovery of titanium and columbium from the known deposit was feasible. From information then available there was no known satisfactory metallurgical process to beneficiate the type of ore already known to exist in substantial quantities. Subsequent to that decision, made on July 23, 1952, Mr. Scott has endeavored several times to persuade the DMEA to reverse its position, and a complete review of the case has been made by specialists of the U.S. Bureau of Mines, the U.S. Geological Survey, and the Defense Materials Procurement Agency. This comprehensive review supported the practical conclusion of DMEA.

Mr. Scott now advises that additional metallurgical information made available by research done subsequent to July 23, 1952, warrants a new look at his request for exploration assistance.

The facts available to me will not support Mr. Scott's conclusions that the difficult metallurgical problem has been solved. The Bureau of Mines, by memorandum agreement with DMPA, has been, and is now, conducting metallurgical investigations aimed toward the economic recovery of columbium from these specific deposits. Although some encouraging laboratory results have been obtained, the studies are still in the experimental stage and no commercially feasible process has been developed. Continued research will be carried out during the current fiscal year at the Bureau of Mines Experimental Station at Rolla, Missouri; however, it is inadvisable to predict at what future date successful results might be attained.

*Surnamed yellow file copy.

For your information, an independent investigation of this entire matter was recently conducted by the Department of Defense, who analyzed all available pertinent data relative to previous drilling records, metallurgical development, and various geological reports prepared by the U.S.G.S. and the Arkansas State Division of Geology. It is my understanding that the Department of Defense has concluded that the extension of known ore reserves would not be practical at this time.

In addition to the experimental work being conducted by the Bureau of Mines at Rolla, Missouri, other research work is going forward at the instigation of two large private firms. The General Electric Company is conducting similar studies on the Arkansas bauxite black sands, and the National Lead Company is interested in identical research on material from the Magnet Cove deposits. No successful method has been reported by either firm.

In the light of the foregoing, I do not feel that the expenditure of Government funds to further explore Mr. Scott's properties is justified at this time.

Sincerely yours,

(sgd) F. E. Wormser

Assistant Secretary

Hon. Arthur S. Flemming
Director
Office of Defense Mobilization
Washington 25, D. C.

COMittendorf/fw/esf - 11-24-53
cc: Secretary's Reading File
Asst. Secretary's File (2) for Mineral Resources
Admr's Reading File, DMEA
Mails & Files, DMEA
Field Team, Reg. VI (2)
Rare & Misc. Metals Div., DMEA
Mr. Mittendorf
Mr. Imhoff
Mr. Cservenyak, Rm. 3511
Mr. Larrabee, Rm. G-232, GSA

"Industry Prosper[illegible] Arkansas

Arkansas RESOURCES AND DEVELOPMENT COMMISSION

STATE CAPITOL LITTLE ROCK

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
NOV 23 1953

November 19, 1953

Docket DMEA-2486

Mr. C. O. Mittendorf
Acting Administrator
U. S. Department of Interior
Defense Minerals Exploration Administration
Washington 25, D.C.

Dear Mr. Mittendorf:

It has been about two years ago that representatives from both our agencies conferred on the columbium mineralization in the Magnet Cove-Potash Sulphur Springs region of Central Arkansas.

As a result of that meeting we made application to participate in a program to explore the properties further. A letter from your office on July 10, 1952 suggested that no decision would be made on the application until results of metalurgical research on the mineral deposit has been obtained. Therefore, our application is still in a status quo position and seemingly no effort is being made or at least very little, to resolve the metalurgical research on the samples which have been obtained from the area.

This is very distressing to me since we are unable to proceed further on the determination of the extent of the columbium in the Magnet Cove area or in other areas since you are not taking any action in either approving or rejecting the application for additional exploratory work. Please advise me the status of the subject application and also of the metalurgy research, And further, please indicate when I may expect some determination of the metalurgy research.

Very truly yours,

Arthur M. Emmerling

Arthur M. Emmerling
Director

AME/vm

In view of the excessive period of time that this application has been held in an inactive state

& ~~for the reason that the~~

& in light of your expressed desire that the application either be ~~the~~ approved or rejected, we deem it advisable for administrative purposes to deny your application as submitted.

If or when the ~~not~~ research indicates etc — you may then submit a new app.

Suppr make reference that present app. involved much drafting that

was essentially development & could not be approved in any event as expla —

Matter discussed previously

DRAFT

11/13/53

Dear Mr. Flemming:

This is with further reference to your letter dated November 5 and to my acknowledgment of November 6 which advised you that I would investigate the results of recent metallurgical research on titanium- and columbium-bearing ores located in Hot Springs County, Arkansas, and also give you my reactions on the propriety of approving Government funds for additional exploratory work on the Magnet Cove property controlled by Mr. C. H. Scott, of Denver, Colorado.

As you are aware, the DMEA considered Mr. Scott's initial request very thoroughly early in 1952 and reached the conclusion that no further exploration work was warranted until technologic investigation demonstrated that the economic recovery of titanium and columbium from the deposit was feasible. Subsequent to that decision, made on July 23, 1952, Mr. Scott has endeavored to reverse the DMEA position several times, and on each occasion a complete review of the case was made at the Secretary's level, in collaboration with specialists of the U.S. Bureau of Mines, the U.S. Geological Survey, and the Defense Materials Procurement Agency. In each instance the original decision was sustained. The question to resolve at this time is whether or not the results of metallurgical research are sufficiently encouraging to warrant further exploration, as Mr. Scott believes to be the case.

The facts available to me will not support Mr. Scott's allegations. The Bureau of Mines, by memorandum agreement with DMPA, has been, and is now, conducting metallurgical investigations aimed

toward the economic recovery of columbium from these specific deposits. Although some encouraging laboratory results have been obtained, the studies are still in the experimental stage and no commercially feasible process has been developed. Continued research will be carried out during the current fiscal year at the Bureau of Mines Experimental Station at Rolla, Missouri; however, it is inadvisable to predict at what future date successful results might be attained. An independent investigation of this entire matter was recently conducted by the Department of Defense, who analyzed all available pertinent data relative to previous drilling records, metallurgical development, and various geological reports prepared by the U.S.G.S. and the Arkansas State Division of Geology. It is my understanding that the Department of Defense has concluded that the extension of known ore reserves would not be practical at this time.

In addition to the experimental work being conducted by the Bureau of Mines at Rolla, Missouri, other research work is going forward at the instigation of two large private firms. The General Electric Company is conducting similar studies on the Arkansas bauxite black sands, and the National Lead Company is interested in identical research on material from the Magnet Cove deposits. No successful method has been reported by either firm.

In the light of the foregoing, I do not feel that the expenditure of Government funds to further explore Mr. Scott's properties is justified at this time.

Sincerely yours,

Assistant Secretary

DRAFT
FLKnouse/gla
11/12/53

Dear Mr. Flemming:

The questions raised in your letter of November 5 concerning further Government assistance to explore the Magnet Cove property of Mr. C. H. Scott in Hot Springs County, Arkansas, for titanium and columbium ~~was~~ were reviewed by the Defense Minerals Exploration Administration and the commodity ~~engineer~~ specialist of the U. S. Bureau of Mines.

During the period The U. S. Bureau of Mines core-drilled this deposit and blocked out a substantial tonnage reserve of rather low content titanium minerals which contain a ~~small~~ minor percentage of columbium. The Defense Minerals Exploration Administration concluded with the U. S. Bureau of Mines and the Defense Materials Procurement Agency that no additional exploration of this deposit was justified until a feasible processing method was developed to recover the titanium minerals and separate and recover the columbium therefrom. ~~from the titanium minerals.~~ The U. S. Bureau of Mines and the General Electric Company are currently working on this problem, and the National Lead Company is interested in a similar investigation, but to date no feasible method of recovery has been reported.

An investigation was recently conducted by the Defense Department in cooperation with the U. S. Bureau of Mines and they (both?) concluded that an extension of the reserves in this deposit was not practical at the present time.

In the light of these findings, we do not feel that additional Government aid to further explore this deposit is justified at this time. However, the application is being held by the Defense Minerals

FLK

SPECIAL

Exploration Administration in an inactive status pending future metallurgical developments.

Sincerely yours,

Felix E. Wormser
Assistant Secretary for
Mineral Resources

Hon. Arthur S. Flemming
Director
Office of Defense Mobilization
Washington 25, D. C.

Mr Liebert

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

November 6, 1953

Dear Mr. Flemming:

I will be delighted to look into the matter of further government assistance in exploring for titanium and columbium in Hot Springs County, Arkansas, referred to in your letter of November 5.

I expect to write you shortly the results of my efforts.

Sincerely yours,

(sgd) F. E. Wormser

Felix E. Wormser
Assistant Secretary for
Mineral Resources

Hon. Arthur S. Flemming
Director
Office of Defense Mobilization
Washington 25, D. C.

FEW:owb
cc: Sec. Files
Sec. Reading File
FEW's Reading File
Mr. Liebert, with incoming for appropriate attention & preparation of reply

Ellis

Will you find out what metallurgical development has transpired since we denied this copy

OFFICE OF THE
ASSISTANT SECRETARY OF THE INTERIOR
WASHINGTON

11-6-53

Mr. Liebert:

Please handle.

F. E. W.

11/6/53

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF DEFENSE MOBILIZATION
WASHINGTON 25, D. C.

OFFICE OF THE DIRECTOR

NOV 5 1953

Honorable Felix Wormser
Assistant Secretary of the Interior
Washington 25, D. C.

Dear Mr. Wormser:

Mr. C. H. Scott of Denver, Colorado, has written and visited me in connection with his efforts to secure further government assistance in exploring for titanium and columbium on his properties in Hot Springs County, Arkansas. The Arkansas Resources and Development Commission also is interested in this matter and applied to Defense Minerals Exploration Administration for assistance.

I understand that the Defense Minerals Exploration Administration has determined that the property does contain large amounts of columbium, titanium, and vanadium. The problem, however, is that a satisfactory method (now being sought) of separating these minerals must be developed. The Defense Minerals Exploration Administration has taken the position that no additional funds should be expended on exploration of the size of the ore body until the metallurgical research work is further along.

Mr. Scott feels that the metallurgical research is now far enough along to warrant additional exploration to mark out more definite limits of the ore body. He also has informed us that if the additional exploration proves the existence of a large enough body of titanium, several large firms interested in titanium will carry on further metallurgical research on a separation process at their expense.

Mr. Scott and Senator McClellan have recently talked with us about this matter. I told them that I would ask you personally to look into this matter and give me the benefit of your reactions. If you can do this, I would certainly appreciate it.

Sincerely yours,

Arthur S. Flemming
Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON 25, D. C.

November 10, 1953

Memorandum

To: Ernest W. Ellis, Chief, Rare and Miscellaneous Metals Division, DMEA

From: R. F. Griffith, Commodity-Industry Analyst, Rare and Precious Metals Branch

Subject: Magnet Cove, Arkansas, Titanium Minerals Deposit

The Bureau of Mines, under memorandum agreement with DMPA, is conducting an investigation aimed toward the economic recovery of columbium from the bauxite deposits of Arkansas and from the titanium-mineral deposits of the Magnet Cove area.

Although encouraging results have been obtained, it should be pointed out that these studies are still in the experimental stage and that a commercially feasible process has not to date been developed. Furthermore, it would be inadvisable at this time to predict at what future date a successful conclusion might be attained.

In view of the large quantities of columbium-bearing black sands being produced as a waste product of the bauxite mining industry and the known reserves of titanium-minerals in the Magnet Cove area, which were indicated by previous Bureau of Mines drilling, it does not appear to be necessary to increase reserves until a successful metallurgical extraction process is assured.

An investigation was conducted recently of this entire matter by the Defense Department, at which time the situation was discussed with the Bureau of Mines. Pertinent data relative to Bureau drilling reports, metallurgical developments, and reports by the Geological Survey and the Arkansas State Division

of Geology, were furnished the Defense Department by the Bureau for analysis. It is reported that the conclusions reached by the Defense Department were that the extension of reserves would not be practical at this time. The verification of these conclusions has been promised at an early date.

The General Electric Company is conducting similar studies for the recovery of columbium from the Arkansas bauxite black sands. Recent correspondence indicates that a solution has not been reached. The National Lead Company is interested in a similar problem regarding the Magnet Cove deposits; again, no successful method has been reported.

Enclosed for your information is the July-September quarterly report to DMPA, which report describes the progress accomplished to date by the Bureau of Mines.

R. F. Griffith

R. F. Griffith

Attachment

QUARTERLY PROGRESS REPORT

TO

DEFENSE MATERIALS PROCUREMENT AGENCY

INVESTIGATION OF DOMESTIC SOURCES AND METALLURGICAL DEVELOPMENT OF COLUMBIUM AND TANTALUM

JULY - SEPTEMBER 1953

A. DEVELOPMENT OF COLUMBIUM RESOURCES IN ARKANSAS, REGION VI

The known columbium resources of Arkansas consist primarily of the titanium minerals of the Bauxite and Magnet Cove areas in which the columbium occurs in solid solution with, or as replacement of, titanium. Pilot plant and laboratory investigations are being conducted to establish the maximum recovery data for the columbium-titanium minerals: Extractive metallurgical investigations are being made to separate the columbium from the titanium.

1. Sampling

A preliminary Mining Branch sample of columbium-titanium ore weighing 780 pounds was taken from the Hardy-Walsh deposit in Magnet Cove and shipped to Rolla for ore dressing tests. Sites were selected for mining a 500-ton sample of the ore for treatment to recover concentrates at the Bauxite Pilot Plant.

A mineral agreement to permit sampling of the Mo-Ti deposit was obtained; similar agreements for sampling on part of the Hardy-Walsh and on the Christy deposits, also in the Magnet Cove area, are still pending.

2. Laboratory Research

Rolla, Missouri Laboratory

Beneficiation: Mineral dressing phases of this problem consist of investigations to recover the maximum yield of columbium-titanium concentrates from various Arkansas mineral resources for metallurgical extractive research.

A sample being beneficiated is from the property of Magnet Cove Titanium Corp., Magnet, Ark. Gravity concentration and flotation of this material have yielded 53.7 percent recovery of the titanium at a grade of 73.4 percent TiO_2 and 1.1 percent Cb. Recovery of columbium was substantially the same as that of the titanium. .0242% Cb. recovery.

In the treatment of Magnet Cove ore, an additional 11.5 percent of the columbian-titanium mineral is contained in table middlings, flotation of which is in progress at this time. This experimentation is still in the preliminary stages and optimum conditions for recovery of the rutile are still being sought. However, flotation of a bulk carbonate-rutile product and subsequent depression of the rutile into the middlings appear by visual inspection to be promising. An alternate procedure is to depress the rutile into the tailings during the carbonate float, followed by subsequent reflotation of the rutile away from the gangue minerals. The latter method did produce a concentrate of 48.7 percent TiO_2 but recovered only 19.7 percent of the titanium in the feed.

Work on samples from the Hardy-Walsh property has included a float-sink analysis on a composite sample and preliminary flotation testing. Chemical analyses indicated that the 7 samples ranged from 4.1 to 7.1 percent in TiO_2 content, averaging about 5.3 percent. The columbium content of the ore sample had an average value of 0.045 percent.

Heavy liquid fractionation of sized portions of the Hardy-Walsh ore indicated that gravity concentration would effect only a limited concentration, as grinding to at least 48-mesh would be necessary to liberate titanium minerals from gangue. In addition slime losses would also be high as 62 percent of the minus 1-inch ore is finer than 200-mesh and this screen fraction contains 48 percent of the total titanium.

In preliminary flotation experiments on Hardy-Walsh ore, activation of the titanium minerals with lead salts and flotation with fatty acid are being investigated. The anatase in the ore showed a definite response to this treatment but the recovery to date has been low, 24.2 percent, and the cleaner circuits will require modification to exceed the 66.1 percent TiO_2 reported as an analysis of the concentrates.

Other investigations in current progress are directed toward improving the recovery of brookite from a drill hole composite from the Christy property. Previous work on this material reported in R.I. 4851 showed a 55.2 percent recovery of the titanium with a 21.7 percent loss in the slime fraction. It is

hoped that some satisfactory method of treatment can be evolved that will recover the slimed brookite.

Future plans are to continue the present investigations with particular emphasis on flotation research and on methods to recover the values from the slimes.

3. Pilot Plant Studies - Bauxite, Arkansas

Pilot plant beneficiation of black sands from the Reynolds Metals Co. was completed at the close of the previous fiscal year. The average analysis of the black sand feed in the three pilot plant tabling campaigns was 4.2 percent TiO_2, 0.08 percent Cb, and 28.9 percent Fe. From this material a recovery of 71.3 percent of the TiO_2 and 64.8 percent of the Cb was effected at a concentrate grade of 9.6 percent TiO_2, 0.17 percent Cb, and 41.3 percent Fe. Losses in the table tailings amounted to 23.6 percent of the TiO_2 and 29.4 percent of the Cb at a grade of 1.6 percent TiO_2, 0.04 percent Cb, and 23.8 percent Fe. In addition, 5.1 percent of the titanium and 5.8 percent of the columbium were lost in overflow slimes which analyzed 2.7 percent TiO_2, 0.06 percent Cb, and 18.6 percent Fe.

An investigation of pilot plant jigging and tabling on rutile ore from Magnet Cove Titanium Corp. was in progress during this reporting period. The pilot plant was operated a total of 40.35 hours while treating 35.972 dry tons of the columbium-titanium ore. The most satisfactory flowsheet during this period was as follows: The ore was crushed at the rate of 0.5 ton per hour by open circuit hammer mill to a maximum size of approximately minus 1-1/4-inch.

The crushed ore was blunged in a Wemco Attrition Unit which disintegrated the clay and soft feldspars to such a degree that the maximum grain size of the pulp leaving the unit was less than 3/8-inch. The pulp was screened on 10-mesh and the oversize fed to the jigs. The undersize was deslimed in a bowl classifier and the sands then went to tables. Table middlings formed a circulating load which was returned to the head of the table circuit without further treatment. A small amount of fine table sands was scavenged from the bowl overflow by dilution and treatment in a hydroseparator.

The results of this operation showed recoveries of 51.0 and 50.3 percent for columbium and titanium, respectively, in a combined jig and table concentrate analyzing 19.6 percent TiO_2, 0.33 percent Cb, and 22.5 percent iron. These recovery figures are a good confirmation of the laboratory data on this material presented elsewhere in this report. The concentrate grade is lower because a flotation step was not incorporated in the pilot plant circuit. However, the principal contaminant is pyrite which is readily separable by conventional xanthate flotation.

4. Extractive Metallurgy, Rolla, Missouri

Work was continued through this quarter on Method 3 which showed the most promise previously. This method consisted of sintering the black sands with coke, separating a metallic iron button, then grinding and chlorinating the remainder.

The series of sinters mentioned in the last report that varied in increments of 1 percent coke from 5 to 15 percent has been finished.

The lowest recovery of Cb was 74 percent and the concentration factors (the ratio of Cb percentage in the charge before and after furnacing) varied from 1.17 to 2.18 but none of these values bore any relation to the quantity of coke in the charge.

Since the above series was run in a 3 kv.-a. induction furnace where the temperature was very difficult to measure and control, the work was continued in a 100 kv.-a. Glebar furnace using larger charges (1500 g. compared to 250 g.). It was disclosed in the Globar furnace that 1400° C. was not hot enough to effect a reduction of the charge to suboxides, but at 1500° C. a reduction took place.

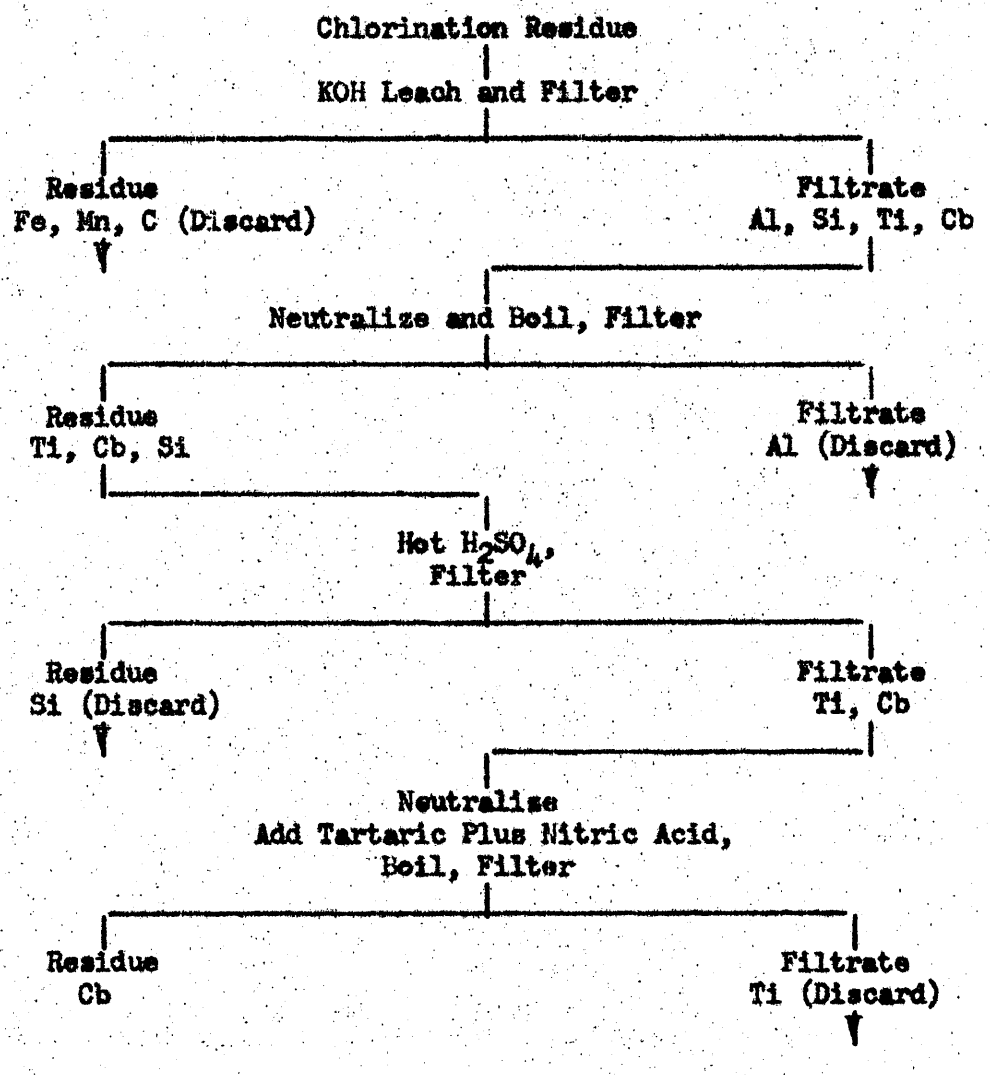
It was found by chlorinating these 1500° C. sinters that at least 11 percent coke is necessary to produce a fairly complete reduction of the black sands but coke in excess of 11 percent seemed to have very little added effect. The recoveries of $TiCl_4$ ran up to 70 percent but the chlorination was stopped in all cases before the reaction was finished due to the excessive time required per cc. of distillate toward the end of the run.

A series of charges was run in the 100 kv.-a. Globar furnace to evaluate the effect of particle size (-100 mesh vs. 65 mesh) but this has not yet been completed.

A considerable effort has been spent developing a suitable extraction scheme for removing columbium from the chlorination residue. The guiding principles used in determining the suitability of any scheme were as follows:

1. It should be simple, containing the minimum number of operations.
2. It should require only plentiful and cheap reagents.
3. It should not require highly specialized equipment.

The first scheme worked with was as follows:



Several methods were tried for the last step such as tannic acid separation and salicylic acid separation, but these did not seem to work as well as selective hydrolysis by the tartaric-nitric acids.

A very crude Cb_2O_5 has been prepared a number of times using the above system but in all cases the purity was not suitable and the recovery was low. Analysis of all the discarded portions disclosed that the ineffectiveness of the above system lies in the first step, viz., the limited solubility of columbium oxide in hot KOH solution and the limited solubility of potassium columbate in water. Accordingly a caustic fusion has been substituted for the caustic leach in the first step and the entire scheme simplified from four filtrations to two. The revised scheme is as follows:

Chlorination residue

KOH Fusion, Dissolve in H_2SO_4, Heat, Filter

Residue
Si, C (Discard)

Filtrate
Fe, Al, Ti, Cb, Mn

Neutralize
Add Tartaric Plus Nitric Acids, Boil, Filter

Residue
Cb

Filtrate
Fe, Al, Ti, Mn (Discard)

Results of the above scheme are not yet available.

It has been deemed advisable to construct a chlorinator of a different type and larger dimensions for this project. This should enable the sinters to be chlorinated in quantities of roughly ten times laboratory size and allow yields of columbium in sizes large enough to conveniently handle. The substitution of NaOH for KOH will also be studied in the caustic fusions.

UNITED STATES
DEPARTMENT OF THE INTERIOR
Office of the Secretary
Washington 25, D. C.

November 6, 1953

Dear Mr. Flemming:

I will be delighted to look into the matter of further government assistance in exploring for titanium and columbium in Hot Springs County, Arkansas, referred to in your letter of November 5.

I expect to write you shortly the results of my efforts.

Sincerely yours,

/s/ F. E. Wormser

Felix E. Wormser
Assistant Secretary for
Mineral Resources

Hon. Arthur S. Flemming
Director
Office of Defense Mobilization
Washington 25, D. C.

FEW:owb
cc: Sec. Files
Sec. Reading File
FEW's Reading File
Mr. Liebert, with incoming for appropriate attention & preparation of reply

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EXECUTIVE OFFICE OF THE PRESIDENT
Office of Defense Mobilization
Washington 25, D. C.

Office of the Director

Nov. 5, 1953.

Honorable Felix Wormser
Assistant Secretary of the Interior
Washington 25, D. C.

Dear Mr. Wormser:

Mr. C. H. Scott of Denver, Colorado, has written and visited me in connection with his efforts to secure further government assistance in exploring for titanium and columbium on his properties in Hot Springs County, Arkansas. The Arkansas Resources and Development Commission also is interested in this matter and applied to Defense Minerals Exploration Administration for assistance.

I understand that the Defense Minerals Exploration Administration has determined that the property does contain large amounts of columbium, titanium, and vanadium. The problem, however, is that a satisfactory method (now being sought) of separating these minerals must be developed. The Defense Minerals Exploration Administration has taken the position that no additional funds should be expended on exploration of the size of the ore body until the metallurgical research work is further along.

Mr. Scott feels that the metallurgical research is now far enough along to warrant additional exploration to mark out more definite limits of the ore body. He also has informed us that if the additional exploration proves the existence of a large enough body of titanium, several large firms interested in titanium will carry on further metallurgical research on a separation process at their expense.

Mr. Scott and Senator McClellan have recently talked with us about this matter. I told them that I would ask you personally to look into this matter and give me the benefit of your reactions. If you can do this, I would certainly appreciate it.

Sincerely yours,

/s/ Arthur S. Flemming
Director

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/On letterhead of Hotel Astor, NYC/

C
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P
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November 26, 1952

DMEA-2486

Hon. Oscar Chapman
Secretary of the Interior
Interior Building
Washington, D. C.

My dear Mr. Chapman:

First permit me to thank you for an engagement out of your very tight schedule. It gave me enough time to hit the high points pertaining to the application of the Magnet Cove Titanium Corporation application pending with the DMEA.

Letters from Mr. Norman Williams, State Geologist of Arkansas, of January 23rd and March of this year, indicates the interest that the State Department and the U.S. Geological Survey had in getting consent from our company to file an application with the DMEA for exploration work for the purpose of core drilling for columbium, titanium and vanadium.

Mr. Williams became interested in our property after he found columbium last year from samples of ore that he secured, hoping to find uranium. He contacted the U.S. Geological Survey and told them of his finding columbium and they became interested in our property in the Magnet Cove area.

There were five men from the U.S. Geological Survey on our property in September of 1951 and three additional men spent some time in February of this year. In fact, one of the men counselled with Mr. Norman Williams pertaining to the application and offered suggestions that would help to expedite the application with the DMEA. We thought it would be approved within sixty to ninety days.

Mr. Tom Lyons of the DMPA, told me - after the application had been held up by the DMEA, that he thought they were making a grave mistake because of the strategic value of columbium in the furtherance of our war effort. He stated that the exploration work should be done at once with the hope of finding a large enough tonnage of titanium, columbium and vanadium that would justify at least six large companies with the know-how and finances to develop a process that would separate the three strategic minerals.

He has changed his mind pertaining to that approach since making a contract with the National Lead Co. to do metallurgy work in developing a process that will separate the minerals.

Then, too, he stated to me on my last interview on October 9th, that the DMPA was allocating enough money to the U.S. Bureau of Mines to do metallurgy work but that he had confidence that the National Lead Co. would move faster than the Bureau, but up to date the U.S. Bureau of Mines at Rolla has not been notified of any definite amount for the work, and we were both told yesterday by Mr. Mittendorf that the application had not yet been executed with the National Lead Co.

It seems to me that if this exploration work can be done and that if they are successful in finding titanium at a depth of, say, 500 feet, that they will most likely find columbium at the same depth - as it has an affinity for titanium. The deepest hole core-drilled in 1948 by the Bureau of Mines is 188 feet. We like the idea of the suggestions made by Mr. Mittendorf yesterday that they would like to broaden a base and cover more acreage than outlined in our application, but at the same time we would like to see three or four additional holes core drilled within the area that was core-drilled by the Bureau of Mines in 1948.

In other words, if this additional exploration work could develop many additional tons of titanium and columbium, that several major companies would become interested in doing metallurgy work that would be helpful in the future on any deposits that they might acquire.

It is true that on October 10th in conference with Mr. Joel Wolfsohn, and Mr. Emhoff and Mr. Mittendorf, that I would go along on their decision that metallurgy work would be done first before the exploration, although I went against my own judgment.

I have changed my mind pertaining to the application because of the election. This is a matter of policy involved. There will be a change of Administration and I would have to start from the bottom up to bring the application where it is today.

Any courtesy that you can extend in getting this application approved will be greatly appreciated.

Sincerely yours,

s/ C. H. SCOTT

CHS:LS

10/21/52 gla

Min. & Fuels
Mittendorf
Rewritten by

DES 3093

OCT 17 1952

My dear Mr. Miller:

Reference to your interest in the application for exploration assistance on the property of [illegible] Scott, located at [illegible], Arizona (docket [illegible]-2,6), as evidenced by your telegram, I am enclosing a copy of my recent letter to Mr. Scott, which was prepared after a conference with him on October 7, 1952.

I am quite sure that the enclosure will adequately inform you as to the salient information which was reached in this case.

Sincerely yours,

(sgd) Joel D. Wolfsohn

Assistant Secretary of the Interior

Mr. Miller [illegible] Miller
Mayor of Kingman
Kingman, Arizona

Enclosure

cc to your Washington office

COMittendorf/fw - 10-15-52
Rewritten:
HEInhoff/fw - 10-16-52
cc: Secretary's Reading File
Asst. Secretary's File
Adm's Reading File, DMEA
Mails & Files, DMEA
Rare & Misc. Metals Div., DMEA
Mr. Mittendorf
Mr. Inhoff

Field Room Reg VI (2)

FILE COPY
Surname:

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

Min. & Fuels
Mittendorf
Rewritten by

PES 3093

OCT 17 1952

My dear Mr. Miller:

Due to your interest in the application for exploration contained on the property of C. H. Scott, located at Magnet Cove, Arkansas (docket DMEA-[illegible]), as evidenced by your telegram, I am enclosing a copy of my recent letter to Mr. Scott, which was prepared after a conference with him on October 7, 1952.

I am quite sure that the enclosure will adequately inform you as to the mutual understanding which was reached in this case.

Sincerely yours,

(sgd) Joel D. Wolfsohn

Assistant Secretary of the Interior

Hon. Wilbur D. Mills
Member of Congress
Searcy, Arkansas

Enclosure

cc: to your Washington Office

COMittendorf/fw - 10-15-52
Rewritten:
LMInhoff/pw - 10-16-52
cc: Secretary's Reading File
Asst. Secretary's File
Admr's Reading File, DMEA
Mails & Files, DMEA
Rare & Misc. Metals Div., DMEA
Mr. Mittendorf
Mr. Inhoff

TELEGRAM

C
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Y

SEARCY, ARK., AUG. 20, 1952

HON. OSCAR L. CHAPMAN
SECY OF THE INTERIOR
DEPT OF INTERIOR
WASH, D.C.

RE DOCKET DMEA 2486 COLUMBIUM MAGNET COVE MINE HOT SPRINGS COUNTY ARKANSAS, WORK NOW IN PROGRESS DETERMINING PROCESS FOR HANDLING SUCH ORE, SCOTT PRESIDENT HAS DISCUSSED WITH JOEL WOLFSOHN IN YOUR ABSENCE DESIRE THAT EXPLORATION WORK BE DONE SIMULTANEOUSLY. LARSON AM INFORMED HAS REQUESTED ALSO TWO THINGS BE DONE TOGETHER. C. E. MITTENDORF HOWEVER REFUSES TO PERMIT EXPLORATION WORK TO COMMENCE UNTIL PROCESSING WORK COMPLETED. IT SEEMS THIS IS UNDULY DELAYING THE POSSIBILITY OF ESTABLISHING DOMESTIC SOURCE OF COLUMBIUM SO HIGHLY CRITICAL AND NECESSARY TO OUR WAR EFFORT. WISH YOU WOULD TAKE OPPORTUNITY TO PERSONALLY CHECK THE SITUATION AND AM CONVINCED WHEN YOU LOOK AT IT YOU WILL RECOMMEND EXPLORATION WORK BEGIN IMMEDIATELY TO AVOID DELAY WHICH WILL RESULT IF EXPLORATION DEFERRED UNTIL PROCESSING FULLY DEVELOPED. PLEASE ADVISE.

WILBUR D. MILLS, MC

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

My dear Mr. Mills:

Due to your interest in the application for exploration assistance on the property of C. H. Scott, located at Magnet Cove, Arkansas (docket DMEA-2486), as evidenced by your telegram, I am enclosing a copy of my recent letter to Mr. Scott, which was prepared after our conference on October 7, 1952.

I am quite sure that the enclosure will adequately inform you as to the mutual understanding which was reached in this case.

Sincerely yours,

Secretary of the Interior

Hon. Wilbur D. Mills
Member of Congress
Searcy, Arkansas

Enclosure

cc to your Washington Office

DMEA
FILE COPY
Surname
Mittendorf

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

My dear Mr. Mills:

Due to your interest in the application for exploration assistance on the property of G. H. Scott, located at Magnet Cove, Arkansas (docket DMEA-2486), as evidenced by your telegram, I am enclosing a copy of my recent letter to Mr. Scott, which was prepared after our conference on October 7, 1952.

I am quite sure that the enclosure will adequately inform you as to the mutual understanding which was reached in this case.

Sincerely yours,

Secretary of the Interior

Hon. Wilbur D. Mills
Member of Congress
Searcy, Arkansas

INTERIOR DEPARTMENT
RECEIVED
OCT 15 1952
DIVISION OF
MINERALS AND FUELS

Enclosure

cc to your Washington Office

COMittendorf/fw
cc: Secretary's Reading File
Asst. Secretary's File
Admr's Reading File, DMEA
Mails & Files, DMEA
Rare & Misc. Metals Div., DMEA
Mr. Mittendorf

10-15-52

COPY FOR THE SECRETARY'S OFFICE

FILE COPY
Surname:
DMEA

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

N.S
R&R

OCT 10 1952

My dear Mr. Scott:

This is with reference to our meeting on October 7, 1952 during which we discussed the subject matter of your letter dated August 16, in the presence of Mr. L. E. Imhoff, Director of the Minerals and Fuels Division, and Mr. C. O. Mittendorf, Administrator of the Defense Minerals Exploration Administration. At that time I expressed my regret for not having replied to your courteous letter in advance of your visit. However, I assured you that your request for reconsideration of the action taken on the application of the Arkansas Resources and Development Commission (DMEA-2486) had undergone thorough study.

As stated during our meeting, I did cause a review of your case to be made jointly by representatives of the Department of Interior and the Defense Materials Procurement Agency. Also, their findings show that your property has been extensively explored by work already done by the Bureau of Mines and that a substantial reserve of material containing titanium, vanadium, and columbium minerals is known to exist. It was the opinion of the reviewers that further exploration work would likely add to the known reserves, but that until a satisfactory process for recovering the columbium and other associated minerals was determined, additional exploration at this time could not be justified. I advised you that, after a careful review of the related material, I concurred in these conclusions.

I understand from your remarks that you had also contacted Mr. Tom Lynn, of the Defense Materials Procurement Agency, since our joint agency conference and that you are now aware that no differences of opinion exist between DMEA and DMPA as to the propriety of the action taken on the subject application.

Arrangements are now being made under the authority granted by the Defense Production Act to investigate the metallurgical processes for recovering columbium and tantalum, as well as to make geological investigations of the occurrences of these metals. Should the results of these investigations show that the economic recovery of columbium from your property is feasible, then we shall be glad to give further consideration to a revised plan of exploration designed to add to the presently indicated ore reserve.

It was a pleasure for me to have had the opportunity to discuss your case on a personal basis, and I wish to express my appreciation of your courteous understanding of the position we have taken and your expressed willingness to defer further requests for reconsideration until the metallurgical problems can be solved.

Sincerely yours,

(sgd) Joel D. Wolfsohn

Assistant Secretary
of the Interior

Mr. C. H. Scott
Magnet Cove Titanium Corporation
308 Boyle Building
Little Rock, Arkansas

COMittendorf/fw
10-10-52

cc: Secy's Reading File
Asst. Sec'y Wolfsohn
Mr. Tom Lyon, DMPA
Mr. Jess Larson, DMPA
Admr's Reading File, DMEA
Mails & Files, DMEA
EWEllis, DMEA
FLKnouse, DMEA
COMittendorf, DMEA

C
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MAGNET COVE TITANIUM CORP.
308 Boyle Building
Little Rock, Arkandas

August 16, 1952

Mr. Joel Wolfsohn
Asst. Secretary of the Interior
Interior Building
Washington, D. C.

My dear Mr. Wolfsohn:

First, permit me to thank you for your thoughtful, sympathetic interview of this week pertaining to exploration work application before the DMEA.

This application of ours was thoroughly discussed Tuesday and Wednesday with Mr. Tom Lyons' office and with Hon. Jess Larson, and with Mr. C. E. Mittendorf.

Your spirit of cooperation is appreciated and I am sure you will have Mr. Lyons and Mittendorf in conference as soon as your busy, tight schedule will permit.

Certainly, I am selfish in pressing this application but not to the extent of doing it just because I want it done. As I have stated before, I gained the impression approximately two months ago while in Washington that Columbium was recognized by men who are responsible for stock-piling strategic minerals to be shorter than even Uranium is, and that every Governmental agency responsible should do everything possible to encourage the development and the mining of Columbium.

As I stated before, Mr. Tom Lyons and his associates of the DMPA feel that the exploration work should go hand in hand with the metallurgy that is being done by the Bureau of Mines of Rolla, Mo. The need is so urgent to have this most precious strategic mineral in the construction of jet bombers that justifies some risk in making this decision to approve our application at once.

Any courtesy that you can extend in meeting my request in discussing this very important pending application with these gentlemen will be greatly appreciated.

Sincerely yours,

s/ C. H. SCOTT

9/23/52 jem

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

Memorandum September 19, 1952

To: Mr. E. W. Ellis
Chief, Rare and Miscellaneous Metals Division

From: C. O. Mittendorf
Administrator

COM (DMEA-248)

Subject: Scott-Magnet Cove case

Transmitted herewith is the correspondence which has just been forwarded to me by Assistant Secretary Wolfsohn, which necessitates a reply to be prepared for his signature. There is also attached Scott's letter to me dated August 16. It will be readily apparent to you that Scott is playing DMPA against DMEA, and that the "squeeze" has been put on us.

Following is a brief summary of my recent discussions in this case, which might serve as useful background in preparing our reply:

1. About three weeks ago Jess Larson phoned me, late in the afternoon, for a summary of the case, which he wished before answering a telephone call from the Arkansas Senator. I explained in detail the reasons for the action we had taken, and he appeared to be fully in accord with it. I made it clear to Jess, however, that Tom Lyon felt that the exploration application should have been approved. I do not know, of course, what Larson told the Senator; however, during our conversation he led me to believe that he would stand on our position that the current problem was one of a metallurgical nature and that his agency was already moving forward to resolve that point.

2. In lieu of calling a meeting between Wolfsohn, DMPA, and DMEA (Scott alleges that Wolfsohn agreed), it was suggested to Mr. Wolfsohn that I contact Tom Lyon directly in order to reach a mutual agreement as to the practical disposition of the case. I pointed out to Tom that our information indicated the existence of about 9,000,000 tons of inferred ore, and that there were an additional 10,000,000 or 12,000,000 tons of indicated ore. Tom admitted that he was unaware of this situation and that he would not have told Scott that he personally recommended further exploration work had he been in possession of these facts at the time of his conversation with Scott. Tom then agreed that our action in denying the application was proper, and he indicated his willingness to surname our next letter, which would reaffirm our previous denial.

3. Yesterday, while over at DMPA on a Turkish matter, I saw Tom for a moment and he again brought up this case. From his remarks, I assume that he has been in touch with Scott since my meeting recorded above. Tom stated that he had informed Scott of his request to Rove, of the Survey, to make an immediate field examination of the area for the purpose of determining whether the existing drilling has been adequate and, if not, to recommend a definite drilling program. I gathered that Tom had told the applicant that he would exert his influence on DMEA to approve of additional drilling provided it was in line with the Survey recommendations. I again reviewed the ore position data that we had available and told him that all of us in DMEA, including the Operating Committee, unanimously supported a denial of the exploration application. I began to recognize the difficulty of obtaining Tom's surname on our next letter, in view of the most recent opinion he had expressed to the applicant. I told him that we were undertaking the preparation of a letter and that we would present it to him. I also promised to furnish him our files, so that he personally could review the available data. He agreed to that procedure.

4. I gathered that Tom's position would be relieved if we were permitted to tell the applicant in our letter something about the tonnage which has been developed by previous drilling. I told him that the tonnage and grade estimates were classified material and as such could not be revealed. Tom seemed to question this ruling and wondered why the information could not be made available to the owner of the property. I told him that we would explore the matter when drafting our reply.

5. Since we first denied this application, it is my understanding that the following developments have taken place:

a. A contract has been agreed to between DMPA and National Lead to advance $15,000 for metallurgical work on Magnet Cove ores. I heard, last week, that the contract had been finalized, but that National Lead had not actually received funds at that time.

b. DPA approved a project to give Survey $50,000 per year, for a period of five years, to undertake a specific project on columbium and other rare metals. A contract has been made between DMPA and USGS and, as is noted in "3" above, Lyon has requested Rove to send a field team to Magnet Cove.

c. A similar project has been approved by DPA, to advance the Bureau of Mines $75,000 per year to undertake metallurgical research work on various critical metals, including columbium. It is not known to me that an actual contract has been entered into between DMPA and USBM to implement this program, nor if a request will be made to give a high priority to Magnet Cove ores, as in the case of Survey.

Administrator

DMEA

My dear Mr. Scott:

Reference is made to your letter of August 16, 1952, concerning the application of the Arkansas Resources and Development Commission (DMEA-2206) for Government aid in exploring for columbium in your Magnet Cove property located in Hot Springs County, Arkansas.

A further review of your application and other available related data has been made by the Government agencies concerned. Their findings show that your property has been extensively explored and a substantial reserve of material containing titanium, vanadium, and columbium minerals is known to exist. Also, further exploration would likely add to these reserves but, until a satisfactory process of recovering the columbium and other associated minerals is determined, further exploration work should be deferred. After a careful review of the related material, I regret to advise that I concur with the findings.

Since Defense Minerals Exploration Administration denied your application, I understand that arrangements are now being made under the authority granted by the Defense Production Act to investigate metallurgical processes for columbium and tantalum, as well as to make geological investigations of the occurrence of these metals.

Under these circumstances, until the results of these investigations are made available, I feel further processing of the application of the Arkansas Resources and Development Commission should be held in abeyance.

Sincerely yours,

Assistant Secretary
of the Interior

Mr. C. H. Scott
Magnet Cove Titanium Corporation
300 Boyle Building
Little Rock, Arkansas

Klinehouse/Wallis/Mittendorf/jem/fw
10-6/52
cc: Secy's reading file
Asst. Sec'y Wolfsohn
Admr's reading File, DMEA
Mails & Files, DMEA
Mr. Tom Lyon, DMEA
Mr. Jess Larson, DMEA
Mr. L.W. Wallis, DMEA
Mr. F.L. Klinehouse, DMEA
Mr. C.J. Mittendorf, DMEA

I understand that arrangements are now being made under the authority granted by the Defense Production Act to investigate metallurgical processes for columbium and tantalum, as well as to make geological investigations of the occurrence of these metals.

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

Mr. C. H. Scott
Magnet Cove Titanium Corp.
308 Boyle Building
Little Rock, Arkansas

Dear Mr. Scott:

Reference is made to your letter of August 16, 1952, concerning the application of the Arkansas Resources and Development Commission (DMEA-2486) for Government aid in exploring for columbium in your Magnet Cove property located in Hot Springs County, Arkansas.

A further review of your application and other available related data, has been made by the Government Agencies concerned. Their findings show that your property has been extensively explored and a substantial reserve of material containing titanium, vanadium and columbium minerals is known to exist. Also, further exploration would likely add to these reserves but, until a satisfactory process of recovering the columbium, and other associated minerals, is determined, further exploration work should be deferred. After a careful review of the related material I regret to advise that I concur with the findings.

Since Defense Minerals Exploration Administration denied your application, I understand the ~~following developments have transpired:~~

1. A contract between Defense Materials Procurement Agency and the National Lead Company has been executed for research work to develop a process for recovering the rutile, brookite, and columbium from the Magnet Cove deposits.

2. A project has been approved by the Defense Production Administration for the allocation of funds for a period of five years to undertake a specific investigation for columbium and tantalum and the Defense Materials Procurement Agency has made a contract with the United States Geological Survey to do this work and have requested that a field team be sent to Magnet Cove.

3. An additional project has been approved by Defense Production Administration to advance to the Bureau of Mines a fund to undertake metallurgical research work on columbium and tantalum mineral deposits.

Under these circumstances, until the results of these investigations are made available, I feel further processing of the application of the Arkansas Resources and Development Commission should be held in abeyance.

Sincerely yours,

Assistant Secretary of the Interior

FILE COPY
Surname:
DMEA

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

Mr. C. W. Scott
Magnet Cove Titanium Corp.
308 Boyle Building
Little Rock, Arkansas

Re: Docket No. DMEA-2486 (Columbium)
Arkansas Resources and Development Commission
Magnet Cove Deposit
Hot Springs County, Arkansas

Dear Mr. Scott:

Reference is made to your letter of August 16, 1952, concerning the application of the Arkansas Resources and Development Commission (DMEA-2486) for Government aid in exploring for columbium in your Magnet Cove property located in Hot Springs County, Arkansas.

Further review of your application and other available related data, has been made by the Government agencies concerned. Their findings show that your property has been extensively explored and a substantial reserve of material containing titanium, vanadium and columbium minerals is known to exist. Also, further exploration would likely add to these reserves but, until a satisfactory process of recovering the columbium, and other associated minerals, is determined, further exploration work should be deferred. After a careful review of the related material I regret to advise that I concur with the findings.

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INTERIOR DEPARTMENT
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SEP 30 1952
DIVISION OF
MINERALS AND FUELS

COPY FOR THE SECRETARY'S OFFICE

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Under these circumstances, until the results of these investigations are made available, I feel further processing of the application of the Arkansas Resources and Development Commission should be held in abeyance.

Sincerely yours,

Assistant Secretary of the Interior

FLKnouse/EWEllis/jem
9/26/52
cc to: Secy's Reading File
Asst. Secy's Reading File
Adm. Reading File R-4624
~~Docket-R4539~~
Messrs. Tom Lyon-R7131
Jess Larson-6137
Ellis-R4640
Knouse-R4640

FILE COPY
Sur DMEA:
DMEA

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

J. L. Kuegel
Attorney
Dyon

Mr. C. H. Scott
Magnet Cove Titanium Corp.
308 Boyle Building
Little Rock, Arkansas

Re: Docket No. DMEA-2486 (Columbium)
Arkansas Resources and Development Commission
Magnet Cove Deposit
Hot Springs County, Arkansas

Dear Mr. Scott:

Reference is made to your letter of August 16, 1952, concerning the application of the Arkansas Resources and Development Commission (DMEA-2486) for Government aid in exploring for columbium in your Magnet Cove property located in Hot Springs County, Arkansas.

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3. An additional project has been approved by Defense Production Administration to advance to the Bureau of Mines a fund to undertake metallurgical research work on columbium and tantalum mineral deposits.

Under these circumstances until the results of these investigations are made available, I feel further processing of the application of the Arkansas Resources and Development Commission should be held in abeyance.

Sincerely yours,

Assistant Secretary of the Interior

Flanouse/Ellis/jem
9/26/52
cc to: Secy's Reading File
Asst. Secy's Reading File
Adm. Reading File R-4624
Docket-R4539
Messrs. Tom Lyon-n/131
Jess Larson-6137
Ellis-4640
Flanouse-4640

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

Mr. C. H. Scott
Magnet Cove Titanium Corp.
308 Boyle Building
Little Rock, Arkansas

Re: Docket No. DMEA-2486 (Columbium)
Arkansas Resources and Development Commission
Magnet Cove Deposit
Hot Springs County, Arkansas

Dear Mr. Scott:

My reply to your letter of August 16, 1952, was delayed until further review of the captioned application and other available data on the Magnet Cove property was made in cooperation with the other interested agencies.

I understand the Assistant Secretary of the Interior has written you with respect to our findings after this review, with which I concur.

I regret that we are unable to approve a project on your property at this time but hope that the work to be done by the U. S. Bureau of Mines and the U. S. Geological Survey in investigating possibilities of production of columbium and rutile from your property, will bring favorable results.

Sincerely yours,

C O Mitchell

Administrator

not used

FILE COPY
SURNAME:
700

F.L. Knouse
Ellis
F.G. Johnson

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

Mr. C. H. Scott
Magnet Cove Titanium Corp.
308 Boyle Building
Little Rock, Arkansas

Re: Docket No. DMEA-2486 (Columbium)
Arkansas Resources and Development Commission
Magnet Cove Deposit
Hot Springs County, Arkansas

Dear Mr. Scott:

My reply to your letter of August 16, 1952, was delayed until further review of the captioned application and other available data on the Magnet Cove property was made in cooperation with the other interested agencies.

I understand the Assistant Secretary of the Interior has written you with respect to our findings after this review, with which I concur.

I regret that we are unable to approve a project on your property at this time but hope that the work to be done by the U. S. Bureau of Mines and the U. S. Geological Survey in investigating possibilities of production of columbium and rutile from your property, will bring favorable results.

Sincerely yours,

C. O. Mittendorf (for)

Administrator

FLKnouse/EWEllis/jem
9/26/52
cc to: Adm. Reading File
Docket
Messrs. S.Needleman R-1347
J.J.Norton-G-232
Ellis
Knouse
Field Team, Reg. VI (2)

FILE COPY
SURNAME:

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

Memorandum September 19, 1952

To: Mr. E. W. Ellis
Chief, Rare and Miscellaneous Metals Division

From: C. O. Mittendorf
Administrator

Subject: Scott-Magnet Cove case - DMEA 2486

Transmitted herewith is the correspondence which has just been forwarded to me by Assistant Secretary Wolfsohn, which necessitates a reply to be prepared for his signature. There is also attached Scott's letter to me dated August 16. It will be readily apparent to you that Scott is playing DMPA against DMEA, and that the "squeeze" has been put on us.

Following is a brief summary of my recent discussions in this case, which might serve as useful background in preparing our reply:

1. About three weeks ago Jess Larson phoned me, late in the afternoon, for a summary of the case, which he wished before answering a telephone call from the Arkansas Senator. I explained in detail the reasons for the action we had taken, and he appeared to be fully in accord with it. I made it clear to Jess, however, that Tom Lyon felt that the exploration application should have been approved. I do not know, of course, what Larson told the Senator; however, during our conversation he led me to believe that he would stand on our position that the current problem was one of a metallurgical nature and that his agency was already moving forward to resolve that point.

2. In lieu of calling a meeting between Wolfsohn, DMPA, and DMEA (Scott alleges that Wolfsohn agreed), it was suggested to Mr. Wolfsohn that I contact Tom Lyon directly in order to reach a mutual agreement as to the practical disposition of the case. I pointed out to Tom that our information indicated the existence of about 9,000,000 tons of inferred ore, and that there were an additional 10,000,000 or 12,000,000 tons of indicated ore. Tom admitted that he was unaware of this situation and that he would not have told Scott that he personally recommended further exploration work had he been in possession of these facts at the time of his conversation with Scott. Tom then agreed that our action in denying the application was proper, and he indicated his willingness to surname our next letter, which would reaffirm our previous denial.

Frances

I promised Lyon we would send file for his review. Pls remove my memo 9/19 as suggested.

Removed for

Rick — Why not call Tom & advise letter is ready — with view of taking it over & discussing. Phone he wish. He just got back from Denver & is probably swamped & might find it difficult to meet with you.

3. Yesterday, while over at DMPA on a Turkish matter, I saw Tom for a moment and he again brought up this case. From his remarks, I assume that he has been in touch with Scott since my meeting recorded above. Tom stated that he had informed Scott of his request to Rove, of the Survey, to make an immediate field examination of the area for the purpose of determining whether the existing drilling has been adequate and, if not, to recommend a definite drilling program. I gathered that Tom had told the applicant that he would exert his influence on DMEA to approve of additional drilling provided it was in line with the Survey recommendations. I again reviewed the ore position data that we had available and told him that all of us in DMEA, including the Operating Committee, unanimously supported a denial of the exploration application. I began to recognize the difficulty of obtaining Tom's surname on our next letter, in view of the most recent opinion he had expressed to the applicant. I told him that we were undertaking the preparation of a letter and that we would present it to him. I also promised to furnish him our files, so that he personally could review the available data. He agreed to that procedure.

4. I gathered that Tom's position would be relieved if we were permitted to tell the applicant in our letter something about the tonnage which has been developed by previous drilling. I told him that the tonnage and grade estimates were classified material and as such could not be revealed. Tom seemed to question this ruling and wondered why the information could not be made available to the owner of the property. I told him that we would explore the matter when drafting our reply.

5. Since we first denied this application, it is my understanding that the following developments have taken place:

a. A contract has been agreed to between DMPA and National Lead to advance $15,000 for metallurgical work on Magnet Cove ores. I heard, last week, that the contract had been finalized, but that National Lead had not actually received funds at that time.

b. DPA approved a project to give Survey $50,000 per year, for a period of five years, to undertake a specific project on columbium and other rare metals. A contract has been made between DMPA and USGS and, as is noted in "3" above, Lyon has requested Rove to send a field team to Magnet Cove.

c. A similar project has been approved by DPA, to advance the Bureau of Mines $75,000 per year to undertake metallurgical research work on various critical metals, including columbium. It is not known to me that an actual contract has been entered into between DMPA and USBM to implement this program, nor if a request will be made to give a high priority to Magnet Cove ores, as in the case of Survey.

Attachments-3 (See attached list)

C. O. Mittendorf (fw)

Administrator

COMittendorf/fw
cc: Mr. F. E. Johnson Mails & Files
Admr Reading File Mr. Mittendorf

MF-500

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

REFERENCE SLIP

DATE 9/26/52

REFERRED TO:

DMEA-2486

1. ~~Mr. Mittendorf, Rm. 4624~~
2. Mails and Files
3.
4.

FOR:

____ Action	____ Recommendation
____ Approval	____ Record of ____
____ Comment	____ Referring to ____
____ Conference	____ Reply for signature of ____
____ Consideration	____ Rewriting
____ Filing	X Signature
____ Instructions	____ Suggestions
____ Investigation	____ Your information
____ Initials	
____ Mailing	
____ Previous correspondence	

REMARKS: You will probably want to withdraw your memorandum to Mr. Ellis of Sept. 19 before this goes to Tom Lyons for surnaming. If you desire me to hand carry this to Tom Lyons for surnaming before it goes to the Assistant Secretary, please let me know. F.L.Knouse

Check (X) before the items needing attention.

Ernest Wm. Ellis

Jem

Initials of sender.

GPO 16—63815-1

Attachments:

8/20/52 telegram Congressman Wilbur D. Mills to Secy Chapman

8/16/52 letter C. H. Scott to Asst. Sec'y Wolfsohn

8/16/52 letter C. H. Scott to "G. E. Mittendorf"

all re Magnet Cove case

G.S. 'no' on Magnet Cove. Bauxite G.S. considers not problem

MAGNET COVE TITANIUM CORP.
308 BOYLE BUILDING
TELEPHONE 5-7168
LITTLE ROCK, ARKANSAS

August 16, 1952

Mr. G. E. Mittendorf
Acting Chief, DMEA,
Interior Building
Washington, D. C.

My dear Mr. Mittendorf:

I hope that you were successful since Wednesday in finding out the status of any anticipated Geology that is to be done by the U. S. Geological Survey on the Magnet Cove Titanium property, as well as other areas in the Magnet Cove district, and, too, if the allocation has actually been made to the Bureau of Mines in Rolla to continue its metallurgy in developing the process in separating these three strategic and important minerals - Titanium (Rutile), Columbium and Vanadium.

Mr. Joel Wolfsohn told me that shortly he would discuss this whole subject matter with you and Mr. Tom Lyons. I am sure a favorable action will be made on our application. Columbium is too essential in the construction of jet bombers, to take too much chance in delaying the exploration until a definite, proven process has been developed in separating these minerals. Time means everything in air warfare. We are told that there is a tremendous shortage and, of course, we are all aware of that fact. It seems to me that because of this urgency and great need that your department is justified in taking some gamble or chance that a process will be developed that will not be prohibitive, in cost.

The U. S. Geological Survey and our State Geologist are the ones who actually worked on the exploration phase of this development before I even became owner of the property. I was asked by the State Geologist if I would permit them to file the application in its name. I readily agreed, so it was not on my initiative that this application was filed in this manner.

I do hope that you can reconsider and go along with the conscientious thinking of Mr. Tom Lyons, Hon. Jess Larson and others in the DMPA, who are responsible for stock-piling these strategic minerals.

Any courtesy that you can extend in expediting this matter will be greatly appreciated.

Sincerely yours,

C. H. Scott

C. H. Scott

DIVISIONS OF
ADMINISTRATION • FORESTRY • PARKS • PUBLICITY • GEOLOGY • INDUSTRY • FLOOD CONTROL WATER AND SOIL CONSERVATION
"Industry Prospects in Arkansas"

Arkansas RESOURCES AND DEVELOPMENT COMMISSION
STATE CAPITOL LITTLE ROCK

8/12/52

August 7, 1952

Mr. C. O. Mittendorf
Defense Minerals Exploration Administration
Washington 25, D.C.

Re: Docket No. DMEA-2486 (Columbium)
Magnet Cove Rutile Company Deposit
Hot Springs County, Arkansas

Dear Mr. Mittendorf:

This is to acknowledge receipt of your letter dated July 10, which outlined your decision to hold the subject application in abeyance until after metallurgical work.

The Director of our Geology Division, Mr. Williams, and I were in Washington the week of July 14th, so I had Mr. Williams go to all of the government offices connected with the columbium program to be sure that there was a general understanding of our problem. It was our belief that the decision to hold our application in abeyance must have been based on incomplete knowledge of the facts and we proposed to correct this omission through Mr. Williams.

In addition to outlining the presently known facts to Mr. Johnson, your assistant, and to Mr. Knause of your organization, Mr. Williams talked to the interested people in the Bureau of Mines, the Geological Survey and the D.M.P.A. As you know, the D.M.P.A. is providing some funds to the Geological Survey for columbium work. Mr. Tom Lyons of the D.M.P.A. called Mr. Olaf Rove, of the U. S. Geological Survey, about our problem and Mr. Rove agreed to put some of his people back in our area to complete the surface geology picture.

Mr. Lyons feels as we do that the exploratory work should not be delayed for the metallurgy on a small part of the deposit. It is our hope that you will see fit to re-examine this situation especially in the light of the additional work the U. S. Geological Survey will do, and that we may be allowed to further explore the possibilities of this partially explored deposit.

It is our feeling that the total money applied for should be revised downward because much of the analytical work we planned for has already been accomplished. We do feel strongly, however, that additional drilling is indicated by presently known facts and that delays in starting the drilling may also delay intense work on the metallurgy by private organizations.

Yours very truly,

Chas R Bowers

Chas. R. Bowers
Executive Director

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
AUG 12 1952

FILE COPY
SURNAME:

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

JUL 23 1952

Mr. C. H. Scott
Magnet Cove Titanium Corporation
308 Boyle Building
Little Rock, Arkansas

Dear Mr. Scott:

This will acknowledge receipt of your letter of July 9, 1952, addressed to Mr. Robert R. Rose, Jr., concerning the application of the Arkansas Resources and Development Commission (DMEA No. 2486) for aid for an exploration project on your property located in Hot Springs County, Arkansas. Since Mr. Rose is out of the city, your letter has been referred to me for reply.

This application and other available data relating to it have been reviewed by members of the U. S. Geological Survey and the U. S. Bureau of Mines, as well as by the Commodity men in Defense Minerals Exploration Administration. Their reviews indicate that the property has already been explored sufficiently to show large reserves of refractory material containing columbium, rutile and vanadium. Although further exploration would probably add to these reserves, the expenditure of Government funds for this purpose does not seem warranted until it has been determined that satisfactory recovery of the columbium and rutile can be attained.

We greatly appreciate your interest in obtaining new sources of these strategic minerals needed for National Defense. However, in this case the problem appears to be one of complex metallurgy, which even if solved technically, poor recoveries and high costs might prohibit production. It seems to us that before doing further exploration, metallurgical testing should be done to determine whether or not production of columbium and rutile from the deposit is feasible. I understand that funds are being made available for this purpose through Defense Materials Procurement Agency.

Under the circumstances, we feel that processing of the application of the Arkansas Resources and Development Commission for exploration of your property should be held in abeyance pending the results of the metallurgical testing to be made in the near future.

FEJohnson/bih 7/22/52
cc to: Mails & Files
Admr's Reading File
Asst. Secr. Rose
Asst. Secr. White
Messrs. Ellis
Knouse
FEJohnson

Sincerely yours,

(signed) FRANK E. JOHNSON

Acting Administrator

(B.D.H.)

J.M.H. 7-23-52

Secretary's Pending File

FILE COPY
Surname:

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

SECRETARY'S MAIL CENTER
JUL 17 1952
INTERIOR D

Mr. C. H. Scott
Magnet Cove Titanium Corporation
308 Boyle Building
Little Rock, Arkansas

Dear Mr. Scott:

This will acknowledge receipt of your letter of July 9, 1952, addressed to Mr. Robert R. Rose, Jr., concerning the application of the Arkansas Resources and Development Commission (DMEA No. 2486) for aid for an exploration project on property located in Hot Springs County, Arkansas. Mr. Rose is out of the city, and I am, therefore, taking the liberty of replying to your letter in his absence.

The application of Magnet Cove Titanium Corporation and other available data relating to its property have been reviewed by members of the U. S. Geological Survey and the U. S. Bureau of Mines, as well as by the Commodity men in Defense Minerals Exploration Administration. Their reviews indicate that the property has already been explored sufficiently to show large reserves of refractory material containing columbian, rutile and vanadium. There also appears to exist a possibility of adding to these reserves by doing additional exploration work. However, there is no evidence to show that any significant production of columbian and rutile would result from this work. Consequently, expenditures of Government funds at this time for further exploration does not seem warranted.

The problem appears to be one of complex metallurgy, which even if solved technically, poor recoveries and high costs might prohibit production. It seems to us that before doing further exploration, metallurgical testing should be done to determine whether or not production of columbian and rutile from the deposit is feasible. I understand that funds are being made available for this purpose through Defense Materials Procurement Agency.

COPY FOR THE SECRETARY'S OFFICE

Under the circumstances, we feel that processing of the application for exploration on your property should be held in abeyance pending the results of the metallurgical testing to be made in the near future.

Sincerely yours,

Assistant Secretary of the Interior

FEJohnson/bih
7/16/52
cc to: Secy's Reading File
Asst. Secy's Reading File
Admr's Reading File - R-4624
Mails & Files - R-4539
Mr. Ellis - R-4640
Mr. Johnson - R-4624

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

JUL 18 1952

Memorandum

To: Acting Administrator,
Defense Minerals Exploration Administration

From: Acting Assistant Secretary White

Subject: Proposed reply to Mr. C. H. Scott, Magnet Cove Titanium Corporation

I am returning the file containing the proposed letter to Mr. C. H. Scott, President of the Magnet Cove Titanium Corporation, replying to his letter dated July 9, 1952, to Assistant Secretary Rose.

I think that the proposed letter to Mr. Scott is confusing. The first paragraph of the letter indicates that Mr. Scott's letter of July 9 concerns "the application of the Arkansas Resources and Development Commission" for aid in an exploration project on property located in Hot Springs, Arkansas. The second paragraph of the letter, however, begins a discussion of "The application of Magnet Cove Titanium Corporation." Then the concluding paragraph merely refers to "the application."

I suggest that the proposed letter be revised in order to achieve greater clarity.

In the absence of Assistant Secretary Rose from the Department, it seems to me that the response to Mr. Scott's letter might appropriately be signed by the Administrator of D.M.E.A.

Mastin G. White

Mastin G. White
Acting Assistant Secretary

Attachment

C. H. Scott
Magnet Cove Titanium Corp.
308 Boyle Building
Little Rock, Arkansas

July 9, 1952

Mr. Robert R. Rose, Jr.
Assistant Secretary of the Interior
Washington 25, D. C.

ERIOR DEPT.
CRETARY'S
IL CENTER
JL 14 1952
TO MINES

Dear Mr. Rose:

We are naturally pleased to find out that the key men in the D. M. E. A. have come to a definite conclusion that there is enough columbium found on the Magnet Cove Titanium Corporation property to warrant mining operations, provided that they are convinced that columbium can be separated from titanium as well as the vanadium.

Dr. Knickerbocker, of the Bureau of Mines at Rolla, Missouri, told me two weeks ago while I was in Rolla that there was no doubt in his mind but what these minerals could be separated from each other. He also stated that he had made a request of the Bureau of Mines in Washington to approve an application for him to continue to do some special work in separating the minerals.

We feel that the exploration work should be carried forward during the period of finding out about the methods to be used in separating the minerals.

Mr. Tom Lyons, of the D. M. P. A., told me last week in Washington that he felt by all means that the exploration work should go on because if titanium should be found at a deeper depth than the present 188 feet then we would naturally find columbium and vanadium. In other words, if we should find titanium at 500 feet, then it would indicate that columbium and vanadium would also be found at that depth, which would lend encouragement to several mining companies to become interested in actually mining for these three strategic minerals that are so sorely needed by the Government in its reammament program.

I saw Mr. E. P. Kaiser, of the U. S. Geological Survey here in Denver Monday of this week. He and other associates have been on our property and are very anxious to see the exploration work started soon.

To — Mr. Mittendorf

DI-17

SPECIAL

OFFICE OF THE
ASSISTANT SECRETARY OF THE INTERIOR
WASHINGTON

Mitt
Please acknowledge for my signature
This case to be handled as another
Bob

I was solicited by the executive director of the Arkansas Resources and Development Commission to permit them to file an application with the D. M. E. A. for the purpose of exploring the property for columbium. I readily agreed without any restrictions. I was told that they felt that there would be no hesitancy on the part of the D. M. E. A. in approving this application for exploration work.

I was told in Washington on my last two trips that the Government actually considered columbium with a higher rating than uranium at this particular time. We do know that we have columbium and vanadium on this property, so it seems to me that the Government can with good judgment approve this application.

I do appreciate the time that you have given me on my last two trips to Washington, and I know you sense the importance of finding as much columbium as possible and in the quickest time.

Any courtesy that you can extend in following this application through Mr. Mittendorf and his associates will be greatly appreciated.

I shall be in Washington Monday of next week and would like to either have a short interview in your office or talk to you on the telephone relative to our application.

Sincerely yours,

C. H. Scott

C. H. Scott

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON 25, D. C.

July 18, 1952

Memorandum

To: Assistant Director, Rare and Miscellaneous Minerals Division. D. M. E. A.

From: F. J. Cservenyak, Chief, Light Metals Branch, Minerals Division

Subject: Magnet Cove deposit rutile reserves from confidential files

The following information on Magnet Cove rutile reserves was received by telephone today from the Bureau of Mines laboratory at Rolla, Missouri.

On the basis of Bureau of Mines drilling, with no ore inferred below limits of drilling, it is estimated that 8,900,000 tons * of rutile of 3% TiO_2 average grade is present at Magnet Cove.

Petrographic examinations show that rutile occurs predominantly in the feldspar carbonate and therefore only those parts of the drill holes in the rock were considered as ore. Nine other titanium minerals occur in the ore and have been identified. The total reserves of all titanium minerals is therefore greater than the above estimate.

The estimate does not include any inferred tonnage below the drill holes. As most of the drill holes ended in ore it might be inferred that several million additional tons of rutile are present.

The above estimate of rutile reserves at Magnet Cove bears out our previous statement that metallurgical testing to recover titanium and columbium is more important at this time than any additional drilling.

The above will be supplemented by a letter from Rolla, a copy of this letter will be sent to you within the next few days.

F. J. Cservenyak
F. J. Cservenyak

* Indicated ore reserves

July 18, 1952

Air Mail

Memorandum

To: F. J. Cservenyak, Chief, Light Metals Branch, Minerals Division, Washington, D. C.

From: Chief, Minerals Technology Division, Region VI

Subject: Titanium reserves--Magnet Cove and Christy deposits, Hot Spring County, Arkansas

The following information is from the confidential sections of the Reports of Investigations on Magnet Cove Rutile Deposit (Project 3603) and Christy Titanium Deposit (Project 3602), Hot Spring County, Arkansas by Donald F. Reed. These confidential sections are on file in Washington.

The contents of this memo were read to you over the telephone July 18.

Magnet Cove Rutile Deposit

On the basis of Bureau of Mines drilling, with no ore estimated below the limits of actual drilling, the deposit was estimated to contain 8,900,000 tons of an average grade of 3 percent TiO_2.

Inasmuch as petrographic studies disclosed that rutile occurs predominantly in the feldspar carbonates, only those portions of the drill holes that were in those rocks were considered ore.

Although the principal titanium mineral, and the only one of interest, is rutile, at least nine other titanium minerals have been identified in the Magnet Cove ores. The chemical analyses are not, therefore, reliable guides to what is, and what is not, ore. All, part, or none of the TiO_2 content may be in the form of rutile.

Christy Titanium Deposit

Ore reserves, calculated on the basis of titania assays on samples obtained from Bureau of Mines drilling, were estimated to be 1,500,000 tons of an average grade of 5.8 percent TiO_2 (mostly in the form of brookite) and 0.52 percent V_2O_3. The estimate includes inferred reserves of 442,000 tons below the limits of actual drilling.

It might be well to inform you that columbium is associated with the titanium minerals of the Magnet Cove area, including the Christy deposit, but in as yet undetermined quantity.

L. T. McELVENNY

L. T. McElvenny, Acting for
R. G. Knickerbocker

Copy to: W.O.

LTMcElvenny:ngj

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

OFFICE OF THE
ASSISTANT SECRETARY

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JUL 21 1952

July 17, 1952

Memorandum for the File:

On Wednesday, July 16, Mr. C. H. Scott of Little Rock, Arkansas, was referred by the Secretary's office. Mr. Scott is interested in Application DMEA-2486 which relates to exploration for Columbium in the Magnet Cove Mine, Arkansas.

Mr. Scott asserted that the application has been pending for some little time, that Columbium is a very scarce and a very important mineral useful particularly in alloys for jet planes, that the DMEA on recommendation of the Bureau of Mines proposed to reject the application because Columbium in this particular area was combined with other minerals in such ways as to make the separation of the Columbium very difficult.

Mr. Scott urged that the DMEA reconsider the matter with a view to granting the application for an exploration grant.

While Mr. Scott was with me I talked with Mr. Ellis, the Chief of the Rare Metals Branch of DMEA. He confirmed the facts set forth by Mr. Scott adding only that in the opinion of the experts in DMEA and the Bureau of Mines a study needed to be made in order to find a method by which this metal can be extracted. Probably, he thought, it would require some form of chemical treatment.

Later I spoke with Mr. Knouse in the Rare Metals Section of DMEA who in substance affirmed what Mr. Ellis had told me. He stressed the point that a metallurgical process needed to be found and that until such a process was found, in his judgment it was not wise to expend further monies for exploration since there seemed to be ample knowledge of the availability of Columbium in this area.

On Thursday morning, July 17, Mr. Scott spoke with me by telephone and urged that I get in touch with Tom Lyon, Director, Domestic Expansion Division, DMPA. Mr. Scott added that he would then be content to wait until the return of Mr. Mittendorf, Administrator of DMEA, with whom the whole matter could be discussed.

I spoke with Mr. Lyon. Mr. Lyon stated that in his judgment it was desirable to wait until some additional preliminary studies had been made by the Geological Survey. If, on the basis of these studies, it appeared that Columbium veins of some size were present in the Magnet Cove Mine area, then he felt the exploration money should be made available. He stated that in his judgment to perform the metallurgy without knowing whether an ample supply of the mineral was available was "putting the cart before the horse."

I talked again with Mr. Scott later on July 17 and told him that on the basis of my conversation with Mr. Lyon it seemed wise to wait until Mr. Mittendorf returned at which time the matter could be thrashed out and some final decision reached.

Wolfsohn

Assistant Secretary

Copy to Mr. C. O. Mittendorf, Administrator
Defense Minerals Exploration Administration

Mr. William E. Wrather, Director
Geological Survey

700

FILE COPY
SURNAME:

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

JUL 1 0 1952

J. L. Knowe
Hodges
Fogelman

AIR MAIL

Mr. Charles S. Bowers, Executive Officer
Arkansas Resources and Development Commission
104 State Capitol Building
Little Rock, Arkansas

Re: Docket No. DMRA-2486 (Columbium)
Magnet Cove Rutile Company Deposit
Hot Springs County, Arkansas

Dear Mr. Bowers:

A careful study has been made of your application for exploration aid in the amount of $50,550.00 for the captioned project.

The exploration of this property by the U. S. Bureau of Mines has indicated a substantial reserve of titanium minerals with some columbium. Inasmuch as a considerable quantity of mineralized material is indicated, metallurgical work should be done on this material to determine the feasibility of recovering columbite and rutile before additional funds are expended for further exploration. Such a metallurgical research program is being developed by the Defense Materials Procurement Agency to allocate funds to the U. S. Bureau of Mines to cover the cost of this work. Without satisfactory metallurgical recovery of the columbium and rutile, the proposed exploration would not result in production of significant importance to national defense.

Under the circumstances, we feel that any decision on your application should be held in abeyance until the results of metallurgical research on this mineral deposit has been obtained.

If metallurgical research work can prove the feasibility of recovering the minerals from your deposit we will be glad to again consider your application for exploration to increase the mineral reserves.

Sincerely yours,

4/10/52

C. O. Mittendorf (for) cc
Acting Administrator

cc to: Adm. Reading File
Operating Committee
Docket
Messrs. S. Needleman, Rm. 1347
J.J.Norton, Rm. G-232 GSA
Ellis
Knouse
Field Team, Region VI (2)

7/9/52 gla

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

COLLEGE PARK, MARYLAND

July 8, 1952

DMEA-2486

Mr. F. L. Knouse
D. M. E. A., Rm. 4620
Department of Interior
Washington 25, D. C.

Dear Mr. Knouse:

In accordance with our telephone conversation this morning, I am enclosing a photostatic copy of a technical paper dealing with electrode coatings containing rutile. This paper summarily presents the investigations of the Bureau of Mines dealing with utility of rutile concentrates made from the titania ores of the Magnet Cove district in Arkansas.

Your attention is called to item three under the summary which may be taken as a general statement with respect to the behavior of coated electrode weldments made with the Arkansas rutile. From the numerous tests conducted the average values of all weld metal specimens are on the borderline of the 17% minimum elongation requirement by A.S.T.M. and A.W.S., thereby placing the welds in a questionable category.

The mineral beneficiation paper which the Bureau has recently released on the titanium ores characteristic of the Magnet Cove area are summarily presented in a Report of Investigations, R.I. #4851 entitled "Mineral Dressing Investigation of Titanium Ore from the Christy Property, Hot Spring County, Ark." by M. N. Fine and D. W. Frommer.

We trust that these two references will be of some value in connection with the Magnet Cove district.

Very truly yours,

T. R. Graham

T. R. GRAHAM, Chief
Physical Metallurgy Branch
Minerals-Technology Div.
Region VIII

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JUL 9 - 1952

Enclosure

Electrode Coatings Containing Rutile

Properties of weld-metal tests of experimental electrodes containing approximately 40% rutile were found to be directly influenced by the rutile component. Arkansas rutile in the electrode coating produces weld metal with higher strength and lower ductility than electrodes containing commercial rutile

by R. D. Van Zante, T. R. Graham and R. G. Knickerbocker

INTRODUCTION

ONE phase of the Federal Bureau of Mines research program on marginal reserves of our mineral resources has been a utilization study of the mineral products of these deposits. This report presents the progress of an investigation concerned with the usability of rutile concentrates made from the titania ores of the Magnet Cove district in Arkansas in the coating of arc-welding electrodes. Comparisons have been made on the electrode performance and mechanical properties of experimentally prepared welding rods in which various rutile products were used in the coating. It will be apparent that the study is in the nature of a preliminary investigation which indicates the necessity of a more detailed study of certain phases of the general problem.

The report is offered at this time in the hope that it will invoke general discussion and commentary which will serve as a guide to future investigations on the fundamentals of rutile and other materials used in electrode coatings. The influence of these materials and the mechanisms in metal transfer may be known by electrode manufacturers and various research organizations, but they have not been given full consideration in published work. The data in the present report present fundamental differences in the mechanical properties of all-weld-metal specimens which are directly influenced by the rutile component used in the electrode coating.

SUMMARY

1. Under the conditions of the present investigation, all-weld-metal test specimens made with Arkansas rutile concentrates in the electrode coating are inferior to similarly produced weld metal from arc-welding rods containing commercial rutile in the coating and to commercial electrodes.

2. The mechanical properties of metal deposited from Arkansas-rutile-coated rods exhibit higher strength and lower ductility than weld metal from electrodes coated with commercial rutile.

3. Several individual weldments made with Arkansas-rutile-coated electrodes were found to conform to the A.W.S.-A.S.T.M. requirements, although the average values from numerous tests are on the border line of the 17% minimum elongation and place the welds in a questionable category.

4. Sulphur content of the Arkansas rutile samples used in formulating the experimental electrode coatings ranged from 0.024 to 1.06%. Reduced ductility of the weld metal was indicated throughout the range in varying degrees. With 0.20% sulphur and less in the rutile concentrates used to make up the coating, the effects of this impurity were obscured by factors not definitely identified or evaluated. Above 0.20% sulphur, both the performance of the electrodes during welding and the physical qualities of the deposited weld metal were unsatisfactory.

5. Commercial rutile, to which pyrite was added as an impurity in quantities equivalent to 0.09 to 1.06% sulphur, was used for the titania constituent of experimental electrode coatings. An embrittling effect on the deposited weld metal was indicated throughout the entire range; but at 0.20% and below, the comparative effects were so small as to be inconclusive. At 0.33% and higher, both the performance of the electrodes during welding and the physical qualities of the deposited metal were unsatisfactory.

6. Comparisons were made between electrode coatings carrying equal sulphur contents. In one case the impurity was present as a normal constituent of Arkansas rutile, and in the other as the deliberate addition of fine ground pyrite to commercial rutile. Pyritic sulphur added to commercial rutile was less effective than an equivalent amount of naturally associated sulphur in the Arkansas rutiles on the mechanical properties of the weld metal.

7. So far as the results of the investigation disclose, the presence of phosphorus in the Arkansas rutile in quantities up to 0.29% exerted no deleterious influence on the performance characteristics of electrode coatings formulated from this material.

8. Analytical studies detected no significant concentration of sulphur in weld metal until the sulphur content of the rutile from which electrode coatings were made reached 1.06%.

9. The stress-relieving treatment in trials involving the use of Arkansas rutile was normally effective in the great majority of cases. In the isolated instances where this was not true the causes are obscure and possibly attributable to factors not related to the coating constituents, so far as the investigation discloses at the present time.

ACKNOWLEDGMENTS

Acknowledgment is made to L. H. Clarke, formerly of the Rolla Branch, now in the Fuels and Explosives Division, who carried out the initial phases of the investigation, and to Heine Kenworthy, metallurgist of the Rolla Branch, who rendered assistance at one stage of the work.

GENERAL

The deposits of titanium minerals that occur in Arkansas are extensive and accessible. The products from intermittent attempts to work them have been difficult to market domestically and virtually excluded from a most important use for rutile, that is, in the coatings for arc-welding electrodes. Various explanations for this situation expressed by users and purveyors of this product did not agree, nor were any factual data available as to

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the deficiencies or disadvantages peculiar to these minerals.

Nevertheless, these deposits represent a potential domestic source of a mineral commodity whose importance has increased proportionately with the growth of welding. It therefore appeared desirable to supplement existing knowledge regarding the extent, nature, beneficiation problems and utilization of the products of these ore bodies. One aspect of the utilization studies was the investigation into the use of suitable products in welding-electrode coatings. The plan followed was to use samples prepared by the Mineral Dressing Section for the titania constituents of experimental electrode coatings and to compare the performance of these electrodes with (1) A.S.T.M. specifications, (2) commercial electrodes of the same type, (3) experimental electrodes in whose coatings Arkansas rutile was replaced by commercial rutile and (4) each with the other.

PRELIMINARY WORK AND PROCEDURES

The special equipment ordinarily used for coating electrodes by extrusion was not available. It was necessary to develop a technique for applying the coatings by hand dipping. After a period of experimentation, it was judged feasible to produce satisfactory coatings by this method in the quantities required for the investigation. The steel cores of commercial E-6012 rods, stripped of their coating, were used in this investigation. The wire analysis was found to average 0.15 carbon, 0.035 sulphur, 0.018 phosphorus and 0.22% silicon. The established procedure in preparing the experimental coverings consisted of conditioning a slurry of the coating components to a suitable consistency for adhering to the bare wire without running. Two dips, each followed by an air-drying period of several hours, were found most satisfactory. Proper technique would produce a smooth, concentric coating of about 6.5 to 7 gm. weight on a $^3/_{16}$- by 14-in. wire, which is approximately the weight of coating on some popular brands of commercial type E-6012 electrodes. The final air-drying period was followed by a baking treatment during which temperature was gradually raised to 300° F. over a period of 6 hr. and held at that level for 2 hr.

The drying treatment proved to be satisfactory to the extent that properly prepared experimental electrodes dried by this procedure exceeded requirements as to performance and character of the deposited weld metal. It was therefore adopted as standard, although the fact that it probably did not represent the optimum was thoroughly appreciated. The principal consideration was to standardize on a given set of conditions and thereby eliminate the drying treatment as a variable from the experimental procedure.

Manufacture of electrodes is highly competitive, and each producer's position depends on keeping abreast of the field. Considerable effort and expense are devoted to development work, particularly in coating formulas. Available information on this phase of arc welding is usually fragmentary and incomplete. Preliminary to making an attack on the problem it was therefore necessary to conduct a series of experiments toward the development of coating formulas, using standard commercial rutile as the titania constituent. The mild-steel type E-6012, a titania-coated electrode, was selected as the most convenient comparison standard. With the welding production established in the postwar period, the demand for this type electrode is greater than for all others. The E-6012 electrode is often referred to as a general-purpose electrode because of the various applications of the rod in light and heavy structural work and in maintenance repair. In most formulations, the rutile in the coverings of these electrodes is more than 35% by weight. Other ingredients are likely to include aluminum silicates, ferromanganese, cellulose and calcium and potassium compounds, with sodium silicate as the binder.

From the preliminary work two formulas were adopted for the more detailed investigation. These two mixtures, designated "A" and "B" in Table 1, are both typical of the general type E-6012 in composition. Commercial electrodes, however, use less binder, since they are extruded rather than dipped.

Table 1—Experimental Coating Formulas

Ingredient	*Formula, %* A	B
Rutile	41	41
Calcium carbonate	5	3
Asbestos	5	..
Mica	..	7
Feldspar	..	9
Kaolin	9	5
Magnesite	2	2
Ferromanganese (80% Mn)	10	10
Flour	2	2
Soda ash	1	1
Sodium silicate (N grade, 38%)	25	20

Electrodes coated according to Formula A performed in a manner comparable to the commercial counterpart. Those according to Formual B were a quieter, easier-handled, smoother-acting electrode and were believed to approximate in performance the commercial type E-6013. These formulas, while not necessarily comparable in every particular to those in use commercially, were nevertheless satisfactory for the purpose of making comparisons between various rutiles, and one or the other is the medium of comparison in the experiments subsequently reported.

Comparisons between electrodes were made on the basis of the requirements of A.W.S.-A.S.T.M. specifications for arc-welding electrodes, Serial Designation A233–45T, with particular reference to the all-weld-metal tension test as described therein. Briefly, the procedure consists of preparing a welded joint of such size and shape that a standard tensile specimen can be cut from the weld metal and applying the standard tension test to the specimens for the determination of ultimate tensile strength, yield point and elongation, in both the as-welded and the stress-relieved conditions. More recent A.W.S.-A.S.T.M. standards have eliminated the stress-relieved property requirement and have increased the minimum as-welded strength specification to 68,000 psi., with an elongation of 17% in 2 in. The individual test specimens were broken in tension within 6 to 8 days after weldment. Since this class of rod has been reported to produce considerable hydrogen in the welds, which in turn have a bearing on the resultant properties, standardizing on the time factor reduces the probability of additional variables.

The number of variables involved in making these comparisons, not the least of which is the human element in preparing the welded test plates, inevitably produce scattering in the results from duplicate tests. A.W.S.-A.S.T.M. standards recognize this tendency and provide for a second determination of the physical qualities of the metal if the first trial fails. Results presented in this report are averages of groups whose individual deviations from the norm, after making due allowance for the inherent tendency to scatter, do not contradict the major indication.

Since the purpose for which these formulas were developed was a comparison vehicle rather than the production of an electrode comparable to the commercial article, the guided-bend and fillet-weld usability tests were not made. However, repeated informal trials on both a.-c. and d.-c. current, and in the flat, horizontal, overhead and vertical positions, were made by several experienced welders, and it was agreed that the usability characteristics of the electrodes coated according to the experimental formulas were excellent.

A comparison, based on the standard all-weld-metal tension test for arc-welding electrodes, between A.W.S.-A.S.T.M. minimum requirements, the metal from commercial type E-6012 electrodes deposited and tested under exactly duplicated conditions and the metal from experimental electrodes of coating formulations A and B is presented in Table 2. Results are shown for the not-stress-relieved and stress-relieved conditions, designated, respectively, *NSR* and *SR*. Rutile from a commercial supplier was used in the preparation of the experimental coatings.

Reliability of the experimental procedures was confirmed by the fact that the weld metal deposited from commercial electrodes was well above A.W.S.-A.S.T.M. requirements. Using these results as

Table 2—Comparison of Physical Properties of Weld Metal

Property	A.W.S.-A.S.T.M. minimum requirements NSR	A.W.S.-A.S.T.M. minimum requirements SR	Commercial type E-6012 electrode NSR	Commercial type E-6012 electrode SR	Experimental electrode, Formula A NSR	Experimental electrode, Formula A SR	Experimental electrode, Formula B NSR	Experimental electrode, Formula B SR
Yield point, psi.	52,000	47,000	64,150	61,500	65,500	58,150	67,300	64,700
Tensile strength, psi.	62,000	60,000	76,600	71,200	76,500	70,100	79,700	76,600
Elongation, per cent in 2-in.-gage length	17	22	18.6	24.3	19.6	25.2	17.3	23.0

Table 3—Chemical Analysis of Rutile Samples

Constituent, %	Commercial-type rutile	Arkansas rutiles S-1	S-2	S-3	S-4	S-5	S-6
TiO_2	92.55	94.00	92.44	95.30	92.10	92.20	92.59
Fe	1.09	1.26	2.86	...	1.90	1.40	2.74
SiO_2	2.33	<0.05	1.28	...	0.79	0.63	1.56
Zr	2.13	Nil	...	...	...	...	...
S	0.02	0.20	1.06	0.33	0.20	0.09	0.024
P	0.06	0.095	0.09	...	0.05	0.29	0.01
CaO	...	...	...	...	...	0.52	0.06
Al_2O_3	...	...	...	...	...	...	0.36
Cr	<0.05	0.06	...	...	...	...	<0.05
V	<0.05	0.32	...	...	...	0.34	0.24
Cl	...	0.01	...	...	...	...	...
F	...	0.07	...	...	...	...	...
Zn	...	Nil	...	...	...	<0.05	0.17

the basis for comparison, experimental electrodes with coating Formula A produced weld metal of comparable or superior properties. Those with coating Formula B also produced metal exceeding A.W.S.-A.S.T.M. requirements but by a narrower margin. In the numerous tests, as-weld test specimens made from Formula B invariably produced slightly higher strength properties and lower ductility. While these differences are not great, they are quite consistent and amount to approximately 3000 psi. for the tensile strength and about 2% for the elongation values. In performance the advantage was with Formula B; in physical character of the deposited metal, Formula A was best. Both, however, were capable of meeting A.W.S.-A.S.T.M. requirements and were satisfactory for the purpose intended.

With completion of the proof tests for procedure and experimental technique, the investigation was directed to a comparison of the Arkansas rutiles and commercial rutile as a constituent in electrode coatings using the two formulas developed in the preliminary work.

COATINGS CONTAINING ARKANSAS RUTILES

Six individual lots of concentrates prepared from the Arkansas ores were available for this investigation. Some of these products were obtained from previous beneficiation experiments, and others were especially prepared by the Mineral Dressing Section of the Rolla Branch of the Bureau of Mines. The respective analysis of these lots is given in Table 3. Details of the beneficiation procedures for the rutile are described in published reports.[1,2] As a basis for comparison, the analysis of the commercial rutile used in the formula-development tests is included in the tabulation.

It will be noted that fundamental differences based on the genetics of the ore deposits exist between the commercial and the Arkansas rutiles. Also a considerable range of constitution occurred from sample to sample in the Arkansas rutiles. Variations for any particular constituent depended principally on the nature of the processes employed in the preparation of the product. A uniform characteristic of the Arkansas samples is the 92% plus titanium dioxide content. The principal differences between the commercial type of rutile and the products of the Arkansas deposits are the higher iron, sulphur, vanadium and phosphorus contents of the Arkansas rutile. The commercial product is similarly higher in Zr and SiO_2. In a comparison of these materials in electrode coatings, it should be noted that the coating usually represents approximately 15% of the total weight of the rod. The titania content, in the case of the formulas in this investigation, is about 6% of the total weight of the electrode. Hence, assuming no losses in the arcing process, elements present to the extent of 0.5% in the rutile would be 0.03% in the deposited material.

Coincidentally with completion of the work on formula development, a preliminary experiment was made on the use of Arkansas rutile. The only sample of this product available at the time was sample S-1, which represented a small amount of material prepared by special methods. This sample, and commercial rutile, were used for the titania constituent of the coatings of two comparable lots of experimental electrodes. Coatings were prepared according to a preliminary formula which represented a step in the development of Formula A.

Table 4 presents the results from tension tests on all-weld-metal specimens from these electrodes. As a basis for comparison, A.S.T.M. minimum requirements and comparable data from commercial electrodes are also shown.

These data, while preliminary in nature, indicated that electrodes having Arkansas rutile in their coatings were capable of depositing metal exceeding A.W.S.-A.S.T.M. minimum requirements for physical properties. The metal was somewhat less ductile than that from duplicate electrodes with commercial rutile in their coatings and also less than the metal from commercial electrodes. At this stage of the work these indications were regarded as encouraging.

As the other samples of Arkansas rutile became available, they were used as the titania constituent of experimental electrodes. Table 5 presents the results from a group coated according to Formula A, using samples S-4, S-5 and S-6 as the titania constituents. Included in the tabulation for comparison purposes are A.W.S.-A.S.T.M. minimum requirements and comparable data from experimental electrodes, the coatings of which were duplicates except for the substitution of commercial rutile for Arkansas rutile.

Weld metal exceeding minimum requirements was deposited from the electrodes coated with the formulation con-

Table 4—Comparison of Physical Properties of Weld Metal

Property	A.W.S.-A.S.T.M. minimum requirements NSR	A.W.S.-A.S.T.M. minimum requirements SR	Commercial type E-6012 electrodes (from Table 2) NSR	Commercial type E-6012 electrodes (from Table 2) SR	Experimental electrodes, preliminary coating formula: Containing commercial rutile NSR	Containing commercial rutile SR	Containing S-1 Arkansas rutile NSR	Containing S-1 Arkansas rutile SR
Yield point, psi.	52,000	47,000	64,150	61,500	61,700	50,500	67,900	62,200
Tensile strength, psi.	62,000	60,000	76,600	71,200	71,900	64,400	77,600	71,900
Elongation, per cent in 2-in.-gage length	17	22	18.6	24.3	20.3	22.6	17.2	22.6

taining S-4 Arkansas rutile. Compar[illegible] with the duplicate electrodes containi[illegible] commercial rutile, a small loss in ductility and a corresponding increase in tensile properties were indicated, and a slightly reduced effectiveness for the stress-relieving step.

The data for the S-4 and S-5 rutile electrodes give tensile strengths of 78,200 and 81,200 psi., respectively, which is somewhat higher than the standard rods containing commercial rutile. The elongation values for these rods are of the same general order as the commercial rutile electrodes. The S-6 specimens compare favorably in strength but were consistently low in ductility, averaging about 2% less than similarly processed commercial rutile rods. The yield-strength properties show similar trends. While the experimental rods respond to the stress-relieving treatment, the decrease in strength and increase in ductility are definitely less than was noted for the control specimens made with commercial rutile.

No outstanding advantage was apparent in these rutile products, although from the reduced sulphur content of S-5 and the reduced sulphur and phosphorus contents both of S-6 such an advantage might logically have been expected.

Lots of experimental electrodes were also prepared according to Formula B, using samples S-2, S-3, S-4, S-5 and S-6 of Arkansas rutile as the titania constituent of the coatings. Results from these electrodes are shown in Table 6, together with A.W.S.-A.S.T.M. minimum requirements and comparable data from duplicate electrodes with commercial rutile in the coating.

The results from the B-formula coatings containing Arkansas rutile were definitely inferior to the duplicates containing commercial-grade rutile, and in no case met A.W.S.-A.S.T.M. minimum requirements.

The tensile strength of weld metal made from the Arkansas rutile electrodes was found to be in excess of 80,000 psi., with elongations considerably less than the minimum A.W.S.-A.S.T.M. requirements. The as-welded or not-stress-relieved test specimens varied from 9.4 to 15.1%. It will also be noted that the stress-relieving treatment increased the ductility substantially, but in all instances the average values were less than the control samples made with commercial rutile. The ductility was also less than the minimum acceptance requirements. Ductility in inverse ratio to the sulphur content of the rutile was noted in samples S-2, S-3 and S-4, but the relation did not persist through the lowest sulphur samples S-5 and S-6. One or more factors other than sulphur evidently exerted the dominating effect in the case of these samples, or at least contributed materially to the effect.

The indication that no outstanding advantage resulted from the reduced [illegible]hur and phosphorus contents of [illegible]ples S-5 and S-6, previously noted in the analysis of the results presented in Table 5, was confirmed.

It was noted during welding the test plates that, in cases involving the use of rutiles of sulphur contents of 0.33% and above, the performance of the electrodes was adversely affected. The molten pool was very turbulent, and the slag failed to furnish a uniform protective coating over the solidifying weld metal. At 0.20% and below, performance was satisfactory.

Information on the quantitative effects of sulphur in welding electrode coatings, independent of other possible effects inherent in the Arkansas rutiles, was sought by preparing lots of experimental electrodes, using in their coatings commercial-grade rutile to which pyrite was added in varying amounts as an impurity. The quantity added was calculated to correspond to the sulphur content of samples S-2, S-3, S-4 and S-5 of Arkansas rutile, and Formula B was used in the coating preparations. These lots were designed to furnish information on the basic effect of the sulphur against which the corresponding results from Arkansas rutile, as shown in Table 6, could be judged.

The results from these electrodes are tabulated in Table 7, together with A.S.T.M. minimum requirements and comparable data from experimental electrodes not containing sulphur contamination.

Table 5—Comparison of Physical Properties of Weld Metal

			Experimental electrodes, coating Formula A							
	A.W.S.-A.S.T.M. minimum requirements		*Containing commercial-type rutile (from Table 2)*		*Containing S-4 Arkansas rutile*		*Containing S-5 Arkansas rutile*		*Containing S-6 Arkansas rutile*	
Property	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*
Yield point, psi.	52,000	47,000	65,500	58,150	66,700	62,400	69,200	64,700	67,900	66,900
Tensile strength, psi.	62,000	60,000	76,500	70,100	78,200	74,450	81,200	75,900	76,900	74,100
Elongation, per cent in 2-in.-gage length	17	22	19.6	25.2	17.7	23.0	19.7	20.0	16.8	21.3

Table 6—Comparison of Physical Properties of Weld Metal

			Experimental electrodes, coating Formula B											
	A.W.S.-A.S.T.M. minimum requirements		*Containing commercial-type rutile (from Table 2)*		*Containing S-2 Arkansas rutile*		*Containing S-3 Arkansas rutile*		*Containing S-4 Arkansas rutile*		*Containing S-5 Arkansas rutile*		*Containing S-6 Arkansas rutile*	
Property	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*
Yield point, psi.	52,000	47,000	67,300	64,700	70,700	67,300	70,200	67,850	73,200	70,900	73,000	70,850	73,400	72,150
Tensile strength, psi.	62,000	60,000	79,700	76,600	77,800	75,800	82,350	82,100	86,100	80,100	86,700	82,600	84,800	82,500
Elongation, per cent in 2-in.-gage length	17	22	17.3	23.0	9.4	17.2	12.5	13.65	15.1	20.9	14.8	18.9	12.9	18.3

Table 7—Comparison of Physical Properties of Weld Metal

			Experimental electrodes—coating Formula B									
	A.W.S.-A.S.T.M. minimum requirements		*Containing commercial-type rutile, (from Table 2)*		*Containing commercial-type rutile, 1.06% S added*		*Containing commercial-type rutile, 0.33% S added*		*Containing commercial-type rutile, 0.20% S added*		*Containing commercial-type rutile, 0.09% S added*	
Property	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*	*NSR*	*SR*
Yield point, psi.	52,000	47,000	67,300	64,700	55,100	50,000	69,300	65,200	68,650	67,350	67,900	68,500
Tensile strength, psi.	62,000	60,000	79,700	76,600	55,600	50,000	80,600	76,150	80,100	77,050	79,700	78,350
Elongation, per cent in 2-in.-gage length	17	22	17.3	23.0	3.4	3.4	16.2	19.2	18.7	23.5	17.7	25.0

The results disclose an embrittling effect for the sulphur additions, inclusively in the cases of 0.33- and 1.06-% additions, and tentatively in the cases of the 0.20- and 0.09-% additions. Performance and test results in this and former trials involving rutiles containing 1.06% sulphur were so erratic as to render quantitative comparisons unreliable.

At 0.20% sulphur and below, the adverse effects were so slight as to be inconclusive. At the higher figures, performance of the electrodes during welding of the test plates was unsatisfactory, corresponding closely to that previously observed with the high sulphur Arkansas rutiles.

Comparison between commercial and Arkansas rutiles of equal sulphur contents, as they appear in Tables 6 and 7, respectively, indicates that sulphur did not have as great an adverse effect as an added pyrite impurity in commercial rutile as an equivalent natural sulphur content in Arkansas rutile. The uncomplicated presence of a pyrite impurity was therefore insufficient grounds for satisfactorily explaining the behavior of the Arkansas rutile samples. The complexity of occurrence of the sulphides in the Arkansas rutile opens a wide area for investigation as to the effect of small quantities of these and other constituents on electrode performance.

Analytical studies were made on the distribution of the sulphur and phosphorus impurities in rutiles, the coatings in which these rutiles appeared as a constituent and weld metal deposited from electrodes so coated. A concentration of sulphur in the weld metal above the tolerable limits for mild steel was detected in the cases of coatings made from rutiles containing 1.06% sulphur, and this was true both for Arkansas rutile and for commercial rutile to which this quantity of sulphur was added as an impurity. When rutiles below this sulphur content were used, no relationship was established between the quantities of sulphur present in the electrode coating and in the resultant weld metal.

All the weld samples showed paler sulphur prints than the adjacent plate material or the core wire, even though the sulphur content was in some cases actually higher. This effect is attributed to the higher degree of dispersion or finer state of division of the sulphide in the weld metal. Sloman, Rooney and Schofield reported the same behavior in an investigation of the constitution of weld deposits.[8]

No significant concentration of phosphorus in the weld metal was detected in tests of electrodes in which the coating contained up to 0.29% of this element in the rutile component. Hence the observed variation in properties of the experimental electrodes cannot be directly associated with this impurity. One of the leading producers of welding electrodes stated in a private communication that 0.5% phosphorus in the rutile has been permissible without deleterious effects on the deposited metal. Reeve[4] has reported that the ductility of mild-steel weldments is not impaired by the presence of 0.070% phosphorus.

Photographs of representative fractures of the all-weld-metal tensile specimens, both as-welded and stress-relieved, are reproduced in Figs. 1 to 5, inclusive. The stress-relieved specimens are readily identified by the comparatively greater reduction in area and the absence of "fish eyes." Although some questions remain unanswered regarding the formation of this characteristic imperfection, which has been associated with hydrogen and moisture contents,[5] it is evident that all specimens in this investigation, including the commercial rods, exhibited substantially the same size and number of fish eyes. Extensive metallographic study of the microstructure of the various specimens in this investigation has revealed that the welds have substantially the same grain size and cleanliness ratings. Only a few specimens were found that contained nitride structures, and these were small areas of a rather localized nature. Thus far, no correlation has been found between the microstructural characteristics of the metal, fractures and the mechanical properties of the various coated electrodes.

Welding engineers have repeatedly pointed out that the E-6012 type electrode does not excel in ductility and in many instances barely passes the minimum specifications,[6,7] although they have given quite satisfactory service. Under the conditions of this investigation, the mechanical properties of weld metal from Arkansas rutile rods are inferior to the commercial rutile rods in that the strength values are high and the ductility is low. In several instances, individual welds produced have enough ductility to meet the A.W.S.-A.S.T.M. requirement of 17%, but the values from weld to weld vary and the observed properties place the material in a doubtful category.

An independent test of the Arkansas rutile in electrode coatings was made through the cooperative efforts of Dr. David F. Helm, senior fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa. Dr. Helm arranged for the fabrication of "typical commercial" electrodes containing both Arkansas rutile and a control electrode with commercial rutile which were subsequently used in the standard weld-metal test. The results of these tests confirmed the technique used in this investigation and substantiated the findings regarding the weld-strength properties as influenced by the character of the rutile in the coating formula. The performance and mechanical properties for both the commercial rutile and Arkansas-rutile-coated electrodes were found to be approximately the same as given in this report.

An explanation of the experimental re-

Fig. 1 As-welded and stress-relieved fracture sections of weld-metal tensile specimens made with Type E-6012 commercial electrode. × 2

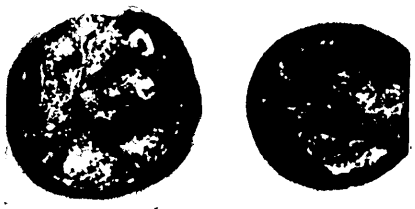

Fig. 2 As-welded and stress-relieved fracture sections of weld-metal tensile specimens made with experimental electrode containing commercial rutile in Formula A. × 2

Fig. 3 As-welded and stre fracture sections of weld- sile specimens made wit tal electrode containing rutile in Formula

Fig. 4 As-welded and stress-relieved fracture sections of weld-metal tensile specimens made with experimental electrode containing Arkansas rutile S-4 in Formula A. × 2

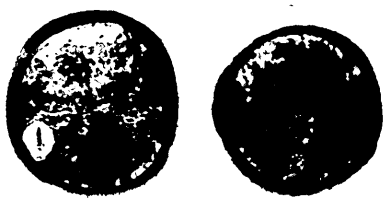

Fig. 5 As-welded and stress-relieved fracture sections of weld-metal tensile specimens made with experimental electrode containing Arkansas rutile S-4 in Formula B. × 2

sults requires further investigation and identification of those factors which have a direct bearing on the suitability of the material as a component in electrode coatings. Additional information regarding slag characteristics such as softening and fusion temperatures, viscosity, etc., the influence of the reducibility of the various forms of rutile and a quantitative evaluation of their arc-stabilizing power or possible breakdown in structure in the range of the arc temperature will assist materially in analysis of the general problem.

Isolation of the inherent factor may also permit the development of coating mixtures which would compensate the inhibiting characteristics of Arkansas rutile and make this mineral deposit acceptable for commercial use in welding electrodes.

References

1. Fine, M. M., Kenworthy, H., Fisher, R. B., and Knickerbocker, R. G., "Titanium Investigations: The Laboratory Development of Mineral Dressing Methods for Arkansas Rutile," A.I.M.E., Mining Engineering, T.P. 2668-H, 1949.

2. Spencer, R. V., "Exploration of the Magnet Cove Rutile Co. Property, Magnet Cove Area, Hot Springs County, Ark.," Bureau of Mines Rept. of Invest. 3900, 1946.

3. Sloman, H. A., Rooney, T. E., and Schofield, T. H., "A Preliminary Investigation of the Constitution of Mild-Steel Arc-Weld Deposits," THE WELDING JOURNAL, 25 (1), Research Suppl., 39-s to 52s, (1946).

4. Reeve, L., "Influence of Sulphur and Phosphorus on Weldability of Mild Steel," *Trans. Inst. Welding*, London, 80 (May 1945).

5. Arthur, J. B., "Fish Eyes in Arc Welds," *The Iron Age*, 52 (May 16, 1946).

6. Barnett, O. T., "Why Use E6012 Electrodes" *Steel*, 73 (Dec. 30, 1946).

7. Barnett, O. T., "The E601X Electrode Group," THE WELDING JOURNAL, 25 (10), 962 (1946).

A.S.T.M. Meetings

Sessions on Plasticity and Creep of Metals; Fatigue of Metals; Application of Statistics; Dynamic Stress Determinations; Symposium on Cast iron at A.S.T.M. Pacific Area Meeting

DURING the First Pacific Area National Meeting of the American Society for Testing Materials in San Francisco, Calif., October 10–14th inclusive, numerous technical papers will be presented of interest to those in the metals field. Sessions on Monday, October 10th, cover Plasticity and Creep of Metals and Fatigue of Metals. There are sessions on Tuesday dealing with Dynamic Stress Determinations and Applications of Statistics that will interest the metals fraternity, and on Thursday, a Symposium on Cast Iron is scheduled, sponsored by A.S.T.M. Committee A-3 on Cast Iron.

PLASTICITY AND CREEP OF METALS

The four papers in this session at 2 P.M., October 10th, are by leading authorities in their fields and cover the following: "The Experimental Exploration of Plastic Flow in Sheet Metals"—L. R. Jackson, Battelle Memorial Institute, Columbus, Ohio, and W. T. Lankford, Carnegie-Illinois Steel Corp., Pittsburgh, Pa.; "Application of Forming Criteria to Production Problems"—W. Schroeder, Lockheed Aircraft Corp., Burbank, Calif.; "Use of Creep Data in Design"—Howard C. Cross and L. R. Jackson, Battelle Memorial Institute, Columbus, Ohio; "Super Creep-Resistant Alloys"—J. W. Freeman, D. N. Frey and E. E. Reynolds, University of Michigan, Ann Arbor, Mich.

FATIGUE OF METALS

On Monday evening, October 10th, four papers on the subject of Fatigue will be given as follows: "Introduction to Fatigue Session"—"A Broad Look at the Fatigue of Materials Field"—R. E. Peterson, Westinghouse Electric Corp., East Pittsburgh, Pa.; "Fatigue Strength of Steel Through the Range from 0.5 to 30,000 Cycles of Stress"—M. H. Weisman, North American Aviation, Inc., Inglewood, Calif.; "Fatigue Notch Sensitivities of Some Aircraft Materials"—H. Grover, Battelle Memorial Institute, Columbus, Ohio; "Fatigue Strength of Aircraft Materials and Fastenings"—Thomas Piper, Northrop Aircraft, Inc., Hawthorne, Calif.

DYNAMIC STRESS DETERMINATIONS

Growing interest in dynamic testing and stress analysis is recognized through a separate session the morning of October 11th, with the following four papers: "A Survey of Pick-ups for Dynamic Physical Measurements"—Gifford White, Statham Laboratories, Beverly Hills, Calif.; "Selection of Recording Equipment for Dynamic Testing"—K. D. Swartzel, Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y.; "Analysis and Interpretation of Dynamic Records"—H. C. Roberts, University of Illinois, Urbana, Ill.; "Some Examples of Dynamic Testing in the Field of Materials and Structures"—Douglas McHenry and H. E. Hosticka, U. S. Bureau of Reclamation, Denver, Colo.

APPLICATION OF STATISTICS

The Society and its members are much concerned with quality control of materials and the application of statistics, and a separate session on Tuesday afternoon, October 11th is devoted to applying statistics, with three papers: "Some Economic Aspects of Vendor-Purchaser Relationships When Specifications Are Statistically Unenforceable"—E. L. Grant, Stanford University, Stanford University, Calif.; "Precision and Accuracy of Test Methods"—Grant Wernimont, Eastman Kodak Co., Rochester, N. Y., and "Use of Statistics to Determine Accuracy of Tentative Test Methods"—W. J. Youden and J. M. Cameron, National Bureau of Standards, Washington, D. C.

SYMPOSIUM ON CAST IRON

A wealth of information on the properties and testing of cast iron, the significance of specifications for this material and information on extensive uses of castings will be covered in this Symposium the afternoon of October 13th. Four papers will form the basis of the Symposium, as follows: "Mechanical Testing and Properties of Gray Cast Iron"—C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala.; "Development, Significance and Uses of Specifications for Cast Iron"—H. Bornstein, Deere and Co., Moline, Ill.; "Automotive Cast Irons, Including Brake Drums"—R. G. McElwee, Vanadium Corporation of America, Detroit, Mich.; "Applications and Uses of Gray Iron Castings, Including Significance of Various Properties of Gray Cast Iron"—C. O. Burgess, Gray Iron Founders' Society, Cleveland, Ohio. In one or more of the papers, the use of cast iron at elevated temperatures will be reviewed.

All engineers, technical people and others concerned with materials are cordially invited to attend this A.S.T.M. National Meeting. Copy of the complete program can be obtained by writing to A.S.T.M. Headquarters, 1916 Race St., Philadelphia 3, Pa. It is not expected that the papers will be preprinted, but duplicated copies are to be made available to those registering at the Meeting. All sessions are at the Fairmont Hotel.

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

Memorandum

To: Docket File

From: F. L. Knouse, Mining Engineer
Rare and Misc. Metals Division

Subject: Docket No. DMEA-2486 (Columbium)
Magnet Cove Property
Arkansas Resources & Dev. Commission
Little Rock County, Arkansas

June 26, 1952

Mr. C. H. Scott (Magnet Cove Titanium Corp.) was in the office discussing the captioned application and stated Mr. Knickerbocker (U.S.B.M., Rolla, Missouri) advised him the columbium could be separated from the titanium minerals. Mr. Scott admitted he had no knowledge of the economics of making this separation. He was of the impression the separation could be made economically.

June 28, 1952

Barr's office, D.M.P.A., advised a verbal agreement has been made with National Lead Co. for them to do metallurgical research on the titanium minerals from the "Christie Deposit" and on minerals from nearby deposits, including the "Magnet Cove Deposit". The purpose of this work is to determine if the rutile and brookite minerals can be concentrated and separated, and the resulting product satisfactory for welding rod coating. Included in this agreement is research for the recovery of the columbium associated with the titanium minerals. D.M.P.A. expects to complete this formal agreement within two weeks. Funds for this work are to be about $15,000.00.

June 30, 1952.

Telephoned Mr. Knickerbocker's office and talked with Mr. McElvenny, who advised no metallurgical research work has been done on the material from the Magnet Cove Deposit by his office to separate columbium from the TiO_2 minerals as no funds were available for this work. He was, however, of the opinion that columbium could be recovered from the titanium minerals but the economics of making the recovery would have to be determined by actual work. He indicated the process would no doubt

be chemical, which would change the chemical composition of the titanium oxide probably to a chloride and the resulting product, unless further beneficiated, would not meet industry specifications for welding rod coating.

July 8, 1952

Mr. T. R. Graham, U.S.B.M., College Park, states metallurgical research work done by him during 1948 "did not produce a welding rod coating entirely acceptable to industry specifications, and more research work should be done."

U.S.B.M. R.I.4851 indicates 60.6% of the Titania from the residual ores "Christie Deposit" was made producing a 92.8% TiO_2 concentrate, and 55.2% of the titania was recovered from drill hole (of a composite sample) producing a 91.2% TiO_2 concentrate.

Attached is an arithmatical average of the sample values from drill cores of the Magnet Cove property, U.S.B.M. and U.S.G.S. If only 60% of the TiO_2 minerals contained in the "Magnet Cove Deposit" can be recovered by known methods and an unknown quantity of the columbium associated with these minerals, the probable value of the recoverable minerals may be

$\frac{\$3.85}{60\%}$ TiO_2 = \$2.31/ton \$2.31

$\frac{1.56}{60\%}$ Columbium = $\frac{\$0.93}{60\%}$ est.recovery = $\frac{\$0.56}{}$

Possible recovery value/ton \$2.87

The economics of recovering this mineral is the big question. Inasmuch as a substantial indicated tonnage of TiO_2 has been explored by the U.S.B.M. drilling and sampling program, additional metallurgical research is indicated prior to exploring for additional reserves.

MAGNET COVE PROPERTY

Sample Values - USBM and USGS

	NB	TiO_2	TiO_2 (Chemical)	V_2O_5	V_2O_5 Chem.	Y	La	Total Value
	.028%	2.30%	2.23%	.063%	.095%	.011	.04%	
# /ton	.56	46	44.6	1.26	1.9	.22	.8	
Value/ton	$1.56*	$3.91**	$3.79**	$ .39 x	$ .59 x	xx	o	
		2 = $3.85		2 = $.49				~~$6.00~~
								5.90

* Value @ $2.80/# Columbium - 100% incentive bonus

** Value @ .085/# Est. as Rutile rate $170/ton

x Value @ .31/#

xx No value Yttium

o " " Lanthanum

IN REPLY REFER TO:
G-MD-JJN

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

June 3, 1952

Memorandum

To: F. L. Knouse, Rate and Miscellaneous Metals Division, DMEA.

From: J. J. Norton, U. S. Geological Survey.

Subject: Application DMEA-2486 for exploration of the Magnet Cove Rutile property.

Mr. Michael Fleischer of the Geochemistry and Petrology Branch of the U. S. Geological Survey has supplied data necessary to reply to your recent telephone call. Mr. Fleischer says that assays of 30 to 40 columbium samples from the Magnet Cove area will be available this week. These samples will include several from the Magnet Cove Rutile property.

The known geochemical affinity of columbium and titanium as well as the few available analyses of samples from Arkansas titanium deposits encourage the belief that exploration should be seriously considered. The only analysis of material from the Magnet Cove Rutile property is of a sample of rutile concentrate. This sample contained 1.3 percent columbium, according to spectrographic and wet chemical analytical methods.

I will forward other analytical data to you as soon as they are available. I think, however, that referral to the field team is justified on the basis of presently available information.

J. J. Norton

JJNorton:hhp
G-6/3/52
cc: Director's Reading file, 4212
Branch Reading file, 4212
DMEA
JJNorton, G-230, GSA Bldg., USGS
extra
extra

MAGNET COVE PROPERTY

Sample Values - USBM and USGS

	NB	TiO_2	TiO_2 (Chemical)	V_2O_5	V_2O_5 Chem.	Y	La	Total Value
	.028%	2.30%	2.23%	.063%	.095%	.011	.04%	
# /ton	.56	46	44.6	1.26	1.9	.22	.8	
						xx	o	
Value/ton	$1.56*	$3.91**	$3.79**	$ .39 x	$ .59 x			~~$6.00~~ 5.90
		2 = $3.85		2 = $.49				

* Value @ $2.80/# Columbium - 100% incentive bonus

** Value @ .085/# Est. as Rutile rate $170/ton

x Value @ .31/#

xx No value Yttium

o " " Lanthanum

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

G-C&P; P

June 11, 1952

Mr. [illegible] C. Knickerbocker
U. S. Bureau of Mines
Rolla, Missouri

Dear Mr. Knickerbocker:

Enclosed is a copy of Report [illegible]-[illegible], Part 1, by [illegible] of our spectrographic laboratory. This gives analyses for Nb, TiO_2, V_2O_5, Y, and La on 25 drill core samples from Magnet Cove, Arkansas, kindly supplied by you to Mr. V. C. Frykland, Jr., of the Geological Survey.

As you will note, the Nb content shows a good correlation with the content of TiO_2, with about 0.01[illegible] Nb for each per cent of TiO_2, on the average, although individual determinations vary somewhat with 0.007 and 0.02[illegible] as the extremes.

It is interesting to note that this corresponds to 1.[illegible] Nb for 100% TiO_2 and 1.17% for 90% TiO_2. Analysis of a rutile concentrate (TiO_2 content unknown) from Magnet Cove in our laboratory gave [illegible] Nb. No much correlation is apparent between Nb and V_2O_5, Y, or La.

We shall be very much interested in your results on these samples, and shall send you results on other samples as we obtain them.

Sincerely yours,

Enclosure

O. M. Rove, Chief
Mineral Deposits Branch

cc: [illegible]
[illegible]
Frykland
[illegible]
[illegible]
[illegible]

9-011

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

V. C. Fryklund, Jr., P. Kaiser,
M. Fleischer, and U.S. Bur. Mines

Report No. [illegible]-708, (Pt. 1) For Date June 10, 1952
Job 924 Requested by

Lot No. _____

Quantitative spectrographic analysis for Nb, Ti, V, and other minor elements in rocks from Magnet Cove, Arkansas

Plates M-428 & M-429

Lab. No.	Field No.	Core No.	Hole */	Depth
52-782	VP-RP-1	1333	B-2	1'-95'
-783	-2	1347	"	110'-115'
-784	-3	1758	B-3	27'-31'
-785	-4	1765	"	73'-79'
-786	-5	1553	BCC-2	30'-36'
-787	-6	1560	"	73'-80'
-788	-7	1561	"	80'-86'
-789	-8	1597	BCC-1	54'-60'
-790	-9	1396	E-7	48'-49.8'
-791	-10	1397	"	49.[illegible]'-52'
-792	-11	1405	"	73'-76.5'
-793	-12	1438	"	108.2'-111.4'
-794	-13	1716	F-1	10.7'-19.4'
-795	-14	1727	"	110.4-120.1'
-796	-15	1219	G-2	56'-58'
-797	-16	1234	"	115'-118'
-798	-17	1218	"	53'-56'
-799	-18	1816	G-4	135.8'-145'
-800	-19	1189	I-1	20'-26'
-801	-20	1192	"	36'-40'
-802	-21	1200	"	67'-72'
-803	-22	1911	I-1	32.5'-35.9'
-804	-23	1946	J-2	31.[illegible]'-39.4'
-805	-24	1865	J-3	33'-39'
-806	-25	1872	"	75'-82'

*/ For detailed description of location and petrology of the rocks, see Ark. Resources and Develop. Comm., Div. Geol., Bull. 16, 1950 by V. C. Fryklund, Jr., and [illegible]. F. Holbrook.

By

Geochemistry and Petrology Branch

☆ U. S. GOVERNMENT PRINTING OFFICE: 1951 - 974763

9-011

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Report No. [illegible]-305-1 For Date

Requested by

Lot No. _____

	Be	TiO_2	TiO_2 (chemical)	TiO_2 (chemical)	V_2O_5	V_2O_5 (chemical)	Y	La
52-[illegible]	.039	4.3	4.95		.065	.11	.008	.039
-783	.028	1.1	1.70		.042	.19	.025	.15
-784	.03[illegible]	2.4	2.65		.036	.	.014	.054
-785	.021	1.3	1.05		.025		.008	.029
-786	.022	2.6			.033		.006	.012
-787	.12	9.5		10.4	.021		.013	.008
-788	.02[illegible]	1.7			.032		.011	.006
-789	.0[illegible]	1.1			.028		.030	.070
-790	.041	2.7	3.20		.13	.05	.013	.033
-791	.019	2.0	2.70		.072	.10	.010	.030
-792	.015	1.2	1.35	1.1	.070	.18	.001	.031
-793	.021	1.3	2.30	1.6	.043	.08	.004	.027
-794	.020	1.[illegible]	1.10		.030		.014	.039
-795	.023	1.5	1.55		.021		.036	.020
-796	.042	2.4	2.30		.066	.07	.011	.068
-797	.022	2.6	2.30		.065	.05	.012	.042
-798	.014	1.4	1.73		.071	.05	.022	.078
-799	.037	4.1	3.79		.052	.08	.014	.055
-800	.013	1.7	.88		.098	.07	.006	.11
-801	.012	1.3	2.35		.033	.05	.010	.006
-802	.014	1.0	1.15		.022	.05	.004	.005
-803	.026	3.3	3.14		.14	.09	.008	.009
-804	.026	2.1	2.38		.024	.07	.017	.068
-805	.012	1.2	1.08		.030	.03	.006	.018
-806	.019	2.9	.62		.11	.08	.008	.013

69%/25 = .028% 57.4/25 = 2.30% 46.78/21 = 2.23% 15.69/25 = .063% 1.45/17 = .095 .286/25 = .011% .988/25 = .04

** Chemically determined TiO_2 by L. [illegible]

By Michael Fleischer
Geochemistry and Petrology Branch

☆ U. S. GOVERNMENT PRINTING OFFICE: 1951 - 974763

6/30/52 gla

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON 25, D. C.

June 27, 1952

Memorandum

To: F. L. Knouse, DMEA
Rare and Misc. Metals Division
Room 4640

From: Chief, Rare and Precious Metals Branch

Subject: Additional comments on Magnet Cove Rutile Property (DMEA-2486).

I have read the several memoranda you submitted recently on the subject docket and do not feel that this Branch should change the recommendations made in the memo, dated May 16, 1952, from Paul Zinner to L. G. Houk.

There appears to be little need for additional drilling, at this time, to indicate more reserves before a metallurgical process is developed. A program, prepared by this Branch, outlining metallurgical research to be done on the problem has been certified by DMPA. As soon as the necessary funds are made available by that agency this important research will be started.

M. H. Kline

Attachment

UNITED STATES 13771
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION

REFERENCE SLIP

DATE 6/17/52

REFERRED TO:

1. ~~M. Kline, Rm.~~ 1347
2. A.J.Kauffman, Rm. 1347
3.
4.

FOR:

....Action	....Recommendation
..X..Approval	....Record of....
....Comment	
....Conference	....Referring to....
....Consideration	
....Filing	....Ready for signature of....
....Instructions	
....Investigation	....Rewriting
....Initials	....Signature
....Mailing	....Suggestions
....Previous correspondence	....Your informtion

REMARKS: As per my conversation with Mr. Kauffman on 6/16/52. I would appreciate receiving your comments.

Check (X) before the items needing attention.

Ernest Wm. Ellis

INT.-DUP. SEC., WASH., D.C. Initial of sender jem

C
O
P
Y

MEMORANDUM

June 13, 1952

To: F. L. Knouse, DMEA

From: J. J. Norton

Subject: DMEA-2486

I am sending you herewith a copy of a letter from Olaf N. Rove. U. S. Geological Survy, to R. G. Knickerbocker, U.S.B.M., accompanied by an assay report on samples from the Magnet Cove Rutile property (DMEA-2486). Copies of these data have been sent to the field team.

/s/ J. J. Norton
J. J. Norton

June 11, 1952

Mr. R. G. Knickerbocker
U. S. Bureau of Mines
Rolla, Missouri

Dear Mr. Knickerbocker:

Enclosed is a copy of Report IWS-308, Part 1, by K. J. Murata of our spectrographic laboratory. This gives analyses for Nb, TiO_2 V_2O_5, Y, and La on 25 drill core samples from Magnet Cove, Arkansas, kindly supplied by you to Mr. V. C. Fryklund, Jr., of the Geological Survey.

As you will note, the Nb content shows a good correlation with the content of TiO_2, with about 0.013% Nb for each per cent of TiO_2, on the average, although individual determinations vary somewhat with 0.007 and 0.025 as the extremes.

It is interesting to note that this corresponds to 1.3% Nb for 100% TiO_2 and 1.17% for 90% TiO_2. Analysis of a rutile concentrate (TiO_2 content unknown) from Magnet Cove in our laboratory gave 1.3% Nb. No such correlat on is apparent between Nb and V_2O_5, Y, or La.

We shall be very much interested in your results on these samples, and shall send you results on other samples as we obtain them.

Sincerely yours,

O. N. Rove, Chief
Mineral Deposits Branch

Enclosure

cc: Kaiser
Murata
Fryklund
St. Clair
D. Gallagher
J. J. Norton

COPY

V. C. Fryklund, Jr., P. Kaiser,
M. Fleischer, and U.S. Bur. Mines

Report No. IWS-308,(Pt. 1) Date June 10, 1952
Job 924

Quantitative spectrographic analysis for Nb, Ti, V, and other miner elements in rocks from Magnet Cove, Arkansas

Plates W-428 & W-429

Lab. No.	Field No.	Core No.	Hole a/	Depth
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a/ For Detailed description of location and petrology of the rocks, see Ark. Resources and Develop. Comm., Div. Geol. Bull, 16, 1950 by B. C. Fryklund, Jr., and D. F. Holbrook.

	MB	TiO_2	TiO_2 USBM (chemical)	TiO_2 USGS (chemical) aa/	V_2O_5	V_2O_5 USBM (chemical)	Y	La
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-785	.021	1.2	1.05		.025		.008	.029
-786	.022	2.6			.098		.006	.012
-787	.12	9.5		10.4	.091		.013	.008
-788	.026	1.7			.032		.011	.006
-789	.009	1.1			.028		.020	.070
-790	.041	2.7	3.20		.13	.05	.013	.033
-791	.039	2.0	2.70		.072	.10	.010	.030
-792	.015	1.2	1.35	1.1	.070	.18	.004	.031
-793	.021	1.3	2.30	1.6	.048	.08	.004	.027
-794	.020	1.3	1.10		.030		.014	.039
-795	.023	1.5	1.55		.021		.016	.020
-796	.042	2.4	2.90		.066	.07	.011	.068
-797	.022	2.6	2.30		.085	.05	.012	.042
-798	.014	1.4	1.73		.071	.05	.022	.078
-799	.037	4.1	3.78		.052	.08	.014	.055
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-801	.012	1.3	2.35		.033	.05	.010	.006
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-805	.012	1.2	1.00		.030	.08	.006	.018
-806	.019	2.9	2.62		.11	.08	.008	.013

aa/ Chemically determined TiO_2 by L. Shapire

/s/ Michael Fleischer
Geochemistry and Petrology Branch

C
O
P
Y

June 3, 1952

Memorandum

To: F. L, Knouse, Rare and Miscellaneous Metals Division, DMEA.

From: J. J. Norton, U. S. Geological Survey.

Subject: Application DMEA-2486 for exploration of the Magnet Cove Rutile property.

Mr. Michael Fleischer of the Geochemistry and Petrology Branch of the U. S. Geological Survey has supplied data necessary to reply to your recent telephone call. Mr. Fleischer says that assays of 30 to 40 columbium samples from the Magnet Cove area will be available this week. These samples will include several from the Magnet Cove Rutile property.

The known geochemical affinity of columbium and titanium as well as the few available analyses of samples from Arkansas titanium deposits encourage the belief that exploration should be seriously considered. The only analysis of material from the Magnet Cove Rutile property is of a sample of rutile concentrate. This sample contained 1.3 percent columbium, according to spectrographic and wet chemical analytical methods.

I will forward other analytical data to you as soon as they are available. I think, however, that referral to the field team is justified on the basis of presently available information.

/s/ J. J. Norton
J. J. Norton

C
O
P
Y

May 13, 1952

Memorandum

REVIEW OF APPLICATION DMEA-2486 (columbium)

To: Ernest W. Ellis, Defense Minerals Exploration Administration
From: J. J. Norton, U. S. Geological Survey
Commodity: Columbium.
Applicant: Arkansas Resources and Development Commission.
Name of property: Magnet Cove Rutile.
Location of property: Magnet Cove, Arkansas.
Estimated cost of project: $50,550.
Summary of applicant's proposal:

Stage 1: Determine columbium content of cores from past U. S. Bureau of Mines drilling on this property.

Stage 2: 6,200 feet of diamond drilling to determine: a) extension in depth of mineralized rocks, b) columbium content in areas not tested by U. S. Bureau of Mines or others, c) subsurface structure.

Sources of information on applicant's property:

1. Frylund, V. C., and Holbrook, D. F., Arkansas Division of Geology Bull. 16.

2. Various U. S. Geological Survey memoranda on studies of this area during the past few months. Copies are in possession of the field team.

3. U. S. Geological Survey report in preparation by V. C. Fryklund on columbium in the Magnet Cove area. Field work was completed in March 1952, and the report is now being written.

4. Conversations with V. C. Fryklund and David Gallagher, executive officer of the field team.

Comments:

1. I have been told that DMEA has decied that state government organizations such as the Arkansas Resources and Development Commission can receive exploration grants. If such a decision has not been made, then this problem should be settled before proceeding further.

2. Several properties in the Magnet Cove area, including the property covered by this application, appear to offer promise as columbium sources. Columbium might be obtainable as a by-product of proposed rutile and brookite mining in such places as the Magnet Cove Rutile mine and other properties described in the Fryklund-Holbrook bulletin. Study of various localities in this area is part of the columbium program that the Geological Survey has started, and we hope to have a preliminary report soon. Samples that are being analyzed include surface samples as well as material from the U. S. Bureau of Mines drill holes at the Magnet Cove Rutile property. The results of these analyses will cast light on the merit of further work on columbium in this deposit.

3. Available data show clearly that the Magnet Cove Rutile property would be chiefly a rutile source, and any columbium obtained would be a by-product. Studies of the columbium content and columbium mineralogy in the drill cores collected by the Bureau of mines will be of value; but the merit of doing more drilling cannot be judged until work on samples already available shows that the columbium is actually worth recovery as a by-product of rutile.

4. The feasibility of obtaining columbium fromthis property is directly dependent on the likelihood that the rutile can be profitably mined and milled. The Bureau of Mines station at Rolla, Missouri, probably has data on the milling methods that might be used. Grade and reserves are probably adequate, but unfortunately satisfactory recovery and cost.

estimates cannot be made with available data. Frykland and Holbrook point out, on page 36 of their report, that a portion of the titanium in the igneous rocks, where it occurs as ilmenite, probably is not economically recoverable. Unfortunately, the assay data make no distinction between titanium in ilmenite and titanium in rutile. More comple information can be obtained only be a resampling job in which the rutile-bearing rocks are treated separately from the ilmenite-bearing rocks.

5. The drilling proposed by the applicant is generally satisfactory. Frykland states that reserves may be substantially increased if the holes are drilled to a depth of 250 to 300 feet. Furthermore, he recommends that additional holes be drilled south of the previously explored area, especially (1) south of the East pit, and (2) between W 200 and E 1300, along a line that is approximately at S 200 or S 300. On the other hand, he recommends elimination of the applicant's proposed holes at (1) N 1000, E 1000, (2) N 1000, E 1200, (3) N 800, E 400, (4) N 400, E 1600 and (4) N 400, E 2000.

6. The Arkansas Resources and Development Commission is considering submitting at least one more application on columbium.

7. The number of assays required for these projects will be large, and spedial assistance may be required to obtain adequate analytical facilities.

RECOMMENDATION:

If the Arkansas Resources and Development Commission is eligible for DMEA assistance, refer the docket to the field team to attempt to work out a suitable program with the applicant.

J. J. Norton

Norton:jeh
G-5/13/52
cc: Director's Reading File 4212
Branch Reading file 4212
DMEA files
Norton G-230

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : F. L. Nouse, DMEA

DATE: June 13, 1952

FROM : J. J. Norton

SUBJECT: DMEA-2486

I am sending you herewith a copy of a letter from Olaf N. Rove, U. S. Geological Survey, to R. G. Knickerbocker, U.S.B.M., accompanied by an assay report on samples from the Magnet Cove Rutile property (DMEA-2486). Copies of these data have been sent to the field team.

J J Norton

J. J. Norton

FILE COPY
SURNAME:
700

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

JUN 4 1952

Mr. Charles [illegible] Owens, Executive Director
Arkansas Resources and Development Commission
104 State Capitol Building
Little Rock, Arkansas

[illegible] Docket No. [illegible]-2[illegible]5 ([illegible])
Magnet Cove [illegible]
[illegible] Grid [illegible]

Dear Mr. Owens:

Your application for an extension in exploring the captioned property is being reviewed by the [illegible] and local [illegible] Division of the Defense Minerals Exploration Administration.

The work proposed under [illegible] your application [illegible] or calendar [illegible] of time drilling, [illegible] survey. The results of this [illegible] available to this group within the next two or three weeks. Upon receipt of the analyses of the [illegible] further consideration in your application.

Sincerely yours,

SIGNED

[illegible], Chief
[illegible] Division

Filenouse/jem
6/4/52
cc to: Adm. Reading File
Docket
Messrs. [illegible] Goodleman-1347
J.J. Horton-G-232
Andrew Ellis
Olaf Rove-4214
Paul Zimmer-3610
[illegible] Kline-1343
Field Team, Region VI (2)

6/3/52 gla

IN REPLY REFER TO:

G-MD-JJN

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

June 3, 1952

Memorandum

To: F. L. Knouse, Rate and Miscellaneous Metals Division, DMEA.

From: J. J. Norton, U. S. Geological Survey.

Subject: Application DMEA-2486 for exploration of the Magnet Cove Rutile property.

Mr. Michael Fleischer of the Geochemistry and Petrology Branch of the U. S. Geological Survey has supplied data necessary to reply to your recent telephone call. Mr. Fleischer says that assays of 30 to 40 columbium samples from the Magnet Cove area will be available this week. These samples will include several from the Magnet Cove Rutile property.

The known geochemical affinity of columbium and titanium as well as the few available analyses of samples from Arkansas titanium deposits encourage the belief that exploration should be seriously considered. The only analysis of material from the Magnet Cove Rutile property is of a sample of rutile concentrate. This sample contained 1.3 percent columbium, according to spectrographic and wet chemical analytical methods.

I will forward other analytical data to you as soon as they are available. I think, however, that referral to the field team is justified on the basis of presently available information.

J. J. Norton

J. J. Norton

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JUN 4 1952

5/28/52 gla

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON 25, D. C.

May 26, 1952

Memorandum

To: F. L. Knouse, DMEA
Room 4640

From: A. J. Kauffman, Jr., Acting Chief,
Rare and Precious Metals Branch

Subject: DMEA - Docket No. 2486, Magnet Cove, Ark.

A joint comment was prepared, on the subject docket, by the Light Metals Branch and Rare and Precious Metals Branch. It is agreed that it would be desirable to have the Bureau conduct metallurgical research to determine the feasibility of recovering the columbium and titanium from the material. We have a proposal for a columbium-tantalum research program before DMPA at the present time. Investigation of the Magnet Cove material is included. You may care to acquaint DMPA with your interest in the program.

A. J. KAUFFMAN, JR.

5/20/52 glu

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON 25, D. C.

May 16, 1952

Memorandum

To: Lawrence G. Houk
DMEA, Room 4637

From: Chief, Minerals Division

Subject: DMEA-Docket No. 2486 - Arkansas Resources and Development Commission

The subject application, concerned with the determination of columbium in titanium minerals at the Magnet Cove, Arkansas, deposit, has been reviewed with the following comments.

The first phase of the subject application as shown on page 7 appears to be a duplication of work currently being carried out by the Bureau of Mines and the U. S. Geological Survey. The Survey is checking the distribution of columbium in various minerals including the titanium bearing ores of the Magnet Cove deposit and, in cooperation with the Bureau, is sampling and analyzing the drill cores previously obtained by the Bureau in the Magnet Cove deposit.

The Bureau has conducted exploration in the Magnet Cove area and in nearby areas and has determined the nature of the minerals present. The main problem now is a metallurgical problem requiring research to determine the feasibility of recovering columbium and titanium. The Rolla, Missouri, laboratories have initiated a project to do this research. Additional drilling at this time would not contribute to the solution of this problem. Incidently, the columbium content in the titanium concentrates present in residues obtained from processing of Arkansas bauxite is reported to be higher than that reported in rutile. Confirmation of these results would indicate that initial metallurgical testing should be done on the bauxite residues.

PAUL ZINNER

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
MAY 20 1952

Attachment

5/20/52 gla

MAGNET COVE TITANIUM CORP.
308 BOYLE BUILDING
TELEPHONE 5-7168
LITTLE ROCK, ARKANSAS

May 15, 1952

Mr. C. E. Mittendorf
Acting Chief
Defense Mineral Exploration Administration
Washington, D. C.

DMEA-2486

Dear Mr. Mittendorf:

First, permit me to thank you for your most courteous interview Tuesday morning, pertaining to Columbium and Titanium (Rutile).

My understanding is that the U. S. Bureau of Mines of Rolla, Mo., and the U. S. Geological Survey of Washington, D.C. are now making analyses of the 400 cores that were taken from this property in 1948, when the Bureau of Mines of Rolla drilled 27 holes from 25 feet to 188 feet in depth.

It was my understanding that the U. S. Geological Survey found that some of the ore from this property contained at least one-half of one per cent of Columbium. It is also my understanding that if that amount is found consistently, along with Titanium, that the Government is vitally interested in seeing that it is eventually made available to be used as an alloy with stainless steel in the construction of jet bombers.

Our group is well pleased with the manner in which the U. S. Geological Survey have handled the application made by the Resources Board of Arkansas, through its Geology Department; in other words, we know it takes time for it to be cleared in Washington and referred to its Joplin office. Frankly, I have always marveled at the work that is actually turned out by the U. S. Bureau of Mines and the U. S. Geological Survey, as I have felt that each agency has always been limited in its finances and manpower to do the kind of job that they would like to do.

I had the pleasure of discussing this general program with Mr. Robert R. Rose, Jr., Assistant Secretary for Mineral Resources, and also with Mr. Howard Young of DMPA. They are both impressed with the possibility of finding enough Columbium to justify the Government's support of this project.

I was told that Columbium was now more critical and urgent than Uranium. I do hope that you can find time to discuss this very important proposed exploration project with Mr. Young and Mr. Rose.

There is no pressure back of my visit with you or in this letter as I feel under the circumstances U. S. Geological Survey has done a good job. Any courtesy that you can extend in following through pertaining to this application will be greatly appreciated.

Defense Mineral Exploration Administration
MAY 19 1952

Again thank you!

Sincerely yours,

Thank you Miss Wheeler.

C. H. Scott

C. H. Scott

UNITED STATES 13771
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION

REFERENCE SLIP

DATE MAY 19 1952

REFERRED TO:
1. Code 100
2.
3.
4. Mr. Krause

DMEA-2486

FOR:

.....Action	.....Recommendation
.....Approval	.....Record of.....
.....Comment	.....Referring to.....
.....Conference	.....Ready for signature of.....
.....Consideration	.....Rewriting
.....Filing	.....Signature
.....Instructions	.....Suggestions
.....Investigation	.....Your informtion
.....Initials	
.....Mailing	
.....Previous correspondence	

REMARKS: Copy for [illegible] sent to Mr. Krause.
J.L.M.

Check (X) before the items needing attention.

ROBERT E. ADAMS
Initial of sender

INT.-DUP. SEC., WASH., D.C.

5/14/52 gla

IN REPLY REFER TO:

G-MD-JJN

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

May 13, 1952

Memorandum

REVIEW OF APPLICATION DMEA-2486 (columbium)

To: Ernest W. Ellis, Defense Minerals Exploration Administration
From: J. J. Norton, U. S. Geological Survey
Commodity: Columbium.
Applicant: Arkansas Resources and Development Commission.
Name of property: Magnet Cove Rutile.
Location of property: Magnet Cove, Arkansas.
Estimated cost of project: $50,550.
Summary of applicant's proposal:

Stage 1: Determine columbium content of cores from past U. S. Bureau of Mines drilling on this property.

Stage 2: 6,200 feet of diamond drilling to determine: a) extension in depth of mineralized rocks, b) columbium content in areas not tested by U. S. Bureau of Mines or others, c) subsurface structure.

Sources of information on applicant's property:

1. Fryklund, V. C., and Holbrook, D. F., Arkansas Division of Geology Bull. 16.

2. Various U. S. Geological Survey memoranda on studies of this area during the past few months. Copies are in possession of the field team.

3. U. S. Geological Survey report in preparation by V. C. Fryklund on columbium in the Magnet Cove area. Field work was completed in March 1952, and the report is now being written.

4. Conversations with V. C. Fryklund and David Gallagher, executive officer of the field team.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
MAY 14 1952

7-20-82

J. T. Norton:
Reports 150 Samples
are in C.B.G.S.
Feb. analysis
analysis — 30-40
Samples are expected
to be completed
within 2 weeks

Comments:

1. I have been told that DMEA has decided that state government organizations such as the Arkansas Resources and Development Commission can receive exploration grants. If such a decision has not been made, then this problem should be settled before proceeding further.

2. Several properties in the Magnet Cove area, including the property covered by this application, appear to offer promise as columbium sources. Columbium might be obtainable as a by-product of proposed rutile and brookite mining in such places as the Magnet Cove Rutile mine and other properties described in the Fryklund-Holbrook bulletin. Study of various localities in this area is part of the columbium program that the Geological Survey has started, and we hope to have a preliminary report soon. Samples that are being analyzed include surface samples as well as material from the U. S. Bureau of Mines drill holes at the Magnet Cove Rutile property. The results of these analyses will cast light on the merit of further work on columbium in this deposit.

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4. The feasibility of obtaining columbium from this property is directly dependent on the likelihood that the rutile can be profitably mined and milled. The Bureau of Mines station at Rolla, Missouri, probably has data on the milling methods that might be used. Grade and reserves are probably adequate, but unfortunately satisfactory recovery and cost

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5. The drilling proposed by the applicant is generally satisfactory. Fryklund states that reserves may be substantially increased if the holes are drilled to a depth of 250 to 300 feet. Furthermore, he recommends that additional holes be drilled south of the previously explored area, especially (1) south of the East pit, and (2) between W 200 and E 1300, along a line that is approximately at S 200 or S 300. On the other hand, he recommends elimination of the applicant's proposed holes at (1) N 1000, E 1000, (2) N 1000, E 1200, (3) N 800, E 400, (4) N 400, E 1600, and (5) N 400, E 2000.

6. The Arkansas Resources and Development Commission is considering submitting at least one more application on columbium.

7. The number of assays required for these projects will be large, and special assistance may be required to obtain adequate analytical facilities.

RECOMMENDATION:

If the Arkansas Resources and Development Commission is eligible for DMEA assistance, refer the docket to the field team to attempt to work out a suitable program with the applicant.

J. J. Norton

J. J. Norton

Form MF-103
(Revised June 1951)

UNITED STATES DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

Budget Bureau No. 42-R1035.1.

MF-103 Should Be Filed With General Technical Data Form MF-100

APPLICATION FOR AID FOR AN EXPLORATION PROJECT PURSUANT TO MINERAL ORDER 5, UNDER DEFENSE PRODUCTION ACT OF 1950

Not To Be Filled in by Applicant

Docket No. DMEA-2486
Metal or Mineral
Date Received 4-15-52
Amount $
Participation (Government %)

Arkansas Resources & Development Commission
104 State Capitol Building
Little Rock, Arkansas

Name and address of applicant

Date April 2, 1952

If you have already filed MF-100, give date filed _____, type of assistance requested _____,

DMA Docket Number (if available) _____

INSTRUCTIONS

Read Mineral Order 5, Regulations Governing Government Aid in Defense Projects, before completing this application. Submit four copies each, of the signed application form, General Technical Data Form MF-100, and answers to questions as specified, to Defense Minerals Administration, Department of the Interior, Washington 25, D. C., or to the nearest field executive office thereof, with your name and address on each sheet of the application and all accompanying papers. If you have previously filed MF-100, it is not necessary to file it again. However, you should indicate in space provided above the type of assistance previously applied for (loans, procurement contracts, etc.) and DMA Docket Number, if available. *When a question is inapplicable it should be so stated in the form.* Additional sheets should be attached in answering any questions or in supplying additional information. IF YOU CANNOT ANSWER A QUESTION, SO STATE.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
APR 15 1952

1. (*a*) Give a description of the real property that will be in any way involved in the exploration project, including any existing mine or operating property.

   (*b*) If you are not the owner of the property, submit a copy of the lease, purchase option, or other agreements under which you are authorized to operate the property with each copy of your application.

   (*c*) Give the legal description of the exact parcel, plot, or area upon which the exploration is to be conducted.

   NOTE: (1) If both areas are the same, so state. The only obligation to repay the Government is from the net earnings from any commercial discovery made in the area specified in (*c*) above in which the exploration is to be conducted, and the expenditure of funds which may be charged as costs of the project must be limited to that area or to work necessary to perform the exploration in that area.

   (2) If applicant is not the owner of the property or if there are any liens or encumbrances against the property, copy of agreements of claimants, lienors, encumbrances, and lessors subordinating their interests in the property to the interest of the Government under the Exploration Project Contract will be required for attachment to the Contract.

2. (*a*) What metals or minerals do you expect to find?

   (*b*) Furnish statement of the geologic features of your property, giving type of ore deposit and reasons for expecting to find commercial ore bodies. Illustrate with maps or sketches. If you have a geologic or engineering report, or assay maps showing width and grade, please send them with application, stating whether or not you wish to have them returned.

The information requested in questions 3, 4, 5, 6, 7, 8, and 9 below should be answered specifically and in detail, as this information will be attached to and incorporated as part of the Exploration Project Contract, if such contract is entered into with you by the Government.

ANSWER EACH QUESTION ON SEPARATE SHEETS OF PAPER AND SUBMIT A COPY OF EACH ANSWER FOR EACH COPY OF YOUR APPLICATION.

3. (*a*) Describe fully the proposed work and give the total cost of the project.

   (*b*) State the time required to start the project and to complete it.

4. Submit a map or sketch of the property involved showing a plan (and cross section, if needed) of the present mine workings and the *location of the proposed exploration work* as related to geologic features, such as contacts, veins, ore-bearing beds, etc.

5. Furnish an itemized list of existing facilities, buildings, installations, and fixtures with a statement of the cost of any necessary rehabilitation or repairs to put into useful and operable condition.

6. Furnish a detailed list of additional facilities, buildings, and fixtures to be purchased, installed, or erected by you, with the estimated cost of each item.

7. Furnish a detailed list of operating equipment, separated into items to be—

   (*a*) Rented

   (*b*) Purchased

   (*c*) Furnished by you

   with the rental, purchase price, or depreciation of each item, as the case may be, to be charged as a cost of the project.

8. Furnish an itemized schedule of labor, by numbers and classes (miners, muckers, etc.) and of supervisors by numbers and positions, with the maximum wages or salaries to be paid to each.

9. Furnish a detailed list with estimated cost of each item for materials, supplies, engineering, assaying, accounting, power, water, utilities, and any other items not provided for above.

10. (*a*) How much are you prepared to invest in the proposed project?

    (*b*) Is this amount sufficient to pay your part of the cost of the project, in accordance with the regulations on Government participation (Sec. 9 of MO–5)?

11. State any conditions or circumstances regarding the property not sufficiently brought out by the foregoing questions.

CERTIFICATION

The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this form and accompanying papers is correct and complete to the best of their knowledge and belief.

State of Arkansas,
Arkansas Resources & Development Commission

(Name of company)

By Chas R Bowers
(Signature of authorized official)

Charles R. Bowers
Executive Director
Arkansas Resources & Development Commission

April 2, 1952
(Date)

(Title)

Title 18, U. S. Code (Crimes), Section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE 16—64067-2

1. (a)

LANDS OWNED IN FEE BY MAGNET COVE
RUTILE COMPANY

Part of the Southwest Quarter (SW¼) of the Northwest Quarter (NW¼) of Section Seventeen (17), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Southwest corner of said Southwest Quarter (SW¼) of the Northwest Quarter (NW¼) of Section 17, thence North along the West line of the said tract 1146 feet, thence North 75 degrees East 378 feet, thence South 61 degrees East 264 feet, thence South 61 degrees West 200 feet, thence South 20 degrees and 30 minutes East 170 feet, thence North 80 degrees East 370 feet, thence South 20 degrees and 30 minutes East to a point 132 feet North of the South line of the said tract and 395½ feet West of the East line of the said tract, thence East parallel with the South line of the said tract 395½ feet to the East line, thence South along the East line of said tract 132 feet to the Southeast corner of the Southwest Quarter (SW¼) of the Northwest Quarter (NW¼) of Section 17, Township 3 South, Range 17 West, thence West along the South line of the said tract to the Southwest corner to the point of beginning.

Part of the South Half (S½) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Northwest corner of said South Half (S½) of Section 18, thence East along the North line thereof 2742 feet, thence South parallel with the East line of the Southwest Quarter (SW¼) of Section 18, 1670 feet to the Northeast corner of the tract of land now owned by J. W. Kimzey, thence West parallel with the South side of said Section 2664 feet to a point on the West line of said Section that is 990 feet North of the Southwest corner thereof, thence North along the West line of Section 18 to the point of beginning, with the exception of ten acres described as follows: Beginning at a point 990 feet North and 283 feet East of the Southwest corner of Section 18, thence North 30 degrees and 30 minutes East 918 feet, thence East parallel with the South line of said Section 474.5 feet, thence South 30 degrees and 30 minutes West 918 feet, thence West 474.5 feet to the point of beginning.

Part of the South Half (S½) of the Southwest Quarter (SW¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Southwest corner of said tract, thence East along the South line of said Section 1345.5 feet to the Southwest corner of the land now owned by J. W. Kimzey, thence North 990 feet, thence West 1343.5 feet to the West line of said Section, thence South 990 feet to the point of beginning.

The Southeast Quarter (SE¼) of the Southeast Quarter (SE¼) of Section Thirteen (13), Township Three (3) South, Range Eighteen (18) West.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

1. (a) (Continued)

LEGAL DESCRIPTION OF PROPERTY
AS DESCRIBED IN MINERAL LEASE

The Northeast Quarter (NE¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, containing 160 acres, more or less; the Fractional East Half (Frl. E½) of the Northwest Quarter (NW¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, containing 64.08 acres, more or less; and all that part of the East Half (E½) of the Southeast Quarter (SE¼) and all that part of the East Half (E½) of the West Half (W½) of the Southeast Quarter (SE¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, lying North and West of Cove Creek, containing 82.32 acres, more or less; Hot Spring County, Arkansas, containing in all 306.4 acres, more or less.

1. (b)

See attached sheet numbered page 3.

1. (c)

The area upon which the exploration is to be conducted is the same as that described in 1 (a) above. Attached sheets (numbered pages 4 and 5) are properly authenticated "owner's consent to lien" forms.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

Exploration Permit

The Magnet Cove Titanium Corporation, being the owner in fee of 207 acres in Hot Spring County, Arkansas, described as:

> part of the S½ of the NW¼ of section 17, T. 3S, R. 17W, 21 acres;
>
> the west 2742 feet of S½ of section 18, T. 3S, R. 17W except the E 1320.5 feet of the S 990 feet thereof and except 10 acres;
>
> the SE¼ of the NW¼ of section 13, T. 3S, R. 18W;

and being the lessee of the mineral rights on a contiguous tract of land consisting of 306 acres, owned by the Rutherford Estate, described as:

> the NW¼; N½ SW¼; and part of the SE¼; all in section 18, T. 3S, R. 17W;

do grant for the period of one year to the State of Arkansas, Resources & Development Commission, Division of Geology, a permit to carry on such exploration as they deem necessary to determine the nature and extent of rocks and minerals at or beneath the surface of the above described fee and leased property. It is understood that in granting this permit, said Division of Geology is authorized to apply for financial assistance from the Federal Government to this exploration, in accordance with provisions establishing the Defense Minerals Exploration Administration of the Department of Interior. In the event that financial assistance is obtained from the D.M.E.A. the above mentioned Division of Geology, under the terms of this permit, are authorized to carry out all phases of exploration provided in any agreements they make with the D.M.E.A. concerning the above described properties.

ARKANSAS RESOURCES AND
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STATE CAPITOL
LITTLE ROCK, ARKANSAS

The Division of Geology, acting for the State of Arkansas, Resources & Development Commission, agrees to diligently explore the above described tracts, within the limits of its facilities and to promptly apply for financial assistance from the D.M.E.A. to carry on exploration to determine nature and extent of the minerals and ores occurring on or below the subject properties. It further agrees to furnish the grantors of this permit complete records of the results of all exploration performed under this permit.

It is further agreed between the parties that this permit can only be cancelled (prior to its normal expiration, one year from date) by notice in writing delivered thirty days in advance of date on which the cancellation is to take effect. In the event that an exploration contract with the D.M.E.A. is in effect at the time of cancellation date it is understood by both parties that an agreement satisfactory to the D.M.E.A., to terminate such contract must be reached before the cancellation shall become effective.

C. H. Scott Pres.

C. H. Scott, President
Magnet Cove Titanium Corporation

March 20, 1962

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

OWNER'S CONSENT TO LIEN

WHEREAS, the undersigned, as owner, co-owner, lessor, or seller has an interest in certain property in the State of _____, County of HOT SPRING, which is the subject of a proposed Exploration Project Contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government", and

~~The State of Arkansas, Arkansas Resources~~ & Development Commission

hereinafter called the "Operator"; and

WHEREAS, under certain provisions of said Contract which are set forth on the reverse side hereof, the Government will acquire certain rights and equities which do or may conflict with or be adverse to the interest of the undersigned in said property;

NOW THEREFORE, the undersigned, in consideration of said Contract and as an inducement to the Government and Operator to enter into same, undertakes and agrees as follows:

1. The Government's equity in and right to remove facilities, buildings, fixtures, and equipment, as provided in the Contract, shall prevail over and be prior and superior to any conflicting or adverse rights of the undersigned.

2. The Government's percentage royalty on net smelter returns or other net proceeds realized from ore, concentrates, or metal produced within ten (10) years from the date of the Contract, and the Government's lien for the payment of said percentage royalty shall attach to the mineral deposit and the production therefrom, in the amount of the Government's contribution, not in excess of $50,000.00 (fifty thousand dollars), all upon the terms and conditions set forth in said Contract.

3. The undersigned shall commit no act nor assert any claim that may contravene or conflict with the lien, claim, or rights of the Government under the provisions of the said Contract. This agreement shall be binding upon the heirs, executors, administrators, successors, and assigns of the undersigned.

Dated this second day of April, 1952.

C. D. Scott Pres.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION of GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

OWNER'S CONSENT TO LIEN

WHEREAS, the undersigned, as owner, co-owner, lessor, or seller has an interest in certain property in the State of ARKANSAS, County of HOT SPRING, which is the subject of a proposed Exploration Project Contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government", and

~~The State of Arkansas, Arkansas Resources & Development Commission~~

hereinafter called the "Operator"; and

WHEREAS, under certain provisions of said Contract which are set forth on the reverse side hereof, the Government will acquire certain rights and equities which do or may conflict with or be adverse to the interest of the undersigned in said property;

NOW THEREFORE, the undersigned, in consideration of said Contract and as an inducement to the Government and Operator to enter into same, undertakes and agrees as follows:

1. The Government's equity in and right to remove facilities, buildings, fixtures, and equipment, as provided in the Contract, shall prevail over and be prior and superior to any conflicting or adverse rights of the undersigned.

2. The Government's percentage royalty on net smelter returns or other net proceeds realized from ore, concentrates, or metal produced within ten (10) years from the date of the Contract, and the Government's lien for the payment of said percentage royalty shall attach to the mineral deposit and the production therefrom, in the amount of the Government's contribution, not in excess of $50,000.00 (fifty thousand dollars), all upon the terms and conditions set forth in said Contract.

3. The undersigned shall commit no act nor assert any claim that may contravene or conflict with the lien, claim, or rights of the Government under the provisions of the said Contract. This agreement shall be binding upon the heirs, executors, administrators, successors, and assigns of the undersigned.

Dated this 31st day of March, 1952.

J. H. Rutherford Estate

BY: J. E. Rutherford, Trustee

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

2. (a)

Columbium bearing minerals are the ones we expect to find.

2. (b)

A geologic report on this deposit was included in Bulletin 16 of the Division of Geology, Arkansas Resources & Development Commission, published in 1950. In this report it is described as the "Magnet Cove Rutile Company Deposit" (pages 13-41 inclusive). Plate II of this report is a geologic and topographic map of that part of the subject area described and Plate III has a series of cross sections across the old workings. Four copies of the above-mentioned Bulletin 16 are being submitted with this application (Bulletins are marked Exhibit A).

Preliminary sampling and testing by the U. S. Geological Survey has shown that columbium is present in this area of titanium mineralization, probably included in the rutile and brookite crystals and also possibly present in other titanium minerals in the deposit. The U. S. Geological Survey laboratories also analyzed samples of rutile concentrates from this property and found that they contained an appreciable percentage of columbium. The reports of these analyses are in the files of the U. S. Geological Survey and can be obtained from that agency to substantiate statements included in this paragraph.

ARKANSAS RESOURCES AND
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3. (a)

The purpose of this project is to determine the extent and nature of columbium mineralization on these properties. It is proposed that this be accomplished in two phases.

Phase I
(Sampling and analyzing cores from previous drilling)

This phase is to consist of sampling cores from previous U. S. Bureau of Mines drilling and the determination of the columbium content of these samples.

Cost:	Geologists (including field and traveling expenses)	$ 550
	Analysis of samples	5,000
	Total (not to exceed)	$5,550

Phase II
(New drilling and analysis)

The development of this phase will be predicated on the results of Phase I work, details being subject to the approval of the DMEA Field Team. The purpose of Phase II is to determine:

(1) The extension in depth of the mineralized area.

(2) The columbium content of ore occurring in areas not penetrated by U. S. Bureau of Mines drilling.

(3) The subsurface structure of the mineralized area.

It is also contemplated that the samples obtained during this phase will be valuable for use in ore dressing tests.

Cost:	Geologists (including field and traveling expenses)	$3,000
	Diamond drilling (6200 feet @ $5/foot)	31,000
	Sampling and analyses	10,000
	Power auger drilling as a preliminary to diamond drilling areas now covered with soil	1,000
	Total (not to exceed)	$45,000

The total cost of the project as outlined above is not to exceed $50,550.

3. (b)

It is anticipated that work can be started on the project immediately after the contracts are signed and that the work can be completed within 8 months.

ARKANSAS RESOURCES AND
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4.

A map showing the location of proposed drill hole locations is included as Exhibit B.

ARKANSAS RESOURCES AND
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LITTLE ROCK, ARKANSAS

5.

An office building and a partially dismantled mill are now on the property, but no expenditure from this project's funds will be made to repair these buildings or to put them in operable condition.

ARKANSAS RESOURCES AND
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6.

No additional facilities, buildings or fixtures will be purchased, installed or erected by us for this project.

ARKANSAS RESOURCES AND
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7. (a)

No operating equipment is to be rented.

7. (b)

No operating equipment is to be purchased.

7. (c)

Equipment to be furnished by operator:

1 Jeep mounted D-35 Mobile drill equipment with "N" drill pipe, "NX" core barrel and 3½" auger (depreciation, maintenance and fuel to be charge at $2/operating hour)

1 (or more) passenger cars or light trucks (as needed), to be charged at 4¢/mile plus gas and oil consumed.

ARKANSAS RESOURCES AND
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3.

List of supervisors and labor (includes those attached for short periods only)

1	Geologist supervisor	$400/mo.
1	(or more) Assistant Geologist	350/mo.
1	Chemist	375/mo.
1	Engineer	375/mo.
1	Manual driller	$3/hr.
2	(or more) laborers	$1/hr.

OFFICE OF TECHNICAL SERVICES
MAIL ROOM
DEPARTMENT OF COMMERCE
ALBANY, NEW YORK

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

Assaying: Present plans are for obtaining spectrographic determination of columbium in 300 samples @ approximately $50 each (total approximately $15,000). In the event that results satisfactory to the [illegible] Field Team can be obtained by analysis in our own laboratory, then the cost will be considerably reduced. Approximately $1000 for reagents and expendable items is to be provided if this latter course is followed.

Diamond drilling: A total of approximately 6200 feet of diamond core drilling is planned for the project at an estimated average cost of $5 per foot. Hole size to be programmed as NX and AX combinations. Drilling to be done essentially by contract companies. Contracts being let to qualified bidder submitting lowest sealed bid.

Drilling bits, drill pipe, auger, casing and miscellaneous hand tools for operators drill: $500
(In the event that it is more economical for operator to use his own drill on upper 50 feet of the 25 programmed holes, this amount should be increased to approximately $5,500 and the amount for contract drilling reduced).

Miscellaneous services and expendable supplies (such as sample sacks, notebooks, office and drafting supplies, blue printing, etc.): $200

Gasoline and oil (for trucks, cars and power drill furnished by operator): $500

Utilities for laboratory (in event that operator's laboratory does analytical work for this project): $50

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10. (a)

The operator is prepared to invest £6,000 in the proposed project.

10. (b)

This amount is sufficient to pay the operator's share (10%) in accordance with the regulations on Government participation.

[illegible]

ARKANSAS RESOURCES AND
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DIVISION OF GEOLOGY
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LITTLE ROCK, ARKANSAS

11.

Not applicable.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

IN REPLY REFER TO:

G-MD-JJN

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

May 13, 1952

Memorandum

REVIEW OF APPLICATION DMEA-2486 (columbium)

To: Ernest W. Ellis, Defense Minerals Exploration Administration
From: J. J. Norton, U. S. Geological Survey
Commodity: Columbium.
Applicant: Arkansas Resources and Development Commission.
Name of property: Magnet Cove Rutile.
Location of property: Magnet Cove, Arkansas.
Estimated cost of project: $50,550.
Summary of applicant's proposal:

Stage 1: Determine columbium content of cores from past U. S. Bureau of Mines drilling on this property.

Stage 2: 6,200 feet of diamond drilling to determine: a) extension in depth of mineralized rocks, b) columbium content in areas not tested by U. S. Bureau of Mines or others, c) subsurface structure.

Sources of information on applicant's property:

1. Fryklund, V. C., and Holbrook, D. F., Arkansas Division of Geology Bull. 16.

2. Various U. S. Geological Survey memoranda on studies of this area during the past few months. Copies are in possession of the field team.

3. U. S. Geological Survey report in preparation by V. C. Fryklund on columbium in the Magnet Cove area. Field work was completed in March 1952, and the report is now being written.

4. Conversations with V. C. Fryklund and David Gallagher, executive officer of the field team.

Comments:

1. I have been told that DMEA has decided that state government organizations such as the Arkansas Resources and Development Commission can receive exploration grants. If such a decision has not been made, then this problem should be settled before proceeding further.

2. Several properties in the Magnet Cove area, including the property covered by this application, appear to offer promise as columbium sources. Columbium might be obtainable as a by-product of proposed rutile and brookite mining in such places as the Magnet Cove Rutile mine and other properties described in the Fryklund-Holbrook bulletin. Study of various localities in this area is part of the columbium program that the Geological Survey has started, and we hope to have a preliminary report soon. Samples that are being analyzed include surface samples as well as material from the U. S. Bureau of Mines drill holes at the Magnet Cove Rutile property. The results of these analyses will cast light on the merit of further work on columbium in this deposit.

3. Available data show clearly that the Magnet Cove Rutile property would be chiefly a rutile source, and any columbium obtained would be a by-product. Studies of the columbium content and columbium mineralogy in the drill cores collected by the Bureau of Mines will be of value; but the merit of doing more drilling cannot be judged until work on samples already available shows that the columbium is actually worth recovery as a by-product of rutile.

4. The feasibility of obtaining columbium from this property is directly dependent on the likelihood that the rutile can be profitably mined and milled. The Bureau of Mines station at Rolla, Missouri, probably has data on the milling methods that might be used. Grade and reserves are probably adequate, but unfortunately satisfactory recovery and cost

estimates cannot be made with available data. Fryklund and Holbrook point out, on page 36 of their report, that a portion of the titanium in the igneous rocks, where it occurs as ilmenite, probably is not economically recoverable. Unfortunately, the assay data make no distinction between titanium in ilmenite and titanium in rutile. More complete information can be obtained only by a resampling job in which the rutile-bearing rocks are treated separately from the ilmenite-bearing rocks.

5. The drilling proposed by the applicant is generally satisfactory. Fryklund states that reserves may be substantially increased if the holes are drilled to a depth of 250 to 300 feet. Furthermore, he recommends that additional holes be drilled south of the previously explored area, especially (1) south of the East pit, and (2) between W 200 and E 1300, along a line that is approximately at S 200 or S 300. On the other hand, he recommends elimination of the applicant's proposed holes at (1) N 1000, E 1000, (2) N 1000, E 1200, (3) N 800, E 400, (4) N 400, E 1600, and (5) N 400, E 2000.

6. The Arkansas Resources and Development Commission is considering submitting at least one more application on columbium.

7. The number of assays required for these projects will be large, and special assistance may be required to obtain adequate analytical facilities.

RECOMMENDATION:

If the Arkansas Resources and Development Commission is eligible for DMEA assistance, refer the docket to the field team to attempt to work out a suitable program with the applicant.

J. J. Norton

Norton:jeh
G-5/13/52
cc: Director's Reading file 4212
Branch Reading file 4212
DMEA files
Norton G-230

EXPLORATION

Subject: DMEA-2486
Re: Exploration Loan
Magnet Cove
April 15, 1952

Mr. Charles R. Bowers
Arkansas Resources & Development
Company
104 State Capitol Building
Little Rock, Arkansas

My dear Mr. Bowers:

This will acknowledge receipt of your application dated April 2, 1952 for a loan under the Defense Production Act of 1950.

Your application was assigned Docket Number DMEA-2486 and referred to the Rare and Miscellaneous Metals Division.

Kindly refer to DMEA-2486 in any future correspondence relating to your application.

Sincerely yours,

ROBERT E. ADAMS

Robert E. Adams
Administrative Officer

7862

Form MF-100
(May 1951)

U. S. DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

Form approved.
Budget Bureau No. 42-R1026.

GENERAL TECHNICAL DATA
FOR USE UNDER THE
DEFENSE PRODUCTION ACT OF 1950

NOT TO BE FILLED IN BY APPLICANT

Docket No. DMEA-2486

Date received 4-15-52

Arkansas Resources & Development Commission
10h State Capitol Building
Little Rock, Arkansas

Name and address of applicant

Date April 2, 1952

INSTRUCTIONS

This form is to be filed with Defense Minerals Administration, Department of the Interior, Washington 25, D. C. It should be accompanied by appropriate application form when a specific type of Government assistance is requested, in the form of (1) loan, (2) purchase contract, (3) Government guarantee of a private loan, (4) priorities or allocation of mining equipment, and maintenance, repair and operating supplies, and (5) other forms of Government assistance that might arise under the Act. Submit four (4) signed copies of the form and accompanying papers. Name and address should be stamped or typed on each sheet of this form and all accompanying papers. *When a question is inapplicable it should be so stated on the form.* Additional sheets may be attached in answering any questions or in supplying additional information. (IF YOU CANNOT ANSWER A QUESTION, SO STATE.) If a question is answered elsewhere indicate where answered. It is not necessary to answer it again.

GENERAL TECHNICAL DATA

Supply the following information on separate sheets, arranged, numbered, and lettered as indicated:

1. Materials produced:
   (*a*) What are the chief mine, mill, or smelter products? Not applicable.
   (*b*) What are the byproducts, if any?

*2. Name(s) and type(s) of mine(s), mill(s), smelter(s), refinery(ies), pit(s), quarry (ies), drilling operation(s). Include old names of property, if any. Show extent of workings, including the following:
   (*a*) Linear feet of shafts.
   (*b*) Linear feet of drifts and crosscuts.
   (*c*) Linear feet of tunnels or adits.
   (*d*) Linear feet of other mine openings (explain briefly).
   Indicate whether mine is flooded or not. Describe any pumping problems. Give size or productive capacity.

*3. For each operation listed above supply the following:
   (*a*) Distance and direction from nearest town and shipping point.
   (*b*) Mining district.
   (*c*) Township, Section, Range.
   (*d*) County, State.

4. (*a*) State whether or not property is now in operation, and if in operation, by whom operated.
   (*b*) Are you operating this property as: Property is not in operation.
   ☐ Owner.
   ☐ Lessee.
   ☐ Contractor.

5. Number of years in production 12
   If not in production or operation, estimated date when production will begin Not known

6. Experience of operators:
   Describe the mining and general business experience of (*a*) the applicant, and (*b*) the person or persons who manage the project. Not applicable (project under management of the State Geologist's office.)

7. History:
   *(*a*) Give a statement, as complete as possible, of previous exploration, development, operation, and production of property, with reasons for suspension of operation.
   *(*b*) State briefly the known history and production of adjoining and neighboring properties.
   (*c*) Furnish any available (private) reports that may apply to this application, including results of mine examinations, recommended exploration and development, and metallurgical investigations.

* See Exhibit A of accompanying DMEA application.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
APR 15 1952

8. Names and addresses of Officers, Directors, or Partners, and in addition thereto, the five largest stockholders if applicant is a corporation.

Not applicable (Applicant is an agency of the State of Arkansas)

Name and Address (a)	Official Title (If officer is also director indicate by "D") (b)	Total of Annual Salary, Commissions, Bonuses, Etc., Received From Applicant and Affiliates During Last Fiscal Year (c)	Estimated Net Worth Outside of Interest in Applicant (d)	Number of Shares Held in Applicant Corporation: Common (e)	Number of Shares Held in Applicant Corporation: Preferred (f)	Life Insurance Carried for Benefit of Applicant: Amount (g)	Life Insurance Carried for Benefit of Applicant: Net Cash Surrender Value After Loans (h)
	Total		x x x x x			x x x x x	x x x x x

If more lines are needed continue on separate sheet.

9. Capital Stock Issues: Not applicable (see D above)

For Corporate Applicants

Item	Authorized (a)	Outstanding (b)	Par Value (c)	Number of Shares Outstanding (d)	Dividend Rate Last Paid* (e)
Common stock	$	$	$		
Preferred stock	$	$	$		

*Indicate period covered.

10. Production: None since 1944

Item	Kind of Product (a)	1948 Total (b)	1949 Total (c)	1950 Total (d)	Present Average Monthly (e)
1. Quantity of product mined or quarried (Short, long, metric tons; barrels; pounds; etc.)					
2. Quantity of product processed (specify unit of measure and type of process)					
3. Quantity and grade of product sold or shipped (specify units of measure)					

11. Do you contemplate a change in the present average monthly rate of production? If so, state estimated maximum monthly production and basis of change. Not applicable

12. Ore or Mineral Reserves:

(a) Describe the ore or mineral deposit briefly. Accompany the application by any available report on the geology and ore reserves. The maximum known dimensions of the ore body are about 2400 feet in an east-west direction and about 1000 feet north-south (total area about 30 acres). The deepest drill hole (188 ft.) was still in rutile bearing ore. Since

16—03792-1

columbium is apparently intimately associated with the titanium minerals, there is a good possibility that the whole deposit is also columbium bearing.

(*b*) If deposit is other than placer: (Drilling not sufficient to properly determine this.)

(1) Submit assay plans and/or sections showing location and size of proved (measured) and probable (indicated) ore or mineral reserve.

(2) State the tonnage (indicate type of ton) and grade of each class of ore reserve, as above, and show how computed. Tabulated total ore reserve as follows:

TOTAL ORE OR MINERAL RESERVES

Ore or Mineral Reserve	Estimated Tons (a)	Metal or Mineral Content Per Ton (Grade) (b)	Gross Value Per Ton (c)	Recoverable Unit Value Per Ton (d)	Estimated Cost of Production Per Ton (e)
Measured (proved)					
Indicated (probable)					

(*c*) If placer: Not applicable

(1) Give estimated total yardage and average marketable mineral content of each deposit.

(2) Submit map showing location of placer deposit and surrounding area, with all test holes or pits. Submit logs of each hole and test pit with depth and average value of each.

(3) Describe gravel, stating whether fine, medium or coarse; loose, tight, cemented, or frozen, and whether it contains stumps or boulders more than 1 foot in diameter; if so, how large, and in what proportion.

(4) Describe bedrock, giving type (granite, sandstone, shale, etc.) and state whether it is hard or soft, smooth, uneven or rough.

(5) Describe overburden, stating whether loose, tight, or cemented; fine or coarse textured; furnish estimate of average thickness and total amount.

(6) Tabulate the reserves using the form outlined above for ore or mineral reserves.

13. Access Roads: See Exhibit A of accompanying DMEA application.

Give road distances to shipping, supply and residence points, stating kind and condition of roads.

14. Water Supply: Information not known.

State source and quantity of water available for operations and whether sufficient for all seasons of year.

15. Power: Not applicable.

State amount of power used, rate per hour, and source thereof.

16. Labor: Not applicable (no operation).

State number and classes (miners, muckers, millmen, etc.) of men employed during a recent representative payroll period.

17. Equipment and Facilities: Answered as question 5 of accompanying DMEA application.

Describe present equipment on the property, including buildings. (State condition.) List major pieces of equipment now owned or controlled and in serviceable condition available for this operation.

18. Are there any particular conditions or circumstances affecting your operations that are not described above? If so, explain.

CERTIFICATION

The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this form and accompanying papers is correct and complete to the best of their knowledge and belief.

State of Arkansas,
Arkansas Resources & Development Commission
(Name of company)

By Chas R. Bowers
(Signature of authorized official)
Charles R. Bowers
Executive Director
Arkansas Resources & Development Commission
(Title)

April 2, 1952
(Date)

Title 18, U. S. Code (Crimes), Section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE 16—63792-1

Form MF-100
(May 1951)

U. S. DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

Form approved.
Budget Bureau No. 42-R1026.

GENERAL TECHNICAL DATA
FOR USE UNDER THE
DEFENSE PRODUCTION ACT OF 1950

NOT TO BE FILLED IN BY APPLICANT

Docket No. DMEA-2486

Date received 4-15-52

Arkansas Resources & Development Commission
104 State Capitol Building
Little Rock, Arkansas

Name and address of applicant

Date April 2, 1952

INSTRUCTIONS

This form is to be filed with Defense Minerals Administration, Department of the Interior, Washington 25, D. C. It should be accompanied by appropriate application form when a specific type of Government assistance is requested, in the form of (1) loan, (2) purchase contract, (3) Government guarantee of a private loan, (4) priorities or allocation of mining equipment, and maintenance, repair and operating supplies, and (5) other forms of Government assistance that might arise under the Act. Submit four (4) signed copies of the form and accompanying papers. Name and address should be stamped or typed on each sheet of this form and all accompanying papers. *When a question is inapplicable it should be so stated on the form.* Additional sheets may be attached in answering any questions or in supplying additional information. (IF YOU CANNOT ANSWER A QUESTION, SO STATE.) If a question is answered elsewhere indicate where answered. It is not necessary to answer it again.

GENERAL TECHNICAL DATA

Supply the following information on separate sheets, arranged, numbered, and lettered as indicated:

1. Materials produced:
   (*a*) What are the chief mine, mill, or smelter products? Not applicable.
   (*b*) What are the byproducts, if any?

*2. Name(s) and type(s) of mine(s), mill(s), smelter(s), refinery(ies), pit(s), quarry (ies), drilling operation(s). Include old names of property, if any. Show extent of workings, including the following:
   (*a*) Linear feet of shafts.
   (*b*) Linear feet of drifts and crosscuts.
   (*c*) Linear feet of tunnels or adits.
   (*d*) Linear feet of other mine openings (explain briefly).
   Indicate whether mine is flooded or not. Describe any pumping problems. Give size or productive capacity.

*3. For each operation listed above supply the following:
   (*a*) Distance and direction from nearest town and shipping point.
   (*b*) Mining district.
   (*c*) Township, Section, Range.
   (*d*) County, State.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
APR 15 1952

4. (*a*) State whether or not property is now in operation, and if in operation, by whom operated.
   (*b*) Are you operating this property as:
   ☐ Owner.
   ☐ Lessee.
   ☐ Contractor.

   Property is not in operation.

5. Number of years in production 12
   If not in production or operation, estimated date when production will begin Not known

6. Experience of operators:
   Describe the mining and general business experience of (*a*) the applicant, and (*b*) the person or persons who manage the project. Not applicable (project under management of the State Geologist's Office.)

7. History:
   *(*a*) Give a statement, as complete as possible, of previous exploration, development, operation, and production of property, with reasons for suspension of operation.
   *(*b*) State briefly the known history and production of adjoining and neighboring properties.
   *(*c*) Furnish any available (private) reports that may apply to this application, including results of mine examinations, recommended exploration and development, and metallurgical investigations.

16—63792-2

* See Exhibit A of accompanying DMEA application.

8. Names and addresses of Officers, Directors, or Partners, and in addition thereto, the five largest stockholders if applicant is a corporation.

Not applicable (Applicant is an agency of the State of Arkansas)

Name and Address (a)	Official Title (If officer is also director indicate by "D") (b)	Total of Annual Salary, Commissions, Bonuses, Etc., Received From Applicant and Affiliates During Last Fiscal Year (c)	Estimated Net Worth Outside of Interest in Applicant (d)	Number of Shares Held in Applicant Corporation: Common (e)	Number of Shares Held in Applicant Corporation: Preferred (f)	Life Insurance Carried for Benefit of Applicant: Amount (g)	Life Insurance Carried for Benefit of Applicant: Net Cash Surrender Value After Loans (h)
	Total		x x x x x			x x x x x	x x x x x

If more lines are needed continue on separate sheet.

9. Capital Stock Issues: Not applicable (see B above)

For Corporate Applicants

Item	Authorized (a)	Outstanding (b)	Par Value (c)	Number of Shares Outstanding (d)	Dividend Rate Last Paid* (e)
Common stock	$	$	$		
Preferred stock	$	$	$		

*Indicate period covered.

10. Production: None since 1944

Item	Kind of Product (a)	1948 Total (b)	1949 Total (c)	1950 Total (d)	Present Average Monthly (e)
1. Quantity of product mined or quarried (Short, long, metric tons; barrels; pounds; etc.)					
2. Quantity of product processed (specify unit of measure and type of process)					
3. Quantity and grade of product sold or shipped (specify units of measure)					

11. Do you contemplate a change in the present average monthly rate of production? If so, state estimated maximum monthly production and basis of change. Not applicable

12. Ore or Mineral Reserves:

(a) Describe the ore or mineral deposit briefly. Accompany the application by any available report on the geology and ore reserves. The maximum known dimensions of the ore body are about 2400 feet in an east-west direction and about 1000 feet north-south (total area about 30 acres). The deepest drill hole (188 ft.) was still in rutile bearing ore. Since

16—63792-1

columbium is apparently intimately associated with the titanium minerals, there is a good possibility that the whole deposit is also columbium bearing.

(*b*) If deposit is other than placer: (Drilling not sufficient to properly determine this.)

(1) Submit assay plans and/or sections showing location and size of proved (measured) and probable (indicated) ore or mineral reserve.

(2) State the tonnage (indicate type of ton) and grade of each class of ore reserve, as above, and show how computed. Tabulated total ore reserve as follows:

TOTAL ORE OR MINERAL RESERVES

Ore or Mineral Reserve	Estimated Tons (a)	Metal or Mineral Content Per Ton (Grade) (b)	Gross Value Per Ton (c)	Recoverable Unit Value Per Ton (d)	Estimated Cost of Production Per Ton (e)
Measured (proved)					
Indicated (probable)					

(*c*) If placer: Not applicable

(1) Give estimated total yardage and average marketable mineral content of each deposit.

(2) Submit map showing location of placer deposit and surrounding area, with all test holes or pits. Submit logs of each hole and test pit with depth and average value of each.

(3) Describe gravel, stating whether fine, medium or coarse; loose, tight, cemented, or frozen, and whether it contains stumps or boulders more than 1 foot in diameter; if so, how large, and in what proportion.

(4) Describe bedrock, giving type (granite, sandstone, shale, etc.) and state whether it is hard or soft, smooth, uneven or rough.

(5) Describe overburden, stating whether loose, tight, or cemented; fine or coarse textured; furnish estimate of average thickness and total amount.

(6) Tabulate the reserves using the form outlined above for ore or mineral reserves.

13. Access Roads: See Exhibit A of accompanying DMEA application.

Give road distances to shipping, supply and residence points, stating kind and condition of roads.

14. Water Supply: Information not known.

State source and quantity of water available for operations and whether sufficient for all seasons of year.

15. Power: Not applicable.

State amount of power used, rate per hour, and source thereof.

16. Labor: Not applicable (no operation).

State number and classes (miners, muckers, millmen, etc.) of men employed during a recent representative payroll period.

17. Equipment and Facilities: Answered as question 5 of accompanying DMEA application.

Describe present equipment on the property, including buildings. (State condition.) List major pieces of equipment now owned or controlled and in serviceable condition available for this operation.

18. Are there any particular conditions or circumstances affecting your operations that are not described above? If so, explain.

CERTIFICATION

The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this form and accompanying papers is correct and complete to the best of their knowledge and belief.

State of Arkansas,
Arkansas Resources & Development Commission
(Name of company)

By Chas R Bowers
(Signature of authorized official)

Charles R. Bowers
Executive Director
Arkansas Resources & Development Commission
(Title)

April 2, 1952
(Date)

Title 18, U. S. Code (Crimes), Section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE 16—63792-1

Form MF-103
(Revised June 1951)

UNITED STATES DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

Budget Bureau No. 42-R1035.1.

MF-103 Should Be Filed With General Technical Data Form MF-100

APPLICATION FOR AID FOR AN EXPLORATION PROJECT PURSUANT TO MINERAL ORDER 5, UNDER DEFENSE PRODUCTION ACT OF 1950

Not To Be Filled in by Applicant

Docket No. DMEA-2486
Metal or Mineral
Date Received 4-15-52
Amount $
Participation (Government %)

Arkansas Resources & Development Commission
104 State Capitol Building
Little Rock, Arkansas

Name and address of applicant

Date April 2, 1952

If you have already filed MF-100, give date filed _____, type of assistance requested _____,

DMA Docket Number (if available) _____

INSTRUCTIONS

Read Mineral Order 5, Regulations Governing Government Aid in Defense Projects, before completing this application. Submit four copies each, of the signed application form, General Technical Data Form MF-100, and answers to questions as specified, to Defense Minerals Administration, Department of the Interior, Washington 25, D. C., or to the nearest field executive office thereof, with your name and address on each sheet of the application and all accompanying papers. If you have previously filed MF-100, it is not necessary to file it again. However, you should indicate in space provided above the type of assistance previously applied for (loans, procurement contracts, etc.) and DMA Docket Number, if available. *When a question is inapplicable it should be so stated in the form.* Additional sheets should be attached in answering any questions or in supplying additional information. IF YOU CANNOT ANSWER A QUESTION, SO STATE.

APR 1 8 1952

1. (*a*) Give a description of the real property that will be in any way involved in the exploration project, including any existing mine or operating property.

   (*b*) If you are not the owner of the property, submit a copy of the lease, purchase option, or other agreements under which you are authorized to operate the property with each copy of your application.

   (*c*) Give the legal description of the exact parcel, plot, or area upon which the exploration is to be conducted.

   NOTE: (1) If both areas are the same, so state. The only obligation to repay the Government is from the net earnings from any commercial discovery made in the area specified in (*c*) above in which the exploration is to be conducted, and the expenditure of funds which may be charged as costs of the project must be limited to that area or to work necessary to perform the exploration in that area.

   (2) If applicant is not the owner of the property or if there are any liens or encumbrances against the property, copy of agreements of claimants, lienors, encumbrances, and lessors subordinating their interests in the property to the interest of the Government under the Exploration Project Contract will be required for attachment to the Contract.

2. (*a*) What metals or minerals do you expect to find?

   (*b*) Furnish statement of the geologic features of your property, giving type of ore deposit and reasons for expecting to find commercial ore bodies. Illustrate with maps or sketches. If you have a geologic or engineering report, or assay maps showing width and grade, please send them with application, stating whether or not you wish to have them returned.

The information requested in questions 3, 4, 5, 6, 7, 8, and 9 below should be answered specifically and in detail, as this information will be attached to and incorporated as part of the Exploration Project Contract, if such contract is entered into with you by the Government.

ANSWER EACH QUESTION ON SEPARATE SHEETS OF PAPER AND SUBMIT A COPY OF EACH ANSWER FOR EACH COPY OF YOUR APPLICATION.

3. (*a*) Describe fully the proposed work and give the total cost of the project.

   (*b*) State the time required to start the project and to complete it.

4. Submit a map or sketch of the property involved showing a plan (and cross section, if needed) of the present mine workings and the *location of the proposed exploration work* as related to geologic features, such as contacts, veins, ore-bearing beds, etc.

5. Furnish an itemized list of existing facilities, buildings, installations, and fixtures with a statement of the cost of any necessary rehabilitation or repairs to put into useful and operable condition.

6. Furnish a detailed list of additional facilities, buildings, and fixtures to be purchased, installed, or erected by you, with the estimated cost of each item.

7. Furnish a detailed list of operating equipment, separated into items to be—

   (*a*) Rented

   (*b*) Purchased

   (*c*) Furnished by you

   with the rental, purchase price, or depreciation of each item, as the case may be, to be charged as a cost of the project.

8. Furnish an itemized schedule of labor, by numbers and classes (miners, muckers, etc.) and of supervisors by numbers and positions, with the maximum wages or salaries to be paid to each.

9. Furnish a detailed list with estimated cost of each item for materials, supplies, engineering, assaying, accounting, power, water, utilities, and any other items not provided for above.

10. (*a*) How much are you prepared to invest in the proposed project?

    (*b*) Is this amount sufficient to pay your part of the cost of the project, in accordance with the regulations on Government participation (Sec. 9 of MO–5)?

11. State any conditions or circumstances regarding the property not sufficiently brought out by the foregoing questions.

CERTIFICATION

The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this form and accompanying papers is correct and complete to the best of their knowledge and belief.

State of Arkansas,
Arkansas Resources & Development Commission
(Name of company)

By Chas. R. Bowers
(Signature of authorized official)

Charles R. Bowers
Executive Director
Arkansas Resources & Development Commission
(Title)

April 2, 1952
(Date)

Title 18, U. S. Code (Crimes), Section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE 16—64067-2

1. (a)

LANDS OWNED IN FEE BY KRAMER COVE
HOTEL COMPANY

Part of the Southwest Quarter (SW¼) of the Northwest Quarter (NW¼) of Section Seventeen (17), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Southwest corner of said Southwest Quarter (SW¼) of the Northwest Quarter (NW¼) of Section 17, thence North along the West line of the said tract 1146 feet, thence North 75 degrees East 378 feet, thence South 61 degrees East 264 feet, thence South 61 degrees West 200 feet, thence South 20 degrees and 30 minutes East 170 feet, thence North 80 degrees East 370 feet, thence South 20 degrees and 30 minutes East to a point 132 feet North of the South line of the said tract and 395½ feet West of the East line of the said tract, thence East parallel with the South line of the said tract 395½ feet to the East line, thence South along the East line of said tract 132 feet to the Southeast corner of the Southwest Quarter (SW¼) of the Northwest Quarter (NW¼) of Section 17, Township 3 South, Range 17 West, thence West along the South line of the said tract to the Southwest corner to the point of beginning.

Part of the South Half (S½) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Northwest corner of said South Half (S½) of Section 18, thence East along the North line thereof 2742 feet, thence South parallel with the East line of the Southwest Quarter (SW¼) of Section 18, 1370 feet to the Northeast corner of the tract of land now owned by J. W. Kimzey, thence West parallel with the South side of said Section 2664 feet to a point on the West line of said Section that is 990 feet North of the Southwest corner thereof, thence North along the West line of Section 18 to the point of beginning, with the exception of ten acres described as follows: Beginning at a point 990 feet North and 283 feet East of the Southwest corner of Section 18, thence North 30 degrees and 30 minutes East 918 feet, thence East parallel with the South line of said Section 474.5 feet, thence South 30 degrees and 30 minutes West 918 feet, thence West 474.5 feet to the point of beginning.

Part of the South Half (S½) of the Southwest Quarter (SW¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Southwest corner of said tract, thence East along the South line of said Section 1345.5 feet to the Southwest corner of the land now owned by J. W. Kimzey, thence North 990 feet, thence West 1343.5 feet to the West line of said Section, thence South 990 feet to the point of beginning.

The Southeast Quarter (SE¼) of the Southeast Quarter (SE¼) of Section Thirteen (13), Township Three (3) South, Range Eighteen (18) West.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

1. (a) (Continued)

LANDS OF MUTHERWOOD ESTATE
AS DESCRIBED IN MINERAL LEASE

The Northeast Quarter (NE¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, containing 160 acres, more or less; the Fractional East Half (Frl. E½) of the Northwest Quarter (NW¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, containing 64.08 acres, more or less; and all that part of the East Half (E½) of the Southeast Quarter (SE¼) and all that part of the East Half (E½) of the West Half (W½) of the Southeast Quarter (SE¼) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, lying North and West of Cove Creek, containing 82.32 acres, more or less; Hot Spring County, Arkansas, containing in all 306.4 acres, more or less.

1. (b)

See attached sheet numbered page 3.

1. (c)

The area upon which the exploration is to be conducted is the same as that described in 1 (a) above. Attached sheets (numbered pages 4 and 5) are properly authenticated "owner's consent to lien" forms.

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ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

Exploration Permit

The Magnet Cove Titanium Corporation, being the owner in fee of 207 acres in Hot Spring County, Arkansas, described as:

> part of the S½ of the NW¼ of section 17, T. 3S, R. 17W, 21 acres;
>
> the west 2742 feet of S½ of section 18, T. 3S, R. 17W except the E 1320.5 feet of the S 990 feet thereof and except 10 acres;
>
> the SE¼ of the SW¼ of section 13, T. 3S, R. 18W;

and being the lessee of the mineral rights on a contiguous tract of land consisting of 306 acres, owned by the Rutherford Estate, described as:

> the NW¼; W½ SW¼; and part of the SE¼; all in section 18, T. 3S, R. 17W;

do grant for the period of one year to the State of Arkansas, Resources & Development Commission, Division of Geology, a permit to carry on such exploration as they deem necessary to determine the nature and extent of rocks and minerals at or beneath the surface of the above described fee and leased property. It is understood that in granting this permit, said Division of Geology is authorized to apply for financial assistance from the Federal Government to this exploration, in accordance with provisions establishing the Defense Minerals Exploration Administration of the Department of Interior. In the event that financial assistance is obtained from the D.M.E.A. the above mentioned Division of Geology, under the terms of this permit, are authorized to carry out all phases of exploration provided in any agreements they make with the D.M.E.A. concerning the above described properties.

ARKANSAS RESOURCES AND
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DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

The Division of Geology, acting for the State of Arkansas, Resources & Development Commission, agrees to diligently explore the above described tracts, within the limits of its facilities and to promptly apply for financial assistance from the D.M.E.A. to carry on exploration to determine nature and extent of the minerals and ores occurring on or below the subject properties. It further agrees to furnish the grantors of this permit complete records of the results of all exploration performed under this permit.

It is further agreed between the parties that this permit can only be cancelled (prior to its normal expiration, one year from date) by notice in writing delivered thirty days in advance of date on which the cancellation is to take effect. In the event that an exploration contract with the D.M.E.A. is in effect at the time of cancellation date it is understood by both parties that an agreement satisfactory to the D.M.E.A., to terminate such contract must be reached before the cancellation shall become effective.

C. H. Scott Pres.

C. H. Scott, President
Magnet Cove Titanium Corporation

March 20, 1952

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

OWNER'S CONSENT TO LIEN

WHEREAS, the undersigned, as owner, co-owner, lessor, or seller has an interest in certain property in the State of ARKANSAS, County of HOT SPRING, which is the subject of a proposed Exploration Project Contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government", and The State of Arkansas, Arkansas Resources & Development Commission

hereinafter called the "Operator"; and

WHEREAS, under certain provisions of said Contract which are set forth on the reverse side hereof, the Government will acquire certain rights and equities which do or may conflict with or be adverse to the interest of the undersigned in said property;

NOW THEREFORE, the undersigned, in consideration of said Contract and as an inducement to the Government and Operator to enter into same, undertakes and agrees as follows:

1. The Government's equity in and right to remove facilities, buildings, fixtures, and equipment, as provided in the Contract, shall prevail over and be prior and superior to any conflicting or adverse rights of the undersigned.

2. The Government's percentage royalty on net smelter returns or other net proceeds realized from ore, concentrates, or metal produced within ten (10) years from the date of the Contract, and the Government's lien for the payment of said percentage royalty shall attach to the mineral deposit and the production therefrom, in the amount of the Government's contribution, not in excess of $50,000.00 (fifty thousand dollars), all upon the terms and conditions set forth in said Contract.

3. The undersigned shall commit no act nor assert any claim that may contravene or conflict with the lien, claim, or rights of the Government under the provisions of the said Contract. This agreement shall be binding upon the heirs, executors, administrators, successors, and assigns of the undersigned.

Dated this second day of April, 1952.

C. H. Scott Pres.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

OWNER'S CONSENT TO LIEN

WHEREAS, the undersigned, as owner, co-owner, lessor, or seller has an interest in certain property in the State of ARKANSAS, County of HOT SPRING, which is the subject of a proposed Exploration Project Contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government", and The State of Arkansas, Arkansas Resources & Development Commission

hereinafter called the "Operator"; and

WHEREAS, under certain provisions of said Contract which are set forth on the reverse side hereof, the Government will acquire certain rights and equities which do or may conflict with or be adverse to the interest of the undersigned in said property;

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3. The undersigned shall commit no act nor assert any claim that may contravene or conflict with the lien, claim, or rights of the Government under the provisions of the said Contract. This agreement shall be binding upon the heirs, executors, administrators, successors, and assigns of the undersigned.

Dated this 31st day of March, 1952.

J. H. Rutherford Estate

BY: J. E. Rutherford, Trustee

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

2. (a)

Columbium bearing minerals are the ones we expect to find.

2. (b)

A geologic report on this deposit was included in Bulletin 16 of the Division of Geology, Arkansas Resources & Development Commission, published in 1950. In this report it is described as the "Magnet Cove Rutile Company Deposit" (pages 13-41 inclusive). Plate II of this report is a geologic and topographic map of that part of the subject area described and Plate III has a series of cross sections across the old workings. Four copies of the above-mentioned Bulletin 16 are being submitted with this application (Bulletins are marked Exhibit A).

Preliminary sampling and testing by the U. S. Geological Survey has shown that columbium is present in this area of titanium mineralization, probably included in the rutile and brookite crystals and also possibly present in other titanium minerals in the deposit. The U. S. Geological Survey laboratories also analyzed samples of rutile concentrates from this property and found that they contained an appreciable percentage of columbium. The reports of these analyses are in the files of the U. S. Geological Survey and can be obtained from that agency to substantiate statements included in this paragraph.

ARKANSAS RESOURCES AND
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STATE CAPITOL
LITTLE ROCK, ARKANSAS

3. (a)

The purpose of this project is to determine the extent and nature of columbium mineralization on these properties. It is proposed that this be accomplished in two phases.

Phase I
(Sampling and analyzing cores from previous drilling)

This phase is to consist of sampling cores from previous U. S. Bureau of Mines drilling and the determination of the columbium content of these samples.

Cost:	Geologists (including field and traveling expenses)	$ 550
	Analysis of samples	5,000
	Total (not to exceed)	$5,550

Phase II
(New drilling and analysis)

The development of this phase will be predicated on the results of Phase I work, details being subject to the approval of the DMEA Field Team. The purpose of Phase II is to determine:

(1) The extension in depth of the mineralized area.

(2) The columbium content of ore occurring in areas not penetrated by U. S. Bureau of Mines drilling.

(3) The subsurface structure of the mineralized area.

It is also contemplated that the samples obtained during this phase will be valuable for use in ore dressing tests.

Cost:	Geologists (including field and traveling expenses)	$3,000
	Diamond drilling (6200 feet @ $5/foot)	31,000
	Sampling and analyses	10,000
	Power auger drilling as a preliminary to diamond drilling areas now covered with soil	1,000
	Total (not to exceed)	$45,000

The total cost of the project as outlined above is not to exceed $50,550.

3. (b)

It is anticipated that work can be started on the project immediately after the contracts are signed and that the work can be completed within 8 months.

4.

A map showing the location of proposed drill hole locations is included as Exhibit B.

ARKANSAS RESOURCES AND
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5.

An office building and a partially dismantled mill are now on the property, but no expenditure from this project's funds will be made to repair these buildings or to put them in operable condition.

ARKANSAS RESOURCES AND
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DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

6.

No additional facilities, buildings or fixtures will be purchased, installed or erected by us for this project.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
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STATE CAPITOL
LITTLE ROCK, ARKANSAS

7. (a)

No operating equipment is to be rented.

7. (b)

No operating equipment is to be purchased.

7. (c)

Equipment to be furnished by operator:

1 Jeep mounted D-35 Mobile Drill equipment with "N" drill pipe, "NX" core barrel and 3½" auger (depreciation, maintenance and fuel to be charge at $2/operating hour)

1 (or more) passenger cars or light trucks (as needed), to be charged at 4¢/mile plus gas and oil consumed.

ARKANSAS RESOURCES AND
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LITTLE ROCK, ARKANSAS

8.

List of supervisors and labor (includes those attached for short periods only)

1 Geologist supervisor	$400/mo.
1 (or more) Assistant Geologist	350/mo.
1 Chemist	375/mo.
1 Engineer	375/mo.
1 Diamond driller	$3/hr.
2 (or more) laborers	$1/hr.

ARKANSAS RESOURCES AND
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DIVISION OF GEOLOGY
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LITTLE ROCK, ARKANSAS

9.

Assaying: Present plans are for obtaining spectrographic determination of columbium in 300 samples @ approximately $50 each (total approximately $15,000). In the event that results satisfactory to the DMEA Field Team can be obtained by analysis in our own laboratory, then the cost will be considerably reduced. Approximately $1000 for reagents and expendable items is to be provided if this latter course is followed.

Diamond drilling: A total of approximately 6200 feet of diamond core drilling is planned for the project at an estimated average cost of $5 per foot. Hole size to be programmed as NX and AX combinations. Drilling to be done essentially by contract companies. Contracts being let to qualified bidder submitting lowest sealed bid.

Drilling bits, drill pipe, auger, casing and miscellaneous hand tools for operators drill: $500
(In the event that it is more economical for operator to use his own drill on upper 50 feet of the 25 programmed holes, this amount should be increased to approximately $5,500 and the amount for contract drilling reduced).

Miscellaneous services and expendable supplies (such as sample sacks, notebooks, office and drafting supplies, blue printing, etc.): $200

Gasoline and oil (for trucks, cars and power drill furnished by operator): $500

Utilities for laboratory (in event that operator's laboratory does analytical work for this project): $50

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

10. (a)

The operator is prepared to invest $6,000 in the proposed project.

10. (b)

This amount is sufficient to pay the operator's share (10%) in accordance with the regulations on Government participation.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

11.

Not applicable.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

Form MF-103
(Revised June 1951)

UNITED STATES DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

Budget Bureau No. 42-R1035.1.

MF-103 Should Be Filed With General Technical Data Form MF-100

APPLICATION FOR AID FOR AN EXPLORATION PROJECT PURSUANT TO MINERAL ORDER 5, UNDER DEFENSE PRODUCTION ACT OF 1950

Not To Be Filled in by Applicant

Docket No. DMEA-2486
Metal or Mineral
Date Received 4-15-52
Amount $
Participation (Government %)

Arkansas Resources & Development Commission
104 State Capitol Building
Little Rock, Arkansas

Name and address of applicant

Date April 2, 1952

If you have already filed MF-100, give date filed _____, type of assistance requested _____,

DMA Docket Number (if available) _____

INSTRUCTIONS

Read Mineral Order 5, Regulations Governing Government Aid in Defense Projects, before completing this application. Submit four copies each, of the signed application form, General Technical Data Form MF-100, and answers to questions as specified, to Defense Minerals Administration, Department of the Interior, Washington 25, D. C., or to the nearest field executive office thereof, with your name and address on each sheet of the application and all accompanying papers. If you have previously filed MF-100, it is not necessary to file it again. However, you should indicate in space provided above the type of assistance previously applied for (loans, procurement contracts, etc.) and DMA Docket Number, if available. *When a question is inapplicable it should be so stated in the form.* Additional sheets should be attached in answering any questions or in supplying additional information. IF YOU CANNOT ANSWER A QUESTION, SO STATE.

1. (*a*) Give a description of the real property that will be in any way involved in the exploration project, including any existing mine or operating property.

   (*b*) If you are not the owner of the property, submit a copy of the lease, purchase option, or other agreements under which you are authorized to operate the property with each copy of your application.

   (*c*) Give the legal description of the exact parcel, plot, or area upon which the exploration is to be conducted.

   NOTE: (1) If both areas are the same, so state. The only obligation to repay the Government is from the net earnings from any commercial discovery made in the area specified in (*c*) above in which the exploration is to be conducted, and the expenditure of funds which may be charged as costs of the project must be limited to that area or to work necessary to perform the exploration in that area.

   (2) If applicant is not the owner of the property or if there are any liens or encumbrances against the property, copy of agreements of claimants, lienors, encumbrances, and lessors subordinating their interests in the property to the interest of the Government under the Exploration Project Contract will be required for attachment to the Contract.

2. (*a*) What metals or minerals do you expect to find?

   (*b*) Furnish statement of the geologic features of your property, giving type of ore deposit and reasons for expecting to find commercial ore bodies. Illustrate with maps or sketches. If you have a geologic or engineering report, or assay maps showing width and grade, please send them with application, stating whether or not you wish to have them returned.

Defense Minerals Administration
APR 1 8 1952

The information required in questions 3, 4, 5, 6, 7, 8, and 9 below should be answered specifically and in detail, as this information will be attached to and incorporated as part of the Exploration Project Contract, if such contract is entered into with you by the Government.

ANSWER EACH QUESTION ON SEPARATE SHEETS OF PAPER AND SUBMIT A COPY OF EACH ANSWER FOR EACH COPY OF YOUR APPLICATION.

3. (*a*) Describe fully the proposed work and give the total cost of the project.

   (*b*) State the time required to start the project and to complete it.

4. Submit a map or sketch of the property involved showing a plan (and cross section, if needed) of the present mine workings and the *location of the proposed exploration work* as related to geologic features, such as contacts, veins, ore-bearing beds, etc.

5. Furnish an itemized list of existing facilities, buildings, installations, and fixtures with a statement of the cost of any necessary rehabilitation or repairs to put into useful and operable condition.

6. Furnish a detailed list of additional facilities, buildings, and fixtures to be purchased, installed, or erected by you, with the estimated cost of each item.

7. Furnish a detailed list of operating equipment, separated into items to be—

   (*a*) Rented

   (*b*) Purchased

   (*c*) Furnished by you

   with the rental, purchase price, or depreciation of each item, as the case may be, to be charged as a cost of the project.

8. Furnish an itemized schedule of labor, by numbers and classes (miners, muckers, etc.) and of supervisors by numbers and positions, with the maximum wages or salaries to be paid to each.

9. Furnish a detailed list with estimated cost of each item for materials, supplies, engineering, assaying, accounting, power, water, utilities, and any other items not provided for above.

10. (*a*) How much are you prepared to invest in the proposed project?

    (*b*) Is this amount sufficient to pay your part of the cost of the project, in accordance with the regulations on Government participation (Sec. 9 of MO–5)?

11. State any conditions or circumstances regarding the property not sufficiently brought out by the foregoing questions.

CERTIFICATION

The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this form and accompanying papers is correct and complete to the best of their knowledge and belief.

State of Arkansas,
Arkansas Resources & Development Commission

(Name of company)

By Chas R. Bowers
(Signature of authorized official)

Charles R. Bowers
Executive Director
Arkansas Resources & Development Commission

(Title)

April 2, 1952
(Date)

Title 18, U. S. Code (Crimes), Section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE 16—64067-2

i. (a)

LANDS OWNED IN FEE BY MAGNET COVE RUTILE COMPANY

Part of the Southwest Quarter (SW$\frac{1}{4}$) of the Northwest Quarter (NW$\frac{1}{4}$) of Section Seventeen (17), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Southwest corner of said Southwest Quarter (SW$\frac{1}{4}$) of the Northwest Quarter (NW$\frac{1}{4}$) of Section 17, thence North along the West line of the said tract 1146 feet, thence North 75 degrees East 378 feet, thence South 61 degrees East 264 feet, thence South 61 degrees West 200 feet, thence South 20 degrees and 30 minutes East 170 feet, thence North 80 degrees East 370 feet, thence South 20 degrees and 30 minutes East to a point 132 feet North of the South line of the said tract and 395$\frac{1}{2}$ feet West of the East line of the said tract, thence East parallel with the South line of the said tract 395$\frac{1}{2}$ feet to the East line, thence South along the East line of said tract 132 feet to the Southeast corner of the Southwest Quarter (SW$\frac{1}{4}$) of the Northwest Quarter (NW$\frac{1}{4}$) of Section 17, Township 3 South, Range 17 West, thence West along the South line of the said tract to the Southwest corner to the point of beginning.

Part of the South Half (S$\frac{1}{2}$) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Northwest corner of said South Half (S$\frac{1}{2}$) of Section 18, thence East along the North line thereof 2742 feet, thence South parallel with the East line of the Southwest Quarter (SW$\frac{1}{4}$) of Section 18, 1670 feet to the Northeast corner of the tract of land now owned by J. W. Kimzey, thence West parallel with the South side of said Section 2664 feet to a point on the West line of said Section that is 990 feet North of the Southwest corner thereof, thence North along the West line of Section 18 to the point of beginning, with the exception of ten acres described as follows: Beginning at a point 990 feet North and 283 feet East of the Southwest corner of Section 18, thence North 30 degrees and 30 minutes East 918 feet, thence East parallel with the South line of said Section 474.5 feet, thence South 30 degrees and 30 minutes West 918 feet, thence West 474.5 feet to the point of beginning.

Part of the South Half (S$\frac{1}{2}$) of the Southwest Quarter (SW$\frac{1}{4}$) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, more particularly described as follows: Beginning at the Southwest corner of said tract, thence East along the South line of said Section 1345.5 feet to the Southwest corner of the land now owned by J. W. Kimzey, thence North 990 feet, thence West 1343.5 feet to the West line of said Section, thence South 990 feet to the point of beginning.

The Southeast Quarter (SE$\frac{1}{4}$) of the Southeast Quarter (SE$\frac{1}{4}$) of Section Thirteen (13), Township Three (3) South, Range Eighteen (18) West.

ARKANSAS RESOURCES AND
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1. (a) (Continued)

LANDS OF RUTHERFORD ESTATE
AS DESCRIBED IN MINERAL LEASE

The Northeast Quarter (NE$\frac{1}{4}$) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, containing 160 acres, more or less; the Fractional East Half (Frl. E$\frac{1}{2}$) of the Northwest Quarter (NW$\frac{1}{4}$) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, containing 64.08 acres, more or less; and all that part of the East Half (E$\frac{1}{2}$) of the Southeast Quarter (SE$\frac{1}{4}$) and all that part of the East Half (E$\frac{1}{2}$) of the West Half (W$\frac{1}{2}$) of the Southeast Quarter (SE$\frac{1}{4}$) of Section Eighteen (18), Township Three (3) South, Range Seventeen (17) West, lying North and West of Cove Creek, containing 82.32 acres, more or less; Hot Spring County, Arkansas, containing in all 306.4 acres, more or less.

1. (b)

See attached sheet numbered page 3.

1. (c)

The area upon which the exploration is to be conducted is the same as that described in 1 (a) above. Attached sheets (numbered pages 4 and 5) are properly authenticated "owner's consent to lien" forms.

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Exploration Permit

The Magnet Cove Titanium Corporation, being the owner in fee of 207 acres in Hot Spring County, Arkansas, described as:

> part of the S½ of the NW¼ of section 17, T. 3S, R. 17W, 21 acres;
>
> the west 2742 feet of S½ of section 18, T. 3S, R. 17W except the E 1320.5 feet of the S 990 feet thereof and except 10 acres;
>
> the SE¼ of the SE¼ of section 13, T. 3S, R. 18W;

and being the lessee of the mineral rights on a contiguous tract of land consisting of 306 acres, owned by the Rutherford Estate, described as:

> the NE¼; E½ NW¼; and part of the SE¼; all in section 18, T. 3S, R. 17W;

do grant for the period of one year to the State of Arkansas, Resources & Development Commission, Division of Geology, a permit to carry on such exploration as they deem necessary to determine the nature and extent of rocks and minerals at or beneath the surface of the above described fee and leased property. It is understood that in granting this permit, said Division of Geology is authorized to apply for financial assistance from the Federal Government to this exploration, in accordance with provisions establishing the Defense Minerals Exploration Administration of the Department of Interior. In the event that financial assistance is obtained from the D.M.E.A. the above mentioned Division of Geology, under the terms of this permit, are authorized to carry out all phases of exploration provided in any agreements they make with the D.M.E.A. concerning the above described properties.

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The Division of Geology, acting for the State of Arkansas, Resources & Development Commission, agrees to diligently explore the above described tracts, within the limits of its facilities and to promptly apply for financial assistance from the D.M.E.A. to carry on exploration to determine nature and extent of the minerals and ores occurring on or below the subject properties. It further agrees to furnish the grantors of this permit complete records of the results of all exploration performed under this permit.

It is further agreed between the parties that this permit can only be cancelled (prior to its normal expiration, one year from date) by notice in writing delivered thirty days in advance of date on which the cancellation is to take effect. In the event that an exploration contract with the D.M.E.A. is in effect at the time of cancellation date it is understood by both parties that an agreement satisfactory to the D.M.E.A., to terminate such contract must be reached before the cancellation shall become effective.

C. H. Scott Pres.

C. H. Scott, President
Magnet Cove Titanium Corporation

March 20, 1952

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

OWNER'S CONSENT TO LIEN

WHEREAS, the undersigned, as owner, co-owner, lessor, or seller has an interest in certain property in the State of ARKANSAS, County of HOT SPRING, which is the subject of a proposed Exploration Project Contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government", and

~~The State of Arkansas, Arkansas Resources & Development Commission~~

hereinafter called the "Operator"; and

WHEREAS, under certain provisions of said Contract which are set forth on the reverse side hereof, the Government will acquire certain rights and equities which do or may conflict with or be adverse to the interest of the undersigned in said property;

NOW THEREFORE, the undersigned, in consideration of said Contract and as an inducement to the Government and Operator to enter into same, undertakes and agrees as follows:

1. The Government's equity in and right to remove facilities, buildings, fixtures, and equipment, as provided in the Contract, shall prevail over and be prior and superior to any conflicting or adverse rights of the undersigned.

2. The Government's percentage royalty on net smelter returns or other net proceeds realized from ore, concentrates, or metal produced within ten (10) years from the date of the Contract, and the Government's lien for the payment of said percentage royalty shall attach to the mineral deposit and the production therefrom, in the amount of the Government's contribution, not in excess of $50,000.00 (fifty thousand dollars), all upon the terms and conditions set forth in said Contract.

3. The undersigned shall commit no act nor assert any claim that may contravene or conflict with the lien, claim, or rights of the Government under the provisions of the said Contract. This agreement shall be binding upon the heirs, executors, administrators, successors, and assigns of the undersigned.

Dated this second day of April, 1952.

C. H. Scott, Pres.

ARKANSAS RESOURCES AND
DEVELOPMENT COMMISSION
DIVISION OF GEOLOGY
STATE CAPITOL
LITTLE ROCK, ARKANSAS

OWNER'S CONSENT TO LIEN

WHEREAS, the undersigned, as owner, co-owner, lessor, or seller has an interest in certain property in the State of ARKANSAS, County of HOT SPRING, which is the subject of a proposed Exploration Project Contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government", and The State of Arkansas, Arkansas Resources & Development Commission

hereinafter called the "Operator"; and

WHEREAS, under certain provisions of said Contract which are set forth on the reverse side hereof, the Government will acquire certain rights and equities which do or may conflict with or be adverse to the interest of the undersigned in said property;

NOW THEREFORE, the undersigned, in consideration of said Contract and as an inducement to the Government and Operator to enter into same, undertakes and agrees as follows:

1. The Government's equity in and right to remove facilities, buildings, fixtures, and equipment, as provided in the Contract, shall prevail over and be prior and superior to any conflicting or adverse rights of the undersigned.

2. The Government's percentage royalty on net smelter returns or other net proceeds realized from ore, concentrates, or metal produced within ten (10) years from the date of the Contract, and the Government's lien for the payment of said percentage royalty shall attach to the mineral deposit and the production therefrom, in the amount of the Government's contribution, not in excess of $50,000.00 (fifty thousand dollars), all upon the terms and conditions set forth in said Contract.

3. The undersigned shall commit no act nor assert any claim that may contravene or conflict with the lien, claim, or rights of the Government under the provisions of the said Contract. This agreement shall be binding upon the heirs, executors, administrators, successors, and assigns of the undersigned.

Dated this 31st day of March, 1952.

J. H. Rutherford Estate

BY: J. E. Rutherford, Trustee

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2. (a)

Columbium bearing minerals are the ones we expect to find.

2. (b)

A geologic report on this deposit was included in Bulletin 16 of the Division of Geology, Arkansas Resources & Development Commission, published in 1950. In this report it is described as the "Magnet Cove Rutile Company Deposit" (pages 13-41 inclusive). Plate II of this report is a geologic and topographic map of that part of the subject area described and Plate III has a series of cross sections across the old workings. Four copies of the above-mentioned Bulletin 16 are being submitted with this application (Bulletins are marked Exhibit A).

Preliminary sampling and testing by the U. S. Geological Survey has shown that columbium is present in this area of titanium mineralization, probably included in the rutile and brookite crystals and also possibly present in other titanium minerals in the deposit. The U. S. Geological Survey laboratories also analyzed samples of rutile concentrates from this property and found that they contained an appreciable percentage of columbium. The reports of these analyses are in the files of the U. S. Geological Survey and can be obtained from that agency to substantiate statements included in this paragraph.

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3. (a)

The purpose of this project is to determine the extent and nature of columbium mineralization on these properties. It is proposed that this be accomplished in two phases.

Phase I
(Sampling and analyzing cores from previous drilling)

This phase is to consist of sampling cores from previous U. S. Bureau of Mines drilling and the determination of the columbium content of these samples.

Cost:	Geologists (including field and traveling expenses)	$ 550
	Analysis of samples	5,000
	Total (not to exceed)	$5,550

Phase II
(New drilling and analysis)

The development of this phase will be predicated on the results of Phase I work, details being subject to the approval of the DMEA Field Team. The purpose of Phase II is to determine:

(1) The extension in depth of the mineralized area.

(2) The columbium content of ore occurring in areas not penetrated by U. S. Bureau of Mines drilling.

(3) The subsurface structure of the mineralized area.

It is also contemplated that the samples obtained during this phase will be valuable for use in ore dressing tests.

Cost:	Geologists (including field and traveling expenses)	$3,000
	Diamond drilling (6200 feet @ $5/foot)	31,000
	Sampling and analyses	10,000
	Power auger drilling as a preliminary to diamond drilling areas now covered with soil	1,000
	Total (not to exceed)	$45,000

The total cost of the project as outlined above is not to exceed $50,550.

3. (b)

It is anticipated that work can be started on the project immediately after the contracts are signed and that the work can be completed within 8 months.

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4.

A map showing the location of proposed drill hole locations is included as Exhibit B.

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5.

An office building and a partially dismantled mill are now on the property, but no expenditure from this project's funds will be made to repair these buildings or to put them in operable condition.

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6.

No additional facilities, buildings or fixtures will be purchased, installed or erected by us for this project.

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7. (a)

No operating equipment is to be rented.

7. (b)

No operating equipment is to be purchased.

7. (c)

Equipment to be furnished by operator:

1 Jeep mounted B-35 Mobile Drill equipment with "N" drill pipe, "NX" core barrel and $3\frac{1}{2}$" auger (depreciation, maintenance and fuel to be charge at $2/operating hour)

1 (or more) passenger cars or light trucks (as needed), to be charged at 4¢/mile plus gas and oil consumed.

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8.

List of supervisors and labor (includes those attached for short periods only)

1 Geologist supervisor	$400/mo.
1 (or more) Assistant Geologist	350/mo.
1 Chemist	375/mo.
1 Engineer	375/mo.
1 Diamond driller	$3/hr.
2 (or more) laborers	$1/hr.

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9.

Assaying: Present plans are for obtaining spectrographic determination of columbium in 300 samples @ approximately $50 each (total approximately $15,000). In the event that results satisfactory to the DMEA Field Team can be obtained by analysis in our own laboratory, then the cost will be considerably reduced. Approximately $1000 for reagents and expendable items is to be provided if this latter course is followed.

Diamond drilling: A total of approximately 6200 feet of diamond core drilling is planned for the project at an estimated average cost of $5 per foot. Hole size to be programmed as NX and AX combinations. Drilling to be done essentially by contract companies. Contracts being let to qualified bidder submitting lowest sealed bid.

Drilling bits, drill pipe, auger, casing and miscellaneous hand tools for operators drill: $500
(In the event that it is more economical for operator to use his own drill on upper 50 feet of the 25 programmed holes, this amount should be increased to approximately $5,500 and the amount for contract drilling reduced).

Miscellaneous services and expendable supplies (such as sample sacks, notebooks, office and drafting supplies, blue printing, etc.): $200

Gasoline and oil (for trucks, cars and power drill furnished by operator): $500

Utilities for laboratory (in event that operator's laboratory does analytical work for this project): $50

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10. (a)

The operator is prepared to invest $6,000 in the proposed project.

10. (b)

This amount is sufficient to pay the operator's share (10%) in accordance with the regulations on Government participation.

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11.

Not applicable.

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columbium is apparently intimately associated with the titanium minerals, there is a good possibility that the whole deposit is also columbium bearing.

(*b*) If deposit is other than placer: (Drilling not sufficient to properly determine this.)

(1) Submit assay plans and/or sections showing location and size of proved (measured) and probable (indicated) ore or mineral reserve.

(2) State the tonnage (indicate type of ton) and grade of each class of ore reserve, as above, and show how computed. Tabulated total ore reserve as follows:

TOTAL ORE OR MINERAL RESERVES

Ore or Mineral Reserve	Estimated Tons (a)	Metal or Mineral Content Per Ton (Grade) (b)	Gross Value Per Ton (c)	Recoverable Unit Value Per Ton (d)	Estimated Cost of Production Per Ton (e)
Measured (proved)					
Indicated (probable)					

(*c*) If placer: Not applicable

(1) Give estimated total yardage and average marketable mineral content of each deposit.

(2) Submit map showing location of placer deposit and surrounding area, with all test holes or pits. Submit logs of each hole and test pit with depth and average value of each.

(3) Describe gravel, stating whether fine, medium or coarse; loose, tight, cemented, or frozen, and whether it contains stumps or boulders more than 1 foot in diameter; if so, how large, and in what proportion.

(4) Describe bedrock, giving type (granite, sandstone, shale, etc.) and state whether it is hard or soft, smooth, uneven or rough.

(5) Describe overburden, stating whether loose, tight, or cemented; fine or coarse textured; furnish estimate of average thickness and total amount.

(6) Tabulate the reserves using the form outlined above for ore or mineral reserves.

13. Access Roads: See Exhibit A of accompanying DMEA application.

Give road distances to shipping, supply and residence points, stating kind and condition of roads.

14. Water Supply: Information not known.

State source and quantity of water available for operations and whether sufficient for all seasons of year.

15. Power: Not applicable.

State amount of power used, rate per hour, and source thereof.

16. Labor: Not applicable (no operation).

State number and classes (miners, muckers, millmen, etc.) of men employed during a recent representative payroll period.

17. Equipment and Facilities: Answered as question 5 of accompanying DMEA application.

Describe present equipment on the property, including buildings. (State condition.) List major pieces of equipment now owned or controlled and in serviceable condition available for this operation.

18. Are there any particular conditions or circumstances affecting your operations that are not described above? If so, explain.

CERTIFICATION

The undersigned company, and the official executing this certification on its behalf, hereby certify that the information contained in this form and accompanying papers is correct and complete to the best of their knowledge and belief.

State of Arkansas,
Arkansas Resources & Development Commission
(Name of company)

By Chas R. Bowers
(Signature of authorized official)
Charles R. Bowers
Executive Director
Arkansas Resources & Development Commission
(Title)

April 2, 1952
(Date)

Title 18, U. S. Code (Crimes), Section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE 16—63792-1

Form MF-100
(May 1951)

U. S. DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

Form approved.
Budget Bureau No. 42-R1026.

GENERAL TECHNICAL DATA
FOR USE UNDER THE
DEFENSE PRODUCTION ACT OF 1950

NOT TO BE FILLED IN BY APPLICANT

Docket No. DMEA-2486

Date received 4-15-52

Arkansas Resources & Development Commission
104 State Capitol Building
Little Rock, Arkansas

Name and address of applicant

Date April 2, 1952

INSTRUCTIONS

This form is to be filed with Defense Minerals Administration, Department of the Interior, Washington 25, D. C. It should be accompanied by appropriate application form when a specific type of Government assistance is requested, in the form of (1) loan, (2) purchase contract, (3) Government guarantee of a private loan, (4) priorities or allocation of mining equipment, and maintenance, repair and operating supplies, and (5) other forms of Government assistance that might arise under the Act. Submit four (4) signed copies of the form and accompanying papers. Name and address should be stamped or typed on each sheet of this form and all accompanying papers. *When a question is inapplicable it should be so stated on the form.* Additional sheets may be attached in answering any questions or in supplying additional information. (IF YOU CANNOT ANSWER A QUESTION, SO STATE.) If a question is answered elsewhere indicate where answered. It is not necessary to answer it again.

GENERAL TECHNICAL DATA

Supply the following information on separate sheets, arranged, numbered, and lettered as indicated:

1. Materials produced:
   (*a*) What are the chief mine, mill, or smelter products? Not applicable.
   (*b*) What are the byproducts, if any?

*2. Name(s) and type(s) of mine(s), mill(s), smelter(s), refinery(ies), pit(s), quarry (ies), drilling operation(s). Include old names of property, if any. Show extent of workings, including the following:
   (*a*) Linear feet of shafts.
   (*b*) Linear feet of drifts and crosscuts.
   (*c*) Linear feet of tunnels or adits.
   (*d*) Linear feet of other mine openings (explain briefly).
   Indicate whether mine is flooded or not. Describe any pumping problems. Give size or productive capacity.

*3. For each operation listed above supply the following:
   (*a*) Distance and direction from nearest town and shipping point.
   (*b*) Mining district.
   (*c*) Township, Section, Range.
   (*d*) County, State.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
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4. (*a*) State whether or not property is now in operation, and if in operation, by whom operated.
   (*b*) Are you operating this property as:
   ☐ Owner.
   ☐ Lessee.
   ☐ Contractor.

   Property is not in operation.

5. Number of years in production 12
   If not in production or operation, estimated date when production will begin Not known

6. Experience of operators:
   Describe the mining and general business experience of (*a*) the applicant, and (*b*) the person or persons who manage the project. Not applicable (project under management of the State Geologist's Office.)

7. History:
   *(*a*) Give a statement, as complete as possible, of previous exploration, development, operation, and production of property, with reasons for suspension of operation.
   *(*b*) State briefly the known history and production of adjoining and neighboring properties.
   *(*c*) Furnish any available (private) reports that may apply to this application, including results of mine examinations, recommended exploration and development, and metallurgical investigations.

16—63792-2

* See Exhibit A of accompanying DMEA application.

8. Names and addresses of Officers, Directors, or Partners, and in addition thereto, the five largest stockholders if applicant is a corporation.

Not applicable (Applicant is an agency of the State of Arkansas)

Name and Address (a)	Official Title (If officer is also director indicate by "D") (b)	Total of Annual Salary, Commissions, Bonuses, Etc., Received From Applicant and Affiliates During Last Fiscal Year (c)	Estimated Net Worth Outside of Interest in Applicant (d)	Number of Shares Held in Applicant Corporation		Life Insurance Carried for Benefit of Applicant	
				Common (e)	Preferred (f)	Amount (g)	Net Cash Surrender Value After Loans (h)
	Total		x x x x x			x x x x x	x x x x x

If more lines are needed continue on separate sheet.

9. Capital Stock Issues: Not applicable (see B above)

For Corporate Applicants

Item	Authorized (a)	Outstanding (b)	Par Value (c)	Number of Shares Outstanding (d)	Dividend Rate Last Paid* (e)
Common stock	$	$	$		
Preferred stock	$	$	$		

*Indicate period covered.

10. Production: None since 1944

Item	Kind of Product (a)	1948 Total (b)	1949 Total (c)	1950 Total (d)	Present Average Monthly (e)
1. Quantity of product mined or quarried (Short, long, metric tons; barrels; pounds; etc.)					
2. Quantity of product processed (specify unit of measure and type of process)					
3. Quantity and grade of product sold or shipped (specify units of measure)					

11. Do you contemplate a change in the present average monthly rate of production? If so, state estimated maximum monthly production and basis of change. Not applicable

12. Ore or Mineral Reserves:

(a) Describe the ore or mineral deposit briefly. Accompany the application by any available report on the geology and ore reserves. The maximum known dimensions of the orebody are about 2400 feet in an east-west direction and about 1000 feet north-south (total area about 30 acres). The deepest drill hole (188 ft.) was still in rutile bearing ore. Since

16—03792-1

Hoffland

Rm. #627

DMEA-2486

CONTAINS BULLETIN,
+ 8 MAPS —
7 of WHICH ARE
ATTACHED to back of
BULLETIN.

Bureau of Mines
Report of Investigations 4851

MINERAL DRESSING INVESTIGATION OF TITANIUM ORE FROM THE CHRISTY PROPERTY, HOT SPRING COUNTY, ARK.

BY M. M. FINE AND D. W. FROMMER

United States Department of the Interior—March 1952

MINERAL DRESSING INVESTIGATION OF TITANIUM ORE FROM THE CHRISTY PROPERTY, HOT SPRING COUNTY, ARK.

BY M. M. FINE AND D. W. FROMMER

* * * * * * * * * **Report of Investigations 4851**

UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary
BUREAU OF MINES
J. J. Forbes, Director

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MINERAL DRESSING INVESTIGATION OF TITANIUM ORE FROM THE CHRISTY PROPERTY, HOT SPRING COUNTY, ARK.

by

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Report of Investigations 4851

INTRODUCTION

Laboratory investigations have produced flotation concentrates containing 91 to more than 92 percent titania, with fair recoveries, from the Christy property, Hot Spring County, Ark.

The titanium-bearing ore on the Christy property occurs in a quartz-clay-iron oxide mineralization, which contains, on the average, about 6.0 percent TiO_2, chiefly as the mineral brookite; brookite and rutile are different crystalline forms of titanium dioxide.

Recent work by the Bureau of Mines2/ has shown that titanium chloride can be produced readily from the rutile-type mineral by reduction with coke followed by low-temperature chlorination. Metallic titanium is in turn derived from the chloride by the Kroll process.3/

DESCRIPTION OF ORE BODY

The occurrence of titanium-bearing minerals at Magnet Cove, in Hot Spring County, Ark., has been known since 1890. The Magnet Cove deposits are in a basinlike area about 2 miles in diameter, containing both brookite and rutile minerals. The main concentrations, however, are in two general areas: The alluvial and residual deposits in the northern part of the cove interior and the brookite-quartz area along the northeastern edge of the cove.4/

A recent drilling project by the Federal Bureau of Mines5/ has established that the Christy brookite deposit consists of a residual ore body and an underlying primary ore body containing the greater tonnage of ore. The residual ore body, extending to a possible depth of 20 feet, is mainly the product of working and weathering of the primary ore body and consists of quartzite fragments, free brookite crystals, and brookite in porous crystalline quartz masses in a matrix of red clay and iron oxides. The primary ore body has much the same constitution, but occurs undisturbed from the original zones of mineralization, with layers of barren clay separating the brookite-bearing quartzite.6/ Evidence also indicates that the primary ore body has undergone oxidation, as one test hole terminated in pyritic brookite ore.

2/ Gorski, C. H., Preparation of Titanium Tetrachloride from Rutile: Journal of Metals, Trans. Am. Inst. Min. and Met. Eng., vol. 191, February 1951, p. 131.

3/ Kroll, W. J., The Production of Ductile Titanium: Trans. Electrochem. Soc., vol. 78, 1940, pp. 35-47.

4/ Holbrook, Drew F., A Brookite Deposit in Hot Spring County, Ark.: Arkansas Resources and Development Commission, Division of Geology, Bull. 11, 1947.

5/ Reed, Donald F., Investigation of Christy Titanium Deposit, Hot Spring County, Ark.: Bureau of Mines Rept. of Investigations 4592, 1948, 10 pp.

6/ Fryklund, Verne C., Jr., and Holbrook, Drew F., Titanium Ore Deposits: Arkansas Resources and Development Commission, Division of Geology, Bull. 16, 1950, p. 53-64.

The Christy deposit contains, in addition to the brookite, the titanium-bearing minerals rutile, leucoxene, and taeniolite. In both the residual and primary ore body the average size of the brookite crystals does not exceed 0.5 mm. in diameter, but individual crystals up to 6 or 7 mm. have been found. In the residual ore, the brookite crystals occur in the free state and attached to quartzite fragments, whereas, in the primary ore the brookite crystals occur within or fastened to the quartzite.6/

Approximately 0.4 to 0.7 percent vanadium as the pentoxide was found within the ore bodies, the exact mode of occurrence being indeterminate.

CHRISTY BROOKITE ORE, SAMPLE 1

Method of Sampling

The initial phase of the present mineral-dressing study was conducted on a composite sample of the residual ore body obtained from a series of 20 test pits sampled in 1947 by engineers of the Bureau of Mines. Sampling of the deposit was made so as to obtain ore from depths ranging from 1 to 25 feet, the approximate mean depth being about 12 feet. Each pit was the source of 1 to 6 samples, each sample representing about 4 feet of depth. Some 3,000 pounds of ore was combined in a composite sample for flotation studies.

Description of Sample 1

Petrographic examination of the sample revealed that the ore had undergone considerable weathering and was composed chiefly of quartz, iron oxides, iron oxide-stained clay, and brookite.

The quartz, for the most part, occurred as bluish gray, doubly terminated crystals to which brookite crystals were frequently attached. Some very fine, needlelike inclusions of titania were present within the quartz grains and would not have been liberated by grinding to 150-mesh. Grinding to that size, however, would insure liberation of most of the nonincluded brookite. In addition, the clay fraction contained an appreciable amount of fine brookite crystals, or crystal fragments.

Chemical analyses of several samples of the residual ore showed the average titanium dioxide content to be 5.9 percent TiO_2. Other constituents were as follows: Iron, 8.3 percent; silica, 69.4 percent; alumina, 7.8 percent; sulfur, less than 0.05 percent; phosphorus, less than 0.05 percent; and vanadium pentoxide, 0.44 percent.

Beneficiation of Ore

Because of the intimate association of the mineral constituents, flotation was the only method of beneficiation that was applicable. Preliminary float-sink separations, employing heavy organic liquids as the separating mediums, showed that gravity methods were not capable of producing concentrates of the desired grade, nor was it possible to reject a clean tailing by this means.

6/ Fryklund, Verne C., Jr., and Holbrook, Drew F., Titanium Ore Deposits: Arkansas Resources and Development Commission, Division of Geology, Bull. 16, 1950, p. 53-64.

The sample was prepared for flotation by crushing to minus-1-1/4-inch size and mixed by repeated coning and quartering. A representative portion was then reduced to minus-20-mesh in a roll crusher, mixed thoroughly to insure homogeneity, and set aside for use as flotation feed.

Preliminary flotation studies were made on pulps ground wet to minus-150-mesh using fatty acid collectors in an alkaline pulp. The initial experiments on undeslimed pulps were not selective enough, so neither the concentrates nor tailings were of the desired quality. It was soon evident the presence of much clay slime caused poor selectivity. Thereafter much of the clay slime was removed before flotation. The slime fraction was lower in titanium than in the ore, so the ultimate recovery was not appreciably decreased as a result of this operation. In the deslimed pulps, petroleum sulfonate promoters functioned as powerful collectors for brookite in strongly acid circuits. Unfortunately, these reagents had an equal affinity for the iron oxides, and the invariable result was a subgrade concentrate and a clean tailing. Experimentation with a wide variety of modifying reagents failed to yield a concentrate in excess of 80 percent titanium dioxide.

It was ultimately discovered that a soluble soap, sodium oleate, was the most satisfactory collector for the brookite in the rougher stage, but an aliphatic amine in the later cleaner stages assisted materially in the rejection of iron oxides. The preflotation procedure was as follows: The primary slime in the crushed 20-mesh head sample was dispersed with caustic soda and a complex glassy phosphate, the pulp was settled, and the dispersed slime was decanted. The settled sand was ground to minus-150-mesh, and the small amount of secondary, or grinding, slime that remained in suspension also was decanted. This preflotation preparation was a matter of some importance in the treatment of the Christy ore. The use of the glassy complex phosphate as a dispersant was particularly beneficial.

Following the preparation outlined above, the brookite was selectively activated and promoted by alternate stage additions of either barium or lead salts and sodium oleate. The rougher concentrate was essentially a mixture of much brookite and smaller amounts of occluded quartz and iron oxide. The siliceous gangue was removed by double cleaning the rougher concentrate; the greater dilution in the rougher circuit caused the silica to drop out mechanically. Although repeated cleaning would have reduced the iron content in a similar manner, such prolonged treatment caused a reduction in the floatability of the brookite with a corresponding loss in recovery.

A sharper separation of the iron oxides was effected by amine flotation. The double-cleaned concentrate from above was conditioned with enough sulfuric acid and sodium fluoride to destroy the soap froth. A small amount of aliphatic amine introduced at this point selectively floated the brookite from the iron oxides. In addition, the presence of hydrofluoric acid effectively depressed any residual silica and permitted the recovery, after two additional cleanings, of a high-grade brookite.

The results of a typical test on the sample from the residual ore body are presented in table 1.

TABLE 1. - Christy brookite ore

Sample 1 - Composite sample, residual ore body

(Metallurgical data)

Product	Weight, percent	Analysis, percent				Recovery, percent of total TiO_2
		TiO_2	SiO_2	Fe	V_2O_5	
Concentrate	3.8	92.8	1.4	1.6	0.41	60.6
Amine middlings	1.9	33.5	-	-	-	10.9
Soap middlings	2.8	12.8	-	-	-	6.2
Tails	66.6	1.16	-	-	-	13.3
Slimes	24.9	2.1	-	-	-	9.0
Composite	100.0	5.8	-	-	-	100.0

(Operating data)

Reagents	Pounds per ton of crude ore									
			Soap flotation			Amine flotation				
				Cleaners		Condition			Cleaners	
	Grind	De-slime	Rougher	1	2	1	2	Rougher	1	2
Caustic soda	2.0	-	-	-	-	-	-	-	-	-
Sodium tetraphosphate 1/	2.0	-	-	-	-	-	-	-	-	-
Lead acetate	-	-	0.4	-	-	-	-	-	-	-
Sodium oleate	-	-	.4	-	-	-	-	-	-	-
Pine oil	-	-	-	0.05	-	0.05	-	-	-	-
Methyl amyl alcohol ...	-	-	-	-	-	-	-	-	-	0.05
Sulfuric acid	-	-	-	-	-	3.0	-	-	1.0	1.0
Sodium fluoride	-	-	-	-	-	1.0	-	-	.25	.25
Armac-CD 2/	-	-	-	-	-	-	0.13	-	-	-
pH	-	-	8.5	-	-	2.0	-	-	-	-
Time ..... minutes	5	15	15	5	5	5	1	5	5	5

1/ Heyden Chemical Corp., Rumford Division, Rumford 16, R. I. (Quadrafos).
2/ Armour and Co., 1355 W. 31st St., Chicago 9, Ill.

It may be noted that a concentrate containing 92.8 percent titanium dioxide, 1.4 percent silica, 1.6 percent iron, and 0.41 percent vanadium pentoxide was achieved with a recovery of 60.6 percent of the contained titania. To produce such high-grade concentrates, however, requires careful manipulation of the process in which the preflotation treatment plays an important part. For example, in a similar test, differing only in a slight variation in preflotation treatment, 72 percent of the titanium was recovered in a concentrate of the following composition: 90.9 percent titania, 2.4 percent silica, 2.0 percent iron, and 0.41 percent vanadium pentoxide. It is particularly important that the ore be devoid of slimes before changing to the acid circuit and amine float.

Approximately 9.0 percent of the titania is rejected in the slimes, the major portion of which is probably in titanium-bearing clays and other equally unrecoverable minerals.

CHRISTY BROOKITE ORE, SAMPLE 2

Method of Sampling

Sample 2 was prepared by compositing portions of drill-hole cores.7/ About 600 pounds of sample was submitted for metallurgical testing, representing those portions of the drill holes considered to be ore in preparing tonnage estimates.

Description of Sample 2

Megascopic and microscopic examination of the drill hole composite showed that it was similar mineralogically to sample 1. The only notable difference was the presence of more clay and less quartz.

The chemical composition was as follows: 6.1 percent titanium dioxide; 8.3 percent iron; 61.6 percent silica; 8.9 percent alumina; and 0.67 percent vanadium pentoxide.

Beneficiation of Sample 2

The sample was prepared for flotation by the procedure previously outlined. The ore was deslimed before flotation with caustic soda and Quadrafos, as in sample 1. Because of the greater clay content of sample 2, the deslimed ore was washed once before pulping in the flotation cell.

Actual flotation of the ore was similar to that of sample 1, except that because of the greater proportion of slimes slightly greater quantities of reagents were needed for adequate activation and collection. This may be noted in table 2, which summarizes a typical test on sample 2.

Both recovery and grade of concentrate were lower than in the data of table 1. The lower recovery, of course, is due to the higher clay content of the drill-hole composite, which resulted in a loss of 21.7 percent of the titania in the slimes as against only 9.0 percent in the case of the surface sample. The additional clay probably reduced the selectivity in the flotation of sample 2 giving a lower-grade concentrate.

7/ See reference 6, p. 1.

TABLE 2. - Christy brookite ore

Sample 2 - Drill-hole composite

(Metallurgical data)

Product	Weight, percent	Analysis, percent				Percent of total TiO_2
		TiO_2	SiO_2	Fe	V_2O_5	
Concentrate	3.6	91.2	1.15	1.87	0.30	55.2
Amine middlings	1.0	24.9	-	-	-	4.2
Soap middlings	3.3	11.5	-	-	-	6.4
Tails	52.9	1.4	-	-	-	12.5
Slimes	39.2	3.3	-	-	-	21.7
Composite	100.0	5.9	-	-	-	100.0

(Operating data)

Reagents	Pounds per ton crude ore								
			Soap flotation				Amine flotation		
	Grind	De-slime	Condi-tion	Rougher	Cleaners 1	Cleaners 2	Condi-tion	Rougher	Cleaner 1
Caustic soda	2.0	-	-	-	-	-	-	-	-
Sodium tetraphosphate	2.0	-	0.5	-	-	-	-	-	-
Lead acetate	-	-	-	0.50	-	-	-	-	-
Sodium oleate	-	-	-	.50	-	-	-	-	-
Methyl amyl alcohol.	-	-	-	.08	0.08	0.05	-	-	-
Pine oil	-	-	-	-	-	-	0.08	-	-
Sulfuric acid	-	-	-	-	-	-	3.0	-	1.0
Sodium fluoride	-	-	-	-	-	-	1.0	-	.25
ARMAC-CD	-	-	-	-	-	-	-	0.125	-
pH	-	-	7.6	-	-	-	±2.0	-	-
Time ..... minutes	5	15	5	15	5	5	5	5	5

CHRISTY BROOKITE ORE - A POSSIBLE SOURCE OF VANADIUM

Examination of the drill cores and sludges showed appreciable amounts of vanadium in both the residual and primary ore bodies. Analysis of the composite samples gave values of 0.44 and 0.67 percent vanadium pentoxide in samples 1 and 2 respectively.

The mode of occurrence and distribution of the vanadium are not known. Fryklund and Holbrook[8/] believed that most of the vanadium was contained within the brookite crystals, but the vanadium content of the brookite concentrates, as shown in tables 1 and 2, does not show any such concentration.

The vanadium content is not high enough to warrant exploitation of the Christy deposit for that metal alone. Should it become possible to work the ore body for its titanium content, the recovery of the vanadium as a byproduct would undoubtedly be considered. Recent reports of the recovery of vanadium

8/ See reference 7, p. 5.

from shales[9] and from titaniferous magnetite[10] indicate that vanadium extraction from the Christy ore would be of interest.

SUMMARY AND CONCLUSIONS

Flotation research on samples of residual brookite ore and a drill-hole composite from the Christy property, Hot Spring County, Ark., showed that high-grade flotation concentrates can be produced. The residual ore yielded a 60.6 percent recovery at a grade of 92.8 percent TiO_2, 1.4 percent silica, and 1.6 percent iron; the other, a 55.2 percent recovery at a grade of 91.2 percent TiO_2, 1.2 percent silica, and 1.9 percent iron. Recoveries could be increased 10 to 15 percent if a concentrate comparable in titania content to ilmenite were produced.

The success of the flotation depends, to a considerable extent, on an adequate preflotation treatment including an alkaline blunge and nearly complete slime removal from the ground ore. The brookite can be activated with a heavy metal salt and floated with a soluble soap. Final concentration of the brookite is effected by cationic flotation in an acid circuit.

9/ Ravitz, S. F., Nicholson, I. W., Chindgren, C. S., Bauerle, L. C., Williams, F. P., Martinson, M. T., Treatment of Idaho-Wyoming Vanadiferous Shales; Am. Inst. Min. and Met. Eng. Tech. Pub. 2176, Metals Technology, June 1947.

10/ Cole, Sanford S., and Breitenstein, John S., Recovery of Vanadium from Titaniferous Magnetite; Am. Inst. Min. and Met. Eng. Meeting, St. Louis, Mo., 1951.

Int. - Bu. of Mines, Pgh., Pa.

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

Surname
DOCKET COPY

Ellis

JAN 21 1954

Mr. Norman F. Williams
Arkansas Resources and Development Commission
446 State Capitol
Little Rock, Arkansas

Re: Docket DMEA-2486 (Columbium)
Magnet Cove Property
Hot Spring County, Arkansas

Dear Mr. Williams:

Reference is made to your letter of January 18, 1954, requesting that a copy of the letter which was mailed to Mr. Arthur M. Emmerling, Director, in December, concerning the captioned docket, be furnished for your files. Enclosed in the self-addressed stamped envelope which you provided is a copy of my letter under date of December 4, 1953.

Sincerely yours,

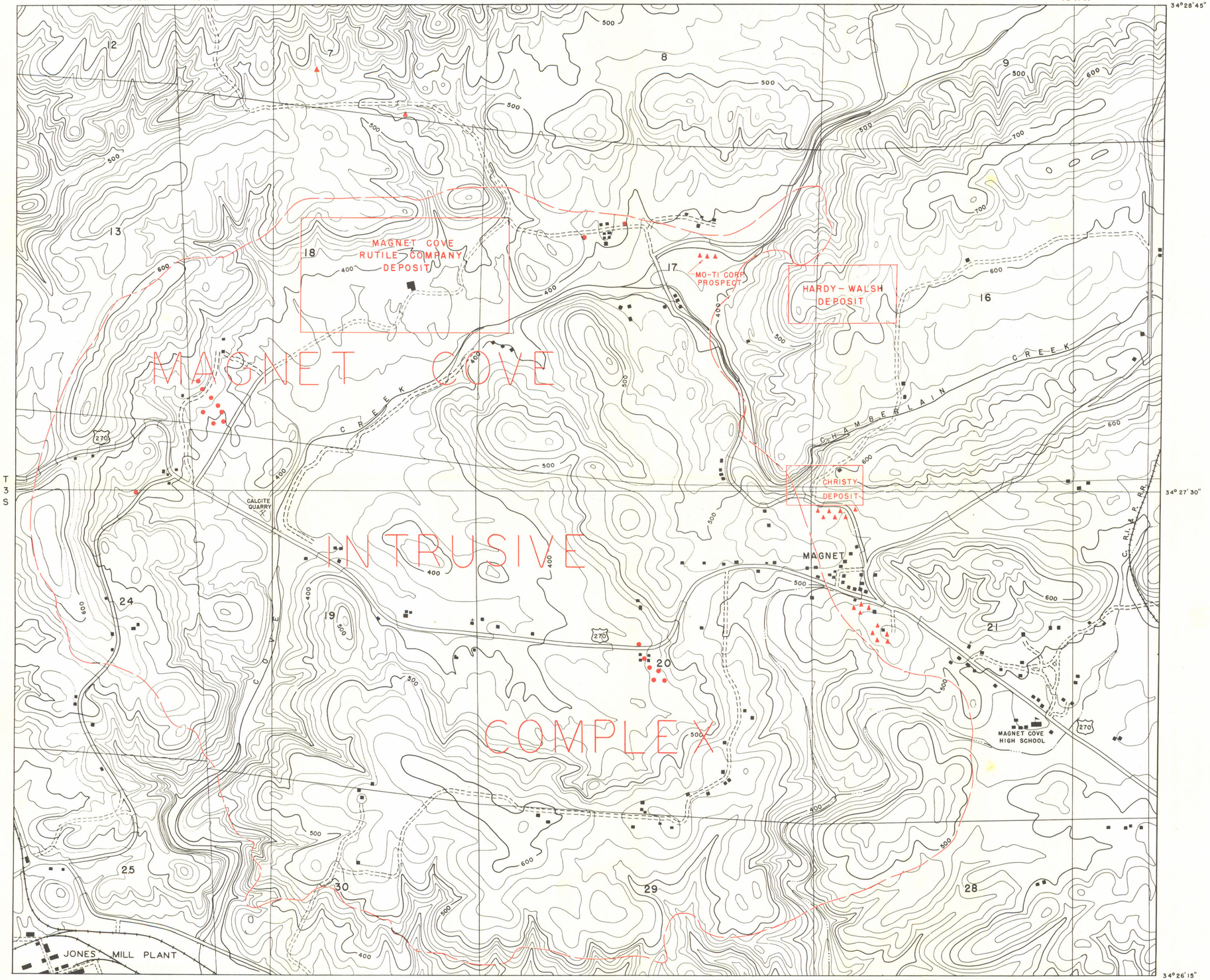
C. O. Mittendorf (fw)

Administrator

Enclosure

EWEllis/gla
1-20-54
cc to: Adm. Reading File
Docket
Messrs. FFGriffith, Rm. 3641-A
DMLarrabee, Rm. G-232, GSA
Ellis
DMEA Field Team, Region VI (2)

R.C.B. 1-21-54



EXPLANATION

- CHRISTY DEPOSIT — AREA INCLUDED IN THE MAP OF A KNOWN DEPOSIT
- SURFACE RUTILE
- SURFACE BROOKITE
- APPROXIMATE BOUNDARY OF THE MAGNET COVE INTRUSIVES
- BUILDING
- IMPROVED ROAD
- UNIMPROVED ROAD
- INTERMITTENT STREAM
- RAILROAD

TOPOGRAPHIC MAP
OF THE
MAGNET COVE TITANIUM DISTRICT
HOT SPRING COUNTY, ARKANSAS

SHOWING

LOCATION OF THE KNOWN TITANIUM DEPOSITS AND PROSPECTS

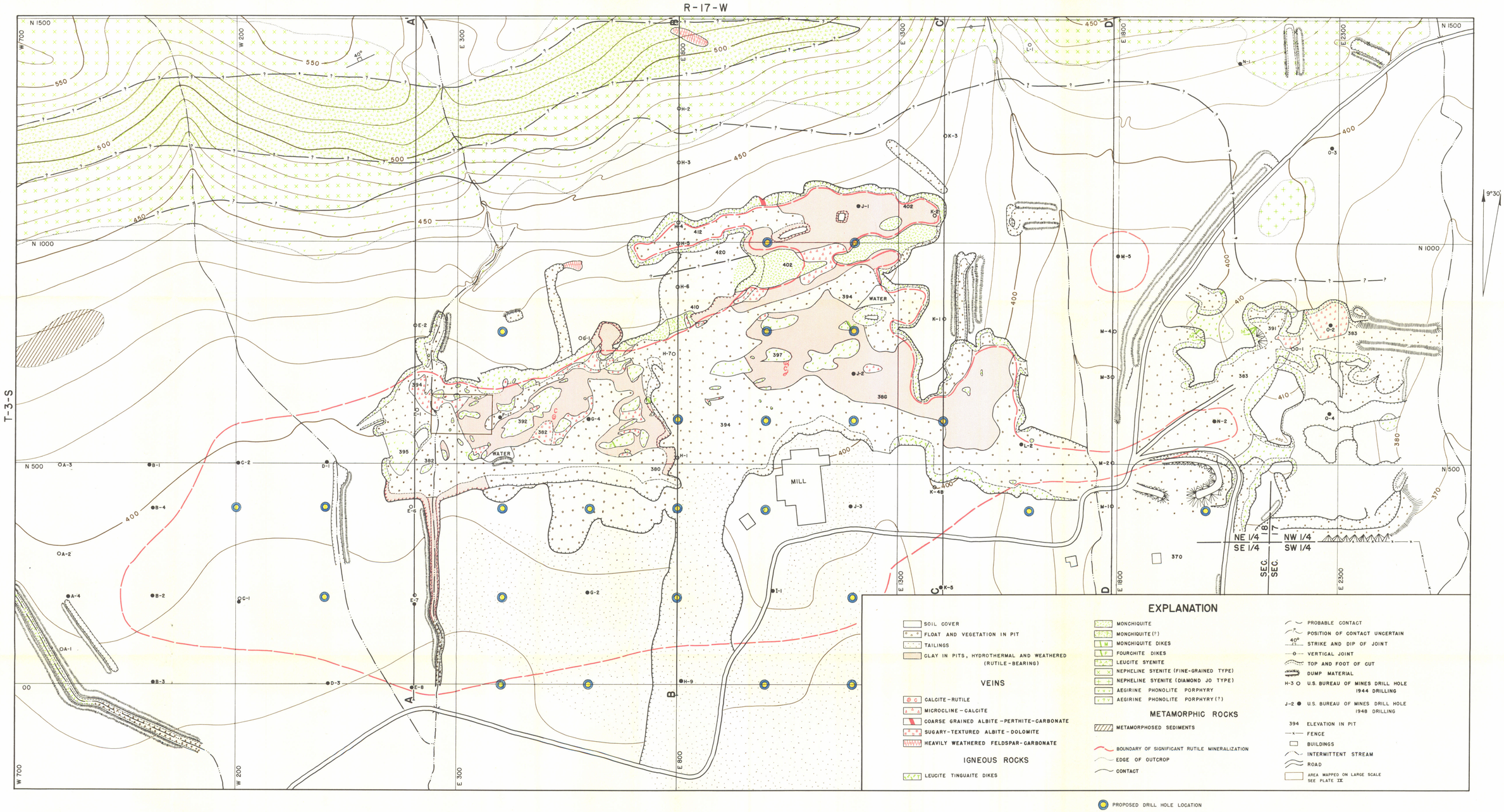
1949

SCALE IN FEET

0 1000 2000 3000 4000

CONTOUR INTERVAL 20 FEET

Base map from U.S. Geological Survey Malvern Quadrangle



GEOLOGIC AND TOPOGRAPHIC MAP

OF THE

MAGNET COVE RUTILE COMPANY PIT, HOT SPRING COUNTY, ARKANSAS

V. C. FRYKLUND JR.

1949

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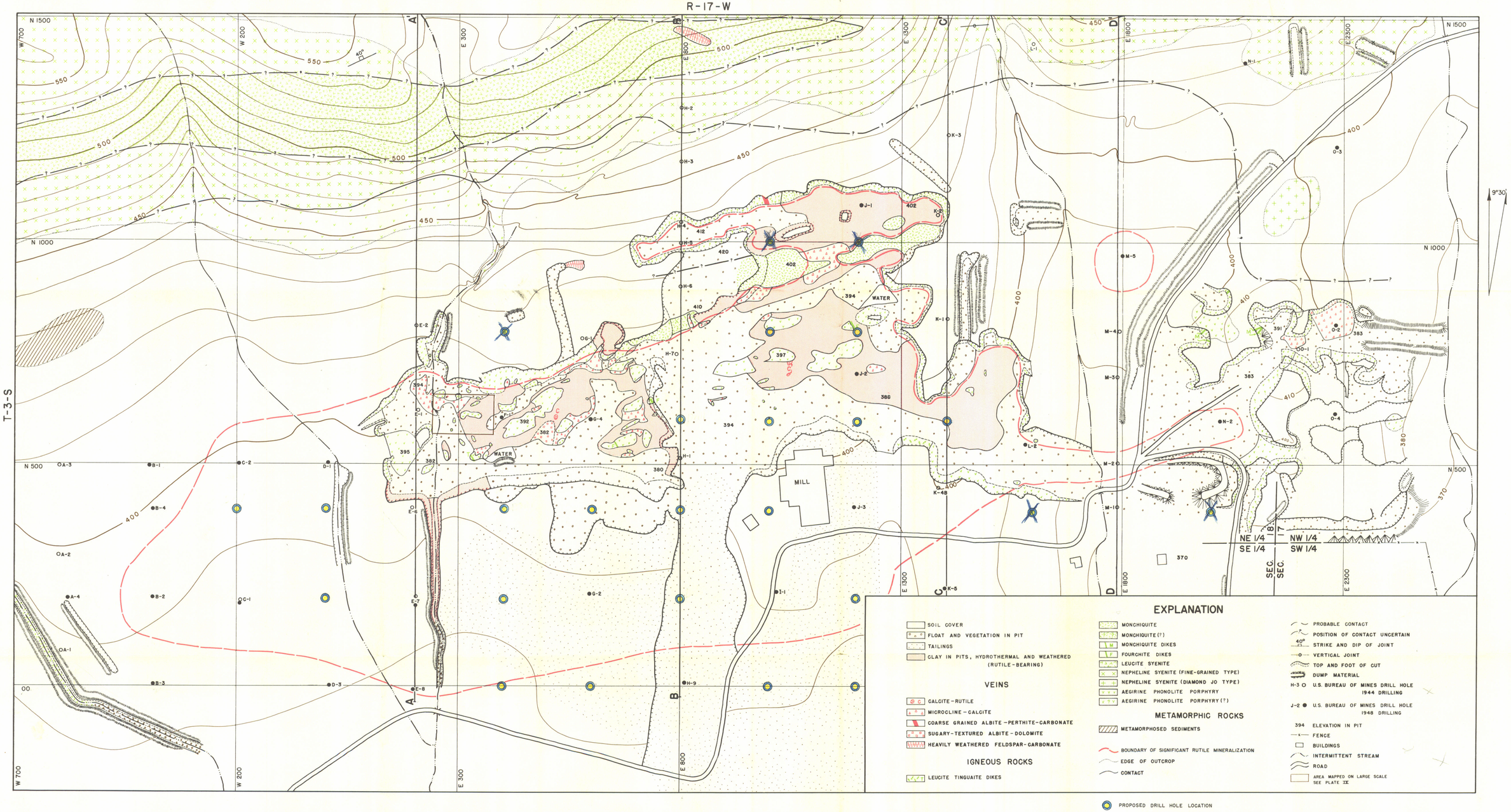
CONTOUR INTERVAL 10 FEET



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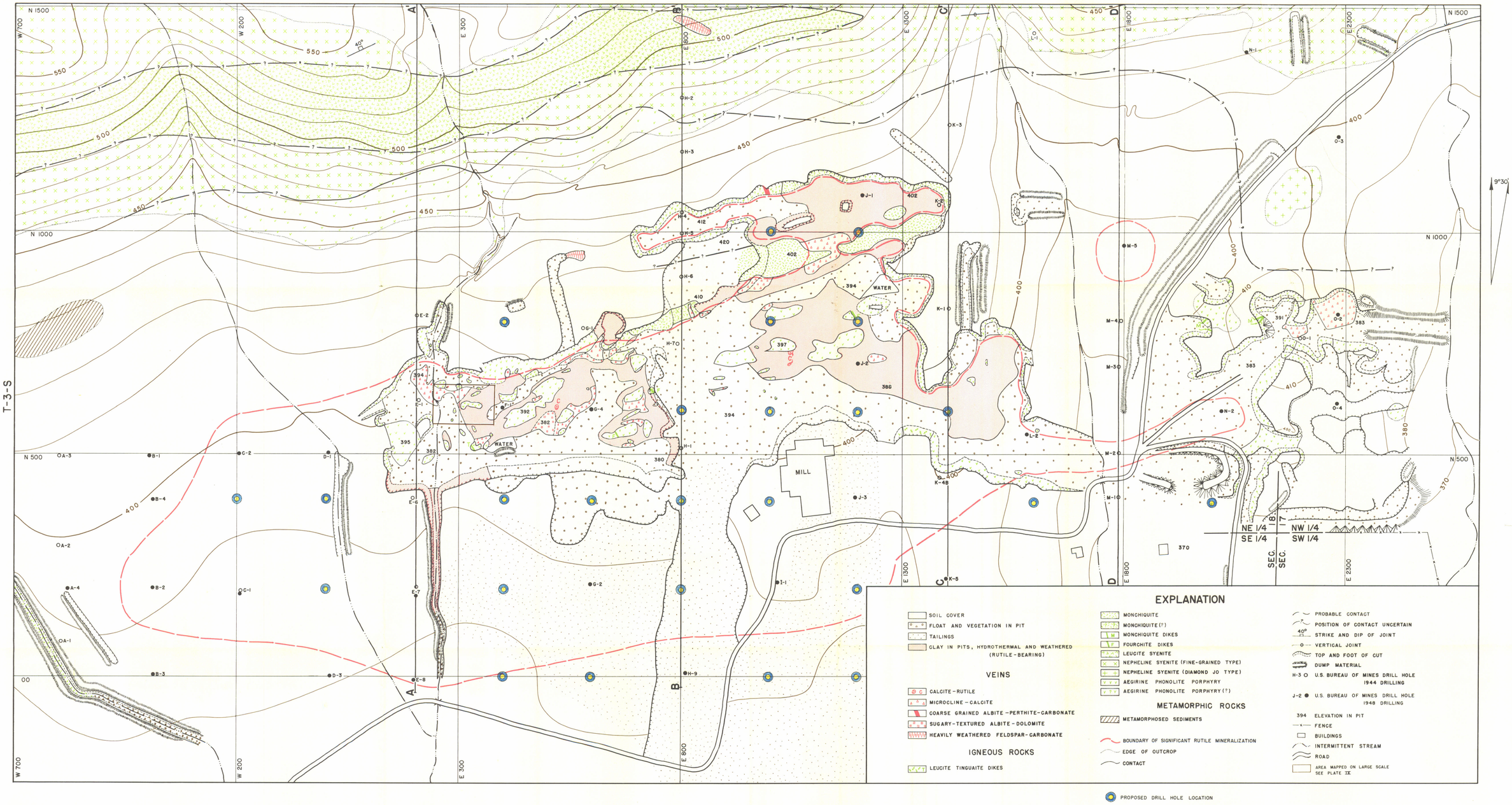

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