DMA Form 1

DEFENSE MINERALS ADMINISTRATION
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DMA Docket No. 2773

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To:	CODE 700 , Rm. 4649	Date	11-13-52
To:	Open Corr	Date	12-17-52
To:	code 700-Rm 4640	Date	6-10-53
To:	Open Corr	Date	12-8-54
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700

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

Ching
J. L. Kennedy
Hedges
Kiilsgaard
Selfridge
Fleischer

JAN 10 1955

Mr. Howard Steven Strouth
Standard Ore & Alloys Corporation
120 Wall Street
New York 5, New York

Re: Your HSS-2805-Lithium
Our Docket No. DMEA-2773
(Tin, columbite-tantalite, beryl)
Lincoln Mining Corporation
Ka-Mi-Tin Mine
Lincoln County, North Carolina

Dear Mr. Strouth:

Thank you for your letter of December 29, 1954. We found your description of the results of your exploratory work at the Ka-Mi-Tin property very interesting and believe that you have made a valuable contribution to the over-all knowledge we have of the tin-spodumene belt of North Carolina.

We note, with interest, that you have been doing work on properties in Canada, South Africa and Rhodesia in recent years.

Sincerely yours,

O. O. Mittendorf

Administrator

MChing/gla 1-5-55
cc to: Admr.'s Reading File
Docket
Messrs. A. Renick, Rm. 3624
T. H. Kiilsgaard, Rm. 5224
Code 700
Mr. Ching
DMEA Field Team, Region VII (2)

R.C.S.

700

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

Ching
J. L. Kayonde
Selfridge
R. J. Swan

JAN 10 1955

Mr. Robert A. Laurence
Executive Officer
DMEA Field Team, Region VII
Room 13 Post Office Building
Knoxville 2, Tennessee

Re: Docket No. DMEA-2773
(Tin, columbite-tantalite, beryl)
Lincoln Mining Corporation
Ka-Mi-Tin Mine
Lincoln County, North Carolina

Dear Mr. Laurence:

In accordance with your memorandum of December 27, 1954, we are forwarding two copies of a letter dated December 29 from Howard Steven Strouth to the Administrator, which describes the results of exploratory work on the subject property.

Sincerely yours,

George C. Selfridge

Chairman, Operating Committee (GCS)

Enclosures

APPROVED:

J. H. Hedges (JHB)
Member, Bureau of Mines

Thor H. Kiilsgaard
Member, Geological Survey (THK)

MChing/gla
1-5-55
cc to: Admr.'s Reading File
Operating Committee
Docket
Messrs. A. Renick, Rm. 3624
T. H. Kiilsgaard, Rm. 5224
Code 700
Mr. Ching
(All of above with copies Mr. Strouth's letter December 29, 1954)

R.C.J.

1/4/55 ugh

CABLE: STANDORES

STANDARD ORE & ALLOYS CORPORATION

120 WALL STREET

NEW YORK 5, N. Y.

WHITEHALL 3-1600

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
DEC 30 1954

IN REPLY REFER TO: HSS-2805
Lithium
Your Docket #DMEA-2773
Tin, Columbite-Tantalite, Beryl
Ka-Mi-Tin Mine
Lincoln County, North Carolina

December 29, 1954

Mr. C. O. Mittendorf, Administrator, DMEA
U.S. Department of the Interior
Washington, 25, D.C.

Dear Mr. Mittendorf:

Further to our above referenced correspondence, the following information is herewith given to you, and I trust that it will be of some use. I refer to the reports made by the government several years ago which outlined the very locations and orebodies of which we speak, referred to even then as the Ka-Mi-Tin property.

In checking these reports you will find that work previously had been done under the supervision of an engineer named St. Clair back in the thirties, and a considerable amount of surface work and some shaft sinking had taken place in an effort to find a sufficient quantity of tin to set up a small tin smelter.

Such a tin smelter was supposed to have existed before the first World War, and its foundations and connecting railroad tracks still exist, as well as some reports that the tin concentrates shipped carried some columbium values, which in those days fetched a premium from the British buyers.

An inclined shaft dating from that period and close to the mill was investigated but was very badly weathered, and it was too dangerous to go down more than 50' or 70'.

Our own interest lay in the blocking out of sufficient spodumene to fit a medium size mill and find a sufficient quantity of beryl, columbium, tin, and other by-products minerals to help in the cost of operation. Surface indications as well as samples taken by the undersigned showed several dykes with a considerable surface width having an average grade of 15% spodumene and good columbium-tantalum values.

Pumping dry some of the shafts revealed that the shafts some 50' down were still in good ore.

By-products--heavy metals--while occurring only in clusters, were quite plentiful, and assays showed considerable values.

We subsequently cleared some of the land and brought in a large Longyear diamond drill, sinking seven holes in all, averaging some 500' to a hole, with full core recovery, most of the holes being drilled at a 45° angle.

Over-all planning was made by Dr. S. Duncan Heron Jr. of Duke University, who estimated that if the dikes continued in depth at least 150' and possibly down to 500', several million tons of ore would be available as mill feed.

The first hole was sunk at the so-called incline shaft, and this was the only good hole, showing both high spodumene and tin values and persistent in depth. However, other holes along the same dyke indicated that the dyke as such, except in one or two spots, was very shallow and could not be found at the 100' depth.

The values of the first hole actually intercepted three pegmatite dykes in all, parallel to each other, showing a total true thickness of 44'.

An additional hole was placed between the Carpenter dyke and the incline shafts, and passing at an oblique angle to the dyke, through an extremely soft micaceous formation, passing eventually through 16' of soft greisenous material with excellent values of plate mica and tin; but failed to encounter the main incline dyke at depth, again bringing home the theory that this particular dyke was much shallower than expected.

An additional hole in the swamp shaft region where St. Clair reported a 40' dyke, ~~we~~ encountered only 9' of dyke at depth, and figuring that there might be smaller parallel dykes in depth similar to the first hole, the hole was continued for 283' without encountering any other such dykes.

The last hole, at the Jake dyke, passed through nothing but a few stringers in depth, which were not of minable width.

Theoretically, an estimate could be made of the ore encountered, and such ore mined at relatively shallow depth by cleaning out the few existing shafts might serve as contributory ore to an existing mill nearby.

Mr. C. O. Mittendorf
U.S. Dept. of the Interior
Washington, D.C.

Since our sole interest was in the possibility of blocking out sufficient ore to set up a modest size flotation plant and conceivably build in conjunction therewith a small chemical plant to make lithium carbonates, the showings were too small to warrant such expenditure.

For this and other reasons we acquired more promising lithium properties in Canada, on which we are continuing our work.

I trust this information will be of help to you, and that it will especially bring the reports in your files up-to-date on these properties.

During the last few years we have also done considerable work on properties in South Africa, Rhodesia, and Canada; and should you run across some of our operations and be interested in some additional information, the undersigned will be glad to furnish you with such information as far as consistent with the firm's policy.

Very sincerely yours,

STANDARD ORE & ALLOYS CORPORATION

Howard Steven Strouth

hss-vmg

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.
ROOM 15 POST OFFICE BLDG.
KNOXVILLE 2, TENN.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
DEC 28 1954

December 27, 1954

Memorandum

To: Operating Committee, DMEA, Washington, D. C.

From: Executive Officer, DMEA Field Team, Region VII

Subject:

DMEA-2773 (Tin, columbite-tantalite, beryl)
Ka-Mi-Tin Mine, Lincoln County, North Carolina
Lincoln Mining Corporation

We have received the copies of Mr. Mittendorf's letter of December 22 to Mr. Howard Steven Strouth. If a copy of the report on drilling by the Lincoln Mining Corporation is received, I wonder if it would be possible to have a copy for our use. If so, we would greatly appreciate having one; if not, we would like to borrow your copy for a while.

Robert A. Laurence

Robert A. Laurence

700

Ching

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

DEC 22 1954

Mr. Howard Steven Strouth
Executive Vice President
Lincoln Mining Corporation
120 Wall Street
New York 5, New York

Re: Docket No. DMEA-2773
(Tin, columbite-tantalite, beryl)
Ka-Mi-Tin Mine
Lincoln County, North Carolina

Dear Mr. Strouth:

Thank you for your letter of December 13, 1954, regarding the results of your own drilling on the subject property.

We are naturally interested in your results; consequently, if you find it convenient and in accordance with the policy of your corporation, we would be pleased to receive a copy of such drilling results for the Defense Minerals Exploration Administration files.

Your courteous offer and the information contained in your letter are greatly appreciated.

Sincerely yours,

C. O. Mittendorf

Administrator

MChing/gla
12-21-54
cc to: Admr. Reading File
Docket
Messrs. A. Renick, Rm. 3624
Mr. T.H. Kiilsgaard, Rm. 5224
Code 700
Mr. Ching
DMEA Field Team, Region VII (2)

R.C.S.

12/15/54 gla

TEL. WHITEHALL 3-1600

Defense Minerals Administration
RECEIVED
DEC 15 1954

LINCOLN MINING CORPORATION

MINE & PLANT:
LINCOLNTON, N. C.

EXECUTIVE OFFICES
120 WALL STREET
NEW YORK 5, N. Y.

December 13, 1954

2773

Mr. C.O. Mittendorf
US Department of the Interior
Defense Minerals Exploration
Administration
Washington 25 D.C.

Dear Mr. Mittendorf:

Thank you for your letter of December 8th contents of which have been duly noted.

Our own drilling results, unfortunately, have been disappointing - similar to your own - not only with respect to the erratic and uneconomic nature of the tin/columbite and beryl occurences but also to the spodumene narrowing down in depth.

Actually, this makes the Government publications showing these deposits inaccurate and, should you so desire, I would be happy to show you the drilling results on these properties.

Thanking you for your help and courtesy, I am

Very truly yours,

LINCOLN MINING CORPORATION

Howard Steven Strouth

HSS/FJK

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

DEC - 8 1954

Ching
Ellis
Kiilsgaard
Hedges
Selbridge
Jefferson

Mr. Howard Steven Strouth
Executive Vice President
Lincoln Mining Corporation
120 Wall Street
New York 5, New York

Re: Docket No. DMEA-2773
Tin, columbite-tantalite, beryl
Ka-Mi-Tin Mine
Lincoln County, North Carolina

Dear Mr. Strouth:

Reference is made to my letters of June 15 and June 23, 1953, and yours of June 17, 1953, regarding the subject docket and application.

As you know your application has been held in abeyance pending completion of a Defense Minerals Exploration Administration project in the Kings Mountain area of North Carolina. This project has now been completed and the results appraised. As would be the case on your property the exploration was for certain minerals and metals which are on our list as being critical and strategic; namely, tin, columbite-tantalite and beryl. The work indicated that the pegmatite dikes of the area explored contained economic deposits of spodumene, but the tin, columbite-tantalite, and beryl content were of such minor proportions that their recovery would not be economically feasible except, perhaps, as byproducts.

With the foregoing results in mind we have reviewed your application for aid in an exploration project and other information available to us in Washington concerning your above-named property.

Projects approved by the Defense Minerals Exploration Administration must, in its judgment, show definite promise of yielding strategic materials of acceptable grade in quantities that will significantly improve the mineral supply position for the National Defense Program.

Careful study of all our information indicates to us that the probability of disclosing minable reserves of tin, columbite-tantalite, and beryl by your proposed program is not sufficiently promising to justify Government participation. We regret to advise you, under these circumstances, that your application for exploration assistance is denied.

We wish to thank you for your interest in the Defense Minerals Program and for bringing your property to our attention.

Sincerely yours,

[illegible] Mittendorf

Administrator

MChing:am
12-3-54
cc to: Admr. Reading File
Operating Committee
Docket
Messrs. A. Renick, Rm. 3624
T. H. Kiilsgaard, Rm. 5224
Mr. Ching
Code 700
DMEA Field Team, Region VII(2)

Ching

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

December 3, 1954

SUMMARY OF PROPOSED PROJECT

Object: Denial of application for an exploration project

Docket No.: DMEA-2773 (Tin, columbite-tantalite, beryl)

Commodity: Tin, columbite-tantalite, beryl

Applicant: Lincoln Mining Corporation
120 Wall Street
New York 5, New York

Property: Ka-Mi-Tin Mine, consisting of approximately 650 acres in Lincoln County, North Carolina, leased by the Lincoln Mining Corporation from the Ka-Mi-Tin Concentrating Corporation.

Date of application: November 6, 1952

Amount of application: $32,050.00

Work Proposed:

Road improvement with bulldozer	$1,500.00
6 D. D. holes to intersect dykes Nos. 2 and 3. 3600 ft. @ $3.00/ft.	$10,800.00
Rehabilitate and sink shaft No. 1, 40 ft. and shaft No. 3, 20 ft. 60 ft. @ $140/ft.	$8,400.00
Crosscut 40 feet each from shafts 1 and 3. 80 ft. @ $40.00/ft.	$3,200.00
5000 cu. yds. surface stripping on dyke 2	$2,000.00
Equipment and other expenses	$6,150.00
Total	$32,050.00

Field Team Report:

No field examination of the property was made, but W. R. Griffitts, USGS, who had completed a field examination of the entire tin-spodumene belt and was familiar with the subject property, submitted a report dated January 6, 1953. He concluded that the main point to consider appeared to be the propriety

of providing Government assistance in the exploration of deposits in which strategic materials entitled to such support are minor constituents, minable only as byproducts. He also believed that no assistance should be given unless a mill could be profitably operated for non-strategic spodumene, feldspar and ground mica to support the production of tin and columbite.

Commodity Committee Members' Comments:

Bureau of Mines - Abbott Renick, November 18, 1952

Microscopic examination of a considerable number of specimens of pegmatite by Mr. Kesler revealed that cassiterite is present in most cases only as a minor accessory mineral. Of four samples taken by Lowell B. Moon three assayed 0.05% Sn and one 0.10% Sn. A review by J. C. Arundale is suggested.

J. C. Arundale, December 4, 1952. Since lithium minerals are not eligible to receive exploration assistance the subject loan could not be justified on the basis of the spodumene alone. However, spodumene might contribute to the economics of a future commercial operation. If, in aggregation, the quantities of cassiterite, columbite-tantalite and (potentially) beryl that might be made available are significant, then the application should be considered.

[redacted]ical Survey - Erwin J. Lyons and A. R. Kinkel, Jr., December 10, 1952

It would appear that any deposit that might be developed would be essentially a spodumene producer. Any tin produced would be as a by-product and the yearly production of that metal would probably be very small. It may be economic to recover the small amount of tin if the deposit is mined for spodumene. We recommend that the application be denied.

Erwin J. Lyons, January 27, 1953. Believes that the principal product would be spodumene and that there would not be significant production of tin and columbite as by-products. Again recommends denial of the application.

Rare and Miscellaneous Metals Division - Michael Ching December 1, 1954.

Because of the great extent of the tin-spodumene belt of North Carolina, and the possibility that many similar applications would be received from the area

it was decided to enter into a single contract with Foote Mineral Company with the expectation that the results of that project would help greatly in determining future policy regarding this type of application. The Foote project (DMEA-[illegible]) was selected because it was the first of this type of application, and Foote was well qualified to carry out such a test project. As a consequence, the subject Lincoln Mining Corporation application was held in abeyance pending completion of the Foote project and appraisal of the results.

The Foote project indicated that the pegmatites southwest of Kings Mountain, North Carolina might be expected to contain approximately 10.00% spodumene, 0.17% beryl, 0.006% cassiterite and 0.013% columbite-tantalite.

It appears that the quantity of minerals present, other than spodumene are too insignificant to warrant further Government participation at this time in projects of this type.

It is recommended that the long deferred decision on the subject application be a denial.

Conclusions and Recommendations:

While different properties in the tin-spodumene belt of North Carolina may have varying degrees of mineralization, the Foote Mineral project confirms previous indications that any economic mining operation would be based upon the spodumene content, and beryl, tin and columbite-tantalite, if recoverable, would be produced only as a byproduct. It is recommended that the subject application, a decision upon which has long been deferred, be formally denied.

Ernest Wm. Ellis

Ernest Wm. Ellis

FILE COPY
SURNAME:
Docket
Ellis

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

Coe

JUN 23 1953

Mr. Howard Steven Strouth
Executive Vice President
Lincoln Mining Corporation
120 Wall Street
New York 5, New York

Re: Docket No. DMA-2773
(Tin, columbite, beryl)
Ka-Mi-Tin Mine
Lincoln County, North Carolina

Dear Mr. Strouth:

This will acknowledge receipt of your letter of June 17, 1953, appertaining to the captioned application.

I note that you refer to work presently being done under Government contract in the Kings Mountain area of North Carolina, and furthermore you trust this work has now advanced sufficiently to consider your application. While it is true the said exploration work is progressing, nevertheless, the situation remains unchanged from that stated in my letter of June 15, 1953.

Sincerely yours,

C. O. Mittendorf

Administrator

6-23-53

EWEllis/db
6-22-53
cc to: Adm. Reading File
Docket
Messrs: A. Benick, Rm. 3061
A.R. Kinkel, Rm. B-242A, GSA
Ellis
DMEA Field Team, Region VII (2)

F-500

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION

REFERENCE SLIP

DATE 6/18/53

REFERRED TO:

1. ~~Code 700 - Room 4640~~
2. ~~Mr. Ellis~~
3. Mr. Mittendorf
4. Code 700 - Rm 4640

FOR:

..... Action	✓ Recommendation
..... Approval	..... Record
..... Comment	of .....
..... Conference	..... Referring
..... Consideration	to .....
..... Filing	..... Reply for signa-
..... Instructions	ture of .....
..... Investigation	..... Rewriting
..... Initials	..... Signature
..... Mailing	..... Suggestions
..... Previous correspondence	..... Your information

REMARKS: Evidently Mr. Strouth wishes to misunderstand us. To write him further at this time would be repetitious, unless we only wish to acknowledge this letter

Check (X) before the items needing attention.

Ernest M. Ellis

~~ROBERT E. ADAMS~~ (ilb)

Initials of sender.

GPO 16:—63815-1

6/18/53 gla

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
JUN 18 1953

STANDARD MINING CORPORATION

GENERAL OFFICE:
120 WALL STREET
31ST FLOOR
NEW YORK 5, N.Y.
WHITEHALL 3-1600

MINES:
CUSHMAN, ARKANSAS
TEL: CUSHMAN 987M-4

June 17, 1953

Mr. C. O. Mittendorf, Administrator, DMEA
United States Department of the Interior
Washington, 25, D.C.

Dear Mr. Mittendorf:

SUBJECT: Ka-Mi-Tin Mines, Lincolnton, N. C.;
Your Docket #DMEA-2773;
Tin-Columbite-Beryl.

Thank you for your letter dated June 15.

Unfortunately, I cannot find anything in our letter of March 27, or other letters sent to you, stating that we had agreed to have the application withdrawn.

Needless to say, with the number of applications which you must handle day by day these details might not be as fresh in your mind as they are in ours, and we were somewhat annoyed by the delay occasioned in reaching nothing but an impasse, as per your letter of March 25.

However, we feel it was distinctly understood then, as it is now, that the application had not been declined, and to quote your own letter:

> "It is our thought that it may be a matter of a few months before we can make any decision on your application.....we do not regard our present position as being in any way a denial of your application." (March 25, 1953).

It is perfectly true that we have meanwhile had a team working at Lincolnton, have done a given amount of diamond drilling, and produced a few tons of average ore for test purposes; but much remains to be done, and obviously we would not use any government loans for such portion of the work as has already been accomplished by us and been paid for.

We also feel that no additional arguments should be needed to convince you of the advisability of blocking out the large ore bodies at the Lincoln Mine, and that most certainly we should not pass on additional information to you regarding our property--considering that we were denied not only a report made by the government on our own property but also any details about the project, which took precedence over ours and which for all we know is being done for one of our competitors.

Mr. C. O. Mittendorf
DMEA -- U.S. Dept. of the Interior
Washington, D.C.

6/17/53
Page 2

I might add that in exploring the southern portion of our property we have found several additional promising looking dykes, which might easily increase our estimated two million-ton tonnage considerably, more so since our original application was based only upon a program to ascertain tonnages in a district not exceeding 200 acres, out of a thousand acres of a highly mineralized zone controlled by us.

Certainly, the modest goal and amount set for this exploration program could be applied toward proving these additional ore bodies, and the results might be of considerable help for government planning.

The encouragement which we have received from large industrial consumers has certainly been most promising and seems to bear out our own contention for the future of these deposits.

Since you promised us in your letter of March 1953 that within a few months a final decision could be reached regarding our final application, we sincerely trust that your own work in this field has now advanced sufficiently to grant our application; and our past exploration experiences will indicate that granting such a loan would considerably further the government's goal on strategic minerals.

Very truly yours,

STANDARD MINING CORPORATION

Howard Steven Strouth

hss-vmg

FILE COPY
SURNAME:

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

JUN 15 1953

Mr. Howard Steven Strouth
Executive Vice President
Lincoln Mining Corporation
120 Wall Street
New York 5, New York

Re: Docket DMEA-2773
(Tin, colombite, beryl)
Ka-Mi-Tin Mine
Lincoln County, North Carolina

Dear Mr. Strouth:

This will acknowledge receipt of your letter of June 8, 1953, and a photostat of a letter dated June 6, from the office of Congressman McCormack, addressed to Mr. Walter J. McCauley, both letters appertaining to the captioned project.

It was our understanding from your letter of March 27, 1953, that you were proceeding with your project as planned and, furthermore, that you would be interested in comparing your costs with those of the only Government contract we have entered into in the North Carolina Spodumene Belt. Accordingly, we concluded that since you were apparently doing the work covered in the proposed project, your application should be considered withdrawn. Furthermore, it would seem to follow that, after doing your proposed work, if you still needed Government aid, you would submit a new application, giving the results of the work that had been accomplished, what additional work you proposed to do, and the detailed cost estimates of such work. We would then consider your revised application, taking into consideration the results obtained by the work which is now going on under another Government contract.

Notwithstanding the above, we are holding your present application in abeyance, in accordance with your letter of June 8, pending further word from you and also pending the results of our present contract in that area.

Sincerely yours,

C. O. Mittendorf

Administrator

6-15-53

EWEllis/COMittendorf/jh/fw
6/15/53

cc: Admr Reading File
Docket
Messrs. A. Renick, Rm. 3061
A. R. Kinkel, Rm. B-242A GSA Bldg.
Ellis
Hon. John W. McCormack
Field Team, Reg. VII (2)

dmea 2773

CABLE: STANDORES

~~DMEA 2262~~

STANDARD ORE & ALLOYS CORPORATION

120 WALL STREET

NEW YORK 5, N. Y.

WHITEHALL 3-1600

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JUN 9 1953

Rec'd. 6/11/53

IN REPLY REFER TO: HSS-2805

June 8, 1953

Mr. C. O. Mittendorf, Administrator
U.S. Department of the Interior -- DMEA
Washington, 25, D.C.

Dear Mr. Mittendorf:

Reference is made to a letter just received from the Honorable John W. McCormack, Member of the House of Representatives, Office of the Democratic Whip, who has written to our president, Mr. Walter McCauley, as per enclosed photocopy of letter dated June 6.

Apparently there is some misunderstanding regarding our pending DMEA application.

It is true that you wrote us a letter stating that our application had not been either declined or granted, but had been held in abeyance subject to certain test work presently undertaken by your department. You informed us that as soon as such work had come to a satisfactory conclusion, our request for a loan would be granted.

It is true that we wrote in and received from you the return of one copy of our application. However, this copy was an extra copy not filed in the normal manner with all necessary application papers, and the five copies filed under the application remain with your office.

We sincerely trust that your test work will be satisfactory and that our request for drilling funds will be granted at the earliest moment.

Very truly yours,

STANDARD ORE & ALLOYS CORPORATION

Howard Steven Strouth

hss-vmg
Enc

JOHN W. McCORMACK
12TH DIST., MASSACHUSETTS

EUGENE T. KINNALY
ADMINISTRATIVE ASSISTANT

BOSTON OFFICE:
JAMES V. HARTREY
SECRETARY

Congress of the United States
House of Representatives
Office of the Democratic Whip
WASHINGTON, D. C.

June 6, 1953

Mr. Walter J. McCauley
31st Floor
120 Wall Street
New York City 5, New York

Dear Walter:

I talked to Mr. Mittendorf on Friday the 5th and he told me that he thought the Lincoln Mining Corporation had withdrawn from the program. I explained to him that this was not the case. His files indicate that your Company asked for the return of its papers and stated that they would get in touch with Mr. Mittendorf when they felt they could offer additional arguments etc.

Mr. Mittendorf has reactivated this matter and he assured us that your Company would be given every consideration when he was in an opportunity to so do. They are still making studies to see if Beryl can be recovered, and the Foote people are doing this study for them.

It is my suggestion that you write again to Mr. Mittendorf advising him that your Company is interested in the program and would appreciate every consideration.

With kind regards, I am

Sincerely yours,

Walter

Rec'd 6/11/53

Notation for Files: 6/5/53

Mr. Sweig, of Congressman McCormack's office, phoned to check on the status of the Lincoln Mine Corp., DMEA-2773. I told him there had been no change since our letter to the applicant dated May 25. I told him our docket indicated that the application had been withdrawn by the applicant's letter dated March 30. Sweig said this was not the case, since one of the Congressman's constituents is interested in the case and is anxious to have it approved. After reading the March 30 letter, I admitted that it was difficult for me to place the same interpretation on it that the Rare Metals Division did when suggesting that the case be withdrawn. I put a note on the docket for Adams to change his records accordingly.

C. O. Mittendorf

Mr. Sc[redacted]dt: [redacted]4/14/53

Mr. Mittendorf says (re phone call from Mr. Sweig, of Congressman McCormack's office) that Mr. Strouth was working through the Congressman in an attempt to find out how much we would allow Foote Co. for drilling, and also what their costs of operation are.

Mr. Mittendorf told Mr. Sweig that this is confidential information which we would at no time release to an outsider.

fwebster

Adams — see
Ellis memo 4/7.
His premise is wrong. No [illegible]
Company considers case
in abeyance

Mr.M: 6/5/53

To call:

Mr. Sweig, Cong. McCormack's office - re

your letter to Strouth, Lincoln Mine Corp.
DMEA-2773

X768

Do not consider as mishandled

700
FILE COPY
SURNAME:

Schmidt
Ellis

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

Mr. Howard Steven Strouth
Standard Mining Corporation
120 Wall Street, 31st Floor
New York 5, N. Y.

APR 8 1953

Re: Docket No. DMA-2773
(Tin-columbite-beryl)
Lincoln Mining Corporation
Ka-Mi-Tin Mine,
Lincoln County, North Carolina

J. C. 4/8/53

Dear Mr. Strouth:

Further reference is made to your letter of March 27, 1953, particularly with reference to item (2), wherein you requested that the report prepared by an engineer of the U. S. Bureau of Mines, which is a part of this docket, be made available to you.

We regret to advise you that reports prepared by Government agency personnel are of a confidential nature and cannot be released for public use. Therefore, we are unable to comply with your request.

We trust you have received the material from the docket which was returned to you under date of April 1, 1953.

We wish to thank you for your interest in bringing the subject property to our attention, and regret our inability at this time to be of assistance to you, as explained in our letter of March 25, 1953.

Sincerely yours,

C. O. Mittendorf (for)
Administrator

GLAult/FSSchmidt/gla
4-7-53
cc to: Adm. Reading File
Docket
Mr. Ellis
Mr. Schmidt
DMA Field Team, Region VII (2)

FILE COPY
SURNAME:

200

Adams

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

APR 8 1953

APR 1 1953

Mr. Howard Steven Strouth
Standard Mining Corporation
120 Wall Street - 31st Floor
New York 5, New York

R. C. 4/1/53

Dear Mr. Strouth:

This will acknowledge receipt of your letter dated March 27, 1953 requesting the return of certain material filed by you with your application for exploration project assistance, Docket No. DMEA-2773, Tin-Columbite-Beryl, Ka-Mi-Tin Mines, Lincolnton, North Carolina.

In accordance with your request the material is enclosed herewith.

Sincerely yours,

C. O. Mittenhoff (for)

Administrator

Enclosure
READams/meb
4-1-53
cc to: Adm.Reading File
Mails & Files Br.
Mr. Ellis

3/31/53 gla

STANDARD MINING CORPORATION

GENERAL OFFICE:
120 WALL STREET
31ST FLOOR
NEW YORK 5, N.Y.
WHITEHALL 3-1600

MINES:
CUSHMAN, ARKANSAS
TEL: CUSHMAN 987M-4

March 27, 1953

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
MAR 30 1953

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

Dear Mr. Mittendorf:

SUBJECT: Your Docket #DMEA-2773,
Tin-Columbite-Beryl,
Ka-Mi-Tin Mine, Lincolnton, N.C.

Reference is made to your letter dated March 25, 1953, the contents of which I find somewhat baffling. However, at this time I would like you to do the following for me:

(1) You have in your possession one large folder which was part of our application but more explicit than the five copies submitted in accordance with regulations. I would greatly appreciate if this folder could be returned to me, while the five copies can remain in your file for future action.

(2) We understand that as part of our application our property was inspected by an engineer connected with the U.S. Bureau of Mines, whose findings are on file. In accordance with our previous request, we would appreciate receiving a copy of this report for our files and guidance.

In the meantime we are proceeding with our project as planned, except for the last four months' delay, and it will be interesting to compare our costs and results with those of the government project.

Very sincerely yours,

STANDARD MINING CORPORATION

Howard Steven Strouth

6-11-53
It was my understanding that by phone Company said they were going ahead with the project themselves. Thus if they did and then wanted aid it would be on the basis of the new work and a new application would be in order.
E.W.E.

April 1, 1953

On the basis of this letter we consider the application withdrawn.

hss-vmg

Ernest Wm. Ellis, Chief
Rare & Misc. Metals Division
DMEA

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

April 7, 1953

Memorandum

To: Mails & Files

From: Ernest Wm. Ellis, Chief
Rare & Misc. Metals Division

Subject: Docket No. DMEA-2773 (Tin-columbit-beryl)
Lincoln Mining Corporation
Ka-Mi-Tin Mine, Lincoln County, N. C.

In accordance with the note dated April 1, 1953, placed at the bottom of the company's letter dated March 27, we consider this application withdrawn. The docket should be placed in the closed file.

Ernest Wm. Ellis

Ernest Wm. Ellis

cc to: Adm.Reading File
Docket
Mr. Ellis

FILE COPY
SURNAME:

Schmidt
Ellis
Hoffman
Selfridge

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

[illegible]

MAR 25 1953

[illegible]

J. C. 3/25/53

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

We regret that it has taken considerable time to arrive at this conclusion but it has been influenced by a number of factors which required detailed study.

For your own guidance, it is our thought that it may be a matter of a few months before we can make any decision on your application. Since we do not regard our present position as being in any way a denial of your application, we will be pleased to keep it open, if you wish, for future consideration.

Sincerely yours,

C. O. Mittendorf (fw)

Administrator

FSSchmidt/gla 3-23-53
cc to: Adm. Reading File
Docket
Messrs. ARKinkel, Jr., Rm. 4234 GSA
A.Reniok, Rm. 3061
Ellis
Schmidt
DMEA Field Team, Region VII

Notes by Schmidt 3/20/53

Considerable study had been given to this North Carolina spodumene belt and the data written by Schmidt for the purpose of deciding on a policy for the belt as a whole. This data has been filed under DMEA 2841 Foote Mineral Co. and served the purpose of crystallizing a policy of first writing a contract with Foote and letting the results of that project determine our future course.

One project had to be selected and the reason the Foote Project was selected ~~xxx~~ were as follows;

Footes original application preceded the Lincoln application

Foote has certificate of necessity for mining spodumene at Kings Mountain and also for making lithium salts.

~~Foote has a going mill which is expanding from 120,000 tons to 360,000 tons/yr~~

~~Foote has a joint project with Bureau of Mines for metallurgy of beryl~~

~~Foote has mined and milled over 150,000 tons of the pegmatite ores and is equipped with machines and men and technically trained men to do justice to an exploration project in this belt~~

They are therefore the logical operators with whom to cooperate in the execution of this ~~xxxxxxxxxxxxxxxx~~ first test project from which we propose to learn whether these dikes are fairly uniform and whether they vary in their strategic content and whether the dikes drilled average higher content of strategics than the ones already developed.

2773

CABLE: STANDORES

STANDARD ORE & ALLOYS CORPORATION

120 WALL STREET

NEW YORK 5, N. Y.

WHITEHALL 3-1600

IN REPLY REFER TO: HSS-2805

February 24, 1953

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
FEB 25 1953

Department of the Interior
Bureau of Mines -- DMEA
Washington, D.C.

Attention: Mr. Sumner Schmitt.

Dear Mr. Schmitt:

Reference is made to our application for a DMEA loan on our Lincolnton property based upon the occurrence of various heavy minerals, besides the lithium.

We would greatly appreciate learning the final outcome of our application.

The undersigned would appreciate it if you would call him, collect, at your earliest convenience, at our New York office--

WHitehall 3-1600.

Thanking you, I remain,

Sincerely yours,

STANDARD ORE & ALLOYS CORPORATION

Howard Steven Strouth

hss-vmg

1/29/53 gm

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
~~WASHINGTON 25, D. C.~~
ROOM 13, POST OFFICE BLDG.
KNOXVILLE 2, TENN.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JAN 22 1953

January 20, 1953

Memorandum

To: Operating Committee, D M E A - Washington

From: Field Team, D M E A - Region 7

Subject: DMEA-2773, Lincoln Mining Corp.(Tin, Columbium, Beryl).

Enclosed herewith are 4 copies of a memorandum by Wallace R. Griffitts, concerning the subject application. Mr. Griffitts did not make a special field examination at this time, but he has recently completed a thorough field examination of the entire tin-spodumene belt of the central Carolina Piedmont, and is familiar with the Ka-Mi-Tin property.

Mr. Griffitts has pointed out, in a separate letter, that although there is little doubt that by-product recovery of cassiterite, columbite and beryl would result from large-scale milling of spodumene and feldspar from these deposits, the economics of the situation leave considerable doubt as to the "significance" of such by-product recovery. The information on which this is based was received after Mr. Beck's telephone conversation with Mr. Schmidt on January 19, 1953.

The following table shows the estimated composition of the rock, and the amount of the various minerals that would be mined for each 100 tons of cassiterite-columbite concentrate, and recent production data:

Mineral		Percent	Production Short tons	U. S. Annual Production 1948	1949
Columbite and Cassiterite	0.02	0.03	100		
Ground mica		3	10,000	52,157	32,856
Spodumene	10.00	20	66,700 (4000 T. Li_2O)	291(Li_2O)	475(Li_2O)
Ground feldspar		45	150,000	506,451	386,707
Beryl	.17	0.4	1,300		

Reviewed by
BMEA OPERATING COMMITTEE
1-28-53
(date)

Thus, to get 100 tons of cassiterite-columbite concentrate, it would be necessary to produce spodumene equal to about 10 times the total U. S. Production, ground mica equal to about 25% of the entire U. S. production, and ground feldspar equal to about a third of the entire U. S. production. Recovery of the 1300 tons of beryl indicatedin the table is doubtful, and would be dependent upon metallurgical research.

We are, therefore, in agreement with Mr. Griffitts conculsion that "If the by-product tin and columbium will justify government assistance, some contribution less than 90% should be made." Decision on approval or rejection of this project should take into consideration the fact that a similar proposal has been received from Foote Mineral Co. (DMEA-2841) and similar ones will undoubtedly be received from Mathieson and other companies.

Robert A. Laurence

Robert A. Laurence, Executive Officer
Field Team, D M E A - Region 7

Wm A Beck

Wm. A. Beck, for V. J. Lynch
U. S. Bureau of Mines

C O P Y

C O P Y

UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
Denver Federal Center
Denver, Colorado

January 6, 1953

To: Robert A. Laurence, Executive Officer, DMEA-Field Team, Region VII

From: Wallace R. Griffitts, Geologist, U. S. Geological Survey

Subject: DMEA docket 2773 (Tin, Columbite, beryl, etc.)

The main point to consider in this application seems to be the propriety of providing government assistance in the exploration of deposits in which strategic materials entitled to such support are minor constituents, mineable only as byproducts. It seems to me that the government's participation, if any, should not be to the extent of 90 percent. This is a matter of policy which I am not qualified to decide. It should be borne in mind that the Consolidated Feldspar Corp., the Lithium Corp., of America, Commercial Ores, Inc., Mathieson Chemical Corp., and Fletcher Phillips have also shown interest in the spodumene deposits. If a precedent is set by giving DMEA assistance to the Lincoln Mining Co., (DMEA-2773), we can expect applications from some of the others which could hardly be denied if they contain similar evidence of the presence of cassiterite and columbite.

The proposed exploration seems to be far better than that proposed in most pegmatite applications. Two questions have come to mind, however; 1. Why does the applicant want to drill the incline dike from the footwall side? and 2. What purpose would be accomplished by underground exploration from the Swamp shafts?

The two sections showing diamond drill holes proposed by the applicant show holes to be drilled in the eastern (footwall) side of the dike and the dike dipping 90 or 65 degrees (alternates A and B respectively). With the 65 degree dip, the intersection between hole 2 and the dike is only 10 degrees, which means great errors will be introduced in determining both the depth to and thickness of the dike if the hole is deflected at all. There is evidence, summarized below that 65 degrees is nearly the maximum dip to be expected for the incline dike and the dip might actually be as low as 30 degrees; less steep than any of the drill holes.

1. I measured no dips on dikes on this property east of the highway, but those nearby range from 30 to 65 degrees.

2. D. B. Sterrett's field notes of November 7, 1912, taken when the Condon shaft was accessible and the diamond drill holes mentioned on pages 28 and 29 of St. Clair's report were being drilled, states that the Jap vein in the Condon

Reviewed by
DMEA OPERATING COMMITTEE

1-28-53
(date)

shaft area is "probably rather flat-lying with W. dip." and in a shaft 100 feet south of the Jake vein--"vein cuts irregularly across schist by steps - average dip 30° - 35° W." This step-like dip naturally makes it difficult to determine accurately dips on small exposures. Sterrett made a cross-section along a drill hole that was drilled N.E. from the D-H shaft on Kesler's map directly under the Condon shaft. It shows the intersections and outcrops with about 30° dip. Another specific statement about the Jake vein was "dip uncertain but about 30° N. W."

3. In the section through the Condon workings, St. Clair has shown dips to be 35° to 80°. Some of the steeper interpolations between levels could be re-interpreted and made gentle. The depths shown to the pegmatite contacts in the shaft agree with the depths given by Sterrett.

Because of the likelihood that the incline dike, like the others, dips rather gently I would suggest that any diamond drill holes that are approved be drilled from the western or hanging-wall side of the dike. This would pick up any parallel dike such as the one inferred by the applicant to be west of the incline dike. If each hole were moved to the west side, I would see nothing wrong with the drilling proposal. In interpreting the results it should be borne in mind that the dikes may plunge at a low angle, like those drilled by the Solvay Process Co., and Foote Mineral Co.

My understanding of exploration is that it is an effort to determine approximately the size, continuity and composition of a mineral deposit. I do not see how the proposed work in the Swamp shafts could increase our knowledge of anything but the composition of the dike, and I think the dumps give us at least a general idea of that. The proposed shaft sinking and drifting seems strange until the shape, attitude, continuity and dimensions of the dike are known. It will in no way give any idea of the amount of rock to be mined. I would suggest that the dike be explored at the surface by trenching (not bulldozing) or hand-augering and preferably at depth by diamond drilling before attempting underground sampling. If surface work shows the dike to be thick and continuous a couple of holes to prove 200 feet or more of downward extent would suffice. The major constituents- spodumene, feldspar, and quartz- are evenly enough distributed in most of these dikes to permit an approximate grade estimate from a very few samples. The cassiterite and columbite are so erratically distributed as to require an impractically large number of drill holes for reliable sampling. Bulk samples from drifts would be far better, but more expensive, and would not be justifiable unless the amount of rock present was rather large.

Except for the probability that the dikes dip more gently than the applicant indicated, I see little wrong with the geologic data given in the application. Without having sample data to justify the belief, I think the lower tin assays (those of Moon) are more likely to be correct than the higher ones. If nothing else, one is entitled to wonder why the earlier operations were unsuccessful if the tin content of the pegmatite were as high as some assays indicate. The high-grade tin ore is apt to be concentrated into small areas that probably could not be mined selectively. Sterrett mentioned a shoot exceedingly rich in cassiterite found in 1908 in the Jap vein. It was 1/2 to 2 feet thick, about 15 feet long and about 8 feet high; these are the only dimensions I've run across. I don't believe that there is need to worry about the operator's failing to recover cassiterite and columbite in any mill that might be constructed, as suggested by Lyons and Kinkel. A mixed heavy concentrate can very easily be made. At the Foote Mineral Co., the cost of operation of one Wilfrey table is all that is needed to concentrate the cassiterite and columbite of 600 tons a day or so of mill feed. A profit could be made even if there were only a few cents worth of the minerals per ton of rock.

The applicant's consulting geologist has emphasized that spodumene is probably in all the dikes but cannot be found in outcrops because of its rapid weathering. I did not examine the incline dike, but found the others on the property to be unusually rich in spodumene. The spodumene can be recognized by the characteristic shape of the grains even in completely kaolinized pegmatite. As would be expected, he expressed great enthusiasm over the potentialities of the property, comparing it with the Foote property at Kings Mountain. Just to give a little perspective, we may assume the average length and width of the incline dike to be 500 to 25 feet respectively; there should then be about 1250 tons of pegmatite per foot depth. In the Kings Mountain area, there are 140 dikes with 1300 tons or less per foot depth and 31 with more than 1300. The 31 larger dikes contain about 88 percent of the total resources of the area and the four largest dikes on the Foot Mineral Co., property contain 49 per cent of the total, aggregating 116,900 tons per foot depth. The Ka-Mi-Tim property is a rather typical sample of the northern part of the tin-spodumene belt. Several areas with much larger dikes, probably of comparable grade, could be found on Keisler's Beaverdam Creek Area map.

P. M. Landolt, Vice President of the Lithium Corp. of America has estimated that in spodumene operations "A flotation mill treating 150 to 200 tons of heads per 24 hours is about the minimum for an economical operation." Since the deposits on the KA-MI-tim property will make no contribution to the tin or columbium stockpile unless a mill can profitably be operated for spodumene, feldspar and ground mica (non-strategic), no assistance should be given unless a mill could be profitably operated on the ore discovered. Technologic problems of this

sort are, of course, the province of the Bureau of Mines. It can be pointed out that in a year with 300 working days a 150 ton mill will require 45,000 tons of feed per year. It is unlikely that the operations would be feasible if the life were less than 5 years. This would require a total of 225,000 tons of rock. Assuming nearly 100 percent recovery in mining, ore will have to be found in the Incline dike through 120 feet vertically to provide a 5 year supply of ore. It is likely that this can be obtained, and it is likely that 15 years or more supply could be found in the Incline, Swamp, and Jake dikes.

In summary, I believe that, if the by product tin and columbium will justify government assistance, some contribution less than 90 percent should be made to aid in diamond drilling the Incline dike and surface exploration and drilling in the Swamp dike, followed by reopening of the Swamp shaft for bulk sampling of the pegmatite.

Sincerely yours

s/
Wallace R. Griffitts

Copies by zn.
1/16/53.

1/22/53 gla

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS ADMINISTRATION
~~WASHINGTON 25, D.C.~~
Room 13, Post Office Bldg.
Knoxville 2, Tenn.

c
o
p
y

January 20, 1953

Memorandum

To: Operating Committee, D M E A - Washington

From: Field Team, D M E A - Region 7

Subject: DMEA-2773, Lincoln Mining Corp.(Tin, Columbium, Beryl)

Enclosed herewith are 4 copies of a memorandum by Wallace R Griffitts, concerning the subject application. Mr. Griffitts did not make a special field examination at this time, but he has recently completed a thorough field examination of the entire tin-spodumene belt of the central Carolina Piedmont, and is familiar with the Ka-Mi-Tin property.

Mr. Griffitts has pointed out, in a separate letter, that although there is little doubt that by-product recovery of cassiterite, columbite and beryl would result from large-scale milling of spodumene and feldspar from these deposits, the economics of the situation leave considerable doubt as to the "significance" of such by-product recovery. The information on which this is based was received after Mr. Beck's telephone conversation with Mr. Schmidt on January 19, 1953.

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We are, therefore, in agreement with Mr. Griffitts conclusion that "If the by-product tin and columbium will justify government assistance, some contribution less than 90% should be made." Decision on approval or rejection of this project should take into consideration the fact that a similar proposal has been received from Foote Mineral Co. and similar ones will undoubtedly be received from Mathieson and other companies.

DMEA-2841

/s/ Robert A. Laurence
Robert A. Laurence, Executive Officer
Field Team, D M E A - Region 7

/s/ Wm. A. Beck
Wm. A. Beck, for V. J. Lynch
U. S. Bureau of Mines

c
o
p
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C O P Y

C O P Y

UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
Denver Federal Center
Denver, Colorado

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JAN 21 1953

January 6, 1953

To: Robert A. Laurence, Executive Officer, DMEA-Field Team, Region VII

From: Wallace R. Griffitts, Geologist, U. S. Geological Survey

Subject: DMEA docket 2773 (Tin, Columbite, beryl, etc.)

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My understanding of exploration is that it is an effort to determine approximately the size, continuity and composition of a mineral deposit. I do not see how the proposed work in the Swamp shafts could increase our knowledge of anything but the composition of the dike, and I think the dumps give us at least a general idea of that. The proposed shaft sinking and drifting seems strange until the shape, attitude, continuity and dimensions of the dike are known. It will in no way give any idea of the amount of rock to be mined. I would suggest that the dike be explored at the surface by trenching (not bulldozing) or hand-augering and preferably at depth by diamond drilling before attempting underground sampling. If surface work shows the dike to be thick and continuous a couple of holes to prove 200 feet or more of downward extent would suffice. The major constituents- spodumene, feldspar, and quartz- are evenly enough distributed in most of these dikes to permit an approximate grade estimate from a very few samples. The cassiterite and columbite are so erratically distributed as to require an impractically large number of drill holes for reliable sampling. Bulk samples from drifts would be far better, but more expensive, and would not be justifiable unless the amount of rock present was rather large.

Except for the probability that the dikes dip more gently than the applicant indicated, I see little wrong with the geologic data given in the application. Without having sample data to justify the belief, I think the lower tin assays (those of Moon) are more likely to be correct than the higher ones. If nothing else, one is entitled to wonder why the earlier operations were unsuccessful if the tin content of the pegmatite were as high as some assays indicate. The high-grade tin ore is apt to be concentrated into small areas that probably could not be mined selectively. Sterrett mentioned a shoot exceedingly rich in cassiterite found in 1908 in the Jap vein. It was 1/2 to 2 feet thick, about 15 feet long and about 8 feet high; these are the only dimensions I've run across. I don't believe that there is need to worry about the operator's failing to recover cassiterite and columbite in any mill that might be constructed, as suggested by Lyons and Kinkel. A mixed heavy concentrate can very easily be made. At the Foote Mineral Co., the cost of operation of one Wilfrey table is all that is needed to concentrate the cassiterite and columbite of 600 tons a day or so of mill feed. A profit could be made even if there were only a few cents worth of the minerals per ton of rock.

The applicant's consulting geologist has emphasized that spodumene is probably in all the dikes but cannot be found in outcrops because of its rapid weathering. I did not examine the incline dike, but found the others on the property to be unusually rich in spodumene. The spodumene can be recognized by the characteristic shape of the grains even in completely kaolinized pegmatite. As would be expected, he expressed great enthusiasm over the potentialities of the property, comparing it with the Foote property at Kings Mountain. Just to give a little perspective, we may assume the average length and width of the incline dike to be 500 to 25 feet respectively; there should then be about 1250 tons of pegmatite per foot depth. In the Kings Mountain area, there are 140 dikes with 1300 tons or less per foot depth and 31 with more than 1300. The 31 larger dikes contain about 88 percent of the total resources of the area and the four largest dikes on the Foot Mineral Co., property contain 49 per cent of the total, aggregating 116,900 tons per foot depth. The Ka-Mi-Tim property is a rather typical sample of the northern part of the tin-spodumene belt. Several areas with much larger dikes, probably of comparable grade, could be found on Keisler's Beaverdam Creek Area map.

P. E. Landolt, Vice President of the Lithium Corp. of America has estimated that in spodumene operations "A flotation mill treating 150 to 200 tons of heads per 24 hours is about the minimum for an economical operation." Since the deposits on the KA-MI-Tin property will make no contribution to the tin or columbium stockpile unless a mill can profitably be operated for spodumene, feldspar and ground mica (non-strategic), no assistance should be given unless a mill could be profitably operated on the ore discovered. Technologic problems of this

sort are, of course, the province of the Bureau of Mines. It can be pointed out that in a year with 300 working days a 150 ton mill will require 45,000 tons of feed per year. It is unlikely that the operations would be feasible if the life were less than 5 years. This would require a total of 225,000 tons of rock. Assuming nearly 100 percent recovery in mining, ore will have to be found in the Incline dike through 120 feet vertically to provide a 5 year supply of ore. It is likely that this can be obtained, and it is likely that 15 years or more supply could be found in the Incline, Swamp, and Jake dikes.

In summary, I believe that, if the byproduct tin and columbium will justify government assistance, some contribution less than 90 percent should be made to aid in diamond drilling the Incline dike and surface exploration and drilling in the Swamp dike, followed by reopening of the Swamp shaft for bulk sampling of the pegmatite.

Sincerely yours

s/
Wallace R. Griffitts

Copies by zm.
1/16/53.

1/28/53 gla

IN REPLY REFER TO:

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

January 27, 1953

Re: Docket DMEA-2773
Lincoln Mining Corp.
Ka-Mi-Tin property,
Lincoln County,
North Carolina
Total Cost: $32,050
Tin, Columbium, Beryl

Memorandum

To: Mr. E. Wm. Ellis

From: Erwin J. Lyons

Subject: Recommendation for denial

Wallace R. Griffitts, in a memorandum on the subject application to Robert A. Laurence, recommends that Government assistance in some amount less than 90% of the total cost might be considered provided that the by-products tin and columbium are in sufficient amounts to justify Government assistance.

Two applications by the Foote Minerals Company have been submitted on properties in this same belt. These were denied on the basis that the principal product would be spodumene and that there would not be significant production of tin and columbite as by-products. The present reviewer believes that the same applies to the subject application and recommends that the application be denied.

DMEA-2841

Erwin J. Lyons
Geologist

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

January 27, 1953

Re: Docket IMEA-2773
Lincoln Mining Corp.
Ka-Mi-Tin property,
Lincoln County,
North Carolina
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Memorandum

To: Mr. E. Wm. Ellis

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Erwin J. Lyons
Geologist

1/23/53 gla

CABLE: STANDORES

STANDARD ORE & ALLOYS CORPORATION
120 WALL STREET
NEW YORK 5, N. Y.
WHITEHALL 3-1600

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JAN 23 1953

IN REPLY REFER TO:

January 22, 1953

Captain D. Ellis
Defense Minerals Exploration Administration
Department of the Interior
Washington 25, D. C.

RE: DMEA-2773 - Ka-Mi-Tin Mines.

Dear Mr. Ellis:

Reference is made to our above DMEA application and the fact that your Tennessee engineer of the Bureau of Mines has turned in a favorable report on our mines at Lincolnton, North Carolina, for which an exploration application has been made.

We wondered whether eventually a copy of this report could be made available to us, since doubtlessly your Bureau of Mines engineer has made suggestions and expressed opinions which might be of considerable help to us during the initial phases of our program.

Thanking you for your courtesy past and present, we remain,

Very sincerely yours,

STANDARD ORE & ALLOYS CORPORATION

Howard S. Strouth

HSS/lew

1/23/53 gla

CABLE: STANDORES

JRY
GCL
1/20/53

STANDARD ORE & ALLOYS CORPORATION

120 WALL STREET

NEW YORK 5, N. Y.

WHITEHALL 3-1600

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
JAN 22 1953

IN REPLY REFER TO:

January 21, 1953

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

Dear Mr. Mittendorf:

Lincoln Mining

We understand from Mr. McCauley that our project DMEA No. 2773 for the production of columbium, tantalum, mica, etc., is progressing satisfactorily and wish to take this opportunity to thank you for your kind assistance and the speed and expediency with which the gentlemen on your staff, such as Mr. Smith, Mr. Ellis and Mr. Griffith have handled this project.

I also wish to express our sincere appreciation for the courtesy and cooperation extended to the undersigned, our Mr. McCauley, our Mr. Hooton and other members on our staff.

Very sincerely yours,

STANDARD ORE & ALLOYS CORPORATION

Howard S. Strouth

HSS/lew

~~xxxxxxxxx~~ Fone to Mc Cauley 1/19/53 President of Co
Whitehall 3-1600

Lincoln Mining Co New England Industries

Explained to Mc Cauley that this application had been put in, with the idea that lithium was one of the strategic metals on our list and that since it was the main constituent of the ore and since we were denied the use of this lithium content as an elemt of value we had to depend on the columbium and tantalum and tin and mica and this crippled the merits of the case. However inspite of that we deicded to make a field referral and the field Mr. ~~xxxxxxx~~ Laurence sent the application to Mr. Griffits of the U.S.G.S. in Denver who had made a complete study of the district and who was familiar with the work of the Foote Mineral Co on which I laid much stress and that this report from Griffits had just arrived and would be sent to me immediately with comments by Laurence and that it proposed some work though not agreeing exactly with the plans of the operator. This therefore meant that the application was very much alive and that unless the commodity men had some objection to the Griffits report that it would terminate in the writing of some contract. All this pleased Mr. McCaluey who thought his application was in the right hands, and he was going to write a lette of appreciation.

12/30/52 gla

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

Room 13, Post Office Building
Knoxville 2, Tennessee

December 23, 1952

Memorandum

To: Operating Committee, D M E A - Washington

From: D M E A Field Team - Region 7

Subject: DMEA-2773, Lincoln Mining Corp. (Tin, etc.)

Your letter of December 18, 1952, requesting field examination on the subject application has been received.

Inasmuch as Mr. Wallace R. Griffitts, of the Geological Survey, now located at Denver, Colorado has recently completed a detailed field study of the tin-spodumene belt, is much more familiar with the type of deposits involved and with the local geology than any of our staff here, we are forwarding the entire file to him for comment and recommendations. It is our opinion that this will be much more satisfactory than a field examination by any of our local staff. Therefore, we plan no further action until we receive Mr. Griffitts' recommendations.

filed with MF-103 in pocket envelope → The copy of USGS Bulletin 936-J which you enclosed with your letter is returned herewith, as we have a copy in our files. Please note, however, that plates 41 and 42 were missing from this copy when we received it.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
DEC 2 3 1952

Robert A. Laurence
R. A. Laurence, Executive Officer
DMEA Field Team, Region 7

Wm A Beck
Wm. A. Beck, for V. J. Lynch
U. S. Bureau of Mines

UNITED STATES
DEPARTMENT OF THE INTERIOR

DEFENSE MINERALS ADMINISTRATION
WASHINGTON 25, D. C.

Room 13, Post Office Building
Knoxville 2, Tennessee

December 23, 1952

Mr. Wallace R. Griffitts
U. S. Geological Survey
Denver Federal Center
Denver, Colorado

Re: DMEA-2773 (tin, etc.)
Lincoln Mining Co.

Dear Wally:

I am enclosing herewith the following data concerning an application for the Lincoln Mining Corporation:

1. Application, dated November 6, 1952, and attached related documents.

2. Letter from the Operating Committee dated Dec. 18, 1952, with notes by Arundale, Renick, and Lyons and Kinkel. Bull. 936-J, mentioned in the letter, is not enclosed as you will have access to a copy of it.

You will note that the Operating Committee has referred this to the Field Team for field examination, if necessary, and recommendations. Inasmuch as you are much more familiar with the geology of the tin-spodumene belt than any of our local staff, we are referring it to you for comments and recommendations. If you think a field examination is necessary, we will arrange it, but in that case we would greatly prefer to have you make the examination.

Will you please send me, at your earliest convenience, your recommendations for this application and any pertinent data concerning the Ka-Mi-Tin property which you can release to DMEA. The proposal should be judged principally on its potential as a producer of the several strategic minerals, though economic considerations would

naturally have to include the probable spodumene production.

Thanks for the reprint of your paper on "Granitic rocks of the western Carolina Piedmont". I'm glad to see the various names finally receive officially legitimate status.

Sincerely,

Robert A. Laurence
Executive Officer, DMEA
Field Team, Region 7

RAL/mm
cc:
Beck
Lynch
Opr. Com.
Files-2

FILE COPY
SURNAME:
700
Schmidt
Ellis

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

DEC 18 1952

Mr. Howard [illegible] Stroth
Executive Vice President
Lincoln Mining Corporation
120 Wall Street, Room 2805
New York 5, New York

Re: Docket No. [illegible]-2773
(Tin, columbite-tantalite, mica, lithium)
Ma-Mi-Tin property
Lincoln County, North Carolina

Dear Mr. Stroth:

The application for assistance in exploring your property under the above captioned docket number, has been reviewed by the Rare and Miscellaneous Metals Division of the Defense Minerals Exploration Administration. It has been referred to the Executive Officer of Region VII at the following address:

Mr. Robert [illegible] Lawrence
Executive Officer
DMEA Field Team, Region VII
Room 13, Post Office Building
Knoxville, 12, Tennessee

It is our understanding that your application is based on the assumption that lithium is one of the critical metals for which the DMEA executes exploration contracts. This is to inform you that while spodumene is one of the important components of your ore the lithium content must be considered a by-product and the merit of the application rests largely on the possible value of the strategic metals.

There has consequently been unavoidable delay in referring this application to the field. It is believed, however, that the Field Team will give it their earliest possible attention.

Sincerely yours,

C. O. Mittendorf (fw)

Administrator

FSSchmidt/jem
12/15/52
cc to: Adm. Reading File
Docket
Messrs. Ellis
Schmidt
Field Team, Reg. VII (2)

A.H.
12-18-52

FILE COPY
SURNAME:
700

Schmidt

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

DEC 18 1952

Mr. Robert L. Laurence
Executive Officer
DMEA Field Team, Region VII
Room 13, Post Office Building
Knoxville, 02, Tennessee

Re: Docket No. [illegible]-2773
(tin, columbite-tantalite, mica, lithium)
Lincoln Mining Corporation
Ko-i-tin property
Lincoln County, North Carolina

Dear Mr. Laurence:

The captioned application is referred to your office for a field examination, if same is deemed necessary, and your recommendations.

Referral of this application to your office has been delayed somewhat, awaiting comments from the commodity specialists. Enclosed is a memorandum from Mr. Robert Renick of the Bureau of Mines, dated November 18, and notes from the Mount Weather files pertaining to the subject application. Likewise enclosed are copies of memoranda from Mr. Joseph L. Gillson, Bureau of Mines, dated December 1, and Mr. Irwin J. Lyons, Geological Survey, dated December 10, together with copy of Geological Survey Bulletin 935-J entitled, "The Kings Mountain belt of the Carolinas." As this is the only copy of the bulletin that is available, kindly return same with your recommendations.

While an examination of the proposed project may not reveal more information than the present physical condition of the property, in view of the fact that the Foote Mineral Company is operating on a similar ore in the King's Mountain area, it is considered desirable to refer this application to you. Furthermore, it is our understanding that the Foote Mineral Company may apply for an exploration contract on their so-called South Tract on. Therefore, a study if possible, of results being obtained geologically and metallurgically at the Foote Mineral Company property would be of considerable value.

[illegible] object to recommend [illegible] suggest [illegible] thought [illegible] proposal [illegible] 1 and 2 [illegible] the [illegible] 2 [illegible] sheets 1 and 3.

[illegible] application [illegible] November [illegible], 195[illegible]. [illegible] forwarded [illegible] the [illegible].

Very truly yours,

(signed) FRANK E. JOHNSON

Chairman, [illegible]

Attorneys:

J. E. Hedges

Member, [illegible]

A. R. Kinkel, Jr.

Member, [illegible]

[illegible]/jen 12/18/52
cc to: [illegible] Pending File
Docket [illegible]
Mr. [illegible] Henrck-3061
A.R. Kinkel-4234 C.
Lillie Hammitt
Mr. Con.
Kirkland, Ellison Vil

P.H.
12-18-52

CABLE: STANDORES

STANDARD ORE & ALLOYS CORPORATION

120 WALL STREET

NEW YORK 5, N. Y.

WHITEHALL 3-1600

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
DEC 16 1952

IN REPLY REFER TO:

December 15, 1952

Mr. Ernest W. Ellis
Defense Minerals Exploration Administration
Department of the Interior
Washington 25, D. C.

RE: DMEA Application No. 2773 - Ka-Mi-Tin Mines.

Dear Sir:

Further to our previous communications on the above application, I trust that you have meanwhile received the maps made by the Lincolnton County Surveyor and the undersigned would like to emphasize again the importance of the strategic minerals on our property, such as tin, columbite, tantalite, beryllium and mica.

We realize that the lithium for which a basic industrial demand exists at this time will eventually be of importance to the defense effort, but has not as yet been put on the strategic list. For this reason the application was made for the other strategic minerals and the fact that at the same time we will be producing lithium ores should serve as a re-assurance to the Government that the operation will be profitable and capable of returning the requested loans to the Government within a reasonably short time.

Very sincerely yours,

STANDARD ORE & ALLOYS CORPORATION

Howard S. Strouth

HSS/lew

ABSTRACT OF NOTES ON NPA-2773 LINCOLN MINING CORPORATION, LINCOLN CO., NORTH CAROLINA
by
F. Sommer Schmidt

Conferences with Arundale and Kline (B.M.) Hosted (AEC) Hooton Geologist for applicant-Koster Chemical Div. NPA.

Applicant is subsidiary of New England Industries Co. reputable mining operator.

Property located in the belt in North Carolina which is largest reserve of Sn Cb and Ta known in this country. The application states ore contains spodumene 18% Cassiterite 0.25%, Cb and Ta 0.01%, Mica 6%, Beryl ? .

Lithium not on exploration list and its production together with the mica is essential for production of the important other elements on this ore.

The application has been denied a field referral by the Survey commodity men; The Bureau member referred it to Arundale (BM Lithium) who takes no definite position. There is no impending shortage of lithium, but there is a need for all anticipated production.

There is a big file-numerous reports-written long ago.

The Foote Mineral Co. is operating-open pit-flotation mill making concentrate of spodumene for their chemical plant. They are skilled operators.

This is not an ordinary application, that must conform to our standard pattern. There is too much tonnage of critical mineral involved. Too much history has been made in this matter by Foote since these reports were written.

I am informed by Kline that the Bureau plans to do some drilling in this belt. This is very important in connection with this subject application.

Our Field Office should know what is being accomplished by Foote, and since we are expecting an exploration application by Foote it would seem advisable for the field team to study this subject application in the light of their present experience.

There is at present nothing more at stake than getting a Field Team report based on familiarity with the activities in this district. This is not a decision concerning a contract.

The decision in this case will establish a precedent for further applications and the results may be far reaching.

We have a great responsibility in this and we do not have proper data. There has not been enough work done on the subject property to determine the difference in mineralization between the weathered and the primary zone and such assay values as are available vary considerably in the different reports. It is questionable whether any accurate figures of average values are available which would apply over a large tonnage.

It is recommended that this application be referred to the Field as per the letter of instructions that has been written.

DM 2773 Lincoln Mining Corp Notes Schmidt 12/15.52
Lincoln County North Carolina

Notes by Schmidt

Conferences Arundale and Kline(B.M.) Hosted(AEC) Hooton geologist for applicant
also Koster NPA

Spodumene, Columbite, Tantalite, Tin, Mica, Beryl

Lincoln County, North Carolina.

Applicant Lincoln Mining Co is subsidiary of New England Industries Co a reputable and extensive mining operator.

Property located in the belt in North Carolina which is the largest storehouse of tin and Cb and Ta known in this country. The grade is very low, and the only way production can be made commercially is to have the larger percentage of spodumene 18% (composition 5.5% Li_2O) carry the expenses. Lithium is not on our exploration list, but since it is possible that the AEC considers it of importance in connection with hydrogen bomb work, I am having Hosted make inquiries.* This information not available as yet.

This is not a project that one can deny simply because it does not fit into one of our standard patterns or meet standard criteria. This is an exceptional situation. There are extraordinary tonnages of these rare metals in this belt of ore reminding one of the gold in the sea water, but the time may come when Cb and Ta or Tin MUST be had at any cost, and it is questionable how far we should go to determine what our national resources are in regard to these metals regardless of economic considerations.

The application has been denied by Erwin Lyons and A.R. Kinkel of the Survey dated 12/10/52 Renick of the Bureau passes the decision to Arundale saying he will go along with Arundale which means nothing. Arundale says that his field is lithium, and he provides me with data to show that the lithium production is keeping pace with the commercial requirements as per attached data which is unofficial, and not for quotation. It is an educated guess but shows that there is no critical demand for lithium in sight for civilian needs.

If it were possible to make a commercial production of the 1.1% of lithia Li_2O and recover the Cb and Ta and Sn as by-products then this

* Hosted reports no information forthcoming

project (which would also produce mica and beryl) might stand on its own feet even if lithium is not on our list, because of the extremely critical status of the Cb and Ta and Sn.

I am informed by Kline that the Bureau has been working for 10 years on the extraction of Cb and Ta in these ores ~~and~~ without success. What the tin is doing he does not know, but the Cb and Ta which amount to o.o1% or 2/10 of a pound per ton, go one half into the spodumene concentrates, and one half stays in the tailings and there is no way known to get them out.

The work at King Mountain by Foote Mineral Co is being done in collaboration with the Bureau who have helped work out the process, and it is the experience of this operating company that should be our criteria rather than reports that were made many yeqrs ago which fatten the present files.

~~No intelligent decision can be made on this application without an understanding of the results and experience of the Foote Minerals Co. for which data see~~ contact their research man S.C. Ogburn

~~The Foote Minerals company should be contacted and since they have received much help from the government they may be cooperative. They are working on this same belt on an ore which Hooton claims over the fone to me is not as good as that of the applicant.~~

I dont see how any one can deny this application without knowing more about it than any of those that have commendted on it, because it is too important. It should be referred to the field who through being on the ground and certainly somewhat familiar with an operation like Footes in their region must have more up-to-date information than is in these files or any other old files of the Survey or Bureau. I think history is being made every day at that Foote operation, and I refuse to deny this aplication without a full concurrence of our Field men.

We have a great responsibility in this matter. "hat we do about denying this application sets a precedent concerning other applications in that belt some of which may turn out to be richer than other areas.

The Foote Co is doing some drilling now.

Kine tells me that the Bureau plans to do some drilling in this belt. There must be justification for this
The Foote Co no doubt picked out what they considred the best ground though naturally they could not know.

I do not agree with commodity men comments that there would be little use in the field team reviewing the extensive literature on these properties. It isnot a question of reviewing old literature but of getting the data from an actual operation based on conditions of today and the foreseezble future.

The Lyons Kinke; comments 12/10 quote it seems doubtful that a new field examination would add additional information." It is my thought that a field examination involving z study of the Foote operation would give us the only data of value on which to base a decision.

Application states 99 year lease with option to purchase but nothing in the file to show this. Summary ~~xxxxx~~ states mine under 10 year lease to Lincoln Ming Co. Mine owned by Ka-Mi-Tin concentrating Corp. J.N. Brenizer Pres.
There was once a tin smelter on the property, unsuccessful but indicative.

Lithium in spodumene is slightly soluble in the oxidized zone, and there would probably be some redeposition of lithium in the primary zone. Nowhere is spodumene fo nd in surface outcrops on this property. The ore is all in pegmatite Not typical, with large crystals, but more like large pegmatized areas, permitting open pit work in them as at Foote. Lincoln would possibly requre underground work.

aganst Foote open pit- serious handicap. Also possibly certain areas where pit could be worked. spodumene weathers, and that reduces flotation saving in mill. Foote has little weathering, but some Lincoln has weathering down to 60 to 80 feet. All old work in weathered zone. Only Swamp shaft 1 and 3 show primary in small dumps. Possibly selective mining rather than open pit is the answer. These 2 shafts mentioned are full of water. They should be unwatered if Field Team examination is made, not only for our work but of benefit to operator who has never been down in them.

There are no croppings of the pegmatite dikes due to weathering. Makes prospecting difficult, much timber and soil. Hence diamond drilling would be of value to show geology, location, thickness, and dip of dikes, and also in general way whether mineralized, without reliable assay average values. If good spodumene were shown it is LIKELY that the dike is mineralized with other metallic ores.

~~Applicant Co has made provision for power for mill and water and has sufficient finances to do justice to the prospecting of such an area with good management.~~

~~There is a map of the property by metes and bounds but does not show the proposed work.~~

~~Any legal matters concerning Owners Consent to Lien can be handled from here if it is necessary.~~

Recommendation; Try to learn all we can from Foote especially Ogborn. Provide the field team with this information and ask them for their report based on this data and what they may already know or can get from the Foote operation. The files while voluminous are not informed as to what is really going on. In any case I recommend that we do not deny without having a field report.

Schwerch

12/12/52

Unofficial estimates by Joe Arundale Bureau Mines

Data on Foote Mineral-King Mountain operation

The spodumene that Foote Mineral Co is producing is 18% of the ore and runs 5.5% lithia Li2O or 6 % Their cut off is about 1.1 or 1.2 % lithia

Their work is all open pit

Recover 50% to 60% in mill. could do better if it were not due to weathering

There is no tin data of recovery.

Production expected by 1955

Metalloy Co S. Dak Black Hills		6,000 tons/yr at 5% spodumene
Holy Terror	"	3,000
Black Hills Tin	"	3,000
Etta Mine	"	3,000
Foote now 7,000 claims they will be		25,000
Searles Lake American Potash		6,000
Pacific Coast Borax tailings good grade		?
	Total	46,000 estimate

Requirements by 1955 exclusive of Hydrogen bomb estimated at 50,000 tons of equivalent of 5%

With AEC requirements unknown it looks as though there would be no great critical need of spodumene.

A fone discussion with Koster chemical Div of N.P.A. corroborated the following.

The the uses for lithium and consumption had increased from 3,000,000 lbs to 10,000,000 in the last 3 years. hat the anticipated consumption would pro ably be met by new production but that if they figured full mobilization the picture would change immediately and we would then be looking for exactly such sources as this North Carolina belt. o the present status is OK so long as it is based on partial mobilization and no new unexpected use such as for instance hudrogen bomb work etc.

12/11/52 glu

CABLE ADDRESS: NEWLANDIN

THE NEW ENGLAND INDUSTRIES, INC.
120 WALL STREET
NEW YORK 5, N. Y.
WHITEHALL 3-1600

IN REPLY REFER TO:

December 10, 1952

Captain D. Ellis
Defense Minerals Exploration Administration
Department of the Interior
Washington 25, D. C.

RE: DMEA-2773 - Ka-Mi-Tin Mines - Exploration Assistance.

Dear Mr. Ellis:

In accordance with your request of recent date, we are herewith submitting three additional copies of maps made for us by the registered Land Surveyor for the County, made at Lincolnton, on November 25th. This map shows the 570 acres stated in our application. It should be borne in mind that while good indications exist that additional ore bodies will be found on this property, the only developed portion of the property, of which more detailed maps exist, are the northern sections marked 1, 2, and 3.

A more detailed description and drawing exists of the property, drawn by Dr. Heron, which also includes the smaller access roads, greater detail regarding the ore bodies previously proven, different mine workings, etc. -

We trust that these maps will be found satisfactory and that our application can be processed with a minimum of delay, more so since we have an engineer now doing preliminary work on the property and would like to start drilling as soon as possible.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
DEC 11 1952

We have previously answered your request for reciprocal guarantees should a loan be granted and demonstrated our willingness to assume all normal obligations required by the Government in connection with such an application.

Very sincerely yours,

THE NEW ENGLAND INDUSTRIES, INC.

Howard S. Strouth

HSS/lew
Encls.3

IN REPLY REFER TO:

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

December 10, 1952

Re: DMEA-2773
Lincoln Mining Corporation
Ka-Mi Tin Mine, Lincoln
County, North Carolina
Total cost: $32,050.00
Tin

Memorandum

To: Mr. E. Wm. Ellis

From: Erwin J. Lyons
A. R. Kinkel, Jr.

Subject: Recommendation for denial

The Lincoln Mining Corporation, subsidiary of New England Industries, Inc., has applied for Government assistance to explore its properties in Lincoln County, North Carolina. Total estimated cost is $32.050.00.

The project proposed by the applicant consists of 6 diamond drill holes having a total footage of 3,600 feet, retimbering and deepening two shafts, one 40 feet and the other 20 feet, and 40 feet of crosscutting from each of the two shafts.

The area to be explored is in the northern part of the tin-spodumene belt in North Carolina. The diamond drilling will be done on a pegmatite body, known as the Incline dike, and will also investigate a possible extension of another pegmatite which is almost parallel to and lies 100 to 200 feet to the west of the first body. The two shafts to be deepened and from which the crosscutting will be done are known as Swamp Shafts No. 1 and No. 3. Shaft No. 1 has about 1,000 feet and Shaft No. 2 about 800 feet southwest of the Incline dike. These two shafts supposedly are located on the second pegmatite body. Information on the property can be obtained from the following:

Kesler, T. L., The tin-spodumene belt of the Carolinas: U.S. Geological Survey Bull. 936-J, 1942.

Consultant's reports by S. D. Heron (1952) and Stuart St. Clair (1937).

The map by Edwards and Barbour which accompanies Kesler's report does not show the second pegmatite dike which lies west of the Incline dike. A map accompanying the application shows the dike extending from the Old Quarry north of the Incline dike to Swamp Shaft No. 1. Its existence apparently is assumed by the pegmatite body in

the Old Quarry, a diamond drill hole, the records of which are lost, which was put down in the vicinity of the Bungalow shaft and which is reported to have cut four dikes east of the shaft, and the alignment of Swamp Shafts Nos. 1, 2, and 3 at the south end.

Kesler reports that the tin deposits are of small size and have a scattered distribution. The feasibility of drilling for orebodies of this type is questionable. Drilling would locate the pegmatite, but underground work would give more information on tin distribution in the pegmatite.

According to Kesler the cassiterite content of the deposits is extremely uneven in adjacent deposits, or even within a single deposit. The metallic tin content can range from a trace to more than 6%. Consequently, any single assay has little significance as to the tin content of the entire body.

The most extensive sampling appears to have been done by St. Clair who states that 6,714 lbs. of samples collected from 70 pits contained 0.18% tin, or 3.6 lbs. per ton of ore. Using the applicant's estimate of 537,000 tons for the size of the orebody which seems optimistic, this would give a total metallic tin content of about 967 tons of tin which would have a value at a market price of $1.20 per pound of $2,320,800.

The applicant estimates the deposit contains 96,600 tons of spodumene having a value of $9,000,000. This is based on an estimated grade of 18% spodumene which appears reasonable.

It would appear from the above that any deposit that might be developed would be essentially a spodumene producer. Any tin produced would be as a by-product and the yearly production of that metal would probably be very small. It may be economic to recover the small amount of tin if the deposit is mined for spodumene.

As the deposit has been carefully mapped by the Survey (Bull. 936-J) it seems doubtful that a new field examination would add additional information. We recommend that the application be denied for the following reasons:

1. The deposit would be mined primarily for spodumene.

2. It would be necessary to specify in the contract that

tin be recovered, as tin recovery may not be economically desirable for the operator.

3. Repayment would have to be on the basis of spodumene production, as well as tin production.

4. The loan could not be made on a basis of 90-10 Government participation because of the small tin content.

Erwin J. Lyons.
Erwin J. Lyons
Geologist

A. R. Kinkel, Jr.
Geologist

Notes by Schmidt on reasons for denial

1-Mined primarily for spodumene. What of it if we get what we want
2-"It would be necessary to spedify in the contract that tin be recovered, as the recovery may not be economically desirable for the operator." I fail to see where this comment is the reason for a denial. The fact is that with the metallurgy worked out by Foote that the incentive now is to find dikes that have the most by-products of tin and columbite and beryl . there does not seem to be any need to try to get operating companies to make the most money they can. See Foote data
3- Repyament would have to be on basis of spodumene production as well as tin. Is this a reason for denial. I see no connection. The contract calls for repayment by royalties of all the contents of the ore.
4- The loan could not be made on the basis of 90-10 Government participation because of the small tin content. Is this a basis for denial? Howabout the Cb and BeO We are in the exploration business.

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

December 10, 1952

Re: DMEA-2773
Lincoln Mining Corporation
Ka-Mi Tin Mine, Lincoln
County, North Carolina
Total cost: $32,050.00
Tin

Memorandum

To: Mr. E. Wm. Ellis

From: Erwin J. Lyons
A. R. Kinkel, Jr.

Subject: Recommendation for denial

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The area to be explored is in the northern part of the tin-spodumene belt in North Carolina. The diamond drilling will be done on a pegmatite body, known as the Incline dike, and will also investigate a possible extension of another pegmatite which is almost parallel to and lies 100 to 200 feet to the west of the first body. The two shafts to be deepened and from which the crosscutting will be done are known as Swamp Shafts No. 1 and No. 3. Shaft No. 1 has about 1,000 feet and Shaft No. 2 about 800 feet southwest of the Incline dike. These two shafts supposedly are located on the second pegmatite body. Information on the property can be obtained from the following:

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Kesler reports that the tin deposits are of small size and have a scattered distribution. The feasibility of drilling for orebodies of this type is questionable. Drilling would locate the pegmatite, but underground work would give more information on tin distribution in the pegmatite.

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The most extensive sampling appears to have been done by St. Clair who states that 6,714 lbs. of samples collected from 70 pits contained 0.18% tin, or 3.6 lbs. per ton of ore. Using the applicant's estimate of 537,000 tons for the size of the orebody which seems optimistic, this would give a total metallic tin content of about 967 tons of tin which would have a value at a market price of $1.20 per pound of $2,320,800.

The applicant estimates the deposit contains 96,600 tons of spodumene having a value of $9,000,000. This is based on an estimated grade of 18% spodumene which appears reasonable.

It would appear from the above that any deposit that might be developed would be essentially a spodumene producer. Any tin produced would be as a by-product and the yearly production of that metal would probably be very small. It may be economic to recover the small amount of tin if the deposit is mined for spodumene.

As the deposit has been carefully mapped by the Survey (Bull. 936-J) it seems doubtful that a new field examination would add additional information. We recommend that the application be denied for the following reasons:

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4. The loan could not be made on a basis of 90-10 Government participation because of the small tin content.

Erwin J. Lyons
Geologist

A. R. Kinkel, Jr.
Geologist

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December 10, 1952

Memorandum

Re: DMEA-2773
Lincoln Mining Corporation
Ka-Mi Tin Mine, Lincoln County, North Carolina
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Tin

To: Mr. E. Wm. Ellis

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Erwin J. Lyons
Geologist

A. R. Kinkel, Jr.
Geologist

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December 10, 1952

Memorandum

Re: DMMA-2773
Lincoln Mining Corporation
Ma-Mi Tin Mine, Lincoln County, North Carolina
Total cost: $32,050.00
Tin

To: Mr. A. M. Ellis

From: Erwin J. Lyons
A. M. Minkel, Jr.

Subject: Recommendation for denial

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The area to be explored is in the northern part of the tin-spodumene belt in North Carolina. The diamond drilling will be done on a pegmatite body, known as the Incline dike, and will also investigate a possible extension of another pegmatite which is almost parallel to and lies 100 to 200 feet to the west of the first body. The two shafts to be deepened and from which the crosscutting will be done are known as Swamp Shafts No. 1 and No. 3. Shaft No. 1 has about 1,000 feet and Shaft No. 2 about 800 feet southwest of the Incline dike. These two shafts supposedly are located on the second pegmatite body. Information on the property can be obtained from the following:

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Consultant's reports by S. D. Heren (1952) and Stuart St. Clair (1937).

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the Old Quarry, a diamond drill hole, the records of which are lost, which was put down in the vicinity of the Bungalow shaft and which is reported to have cut four dikes east of the shaft, and the alignment of Swamp Shafts Nos. 1, 2, and 3 at the south end.

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4. The loan could not be made on a basis of 90-10 Government participation because of the small tin content.

Erwin J. Lyons
Geologist

A. R. Hinkel, Jr.
Geologist

12/4/52 gla

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

December 4, 1952

Memorandum

To: Mr. Ernest W. Ellis, D. M. E. A.

From: Assistant Chief, Construction and Chemical Materials Branch

Subject: DMEA-2773, Lincoln Mining Corporation, November 6, 1952

Of the minerals listed in this application, only lithium minerals are the responsibility of this branch. Since lithium minerals are not eligible to receive exploration assistance the subject loan could not be justified on the basis of the spodumene alone. However, spodumene might contribute to the economics of a future commercial operation. The pegmatites in this area are described as being highly weathered. I might point out that weathering adversely affects the amenability of spodumene to beneficiation by present methods.

A review of the publications and the Bureau's records on this pegmatized area indicates that cassiterite, columbite-tantalite, and beryl occur in varying concentrations. I understand that our supply-requirement situation as regards these minerals is considered to be critical. The operation of Foote Mineral Company near Kings Mountain, North Carolina, has demonstrated the feasibility of recovering cassiterite and columbite-tantalite from a similar ore. The Bureau of Mines currently is conducting research on the recovery of beryl from this type of ore. Although the average content of these four minerals is small, this area is one of our largest potential reserves of these scarce materials. If, in aggregation, the quantities of cassiterite, columbite-tantalite (and potentially, beryl) that might be made available are significant, then the application should be considered.

Joseph C. Arundale

Joseph C. Arundale, Assistant Chief
Construction and Chemical Materials Branch

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
DEC 4 1952

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

December 4, 1952

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Joseph C. Arundale, Assistant Chief
Construction and Chemical Materials Branch

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
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DEC 4 1952

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December 4, 1952

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Construction and Chemical Materials Branch

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December 4, 1952

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From: Assistant Chief, Construction and Chemical Materials Branch

Subject: DMMA-2773, Lincoln Mining Corporation, November 6, 1952

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Joseph C. Arundale, Assistant Chief
Construction and Chemical Materials Branch

12/4/53 gla

CABLE ADDRESS: NEWLANDIN

THE NEW ENGLAND INDUSTRIES, INC.
120 WALL STREET
NEW YORK 5, N. Y.
WHITEHALL 3-1600

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
DEC 4 1952

IN REPLY REFER TO:

December 3, 1952

Capt. D. Ellis
Defense Minerals Exploration Administration
Department of the Interior
Washington 25, D. C.

RE: DMEA-2773 - Ka-Mi-Tin Mines

Dear Sir:

In order to further facilitate the work on our application, we are willing to assume all responsibilities outlined in your printed form, but as you know, we are not the owners but merely the lease-holders of this property and for this reason could not fulfill all the obligations which are normally required of property owners.

As you know, we are a fairly prominent company with an AAA-1 rating and for this reason we suggest that you have a form prepared for us to sign by which we assume all normal obligations connected with the granting of an Exploration Loan.

Thanking you, we remain,

Very sincerely yours,

THE NEW ENGLAND INDUSTRIES, INC.

Howard S. Strouth

HSS/lew

Mount Weather

Technical Files

No. 80.6993 Report: "Carolina Tin Belt" by Lowell B. Moon.

Ka-Mi-Tin Concentrating Co.

About 2 miles south - southeast of Lincolnton is a tract of 475 acres held by the Ka-Mi-Tin Concentrating Co. This property was examined by the writer on December 6 - 7, 1939, A report on the findings of this examination is in the S.M. Exam. Sect. files under number 75.6002. It is not proposed to review that report here, but merely to record a few additional data secured at the time of the general examination of the tin belt.

About 50 feet N 10° E of locality number 25, shown on Plate L, report No. 75.6002, on the same pegmatite, is the entrance to an adit driven to the south along the west wall of the pegmatite. This is the entrance to the "more old workings to the north," (of locality 25) mentioned on page 11 of the earlier report.

In the cut at the entrance to the adit there is exposed a 2-foot width of tin-bearing greisen at the east or footwall side of a 15-foot, barren, kaolinized pegmatite. Sample Moon - 101, a channel cut across the 2 feet of greisen, carried 1.97% tin, while Moon - 102, a channel cut across the 15 feet of kaolinized pegmatite, carried only 0.05% tin.

The adit follows the west contact of the pegmatite for 85 feet, but discloses no cassiterite. Several crosscuts to the east cut the east contact and a total of about 60 feet of drifting was done along it. Some greisen was found along the east contact as much as 45 feet south of that which was sampled, but no cassiterite was found more than 15 feet south of it. The occurrence probably is not of great consequence unless it should continue to the north.

In the earlier report a block of possible ore was calculated on the basis of a report by Mr. Stuart St. Clair and the sampling by the writer of a stock pile of about 75 tons at the "Swamp Shat #1," Mr. St. Clair stated to the writer in an interview on December 9, 1939 that this stock pile is composed only of ore taken from the 30-foot level of the shaft. Mr. Kesler reports that according to local people some of this material was carried in from other localities in the belt. There is no way to check these conflicting stories, as the shaft is full of water, but for the present Mr. St. Clair's story will be assumed to be correct. Mr. St. Clair reported ore on the 30-foot level, 8 feet wide and 30 feet long. The sample of the stock pile, Moon-22, carried 1.2% tin. A block 30 feet long, 8 feet wide, and carrying 1.2% tin would contain 0.24 ton of tin per foot of depth.

In order to check Mr. St. Clair's statements about the 30-foot level it would be necessary to dewater the shaft and sample the drift. It is said that the shaft is 70 feet deep, that a crosscut was driven 15 feet from the bottom of the shaft, but that it did not cut pegmatite before it was abandoned. If sampling of the 30-foot level should show ore, the crosscut on the 70-foot level could be extended and drifts run on the pegmatite.

11/24/52 gla

CABLE ADDRESS: NEWLANDIN

THE NEW ENGLAND INDUSTRIES, INC.
120 WALL STREET
NEW YORK 5, N. Y.
WHITEHALL 3-1600

Sea

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
NOV 21 1952

IN REPLY REFER TO:

November 20, 1952

Mr. Ernest Ellis
Defense Minerals Exploration Administration
Department of the Interior
Washington 25, D. C.

RE: DMEA Contract Application No. 2773.

Dear Mr. Ellis:

Reference is made to our DMEA Application No. 2773. Regarding the form necessary to insure the Government's interest in our workings, should a loan be granted, we are having this form executed by the owners of the property and our own operating subsidiary.

As previously pointed out to you, Lincoln Mining Corporation is a wholly owned subsidiary of the New England Industries, and we stress this point for one reason only, that New England Industries is a well-known concern with a triple A-1 rating and substantial mining experience, as is known to you, while Lincoln Mining Corporation is a newly founded corporation, set up for the purpose of operating the property which is subject of our application.

Regarding the map, I wish to state that I have asked the County Surveyor to make a new map for us, which will be ready within a week and will then be forwarded to you. In the meantime you will find an official map, called Plate 41, Ka-Mi-Tin property ex Geological Survey Bulletin 936-J, in the folder given to Mr. Mittendorf, which unfortunately was my only copy and I have been unable to obtain additional copies of this publication. If you do so desire, you can return this map to me and I will have it photocopied in quadruplicate for you.

Thanking you for your prompt attention to our application, we shall be glad to furnish you with any additional information which you might require in the course of your investigation, we are,

Very sincerely yours,

THE NEW ENGLAND INDUSTRIES, INC.

Howard S. Strouth

HSS/lew

11/19/52 gla

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

November 18, 1952

DMEA 2773 - Tin
Exploration Loan
Lincoln Mining Corp.
120 Wall Street
New York 5, New York

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
NOV 18 1952

Memorandum

To: E. William Ellis

From: Abbott Renick, Base Metals Branch

Subject: Application for DMEA assistance by H. S. Strouth.

Applicant submits a $32,000 tin-spodumene-columbite-tanalite-mica and quartz exploration loan to consist of the following:

To diamond drill cassiterite-bearing bodies located in Lincolnton Township, Lincoln County, North Carolina. Project includes road clearance, retimbering and extension of two shafts, about 25,000 feet of surface stripping, reconditioning of some equipment, hand tools, etc.

The applicant states that diamond drilling and some shaft work would be the most economical means of exploring the dike, which he believes may have an ore body and also may be proven to include excess of 537,000 tons, which when broken down contains the following quantities of minerals believed to be recoverable:

	Pounds per ton	Percent
Spodumene	360	18
Tin	10	1/2 of 1
Mica	120	6
Columbium and tantalum	0.20	0.01

The property (Ka-Mi-Tin) is well known to the Bureau of Mines and the Geological Survey. Two excerpts from Government reports on this property are attached.

Disseminated Ore in Pegmatites 1/

In Lowell B. Moon's report on the Ka-Mi property (Str. Min. Exam. Sect., No. 75.6002), it is mentioned that Mr. Stuart St. Clair, Consulting Geologist, New York City, advances the proposition that there are one and one-half million tons of kaolinized pegmatite within 75 feet of the surface on the property that contain 0.25 percent recoverable tin. His estimate is said to have been based on sampling of a large number of test pits. There is said to be an assay map showing the locations of these pits and the grade of material extracted from them. Mr. St. Clair offered to supply a copy of this map.

Microscopic examination of a considerable number of specimens of pegmatite by Mr. Kesler revealed that cassiterite is present in most cases only as a minor accessory mineral.

The only available assays of pegmatite are those of five samples, four of them from the Ka-Mi property, taken by Mr. Lowell B. Moon.

Sample No.	Location	Material	Sn %
Moon - 18	Ka-Mi, Loc. #4*	20' Cut, Kaolinized peg.	0.05
Moon - 19	Ka-Mi, Loc. #8*	10' Cut, kaolinized peg.	0.05
Moon - 20	Ka-Mi, Loc. #9*	7' Cut, kaolinized peg.	0.10
Moon - 102	Ka-Mi, Entrance to adit a N. end of "Incline" area.	15' Cut, kaolinized peg.	0.05
Moon - 99	Metcalf	Grab of fresh peg. from dump	0.05

* Localities numbered on Plate I, Report 75,6002.

1/ War Minerals Report, July, 1943, U.S. Department of the Interior, Bureau of Mines, College Park, Maryland.

As a consequence of the very low tin values, the writer suggests that docket DMEA # 2773, be sent to Mr. J. C. Arundale for review.

In the event that Mr. Arundale considers a field team report to be justified, then the writer would be pleased to support such a recommendation.

Abbott Renick

Abbott Renick

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Y

November 18, 1952

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Lincoln Mining Corp.
120 Wall Street
New York 5, New York

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Abbott Renick

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/s/ Abbott Renick
Abbott Renick

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November 18, 1952

DMEA 2773 - Tin
Exploration Loan
Lincoln Mining Corp.
120 Wall Street
New York 5, New York

Memorandum

To: . William Ellis

From: Abbott Lenick, Base Metals Branch

Subject: Application for DMEA assistance by H. . Strouth.

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In the event that Mr. Arundale considers a field team report to be justified, then the writer would be pleased to support such a recommendation.

/s/ Abbott Renick
Abbott Renick

November 13, 1952

Mr. H. S. Strouth, Vice President
Lincoln Mining Corporation
120 Wall Street, Room 2805
New York, N. Y.

Subject: DMEA-2773
Re: Exploration Assistance
Ka-Mi-Tin, American Consolidated
Tin Mines

My dear Mr. Strouth:

The receipt of your application dated November 6, 1952 for exploration assistance under the Defense Production Act of 1950, as amended, is hereby acknowledged.

Your application has been assigned Docket Number DMEA-2773 and referred to the Rare & Miscellaneous Metals Division.

Kindly refer to DMEA-2773 in any future correspondence relating to your application.

Sincerely yours,

R. E. ADAMS

Robert E. Adams, Chief
Operation's Control and
Statistics Division

25451

CABLE: STANDORES

STANDARD ORE & ALLOYS CORPORATION

120 WALL STREET

NEW YORK 5, N. Y.

WHITEHALL 3-1600

Dmea-2773

IN REPLY REFER TO:

November 10th, 1952.

Mr. Ernest Ellis,
Care D. M. E. A.
Interior Building,
Washington, D. C.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
NOV 12 1952

Dear Cap,

Enclosed is our application for government participation in the drilling program on the Ka - Mi tin mine in North Carolina. Mr. Mittendorf has the data, which I presume he will turn over to you for review and if there should be anything missing or any further information you desire, if you will get in touch with Mr. Strouth or with me, it will be furnished.

Needless to say " time is of the essence " and we wish to get started as quickly as possible.

With kind personal regards and best wishes,

Yours sincerely,

William A Hooton

WILLIAM A. HOOTON.

WAH:

Phoned last week but you were on "vacation", Bill

CABLE ADDRESS: NEWLANDIN

THE NEW ENGLAND INDUSTRIES, INC.
120 WALL STREET
NEW YORK 5, N. Y.
WHITEHALL 3-1600

DMEA-2473

IN REPLY REFER TO:

November 6th, 1952

United States Department of the Interior
Defense Minerals Exploration Administration
Washington 25, D. C.

Gentlemen:

Enclosed please find application in quadruplicate of a DMEA project for the recovery of substantial quantities of columbite, tantalite, tin, mica, etc., and in order to further clarify this application, a even more detailed report is already in the hands of Mr. Mittendorf.

The application is made in the name of the New England Industries, Inc., and it will be noted that our lease states that New England Industries is the parent corporation of the Lincoln Mining Corporation, a wholly owned subsidiary. All payments with regard to this property, its up-keep, taxes, etc., have been omitted from all calculations and will be taken care of one hundred percent by our corporation without any Government assistance being requested. The lease is a 99-year lease with an option to buy.

Our original folder contains the original U.S. Geological Survey Bulletin 936J, which fully describes the property, and Plate 41 which shows the improvements on the property, fully proven ore bodies, drill holes, dykes, shafts, etc., etc.- Unfortunately we were unable to procure additional copies and therefore can only submit a copy drawing of this map with this folder.

Regarding additional improvements on the property, description of which is contained in our lease and drawn into our maps, the extent of the piece of realestate is of approximately 1000 acres. Our original folder with Mr. Mittendorf again contains photographs taken by the undersigned within the last few weeks, showing improved roads, buildings, fully timbered shafts, power stations, headframes, and list transformers, motors, hoist, incline shafts, drill holes, etc., also a great number of experimental pits which have been dug in the past.

-Over-

A great deal of additional material is contained in the original folder, referring to our application for the erection of a plant and all preliminary work has already been done, such as test work, calculation for installation, flow-sheets, etc. - At this particular point such information would only be of secondary importance in conjunction with the DMEA loan and has therefore been omitted.

Very sincerely yours,

THE NEW ENGLAND INDUSTRIES, INC.

Howard S. Strouth

HSS/lew
Encls.

CABLE ADDRESS: NEWLANDIN

THE NEW ENGLAND INDUSTRIES, INC.
120 WALL STREET
NEW YORK 5, N. Y.

WHITEHALL 3-1600

IN REPLY REFER TO:

October 29, 1952

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

Dear Mr. Mittendorf:

Enclosed please find an application for DMPA loan on a project which we consider will be of very great interest to your stockpiling program and which we believe is an outstanding property of great and proven merit.

Please find enclosed an abstract prepared by our Mr. Howard Steven Strouth, whom you will doubtlessly recall, and other reports prepared by geologists, engineers and others in our employ or working for the United States Government.

We are ready to immediately proceed with the initial work which has to be done and would greatly appreciate if you would favor us with prompt action on this proposal.

Very sincerely yours,

THE NEW ENGLAND INDUSTRIES, INC.

Eugene Schoener

Eugene Schoener
Vice-President

ES/lew

MF-103
(Revised April 1952)

UNITED STATES DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION

Form Approved.
Budget Bureau No. 42-R1035.2.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
NOV 12 1952

APPLICATION FOR AID IN AN EXPLORATION PROJECT, PURSUANT TO DMEA ORDER 1, UNDER THE DEFENSE PRODUCTION ACT OF 1950, AS AMENDED

Not to be filled in by applicant

Docket No. Dmea-2773
Metal or Mineral
Date Received 11-12-52
Estimated Cost
Participation (Government %)

INSTRUCTIONS

1. *Name of applicant.*—(*a*) State here your full legal name, in the form in which you will wish to contract, and your mailing address: Lincoln Mining Corporation -- See Attachment

(*b*) If other than an individual, add to your name above whether a corporation, partnership, etc., and the name of the State which incorporated or otherwise organized.

(*c*) If a corporation, add to above statement, titles, names and addresses of officers.

(*d*) If a partnership, add to the above statement the names and addresses of all partners.

2. *General.*—Read DMEA Order 1, "Government Aid in Defense Exploration Projects," before completing this application. Submit this application and all accompanying papers in quadruplicate (four copies), with your name and address on each sheet of the application and on all accompanying papers. Where sufficient space is not provided on the form for all required information, state it on an accompanying paper, with a reference in each case to the instruction to which it refers by number. Comply with all applicable instructions; or, if not applicable, so state. File the application with Defense Minerals Exploration Administration, Department of the Interior, Washington 25, D. C., or with the nearest field executive officer thereof.

3. *Applicant's property rights.*—(*a*) State the legal description of the land upon which you wish to explore, including all land which you possess or control that may be benefited by the exploration, and excluding any land or interest in land which is not to be included in the exploration project contract

(*b*) State any mine name by which the property is known.

(*c*) State your interest in the land, whether owner, lessee, purchaser under contract, or otherwise

(*d*) If you are not the owner, submit with this application a copy of the lease, contract, or other document under which you control the property.

(*e*) If you own the land, describe any liens or encumbrances on it

(*f*) If the land consists of unpatented claims, add to the description above, the book and page numbers for each recorded location notice.

4. *Physical description.*—(*a*) Describe in detail any mining or exploration operations which have been or now are being conducted upon the land, including existing mine workings and production facilities. State your interest, if any, in such operations. Also describe accessibility of mine workings for examination purposes.

(*b*) State past and current production, and ore reserves, if any, giving quantities and grades.

(*c*) Describe the geologic features of the property, including mineralization, type of deposit (vein, bedded, etc.), and your reasons for wishing to explore. Illustrate with maps or sketches. Send with your application (but not necessarily as a part of it) any geologic or engineering report, assay maps, or other technologic information you may have, indicating on each whether you require its return to you.

(*d*) State the facts with respect to the accessibility of the project: Access roads, distances to shipping, supply and residence points.

(*e*) State the availability of manpower, materials, supplies, equipment, water, and power.

5. *The exploration project.*—State the mineral or minerals for which you wish to explore .....

(*b*) Describe fully the proposed work, including a map or sketch of the property showing a plan (and cross sections if needed) of any present mine workings, and the location of the proposed exploration work as related to such features as contacts, veins, ore-bearing beds, etc.

(*c*) The work will start within ..... days and be completed within ..... months from the date of an exploration project contract.

(*d*) State the operating experience and background of the applicant with relation to the ability to carry out such exploration project, and also that of the person or persons who will supervise the operations.

6. *Estimate of costs.*—Furnish a detailed estimate of the costs of the proposed work (you will have to use a separate sheet), under the following headings. Add the totals under all headings to give the estimated total cost of the project:

(*a*) *Independent contracts.*—(Note.—If the applicant does not intend to let any of the work to contractors, write "none" after this item. To the extent that the work is to be contracted, do not repeat the cost of the contract-work in subsequent items.) State the cost of any proposed independent contracts for the performance of all or any part of the work, expressed in terms of units of work (such as per foot of drilling, per foot of drifting, per hour of bulldozer operations, per cubic yard of material moved, etc.).

(*b*) *Labor, supervision, consultants.*—Include an itemized schedule of numbers, classes and rates of wages, salaries or fees for necessary labor, supervision and engineering and geological consultants.

(*c*) *Operating materials and supplies.*—Furnish an itemized list, including items of equipment costing less than $50 each, and power, water and fuel.

(*d*) *Operating equipment.*—Furnish an itemized list of any operating equipment to be rented, purchased, or which is owned and will be furnished by the Operator, with the estimated rental, purchase price, or suggested use-allowance based on present value, as the case may be.

(*e*) *Rehabilitation and repairs.*—Furnish a detailed list showing the cost of any necessary initial rehabilitation or repairs of existing buildings, installations, fixtures, and movable operating equipment, now owned by the Operator and which will be devoted to the exploration project.

(*f*) *New buildings, improvements, installations.*—Furnish a detailed list showing the cost of any necessary buildings, fixed improvements, or installations to be purchased, installed or constructed for the benefit of the exploration project.

(*g*) *Miscellaneous.*—Furnish a detailed list showing the cost of repairs to and maintenance of operating equipment (not including initial rehabilitation or repairs of the Operator's equipment), analytical work, accounting, workmen's compensation and employers' liability insurance, and payroll taxes.

(*h*) *Contingencies.*—Give an estimate of any necessary allowances for contingencies not included in the costs stated above.

NOTE.—No items of general overhead, corporate management, interest, taxes (other than payroll and sales taxes), or any other indirect costs, or work performed or costs incurred before the date of the contract, should be included in the estimate of costs.

7. (*a*) Are you prepared to furnish your share of the cost of the proposed project in accordance with the regulations on Government participation (Sec. 7, DMEA No. 1)? Yes

(*b*) How do you propose to furnish your share of the costs?

[X] Money [ ] Use of equipment owned by you [ ] Other

Explain in detail on acompanying paper.

CERTIFICATION

The undersigned, whether as an individual, corporate officer, partner, or otherwise, both in his own behalf and acting for the applicant, certifies that the information set forth in this form and accompanying papers is correct and complete, to the best of his knowledge and belief.

Dated November 6th, 1952

Lincoln Mining Corporation
Applicant

By Howard Steven Strouth, Executive Vice-President

120 Wall Street

New York 5, New York

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—66551-1

APPLICATION FOR AID IN AN EXPLORATION PROJECT, PURSUANT TO DMEA ORDER 1 UNDER THE DEFENSE PRODUCTION ACT OF 1950, AS AMENDED.

1.-- Lincoln Mining Corporation, Depositors' National Bank Building, Durham, North Carolina. -- All correspondence to be addressed to our main office, 120 Wall Street, Room 2805, attention Mr. H. S. Strouth, Executive Vice-President.

2. - - -

3.-- a) "SITUATE, lying and being in Lincolnton Township, Lincoln County, North Carolina, about two miles south of the Town of Lincolnton on both sides of U. S. Highway No. 321, and being that certain boundary of land known as the Tin Mine Property", being the identical boundary containing about 650 acres (about 240 acres in fee and the mineral rights on the remaining 410) acres, conveyed by A. L. Quickel, Trustee, to Lessor by deed dated September 4, 1937, and registered in Book 191 at Page 527 in the Lincoln County Public Registry, and being the identical boundary fully described in a deed of trust, now cancelled, dated April 18, 1932, from American Consolidated Tin Mine Corporation, to A.L. Quickel, Trustee, registered in Book 166 at Page 686 in Lincoln County, and also described in a deed from D. E. Rhyne to American Consolidated Tin Mine Corporation dated April 18, 1932, registered in Book 166 at Page 683 in Lincoln County, to all of which conveyances and descritpions specific reference is hereby made for a more particular description of the properties herein leased."

See Enclosed Lease Contract.

b) Ka-Mi-Tin Mine and American Consolidated Tin Mine.

c) 99-year lease with option to purchase. 10 year lease with renewal privilege of 10 years at a time indefinitely.

d) Lease in quadruplicate.

4.-- a) The property presently has two timbered shafts extending to the 90 ft. level with cross-cuts, an incline shaft extending 50 ft. at a 45° angle, drill holes - one extending to 1400 ft., approximately 18 exploration pits dug to various depths to 40 ft., various buildings, power lines, hoists, head assemblies, motors, pumps and other improvements, including a power installation capable of running a 250-ton mill with various transformers. The workings are fully accessible.

b.&c.)
Ore reserves, qualities and grade of ore are estimated up to two million tons with proven ore in excess of 500,000 tons, grades as per included assays, reports by Dr. Heron, report by H. S. Strouth, by Mr. St. Clair, and other references. Property fully described and mapped in Bulletin 936J.

d) Access roads as per enclosed photographs. Nearest railroad station 1 mile. Supply and residence points no problem because property is within 2 miles from Lincolnton, county seat of Lincoln County.

e) Sufficient man-power available; same applies to material, supplies, equipment, water and power, as previously stated.

5.-- a) Tin, columbite, tantalite, lithium, beryllium, quartz, mica.

b) Maps as enclosed. - It is proposed that during the initial period, diamond drilling be done on the Jake dyke as per enclosed drawing and other preliminary work in accordance with attached statement.

c) Within 15 days the work can be started and a period no exceeding four months is considered necessary from the day of commencement of the work.

d) The applicant and its associate firms have successfully operated coal mines in the United States, with a production capacity of 10,000 tons of coal a day, is operating lead-zinc properties in Mexico and has operated at various times tungsten properties in Montana, manganese properties in Arkansas, uranium properties in Utah and Colorado and has managed all operations, which were conducted in miner-like manner and most of them are known to the Government. The work will be done under the supervision of Mr. William A. Hooton, mining engineer, and Dr. S. D. Heron, Jr., geologist, and other qualified engineers and geologists as may be required.

6.-- Estimate of cost is enclosed.

7.-- a) Yes.

b) In money.

October 1952

KA-MI-TIN, NORTH CAROLINA * Estimate at Re-opening Mine for Lithium, Tin, Columbite, etc. Production.

STAGE 1. - Development Work

Road clearance and bulldozing to level and upgrade existing roads	$ 1,500.00
Diamond drilling at dyke 2, six drill holes to intercept 2 at 100 and 400 ft. levels and also intercept continuation of dyke 3 at corresponding levels. 45 degree angle at 100 ft. level - 1200 ft. at 400 ft. level - 2400 ft. at $3.00 per ft. Total 3600 ft.	10,800.00
Two crosscuts at swamp shafts 1 and 3 on dyke 3 40 ft. each, total 80 ft. crosscuts at $40.00 per ft. . .	3,200.00
Transport of drilling equipment	500.00
Retimbering and extension of shafts at dyke 3 at no. 1 shaft 40 ft. two-compartments at no. 3 shaft 20 ft. two-compartments Total 60 ft. at $140. per ft.	8,400.00
Timber	200.00
Weatherproofing of existing buildings to protect equipment and tools	300.00
Surfacr stripping at incline shaft on dyke 2 5000 cu. yds. at 40¢ per yd.	2,000.00
Reconditioning of existing hoist and power equipment . . .	1,000.00
Cable 1" 1000 ft. at 25¢ per ft.	250.00
Two small pumps with motors plus hose for dewatering . . . . shafts $500.00 ea.	1,000.00
3 days labor for dewatering	300.00
Handtools	100.00
Engineering	1,500.00
Assays, flowsheets, etc.	1,000.00
TOTAL	$32,050.00

NORTH CAROLINA

DURHAM COUNTY

THIS CONTRACT, AND AGREEMENT, Made and entered into this the 25th day of October, 1952, by and between:

KA-MI-TIN CONCENTRATING CORPORATION, hereinafter called "LESSOR",

and

LINCOLN MINING CORPORATION, hereinafter called "LESSEE",

W I T N E S S E T H:

That for and in consideration of the mutual promises and covenants, the parties do hereby covenant, promise, agree and declare on behalf of themselves, their successors and assigns:

1. LESSOR hereby grants unto LESSEE an option for the period of six (6) months from the date hereof to lease that certain mine located and situate in Lincoln County, North Carolina, more fully described as follows, to wit:

SITUATE, lying and being in Lincolnton Township, Lincoln County, North Carolina, about two miles south of the Town of Lincolnton on both sides of U. S. Highway No. 321, and being that certain boundary of land known as the "Tin Mine Property", being the identical boundary containing about 650 acres (about 240 acres in fee and the mineral rights on the remaining 410) acres, conveyed by A. L. Quickel, Trustee, to LESSOR by deed dated September 4, 1937, and registered in Book 191 at Page 527 in the Lincoln County Public Registry, and being the identical boundary fully described in a deed of trust, now cancelled, dated April 18, 1932, from American Consolidated Tin Mine Corporation, to A. L. Quickel, Trustee, registered in Book 166 at Page 686 in Lincoln County, and also described in a deed from D. E. Rhyne to American Consolidated Tin Mine Corporation dated April 18, 1932, registered in Book 166 at Page 683 in Lincoln County, to all of which conveyances and descriptions specific reference is hereby made for a more particular description of the properties herein leased.

2. During the term of said option, and as one of the considerations therefor, LESSEE agrees to pay to LESSOR the sum of FIVE HUNDRED ($500.00) DOLLARS per month, the first monthly payment being made in advance and

simultaneously with the execution of this contract, and each subsequent payment being due and payable on the 25th day of each month thereafter so long as LESSEE desires said option to continue. In the event that during said six-month option period the LESSEE should notify LESSOR that it no longer desires to continue said option, then upon payment of all monthly payments due up to the effective date of said notification, the parties shall be relieved of any and all further obligation from one to the other.

3. During said option period, LESSEE shall have the right to enter upon the aforementioned premises and to have its engineers, geologists, executives and workmen enter upon said premises for the purpose of making surveys, drillings, and taking samples, and to make whatever preparations are deemed necessary by LESSEE for the commencement of mining operations. Further, during said option period, LESSEE shall have the right to use all of the equipment presently located on the premises, all of the buildings, power, installations, machinery, timber, rights-of-way, access roads and all other improvements as more fully set forth in the attached schedule, and it is further understood and agreed by and between the parties that the monthly option payment of $500.00 shall include any and all rentals for said items. There is specifically excluded from the provisions of this paragraph three (3) Allis Chalmers motors which are individually owned by J. N. Brenizer and which are located upon the premises. LESSOR reserves the right for Mr. Brenizer to remove these motors from the premises at any time he so desires. The serial numbers of said motors are as follows: Gen. Elec. 30 H.P. No. 1508797, Allis Ch. 90 H.P. No. 172-15/46/17, Allis Chalmers 50 H.P. No. 2055-25-4303-1.

4. In the event LESSEE elects to exercise the option herein granted to enter into a lease for said premises along with all mineral rights thereto, it shall notify LESSOR in writing before the expiration of the said six-months period, and shall pay to LESSOR at the time of the exercise of its said option, the sum of SEVEN THOUSAND DOLLARS ($7,000.00), and upon such notification and payment the following lease between KA-MI-TIN CONCENTRATING

CORPORATION as LESSOR and LINCOLN MINING CORPORATION as LESSEE, on the aforementioned property, shall become effective upon the following terms and conditions:

A. This lease shall commence on the date of the exercise of the option above referred to and the payment of $7,000.00 by LESSEE to LESSOR, and shall continue for a period of ten (10) years from said date provided LESSEE performs and complies with all of the covenants and agreements set forth herein on its part to be performed and complied with.

B. As rent and royalty for said lease, LESSEE shall pay to LESSOR and to its successors and assigns seven (7%) percent of the gross sales of all minerals and metals mined and shipped from the aforementioned premises, provided that in the event the market prices of the products mined under this lease shall fall below the average market prices of the first year's total sales average of said products, then the 7% gross sales royalty above mentioned shall be reduced directly in proportion to such price fall; example: Average market or par prices of products mined under said lease the first year equal 100; average market or par prices of products mined under said lease any subsequent year equal 90; fall in price would equal 10% and the royalty would therefore be reduced to 6.3% for said year. It is understood that an accounting shall be made of all sales at the end of each three months during the period of the lease and that payment of said royalties and rents shall be made in the following manner:

1. On the 20th day of each calendar month, LESSEE shall pay to LESSOR an average of seventy-five (75%) percent of the royalties and rents due to LESSOR based upon the 7% of gross sales made during the preceding calendar month.

2. Thereafter, at the end of each three calendar months, an accounting and adjustment shall be made by LESSEE for obligations during the preceding three months and any balance shown to be due LESSOR by LESSEE to bring the rents and royalties paid up to 7% of gross sales shall promptly be paid by LESSEE to LESSOR.

C. LESSEE agrees that at the earliest possible date after the effective date of said lease that it will install a concentration mill on the aforesaid premises of 100 Tons or more daily capacity. It is understood and agreed that title in and to said mill shall at all times remain in LESSEE whether or not same is affixed to the realty. It is further agreed that during the term of this lease, any and all equipment and machinery that may be placed upon the premises by LESSEE shall remain the property of the LESSEE, whether affixed to the realty or not, and at the termination of the lease the LESSEE shall have the right to remove the same within a period of ninety (90) days from the termination of the lease, PROVIDED that LESSEE shall in moving said property shall do no permanent damage to the realty.

D. If all obligations of LESSEE under this lease shall have been fully complied with, the option is hereby granted unto LESSEE to renew this lease for an additional term of ten (10) years following the expiration of the first 10-year period upon the same terms and conditions as are set forth in this lease appertaining to the first 10-year period. If LESSEE exercises this option to renew, it must give written notice to LESSOR of its intention to renew not later than ninety (90) days prior to the termination of the first 10-year period. It is understood that this lease might be renewed for any number of successive 10-year periods at the option of the LESSEE.

E. LESSEE shall have the right to assign this lease or to sub-lease the property, PROVIDED LESSEE at all times remains fully liable for the performance of all conditions and obligations herein set forth on its part to be performed.

F. It is understood and agreed that the LESSEE, from and after the date of exercise of the option to lease the premises herein mentioned, shall pay all property taxes upon the real and personal property belonging to LESSOR and herein included in this lease to LESSEE. LESSEE shall carry Workmen's Compensation and other insurance in order to fully indemnify and protect LESSOR against any liability for any injuries which may be received by any persons in connection with LESSEE'S operations. It is understood that

LESSOR hereby assumes to pay all taxes accrued to the date that the option is exercised.

G. The LESSOR, through any representatives it may designate, shall have the right at reasonable intervals, but not more often than quarter-annually, to examine LESSEE'S books, records, accounts as to production, shipments and sales of ores and minerals from the leased property, and to inspect the leased property, including the underground workings, the mills and other equipment, and to draw samples of ores, concentrates and tailing from the operation. In addition, LESSEE shall arrange for duplicate copies of all return sheets from smelters, chemical plants or other concerns to which LESSEE ships products from the leased premises, direct to LESSOR.

H. LESSEE does hereby covenant with LESSOR that it will pay the rents and royalties as provided for in this lease when the same shall become due; that if it exercises its option to enter upon the lease of the premises it will thereafter proceed with mining operations in the manner necessary for good and economical mining in a workman like manner.

I. It is specifically understood and agreed that if LESSEE, after once entering upon the lease, abandons the property and discontinues operations altogether, the lease shall thereupon terminate and LESSEE shall promptly pay LESSOR all rents and royalties due to the date of termination. If, after the mining has gotten underway on the leased premises, and royalties and rental payments have become due under the terms of this lease, if thereafter LESSEE ceases or suspends operations of the mine or mines for a continuous period of ninety (90) days, excepting through strikes, acts of God, or circumstances beyond control of LESSEE, but does not exercise its right to abandon the property and cause a termination of the lease, then it is agreed that LESSEE shall pay to LESSOR a minimum rental at the rate of SIX THOUSAND ($6000.00) DOLLARS per year, payable quarter-annually and during the period when operations are suspended.

J. In consideration of the sum of ONE DOLLAR ($1.00) in hand paid to LESSOR by LESSEE, the receipt of which is hereby acknowledged, and in further consideration of the covenants and mutual agreements herein contained, LESSOR does hereby grant unto LESSEE, its successors and assigns, an option to purchase the aforementioned property at any time during the term of the option period, and the term of the lease, or any renewal or extension thereof, for the purchase price as follows: If the LESSEE shall exercise the option given herein within two years from the date of said lease, purchase price shall be THREE HUNDRED THOUSAND ($300,000.00) DOLLARS; if the LESSEE SHALL exercise the option given herein within the first ten (10) years from the date of said lease, purchase price shall be FOUR HUNDRED FIFTY THOUSAND ($450,000.00) DOLLARS; if the LESSEE shall exercise the option given herein within subsequent years from the date of said lease, purchase price shall be SIX HUNDRED THOUSAND ($600,000.00) DOLLARS. All royalties and rental payments made during the terms of the lease, as well as payments made during the option period, shall be credited and applied to the purchase price. Upon the notification by LESSEE of its desire to exercise this option to purchase, LESSOR contracts to tender to LESSEE a warranty deed which will convey the said property without encumbrances to LESSEE or its successors and assigns. Taxes and any other apportionable charges shall be apportioned as of the date of conveyance.

K. If LESSEE shall for any reason default in the payment of any rent or royalty payment due LESSOR as provided for in this lease, or if LESSEE shall default in the performance of any other duty or obligation herein required to be performed by it, and if any of such defaults continue for a period of 90 days after written notice by registered mail of said default is given LESSEE by LESSOR, the lease and option to lease shall, at the option of LESSOR, be terminated; and LESSOR shall thereupon have the right, without any further notice, and with or without legal process, to enter upon the leased premises and dispossess the LESSEE therefrom, and these rights shall not be exclusive but the LESSOR specifically reserves any and all legal rights and remedies now or hereafter authorized and granted

by the State of North Carolina to LESSORS to cancel and terminate leases upon default and to recover possession of leased property.

L. Written notice of any matter requiring notice shall be given LESSEE by LESSOR by depositing such notice in the United States mail, Registered, and addressed to LESSEE, General Delivery, Lincolnton, N. C., and any written notice to LESSOR by LESSEE shall be given by depositing same in the United States mail, Registered, and addressed to LESSEE, at 120 Wall Street, New York, N. Y., and proof of the depositing of such written notice in such manner shall be deemed conclusive upon all concerned.

M. The within agreement shall be binding upon the parties hereto, and their successors and assigns.

N. In the event that any dispute should arise out of the within agreement, same shall be submitted to arbitration to be held in Washington, District of Columbia, in accordance with the rules of the American Arbitration Association then pertaining, and the decision of such arbitration may be entered as a final judgment in any court of record having jurisdiction.

IN TESTIMONY WHEREOF, said LESSOR has caused this contract to be signed in its corporate name by its President and attested by its Secretary and its corporate seal to be hereunto affixed the day and year first above written; and said LESSEE has caused this contract to be signed in its corporate name by its President and attested by its Secretary and its corporate seal to be hereunto affixed the day and year first above written.

KA-MI-TIN CONCENTRATING CORPORATION

ATTEST:

By _____
President

_____
Secretary

LINCOLN MINING CORPORATION

ATTEST:

By _____
President

_____
Secretary

NORTH CAROLINA

Lincoln COUNTY

I, Martha P. Bailey, a Notary Public in and for the County of Lincoln, and State of North Carolina, do hereby certify that Joseph Davis, Secretary of KA-MI-TIN CONCENTRATING CORPORATION, personally appeared before me this day and acknowledged that he is Secretary of KA-MI-TIN CONCENTRATING CORPORATION, a Corporation, and that by authority duly given and as the act of the Corporation, the foregoing instrument was signed in its name by its President J. N. Burrows, sealed with its corporate seal and attested by himself as its Secretary.

WITNESS my hand and Notarial Seal this the 25th day of ~~November,~~ October 1952.

Martha P. Bailey
NOTARY PUBLIC

My Com. Expires:
Sept 12, 1953

NORTH CAROLINA

_____ COUNTY

I, _____, a Notary Public in and for the County of _____, and State of North Carolina, do hereby certify that _____, Secretary of LINCOLN MINING CORPORATION, personally appeared before me this day and acknowledged that he is Secretary of LINCOLN MINING CORPORATION, a Corporation, and that by authority duly given and as the act of the Corporation, the foregoing instrument was signed in its name by its President _____, sealed with its corporate seal and attested by himself as its Secretary.

WITNESS my hand and Notarial Seal this the ____ day of November, 1952.

_____
Notary Public

My Com. Expires:

_____

ABSTRACT ON APPLICATION FOR EXPLORATION DEVELOPMENT AND PRODUCTION LOAN AT LINCOLNTON, NORTH CAROLINA, PROPERTY OF LINCOLN MINING CORPORATION ALSO CALLED THE KA-MI-TIN PROPERTY.

SUMMARY:

For a considerable period of time certain minerals in short supply have been on the strategic list for Government stockpiling, and this abstract, containing an application for Government loan, will attempt to prove that with such loan and on a proven property, the stockpiling program will be assured of a quantity of estimated -

60,000 tons Mica		estimated value $60.00/ton	$ 3,600,000.—
200,000 lbs.)Columbite			
lbs.)Tantalite			
5,000 tons Tin		4.00/lb.	800,000.—
180,000 tons Lithium		24.00/ton	12,000,000.—
50,000 tons Quartz		50.00/ton	9,000,000.—
		15.00/ton	750,000.—
	TOTAL estimated value		$26,150,000.—

plus other minerals of importance and incidental to the production.

Repayment to the Government should therefore not present any problems. The property in question is an improved property, well-known and previously inspected, mapped and commented upon by Government geologists and engineers, as well as engineers of good reputation, working for private companies.

LEGAL STATUS:

The property known as the Ka-Mi-Tin mine, is under 10-year renewable lease to the LINCOLN MINING CORPORATION, an associate of THE NEW ENGLAND INDUSTRIES, INC. which have demonstrated through past mining operations in the United States and abroad, that their organization and mining engineers are well-qualified to schedule, plan and to successfully conduct an operation such as outlined. — Attachment No. 1 - Lease contract between owners of the Ka-Mi-Tin property and the

GEOLOGY:

This property is well-known and described in literature, such as the report of Mr. St. Clair — attachment No. 3; Mr. T. J. Kessler — attachment No. 4 and

in back folder, called "U.S. Geological Bulletin 936 J", which shows the different deposits on the property; reports of the American Consolidated Tin Mines Corporation, which used to have a tin smelter on the property, shipping a tin-columbite-tantalite concentrate to England and Germany, - see attachment No. 5: the Ka-Mi-Tin Corporation which last operated the property in 1936; reports of Government geologist, Mr. Hess, as well as 21 other references listed in attachment No. 6, (and others in back folder).

We believe that these attachments, as well as a complete report by Dr. S. D. Heron, Jr., Vice-Chairman of Duke University, geologist, who visited the property twice during the last month, and whose report forms attachment No. 2, fully documents the type of mineralization and the extent of the ore bodies beyond any reasonable doubt. We also wish to refer to a publication called, "Resources for Freedom", a report to the President, published in June 1952, which stresses the importance of the minerals which we wish to mine, including lithium, their particular application to the defense effort, and the obvious shortage of these strategic minerals existing in the United States at the present time. Excerpts - attachment No. 7 enclosed.

DEVELOPMENT OF PROPERTY:

As evident from attachments submitted, this is a developed property, which has been previously in operation, with roads, housing, shafts, hoists, underground development, diamond drill holes and other improvements in place, including power installations and transformers for a substantial plant and mining operation. Attachment No. 8, report of recent visit of the undersigned to the location with geologist, Dr. Heron. (Pictures, maps).

EXCERPTS FROM REPORTS ON PROPERTY:

T. A. Kessler, U. S. Geological Survey

... the pegmatite bodies are straight, tabular and nearly uniform in thickness .... Speaking of the Ka-Mi-Tin Concentrating Company, Mr. Kessler states, the remaining tin bodies of ore, 1 ft. or more thick, have an average grade of possibly 1.5% tin, an average thickness of 3 ft. and an average length of 100 ft., are assumed giving a calculated reserve of 12,500 tons of ore .... an average of 0.375 ton of tin per ft. of depth on each deposit. The eight deposits of mineable width which have been mined to or below the water level may contain ore of equal or even higher tin

content .... The tin spodumene belt contains an enormous amount of spodumene .... it may contain from 10 to 50% spodumene .... Possible by-product minerals include, cassiterite, columbite, tantalite, beryl, fine grained muscovite, feldspar and possibly ambligonite.....

F. L. Hess, "Economic Geology"

States that hand-cobbed ore mined southwest of Kings Mountain contains more than 50% spodumene. He estimates that the pegmatite bodies of the entire belt may contain an average of 15% spodumene. He estimates 3.7 million tons of possible ore.

Edwards & Barbour

The map of the Ka-Mi-Tin property, made by Edwards & Barbour, Plate 41, Bulletin 936-J, shows 21 tin showings and can be increased to about 50 tin showings according to our work. It contains some two dozen spodumene pegmatite bodies of which the longest, as drawn, is 525 ft. in length with an average 40 ft. width. This body is taken as a basis for our calculation. Actually this ore body is almost 300 ft. longer and the one running parallel and starting from the Swamp shafts, is almost twice that length.

Mr. V. J. Hampton, Manager of the Patino Mine and his assistant

.. estimated the total in four dykes as representing 1.5 million tons of ore to the 500 ft. level.

Banks, McDaniel & Sales

The Banks, McDaniel & Sales report on concentration methods for North Carolina spodumene ores is self-explanatory as to the percentages of the various mineral values contained and ample proof of recovery.

W. R. Hudspeth, Chief Engineer - Foote Minerals Plant, Kings Mountain.

Article by W. R. Hudspeth in Mining and Engineering, August 1952, again proves composition of ore and process of recovery.

H. D. Heron, Jr., Professor of Geology, Vice-Chairman, Duke University.

Professor Heron, Jr. in his report of September 9th, speaks of this property as the most promising in the region. According to his findings, sampling the shafts, yielded spodumene alone with a rather high percentage of cassiterite. He mentions the presence of quartz, mica, columbite and tantalite.... I personally believe this prospect is better than any one single part in the belt, with the exception of Foote's holdings near the town of Kings Mountain..... The possible reserve here might well approach those of Foote's, but let me emphasize again that there is only one way of telling, that is by a diamond drilling program.... The other by-products could be columbite, tantalite.... I believe that spodumene will be found in almost each and everyone in the pegmatite dykes located on the entire property.

Mr. St. Clair, Geologist & Consulting Engineer & formerly with the War Minerals Administration, Washington, D.C.

In his 1937 report states, tin exists in the form of cassiterite with metallic tin content of 60 - 70%, as shown in numerous analyses. The cassiterite occurs as fine disseminations throughout the pegmatite..... He proves the presence and percentage of mica, columbite, spodumene, which he states makes up 80% of the volume,

and quartz.... channel samples taken on the hanging wall side, give assays running from .657 to .921% metallic content, as determined by fire assay. He quotes many series of samples showing such assays and higher, taken by Dr. Banks, Dr. Pryson, Dr. Nelson, and others. He took 6.714 lbs. of samples and states that a composite sample showed .65% metallic content. Mica will be found scattered throughout the pegmatite.... the mica is high grade and should command a good price, especially when ground... The quartz will be found intimately mixed through the pegmatite, but chiefly in the Greisen area. In 1935 nearly a 100,000 tons of material were moved, 1200 ft. of drifting was done... on the incline dyke.... Aside from proving another commercial body of.... mica, tin values run from 1/4 of 1% to 2%.... (The main interest of the Ka-Mi-Tin Corporation was of course solely in the tin.)

Dr. Heron in his report of July 30th, again shows on camparison level, the Kings Mountain Lithium Corporation property in operation producing from an ore with an average of 21% spodumene, showing the columbite, tantalite, quartz and mica values as set forth by us at the beginning of this expose. However, in our particular case, the amount of tin oxide accrueing would be much greater as set forth in Mr. St. Clair's report.

Dr. Heron in his final conclusive report of October 11th, gives figures far in excess of those claimed by us, due to our effort to make our estimates as conservative as possible. He states the average quartz percentage of 35%, whereas we have merely figured 5% in our application. He states a tonnage on the property of 2 million tons, whereas we have given a figure of one million tons as an estimate, and stated as our first objective that we would endeavor to block out 537,000 tons. Otherwise the report confirms our plan of action and the findings of every eminent geologist and mining engineer, who have inspected the property.

ORE:

The ore has been sufficiently described in many of the publications and assays of past operations, which are attachment No. 9, as well as assays taken recently on the property. It has been clearly established which average values exist in the tin-spodumene belt and even though our assays show considerable higher values than the averages for the entire belt, we have taken as a basis for our calculations, the basic figures given by the Bureau of Mines, showing 18% spodumene, containing 7 - 8% Li2O, 1/2 of 1% tin in form of cassiterite, 6% mica, 1/100 of 1% combined columbite and tantalite, 6% quartz, plus a substantial percentage of feldspar, kaolin, etc., and some beryllium which was found on our last investigation trip.

The strong mineralization, starting below the weathered zone of 100 feet and extending to a depth beyond the 500 ft. level, in strong dykes, shown by enclosed drawing, attachment No. 10, demonstrates clearly a quantity of ore far in excess of a million tons of minable ore, but for the sake of our initial phase of operation

to show clearly the presence of sufficient ore, we have merely assumed a 400 ft. block of ore on dyke No. 2, extending over 525 ft. with 40 ft. in width and showing with a specific weight of 2.72, an ore body of 537,000 tons, which breaks down to the following quantities of minerals which can be recovered:

96,600 tons Spodumene
2,685 tons Tin
32,220 tons Mica
107,400 lbs. Columbium and Tantalum
26,850 tons Quartz, etc. -

Dr. Heron's exposé clearly demonstrates that while proving the 537,000 tons in dyke 2, we intercept by diamond drills dyke 3 at the same time thereby establishing possibly twice the tonnage, not counting the swamp dyke extension and other ore bodies. His estimate of the entire property 2,000,000 tons.

COST:

As per attachment No. 11, the first phase of development and diamond drilling to increase the true tonnage estimate, prove the assays and open up the mine sufficiently for a mining operation, is shown at $32,050.- during the initial phase as per attachment No. 12, while the cost of erecting a 250-ton mill and starting operations at 250 tons daily production, is shown with a cost of $686,600.- as per attachment No. 13. - It is our understanding that in view of the strategic importanse of the minerals which will be produced, the Government will grant us a loan amounting to 90% of the moneys to be invested and we will submit clear and sufficient proof that we are capable of contributing our share of such moneys and accounting for all amounts spent, until such time when repayment will be made out of production to the Government.

PROCESSING:

Please find in attachment No. 14, a description of the machinery which we expect to use to set up a concentration plant, which equipment roughly corresponds to similar equipment being presently used on the Kings Mountain operation of Foote Minerals and also proven for mica separation on the property of the Kings Mountain Mica Corporation. Also find in attachment No. 15, a complete flow-sheet, worked out

for the separation of the ores, as prepared for these specific ores by Mr. Banks and others for the Tennessee Valley Authority, Foote Minerals Corporation, and other Government agencies interested in such separation.

Finally we can procure the services of Mr. Ralph Adarr, an ore dressing expert, who built the addition to the Solway and Foote plants, processing these ores.

CONCLUSION:

We again wish to emphasize the proven merit of these properties and deposits, the proof of our qualifications, the complete details which have been worked out to assure proper results and our firm belief that such operations will increase the Government stockpile on mica, columbite, tantalite, tin and lithium to a considerable extent.

Further documentations will be gladly submitted and we respectfully request early action on this request.

Howard Steven Strouth

H.S/lew

REPORT ON THE KA-MI-TIN CONCENTRATING CORPORATION SPODUMENE PROSPECT NEAR LINCOLNTON, LINCOLN COUNTY, NORTH CAROLINA.

By

S. Duncan Heron, Jr.

October 11, 1952.

The Ka-Mi-Tin Concentrating Corporation spodumene prospect is located at the extreme northern end of the tin-spodumene belt of the Carolinas. Mr. Howard S. Strouth of the Standard Ore and Alloys Corporation requested the writer to examine this property and other parts of the belt. Field work was done during parts of August, September and October. The Ka-Mi-Tin property was examined on September 6 and 7 and again on October 6 and 7.

LOCATION, SIZE AND PHYSICAL PROPERTIES

The tin-spodumene belt extends from Grover, North Carolina, in a northeast direction for 25 miles to Lincolnton, North Carolina. The Ka-Mi-Tin property forms the northern portion of the belt and is located two miles southeast of the Lincolnton town limit.

The land is about 2½ miles long, approximately ½ mile wide at the greatest width, and trends in a northeast direction. The property contains about 650 acres, of which 250 acres are owned in fee and the balance in deeded mineral rights. U. S. Highway 321 cuts the property so that most of the land owned in fee is in the northeast portion. This report concerns this section of about 200 acres, because it has the better mineral occurrences. (See accompanying map).

S. D. Heron, Jr.
Professor of Geology
Vice-Chairman of Duke University
Durham, North Carolina

The nearest railway station is 4 miles away in Lincolnton. A metal surfaced road serves the southern portion of the area under discussion and there are several unimproved roads on the property.

The area has gently rolling topography of moderate relief. There is no suitable timber on this property. There are some small pine trees, a few deciduous trees, and undergrowth of honeysuckle vines, kudzu, etc. The annual rainfall is about 47 inches.

GENERAL GEOLOGY

Country rock - The major rocks of this area, like those in the rest of the tin-spodumene belt, are mostly mica schist, hornblende gneiss and mixtures of the two. In general they are well weathered to an average depth of about 100 feet. The mica schists are more thoroughly weathered.

Pegmatites - Throughout the tin-spodumene belt are numerous massive pegmatite dikes that apparently filled fissures aligned with the general northeast trend of the foliation and schistosity of the country rock; however, some of the pegmatites filled joints or fissures formed at right angles to the general structure and, therefore, strike northwest. A few pegmatites are irregular in outline.

Most of the pegmatites of the belt show little, if any, weathering, but the pegmatites of the Ka-Mi-Tin property are almost completely weathered to a depth of between 70 and 100 feet. Some of these pegmatites are very irregular in form while others, like the Inclined Dike and the Jake Dike (named for the Inclined Shaft and the Jake Drift), are tabular.

It is important to note that pegmatite dikes are characterized by changing form and mineral content at different depths.

Minerals - A variety of minerals have been found in the pegmatites of the tin-spodumene belt, but feldspar and quartz make up the bulk of the mass. In most of the pegmatites, mica and spodumene occur in association with minerals like cassiterite, columbite-tantalite, beryl, etc.

The only unweathered pegmatite on the Ka-Mi-Tin property is found on two very small dumps adjacent to Swamp Shafts 1 and 3. The following minerals have been identified by the writer and are listed in order of abundance, according to earlier reports.[1]

Feldspar) Albite)	40%
Quartz	35%
Spodumene	18%
Mica	6%
Cassiterite	0.25%
Columbite-) tantalite)	0.01%
Beryl	?

The percentages listed have not been determined by accurate sampling or assaying and should serve only as a guide.

Spodumene occurs as lath-shaped crystals that are usually fractured and veined with quartz and feldspar. It is not distributed evenly throughout the dikes, nor are the crystals of uniform size. The largest observed crystal was about 18 inches long. The average length appears to be around one or two inches.

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[1]Stuart St. Clair and J. N. Brenizer

Cassiterite is not directly associated with the spodumene but usually occurs as small, irregular grains embedded in masses of muscovite mica and quartz called greisen. The greisen occur as small pockets within the pegmatite. Also cassiterite and columbite-tantalite are found throughout the spodumene pegmatite as very small grains of less than 1 mm in diameter.

ESTIMATED TONNAGE

It is possible to calculate a rough estimate of the tonnage of spodumene-bearing pegmatite within the northern part of the Ka-Mi-Tin property. The following tonnage is based on a pegmatite specific gravity of 2.72 and on the assumptions that the pegmatites have no splits or inclusions of country rock or change in shape to a depth of 500 feet. Since the pegmatites are weathered to an approximate depth of 100 feet, these calculations will apply to the area between the 100 and 500 foot level.

Inclined Dike	430,000 tons
Jake Dike	445,000 tons
Fourteen dikes located near the Condon Shaft	1,170,000 tons
Total	2,045,000 tons

DESCRIPTION OF PREVIOUS WORKINGS

Over the past fifty years the weathered pegmatite has been worked unsuccessfully by a number of companies for the mineral cassiterite. The present owners have sunk two shafts, made several open cuts and worked some in the Condon Shaft. (See map). The most successful work from the standpoint of spodumene was in Swamp Shafts 1 and 3, both of which are now filled with water.

Swamp Shaft 2 is a one-compartment hole about 70 feet deep. Good assay pine grains occur within the greisen reportedly found in a drift at the 30' level. Some spodumene was also found on the dump. No assays are available from this shaft.

Swamp Shaft 3 is a two-compartment shaft about 90 feet deep. The unweathered pegmatite was reported at about 60 feet. Excellent specimens of spodumene pegmatites can be found on the dump next to this shaft.

Two diamond drill holes have been drilled on the property but no record other than hearsay is available. It has been reported that four dikes averaging 10 feet thick each were encountered in a 1300 foot, 45° inclined hole located near the Bungalow shaft and drilled in a general eastward direction.

No records, assays, or written report are available for any of the previous workings.

EQUIPMENT ON HAND

A power line with two single-phase, 75 KVA transformers serves the Swamp Area and several small wooden buildings are located here. At least three of these buildings are in usable condition. Three electric motors of 50, 30, and 20 horsepower appear to be in working condition. One pneumatic hoist of undetermined capacity could be placed in operation without much expense.

MINING COST

Mr. H. Jardin of Waxhaw, North Carolina, for ten years superintendent of the Teck Hughes Mine in Canada, was kind enough to supply the following figures for a 100 ton and 250 ton mine:[2]

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[2] A breakdown of these figures is in the hands of Mr. Strouth.

100 ton

Equipment Total	$46,625.00
Building and Structures	35,150.00
Workmen Compensation, Insurance, Social Security, etc.	8,197.50
Total	$90,172.50

250 ton

Equipment Total	$70,475.00
Building and Structures	63,650.00
Workmen Compensation, Insurance, Social Security, etc.	13,137.50
	$148,137.50

Mine development costs as estimated by Mr. Jardin are $140 per foot for two-compartment vertical shafts, $200 for three-compartment shafts, and $30.00 per foot for drifts and crosscuts 5 X 7 feet.

No estimates are available for milling and concentration costs.

RECOMMENDATIONS

Before any large amounts of money are invested in a mine and concentration plant, it will be necessary to block out at least 300,000 tons of ore. Since all of the pegmatites are completely weathered at the surface, sampling can only be accomplished by diamond drilling. In order to prove the desired tonnage, at least one of the larger dikes must be adequately drilled.

Both the Jake Dike and the Inclined Dike offer theoritical tonnage that would justify proof by drilling. It would seem wiser to drill the Inclined Dike because of the possibility of discovering the reported pegmatites adjacent to this dike (said to be encountered in the 1300' drill hole).

Six holes drilled from three positions would be the most economical way of exploring this dike. These drill holes should be located on the

east side of the dike and drilled so that the first hole will intersect the dike at the 125 foot level and the second hole at the 500 foot level. The first hole should continue on past the dike for a horizontal distance of at least 400 feet. This will provide for exploration of the pegmatites reported from the old diamond drill hole.

It should be emphasized that careful drilling and interpretation of cores will be invaluable to the development of this prospect. Care should be taken during drilling so that adequate cores and sludge may be collected for assays.

Swamp Shaft No. 3 should be pumped out and cleaned so that the pegmatites may be examined and sampled. A small drift would serve to determine the width of the dike and to guide in drilling so as to determine its exact size.

CONCLUSION

The Ka-Mi-Tin Concentrating Corporation property has all the possibilities of developing into a successful spodumene-producing mine. Cassiterite, and to some extent columbite-tantalite, should be very important by-products. A carefully planned drilling program should prove the necessary tonnage and the tenor of the ore.

Respectfully submitted,

S. Duncan Heron, Jr.

S. Duncan Heron, Jr.

Durham, North Carolina

October 11, 1952.

REPORT ON THE KA-MI-TIN CONCENTRATING CORPORATION

SPODUMENE PROSPECT.

Location and Size:

The KA-MI-Tin Concentrating Corporation's property is located about two miles southeast of Lincolnton, North Carolina; U. S. Highway No. 321 cuts the property, slightly north of the middle section. The Southern Railroad crosses the extreme lower end of the property adjacent to the South Fork River. There are approximately 650 acres of which 250 is owned in fee, and the balance in deeded mineral rights. The land is about two-and-a-half miles long, approximately one half mile at the greatest width and trends in a northeast direction. For convenience in this report, we shall divide the property in two parts. The boundary between the northern portion and the southern portion will be represented by U. S. Highway No. 321.

General Comments on the Pegmatites:

The pegmatites of the KA-MI-Tin Concentrating Corporation differ from the pegmatites of the balance of the North Carolina Spodumene belt in that they are more completely weathered. There is no visible hard rock at the surface, and none is reached until a depth of approximately 60 to 90 feet. The upper weathered zone consists of completely kaolinized feldspar and spodumene, along with quartz and minor mines of mica, tin and other accessory minerals such as columbite-tantalite. This is in contrast to the unweathered pegmatites as exemplified in Foote's holdings near Kings Mountain.

At no place on the property of the KA-MI-Tin Concentrating Corporation was spodumene observed on the surface outcrops. However, it was found upon the dumps of the old workings.

North End of the Prospect:

Enclosed with this report is a map made by the U. S. Geological Survey that represents most of the area north of the U. S. Highway No. 321. Most of this property is owned in fee by the KA-MI-Tin Concentrating Corporation.

Condon Shaft Area: In and around the Condon Shaft area several open cuts (10 to 20 ft deep) and old water-filled shafts. The pegmatite exposed here are very difficult to follow along the original surface. They can be followed, however, in the old cuts and they outcrop originally as illustrated on the accompanying map. No spodumene was observed because of the thoroughly weathered nature of the rocks.

Swamp Area: The swamp area is that portion of the map located in and around Swamp Shaft No. 1, 2, and 3. As indicated on the USGS map no recognizable pegmatite is exposed on the surface. As reported in Mr. Stuart St. Clair's report, a rich tin strike was made at a depth of 30 ft. in Swamp Shaft No. 1.

Between the 30 and 70 ft. level of this shaft the hard pegmatite had been encountered and this pegmatite bears spodumene. I have collected several specimens off the dump near Shaft No. 1 that contains spodumene along with a rather high percentage of cassiterite (tin oxide).

Off the dum of Swamp No. 2, more spodumen-cassiterite pegmatite was collected.

Swamp Shaft No. 3 is a two-compartment shaft 14 ft X 8 ft. Spodumene pegmatite samples were collected from the dump near the shaft. One sample weighs approximately 150 lbs. and appears to contain a relatively high percentage of spodumene. It is available for analysis. Another 50 lb. block collected from this dump may run as high as 40% spodumene. These samples were reported to have been removed between the 60 and 90 ft. level. The shaft is down to 90 feet; the hard unweathered pegmatite was encountered below 60 feet.

The Jake Area: The Jake Dike is exposed in an open cut approximately 350 ft long. Here again the pegmatite is completely weathered so that naturally no spodumene would be recognized.

The South End of the Prospect:

Near the lower end of the property approximately 1000 feet from the South Fork River were found two very old hydraulic cuts. One runs approximately north-south and the other tends in a northeast direction. No pegmatite was observed in the former, but one weathered pegmatite was seen in the northwest wall of the latter. It, too, was completely kaolinized and there was no recognizable spodumene.

Other shafts in this southern portion did not go down to sufficient depth to reveal the unweathered pegmatite.

Ownership and History:

The history of this particular portion of the spodumene tin belt of the Carolinas is rather sad. The properties and mineral rights were acquired as early as 1900. There was originally some 6000 acres under lease and was eventually cut down to the present size - mostly under the actions of a Mr. Rhyne. It was in those days a tin prospect. A considerable amount of money was spent by various companies in trying to develop a working tin mine. At least two tin concentrate mills have been erected in the northern portion of the property. It is my opinion that a lot of the money was wasted and pocketed by speculators. Mr. J. N. Brenizer of New York City, between 1930 and 1935 lent a the old American Tin Concentrate Company approximately $75,000.00. When the company went broke he foreclosed, took over the property and formed the KAMI-Tin Concentrating Corporation. He issued stock to the stockholders of the old company at the rate of one share for every two shares. He and his wife owned 55% of the new corporation. Most of the other owners live in New York City. Mr. Brenizer

tried to develop the property as a tin-producing mine. Because of either poor tin, or most probably because of lack of capital, the venture failed. With the advent of spodumene in the district, he had been interested in seeing that the property was developed as a spodumene producer.

Mr. Brenizer is eighty years old and he has a bad heart. He is a very likeable old gentleman, and I believe that he is completely honest. He has told me that his sole interest is to see the property in operation, and that he is willing to sell the property outright, or else to lease it. He has been approached by the Lithium Corporation of America, but he knows the history of that corporation and he does not believe that they have the money or the gumption to actually go into production. In plain words, he doesn't like the company, their methods of operation, or their president. He said that he would give the Standard Ore & Alloys Corporation twice a better deal than he would the Lithium Corporation of America. He is a fine gentleman whom I believe is primarily interested in seeing his property developed and working.

Conclusions and Recommendations:

I personally believe that this prospect is better than any one single area within the belt, with the exception of Foote's holdings near the town of Kings Mountain. The big difference between the two is that you can see what you have at Kings Mountain, because the pegmatites are unweathered and you can't see what you have at Lincolnton because of the weathered nature of the pegmatites. The possible reserves here might well approach those of Footes, but let me emphasize that there is only one way of telling, and that is by a rather extensive diamond drilling program.

All of the removal of spodumene ore will have to be done underground. This will, of course, raise the cost of mining, but I believe that it will be offset by the rather high percentage of the recovery of cassiterite. Then too a very selective type of mining would be possible. The very conservative Hess, principal mineralogist of the Bureau of Mines, told Mr. Brenizer that he believed the whole property would average one quarter of one percent cassiterite. At today's prices this should be over $5.00 a ton, and would certainly pay most of the cost of mining.

The other by-products would be columbite-tantalite — and possibly feldspar. The weathered pegmatites also contain a very high grade of kaolin.

It would be quite possible to start mining the spodumene ore almost immediately. Swamp Shaft No. 8, could be drained and cleaned with a minimum of expense. There is one pneumatic hoist near the shaft, a few electric motors and enough power and water on the land to operate at least a 100-ton concentrate plant.

I would recommend an extensive drilling program before any large-scale concentrate plant is erected. Mr. Stuart St. Clair on page 29 of his report mentions a thirteen hundred drill hole that cuts four pegmatites, each 10 to 20 feet thick. The red pencilled lines on the enclosed map were copied from Mr. Brenizer's map. These red pencilled lines represent pegmatites, and they were put on by Mr. Stuart St. Clair. I believe that the pegmatite extending from Shaft No. 1 through Shafts Nos. 2 and 8 to the first open cut northeast of Swamp

Shaft No. 8 is accurately portrayed. It is possible that this may represent several pegmatites pinched and swelling along the strike. But it seems reasonable to conclude the existence of the pegmatite at least to the open cut. The thickness of this pegmatite is unknown. I could see no evidence of the pegmatite extending on approximately 1000 ft to the northeast, but then it is quite possible to be standing on top of these dikes and never know it. I believe that spodumene will be found in almost each and every one of the pegmatite dikes located on the entire property. The only reason you can't find it now is because of the extensive weathering. The northern portion of the pooperty is by far the best, but drilling on the lower end may reveal more pegmatites. It seems advisable to obtain all of the property because of the railroad and the large quantity of water that could be obtained from South Fork River.

According to Mr. Brenizer, the percentage of spodumene as determined by one analysis is 18.

S. D. Heron, Jr.

S. D. Heron, Jr.

GEOLOGICAL NOTES

on the

NORTH CAROLINA TIN BELT

U. S. A.

By

Stuart St. Clair
Consulting Geologist
New York, N.Y.

June 1, 1967

These geological notes are principally on the north end of t e Tin Belt, North Carolina, as the writer has made a more careful study of this section. Also, the southern end, from Kings Mountain south into South Carolina, has been reported on in the U. S. Geological Survey Folio 222 and Bulletin 680 D.

GENERAL GEOLOGY

The general area lies in the Piedmont Province, an eastward-sloping plateau extending from the Blue Ridge Mountains on the west to the Coastal Plain on the east.

The general topography is a gently sloping surface eastward, dissected by the rivers and streams that flow over the surface.

The rocks are both igneous and sedimentary, most of which have been metamorphosed to varying degrees and now appearing as schists and gneisses. This is especially true in the Pre-Cambrian rocks whereas in some of the later intrusives unaltered facies are common.

The oldest rocks of the area are the Carolina gneiss and schist which primarily were sedimentary, igneous and volcanic rocks but which were highly metamorphosed in Pre-Cambrian time.

The rocks that now make up the Roan gneiss and schist were intruded into the Carolina formation. The Roan rocks are determined chiefly by the amount of associated hornblende. They are metamorphosed along with the Carolina and in places they are

hard to separate. Both of these formations are deeply weathered and make up a large part of the country rock of the area.

Included in the Pre-Cambrian complex is a series of basic rocks intrusive into the Carolina and Roan formations and also occurring as isolated bodies in the Bessemer granite.

The Bessemer granite is a light-colored, schistose granite which is intrusive into the rocks of the Carolina and Roan formations. It has an extensive outcropping in Gaston County and to the south. It occupies chiefly a belt running northeast through Bessemer City, Gaston County. Some pegmatite is associated with the Bessemer granite.

A series of schists, generally dark in color, probably Algonkian in age, and narrow outcrops of Cambrian rocks made up chiefly of dark schists, conglomerates, quartzites, all of which are highly altered, outcrop in bands which extend in a general north-northeast direction. These rocks are often faulted and folded into the older rocks and, therefore, form a most complex series of outcrops. All the outstanding topographic features in the area are the result of differential weathering and erosion of these various rocks.

At a much later time, presumably late Carboniferous, there was intruded into the older rocks granites of light color made up largely of quartz, feldspars and muscovite mica in varying quantities. A large batholithic intrusion of this granite is found in the Cherryville area to the southwest of

Lincolnton.

The younger granites are considered of economic importance as the pegmatite which is found in dikes and which carries tin is probably an early end product of the differentiation of the granite magma, and the quartz and mica which occur in veins and in replacements are probably the final product in the cooling of the granite batholith. The pegmatite will be discussed in detail later.

Younger than any of the intrusives and cutting all other rock formations is a series of diabase dikes which run in a general northwest direction. The dikes vary in width from a few inches to 200 feet and extend for long distances, relatively. They evidently occupy tension cracks that probably resulted from vertical uplift of the area. The dikes are of Triassic age or younger. What economic effect they may have exercised is not known.

The general structure of the region was produced by compressive stresses acting from the southeast, thereby producing folds, faults and schistosity which trend in a general north-northeast direction. Most mineralization should follow this general trend although some may occur nearly perpendicular to it as there would be secondary stress relief in a general northwest direction. Such topographic features as Kings Mountain range, Crowders Mountain and Pasour Mountain have the north-northeast structural trend.

The dips in the Pre-Cambrian rocks are usually steep, but are variable. Long plunging anticlinal and synclinal folds include most of the formations. There has been most normal and thrust faulting, the movement of some being as much as several thousand feet.

One special structural feature should be spoken of as it may have economic significance. Near Beaverdam Creek in Cherryville Township, Gaston County, the general trend of formations, which is north-northeast, including the Tin Belt, has been offset to the east a mile or more. The writer has not worked this change out in the field and is not prepared to say whether this phenomenon is due to a bend in the general strike or to a fault. Probably both conditions exist.

The Pegmatite

The country rock at the north end of the Tin Belt, and, more particularly on the property of Ka-Mi-Tin Concentrating Corporation, is gneiss and schist. Near the surface the schist is soft, but below the weathered zone and near the contacts with pegmatite dikes the schist is highly indurated. The schist has been cut by a paralleling series of pegmatite dikes which are much younger in age and which have undergone no intense metamorphism such as has the earlier enclosing rock.

The pegmatite dikes are in places massive and in other places more in the nature of veins. Such are probably

apophyses which extend into the country rock from the main dikes.

The pegmatite was injected into the schists at depth, as, due to the high degree of crystallization, the cooling was slow. The inclusion of bodies of schist in the pegmatite would indicate that the pegmatite, although probably filling some fault planes or fissures, also stoped its way through and into the schist. We would, therefore, expect irregular masses as well as dike-like bodies of pegmatite between regular inclosing walls.

The primary pegmatite is composed chiefly of quartz, feldspar and mica, the feldspar in many places predominating. A few minor minerals such as spodumene, tourmaline and others may occur in the pegmatite. Cassiterite is found sparingly disseminated throughout the pegmatite, but where in commercial quantities it is found in lenses and pockets throughout the pegmatite mass and along the foot-wall and hanging-wall. The occurrence of the cassiterite and its gangue minerals would indicate that deposition had taken place largely through replacement.

The order of events in the deposition of the pegmatites and the tin ore may be briefly summarized as follows:-

1. Intrusion of a granite magma in the form of a batholith in the west part of the area at or about the time that earth stresses were accumulating and which later caused the great Appalachian revolution.

2. Cooling at depth of this magma and the separation therefrom of aqueo-igneous solutions rich in mineralizers.

3. The expulsion of this highly-mineralized solution into the country rock of schist and gneiss along and filling fault planes and fissures which had been caused by earth movements.

4. Slow crystallization of the pegmatite solutions at depth allowing growth of large crystals of feldspar, quartz and mica. It may be found at depth that primarily the pegmatite is composed chiefly of feldspars.

5. With the cooling of the pegmatite, the formation of shrinkage cracks chiefly at and near the contacts with the walls, around inclusions of country rock that had floated off into the pegmatite, and within the main mass of the dike.

6. Injection into these shrinkage cracks of even a later phase of differentiation of the granitic magma, aqueous solutions rich in silica, fluorine, tin and other minerals and mineralizers. These solutions would replace the feldspars first with quartz and mica and cassiterite as well as crystallize out as primary minerals. The cassiterite would thus be found in greisen, quartz and mica chiefly, the characteristic gangue of tin.

7. The final step in the cooling and crystallization of the granite magma is the giving off of fumaroles, or vapors, rich in mineralizers which would find their way throughout the pegmatite mass wherever porous and replace the feldspars and deposit by crystallization quartz, micas, cassiterite,

and probably such minerals as tourmaline, fluorite, axinite, topaz, and metals, should they be present in the original magma or be absorbed from the enclosing country rock.

6. The final step is the action of supergene agents so that the pegmatite is exposed at the surface through erosion and to alter through weathering those minerals susceptible to change such as the feldspars. Thus we have exposed at the surface now kaolin, as the result of weathering of the feldspars; and quartz and mica, the greisen, with which is associated the cassiterite. Below the zone of weathering there should be the primary rocks, pegmatite which should be made up of feldspars, micas and quartz, with the greisen veins, pockets and lenses, formed as outlined above, in which will be found the cassiterite in minable quantities.

The main pegmatite dikes vary in width from a few inches to as much as 200 feet. The 200-foot thickness is found at Hanover Mill, western Gaston County, and probably represents a joining of several of the dikes into one main dike.

As exposed at the present surface, the dikes represent the filling of faults and fissures many of which may join at depth to form a main dike of pegmatite.

The dikes are not continuous in length, but as they die out others continue at a short offset distance, thus indicating the filling of fissures. However, the dikes must extend to depth as the pegmatite injection came from below and the rock cooled at depth, as indicated by the degree

of crystallization.

At the northern end of the belt, the main dikes are from 2 to 60 feet in width, with several smaller dikes or stringers that outcrop at the surface and which cross by both the main dikes at shallow depth. These stringers or apophyses are usually rich in cassiterite.

There is no question as to the depth to which the pegmatite extends. If the granite batholith underlay the pegmatite at shallow depth, there would not be the perfect parallelism between the pegmatite dikes and the faults and folds of the older sedimentary belt adjoining. The batholith evidently lies to the west and the intense pressure due to thrust and folding during the Appalachian revolution kept the eastern side of the magma fluid longer than the other parts and thus allowed a greater degree of differentiation and provided the necessary channels through which the aqueo-igneous solutions were squeezed. The pegmatite should extend at least to the depth at which mining of this character would be economical.

In the Metcalf and adjoining section, five miles southwest of the Lincolnton area, the pegmatite is more in the nature of veins of quartz and mica in diorite country rock, the latter being of the Roan series. The veins at the surface are narrow, that is up to three feet, and only slightly weathered, and carry cassiterite.

Economic Factors. From the facts above given, it may be well to present at this point the factors which should largely influence the economic value of the pegmatites. Primarily, the area into which the pegmatite is injected should be broken up by faults and fissures so that there should be large and continuous bodies of pegmatite. There should also be irregular walls and there should be numerous embayments and kidney-shaped areas where there may be a segregation of the cassiterite upon crystallization from the original pegmatite or into which the later injections may find their way. Numerous fissures in the country rock will lead to the formation of apophyses running out from the main pegmatite dike, and these should contain some of the richest cassiterite deposits.

The more cooling surfaces to which the solutions are exposed, the more rapid the crystallization with the resulting shrinkage cracks which act as channels for later aqueous solutions and fumaroles to move and replace the feldspars and deposit their mineral content.

In prospecting the area, where one finds where there has been excessive earth stressing in association with the pegmatite, it is a fair assumption that rich pockets or veins of cassiterite may be found. Also where there are a number of paralleling dikes of pegmatite with numerous apophyses or stringers outcropping parallel to the main dikes, one may conclude that earth movements have been severe and there should be some rich cassiterite deposits in the area.

ECONOMIC GEOLOGY

The "tin belt" extends from Lincolnton, North Carolina, to Gaffney, South Carolina, a distance of some [illegible] miles. Many other minerals are found in belts parallel to the above and include gold, iron, barite, manganese, lead, mica, monazite, garnet, graphite, corundum, emerald, beryl, pyrite, clay, limestone, Carrara rock, and building stone. In this report, only the tin and its by-product mica will be discussed.

Ore Minerals

The ore minerals on the property of Ka-Mi-Tin Concentration Corporation are cassiterite, the oxide of tin, theoretically 78.6% metallic tin but usually around 65- 70% due to associated metals and impurities; kaolin, the weathered product of the feldspars; mica, a primary constituent of the pegmatite but enriched in the greisen to commercial proportions; feldspar, when unweathered, primary constituent of the pegmatite; silica, primary constituent of the pegmatite and one of the replacement minerals of the feldspar in greisen veins and lenses; spodumene, a mineral that is found in quantities in the east series of dikes and valuable as a source of lithium; columbite, a mineral found in appreciable quantities in certain sections of the tin-bearing parts of the dikes.

The tin and columbite are recovered by the concentration, the kaolin by washing, the mica by crushing and water separation, the feldspar will be recovered, as a market is developed, by hand picking when mining is in the primary pegmatite, the silica or quartz will be the waste material from the mill and will be intimately mixed with the crushed feldspar rock. Unless the quartz can be mechanically separated from the feldspar, probably the only use for the material will be for road surfacing. The spodumene can be separated on the tables or by decrepitation.

Tin. Cassiterite, the dioxide of tin, SnO_2, is dark brown to black in color, has a specific gravity of 6-7, i.e., seven times as heavy as water, equal volume, and has a metallic tin content in these deposits of 60-70%, as shown by numerous analyses. The cassiterite occurs as fine disseminations throughout the pegmatite and as well-formed crystals of varying size in coarser veins and replacements.

Kaolin. This is a secondary product resulting from the weathering of the feldspars. Primarily, it should be pure and generally white with a composition chiefly of silica and alumina. Small amounts of soda and potash may be present as well as calcium and magnesium. A little iron impurity would probably come from inclosing beds and the color of the kaolin affected to a degree dependent upon the amount of iron oxide washed into it. A large part of the iron can be removed in the processing of the kaolin.

Chemical and refractory tests of the kaolin show it to be very high grade. The uses will be governed by the degree of pureness and the color when processed and ready for market. Reference is made to the report of H. J. Bryson for the kaolin tests.

Mica. The mica is a mechanical separation and is a by-product. It is chiefly muscovite or margarite mica and has a brilliant lustre. When ground and screened it should bring a good price and there should be a ready market for mica of this grade.

Feldspar. The mining of feldspar will come when the primary pegmatite is reached below the zone of weathering. In selective mining for the cassiterite, it will be necessary to mine some feldspar also. Where it can be separated by hand-picking, it can be saved in chunks and ground separately and prepared for market. There should be some rich bodies of feldspar in the pegmatite dikes, and, when a market is developed, selective mining of feldspar can be carried on to a degree to meet requirements. As a rule, the cassiterite does not occur in quantity associated with the feldspar but more in greisen lenses and veins, the minerals of which have largely replaced the feldspars.

Silica. If it were practical to separate the quartz and feldspar after crushing at the mill, the quartz could be used in glass manufacture. However, the specific

gravities of quartz and feldspar are so nearly the same, about 2.65, that their separation does not appear possible and economical. Any separation must be made by hand-sorting before crushing. The tailings, therefore, from the mill run can be used only for road building and probably for concrete mixtures.

Columbite. There is a growing demand for this mineral as it has a valuable use in the metallurgy of Steel. Separation from the cassiterite can be effected.

Spodumene. The eastern series of dikes at the north end of the Tin Belt carry up to 20% of spodumene in the pegmatite mass. The U. S. Bureau of Mines has been carrying on experiments in the beneficiation of spodumene and find a method of separation from the associated feldspar by by decrepitation. Further work is being done at this time and the experimental results will soon be available. The lithium salts are finding increasing uses.

Accessory minerals. No ilmenite, magnetite, wolframite, arsenopyrite or other metallics have been found associated with the cassiterite on this property except as traces. Some ilmenite and magnetite are found in placer deposits with the cassiterite but their source must be outside the tin-bearing pegmatites.

Such fumarole minerals as tourmaline, apatite, beryl, garnet, topaz, fluorite, axinite, lithiophylite, etcetera that might be found in the greisen veins or in the

pegmatite, or at the contacts in the enclosing schists, would mechanically separate from the cassiterite in the milling operation.

Ore Occurrence

All the ores on the property of the Ka-Mi-Tin Concentrating Corporation occurs in and associated with the pegmatite. The pegmatite has been traced by a series of pits, shafts and adits from the north end of the property southward for 2½ miles to near South Fork River. There are at least four parallelin dikes at the north end and several paralleling stringers or apophyses. The present surface outcropping aggregates a width of about 120 feet of pegmatite, and the upper part of each dike has been weathered to kaolin, in some places to a depth of 50 to 70 feet.

The strike of the dikes is N. 30 to 25E. and the general dip is to the northwest. In the major dikes the dip is 70-80 degrees; in the stringers or apophyses the dip may be from 45 degrees up indicating that they probably join the larger dikes at varying and minor depths.

The hanging and foot walls of the dikes and apophyses are not regular. There are numerous bays in which kidney-shaped bodies of pegmatite have formed. Should there have been much cassiterite disseminated in the pegmatite magma and being an original constituent of the magma, we should expect to find segregations of cassiterite, both by magmatic and mechanical separation, in the embayments and pockets which branch off from the dikes and the apophyses.

My opportunities for study of the deposits under ground have been too limited to determine if there are such types of segregation which are free and distinct from the greisen replacement ore bodies, but I should expect to find some. In such case, there should be more feldspar associated with the cassiterite than in the greisen vein and replacement deposits.

In many places where thin quartz veins string through the pegmatite, above and below the quartz there are rich areas of cassiterite associated with quartz and mica chiefly. This would indicate an aqueo-igneous solution injected along a fissure or fracture in the already partly solidified pegmatite mass, the deposits being replacements of the feldspar by quartz, mica and cassiterite. What I term "Tin Roofs" are greisen rock rich in cassiterite which occurs in the hard, primary pegmatite and which is a fissure filling and replacement. Such a roof is typically shown in Swamp Shaft number one on the Ka-ili-Tin property.

The richest greisen should be near the hanging and foot walls, the former being the more favorable for rich areas of cassiterite. Another favorable place is around inclusions and horses of country rock found within the pegmatite. These are caused by stoping action of the pegmatite, the country rock or schist being broken off and floated out into the solidifying magma.

From what has been said, the apophyses extending into the schists should be very favorable places for circulation of the aqueous and aqueous solutions as well as the pneumatolys, and for replacement of the feldspar by greisen minerals and cassiterite, as well as primary deposition of them.

No evidence of typical vein filling such as banded or ribbon structure was noted. Without doubt there has been vein filling, but the walls were at the same time attacked by the solutions and the feldspar replaced by greisen minerals for varying distances back from the fissures, thus giving the appearance of replacement deposits entirely, except where there is a quartz stringer more or less in the center.

Within the pegmatite where shrinkage cracks had developed at the time of crystallization and solidification, greisen minerals and cassiterite are found. Thus when the primary rocks are reached at the base of and below the weathered zone, a selective mining system will be called for.

Where there is a change in the regional direction of the pegmatite dikes, we may look for such fracturing and fissuring as to form favorable areas for the deposition of cassiterite. At the south end of the Ka-Mi-Tin property near South Fork River, the strike of the pegmatite is N. 45-60 W. Approximately at this point, the pegmatite series has been offset to the west. The pegmatite has not been traced over

this offset distance but in the southerly trend again numerous pits have been opened and several mines developed to a point beyond Kings Mountain town.

Examination of the turn in the dike at the southern end of the property, disclosed a much shattered area and very irregular bodies of pegmatite. Channel samples taken on the hanging-wall side gave assays running from 0.567% to 0.921% metallic tin, as determined by fire assay. The association is typical greisen and quartz stringers. The contacts are extremely irregular.

Nineteen samples were taken from the northern part of the property by Dr. John H. Banks and two composite samples milled and assayed. No. 1 gave a return of 1.36% metallic tin; No. 2 gave 0.59% tin, or an average of nearly 1.00% tin from all samples. The reports of Dr. Banks and H. S. James are available for verification and for a full description of the method of procedure.

Dr. H. J. Bryson, State Geologist of North Carolina, took a series of samples in which cassiterite ran from 0.21% to 6.80%, an average he considered of a cut 1.00% tin. Report on file for verification.

Dr. Wilbur Nelson took seven samples at random from the 50 and 70 foot levels of the old Condon shaft. Four ran from 0.30% to 0.85%; three, trace only of tin.

The values of cassiterite in the pegmatite are extremely variable. Some assays show only a trace, others

show up to 50% in some rich shoots. The average for the full thickness of the pegmatite is problematic. In mining the weathered zone, probably all the dike material will be removed. The cost of both mining and milling will be so small that an average of considerably less than 1.00% cassiterite or 0.65% metallic tin will be profitable as the kaolin and mica will also be saved. It would appear safe to say that the average recovery should be at least 0.25% tin for all material mined to the base of the weathered zone. If we take 100 feet for the aggregate thickness of the several dikes, an average depth of 75 feet for the weathered zone, 15 cu. ft. per ton, for a length of 3000 feet along the strike, there would be 1,500,000 tons of minable material.

Below the weathered zone in the primary pegmatite, selective mining can raise the percentage of cassiterite to whatever degree is economically required.

Assays were made on an average of many samples of the surface material or residuum. To a depth of three feet, the average of 70 pits, 6714 lbs. samples, the recovery was 3.8 lbs. of metallic tin per ton, or 0.19%. From a series of pits varying in depth from 8 to 21 feet, and averaging 14½ feet, a composite sample gave 0.56% metallic tin. Map and report of this work are on file.

The kaolin deposit will be found only in the weathered zone of the pegmatites as they are formed by the complete break-down of the feldspars. The high-grade white-ware kaolin comes from the weathering of pure masses of the feldspar. Where found in such pockets, the kaolin should be mined separately. The depth to which the kaolin deposits will extend will not greatly exceed 75 feet.

The upper part of the weathered pegmatite will be iron stained in varying degrees but much of the discoloration should wash out in the milling operation.

The kaolin is all high-grade and runs nearly theoretically pure. The white has little or no iron impurity. Analyses by Dr. Bryson on ten samples show an average kaolin recovery of 48.90%. W. S. James found 31.7% by washing to be clay, all of which can be saved.

The amount of mica in the weathered zone of pegmatite was estimated from one to five percent of the material by Dr. Bryson. In two tests made by W. S. James, the mica recovery was 6.22% and 7.40% respectively.

The mica will be found scattered through the pegmatite and concentrated in the greisen areas with the cassiterite. When the primary rocks are reached, probably the only mica that can be profitably mined will be that associated with the greisen. The mica is high-grade and should command a good price, especially when ground.

Feldspar can be mined and saved cheaply when operations reach the primary pegmatite below the zone of weathering. There should be bodies of pure feldspar which can be mined and hand-picked, if necessary. The only milling operation should be to crush to commercial sizes. The high-grade feldspar should extend to great depth.

The quartz will be found intimately mixed through the pegmatite but chiefly in the green areas. If a method of separation is worked out, the quartz may be used for purposes more valuable than just road material.

Developments

The developments on the Lincolnton property, prior to the fall of 1935 when the Ka-Me-Tin Concentrating Corporation took in portions, are ancient history. Suffice to say that the ten or more shafts and the several thousand feet of underground work were confined almost exclusively to the weathered or soft zone which extend to a maximum depth of about 80 feet. Large bodies of kaolin containing commercial quantities of muscovite mica were proved and good tin values in many places were found. A mill was built, ore milled, and concentrates shipped. Very little work was carried into the hard, primary pegmatite.

From a tin standpoint, there was proved for the Condon area a tin reef six to twelve feet wide for a horizontal length of 149 feet. This was on a 70-foot level. On the Jake dike, promising tin enrichments were found but never carried to depth in the hard rock. The same can be said for the Incline dike and for the Carpenter dike. These are all on the north end of the property.

One mile to the south the Henry shaft was sunk and good tin ore taken from the 65-foot level. Many test pits were sunk over the entire length of the property, a distance of $2\frac{1}{3}$ miles. At the southern end there was some hydraulic work and open-cutting. Assay values are given in the preceding pages, the highest being 0.921 metallic tin.

On the strength of all the early work and following a report on the area by St. Clair, Ka-Mi-Tin began steam shovel operation late in 1935. Cross-cuts and pits were dug and nearly 100,000 tons of material moved. Supplementing this about 1200 feet of drifting was done in the pegmatite dikes in the weathered zone at depths of 20 to 40 feet below the surface, this work being done in 1936.

To conserve space a resume of the 1936 developments as printed in January 1937 is here inserted.

"Progress reports have been made regularly during the year 1936 covering the work done on the property of the American Consolidated Tin Mines Corporation in Lincoln County, North Carolina, by the operating Company, Ka-Mi-Tin Concentrating Corporation. The Management believes that at this time a short recapitulation of these operations will be of interest.

Primarily, it should be understood and appreciated that the work which has been done and which is progressing systematically and continuously will, if successful, add a chapter to American mining. A new enterprise must encounter many problems, some unique, which must be analyzed and safely and successfully overcome before rapid progress can be made. No bridge is built until plans and specifications are drawn, foundations tested, and stresses of materials calculated. No mining project can be successful unless just as careful geological and engineering theory and practice are considered and plans and calculations made.

With no written records or accurate maps available on previous work done on the property, operations under the supervision of Ka-Mi-Tin Concentrating Corporation were begun in the Condon area, for it was known that rich tin ore had been mined and milled from this section.

Three long cross-cuts of the mineralized area were made by steam shovel which gave an excellent picture of the form and character of the pegmatite dikes. Three large pits were dragged, each to a depth of about 40 feet. From the cuts and pits drifts were run into and through the pegmatite dikes to determine contacts and enrichments. All this work was done in the soft, weathered zone, the depth of which extends to about 80 feet where hard-pan is encountered.

The work was made very hazardous and difficult by the continual unexpected encountering of old workings from which large volumes of water and muck would break in upon the new workings.

Without further detailing the work done in the old areas, we may briefly summarize the results. In the Condon area, the management has established the fact that a rich tin-bearing reef rock is near or at the hanging wall of the west pegmatite dike, and the top of the reef is at a depth of about 50 feet from the surface. Later, this will be mined by a shaft to be sunk west of all the old workings and to a depth of at least 150 feet so as to get underneath all the old water and muck-filled drifts. Diamond drilling will first outline the shape and extent of the tin reef.

The work in the Condon area has also established the fact that the company has a large deposit of high-grade Kaolin and Mica which when milling and treating facilities are available should prove a source of income. Other tin enrichments at the several contacts, hanging-and foot-walls of the dikes, will be followed down and should develop into valuable ore bodies at depth.

On the Jake dike, a high-grade deposit of Kaolin and Mica and several enrichments of tin have been proved, none of which have been carried to a depth of more than 20 feet all in the soft weathered zone.

On the Incline dike, a good part of the old workings were cleaned out and extended. All work was in the soft, weathered rock; at no place to a depth of more than 30 feet. Aside from proving another commercial body of Kaolin and Mica, tin values run from ¼ of one percent to two percent, the richer bodies being at the foot-wall contact of the main dike. No work was done in the old Carpenter area.

Work in the Swamp section, which lies about 1,000 feet south of the Incline area, was started early in September 1936. In a cross-cut from Swamp Shaft Number 1 at a depth of only 30 feet from the surface a rich tin

strike was made, assays running up to several percent tin over a reef width of four to six feet. A drift was run north a distance of 85 feet paralleling the reef but in the soft, weathered rock and above the harder reef rock. An incline or slope the full width of the reef has been run for a distance of 33 feet and attaining a depth of 40 feet in the reef. Milling ore is being hoisted to the surface and stored.

Swamp Shaft Number 2 was sunk to a depth of 45 feet, cross-cut made to connect with the north entry from Shaft Number 1, and is now being used for ventilation and drainage of the workings in Number 1. Later it will be deepened and used for both mining and hoisting.

Swamp Number 3 is a two-compartment shaft with pipe and ladder-way and is 14 feet x 6 feet. The present depth is 65 feet and sinking is continuing. Progress has been slow due to the rock being very hard and highly silicified. Earth mechanics and water have also retarded the expected progress. All these are being overcome and the Shaft will be carried to depth. A level will be established within the next 15 to 30 feet where drifting will be done to reach the foot-wall and the hanging-wall. From this level only one compartment of the Shaft will be carried deeper and the sinking will be more rapid.

Very encouraging values for such highly silicified

rock, both in tin and columbite, have been followed down in Number 3 Shaft. It is anticipated that the hanging-wall or foot-wall contact, where the rock should not be so hard, should have tin-bearing rock similar in character to what was found at the hanging wall in Number 1 which is only 300 feet to the south. The formations appear similar.

Practically all work is being concentrated in the Swamp area at this time. There are 27 men on the pay-roll and day and night shifts are [illegible] Shaft Number 3.

The steam shovel is being used as a hoist and stacker for Number 3 Shaft. Hand winches are used on the others. A compressor plant was installed in November and furnishes power for four air drills and one pump. Two gasoline engines and pumps are in Shaft Number 3. A generator plant furnishes Electric current for surface and underground work. There are eight buildings in the Swamp Shaft enclosure including the office and two bunk houses. An ore bin 30 feet by 80 feet is being constructed.

A recent development has added color to the picture. A mile to the south at the Henry Shaft, a recent work has opened a tin reef similar to the strike in Swamp Number 1. Sufficient depth has not yet been reached to determine the full width of the reef.

The work in the Henry is on the 30-foot level. Years ago limited mining was done on a 60-foot level where good ore

values were reported. To mine at this depth now would require the installation of a new unit, including pump, compressor and air drills as well as a hoist. The Company is fully occupied in its development at the Swamp Shafts and nothing more than exploratory work is planned for the Henry area for the moment. Probably by Spring when the weather conditions are more favorable, plans will be made to open up this new area.

In conclusion, the year 1936 has seen the Company develop into a smoothly functioning organization and a well-trained and experienced personnel. Local labor conditions have caused delays in the past but this is being overcome by importing miners from other districts. In Canada the saying is "five years to develop a mine." We hope that the year 1937 will see developed a tin-producing mining and milling company, and later an installation to handle the Mica and Kaolin, and the Feldspar and spodumene (source of lithium).

In all, the year 1936 has seen satisfactory progress and results in the development of this new project. The work is under the supervision of L.H. Hepp, resident superintendent and the consulting geological advice of Stuart St. Clair of New York."

Since this report, the number three shaft has been carried down to 80 feet and number one shaft has reached 70 feet. A cross-cut from shaft number one on the 30-foot level struck a rich tin reef. A cross-cut is now being driven on the 65-foot level to reach the same reef. Assay results on careful sampling of the Swamp number one reef give the following results: Cut number one, width 8 feet, roof channel 3.24% metallic tin, floor channel 2.74% tin. Cut number two, 16 feet north, width 5 feet, roof channel 4.92% metallic tin, floor channel, 5.66% tin. Assays by John H. Banks Laboratories, New York City.

Of some interest, - in sinking Swamp shaft number one and driving 65-foot level cross-cut, considerable iron sulphide was encountered in the gneiss. Assay by Banks gives gold per ton 0.05 oz.; silver per ton 0.12 oz.; copper 0.03%.

After the above report was made, further drifting from the Henry shaft on a 30-foot level struck 5 feet of weathered greisen which panned 3% cassiterite; second sample 1.25% cassiterite. Hard greisen reef, 2 feet in width, uncovered, estimated 2.5% cassiterite.

Early diamond drill holes should be mentioned. Unfortunately, no record is now available except from word of mouth of people who worked on the drill. One hole 450

feet in depth, angle 45° in the Condon area, passed through 40 feet of dike, good tin values. This would be about 60 feet horizontal thickness. This checks with known widths of this dike.

A drill hole west of the Incline area and north 1000 feet from Swamp shafts went to a depth of 1300 feet on a 45° angle. Four dikes were cut ranging from 10 to 20 feet in thickness, tin assays averaging 1.5 to 2.0%. This length of drill hole would give 920 feet on a horizontal and vertical projection. The findings check with known dikes. A few cores picked up around the collars of the holes are of hard gneiss and schist, the country rock.

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NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING

OF THE

UNIVERSITY OF NORTH CAROLINA

MINERALS RESEARCH LABORATORY
Asheville, North Carolina

March, 1952

A METHOD FOR CONCENTRATION

OF

NORTH CAROLINA SPODUMENE ORES

By

Mason E. Banks, William T. McDaniel and Philip N. Sales

Report prepared in cooperation with the North Carolina
Department of Conservation and Development and the
Tennessee Valley Authority

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ABSTRACT

Studies of a froth flotation process for concentration of spodumene from ores obtained in the vicinity of Kings Mountain, North Carolina were made on both batch and pilot plant scales. A process was developed for the production of concentrates which assayed 6.0% Li_2O and 0.45% Fe_2O_3 with 70-75% recovery of spodumene. The process requires two flotation separations, i.e., (1) a procedure whereby mica, feldspar, and quartz are simultaneously removed as a froth product with a cationic collector, and (2) the subsequent removal of iron-bearing minerals as a froth product while spodumene is depressed as a tailing. The process is the reverse of the usual procedure of collecting spodumene as a froth product with anionic collectors.

The investigation was undertaken by North Carolina State College Minerals Research Laboratory of Asheville, North Carolina at the request of Foote Mineral Company of Philadelphia, Pennsylvania. Parts of the process are now being used on a commercial scale at the Foote Mineral Company plant near Kings Mountain, North Carolina

Introduction

During the 1942-45 period of World War II, Solvay Process Company operated a flotation plant with a daily capacity of 300 tons of ore for the production of spodumene concentrate near Kings Mountain, North Carolina. The operation was shut down upon cessation of wartime demand for lithium chemicals and, until recently, there has been no production from the Carolinas.

In April, 1950 an investigation of the problem of spodumene flotation from North Carolina ores was begun at N. C. State College Minerals Research Laboratory at Asheville, N. C. This laboratory, operating under the combined auspices of N. C. State College, N. C. Department of Conservation and Development, and Tennessee Valley Authority undertook the spodumene project at the request of Foote Mineral Company of Philadelphia, Pennsylvania. The work, involving a period of fifteen months of intensive batch and pilot plant investigation, was completed in June, 1951, and resulted in development of a process for concentration of spodumene by flotation which has been hereto unrecorded in the literature. A similar approach has been used before on iron, ilmenite, and other minerals, but the literature shows no record of its having been applied to spodumene. Parts of the process are now being used on a commercial scale at the Foote Mineral Company plant near Kings Mountain, N. C., which has been in production since July, 1951. It is the purpose of this paper to describe some of the results of the investigation.

Acknowledgements

The authors would like to acknowledge with sincere appreciation the assistance of the following people and organizations in connection with this investigation: Dr. J. L. Stuckey, State Geologist of North Carolina and his assistant, Sam D. Broadhurst; Charles E. Hunter, former TVA Geologist, for field sampling and geological assistance; Carolina Mineral Company; United Feldspar and Mineral Company; Research and Development Division, Foote Mineral Company for furnishing checks on analytical control samples, and for part of the pilot plant equipment; W. H. Powell, R. B. Terrell, and W. R. Hudspeth for assistance in carrying out laboratory tests.

The Ore Bodies

According to statements judged to be conservative the tin-spodumene belt of the Carolinas contains an estimated 4,300,000 tons of pegmatite ore averaging 15% spodumene. This amounts to "a reserve of at least 650,000 tons of spodumene (more than 20,000 tons of metallic lithium) to a depth of 100 feet." (1)

Spodumene-bearing pegmatites occur in a narrow belt 24.5 miles long and 1.8 miles wide extending southwestward from Lincolnton to Grover, N. C. There are hundreds of pegmatites in the belt most of which are less than 10 feet wide, however, there are sufficient larger bodies to permit the establishment of the reserves figure of 4,300,000 tons of ore. This figure includes only bodies having an average thickness of 35 feet and length of 550 feet. The largest pegmatite in the area has a maximum thickness of 395 feet and maximum length of 3250 feet. (1)

These larger pegmatites are composed principally of albite and microcline feldspars (albite predominating), quartz, spodumene, and muscovite. There are many accessory minerals, but the important ones are cassiterite and beryl, and possibly columbite-tantalite. Approximate composition of ores from the belt which were used in this investigation is as follows:

Sample No.	Laboratory Test	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Foote Mineral Co.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Consolidated Feldspar Corp.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Foote Mineral Co.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Foote Mineral Co.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. 985	Foote Mineral Co.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Notes: 1. "Others includes hornblende gneiss and cordierite schist particles from wall rock and inclusions, as well as beryl, cassiterite, and numbers of accessory pegmatite minerals present in trace quantities.
2. The Foote samples contained 0.03-0.05% Ta, or approximately 1.0 pound Ta per ton of ore. These came from the old Selwey quarry about 1 mile NW of Kings Mountain.

Table I shows that quartz and muscovite content remain fairly constant in all the ores, while feldspar content increases when spodumene content decreases, and vice versa. This is interesting because feldspar is potentially an important by-product.

The Spodumene

According to Boyd,(3) the following analysis is typical of the Carolina spodumene:

SiO_2	Al_2O_3	Li_2O	TiO_2	CaO	MnO	MgO	Na_2O	Ignition loss
63.84	28.61	7.26	0.39	0.04	Trace	Nil	Nil	0.16

Spectrographic analysis shows the presence of minor amounts of Fe_2O_3, MnO, TiO_2, SnO, Cr_2O_3, Na_2O and MgO in the spodumene. One sample contained Ta_2O_5. Petrographic and X-ray studies indicated that these impurities are probably isomorphous replacements in the crystal structure of the spodumene.(3)

The molecular dispersion of the iron within the spodumene crystal has been substantiated by acid-leaching and magnetic separation tests in which the Fe_2O_3 content of spodumene crystals remained from 0.15-0.40% after magnetic separation and acid leaching.(2)

The iron content of the spodumene crystals is usually reflected in the color of the crystals, the colorless to white variety containing from 0.08-0.20% Fe_2O_3, the buff or cream variety containing 0.20-0.40% Fe_2O_3 and the yellow or greenish-yellow variety containing up to 0.65% Fe_2O_3, etc. The darker the color the higher the iron content of the spodumene.

The amount of iron dispersed in the spodumene crystals is a significant factor since it effects the use to which the concentrates may be put. For use in ceramics the spodumene concentrate should contain less than 0.5% Fe_2O_3, but for use in extraction of lithia for chemical purposes the presence of iron presents no special problem. Some of the samples handled from the Carolina belt contained spodumene with low enough isomorphous iron content to yield a product with less than 0.2% Fe_2O_3. The average iron content of spodumene concentrates prepared from these ores was 0.40-0.50%.

The Carolina spodumene is somewhat variable in Li_2O content, but apparently avarages approximately 7.0% or slightly in excess of this figure, although, the textbook gives 8.03% theoretical Li_2O. Some variation is caused by weathering for it has been established that Li_2O is lost by leaching when the rock undergoes weathering, just as the Na_2O and K_2O are lost in kaolinization of feldspar.

Since the close of World War II there have been numerous developments which have tended to increase the use of lithium by industry. Notable among these has been the development of an industrial lubricant based on lithium stearate. The lubricant is fluid at low temperatures, stable at high temperature, and insoluble in water. A new bleaching agent, lithium hypochlorite, has also been developed recently.(11) Other well-known uses are listed below:

1. Lithium oxide in ceramics reduces firing time, lowers melting temperatures, lowers thermal expansion, raises refractive index, and improves chemical resistivity.
2. Lithium carbonate and lithium strontium nitrate are used in pyrotechnics for their brilliant red color.(10)
3. Lithium chlorides and fluorides are used as fluxes for welding aluminum and magnesium.(10)
4. The affinity of lithium for nitrogen is the basis for a process used in purifying helium.(10)
5. Lithium chlorides and bromides are used in air conditioning for their powers to absorb organic amines, ammonia, and smoke.(11)
6. Lithium hydride has been used as a source of hydrogen to inflate life rafts and balloons used by the Air Forces and Navy.(11)
7. Lithium metal and lithium hydride are useful in the atomic energy program in connection with the production of the isotopes of hydrogen.(7)

Review of Concentration Methods

The literature reveals the following methods which have been used for production of spodumene concentrates: 1. The spodumene of the Black Hills of South Dakota was present in such large crystals that it was easily concentrated by selective mining and hand sorting. 2. The Bureau of Mines developed a method by which alpha spodumene was decrepitated at a temperature between 1000°C and 1100°C, changing its form to beta spodumene, a soft pulverulent material, which could be recovered from the harder gangue minerals by differential grinding following the decrepitation.(6) 3. Froth flotation of spodumene using anionic collectors (fatty acids) in an alkaline circuit was worked out by the Bureau of Mines, and enlarged upon by Norman and Giesche.(2) This method was utilized by Selwy Process Company at Kings Mountain, N. C. during its wartime operation. 4. Froth flotation with sulfonated oils in an acid circuit was also shown to be feasible, as well as a method of producing a feldspar-spodumene mixture by using cationic collectors in an HF circuit.(2) 5. A mill at Keystone, South Dakota operated by Lithium Corp. of America has been utilizing the heavy media method, treating 15 tons of minus 1½-in. ore per hour, and producing a concentrate of 4 to 5% Li_2O.(7)

All of the methods above have their advantages and disadvantages. The method described on the following pages is presented merely as a different approach and is acknowledged also to have both advantages and disadvantages.

The Flotation Process

The final process developed for spodumene concentration of North Carolina ores revolves around two primary flotation separations, i.e., 1. a process whereby mica, feldspar and quartz are simultaneously removed as a froth product while spodumene and iron-bearing minerals are depressed as a tailing; and, 2. the subsequent removal of iron-bearing minerals as a froth product while spodumene is depressed as a tailing. The removal of silicate gangue minerals in Step 1 is accomplished in an alkaline circuit, using a long-chain amine as collector, and a colloidal depressant, such as starch or dextrine as selective depressant for the spodumene and iron-minerals. The iron minerals are removed in an acid circuit, using sodium resinate as collector and hydrofluoric acid as controller for prevention of spodumene flotation. Suitable frothers are used in both floats.

The gangue froth product containing mica, feldspar, and quartz may be split into its component parts for recovery of a feldspar by-product. Since approximately one-third of the feed is generally recoverable as a feldspar concentrate, it was felt that efforts to recover it should be made. The general procedure for feldspar recovery would be to dewater the gangue froth product, and then treat it in the conventional manner for feldspar ores which consists of removal of mica with sulfuric acid and amine, washing by classification, then flotation of other iron-bearing silicates with sulfonated oil or fatty acid collectors, and finally flotation of feldspar from quartz with the conventional hydrofluoric acid-amine process.

The final process which breaks the ore into its component parts is described generally as follows:

1. Grinding. The ore as received was ground in a batch rod mill at 25 percent solids to pass a 28 mesh screen. The plus 28 mesh fraction, consisting almost entirely of mica, was removed. The minus 28 mesh fraction, was deslimed by decanting over a 325 mesh screen. Approximately 0.5 pound caustic per ton of feed was used in the mill to keep the pulp dispersed for desliming. The oversize product consisted of about 1.0 percent weight of the feed, while slime loss amounted to 12-18 percent weight of the feed. Separations were obtained with feed as coarse as 20 mesh, and the general range of 20-28 mesh was satisfactory. The feed should be sized by screening or classification, with oversize returning to the mill in practice. The rod mill is preferred to the ball mill, because it produces a coarser, more granular, feed with much closer size distribution. It is believed that ball milling would produce excessive slimes and a long particle size range, both of which have been shown to be undesirable in this process.

2. Rougher Gangue Flotation. The deslimed minus 28 mesh plus 325 mesh pulp was placed in a Denver 2000 gram laboratory flotation machine and brought to 20-25 percent solids. The following reagents* were added: 1.0 lb/T Lime, 0.5 lb/T dextrine, 0.4-0.7 lb/T Armac T, and 0.4 lb/T B-23. The pulp was conditioned for one minute, then floated for four minutes, with the quartz, feldspar, and mica being simultaneously removed as a froth product. The spodumene and iron-bearing minerals were selectively depressed and removed as a tailing. Most of the froth was removed in two minutes. The float is heavy and fast if sufficient frother is used. The rougher is more selective if little or no frother is used, but requires more collector (Armac T) and an excessive float time. Lime

*Calculated in pounds per ton of dry mill feed.

and dextrine are more selective and cheaper than caustic and dextrine, although either may be used. If dextrine is not available, causticized-starch may be used, although dextrine is preferable. An excess of starch or dextrine does not break down the separation, but merely causes an increase in collector required. Approximately 0.5 lb/T dextrine or causticized-starch is generally sufficient to depress the spodumene. An excess of caustic or lime can cause complete break-down of the separation as the anion collector is unstable when the pH is above 11.5.

3. Cleaner Gangue Flotation. The rougher gangue froth was next placed in the cell at 15-20 percent solids with 0.5 lb/T Lime, 0.5 lb/T Dextrine, and 0.2 lb/T B-23. It was conditioned 15 seconds, then floated four minutes. This is practically a repetition of the rougher, for the purpose of dropping out fine spodumene particles which were mechanically entrained in the heavy rougher froth. It requires no additional collector. If sufficient frother is used, the cleaner tailing or middling is a high-grade spodumene concentrate and may be combined with the rougher tailing.

4. Iron Mineral Flotation. The combined rougher tailing and cleaner tailing, consisting of a high-grade spodumene concentrate with substantially all of the iron-bearing minerals present, was then washed by decantation, thickened to 65-75 percent solids, and conditioned for ten minutes with 0.35 lb/T HF (100 percent), 2.0 lb/T sodium resinate, 0.1 lb/T B-23. The pulp was transferred to the cell and floated four minutes at 25 percent solids, with iron-bearing minerals being removed as a froth product, and relatively iron-free (except for molecularly contained iron) spodumene discharged as a tailing. The tailing is the finished spodumene concentrate, which may be thickened, filtered, and dried in conventional manner. The sodium resinate collector was chosen over sulfonated oils as iron-mineral collector because it tends to concentrate the spodumene by floating mica and feldspar impurities along with the iron minerals, whereas the sulfonated oils tend to float pure spodumene along with the iron minerals. It is most important to maintain pulp density in the conditioner as high as possible before flotation of iron minerals.

5. Mica Flotation. The cleaner gangue froth was next conditioned for three minutes with 1.0 lb/T H_2SO_4, 0.1 lb/T B-23, and 0.05 lb/T Armac T at 35 percent solids. Mica was then removed as a froth product.

6. Feldspar Flotation. The quartz-feldspar tailing from the mica float was washed by decantation, then conditioned six minutes at 50 percent solids with 1.5 lb/T HF (100 percent). It was then placed in the cell, diluted to 25 percent solids, and 0.05-0.20 lb/T Armac T and 0.3 lb/T B-23 were added before flotation. Feldspar was removed as a froth product and quartz was discharged as a tailing.

Using the process as outlined, results on batch testing several ores are shown in Table II. Figure I is a flowsheet of the process.

Table II
Batch Test Results

Lab. No. 808 Head Sample: 38% spodumene, 0.24% Fe_2O_3 in spodumene crystals.

Product	% Wt.	Spodumene %	Spodumene Units	Spodumene Dist.	Fe_2O_3	Al_2O_3	SiO_2	(1) Li_2O	(2) Li_2O
Spodumene Conc.	29.4	91	26.8	70.8	0.26			6.55	
Iron Froth Product	3.2	62	2.0	5.3				4.85	
Mica Froth Product	4.2	4	0.2	0.5				0.45	
Feldspar Froth Product	21.0	14	2.9	7.7	0.07		67.0	1.25	
Quartz Tailing	29.8	8	2.4	6.3	0.04		93.3	0.75	
Slime & Oversize	12.5	29*	3.6*	9.5*					
Total	100.1		37.9	100.1					

Lab. No. 837-A Head Sample: 36% spodumene, 0.43% Fe_2O_3 in spodumene crystals.

Product	% Wt.	Spodumene %	Spodumene Units	Spodumene Dist.	Fe_2O_3	Al_2O_3	SiO_2	(1) Li_2O	(2) Li_2O
Spodumene Conc.	33.8	89	30.1	83.6	0.44			6.50	6.44
Iron Froth Product	1.9	50	1.0	2.8	8.29			4.05	4.50
Mica Froth Product	1.5	3	0.1	0.3				0.35	0.52
Feldspar Froth Product	27.5	8	2.2	6.1	0.09	19.9	68.4	0.70	0.68
Quartz Tailing	20.9	1	0.2	0.6	0.02		98.0	0.10	0.11
Slime & Oversize	14.4	18*	2.4*	6.7*					
Total	100.0		36.0	100.1					

Lab. No. 943 Head Sample: 19% spodumene, ____% Fe_2O_3 in spodumene crystals.

Product	% Wt.	Spodumene %	Spodumene Units	Spodumene Dist.	Fe_2O_3	Al_2O_3	SiO_2	(1) Li_2O	(2) Li_2O
Spodumene Conc.	14.3	82	11.7	63	0.86			6.35	6.40
Iron Froth Product	2.6	55	1.4	7				4.35	4.00
Mica Froth Product	6.0	5	0.3	2				0.50	1.19
Feldspar Froth Product	37.9	7	2.6	14	0.26	20.6	66.0	0.70	1.40
Quartz Tailing	20.1	1	0.2	1	0.14		94.1	0.10	0.36
Slime & Oversize	19.1	13*	2.4*	13*					
Total	100.0		18.6	100					

Lab. No. 971 Head Sample: 23% spodumene, 0.47% Fe_2O_3 in spodumene crystals.

Product	% Wt.	Spodumene %	Spodumene Units	Spodumene Dist.	Fe_2O_3	Al_2O_3	SiO_2	(1) Li_2O	(2) Li_2O
Spodumene Conc.	22.8	84	19.2	83.5	0.56			6.25	
Iron Froth Product	1.0	94	0.9	3.9				6.70	
Mica Froth Product	4.4	1	0.0	0.0				0.10	
Feldspar Froth Product	36.6	4	1.5	6.5	0.12	20.4	68.1	0.40	
Quartz Tailing	20.8	1	0.2	0.9	0.05		96.5	0.10	
Slime & Oversize	14.3	8*	1.2*	5.2					
Total	99.9		23.0	100.0					

(1) By using curve showing Li_2O vs. percent sinks in acetylene tetrabromide.
(2) By actual chemical analysis.

*Calculated using head sample analysis.
Distribution of spodumene based on percentage of sinks in acetylene tetrabromide.
Li_2O analyses by Foote Mineral Company.

PROPOSED SPODUMENE FLOTATION PLANT FLOWSHEET

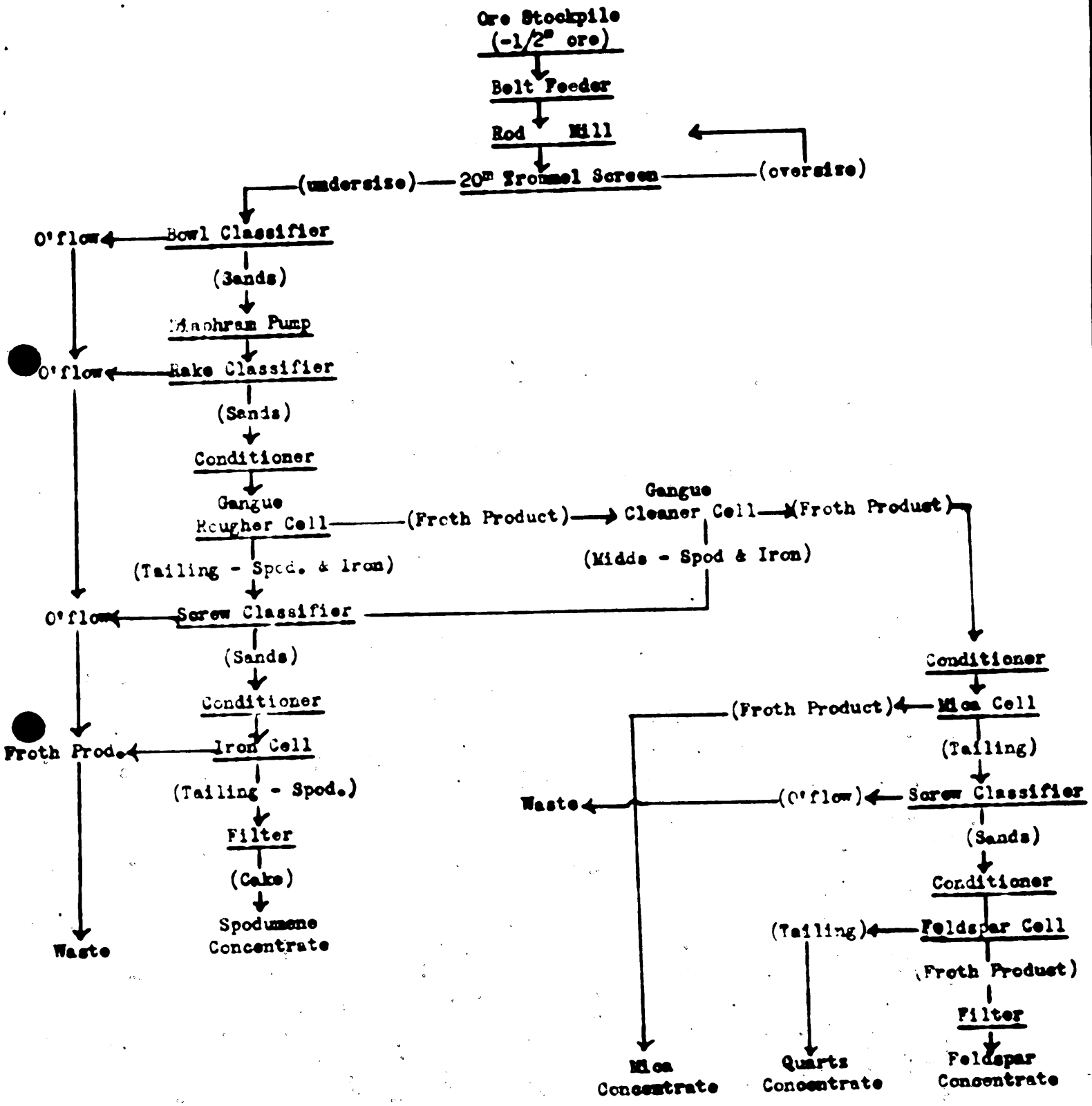


Figure 1

Pilot Plant Tests

Since the method outlined in the preceding pages represented a rather novel approach to spodumene flotation, it was decided to make pilot plant tests so that the spodumene-gangue and spodumene-iron separations could be studied under continuous operating conditions. Part of the necessary equipment was furnished the laboratory by Foote Mineral Company.

The flowsheet followed was the same as that shown in Fig. 2, except that the gangue froth product was collected as a bulk froth product with no attempt made to separate the mica, feldspar, and quartz. Grinding conditions were set-up to utilize the mill as a scrubbing device, i. e., high density grinding with caustic. Feed rate for most of the tests was 300 lbs/hr of minus 1/2 inch ore and a total of 15 tons of ore were used in these tests. Operating time on the test runs varied from two to eight hours. Two ore samples were studied in this manner. Lab. No. 969 containing 22% spodumene, and Lab. No. 985 containing 12.5% spodumene. Seven complete tests were made on each ore. Variables studied in these fourteen continuous pilot plant tests included amount of caustic used in the mill, pH studies in rougher and cleaner gangue floats, conditioning time and cell retention time in the gangue float section, comparison of pine oil, B-23, and cresylic acid as frothers, determination of optimum dextrine and amine amounts required, studies comparing sulfonated oils with soap as iron mineral collector, conditioning time and cell retention time in the iron float section. A short study was also made of the problem of concentration of the small amount of cassiterite which occurs in the spodumene ores. The cassiterite problem is not considered within the scope of this paper, but is mentioned to indicate that the presence of the mineral in interesting quantities was recognized and a method was evolved to recover it.

Table IV shows the results obtained in pilot plant tests number 2 and number 14.

Table IV

Pilot Plant Test 2

Operating Conditions

Feed: -1/2 inch Lab. No. 969, 22% spodumene, 0.89% Fe_2O_3, fed at 300 lbs/hr. Mill discharge minus 28 mesh.

Equipment	Reagent	Quantity Reagents - lbs/T	pH	Percent Solids
Rod Mill	NaOH	4.34		65
Rougher Cell	NaOH	0.27	10.9	20
	Dextrine	1.15		
	Amine	0.90		
	Pine Oil	1.13		
Cleaner Cell	Dextrine	1.10	10.0	15
	Pine Oil	0.69		
Fe Conditioner	Sodium Resinate	3.20	5.0	65
	HF	0.24		
	Pine Oil	0.76		
Fe Cell			5.4	20

Heavy Liquid Control Method

The use of acetylene tetrabromide as a laboratory control aid is worthy of mention here in view of its extensive use in this investigation. The liquid has a specific gravity of 2.96. The only major constituent of the spodumene ores having a specific gravity higher than 2.96 was spodumene itself. It was found that minus 20 mesh ore samples when placed in acetylene tetrabromide, resulted in a sinks product averaging 98 percent spodumene, the remaining 2 percent consisting of traces of cassiterite, hornblende, tourmaline, apatite, pyrite, and numerous others. Therefore, for all practical control purposes, the percentage of sinks in acetylene tetrabromide was the actual percentage of spodumene in the product.

A method was evolved in which the test samples were weighed, placed in acetylene tetrabromide contained in centrifuge tubes, and centrifuged for 10 minutes. Centrifuging brought about excellent separation of gangue minerals as floats and spodumene as sinks. Floats and sinks were then easily separated by a simple pouring technique, filtered, washed with benzene to remove excess tetrabromide, dried and weighed.

A graph (Figure 2) was then drawn in which percentage of sinks in a given sample was plotted against percentage of Li_2O contained in the sample. Li_2O analyses for this graph were kindly furnished by Foote Mineral Co. By obtaining the percentage of sinks in acetylene tetrabromide and reading the corresponding Li_2O value from the graph, it was possible to obtain a reasonably accurate Li_2O analysis.

This method was used as a control on laboratory batch tests and pilot plant tests. All products were quickly and easily evaluated from a lithia standpoint without the costly and somewhat lengthy chemical analytical procedure for lithia determination. From twelve to eighteen Li_2O determinations per eight-hour shift could be made by semi-skilled operators using this method. In addition to its use as laboratory control, the method could easily be adapted in commercial plant operating control.

Conclusions

The two flotation separations described in the foregoing pages produced spodumene concentrates from Kings Mountain ores on a continuous pilot plant scale. The spodumene concentrates contained an average of 6.0% Li_2O and 0.45% Fe_2O_3 with a recovery of 70% of the available spodumene. If the iron removal step was not carried out the recovery of spodumene was approximately 75%. The process was successful on feed ground as coarse as 20 mesh. Weathered ores required light attrition scrubbing for satisfactory separation, but this was carried out in an acceptable manner by milling at high density with a high caustic addition.

The process is not recommended for use on ores containing less than 15% spodumene because recovery tends to drop off as spodumene content in the feed decreases. This is due to the fact that the gangue froth product inherently contains 3-5% spodumene and this becomes an increasingly high percentage of the total distribution as the spodumene content of the ore decreases.

There were no particularly difficult operating problems. The two most important operating points (and the ones which might easily be overlooked) were proper pretreatment of weathered ores, and strict maintenance of high pulp density in the conditioner before iron-mineral flotation.

The most difficult mineral to cope with was hornblende. Spodumene and hornblende are closely related mineralogically, and they exhibited similar reactions to the above described process. In order to satisfactorily remove hornblende, if it were encountered in appreciable amounts in the ore, it would probably be necessary to employ both flotation and magnetic separation.

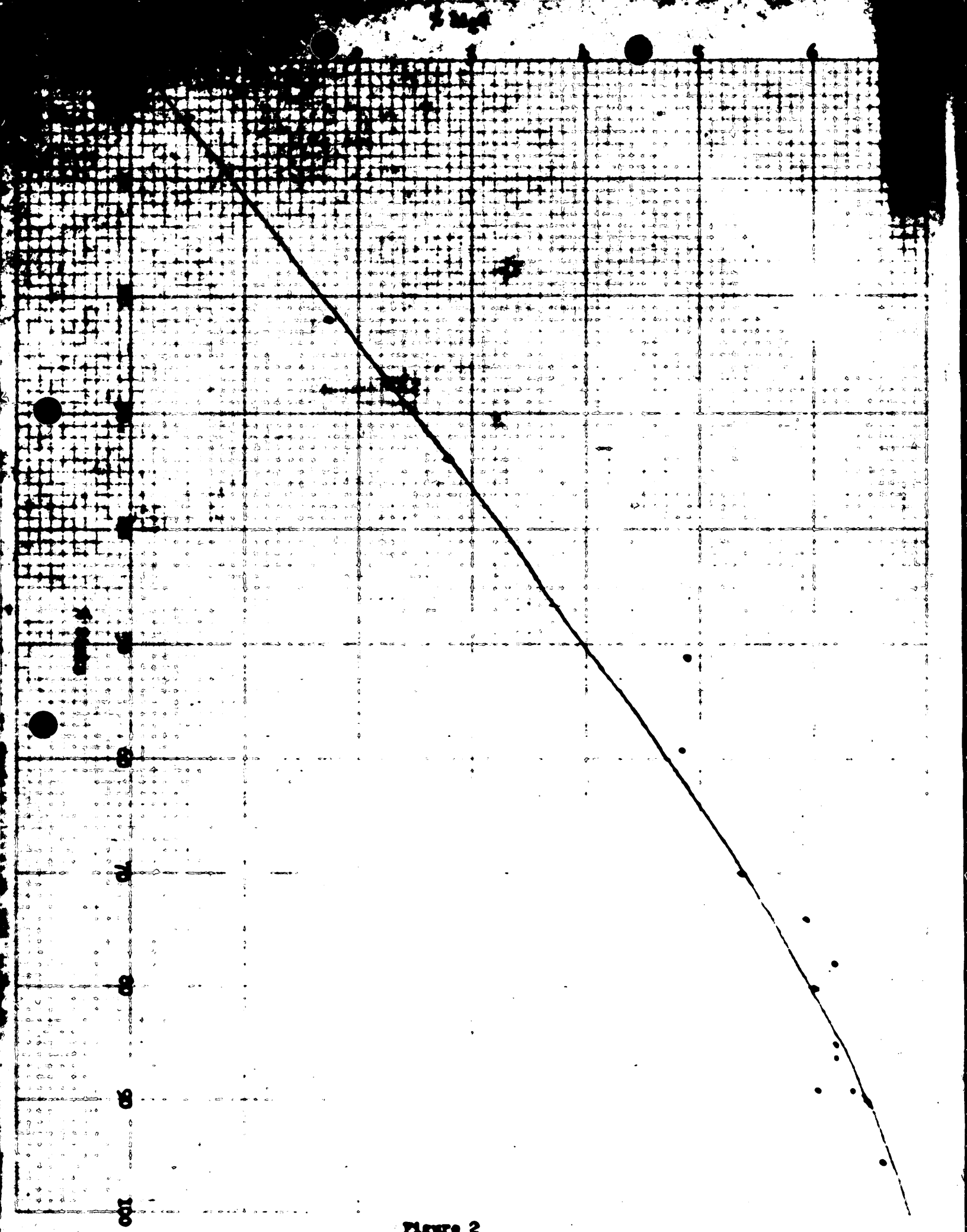


Figure 2

ENGINEERS
INSPECTIONS and TESTS

CHEMISTS
INDUSTRIAL and ANALYTICAL

The Bruce Williams Laboratories

ESTABLISHED 1898
Main Office 618-622 Joplin Street Telephone 556
JOPLIN, MISSOURI

109 S. Connell Street
Picher, Oklahoma
Telephone 710

St. Louis, Missouri
306 Valley Drive
Telephone Imperial 3224

October 28, 1952

Ct nd rd [illegible] Alloys Corporation
120 Wall Street
New York 5, New York

Attn: [illegible] Breath

[illegible] [illegible]

Iron	[illegible]	0.77%	Cassiterite	SnO_2	0.98%
Beryllium	[illegible]	0.1[illegible]	The metal beryllium	[illegible]	0.12%
[illegible]		[illegible]	Columbite	$(Fe,Mn)(Cb,Ta)_2O_6$	6.97%
[illegible]			[illegible] as the oxides	Cb_2O_5 / Ta_2O_5	0.145

[illegible] necessary to grind the entire sample in order to have a representative [illegible]. Iron or feldspar, or any other rock, should be determined on a separate [illegible].

[illegible]

Bruce Williams

Bruce Williams

WHITEHALL 3-1600

SIMPSON COAL & CHEMICAL CORPORATION
120 WALL STREET
NEW YORK 5, N. Y.

October 27, 1952

ANALYSIS

Pegmatite Ore - Composite Sample K M T

	% Present
Spodumene (Lithia content 7% Li_2O)	18
Quartz	35
Mica	6
Tin (In form of Cassiderite)	.5
Columbium-Tantalum Comb.	.015
Beryllium	Trace
Iron	2.0
Feldspar	30.5
Alumina	6
Moisture	Balance
	100 %

SIMPSON COAL & CHEMICAL CORPORATION

D. Shenkin

D. Shenkin, Chemist

[redacted]

[redacted] Building

[redacted]

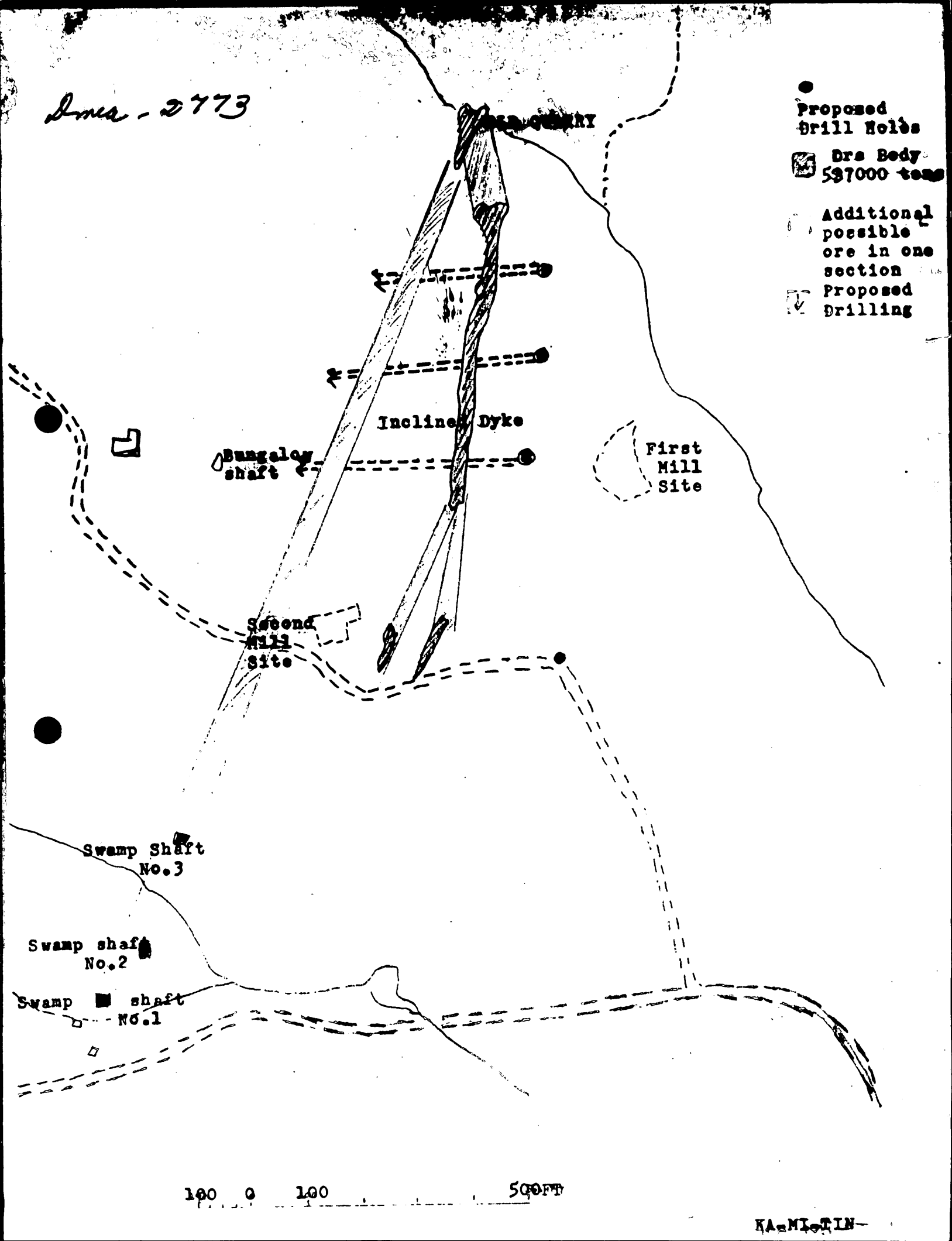
[redacted]

[redacted]

Dmea - 2773

4 maps or diagrams enclosed.

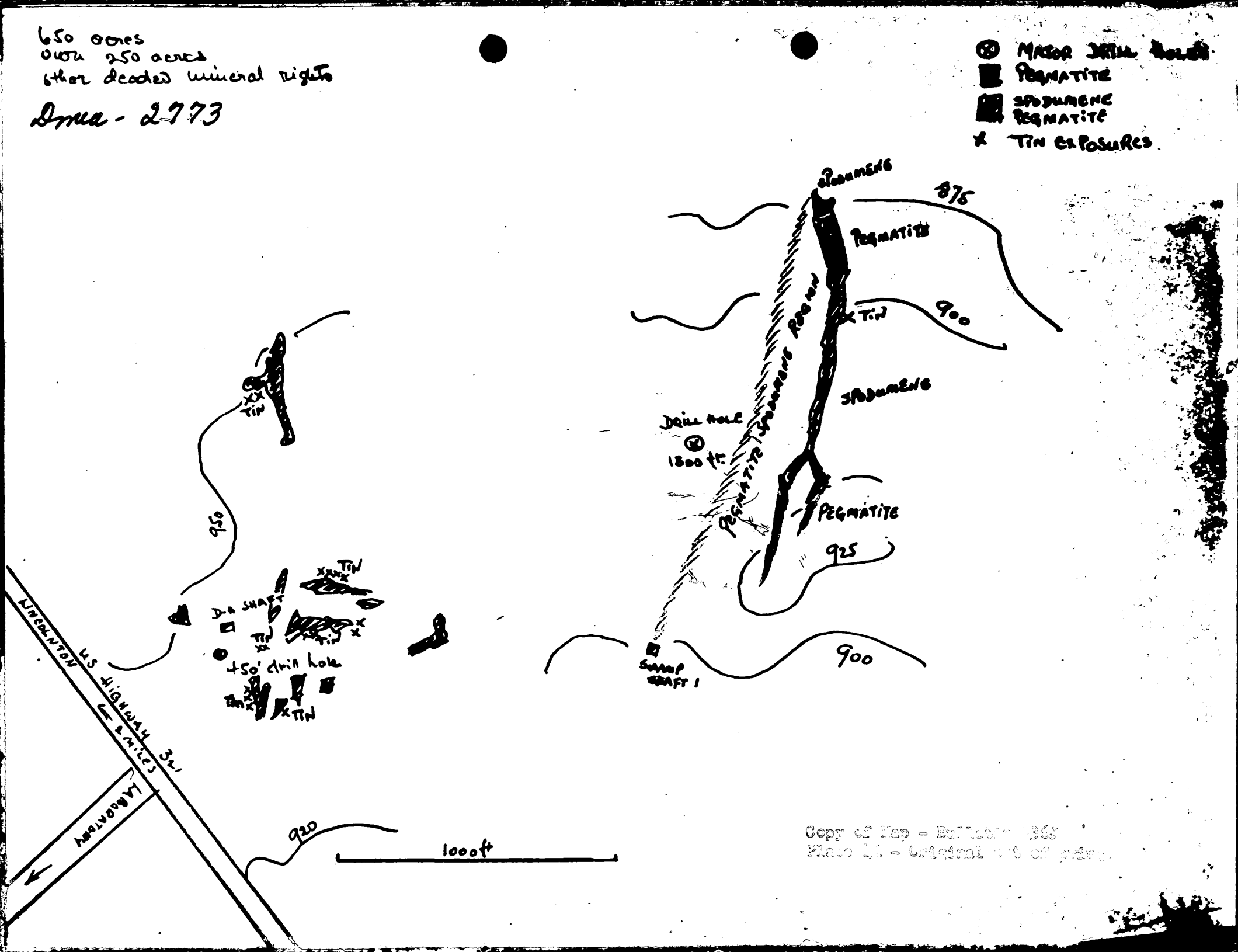
Dmea - 2773



KA-MI-TIN-

650 acres
own 250 acres
other deeded mineral rights

Dmea - 2773

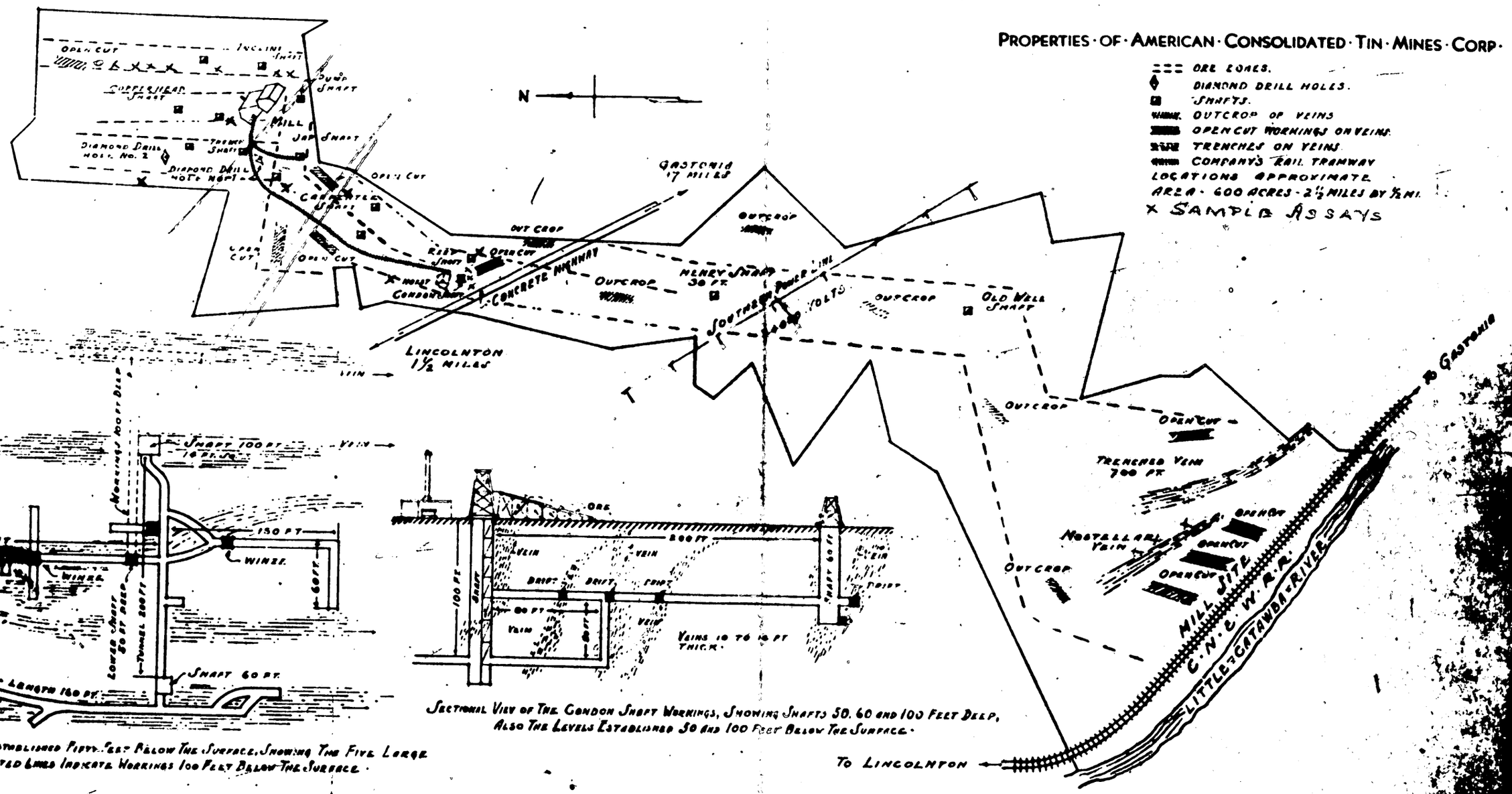


Copy of Map - Bulletin 1363
Plate 1. - Original map of pegm.

Omea - 2773

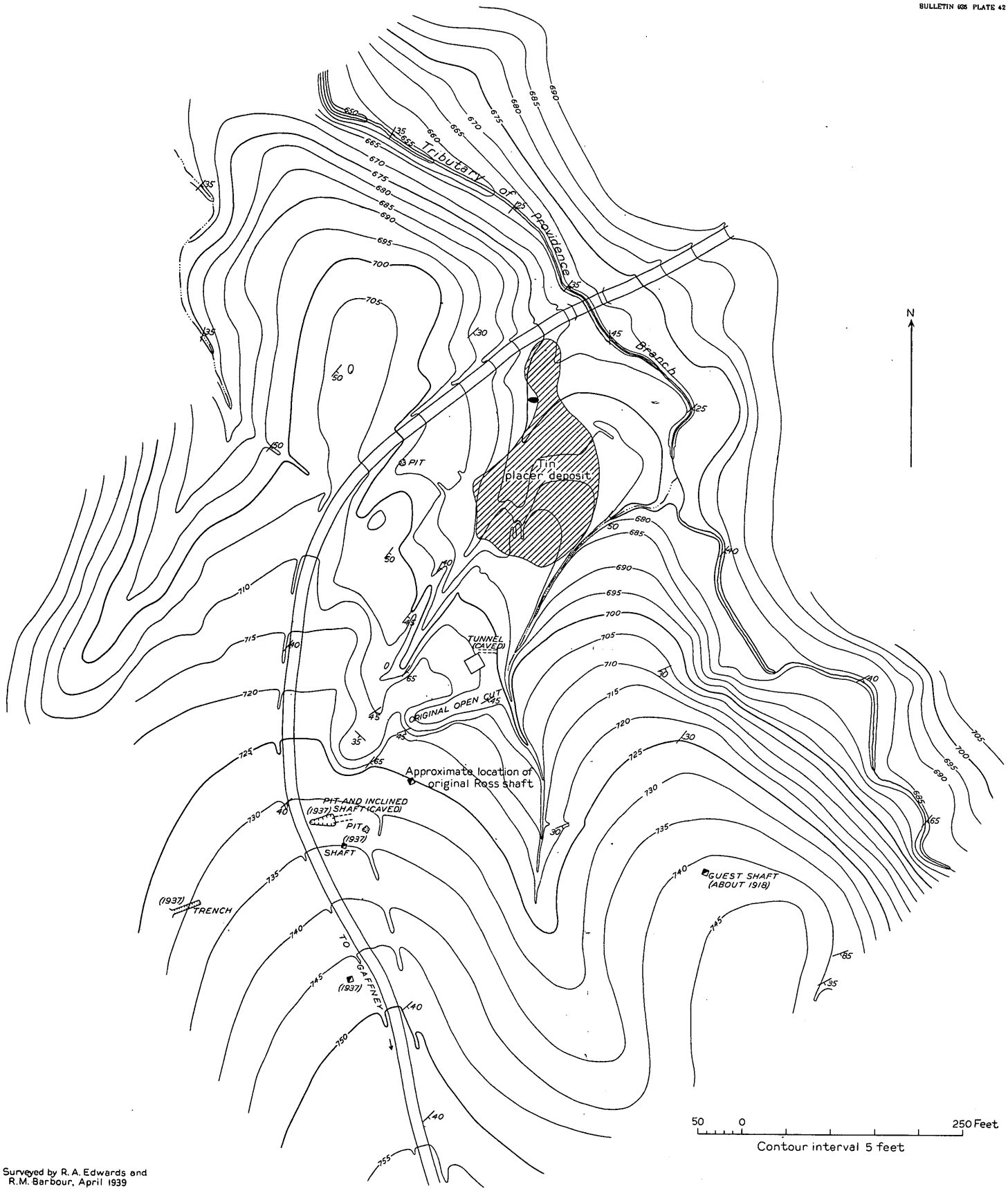
PROPERTIES · OF · AMERICAN · CONSOLIDATED · TIN · MINES · CORP ·

ORE ZONES.
DIAMOND DRILL HOLES.
SHAFTS.
OUTCROP OF VEINS
OPEN CUT WORKINGS ON VEINS.
TRENCHES ON VEINS.
COMPANY'S RAIL TRAMWAY
LOCATIONS APPROXIMATE.
AREA - 600 ACRES - 2½ MILES BY ½ MI.
X SAMPLE ASSAYS



Detail Plan of Workings Established Fifty Feet Below The Surface, Showing The Five Large Veins. The Dotted Lines Indicate Workings 100 Feet Below The Surface.

Sectional View of The Condon Shaft Workings, Showing Shafts 50, 60 and 100 Feet Deep, Also The Levels Established 50 and 100 Feet Below The Surface.



Surveyed by R. A. Edwards and R. M. Barbour, April 1939

PLAN OF THE ROSS MINE AND VICINITY

Structural control of emplacement.--The pegmatite was emplaced in openings formed by minor rock movements that accompanied or followed the folding of the older rocks. The openings include joints that cross the layering (see pl. 40), openings that follow the layering (see pl. 39), and irregular openings (see pl. 41); those of the first two types are common, those of the last rather scarce.

In areas underlain by almost uniformly competent hornblende-biotite gneisses, pegmatite was emplaced in joints that cut at various angles across the strike of the rocks. One such area, which lies in the Beaverdam Creek drainage area, between Lincolnton and Kings Mountain, is shown in plate 40. The pegmatite bodies here are straight, tabular, and nearly uniform in thickness; some bend abruptly where prominent joints intersect. One body in this area is cut by a thick Triassic diabase dike, and an inclusion of pegmatite was found in the diabase. It seems probable that the diabase dikes were intruded into pre-pegmatite joints, however, for their prevailing trend, N. 40°-60° W., falls within the strike range of three sets of the joints.

In areas where country rocks of contrasting competence alternate in relatively thin layers, most of the pegmatite was emplaced parallel to the strike and dip of the layers. Such an area, immediately southwest of Kings Mountain, is shown in plate 39. The interlayered country rocks here are largely competent hornblende gneisses and incompetent muscovite schists.

Some of the pegmatite bodies on the property of the Ka-Mi-Tin Concentrating Co., 2 miles southeast of Lincolnton, are of the third type: they are extremely irregular in shape and attitude. The bodies prospected by power shovel in the western part of the area shown in plate 41 appear to have been emplaced in irregular fractures that commonly cut across the foliation of muscovite schist but are oriented at random.

Origin.--The minerals of the pegmatite bodies were deposited in the order given below. The order of deposition, which is the same throughout the belt, is also the order of increasing abundance with the exception of the minerals of the first stage and the sulfides of the seventh. There is little or no evidence on which to date some of the minerals, and these are not included in the sequence. The relative ages of the minerals listed are apparent from relative degrees of deformation, and from veining and replacement of earlier by later members. Quartz apparently was deposited during all stages but most abundantly in two.

Stage 1. Tourmaline, beryl, and apatite.
Stage 2. Cassiterite and columbite-tantalite.
Stage 3. Quartz (most of the greisen formed).
Stage 4. Spodumene.
Stage 5. Microcline.
Stage 6. Medium-grained albite (minor alteration of spodumene and microcline to muscovite).
Stage 7. Fine-grained albite and quartz (minor quantities of sulfides and apatite).

The minerals are believed to have been deposited by solutions, along channels that were reopened from time to time by intermittent rock movements. The inferred process of deposition may be outlined as follows:

The minerals of stages 1 and 2 developed in and adjacent to prominent joints and fissures forming deposits of three types: (a) Veins and lenticular masses of compact crystalline tourmaline in gneisses and schists; (b) lodes of disseminated tourmaline crystals in muscovite schist; (c) veins and lodes or disseminations of cassiterite, columbite-tantalite, and probably ilmenite, in muscovite schist, between layers of muscovite schist and hornblende gneiss, and in joints that cut obliquely across hornblende-biotite gneisses.

Many deposits of types a, b, and c were fractured and dislocated by wall-rock movements, and the new openings served as channels for the introduction of the quartz of stage 3, which veined the earlier minerals. Quartz also has partially replaced muscovite schist, into which it commonly grades. The muscovite

length observed is 38 inches, and the maximum thickness 10.5 inches.

Cassiterite occurs persistently enough to be characteristic, though in general it is not abundant. It is dark brown in color, and is conspicuous among the white and light-colored minerals of the pegmatite. The grains are mostly between 0.5 mm. and 2.0 cm. in maximum diameter. They are angular and fractured and, although they commonly show one or more crystal faces, only two complete crystals are known to have been found. Cassiterite can be confused with only two other pegmatite minerals, columbite-tantalite and ilmenite, but the three can easily be distinguished by their streak alone: that of the cassiterite is light tan to cream-colored, that of columbite-tantalite is chocolate brown, and that of ilmenite is black.

The spodumene offers probably greater commercial possibilities than the cassiterite, particularly if regarded as the chief product in a possible concentration procedure that would yield other pegmatite minerals as byproducts. The possible reserves of recoverable spodumene in two outstanding areas are considered on pages 267-269. Spodumene is distributed unevenly in the pegmatite bodies, but less so than cassiterite. Many of the finer-grained bodies consist predominantly of albite and quartz, and carry little spodumene, but many of the coarser-grained bodies may contain an average of 15 percent or more. Spectrographic analysis of the spodumene [6/] has shown the presence of eight minor impurities which are believed to be isomorphous constituents of the mineral. These are listed above in the annotated bibliography (p. 250).

A complete list, in alphabetical order, of the minerals that have been found in the pegmatite bodies during the present study is given on the following page. Minerals listed as hypogene

6/ Gabriel, Alton; Slavin, Morris; and Carl, H. F., Minor constituents in spodumene: Econ. Geology, vol. 37, p. 119, 1942.

schist being the more extensively replaced. Minerals that replaced wall rocks were less severely fractured by recurrent rock movements than those deposited in openings, and those in oblique joints somewhat less severely than those in fissures parallel to the bedding.

A relatively fine-grained aggregate of albite and quartz of stage 7 is by far the most abundant replacement product. A similar replacement of country rock by plagioclase has been described by C. S. Ross.[7/] Tourmaline, spodumene, microcline, and plagioclase as calcic as An_{40} also replaced the wall rocks. Replacement by these minerals, in various degrees, is abundantly exemplified in the belt. Spodumene and microcline, the coarsest-grained minerals, developed to greater size in open fissures, particularly those parallel to bedding, than in replaced wall rock.

From the order in which the pegmatite minerals were formed it is inferred that the composition of the solutions from which the minerals were deposited changed as the process went on but was comparatively simple at any given stage. The partial replacement of large bodies of country rock indicates that these solutions could not have been viscous; had they been so they could not so intimately have permeated the rocks. They are thought to have been aqueous.

TIN DEPOSITS

Deposits with greisen gangue

The cassiterite-bearing bodies of greisen, which are the simplest of the ore bodies in mineral composition, are believed to be relatively undisturbed relics of the early pegmatite

7/ Ross, C. S., Origin of the copper deposits of the Ducktown type in the southern Appalachian region: U. S. Geol. Survey Prof. Paper 179, pp. 24-25, 71, 1935.

metamorphosed parts of the marble-schist-quartzite sequence, and not older rocks. Neither sharp contacts nor the strike faults mapped by Keith and Sterrett were found to separate the two groups of rocks; there appears, rather, to be a gradational zone between them in which transitional types of rocks occur. The rocks strike generally northeast and dip steeply northwest except in the vicinity of Gaffney, where they dip southeast.

Large, extremely irregular bodies of granitic rock called the Whiteside granite by Keith,[5] occur in the belt and in the region to the west. The mineral composition of this rock, where adjacent to pegmatite bodies, is similar to that of the pegmatite, but simpler, consisting largely of microcline, quartz, and sodic plagioclase. In places the two rocks intergrade. Pegmatite bodies in the vicinity of Kings Mountain form a peripheral zone along the sinuate east side of a large body of the granitic rock (pl. 39). This areal relationship suggests that the pegmatite minerals that are also constituents of the granitic rock probably were derived from the granitic rock or from its source. The pegmatite minerals that are not constituents of the granitic rock may have had a different source.

All of the rocks, including the pegmatite bodies, described below, are cut by dikes of fine-grained diabase, similar to those that have been intruded into Triassic rocks farther east in the Piedmont. The diabase dikes are steeply dipping, tabular bodies, which range in thickness from a few inches to 35 feet, and trend N. 40°-50° W., but two dikes less than 1 foot thick were seen that are parallel to the bedding in weathered micaceous limestone.

Pegmatite

The tin- and spodumene-bearing pegmatite bodies are mostly tabular, of lenticular horizontal section, and of unknown verti-

5/ Keith, Arthur, op. cit.

Quantity and grade of ore

During the course of the present investigation, 55 tin deposits, most of them poorly exposed, were examined (pl. 38). The locations of 37 others, including some mentioned in published accounts of early mining operations, were established only by float ore; 32 that were reported could not be found. With few exceptions, the 92 known deposits are too widely separated to permit the mining of more than one in a single operation. The maximum thicknesses of deposits in which this dimension could be measured were from 1½ to 6 inches for 21 deposits, from 7 inches to 2 feet for 16 deposits, and from 3 to 4 feet for 4 deposits. Sloan [9] states that the Ross deposit was 9 feet thick near the surface prior to its removal by mining.

The cassiterite content of the ore bodies is very uneven. Assays and mill recoveries have shown that in adjacent deposits, or even within a single deposit, the metallic tin content ranges from a trace to more than 6 percent. Field estimates as high as 10 percent have been made for small parts of ore bodies. There are no geologic indications that the cassiterite content will change materially in grade or mode of occurrence with depth, and this is true also of the associated nonmetallic pegmatite minerals.

Accurate data from which to derive an estimate of ore reserves are lacking. On the basis of the approximate dimensions and general grade of the 55 ore bodies examined, and published information on previous mining (see references listed in table 18), the gross tin content of all the deposits in the area may be as much as 10 tons of metallic tin per foot of depth; this includes at least 7 of the larger deposits that have been mined to depths as great as 175 feet. Most of the deposits are

9/ Sloan, Earle, op. cit., p. 39.

(11) Hess, F. L., The spodumene pegmatites of North Carolina: Econ. Geology, vol. 35, pp. 942-966, 1940.

Discusses the origin of the pegmatite in the tin-spodumene belt and the quality and possible amount of the spodumene. Some of the pegmatite minerals are believed to have been deposited, in several stages, by solutions that circulated through fractures in assumed prelithium, granitic pegmatite, whereas, in the present report, all of the minerals are believed to have been deposited by solutions in successive stages, but in different order, and an "original" pegmatite is not postulated.

(12) Norman, James, and Gieseke, E. W., Beneficiation of spodumene rock by froth flotation: Am. Inst. Min. Met. Eng. Tech. Pub. 1161, (Mining Technology), 9 pp., April 1940.

Samples of spodumene-bearing pegmatite from two localities were ground and treated with solutions of NaOH and NaOH with Na_2S to remove films of weathering products from the mineral grains. The films interfered with the flotation of spodumene with a soap collector, in contrast to feldspar and quartz. After cleaning, concentrates containing from 5.40 to 6.59 percent Li_2O were obtained, principally with the use of oleic acid; a mixture of spodumene and feldspar containing 4.98 percent Li_2O was separated by similar treatment.

(13) Engel, E. L., and Shelton, S. M., Tin ore from North Carolina, in Ore-testing studies, 1939-40: U. S. Bur. Mines Rept. Inv. 3564, p. 15, 1941.

Tin ore with feldspathic gangue, containing 1.06 percent tin, crushed to pass 10 mesh, was separated into four sand products in a laboratory hydraulic classifier. The sand products were treated on a laboratory concentration table, and yielded concentrates that assayed 68.81 percent tin, or 92.3 percent of the total tin.

(14) Gabriel, Alton, Slavin, Morris, and Carl, H. F., Minor constituents in spodumene: Econ. Geology, vol. 37, pp. 116-125, 1942.

Spectrographic analysis of spodumene from three areas in the belt showed the presence of minor amounts of Fe_2O_3, MnO, TiO_2, SnO_2, Ga_2O_3, Na_2O, and K_2O; one of the samples contained Rb_2O. On the basis of X-ray and petrographic studies, it is concluded that the impurities are probably isomorphous replacements in the crystal structure of the spodumene.

Production

Some production of cassiterite concentrates from the Carolinas is recorded [1] for the years 1903-04, 1906-07, 1910,

1/ Mineral Resources U. S. and Minerals Yearbook.
Pratt, J. H., The mining industry in North Carolina during 1911 and 1912: North Carolina Geol. Survey Econ. Paper 34, pp. 16, 73, 1914.

bearing alluvium remains in an area of 25,000 square feet. The remainder of the deposit is probably of low grade. The margin of the deposit is shown in plate 42, which also shows the locations of the original open cut and 121-foot shaft, as well as more recent prospect openings.

A placer deposit, having a surface area of 60,000 square feet [11] adjacent to the Jones mine (locality 23, pl. 38) was prospected in 1903-04, but the results are unknown. Keith [12] states that the Blue Ridge Tin Corporation produced several thousand pounds of concentrates from part of an alluvial area of about 50,000 square feet in the narrow valley immediately south of locality 50, plates 38 and 39.

The three known placers, together with similar small bodies yet to be discovered, might add as much as 100 tons of metallic tin to the reserves. A little additional placer tin might be recovered from the tin-bearing soils, mostly less than 1 foot thick, which cover the weathered bedrock for distances rarely exceeding 300 feet down slope from outcrops of the tin deposits. These shallow soils, which could be removed by scraper, may contain about 50 tons of metallic tin. Very few of the deposits in place, however, are weathered sufficiently to be handled by scrapers.

Summary of deposits

The locations of all deposits examined or reported are shown in plate 38, and available information bearing on geologic and economic features are listed in table 18. Underground workings were not accessible at the time of the survey. A few of these have been described in earlier reports, and references to the descriptions are listed in the table.

11/ Pratt, J. H., and Sterrett, D. B., The tin deposits of the Carolinas: North Carolina Geol. Survey Bull. 19, p. 29, 1904.
12/ Keith, Arthur, and Sterrett, D. B., Tin resources of the Kings Mountain district, N. C. and S. C.: U. S. Geol. Survey Bull. 660, p. 141, 1917.

Atlas prospect shaft.--Early in 1941, at the completion of the present study of the tin deposits, the Atlas Collapsible Tube Co., of Chicago, began prospecting at the old Faires mine near the southern limit of the town of Kings Mountain. A shaft about 30 feet deep was sunk 125 feet northeast of the Faires shaft without encouraging results. Two churn-drill holes approximately 40 feet apart were then drilled about 200 feet N. 15° W. of the Faires shaft. Hole No. 1 was drilled to a depth of 122 feet, and hole No. 2 to a depth of 144 feet. Showings of tin ore were reported from each hole, but No. 2, in which the showings were said to be best at depths of 59, 89 to 104, and 144 feet, was considered the better; a shaft was then sunk adjacent to hole No. 2. The shaft had reached a depth of 125 feet in April 1942, when the management permitted an examination to be made.

The walls of the shaft were boarded up. Crosscuts had been driven from the bottom for 30 feet northwest and 12 feet southeast. Two pegmatite bodies and two layers of greisen, conformable with the foliation in muscovite schist, were exposed in the crosscuts, as shown in figure 28. The larger of the pegmatite bodies is 7 feet thick, and was exposed at the base of the shaft; it is said to have lensed out upward at a depth of 95 feet. The section of this body exposed in the northeast wall of the shaft shows the relative ages of some of the commoner pegmatite minerals. Relatively fine-grained albite and quartz, comprising a lenticular core about 2 feet thick, have invaded a distinctly earlier body composed largely of coarse-grained microcline with some spodumene, quartz, and cassiterite.

The cassiterite was seen only in the microcline-rich rock in the southwest wall of the shaft where the albitic rock has permeated the older mass irregularly, and is not confined to a core. It was obvious that the cassiterite-bearing rock at this point is of commercial grade, averaging possibly as much as 2 percent

(5) Graton, L. C., A reconnaissance of some gold and tin deposits of the Southern Appalachians: U. S. Geol. Survey Bull. 293, pp. 31-57, 1906.

Gives a good account of the discovery and early prospecting of the deposits, detailed descriptions of the Jones, Faires, and Ross mines, and an estimate of the total production of the belt to May 1905. Pegmatites of various compositions, interpreted in the present report as the product of successive mineral-bearing solutions that circulated with various degrees of freedom, were regarded by Graton as representing a genetically related series of intrusions.

(6) Sloan, Earle, Catalogue of the mineral localities of South Carolina: South Carolina Geol. Survey, ser. 4, Bull. 2, pp. 85-93, 1908.

Describes and illustrates workings and geologic features at the Ross mine, and records the total production of concentrates from pegmatite and placer to December 1906.

(7) Keith, Arthur, and Sterrett, D. B., Tin resources of the Kings Mountain district, N. C. and S. C.: U. S. Geol. Survey Bull. 660-D, pp. 123-146, 1917.

A general discussion of the geology of the region, with descriptions of the principal mines and prospects, most of which were abandoned at the time.

(8) Keith, Arthur, U. S. Geol. Survey Geol. Atlas, Gaffney-Kings Mountain folio (No. 222), 1931.

Contains part of the economic material in Bulletin 660-D, but is considerably more specific in treatment of geology. The folio does not recognize the genetic relation, found in the present study, between schistose crystalline limestone and the gneisses and schists that enclose the pegmatite bodies.

(9) Fraas, Foster, and Ralston, O. C., Beneficiation of spodumene by decrepitation: U. S. Bur. Mines Rept. Inv. 3336, 13 pp., 1937.

The natural α spodumene in pegmatite matrix, heated to 1,050° to 1,180° Centigrade, was converted to β spodumene, which was selectively disintegrated by gentle grinding and separated from the coarser quartz and feldspar.

(10) Boyd, J. E., Jr., Pyrometric properties of spodumene-feldspar mixtures: Am. Ceramic Soc. Jour., vol. 21, pp. 385-388, 1938.

Fusion tests of mixtures containing 20 to 40 percent of spodumene with either potash or soda feldspar showed that P. C. E. values were lowered several cones below those of the feldspars alone. The addition of spodumene to a mixture of equal parts of the feldspars showed even greater contrast. The paper includes an analysis of the spodumene, which is quoted on page 269.

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H. E. LeGrand, that during the second season by H. E. LeGrand and J. C. Morris. LeGrand and Morris also made most of the reconnaissance examinations of deposits lying outside the areas mapped in detail.

Helpful discussion and advice on specific problems were contributed by W. T. Schaller and C. S. Ross, though the interpretations presented are those of the writer. Charles Milton identified columbite-tantalite, tin-bearing rutile, molybdenite, and a complex group of supergene phosphates and oxides. H. G. Ferguson, F. C. Calkins, W. C. Smith, and T. B. Nolan reviewed the manuscript, and made numerous helpful suggestions.

Previous work

Material relating to the geology, mineralogy, and economic development of the tin deposits and associated spodumene is contained in 44 reports, articles, and maps. The more important of these are listed in the following annotated bibliography.

(1) Dabney, C. W., Jr., Note on cassiterite from Kings Mountain, N. C.: Elisha Mitchell Sci. Soc. Jour., 1883-84, pp. 79-81, 1884.

The first published account of the discovery of cassiterite in the belt; contains two analyses of the mineral that erroneously list tungsten as a constituent.

(2) Furman, J. H., The tin deposits of North Carolina: New York Acad. Sci. Trans., vol. 8, pp. 136-145, 1889.

An illustrated account of observations on the geology of the belt by the first, and one of the most active, prospectors. Contains useful facts, together with doubtful interpretations.

(3) Ledoux, A. R., Tin in North Carolina: Eng. and Min. Jour., vol. 48, pp. 521-522, 1889.

A record of the general results of tin prospecting by open cuts, shafts, and diamond drilling in a portion of the belt about 2 miles long, presumably southwest of Kings Mountain.

(4) Pratt, J. H., and Sterrett, D. B., The tin deposits of the Carolinas: North Carolina Geol. Survey Bull. 19, 62 pp., 1904.

Describes the deposits and discusses their origin.

of tin, but no cassiterite was seen along the strike in the opposite wall. In order to determine whether or not all of the microcline-rich rock can be regarded as tin ore, a transverse channel sample was taken from the northwest side of the body, in the northeast face.

The pegmatite body exposed in the southeast crosscut is 2 to 4 feet thick, has a layered structure, and consists of fine-grained albite and quartz; a little coarse-grained microcline

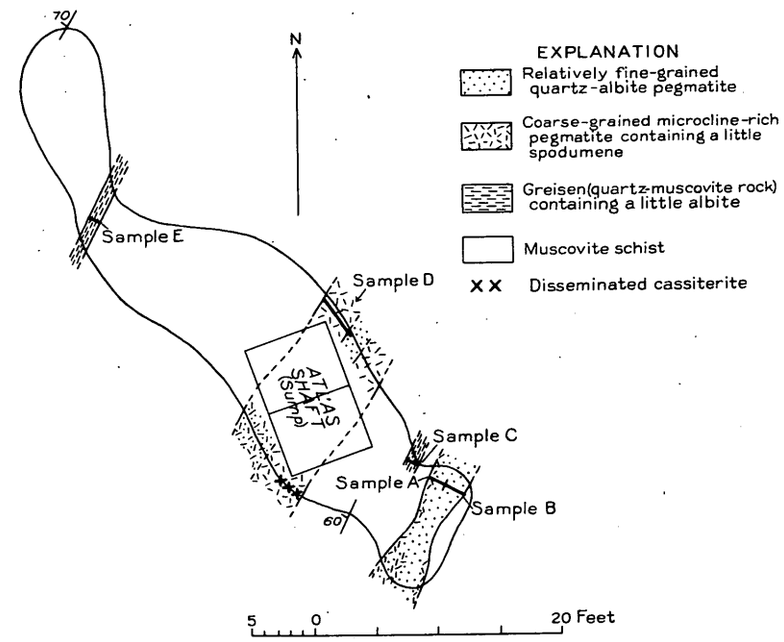

Figure 28.--Plan of crosscut and rocks exposed at base of Atlas shaft, April 1942.

occurs largely, but not entirely, adjacent to the enclosing schist. No cassiterite was visible in this body, but a transverse channel sample was taken from the northwest 14 inches of the body, and another from the southeast 18 inches.

Each of the greisen layers exposed, one in the southeast crosscut, the other in the northwest, is 12 inches thick. Each layer was sampled.

INTRODUCTION

The tin-spodumene belt of the Carolinas is a long and narrow strip of the southeastern Piedmont (see fig. 27) that contains many bodies of tin- and spodumene-bearing pegmatite. The belt lies about 50 miles east of the Blue Ridge and 85 miles west of the Fall Line. The Piedmont is a moderately dissected upland having a general altitude here of about 1,000 feet. A few ridges and peaks consisting of unusually resistant rocks rise above this level; an irregular ridge known as Kings Mountain which lies 2 miles east of the belt, near the town of Kings

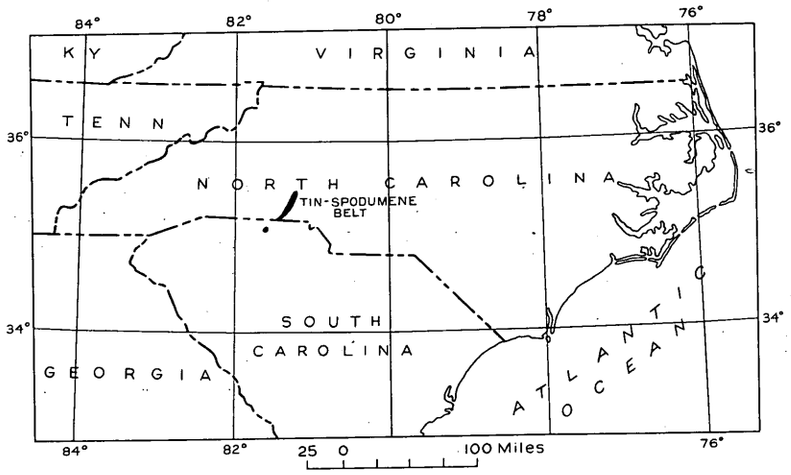

Figure 27.—Index map showing location of the Carolina tin-spodumene belt.

Mountain, reaches an altitude of 1,705 feet. (In this report the name Kings Mountain refers to the town and not the ridge.) The belt is drained by the South Fork and Broad Rivers. Most of it is cultivated, but steep slopes and rocky areas, such as those underlain by the pegmatite bodies described below, are wooded.

Paved highways between the towns and villages, and interconnecting, well-graded roads make the entire region accessible.

that has been taken only from some of the richest outcrops; pegmatite bodies that contain only small, sporadic crystals have apparently escaped general notice. Because of the high proportion of fine-grained bodies that consist largely of albite and quartz, it is neither possible nor practicable to estimate the total amount of spodumene in the belt.

The most favorable showing of spodumene is exposed in a quarry 100 feet long, 12 feet wide, and 35 feet in maximum depth, located 1¼ miles southwest of Kings Mountain. The opening has been made in the east side of a pegmatite body 85 feet thick at this point, and at least 1,450 feet long, but the comparatively rich part exposed in the quarry averages only about 8 feet in thickness. The spodumene crystals here are among the largest in the belt; the maximum length observed was 38 inches. It is reasonable to expect a small quantity of hand-cobbed ore containing as much as 50 percent of spodumene from this quarry, but the large quantity of low-grade rock on the dump shows that only the richest part of the rock exposed is of such grade. The rest of the pegmatite body also contains spodumene, but the average grade is considerably lower than that of the rock in the quarry, and few of the crystals exceed 3 inches in length.

Some of the pegmatite bodies richest in spodumene occur in the two areas shown in plates 39 and 40. Although they constitute only a small portion of the belt, these two areas contain more than 700 pegmatite bodies 1 foot or more thick. The total number in the belt, therefore, must be very large. It is possible to make a rough estimate of the quantity of spodumene ore in these areas, although little is known about the average spodumene content of the pegmatite that could be applied to large tonnages. Comparatively small parts of bodies that may contain as much as 50 percent of spodumene are included because their limits are unknown, and separate estimates cannot be made.

The Beaverdam Creek area, shown in plate 40, contains 388 pegmatite bodies 1 foot or more thick. Spodumene was identified in 245, and about half of these may contain from 10 to 25 percent of spodumene, but probably not more than one-fourth are large enough to be workable. About 60 bodies, therefore, having an average thickness of about 10 feet and an average length of 250 feet, are estimated to contain rock of possible commercial grade. Assuming that not more than half of the material in these bodies would be rich enough to mill, and that this part would yield at least 15 percent of spodumene, it is estimated that the Beaverdam Creek area contains something on the order of 625,000 tons of possible ore, containing about 93,750 tons of recoverable spodumene, to a depth of 100 feet.

The area southwest of Kings Mountain, shown in plate 39, contains 376 pegmatite bodies 1 foot or more thick. Spodumene was identified in 256; it is safe to assume that at least half of these, or 128, include rock that contains from 10 to 25 percent of spodumene, and are thick enough to be quarried. The bodies in this area have a wider range of thickness and length than those in the Beaverdam Creek area, but spodumene is less evenly distributed, so that greater allowance must be made for rock that would not be milled, perhaps not even quarried. It is estimated that the average thickness of the 128 bodies is 35 feet and the average length 540 feet; probably not more than one-fifth of the rock they contain would be workable, and this entire amount probably contains at least 15 percent of spodumene. Using these figures, it is estimated that this sector of the belt contains no less than 3,700,000 tons of possible ore, containing about 555,000 tons of recoverable spodumene, to a depth of 100 feet.

The combined estimate for the two areas is a minimum of nearly 650,000 tons of spodumene in rock that may be minable to

THE TIN-SPODUMENE BELT OF THE CAROLINAS

A PRELIMINARY REPORT

By T. L. Kesler

ABSTRACT

Cassiterite and spodumene, of possible economic importance, occur in a belt, 24.5 miles long and 1.8 miles in maximum width, extending southwestward from Lincolnton to Grover, N. C. This belt is in the Piedmont province, an upland with an average altitude of 1,000 feet, and is readily accessible by rail and highway. The region is underlain by crystalline limestone, quartzite, schists, gneisses, and granite. The rocks strike northeast and, in most of the belt, dip steeply northwest. Most of them are deeply weathered.

The tin-spodumene belt lies mostly in North Carolina between Lincolnton and the State line. Cassiterite occurs sparsely in hundreds of spodumene-bearing pegmatite bodies, which were emplaced in joints where the rocks are uniformly competent, and parallel to the layering where competent and incompetent rocks are interlayered. Locally, cassiterite is sufficiently abundant in the pegmatite bodies and in closely associated greisen (quartz-muscovite rock) to be of possible commercial value. There are at least 91 such deposits of potential tin ore in North Carolina, and 1 near Gaffney in South Carolina.

The deposits vary widely in thickness along their strike and dip; about 18 are more than a foot thick. The maximum strike length is 275 feet. Little is known about the downward extensions of the bodies, but irregular shapes and unpredictable dimensions are to be expected. The tin content of the ore ranges in general from a trace to more than 6 percent, and the grade in any one deposit is likely to be far from uniform. Records of production from the Ross mine, near Gaffney, indicate that its ore averaged possibly 2 percent of tin; this is probably exceptional. Small placer deposits, of which three are known, and thin cassiterite-bearing soils of small extent, might yield 150 tons of metallic tin, but these deposits are likewise low in grade.

Because of their small size, low grade, and scattered distribution, the deposits are not being mined at present, and it seems unlikely that any now exposed could be mined profitably unless the price of tin became extremely high.

Many of the pegmatite bodies contain 15 percent or more of spodumene, and unusually rich parts of bodies average from 30 to 50 percent. The commercial possibilities of the spodumene probably exceed those of the cassiterite, and it is estimated that two unusually favorable areas contain a reserve of at least 650,000 tons of spodumene (more than 20,000 tons of metallic lithium) to a depth of 100 feet.

TABLES

Page

Table 18. Tin deposits known and reported in the Carolina belt..... In pocket IV

a depth of 100 feet. Boyd [16] gives the following analysis of the spodumene obtained from a hand-sorted sample crushed to minus one-half inch, from which fragments containing visible impurities were rejected:

	Percent		Percent
SiO_2.....	63.84	K_2O.....	None
Al_2O_3.....	28.61	Na_2O.....	None
Fe_2O_3.....	.19	Li_2O.....	7.26
CaO.....	.04	Ignition loss.....	.16
MgO.....	Trace		

It has been found [17] that the amounts of the minor constituents, particularly Fe_2O_3, vary considerably even in a single pegmatite body. Assuming an average of 7 percent LiO_2, the possibly recoverable spodumene estimated above would contain about 45,500 tons of lithia, or more than 20,000 tons of metallic lithium. The two areas to which this estimate applies have a combined length of only 6½ miles out of a total of 24½ miles for the belt. Further, the estimate applies only to the very large quantities of spodumene rock that might be minable for a composite mineral output, rather than to the relatively small bodies of rock that contain from 30 to 50 percent of spodumene.

16/ Boyd, J. E., Jr., Pyrometric properties of spodumene-feldspar mixtures: Am. Ceramic Soc. Jour., vol. 21, p. 386, 1938.

17/ Gabriel, Alton; Slavin, Morris; and Carl, H. F., op. cit., pp. 119-121, 124.

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UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. C. Mendenhall, Director

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THE TIN-SPODUMENE BELT OF THE CAROLINAS

A PRELIMINARY REPORT

BY

T. L. KESLER

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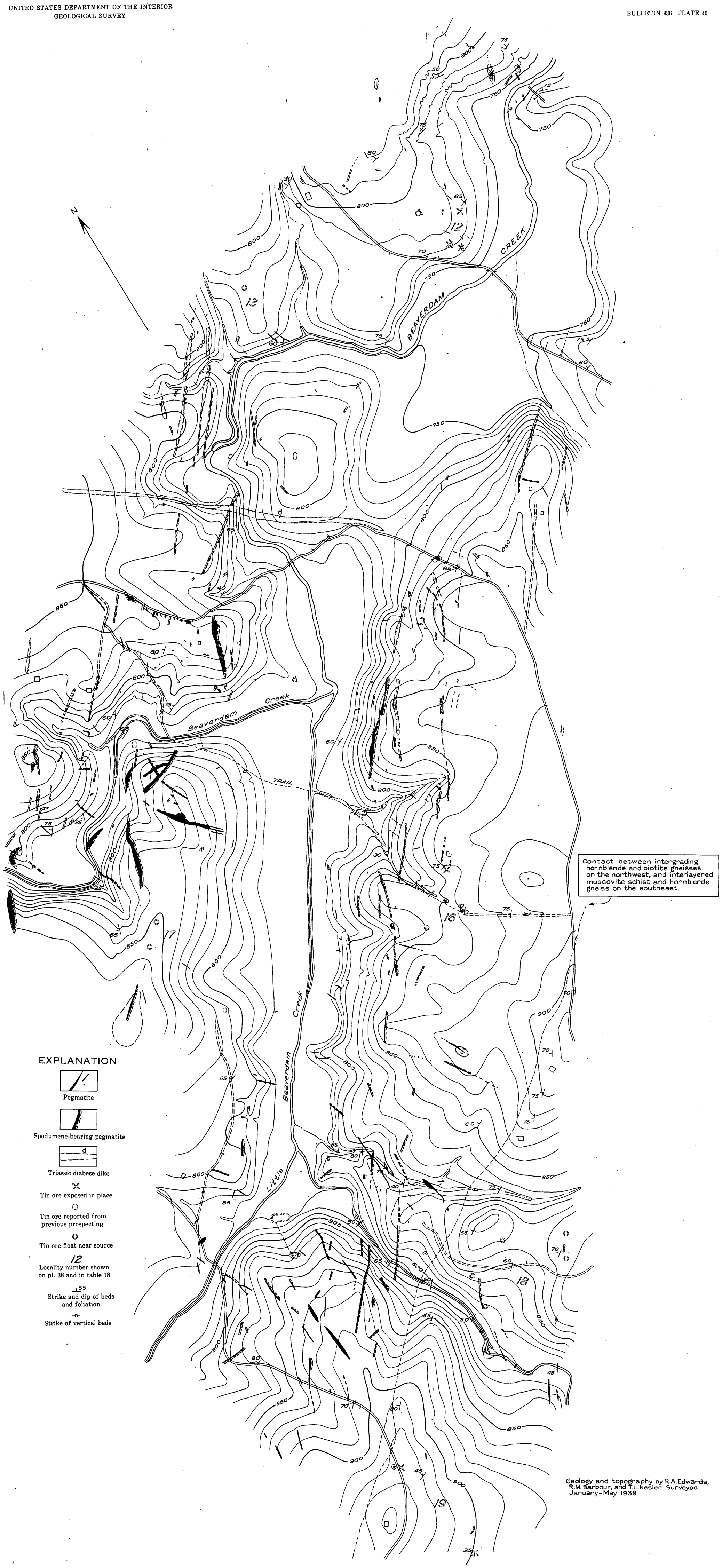

GEOLOGIC MAP OF THE BEAVERDAM CREEK AREA OF THE CAROLINA TIN-SPODUMENE BELT

Table 18.--Tin deposits known and reported in the Carolina belt 1/

Number of deposit on pl. 38	Plate showing deposit	Name or location	Type of ore body 2/	Thickness (inches)	Strike length (feet)	Pitch length (feet)	Type of wall rock 3/	Strike of wall rock	Dip of wall rock	Attitude of ore body 4/	Maximum depth of workings (feet)	References 5/ and remarks
1	.....	S. T. Carpenter	G	.....	.....	....	M	.....	.....	...	.....	.....
2	41	Ka-Mi-Tin Concentrating Co.	G	24	9+	....	M	N. 15° E.	65° NW.	C	10	.....
3	41	....do....(Swamp shaft No. 1)	.....	72	30	....	...	.....	.....	...	70	Inaccessible. Information from Stuart St. Clair.
4	41	....do....(Jake open cut)	G	6	10±	....	M	Variable	SW. and NW.	C	.....	Minor showing of ore 200 ft. to the southeast.
5	41	....do....(Condon shaft)	.....	.....	.....	....	M	NE. ?	NW. ?	...	140 ?	Eight thin bodies in adjacent open cuts. (3) Pp. 21-22. (5) P. 73.
6	.....	0.3 mile south of Condon shaft	G	.....	.....	....	M	.....	.....	...	.....	.....
7	.....	Henry shaft	.....	12-24	.....	....	M	NW.	75° SW. ?	C ?	60	(5) P. 21. Only float ore seen in 1940.
8	.....	J. Mostellar	G	.....	.....	....	M and H	N. 10° E. to N. 8° W.	65° NW. to 63° SW.	...	.....	.....
9	.....	Old Well shaft	.....	.....	.....	....	M	N. 17° E.	Steep NW.	...	65 ft. to water	.....
		Ka-Mi-Tin Concentrating Co.	G	5	.....	....	M	N. 18° W.	62° SW.	C	.....	.....
10	.....	Upper Mostellar cut	G (2)	4, 6	.....	....	M	Variable	Variable	C	20	Ore associated with unconformable pegmatite body.
11	.....	J. E. Gates	.....	.....	.....	....	M	N. 33° E.	65° NW.	...	30	Ore reported found in well. Occurs in gully near well, and as float 250 ft. northwest of well.
12	40	Metcalf prospect	G and F	1½, 6, 18	All 9+	....	H	N. 65° E.	65° NW.	U	20	Greisen gangue, 18-in. body. Feldspathic gangue, 1½- and 6-in. bodies. Two occurrences of float ore to the northwest.
13	40	1,550 ft. N. 70° W. from Metcalf prospect	G	.....	.....	....	H	NE.	NW.	...	.....	.....
14	.....	J. M. L. Carpenter	G	.....	.....	....	M	N. 47° E.	72° NW.	C ?	40	Shaft inaccessible.
		Paul Hastings	.....	.....	.....	....	...	.....	.....	...	.....	Pit 18 ft. deep reported sunk on ore in summer of 1940. Information from Julian S. Jacobs.
15	.....	T. S. Hastings	G	.....	.....	....	M	N. 55° E.	62° NW.	C ?	14	Shaft inaccessible.
16	40	Allen prospect	G	24	20+	....	M and H	N. 85° E.	73° NW.	U	2	(6) Pp. 145-146. Also float ore 750 ft. N. 25° W.
		Baldwin prospect	G	.....	.....	....	H	NE.	NW.	...	45	Early work, results unknown.
17	40	2,225 ft. N. 70° W. from Allen prospect	G (2)	.....	.....	....	H	NE.	NW.	...	.....	Two occurrences within strike distance of 175 ft.
18	40	Vicinity of Jenkins farm	G	.....	.....	....	M and H	NE.	NW.	...	.....	Five ore bodies, indicated by float ore, within radius of 800 ft.
19	40	J. W. Whitesides	G	24	.....	....	M	N. 50° E.	70° NW.	C	3	Ore also reported found in adjacent shallow shaft.
		L. A. C. Kizer	G	24	.....	....	M	N. 35° E.	35° NW.	C	10	Ore seen in place, 1939. Pit since filled.
20	.....	Fred Mauney and Gus Clark farms	G	.....	.....	....	M and H	.....	.....	...	.....	1/4 mile apart; float ore found.
21	.....	Julia Weathers	G (2)	4, 18	.....	....	M	N. 8° E.	48° NW.	C	3	Float ore richer than that in place.
22	.....	Pink Wright	G	.....	.....	....	M	.....	.....	...	.....	.....
23	.....	Jones mine	G and F	"Few" to 48	20-50	125±	H	N. 30° E.	55° NW.	U	175	(1) Pp. 29-30. (2) Pp. 46-48, 53-54. (3) P. 20.
24	.....	Seaman prospect	.....	.....	.....	....	M	N. 15° W.	45° SW.	...	45 ?	Shaft inaccessible.
25	.....	Holland prospect	G	4 ?	.....	....	M	N. 70° E. ?	.....	...	9+	.....
26	.....	Ramseur Mill prospect	G	12-24 ?	.....	....	H	N. 27° E.	55° NW.	U ?	30	(3) P. 29. (6) Pp. 143-144. Only float ore seen in 1940.
27	.....	M. V. Hovis prospect	G	.....	.....	....	H	N. 60° E.	65° NW.	...	35	Shaft inaccessible.
28	.....	E. A. Berry	G	.....	.....	....	M and H	N. 10° W.	50° SW.	...	.....	.....
29	.....	J. A. Ormond	.....	...	.....	....	...	.....	.....	...	.....	Shallow pit reported to have encountered a little ore in 1936; now filled. No ore seen in 1940.
30	.....	Ormond-Carr prospect	G and F	3-6	.....	....	M and H	.....	.....	...	8+	Shaft inaccessible.
31	.....	Cole farm	G	.....	.....	....	M and H	.....	.....	...	.....	.....
32	.....	Kizer-Mauney farm	.....	.....	.....	....	...	.....	.....	...	.....	No ore seen in 1940. Earlier discovery reported.
33	.....	M. Ormond farm	G	.....	.....	....	M ?	.....	.....	...	.....	.....
34	.....	John Plonk farm	G	.....	.....	....	M	N. 20° E.	60° NW.	C ?	8	.....
35	.....	J. C. Horton shaft	.....	.....	.....	....	M	N. 13°-23° E.	63°-70° NW.	...	122 ?	(1) P. 28. Shaft inaccessible.
36	.....	Frank Summers farm	G	.....	.....	....	...	.....	.....	...	.....	Float ore.
37	.....	Mauney Park	G	6 (24?)	.....	....	M and H	N. 5° E.	Vertical	C	5±	(6) Pp. 142-143.
38	.....	Kings Mountain mine	.....	.....	.....	....	M and H	Variable	Variable	...	75 (160?)	Float ore found in 1940, 450 ft. S. 70° W. of main shaft.
39	.....	Occurrences reported in town of Kings Mountain, now hidden by buildings and pavements:										
		(a) Property of O. W. Meyers, 112 N. Piedmont Ave. (formerly Captain Suggs place).	.....	.....	.....	....	...	.....	.....	...	.....	Ore body reported in well.
		(b) Near Post Office.	.....	.....	.....	....	...	.....	.....	...	.....	Tunnel reported to have cut ore body.
		(c) Short distance south of end of West Gold St.	.....	.....	.....	....	...	.....	.....	...	.....	Early discovery of cassiterite "in granite" reported.
40	.....	0.15 mile southeast of Bonnie Mill	.....	.....	.....	....	M and H	NE.	NW.	...	.....	Cassiterite float.
41	.....	Falls prospect	G	24	.....	....	M	N. 35° E.	60° NW.	C	15+	No ore seen in 1940. (1) P. 26. (6) Pp. 138-139.
42	39	Faires mine	G and F (2)	Variable	.....	....	H mostly	N. 35° E.	75° NW.	C	40	(2) Pp. 48-49.
43	39	435 ft. northeast of Faires main shaft	G and F	9-18	.....	....	M	N. 35° E.	70° NW.	C	10	.....
44	39	Atlas shaft	F	24	.....	....	M	N. 25° E.	60° NW.	C	125	Cassiterite float found 575 feet N. 57° W. of shaft.
45	39	1,825 ft. southwest of Faires main shaft	G	.....	20±	....	M	N.	W.	C	.....	350 ft. northeast of Miller residence. Trench now filled.
46	39	Mike Plonk prospect	G	42	9+	....	M	N. 32° E.	50° NW.	C	.....	Float ore seen within 200 ft. southwest.
47	39	1,350 ft. northwest of Plonk prospect	G	.....	.....	....	...	.....	.....	...	.....	.....
48	39	2,000 ft. S. 55° E. of Park Yarn mill	G and F	.....	.....	....	M and H	NE.	NW.	...	85	North end of a series of six exposed ore bodies prospected by A. R. Ledoux in 1888-89, and later by Blue Ridge Tin Corporation. Thickest body reported 3 ft. Maximum seen in 1939, 2 ft. Maximum strike length possibly 275 ft. Thickness and grade known to be uneven in all. Two occurrences of float ore. See map, plate 39. (6) P. 140.. (1) Pp. 24-26.
49	39	2,825 ft. S. 10° E. of Park Yarn mill	G (2)	Each less than 6	.....	....	M	NE.	NW.	C	.....	.....
50	39	3,300 ft. due south of Park Yarn mill	G and F	.....	.....	....	M and H	NE.	NW.	...	130	North end of a series of five exposed ore bodies prospected by Blue Ridge Tin Corporation about 1897. One may have had a strike length of 250 ft.; maximum thickness is 4 ft., minimum thickness 10 in. in two exposures; grade uneven. Other four bodies much smaller. See map, plate 39. (6) P. 141.
51	39	1,675 ft. S. 60° E. of Compact School	G	4-12	75 ?	....	M	N. 25° E.	75° NW.	C	3	.....
52	39	3,000 ft. S. 64° E. of Compact School	.....	.....	.....	....	...	NE.	NW.	...	.....	Float pegmatite, and grains of cassiterite, columbite, and andalusite in soil residual from crystalline limestone.
53	39	3,025 ft. S. 3° E. of Compact School	G	6	.....	....	M	N. 20° E.	65° NW.	C	.....	.....
54	39	3,550 ft. from Hwy. 29 along Dixon School road	G	1.5	.....	....	M	N. 40° E.	60° NW.	U	.....	Exposed in 2½-ft. gully.
55	39	215 ft. west of locality 54	F	6	.....	....	H	N. 30° E.	60° NW.	...	.....	25 ft. north of spodumene prospect.
56	39	Ross prospect	G	.....	.....	....	M	N. 60° E.	70° NW.	...	3	.....
57	39	1,475 ft. S. 47° W. of locality 56	G	6	.....	....	M	N. 45° E.	60° NW.	C	2	.....
58	.....	J. Patterson farm	G	.....	.....	....	M	N. 45° E.	65° NW.	C	7	Opening filled. Ore seen only as float in 1940. Float ore also found 1,300 ft. northeast, at north end of prominent pegmatite.
59	.....	Shiloh Church	G	2	25 ?	....	M and H	N. 75° E.	70° NW.	Variable	.....	Ore in west bank of road.
60	42	Ross mine	F	Compound 24-108	107 ?	200±	H	N. 46° E. (average)	53° SE. (average)	C	121	(1) Pp. 22-24. (2) Pp. 49-50, 54. (4) Pp. 85-93. No ore in place now exposed.

1/ Names of deposits are based on local sources of information.
2/ G, greisen gangue; F, feldspathic gangue. (2) indicates two ore bodies.
3/ M, muscovite schist or fine-grained gneiss; H, hornblende gneiss.
4/ C, conformable with attitude of wall rock; U, unconformable.
5/ Information published by earlier investigators and impossible to verify in this investigation. Numbers in parentheses indicate references listed below:

(1) Pratt, J. H., and Sterrett, D. B., The tin deposits of the Carolinas: North Carolina Geol. Survey Bull. 19, 1904.
(2) Graton, L. C., A reconnaissance of some gold and tin deposits of the southern Appalachians: U. S. Geol. Survey Bull. 293, 1906.
(3) Pratt, J. H., The mining industry in North Carolina during 1905: North Carolina Geol. Survey Econ. Paper 11, 1907.
(4) Sloan, Earle, Catalogue of the mineral localities of South Carolina: South Carolina Geol. Survey, ser. 4, Bull. 2, 1908.
(5) Pratt, J. H., The mining industry in North Carolina during 1911 and 1912: North Carolina Geol. Survey Econ. Paper 34, 1914.
(6) Keith, Arthur, and Sterrett, D. B., Tin resources of the Kings Mountain district, N. C. and S. C.: U. S. Geol. Survey Bull. 660-D, 1917.

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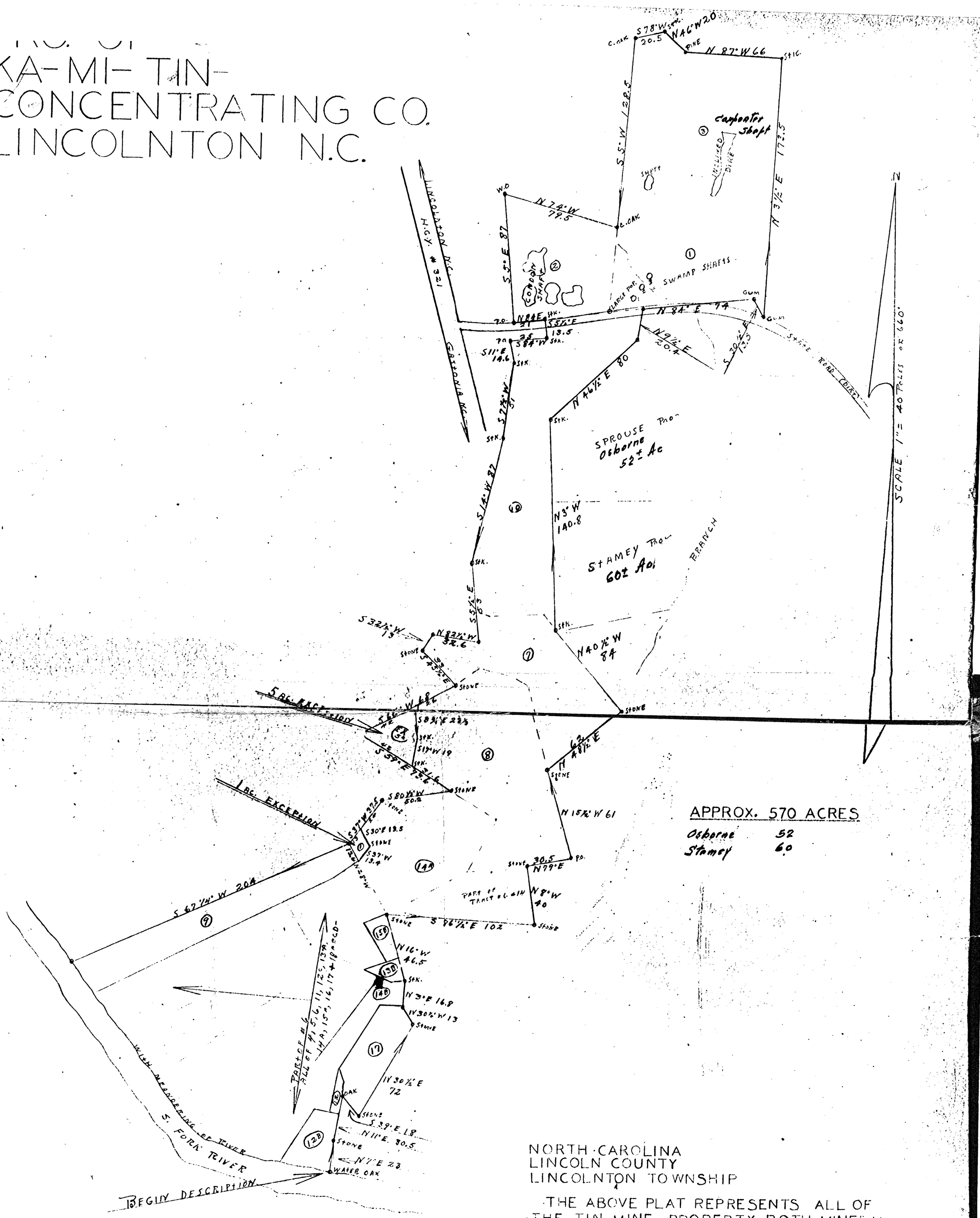


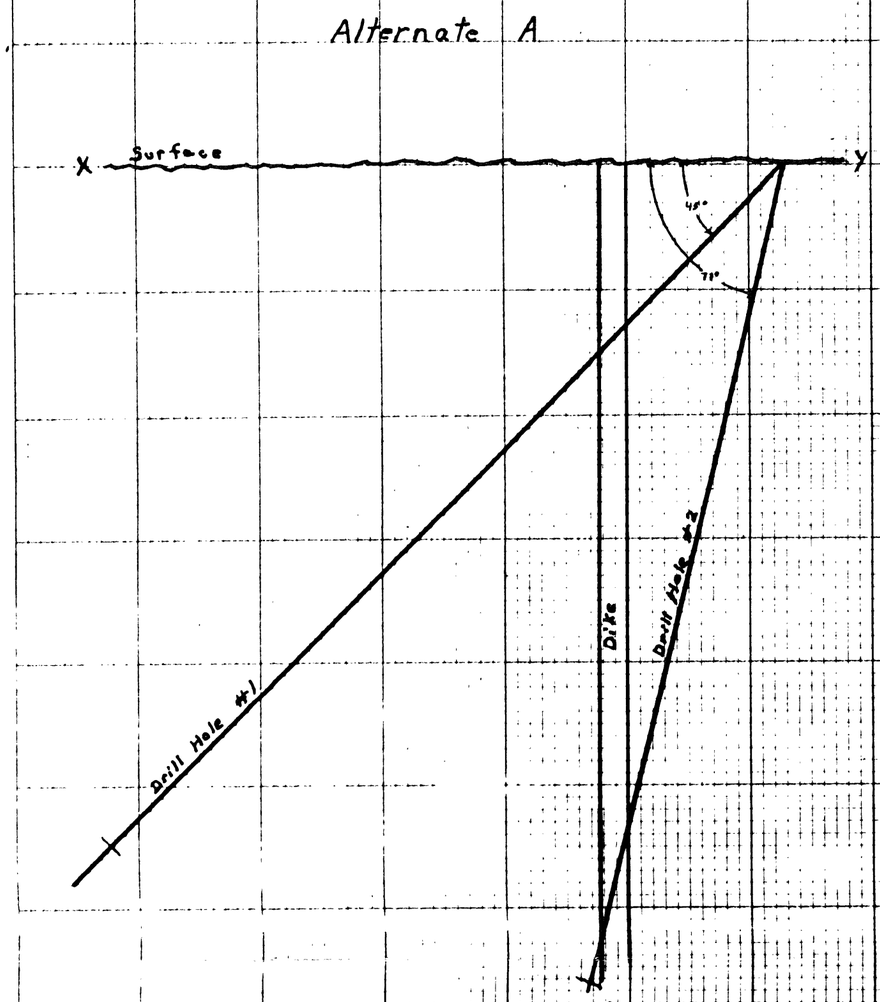
NORTH CAROLINA
LINCOLN COUNTY
LINCOLNTON TOWNSHIP

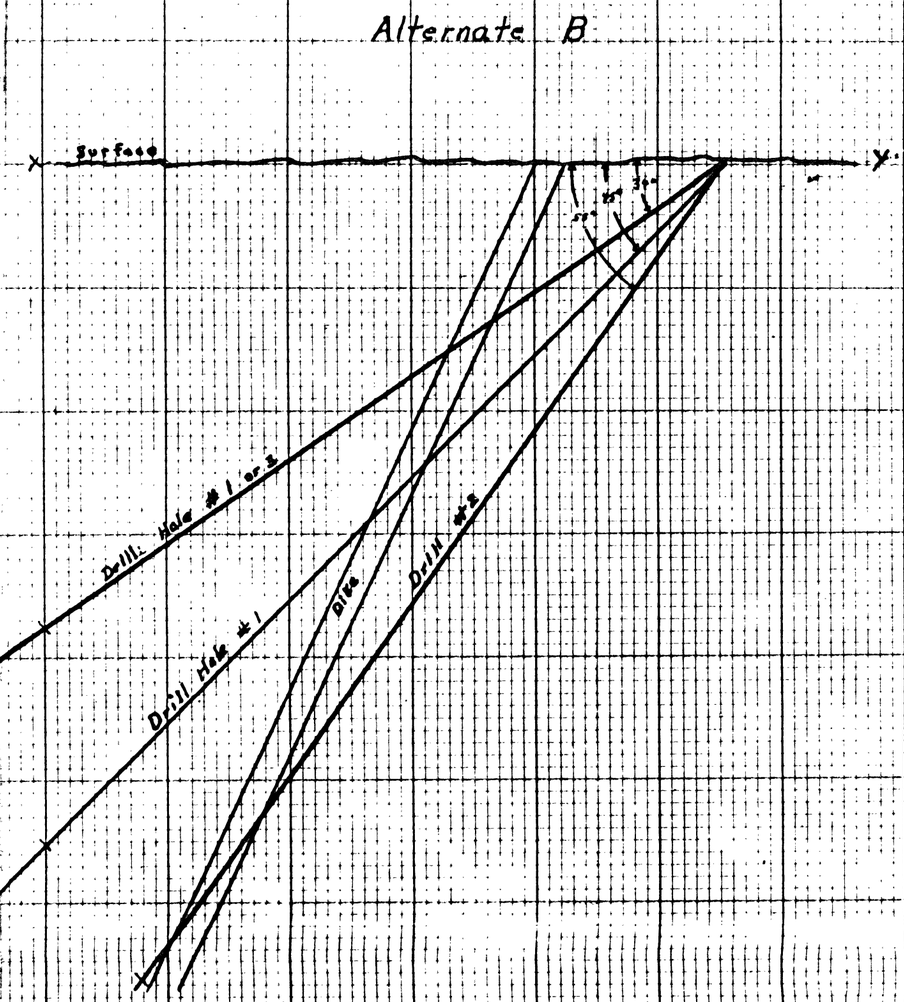
THE ABOVE PLAT REPRESENTS ALL OF THE TIN MINE PROPERTY, BOTH MINERAL RIGHT AND FEE SIMPLE TRACTS.

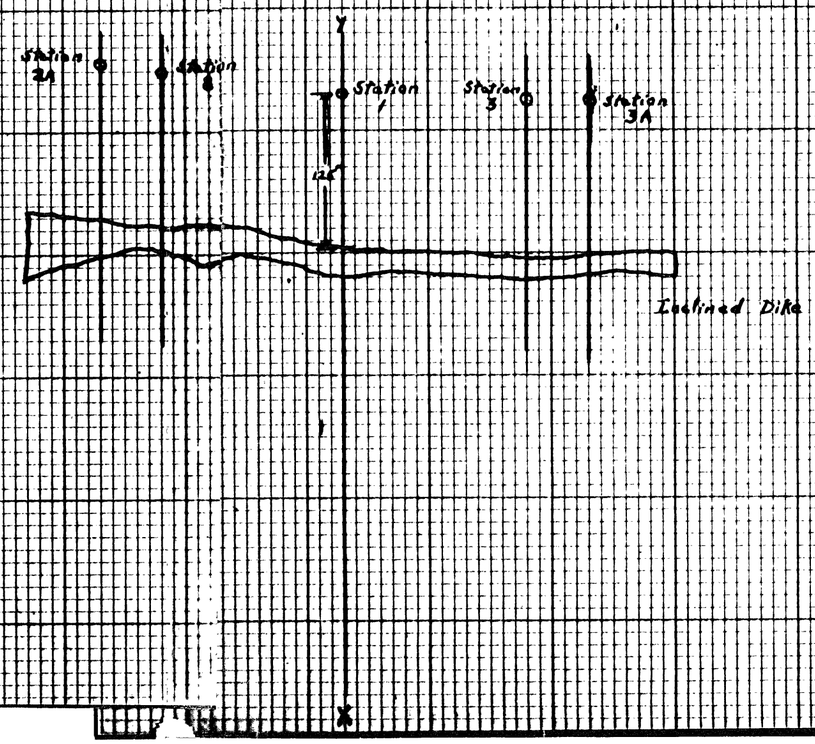
PLATTED FROM RECORDED DESCRIPTION

Hoke S. Kearns

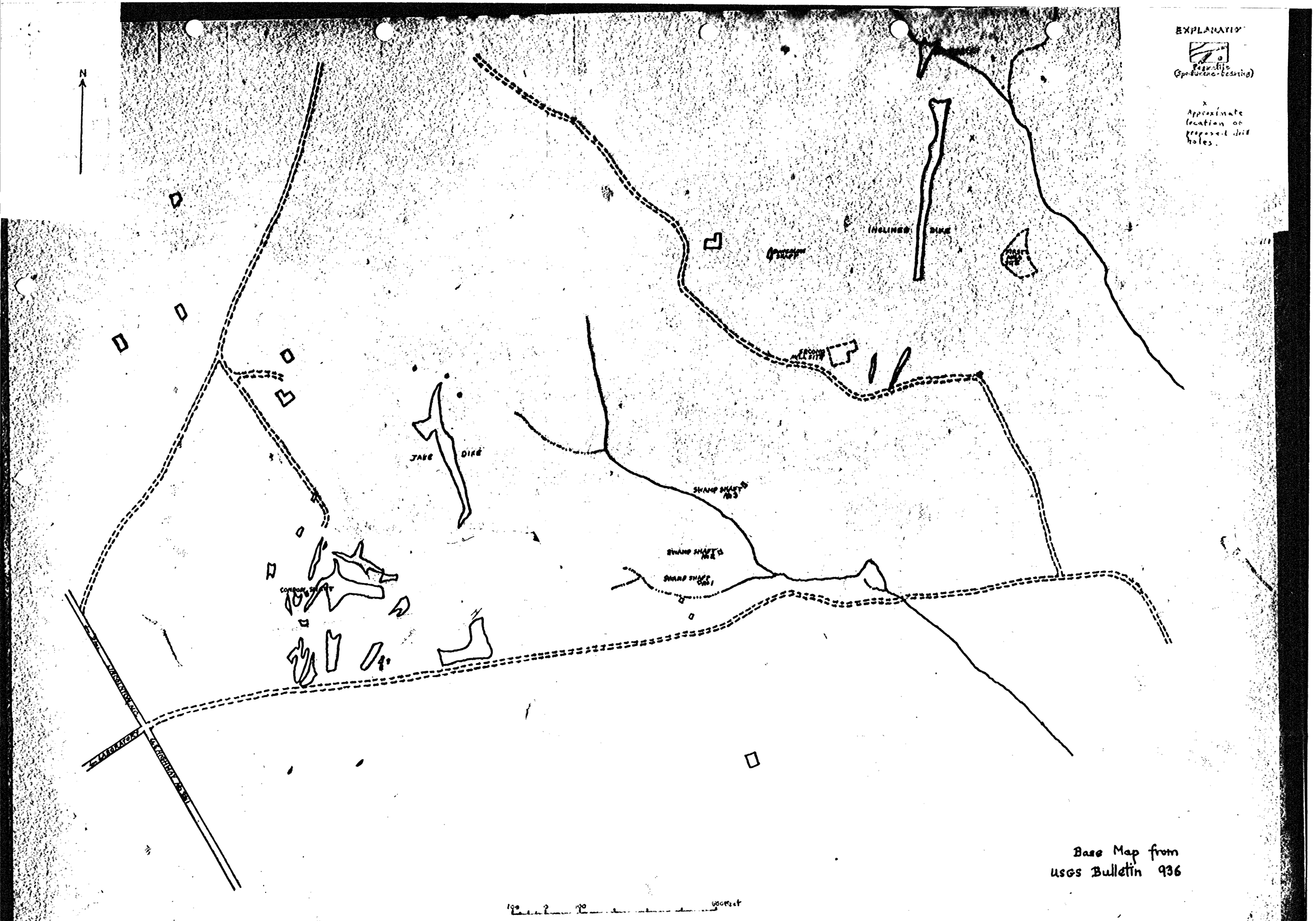
DATED 11/25/52 REG. SURVEYOR.
LINCOLNTON N.C.







S.D. Mason Oct 11-52



PEGMATITE BODIES EXPOSED ON PROPERTY OF THE KA-MI-TIN CONCENTRATING CO.