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Report of

Report of

NORTHERN KYANITE MINES LIMITED

NORTHERN KYANITE MINES LTD.

FOR THE PERIOD FROM INCEPTION

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April 14th, 1955

APRIL 14th, 1955

to

to

December 31st, 1957

December 31st, 1957

Conc III Lot 7

Conc IV Lot 3-6

NORTHERN KYANITE MINES LIMITED

HEAD OFFICE

6th Floor, 360 Bay Street
Toronto, Ontario

Officers

J. M. Cunningham-Dunlop
President

M. J. Tamplin
Vice-President

H. E. Nauss
Secretary

Directors

J.M.Cunningham-Dunlop, Toronto

H. E. Nauss, Toronto

W.S.Jamieson, Toronto

F. C. Sullivan, Toronto

M. J. Tamplin, Toronto

Transfer Agents

Crown Trust Company, Ontario

Solicitors

Salter, Reilly, Jamieson

Toronto, Ontario

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EMG-3071

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NORTHERN KYANITE MINES LIMITED
REPORT OF THE DIRECTORS

To the Shareholders
Northern Kyanite Mines Ltd.

Your Directors submit herewith the Balance Sheet of your company, and a report on your operations to 31st December, 1957.

All assessment work has been completed on the 43 claims held in Dryden Township, Sudbury District, 22 of the claims have been patented. Your company has until 1st July, 1958, to complete patent action of the remainder of your holdings.

1,965,394 tons of ore grading 18.27% kyanite have been indicated to a depth of 100 feet over a length of 2,000 feet with an average width of 140 feet on the principal outcrop of the property. Four other outcrops are known and remain to be investigated.

Research into milling methods has evolved a process that will produce high quality concentrates from the company ore. Further research into methods of processing these concentrates have been successful in developing a mullite aggregate superior to any previously known from North American Kyanite.

Discovery of markets for your company products has been the principal occupation of your Directors. There are good indications that the quality of our concentrates can command a premium price in the United States market.

A strong interest in our mullite aggregate has developed in Europe among manufacturers of high temperature refractory bricks, as a replacement for presently undependable sources.

The work now being carried on into 1958 is expected to establish a market potential firm enough to permit consideration being given to plans for financing a production programme.

Total expenditures to 31st December, 1958 amount to \$71,972.18.

Under the agreement negotiated July 6th, 1955 between Hoyle Mining Company Limited and Northern Kyanite Mines Limited, Hoyle Mining Company are receiving shares from the treasury of Northern Kyanite Mines Limited in satisfaction of cash advances.

Toronto, Canada
March 19th, 1958

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Cunningham-Dunlop
President

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J. M. Cunningham-Dunlop
President



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NORTHERN KYANITE MINES LIMITED

To the President and Directors
Northern Kyanite Mines Limited

This first annual report presents a review of exploration, development and research activities that have been undertaken to establish the values of the 43 claims held by Northern Kyanite Mines Limited in Dryden Township, Sudbury District, Ontario.

Location

43 claims totalling 1720 acres, in Lots 4,5,6,7, Con. IV and Lot 7, Con. III Dryden Township, Sudbury District, Ontario.

Geological

The ground stakes was first examined and reported on for Hoyle Mining Company Limited by C.F.Cockshutt, in 1952. In the same year a detailed examination was made by Dr. D. F. Hewitt, for the Ontario Department of Mines, and reported in their Industrial Minerals Circular No. 4, November, 1952. In 1953, Mr. V. A. Haw examined the property for the Department of Mines and Technical Surveys, Ottawa, reporting his findings in their Department IMR No. 295-1954.

All were in substantial agreement that detailed exploration would prove the existence of commercial tonnage and grades.

Exploration and Development :

In 1953, two trenches were cut, and bulk samples were sent to Lakefiled Research Limited, Lakefield, Ontario. Returns were :
From a 35 ft.trench on Showing "A" north of the C.P.R. tracks -
15% Kyanite
From a 100 ft. trench on shwoing "C" south of # 17 highway -
25% Kyanite.

Pioneer Consulstants Limited of Haileybury, Ontario were engaged to carry out the assessment work on the claim. 10,214 feet of diamind drilling was done, and at the same time some 20 tons of bulk samples made available for test work from the trench on Showing "C".

On completion of all prescribed assessment work, Pioneer Consultants Limited submitted a report in March, 1957. Because Showing "C" appeared on outcrop to contain the major deposit, and was moreover in the best location for initial quarrying operations, as much as possible of the drilling was done at this location. From this work it was calculated by Pioneer Consultants Limited that 1,965,394

tons of ore, grading 18.27% Kyanite were indicated to a length of 2,000 feet on showing "C" to a depth of 100 feet over an average width of 140 feet. Bottom of the deposit was not ascertained, several holes being stopped at 180 feet still in kyanite gneiss.

Research in Processing :

The first research problem encountered was discovery of an accurate method of determining kyanite content. A mineral examination procedure first outlined by Mr. E. O. Foster of Lakefield Research Limited, was later developed and refined in the analytical laboratories of the Industrial Minerals Division Department of Mines and Technical Surveys, Ottawa.

It should be noted that in the final calculations of grade made by Pioneer Consultants Limited, the assays used were those returned from this improved method.

From the first bulk samples, Lakefield Research Limited obtained concentrates containing 90%-92% Kyanite by a combination of jigging, flotation, and magnetic separation. About 2 tons were produced and distributed to consumers in the search for market outlets.

The Industrial Minerals Division of the Department of Mines and Technical Surveys, Ottawa initiated a project to discover methods of recovering kyanite from Canadian ores, and Northern Kyanite Mines Limited has collaborated by supplying all ore for the work.

Both wet and dry re-dressing flowsheets have been developed, and work is still in progress to establish the preferred method. Concentrates of a quality superior to any in North America have been obtained at attractive recoveries. The work has also indicated that garnet of commercial quality may also prove to be recoverable.

The Ceramic Engineers of the Department have been successful in developing and patenting a new process for stabilizing kyanite concentrates, and producing a mullite aggregate with refractory properties superior to any imported kyanite, and the equal of many synthetic products. Northern Kyanite Mines Limited, are collaborating in tests of this process under semi-commercial conditions, and will have use of the (Crown owned) patented features at a nominal fee.

Research in Marketing :

Freight rates to United States consuming points were an adverse competing factor in initial attempts to sell Kyanite concentrates. However, the superior quality of Canadian concentrates is now bringing offers of premium prices that could provide sufficient

incentive for selling concentrates in the U. S. A.

With the freight rates now prevailing to Europe, mullite aggregate produced by the Ottawa process can compete pricewise with present imports from India and Africa. Again on the basis of superior quality, a strong interest is developing in our Canadian source of this material.

1958:

Work now being carried over into 1958 consists of the production of several hundred pounds of both concentrate and aggregate under conditions that can be duplicated in commercial practice. This material should be in the hands of interested consumers in Europe and the U.S.A. some time in May, 1958. The reception accorded this material will enable Northern Kynaite Mines Limited to assess the incentive for initiation of production plans.

Toronto, Ontario
March 19th, 1958

M. J. Tamplin
Metallurgical Engineer

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Metallurgical Engineer

NORTHERN KYANITE MINES LIMITED

Incorporated under the Ontario Companies Act

Balance Sheet

December 31, 1957

ASSETS

Mining Properties	\$750,000.00
Deferred Development	71,972.18
Organization Expense	<u>2,265.00</u>
	<u>\$824,237.18</u>

LIABILITIES

Advances from Hoyle Mining Co. Ltd.	\$ 20,232.18
Capital:	
Authorized 3,500,000 shares at \$1 par value	
Issued:	
Incorporators Shares	5 \$ 5.00
For Properties	750,000 \$ 750,000.00
For expenses	<u>540,000 \$ 540,000.00</u>
	1,290,005 \$1290,005.00
Less Discount	<u>486,000.00</u> 804,005.00
	<u>\$824,237.18</u>

DETAILS OF DEFERRED DEVELOPMENT

December 31, 1957

	<u>Year 1957</u>	<u>Total to date</u>
Diamond drilling - 10,199 feet	\$ -	\$ 28,388.86
Core shed	-	681.81
Bulk sampling and Trucking	-	8,174.36
Engineering Fees and Expenses	1,061.88	12,486.08
Ore Testing and Marketing Research	3,223.01	11,947.90
Assaying	-	1,420.00
Cost of Transferring claims	-	1,059.30
Legal fees	-	500.00
Miner's licence and taxes	130.00	893.27
Sundry Expenses	11.15	311.40
Transfer Agent Fees	250.00	785.20
Patenting 22 claims	<u>5,324.00</u>	<u>5,324.00</u>
	<u>10,000.04</u>	<u>71,972.18</u>

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NORTHERN KYANITE MINES LIMITED

Incorporated under the Ontario Companies Act

Balance Sheet

December 31, 1957

A S S E T S

Mining Properties	\$750,000.00
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	<u>\$10,000.04</u>	<u>\$71,972.18</u>

TRIP TO GERMANY
Feb. 14th to 26th, 1959

Investigations re Kyanite

1. Magnetic separator tests
2. Flotation trials.
3. Conversion of kyanite to mullite.
4. Market investigation.
5. Plant visitation.

H. Maidment
K. Leidhold
J. J. Mather

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I. Magnetic separation of kyanite gneiss from Northern Kyanite property near Sudbury.

Various methods, including air tabling and magnetic separation, had been attempted by American Nepheline Limited in an endeavour to make a preliminary and economical separation of gangue material from the kyanite prior to a flotation process. The apparent capabilities of the Lurgi separator opened another avenue of approach.

I. (a) Test results

	Amps	Roll R.P.M.	Weight Recovery
Low grade (1st Pass	18	300	78.78
2nd Pass	18	150	69.41
3rd Pass	18	150	66.69
4th Pass	18	150	65.04
High Grade 1st pass	19	300	72.60
2nd Pass	19	150	67.27
3rd Pass	19	150	65.95
4th Pass	19	150	64.54

Feed rate-Lab machine-1.1 T.P.H
Commercial -11.0 T.P.H

Feed size - 32 mesh

Examination of the 4th pass non-mags with a microscope indicates that they consist only of kyanite and quartz.

Separation test with feeds coarser than 32 mesh were not successful.

A sink-float separation of the 4th pass high-grade non-magnetic gave a kyanite concentrate analyzing as follows :

	%
Silica	37.64
alumina	60.21
Fe ₂ O ₃	0.47
CaO	0.42
MnO	0.21
Na ₂ O	0.08
K ₂ O	0.15
TiO ₂	0.21
L.O.I.	0.70

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I. (b) Flotation trials :

The non-mags from the high-grade separator tests were subjected to preliminary flotation trials at Lurgi. Using 1 roughing and 2 cleaning stages, the kyanite was readily floated from the quartz. Reagents, to rougher cell only, were .5#/ton oleic acid and Na₂CO₃ to maintain a Ph. of 8.

Additional flotation trials will be conducted at Nepton.

It may be concluded that considerable promise exists for the economical production of a kyanite concentrate using a combination of magnetic separation and flotation processes. Additional work along this line would appear justifiable.

I(c) Conversion of kyanite to mullite.

This process was outlined to Dr. Meyer and the assistance of the Lurgi organization solicited.

Dr. Meyer disclosed that Lurgi had been active in the field of production for synthetic mullites, having installed processes in two separate operations in Germany and consequently were anxious to initiate an appropriate study.

To produce a volume stable mullite of sufficiently low porosity from Canadian kyanite, a simple temperature conversion does not suffice. After considerable effort at the Department of Mines in Ottawa the following process, said to achieve the desired result, was evolved :

1. mix - 200 mesh kyanite
alumina (max. of 20%)
tempering water 5%)
P205 (2%)
2. briquet at 10,000 p.s.i.
3. fire at 1700°C

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The Lurgi pelletizing disc would not be applicable, being incapable of forming pellets under pressure, however, they are prepared to test and recommend suitable briquetting equipment. The possibility that a product having low porosity could be produced, without benefit of pressure, by refiring will be investigated. Refiring where the sinter machine is used would be relatively simple.

For firing, Dr. Meyer selected the sintering machine in preference to the rotary kiln, although Lurgi makes both. The sintering machine is chosen because of lower first costs, lower operating and maintenance costs, and the greater inherent flexibility. The extreme temperature requirements are met by the use of alloy pallets and a bedded arrangement of materials, finished pellets, green pellets, and on the top, partially burned material. This arrangement is accomplished by recirculation. A sinter machine for 60 T.P.D. providing a two hour soak would be approximately 43'0" long and 2'0" wide.

To conduct proper tests Lurgi would require 1 ton of ground concentrate. A Lurgi laboratory separator (capacity 1 T.P.H.) would be almost a requisite to produce sample material in such quantity. Lurgi would arrange for interested parties to view the tests.

I (d) Market investigations :

This information was obtained from Mr. Detering of the firm of Frank & Schulte in Essen. Previous information had been gained from this source by Mr. Tamplin through their agents in Canada, Tennant Union.

Frank and Schulte are suppliers of raw material to the ceramic industry and incidentally expect to include nepheline syenite from Norway by 1961 as one of their imported raw materials.

Mr. Detering insisted that the German market would be for mullite only, and further any such mullite must compete both as to quality and the price with mullite from Indian Kyanite (\$87.00 delivered + \$14.00 for calcining).

India, however, is not considered a reliable source, deliveries have been irregular under a quote system and quality has not been consistent. An alternative material would be looked upon with favour.

African Sillaminite is being imported in small quantities at \$61.50 per ton, it does not require calcining and the reserves are known to be at least 1 million tons. The sole disadvantage appears to the great difficulty in reducing the rock to usable sizes, (present method involves heating to 1200°C and water quenching). The sillimanite assays 75% Al₂O₃. 2 to 2½% TiO₂ and 1½% Fe₂O₃.

Mr. Detering estimated the present major market tonnages to be:

U. K.	10,000 T.P.Y.
Germany	10,000 T.P.Y.
Japan	10,000 T.P.Y.
U. S.	40,000 to 50,000 T.P.Y.

The common grain sizes used in Germany are 0 to 1mm; 1 to 3mm and 3 to 6mm, 0 to .6 mm being the most used. Any of these could be crushed from a ½" dia. pellet provided angular, sharp particles resulted.

Kenya kyanite was considered not to yield a sufficiently dense mullite, nor a suitably shaped particle.

A sensible evaluation of the probably market penetration of our mullite could only be made by providing 10 to 20 tons of product for distribution to potential customers.

I (e) Plant Visitation.

A visit to the refractory plant at Hettenleidelheim was made in connection with the program for kyanite.

This plant was of interest for several reasons, one, it produced high temperature refractories, two, a Lurgi designed sintering process was employed, and three, it was described as producing synthetic mullite. Synthetic mullites are known to be making serious inroads into the business formerly held captive by the kyanite. It was interesting to note that obviously the term synthetic mullite is applied to a wide variety of processes and in this case was not probably strictly accurate.

The raw materials, clay (35% to 39% Al₂O₃-dry basis) high purity alumina and coke breeze were mixed and burned at 1600°C in a batch type sintering machine. Fines and unburned mix was screened from the clinker, the clinker crushed and mixed with fir clay, dry pressed (5% moisture) into the required shapes and dried by using waste gases from the tunnel kiln. The dried shapes were then fired (5 day cycle) in the tunnel kiln. The tunnel kiln cross section was 5' X 8' and the length 395', the hot zone (2800°F) was 130' long.

The quality of brick was described as having a P.C.E of 39 and good for a 2 KG load at 3000°F. The P.C.E quoted, if the basis is the same, would appear superior to that established for the mullite from Canadian kyanite.

The process was obviously very simple and the operating cost extremely low. If the quality is indeed satisfactory, one could not compete with the methods contemplated for the conversion of Canadian kyanite. Frank & Schulte, the raw material agents, described the brick as inferior and not competitive with brick made with mullite from Indian Kyanite.

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I. Magnetic separation of kyanite gneiss from Northern Kyanite property near Sudbury.

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3'0" wide.

To conduct proper tests Lurgi would require 1 ton of ground concentrate. A Lurgi laboratory separator (capacity 1 T.P.H.) would be almost a requisite to produce sample material in such quantity. Lurgi would arrange for interested parties to view the tests.

I. (d) Market investigations.

This information was obtained from Mr. Detering of the firm of Frank & Schulte in Essen. Previous information had been gained from this source by Mr. Tasplin through their agents in Canada, Tennant Union.

Frank & Schulte are suppliers of raw materials to the ceramic industry and incidentally expect to include nepheline syenite from Norway by 1961 as one of their imported raw materials.

Mr. Detering insisted that the German market would be for mullite only, and further any such mullite must compete both as to quality and price with mullite from Indian kyanite (\$87.00 delivered + \$14.00 for calcining).

India, however, is not considered a reliable source, deliveries have been irregular under a quota system and quality has not been consistent. An alternative material would be looked upon with favor.

African Sillimanite is being imported in small quantities at \$61.50 per ton, it does not require calcining and the reserves are known to be at least 1 million tons. The sole disadvantage appears to be the great difficulty in reducing the rock to usable sizes, (present method involves heating to 1200°C and water quenching). The sillimanite assays 75% Al₂O₃, 2 to 2 1/2% TiO₂ and 1 1/2% Fe₂O₃.

Mr. Detering estimated the present major market tonnages to be -

U.K.	10,000 T.P.Y.
Germany	10,000 T.P.Y.
Japan	10,000 T.P.Y.
U.S.	40,000 to 50,000 T.P.Y.

The common grain sizes used in Germany are 0 to 1 m.m.; 1 to 3 m.m. and 3 to 6 m.m., 0 to .6 m.m. being the most used. Any of these could be crushed from a 1/2" dia. pellet provided angular, sharp particles resulted.

Kenya kyanite was considered not to yield a sufficiently dense mullite, nor a suitably shaped particle.

A sensible evaluation of the probable market penetration of our mullite could only be made by providing 10 to 20 tons of product for distribution to potential customers.

I. (e) Plant Visitation.

A visit to a refractory plant at Hettenleidelheim was made in connection with the program for kyanite.

This plant was of interest for several reasons, one, it produced high temperature refractories, two, a Lurgi designed sintering process was employed, and three, it was described as producing synthetic mullite. Synthetic mullites are known to be making serious inroads into the business formerly held captive by the kyanites. It was interesting to note that obviously the term synthetic mullite is applied to a wide variety of processes and in this case was probably not strictly accurate.

The raw materials, clay, (35% to 39% Al_2O_3 - dry basis), high purity alumina and coke breeze were mixed and burned at 1600°C in a batch type sintering machine. Fines and unburned mix were screened from the clinker, the clinker crushed and mixed with fire clay, dry pressed (5% moisture) into the required shapes and dried by using waste gases from the tunnel kiln. The dried shapes were then fired (5 day cycle) in the tunnel kiln. The tunnel kiln cross section was 5' x 8' and the length 395', the hot zone (2800°F) was 130' long.

The quality of brick was described as having a P.C.E. of 39 and good for a 2 KG load at 3000°F. The P.C.E. quoted, if the basis is the same, would appear superior to that established for the mullite from Canadian kyanite.

The process was obviously very simple and the operating cost extremely low, if the quality is indeed satisfactory, one could not compete with the methods contemplated for the conversion of Canadian kyanite. Frank & Schulte, the raw materials agents, described the brick as inferior and not competitive with brick made with mullite from Indian kyanite.

HOYLE MINING COMPANY LIMITED

KYANITE PROPERTY

BRIDGES TOWNSHIP, SUDBURY DISTRICT

MINER CONSULTANTS LIMITED

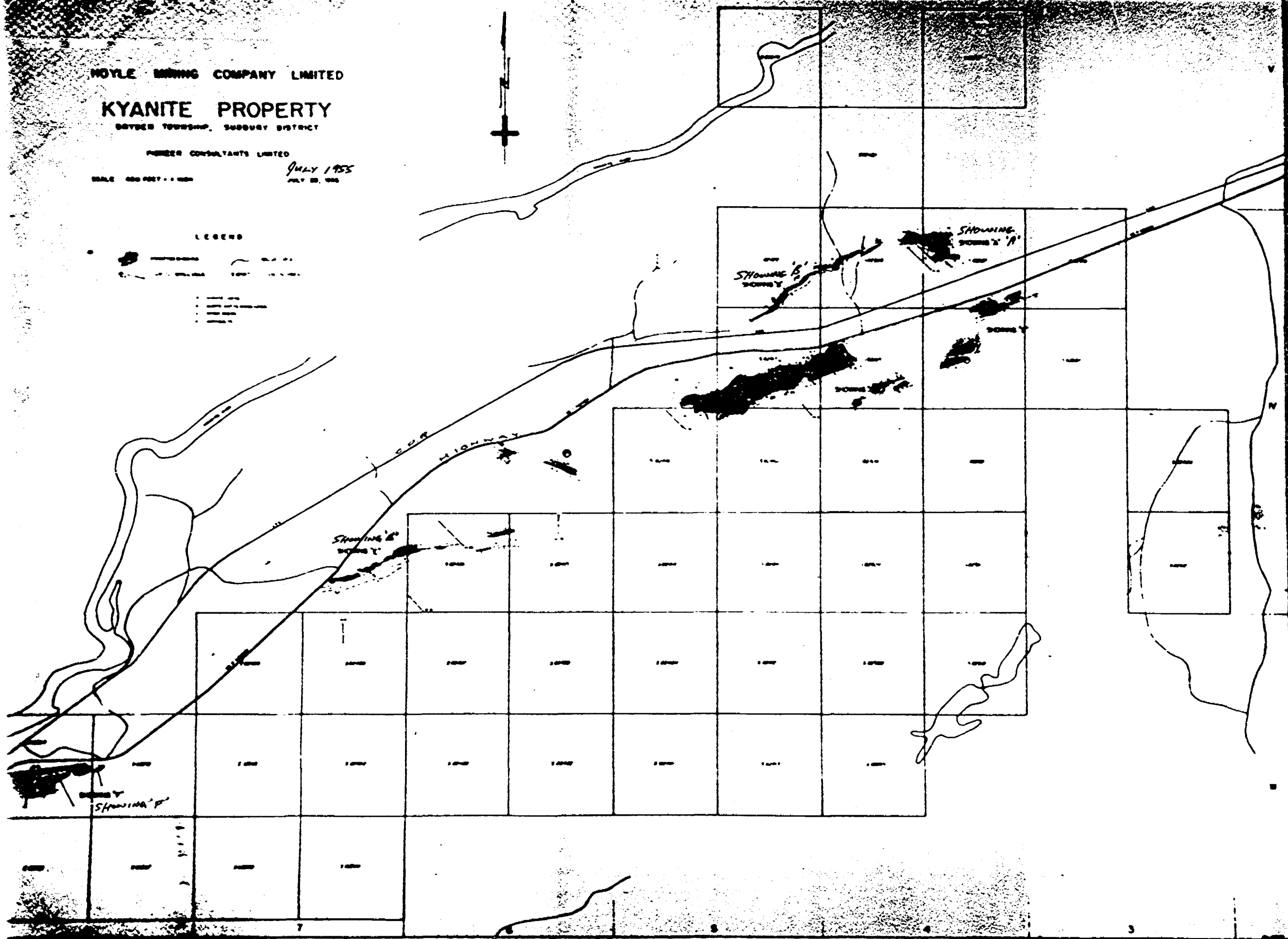
JULY 1955
JULY 22, 1955

SCALE 600 METERS



LEGEND

- Proposed
- Existing
- Water
- Highway
- Other



7

8

9

3

SIXTH FLOOR
360 BAY STREET
TORONTO 1



41107NW0003 DRYDEN18B1 DRYDEN

April 8th, 1958

900

Dr. J. E. Thomson
Department of Mines
Queen's Park
Toronto
Ontario

Dear Dr. Thomson:

Mr. W. C. Martin of this office tells me that you would like a summary of the situation on the Kyanite deposits in Dryden Township, controlled by Hoyle Mining Company Limited.

I think the report just prepared for the Shareholders will contain the information you require. If not, please let me know, and I will do my best to furnish it. Actually, on the property, nothing beyond assessment drilling has been attempted.

Yours very truly,

NORTHERN KYANITE MINES LIMITED

A handwritten signature in dark ink, appearing to read 'M. J. Tamplin', written in a cursive style.

MJT;etg
encl.

M. J. Tamplin
Metallurgical Engineer

Apr. 10, 1958

Mr. M.J. Tamplin,
Metallurgical Engineer,
Northern Kyanite, Ltd.,
360 Bay Street,
Toronto 1.

Dear Mr. Tamplin:

I want to thank you for sending me a copy of your report on the kyanite deposits of Dryden township. This is just what I wanted. With your permission, we will reproduce your report in a geological report on these deposits to be published in 1958 or 1959 by this Department.

The property map accompanying your report does not show the location of "Showing C" very clearly. As we are going to mark this on our geological map I want to be sure of the correct location. My recollection from a hasty visit to the property is that Showing C on your map is the largest area shown in black south of the highway. Possibly someone at your office could call me, at Km. 3-1211, extension 2-1283, and let me know if this is correct.

Your help in this matter is much appreciated.

Sincerely yours,

J.E. Thomson
Asst. Provincial Geologist

2200
25 KING STREET WEST
TORONTO 1, CANADA

May 16, 1961

Mr. J. E. Thomson,
Department of Mines,
Province of Ontario,
Parliament Buildings,
Toronto, Ontario.

Dear Mr. Thomson:

Referring to our telephone conversation of yesterday, we are pleased to enclose a report by Messrs. H. Maidment, K. Leidhold and J. J. Mather of their trip to Germany in 1959 of their investigations re kyanite covering the following subjects:

1. Magnetic separator tests;
2. Flotation trials;
3. Conversion of kyanite to mullite;
4. Market investigations;
5. Plant visitation

Yours very truly,

NORTHERN KYANITE MINES LIMITED


A. C. Callow
Secretary

ACC:IB
Enc.

Falconbridge Twp

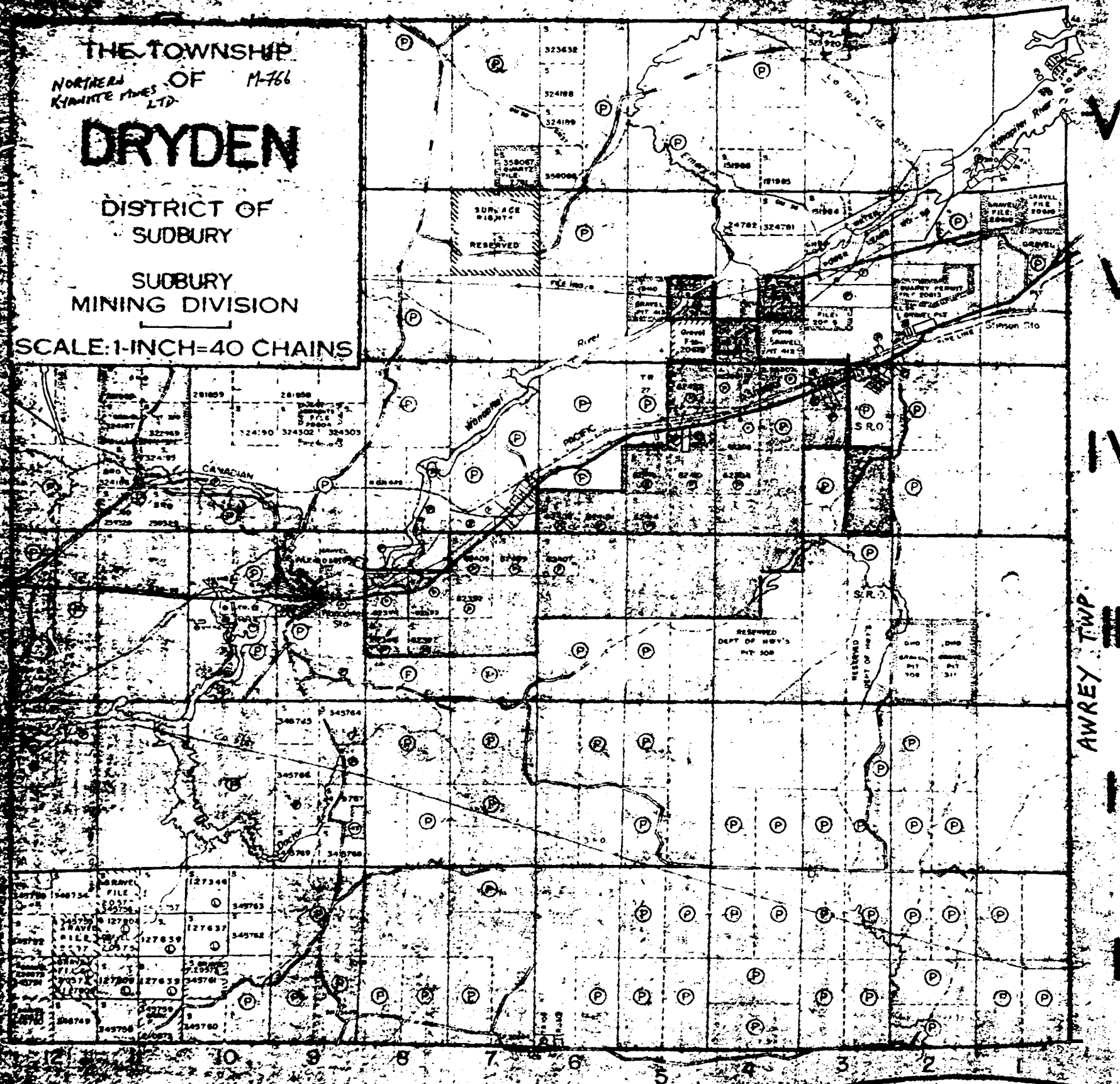
THE TOWNSHIP
NORTHERN
KIAMIITE MINES LTD

DRYDEN

DISTRICT OF
SUDBURY

SUDBURY
MINING DIVISION

SCALE: 1-INCH=40 CHAINS



Cleland Twp

AWREY TWP