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REPORT ON  
BENEFICIATION STUDY  
Mining Claims  
S 340743 et al  
BUTLER AND ANTOINE TOWNSHIPS  
DISTRICT OF NIPISSING  
SUDBURY MINING DIVISION  
PROVINCE OF ONTARIO

RECEIVED  
*By hand*  
FEB 20 1975

PROJECTS UNIT.

Report by

R. M. Blais, P. Eng.

February 1975

BENEFICIATION STUDY

Mining Claims S 340743 et al

BUTLER AND ANTOINE TOWNSHIPS

SUDBURY MINING DIVISION

PROVINCE OF ONTARIO

1. INTRODUCTION

This is a brief report to consolidate information as requested by your letter of January 3, 1975. Your file number 2.1563. Subject: Beneficiation Study - Mining Claims S. 340743 et al, Butler and Antoine Townships.

2. PROJECT LOCATION AND ACCESS

Claim group is located on Crocan Lake which is on boundary between Butler and Antoine Townships. Crocan Lake is immediately north of extreme east end of Timber Lake. Highway 533 passes along most of south shore of Timber Lake.

Property can be reached by following Highway 63 from North Bay 27 miles to intersection of Highway 533. By following Highway 533 toward Mattawa for ten miles a logging road on north side of Highway 533 will be reached. Both Highway 63 and Highway 533 are paved roads. Crocan Lake and centre of claim group are located one mile north on logging road. This road is only open in summer. Best means of transportation on logging road is by half-ton truck. Cars can be used in dry weather. Logging road can also be reached from Mattawa a distance of 22 miles on highway 533. Mattawa is located at intersection of Highway 533 and Highway 17.

3. PAST PERFORMANCE OF WORK

Enclosed is a copy of Report on Kyanite, Muscovite, Garnet, Biotite deposits, Butler and Antoine Townships, District of Nipissing, Ontario. Report was written in 1954 by D. W. Sullivan, B. Sc., P. Eng., Ontario. Mr. Sullivan is now deceased (1971). Mr. Sullivan's report outlines work that was performed on this property from discovery in 1951 until 1954. No work was done on property from 1954 to 1967.

In 1967 Arrowhead Silica Corporation of Chesterton, Indiana acquired Crocan Lake property. Trenching was carried out each year to hold claims in good standing. In 1972 ten claims were brought to lease.

The writer became involved in September 1972 and from that time began managing exploration of property. From September 1972 the following work has been performed.

- (1) Approximately 650 surface samples were taken and assayed for Kyanite.
- (2) Six diamond drill holes were completed in the fall of 1972 for a total footage of 1,014 feet.
- (3) Fifteen diamond drill holes were completed in the summer of 1973 for a total footage of 2,478 ft.
- (4) Considerable diamond drill core was assayed for Kyanite (see enclosed diamond drill core logs and assay results).

Proposed future drilling of 3,000 feet to be undertaken in summer of 1975.

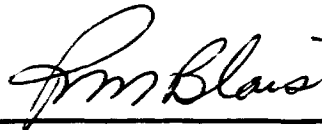
4. METHOD USED FOR DETERMINATION OF MUSCOVITE AND KYANITE CONTENTS OF CROCAN LAKE, CANADA ORE.

All assaying work was carried out by North Carolina State of the University of North Carolina at Raleigh, Engineering Research Department, Minerals Research Laboratory, 180 Coxe Avenue, Asheville, North Carolina.

The procedure is as follows: Samples were shipped to Asheville, No. C. in small cloth bags. Each sample was passed through roll crusher one time and a 50-gram sample cut out by use of splitter. The 50-gram sample was screened on 35 mesh, and oversize was ground on a Bucking Board with frequent screenings to reduce all granular material to minus 35 mesh with minimum of fines. When the oversize was all micaceous, it was weighed and passed over Frantz Isodynamic Separator to separate biotite from muscovite. The muscovite fraction was weighed and percent muscovite was calculated.

A 25-gram sample was split from the minus 35 mesh fraction, and kyanite, and other high gravity material was separated in tetrabromoethane (Sp. G. 2.96). Floats and sinks were washed, dried, and weighed. The sinks were passed over Frantz Isodynamic Separator to separate kyanite from magnetic heavies. Due to presence of pyrite, it was necessary to heat the sinks to 500<sup>o</sup> F before this separation. Weight of magnetics and nonmagnetics was recorded, and the degree of separation was observed under binoculars. Sample weight was adjusted for oversize fraction,

and percent kyanite was calculated. The floats at 2.96 Sp. G. were then separated in a mixture of tetrabromoethane and kerosene at a Sp. G. of 2.72. The sinks were washed, dried, and weighed. Sinks were passed over the Frantz Isodynamic Separator and results were checked under binocular for separation of muscovite and biotite. Percent muscovite was calculated, added to percent muscovite in oversize, and reported as total muscovite.



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R. M. Blais, P. Eng.

REFERENCES

1. Kyanite in Canada  
By: V. A. Haw  
  
(Joint meeting, Industrial Minerals Division,  
A. I. M. E., M. S. N. S., and C. I. M., Keltic  
Lodge, N. S., September, 1953)  
  
(Transactions, Volume LVII, 1954, PP. 25-33)
2. Ontario Department of Mines - Industrial  
Circular Number 4.
3. Report on Kyanite, Muscovite, Garnet,  
Biotite Deposits - Butler and Antoine  
Townships in the District of Nipissing,  
Ontario, Canada  
  
By: D. W. Sullivan, B. Sc.,  
Professional Engineer, Ontario
4. Assessment work files at Mining Recorders  
Office in Sudbury.

Report  
on  
KYANITE, MUSCOVITE, GARNET, BIOTITE DEPOSIT

Butler and Antoine Townships  
District of Nipissing  
Ontario

September 1954

D. W. Sullivan, B. Sc.  
Prof. Engineer, Ontario

### Location and Access:

The property of the Kyanite Corporation of Canada, Limited, consists of a group of 31 claims in the north-east corner and the north-west corner of Butler and Antoine Townships in the District of Nipissing in the Province of Ontario. The main deposit lies to the north-east of Crocan Lake and is easily accessible by road from Mattawa, 23 miles to the south-east. It is also 2 miles west of the Ottawa River and about 6 miles east of the paved highway between North Bay and Temiskaming. A hydro plant is located on the Ottawa River about 16 miles to the south-east.

### History and Development:

The extensive deposits of kyanite-muscovite-garnet-biotite gneiss, were discovered in 1951. Preliminary investigation indicated that the grade and uniformity of the deposits warranted detailed investigation and as a result 2500 feet of diamond drilling was completed and a considerable amount of samples were shipped out for separation tests.

Detailed mapping and prospecting has shown that the broad area of kyanite-muscovite-garnet-gneiss extends over an area approx. 1800' wide and 11,000 feet long. The general strike is in a north-easterly direction with the beds dipping from 35° to 40° to the north-west. A tonnage of at least 50,000,000 tons has been estimated.

### Geology of the Occurrence:

Geologically, the deposit lies in an area of the Grenville sub-province of the Precambrian Shield. In general, the geology consists of highly folded meta-sediments of the Grenville type in which the rock types remain remarkably conformable.

The deposit consists of a wide band of kyanite-muscovite-



garnet-biotite-quartz-feldspar gneiss striking in a north-easterly direction and dipping about 35° to 40° to the north-west. The hanging wall gneisses to the north-west are biotite amphibolite, the footwall gneisses to the south-east strongly foliated biotite amphibolites. The country rock is a pink granite gneiss.

The deposit consists of two types, namely disseminated and massive. The disseminated type of which the greater part of the deposit is formed, is fairly uniform and consists of coarse-grained, flat-bladed gray to blue kyanite crystals 1/2 to 3 inches long and 1/8 to 3/8 inches wide with pinkish-mauve garnet crystals up to 1/2 inch in diameter, muscovite and biotite mica. The kyanite forms up to 25% of the rock, but probably averages in the order of 15 to 20%.

The massive type or variety occurs in the form of lenses or pod-like masses and stringers particularly along the contact of the kyanite gneiss, quartzite and dark gneisses of the hanging and footwall. In some of these massive lenses the kyanite forms up to 90% of the rock. These are limited in size, but one deposit at the south end of Crocan Lake showed a flat lying lense about 10 feet thick and upwards of 150 feet in length and which has not been delimited as to length.

There is another massive kyanite deposit (60%) known locally as 'B' zone where on the hanging wall contact with pyritized quartzite there exists a width of approximately 50 feet in low ground and traced for 100 feet in length. This has been trenched but has never been tested by drilling. It is apparent that there may be many other massive (60% to 90%) kyanite zones or lenses along the two miles of favourable contacts. However, at present the merits of the property are not based on these high grade lenses but on the unlimited tonnages of disseminated kyanite gneiss averaging in the order of 15 to 20%

kyanite and the accompanying commercial by-products such as muscovite and garnet.

The economics of kyanite and the other associated minerals are treated separately in this report.

These two types of kyanite-rich occurrences along with the associated muscovite, garnet and biotite clearly indicated that the deposit warranted detailed milling tests for the efficient recovery of these economic minerals, which tests were subsequently carried out by the Mines Branch at Ottawa, American Cyanamid and others. Details of separation tests are treated separately in this report.

Constituents:

The kyanite - muscovite - garnet - biotite gneiss could be more particularly described as follows:

Kyanite-----	15 to 20%
Muscovite-----	20 to 40%
Garnet-----	10 to 20%
Biotite-----	15 to 25%

These minerals occur in variable amounts throughout the whole deposit.

Milling:

(1) Milling investigations have been concentrated chiefly on the disseminated variety of kyanite. With the increasing importance of muscovite and garnet the tests were carried out with the idea in mind of extracting all three products and possibly the black biotite mica.

Crushing & Grinding:

Initial investigation into methods of concentration has indicated two stages of grinding. First, a dry grind through 20 mesh when magnetic separation could recover the biotite and garnet. The second, prior to flotation when the feed could be wet ground through 48 mesh.

Three desirable features in the primary grind were found to be: (1) Release of the minerals at their natural grain size, (2) delamination of the micas to help subsequent concentration and (3) minimize production of fines.

Initial crushing in jaw and roll crushers to about  $\frac{3}{4}$  - inch. An impact mill similar in action to a hammer mill but owing to the absence of grates there is less excess abrasive wear. The operation and product of this type of mill proved most satisfactory. Closed circuite screening at 14 - mesh was very efficient.

Wet grinding has proven successful in both rod and ball mills in closed circuite with a Hammer screen.

Concentration:

Early investigation results in three suitable stages of concentration:

- (1) High intensity magnetic separation to remove effectively all the garnet and biotite.
- (2) Use of air tables to remove the muscovite and leaving a kyanite concentrate along with quartz and minor mica.
- (3) The air-table concentrate was ground to 48 - mesh and a kyanite concentrate of commercial grade obtained by flotation.

To summarize the results of the concentration, the overall recovery of kyanite in both dry and flotation stages of concentration, utilizing the air-table is about 72% with the production of a 90% kyanite concentrate. By eliminating the air-table and floating the magnetic tailing directly the recovery is increased to 80%.

Chemical analysis of a flotation concentrate and of a cleaned sample of kyanite from the concentrate are given below.

	<u>Concentrate</u>	<u>Kyanite</u>
Al <sub>2</sub> O <sub>3</sub>	59.09	62.22
Si O <sub>2</sub>	39.24	36.40
Fe <sub>2</sub> O <sub>3</sub>	0.87	0.74

## Economics:

The deposit of kyanite-muscovite-garnet-biotite gneiss as described above, and the tremendous tonnage involved would certainly appear to be of great economic importance to the industrial growth which has been evident in Canada for the past ten years and which appears to be even greater as time goes on. The occurrence of the industrial minerals described herein most certainly warrants considerable development and early production. A more careful and detailed study of market conditions for these minerals must be carried out in Canada, the United States and abroad. The Canadian production of these minerals is indeed very limited. A study made on them over the past few months would definitely indicate that a great potential market is available and awaits only an intensive and progressive attempt to make the products available to Canadian industry. This can be done economically when one figures the import data and the current prices which various companies have to pay for the same raw materials as used in the numerous industries in Canada and the U. S..

A brief discussion on each of the minerals follows and is by no means a detailed and final summary of their economical importance.

### Kyanite:

Kyanite is commercially valuable because of its property of converting to mullite and a little free silica when heated to a temperature of 1300° to 1600° C. Mullite is used in the manufacture of refractory materials to withstand high temperatures, resistance to thermal shock and corrosive action of some highly reactive slags. It must also have a low co-efficient of expansion. These features are all important in production of bricks and shapes for lining metallurgical furnaces for melting brasses, bronzes and other alloys as well as in the glass industry where mullite refractories are employed in glass-

melting tanks and furnaces.

Owing to the dependence of the United States on kyanite from India and British East Africa (Kenya) this mineral can be considered to be strategic now and in the immediate future should a state of national emergency develop. The African supply is not too reliable at the present time due to depletion of high grade reserves and for some time the Indian kyanite has all but dried up due principally to higher labour costs, deteriorating quality and a higher asking price.

The kyanite produced from test runs on the Mattawa ore at Ottawa has indicated that it is by far the best they have worked on to date.

An analysis of a flotation concentrate on cleaned kyanite from the Mattawa deposits is as follows:

	<u>Concentrate</u> %	<u>Kyanite</u> %
Al <sub>2</sub> O <sub>3</sub> -----	59.09	62.22
SiO <sub>2</sub> -----	39.24	36.40
Fe <sub>2</sub> O <sub>3</sub> -----	0.87	0.74
MgO -----		0.19
L.O.I -----		0.30

A continued demand for high-temperature refractories together with further research into new uses for this kyanite should lead towards establishing a sound kyanite industry in Canada.

Interesting possibilities are also evident from exploration and milling investigations on the Mattawa kyanite, from which important co-products have been produced such as muscovite and biotite mica, and garnet. The success of the kyanite market is further enhanced by the new and varied uses for ground muscovite mica such as in the protective paint industry and for insulation purposes and on the expanding uses of garnet in large tonnages in the sand-blasting and glass polishing industries.

It is generally known that if there was more kyanite that

greater uses for it could be found.

The market price for U. S. kyanite is about \$50.00 per ton f.o.b. shipping point. The India Kyanite ranges from \$60.00 to \$150.00 per ton f.o.b. Atlantic seaboard.

Muscovite Mica:

Muscovite mica may be considered to be one of the most important products from the deposit. The average content in the deposit is about 27% as derived from a large bulk sample taken for extensive test purposes by the Mines Branch at Ottawa. The mica as produced will range in size between 14 and 100 mesh and will be suitable for the ground mica trade. In recent years new markets have developed for ground mica in such products as special types of paints; its flake-like characteristics give greater coverage, make them more flexible and so on. Bitumastic products such as pipe line enamels, tank and structural coatings, roof coatings have shown greater life and flexibility with mica. Other common uses for mica are in cement paint for prous surfaces, fire-retardant paints, wallboard and wallpaper coatings and in the rubber industry. A new product developed by General Electric called Mica May utilizes finely ground mica.

In recent years the supply of ground mica has been very poor and the demand high, especially for the wet-ground mica. The Mattawa kyanite would be essentially a dry ground mica which would sell for around \$50.00 per ton, but with a well planned milling plant the wet ground mica at about minus 200 mesh could be produced which would bring a considerably higher price, in the range of \$80.00 to \$200.00 per ton. At the present time there is no wet-ground mica produced in Canada.

A careful study of the ground mica market might prove to be the most significant feature in production of the industrial

minerals from the Mattawa deposit and thereby defray the cost of production of high grade kyanite.

Garnet:

There has been no domestic production of garnet for the past few years, but here again the market should develop with anticipated production. The average garnet content from a composite sample was 14% and milling tests have indicated that a good clean garnet concentrate can be produced below 20-mesh from the Mattawa deposit.

The consumption of garnet in the U. S. and Canada combined is about 12,000 tons per year but market research indicates that this figure could be substantially increased with increased production. At the present time the only production of garnet of any importance comes from the Barton Mines Corporation near North Creek, N. Y. The deposit averages 8 to 10% and the intimate association of hornblende with the garnet makes it difficult to make a clean concentrate.

Producers of garnet abrasive ship their garnet as a concentrate rather than as finished grain size ready for use, since the various manufacturers of garnet paper and cloth have their own individual specifications as to grain size. Crude garnet concentrate sells for about \$100.00 per ton. Again, adequate milling equipment to produce the so-called flour-garnet for the glass polishing and optical trades will prove to be a profitable venture since prices for this type of finely pulverized garnet are quoted as high as \$800.00 per ton.

Since there is a short supply of garnet for sand blasting, abrasive cloths, etc., industry has been forced to use fused alumina which is very expensive, costing about 10¢ per pound or \$200.00 per ton. At the present time there is no production of garnet in Canada.

The sand-blasting trade is using larger tonnages yearly and a substitution of garnet for silica sand makes for a more efficient and

effective job especially since the garnet can be recovered for further use by electro-static methods. Steel foundries and aircraft casting manufacturers are employing sand-blasting techniques on a vastly greater scale each year and could use considerable quantities of garnet if it was available.

#### BIOTITE:

The biotite (dark) mica forms about 18% of the Mattawa ore and has been successfully separated by magnetic means the same as the garnet with a recovery of 80%. The Blackburn Bros. of Ottawa grind biotite-mica and are constantly searching for raw material and are paying upwards of \$25.00 per ton for such material. The ground micas go to the roofing manufacturers for backing asphalt shingles and mineral surfaced rolled roofings. The rubber manufacturers use the ground dark micas for dusting on car tubes etc. and the price for this product, ready for use, is approximately \$42.00 per ton in bags. Biotite, like muscovite, is ideal for corrosion-resisting pipe line coating for below-ground installations.

#### CONCLUSION:

The Mattawa deposit of kyanite, muscovite, garnet and biotite which contains upwards of 50,000,000 tons of ore to a depth for efficient open pit operation could prove to be of inestimable importance to Canada's industrial growth now and over the next twenty years. It is hardly necessary to stress the importance of such a storehouse of important strategic materials as the kyanite and the muscovite in the event of a national emergency, when present sources of these minerals which are outside of North American continent may be suddenly discontinued.

The deposit lends itself favourably to an open-pit operation for several years before it would be necessary to go to underground

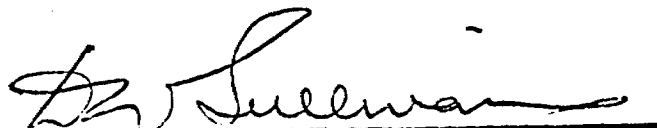


methods of mining. Production could be started almost immediately.

Considerable research has already been done on the ore by the Mines Branch at Ottawa with favourable results. An official of the Mines Branch has stated that the Mattawa kyanite is of exceptionally good grade and is the best to date they have encountered in their investigations and it is planned that in the near future considerable research work is to be done especially on the flotation of the kyanite.

It must be kept foremost in mind that the marketing of the economic minerals from this deposit is of greatest importance and that considerable detailed research will be required to make any operation successful. A large and aggressive sales organization under experienced guidance will of necessity be required.

Very limited research into existing markets and prices has indicated there is an excellent opportunity to develop a profitable industry around the Mattawa deposit. Personal discussions with persons familiar with the Industrial Mineral situation has indicated there is a good opportunity of expanding existing markets with the start of production.



D. W. Sullivan, B. Sc.  
Prof. Engineer, Ontario.

NORTH CAROLINA STATE UNIVERSITY  
MINERALS RESEARCH LABORATORY

Asheville, North Carolina

CHEMICAL ANALYSIS RECORD

Date: 11/1/73

Copies to: Mr. Jack Brettler (2)

Analysis requested by:

Kind of sample: "Kyanite Assays" - Crocan Lake Kyanite Deposit - Mattawa,  
Ontario, Canada; for Arrowhead Silica Corporation.

Analyze for: Check Analyses

Sample No. As Below

Lab. No. 4161

ANALYSIS

Note: This analysis is representative only of the sample submitted and is not to be construed to guarantee the integrity, quality, or size of any particular mineral deposit. This analysis is part of our regional studies and not to be used for private purposes.

<u>Sample No.</u>	<u>% Kyanite</u>
9531	11.9
9532	12.4
9533	13.8
9551	5.2
9552	11.9
9300	11.3
9301	10.5
9302	11.5
9303	8.5
9304	14.8
9305	17.6
9306	12.8
9307	15.5
9319	14.5
9320	17.0
9317	9.0
9318	14.8
9371	13.0
9372	10.6
9364	13.8
9365	13.5

(9316)

14.2%

*check assay  
received from Brettler  
Nov. 14/73.*

Date Completed: 11/6/73

Analyst:

Remarks

*Philip N. Sales*  
Philip N. Sales

NORTH CAROLINA STATE UNIVERSITY  
MINERALS RESEARCH LABORATORY

RECEIVED OCT 16 1973

Asheville, North Carolina

CHEMICAL ANALYSIS RECORD

Date: 12 October 1973

Copies to: Mr. Jack Brettler (2)

Analysis requested by:

Kind of sample: Kyanite Assays - Crocan Lake Kyanite Deposit - Mattawa, Ontario, Canada; for Arrowhead Silica Corporation.

Analyze for:

Sample No.

Lab. No.

ANALYSIS

Note: This analysis is representative only of the sample submitted and is not to be construed to guarantee the integrity, quality, or size of any particular mineral deposit. This analysis is part of our regional studies and not to be used for private purposes.

Hole No. DDH (5-73) (Vertical)			Hole No. DDH (9-73) (Vertical)		
Sample No.	Interval	percent Kyanite	Sample No.	Interval	Percent Kyanite
9364	2' - 12'	14.2%	9551	5' - 15'	5.0%
9365	12' - 22'	13.8%	9552	15' - 25'	11.0%
9366	22' - 32'	18.3%	9553	25' - 35'	15.1%
9367	32' - 42'	16.5%	9554	35' - 45'	18.0%
9368	42' - 52'	14.0%	9555	45' - 55'	18.6%
9369	52' - 62'	13.3%	9556	55' - 65'	16.3%
9370	62' - 70'	9.8%	9557	65' - 75'	17.4%
			9558	75' - 85'	15.2%
			9559	85' - 95'	13.5%
			9560	95' - 105'	16.9%
			9561	105' - 115'	16.3%
			9562	115' - 125'	15.5%
			9563	125' - 135'	16.1%
			9564	135' - 145'	14.5%
			9565	145' - 155'	12.0%
			9566	155' - 165'	15.2%
			9567	165' - 175'	14.8%
			9568	175' - 185'	17.3%
			9569	185' - 195'	17.8%
			9570	195' - 205'	13.5%
			9571	205' - 215'	12.9%

Hole No. DDH (5A-73) (-45°)		
Sample No.	Interval	percent Kyanite
9371	7' - 17'	14.2%
9372	17' - 27'	12.9%
9373	27' - 37'	14.2%
9374	37' - 47'	14.9%
9375	47' - 57'	16.4%
9376	57' - 67'	16.1%
9377	67' - 77'	15.2%
9378	77' - 80'	5.7%

Sample T-Zone

T-Zone - 10.6%

Date Completed: 10/12/73

Remarks

(continued on page 3)

Analyst: *[Signature]*



NORTH CAROLINA STATE UNIVERSITY  
MINERALS RESEARCH LABORATORY

Asheville, North Carolina

CHEMICAL ANALYSIS RECORD

Date:

Copies to: Mr. Jack Brettler (2)

Analysis requested by:

Kind of sample: "Kyanite Assays" - Crocan Lake Kyanite Deposit - Mattawa,  
Ontario, Canada; for Arrowhead Silica Corporation.

Analyze for:

Sample No.

Lab. No.

ANALYSIS

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Hole No. DDH 1-73			Hole No. DDH 7-73		
Sample No.	Interval	Percent Kyanite	Sample No.	Interval	Percent Kyanite
9300	7'- 17'	11.5%	9334	3'- 13'	15.4%
9301	17'- 27'	12.3%	9335	13'- 23'	16.2%
9302	27'- 37'	11.0%	9336	23'- 33'	15.3%
9303	37'- 47'	8.4%	9337	33'- 43'	14.1%
			9338	43'- 53'	14.0%
			9339	53'- 63'	13.4%
			9340	63'- 73'	15.5%
			9341	73'- 83'	15.4%
			9342	83'- 93'	12.6%
			9343	93'-103'	15.4%
			9344	103'-113'	12.8%
			9345	113'-123'	12.5%
			9346	123'-133'	12.1%
			9347	133'-143'	12.7%
			9348	143'-153'	12.7%
			9349	153'-163'	14.7%
			9350	163'-173'	14.9%
			9351	173'-183'	15.8%
			9352	183'-193'	6.6%
			9353	193'-203'	13.2%
			9354	203'-213'	8.9%
			9355	213'-223'	11.7%
			9356	223'-233'	19.0%
			9357	233'-243'	17.8%
			9358	243'-253'	13.4%
			9359	253'-263'	13.8%

Hole No. DDH 2-73

9304	4'- 14'	16.0%
9305	14'- 24'	15.2%
9306	24'- 34'	12.3%
9307	34'- 44'	15.3%
9308	44'- 54'	16.6%
9309	54'- 64'	16.4%
9310	64'- 74'	12.8%
9311	74'- 84'	11.8%
9312	84'- 94'	11.8%
9313	94'-104'	12.3%
9314	104'-114'	11.3%
9315	114'-124'	13.5%

(continued on page 2)

Date Completed:

Remarks

Analyst:

*Oliver H. ...*

NORTH CAROLINA STATE UNIVERSITY  
MINERALS RESEARCH LABORATORY

Asheville, North Carolina

CHEMICAL ANALYSIS RECORD

Date: \_\_\_\_\_ Copies to: Mr. Jack Brettler (2)  
Analysis requested by: \_\_\_\_\_  
Kind of sample: Kyanite Assays - Crocan Lake Kyanite Deposit - Mattawa,  
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Analyze for:

Sample No.

Lab. No.

ANALYSIS

Note: This analysis is representative only of the sample submitted and is not to be construed to guarantee the integrity, quality, or size of any particular mineral deposit. This analysis is part of our regional studies and not to be used for private purposes.

(continued)

Hole No. DDH 8-73 (continued from p. 2)

<u>Sample No.</u>	<u>Interval</u>	<u>Percent Kyanite</u>
9505	165'-175'	11.7%
9506	175'-185'	9.5%
9507	185'-195'	14.4%
9508	195'-205'	17.8%
9509	205'-215'	15.3%
9510	215'-225'	17.2%
9511	225'-235'	16.0%
9512	235'-245'	17.9%
9513	245'-255'	12.9%
9514	255'-265'	14.4%
9515	265'-275'	17.9%
9516	275'-285'	15.5%
9517	285'-295'	14.9%
9518	295'-305'	16.5%
9519	305'-315'	16.7%

9/21/73

P. N. Sales

Date Completed:  
Remarks

Analyst:  
*W. H. Sales*

NORTH CAROLINA STATE UNIVERSITY  
MINERALS RESEARCH LABORATORY

RECEIVED OCT 16 1973

Asheville, North Carolina

CHEMICAL ANALYSIS RECORD

Date: 12 October 1973

Copies to: Mr. Jack Brettler (2)

Analysis requested by:

Kind of sample: Kyanite Assays - Crocan Lake Kyanite Deposit - Mattawa, Ontario, Canada; for Arrowhead Silica Corporation.

Analyze for:

Sample No.

Lab. No.

ANALYSIS

Note: This analysis is representative only of the sample submitted and is not to be construed to guarantee the integrity, quality, or size of any particular mineral deposit. This analysis is part of our regional studies and not to be used for private purposes.

Hole No. DDH <u>4-73</u> (-45°)			Hole No. DDH <u>6-73</u> (-45°)		
Sample No.	Interval	Percent Kyanite	Sample No.	Interval	Percent Kyanite
9531	5' - 15'	12.5%	9379	7' - 17'	16.7%
9532	15' - 25'	11.6%	9380	17' - 27'	24.9%
9533	25' - 35'	11.6%	9381	27' - 37'	17.8%
9534	35' - 45'	14.5%	9382	37' - 47'	16.7%
9535	45' - 55'	12.4%	9383	47' - 57'	15.3%
9536	55' - 65'	13.8%	9384	57' - 67'	15.3%
9537	65' - 75'	15.5%	9385	67' - 77'	13.5%
9538	75' - 85'	15.1%	9386	77' - 87'	12.6%
9539	85' - 95'	16.0%			
9540	95' - 105'	12.3%			
9541	105' - 115'	10.7%			
9542	115' - 125'	15.1%			
9543	125' - 135'	17.0%			
9544	135' - 145'	15.3%			
9545	145' - 155'	14.7%			
9546	155' - 165'	11.8%			
9547	165' - 175'	14.5%			
9548	175' - 185'	15.6%			
9549	185' - 195'	14.9%			
9550	195' - 205'	15.0%			

Hole No. DDH <u>6A-73</u> (Vertical)		
Sample No.	Interval	Percent Kyanite
9387	8' - 18'	14.2%
9388	18' - 27'	16.2%

(continued on page 2)

Date Completed: 10/12/73

Remarks

Analyst: *[Signature]*

MINEOOLS RESEARCH LABORATORY

Asheville, North Carolina

10/11/73

CHEMICAL ANALYSIS RECORD

Date: 12 October 1973

Copies to: Mr. Jack Brettler (2)

Analysis requested by:

Kind of sample: Kyanite Assays - Crocan Lake Kyanite Deposit - Mattawa, Ontario, Canada; for Arrowhead Silica Corporation

Analyze for:

Sample No.

Lab. No.

ANALYSIS

Note: This analysis is representative only of the sample submitted and is not to be construed to guarantee the integrity, quality, or size of any particular mineral deposit. This analysis is part of our regional studies and not to be used for private purposes.

Hole DDH (13-73) (Vertical) Kyanite Bed			Hole No. DDH (10-73) (Vertical)		
Sample No.	Interval	Percent Kyanite	Sample No.	Interval	Percent Kyanite
9597	10.8'-18.3'	55.2%*	9572	112'-122'	6.0%
			9573	122'-132'	10.6%
			9574	132'-142'	11.6%
			9575	142'-152'	11.0%
			9576	152'-162'	11.6%
			9577	162'-172'	13.8%
			9578	172'-182'	14.2%
			9579	182'-192'	12.7%
			9580	192'-202'	13.3%
			9581	202'-212'	10.6%
			9582	212'-222'	11.2%
			9583	222'-232'	8.4%
			9584	232'-242'	13.5%
			9585	242'-252'	14.6%
			9586	252'-262'	13.1%
			9587	262'-272'	14.3%
			9588	272'-282'	14.1%
			9589	282'-292'	13.7%
			9590	292'-302'	9.1%
			9591	302'-312'	15.3%
			9592	312'-322'	12.9%
			9593	322'-332'	9.8%
			9594	332'-342'	11.5%
			9595	342'-352'	13.2%
			9596	352'-363'	9.9%

\*High in sulfides

Hole No. DDH (10-73) (Vertical)		
Sample No.	Interval	Percent Kyanite
9520	2'-12'	11.5%
9521	12'-22'	11.6%
9522	22'-32'	8.1%
9523	32'-42'	8.1%
9524	42'-52'	8.5%
9525	52'-62'	8.0%
9526	62'-72'	9.9%
9527	72'-82'	16.2%
9528	82'-92'	12.8%
9529	92'-102'	12.9%
9530	102'-112'	12.0%

(continued at top of page)

Date Completed: 10/11/73  
Remarks

P. N. Sales

Analyst: *[Signature]*



D.D. Hole

Mining Claim

1-73	S. 323927
2-73	"
3-73	"
4-73	"
5-73	"
5A-73	"
6-73	"
6A-73	"
7-73	340732
8-73	"
9-73	"
10-73	345897
11-73	340734
12-73	"
13-73	"

DIAMOND DRILL LOG

COMPANY ARMORAD SILICA CORP. Page # 1 of 3

PROPERTY Crocan Lake ~~NETS~~ # 323927

CLAIM

PURPOSE OF HOLE \_\_\_\_\_

Start July 15/73 Hole 1-73 Az. 125° Dip -45°

Finish July 16/73 Lat. 20,942.57 N Dep. 19,852.26 E El. 1100.3

Tests \_\_\_\_\_ BQ Core Length 100'

Footage		Description	Sample No.	Assays.	
From	To				
0	7	BQ Casing			
7	50.2	Garnetiferous biotite gneiss with considerable blady kyanite. Details follow.			
7	17	80°-30° to core axis with 1" quartz stringers at 13.3 and 15'			
17	21.3	30°-60° to core axis with 1/2" quartz stringer at 17.9 N.B. 20-21.3 fine grained, abundant biotite, 20° to core axis			
21.3	31.3	70° to core axis with two 1/2" quartz stringers 25-25.3 carrying garnets to 1/2" diameter. KY (Blades to 1/2")			
31.3	42.2	70-40° to core axis (C.A.) Core shattered at 32.5 (fault?) 1/2" fault gouge 50° to C.A. at 33.8  Core shattered 35.6-37(fault?) Two 1/2" quartz stringers at 40. KY (Blades to 1/2")			
42.2	44.2	30° to C.A. intensely sericitic core shattered (fault?)			

C. William Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 2 of 3

PROPERTY Crocan Lake NETS # 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 15/73 Hole 1-73 Az. 125° Dip -45°

Finish July 16/73 Lat. 20,942.57 N Dep. 19,852.26 E El. 1100.3

Tests \_\_\_\_\_ BQ Core Length 100'

Footage		Description	Sample No.	Assays.		
From	To					
44.2	47.0	20° to C.A. 1/2" quartz stringer at 45'				
47.0	48.5	Quartz-glassy, broken, attitude unknown, possibly 20° to C.A. No KY				
48.5	50.2	35° to C.A. 1" quartz stringer at 48.7				
50.2	54.4	80% quartz-intensely siliceous section of the gneiss 25-35° to C.A. Sericitic. Local minor garnets.				
54.4	55	Garnetiferous biotite gneiss -highly siliceous, consid. sericite, 40° to C.A. Minor fine KY.				
55	56.5	80% quartz as 50.2-54.4 with several fault planes. Hole caving and 1/2" fault gouge at 55.6 Core shattered.				
56.5	60	Garnetiferous biotite gneiss -45° to C.A. 57.9-58.2 80% quartz				
60	100	Biotite gneiss-65° to C.A. Numerous conformable quartz & feldspar stringers. Traces of chalcopyrite at 63 and 63.7 also 74-75 (less than 1/4% Cu)				

Canadian Lignite  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_





DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 2 of 2

PROPERTY Crocan Lake CLAIMS. # 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 17/73 Hole 2-73 Az. 125° Dip -45°

Finish July 19/73 Lat. 21,070.38 N Dep. 19,660.74 E El. 1122.1

Tests \_\_\_\_\_ BQ Core Length 200'

Footage		Description	Sample No.	Assays.
From	To			
74	84	as above. 1" quartz stringer 81.3		
84	94	as above.		
94	104	as above. 1/2" quartz stringers at 96.9 and 98.6		
104	114	as above. 1" quartz stringer at 104. 1/2" quartz stringer at 106.7		
114	124	as above. N.B. 118.5-119.6 numerous 1/2" garnets in chlorite ground mass (less than 1% KY)		
124	130.5	as above.		
130.5	134.2	Highly siliceous 80% quartz, 80° to C.A.		
134.2	135	as 124-130.5		
135	137.4	as 130.5-134.5		
137.4	141	as 124-130.5		
141	200	Biotite gneiss 80-90° to C.A. Local minor KY to 143. Occasional conformable quartz feldspar bands to 1".  End of hole 200'  N.B. Orientation of gneissosity very consistent throughout the hole.		

DRILLED BY: Canadian Tongyear North Bay, Ontario LOGGED BY: AmBlair

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 1 of 4

PROPERTY Crocan Lake CLAIMS# 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 20/73 Hole 3-73 Az. 125° Dip -45°

Finish July 21/73 Lat. 20,698.11 N Dep. 19,455.82 E El. 1112.3

Tests \_\_\_\_\_ BQ Core Length 197.5'

Footage		Description	Sample No.	Assays.	
From	To				
0	7	BC Casing			
7	185	Garnetiferous biotite gneiss with considerable kyanite- Details follow.			
7	17	70-90° to core axis (C.A.) 1" lonsy quartz blebs at 8, 8.2, 10.0, 12.7, 15.1, 15.3 and 15.7-16.0			
17	27	70° to C.A. 1" quartz at 17.1 strong haematized fault slips 19-20.5 and 22.1-22.5 Fault angles 10° to 40° to C.A. N.B. 19-22.5 is highly sericitic and haematized throughout.			
27	37	70° to C.A. Very uniform			
37	47	80° to C.A.			
47	57	80-90° to C.A. 47.4-48.2 70° quartz 54.5-54.8 quartz 80° to C.A.  N.B. 3" each side of this stringer is a concentration of coarse blady kyanite			

DRILLED BY: John Alan Longyear  
North Bay, Ontario

LOGGED BY: \_\_\_\_\_

ARMOUR DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 2 of 4

PROPERTY Crocan Lake N.T.S. # 323927

PURPOSE OF HOLE \_\_\_\_\_  
Claim

Start July 20/73 Hole 3-73 Az. 125° Dip -45°

Finish July 21/73 Lat. 20,698.11 N Dep. 19,455.82 W El. 1112.3

Tests \_\_\_\_\_ BQ Core Length 197.5'

Footage		Description	Sample No.	Assays.
From	To			
		At 56.3 haematized fault slip 40° to C.A.		
57	67	80° to C.A. 1/2" lensy quartz at 61.2 and 66.9		
67	77	80° to C.A. Lensy quartz 68.3 -68.4, 72.8-73.1, 74.9-75.1, 80° quartz 66.5-67 with some coarse blady Y.		
77	87	80° to C.A. 80% quartz 67-67.7 with some coarse blady Y. N.B. Quartz stringers 80.4- 80.6 81.7-81.8 82.1-82.4		
87	97	80° to C.A. Blebbly quartz 88.3-88.5 92.2-92.3 94.6-94.7 95.8-96.6		
97	107	80° to C.A. Lensy quartz 98.5-98.6 98.8-98.9 99.3-99.4 103.6-103.8 (Trace Pyrite at 99.2) N.B. Coarse Y at 99-99.4		
107	117	80° to C.A. Quartz stringers 108.5-108.7 114.5-114.6 1/2" stringers at 115.3 & 115.5		

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_ LOGGED BY: \_\_\_\_\_



DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 3 of 4  
 PROPERTY Crocan Lake ~~MINES~~ # 323927  
 Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 20/73 Hole 3-73 Az. 125° Dip -45°  
 Finish July 21/73 Lat. 20,698.11 N Dep. 19,455.82 E El. 1112.3  
 Tests BQ Core Length 197.5'

Footage		Description	Sample No.	Assays.	
From	To				
117	127	80° to C.A. Quartz stringers 125.8-125.9			
127	137	80° to C.A. Quartz stringers 3" at 128.6 2" at 130.0 1" at 131.5 Traces chalcopyrite at 130.8 Quartz str. 1/2" at 136.2			
137	147	80° to C.A. Quartz stringers 139.4-139.5			
147	157	80° to C.A.			
157	167	80° to 70° to C.A. Quartz stringers 158.9-159 162.4-162.5 1" at 165 166.4-166.5 Smaller crystals than before.			
167	177	70° to C.A. Intense fault shear at 176.2-177.5, highly sericitic, minor NY U.B. 169.8-170.8 abundant garnets to 1" in chlorite groundmass.			
177	185	50° to C.A. Quartz stringers 177.6-177.7 179-179.1  Highly sericitic. Fine NY crystals.			
185	187	Sericitized biotite gneiss, minor garnets, core shattered Canadian Longyear North Bay, Ontario			

DRILLED BY: \_\_\_\_\_ LOGGED BY: \_\_\_\_\_



DIAMOND DRILL LOG

COMPANY ARGONNAD SILICA CORP. Page # 1 of 3

PROPERTY Crocan ~~N.S.~~ # 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 23/73 Hole 4-73 Az. 125° Dip -45°

Finish July 24/73 Lat. 20,977.72 N Dep. 19,437.43 E El. 1126.4

Tests \_\_\_\_\_ BQ Core Length 224.2'

Footage		Description	Sample No.	Assays.	
From	To				
0	5	BQ Casing			
5	221	Garnetiferous biotite gneiss with abundant kyanite throughout. Details follow.			
5	15	90° to core axis (C.A.) 1" lensy quartz bleb at 13.6			
15	25	90° to C.A. Strong haematized fault. 50° to C.A. at 22.1 Est. 12-15% HX			
25	35	90° to C.A. 1" Quartz blebs at 29.3-29.6 31.6-31.7 32.9-33.0 34.9-35.0			
35	45	90° to C.A. 1/2" Quartz stringers at 40.5. Quartz stringers 42.4-42.7 42.8-42.9 43.3-43.7			
45	55	90° to C.A. Blebby quartz 45.2-45.4 48.6-48.7			
55	65	90° to C.A. Weakly haematized 56-65			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 2 of 3

PROPERTY Crocan Lake N.T.S. # 323927  
Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 23/73 Hole 4-73 Az. 125° Dip -45°

Finish July 24/73 Lat. 20,977.72 N Dep. 19,437.43 E El. 1126.4

Tests \_\_\_\_\_ BQ Core Length 224.2'

Footage		Description	Sample No.	Assays.	
From	To				
65	75	90°-80° to C.A. Blebby quartz 68.1-68.4 1" Qtz. stringers 68.7-69.1 1/2" Qtz. stringers 71.5 1/2" Qtz. stringers 72.0 Intensely siliceous 73.6-74.0			
75	85	90° to C.A. Blebby quartz 75.8-75.9 76.2-76.3 78.4-78.5 Coarse blady KY 75.4-76.2 Strongly haematized & with fault slips at 83.2, 83.5, 84.0			
85	95	90° to C.A. 1/2" Quartz stringers at 87, 87.2, 88.2, 88.4			
95	105	80-90° to C.A. 1/2" Qtz. stringer at 95.3			
105	115	80-90° to C.A. Sericitic fault zone 106.3-107.3			
115	125	80°-90° to C.A. Sericitic 1/2" Qtz stringer at 119.1 Quartz 122.4-122.6			
125	135	80-90° to C.A. Fault zone 132.1-132.3 80° to C.A. Quartz 133.1-134.1 Coarse blady KY 134-135			
135	145	80° to C.A. Quartz 135-135.8 Sericitic faults at 137.2, 138, 139.5			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_ LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ARMSTRONG SILICA CORP. Page # 3 of 3

PROPERTY Crocan Lake CLAIM # 323927

PURPOSE OF HOLE \_\_\_\_\_

Start July 23/73 Hole 4-73 Az. 125° Dip -45°

Finish July 24/73 Lat. 20,977.72 N Dep. 19,437.43 E El. 1126.4

Tests \_\_\_\_\_ BQ Core Length 224.2'

Footage		Description	Sample No.	Assays.	
From	To				
145	155	90° to C.A. Haematized falu slips 150-150.6			
155	165	90° to C.A. KY crystals smal- ler sericitic. Quartz bleb 163.4-163.5			
165	175	90° to C.A. Sericitic N.B. The garnets have de- creased in size.			
175	185	90° to C.A. Sericitic			
185	195	90° to C.A. fresher small KY crystals.			
195	206.7	90° to C.A. small KY crystals and garnets.			
206.7	218.1	90° quartz			
218.1	221	Biotite gneiss tiny garnets & Kyanite crystals 80° to C.A.			
221	224.2	Biotite gneiss 90° to C.A. Sparse tiny garnets, rare traces KY. 223-223.2 Feldspathic stringer.  End of hole 224.2			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_ LOGGED BY: AmBlair

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 1 of 2

PROPERTY Crocan Lake ~~NEVADA~~ # 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 25/73 Hole 5-73 Az. \_\_\_\_\_ Dip -90°

Finish July 26/73 Lat 21,109.06 N Dep. 19,934.69 E El. 1129.6

Tests \_\_\_\_\_ BQ Core Length 100.2

Footage		Description	Sample No.	Assays.	
From	To				
0	2	BQ Casing			
2	79.5	Garnetiferous biotite gneiss with abundant kyanite through out. Details follow.			
2	12	80-90° to C.A.			
12	22	Contorted 80°? to C.A. Traces Pyrite at 16.7			
22	32	Contorted 80-30° to C.A.			
32	42	Contorted 30-55° to C.A. Quartz bleb 40-40.3			
42	51	Sericitic 60° to C.A.			
51	53.1	Intense fault seam 60° to C.A. Highly sericitic.			
53.1	63	60°-40° to C.A. Sericitic! 62.2-62.5 quartz stringer			
63	63.8	Fine grained, sericitic, 70° to C.A.			
63.8	67.9	70-50° to C.A.			
67.9	68.5	Coarse blebby garnets to 1" elongated in the chloritic shear. Traces of KY only.			
68.5	70.1	80° to C.A. Garnets to 1"			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP.

Page # 2 of 2

PROPERTY Crocan Lake

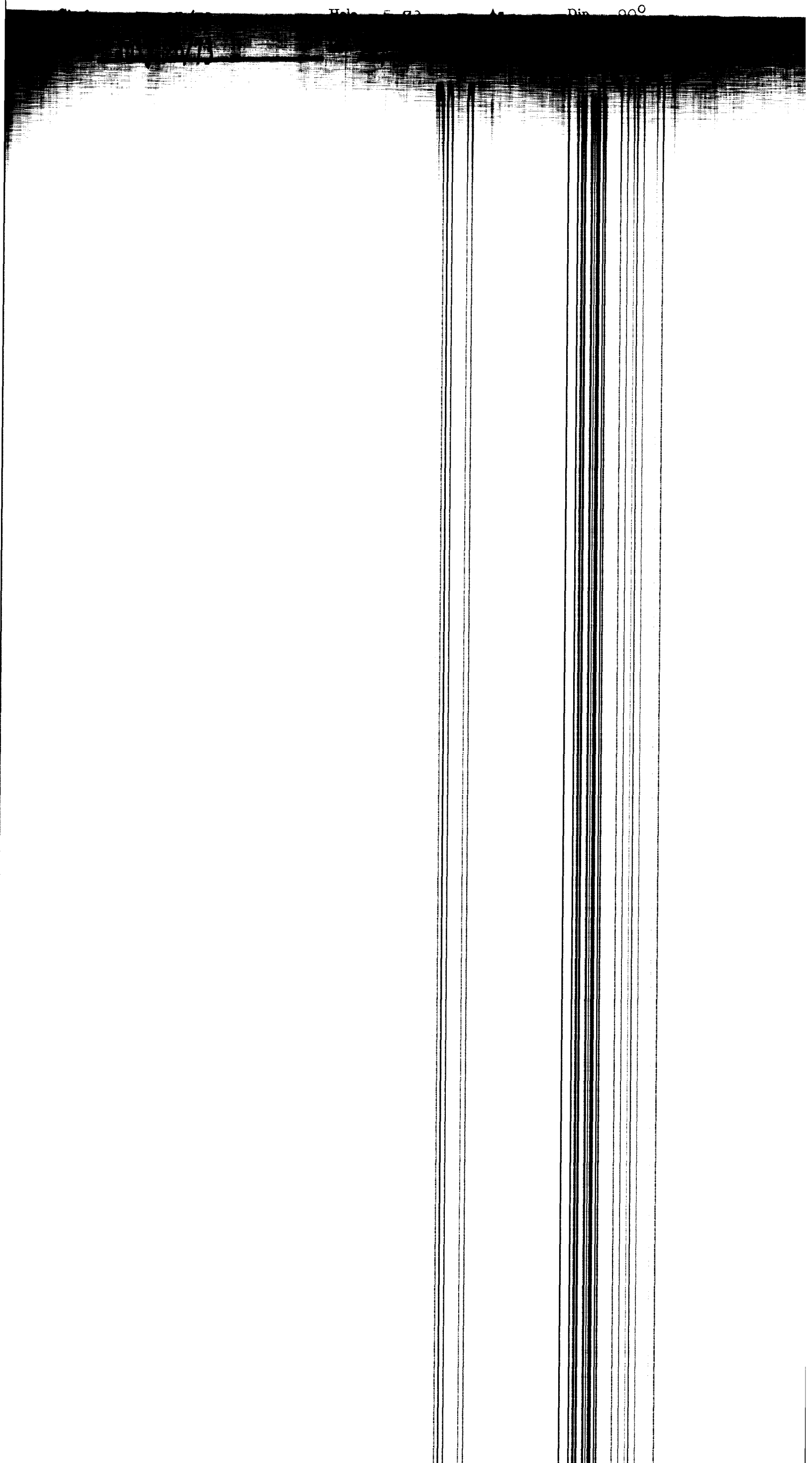
~~MINES~~ # 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Hole # 5-82

Dip 00°



DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP.

Page # 2 of 2

PROPERTY Crocan lake

DIAMOND # 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 25/73

Hole 5-73

Az. \_\_\_\_\_

Dip -90°

Finish July 26/73

Lat. 21,109.06 N

Dep. 19,934.69 W

El. 1129.6

Tests \_\_\_\_\_

BQ Core

Length 100.2

Footage		Description	Sample No.	Assays.		
From	To					
70.7	72.7	90% quartz Trace KY				
72.7	73.5	Tiny garnets and KY crystals. 80° to C.A.				
73.5	74.7	Quartz vein, no KY				
74.7	75.5	as 72.7-73.5 80° to C.A.				
75.5	77	90% quartz Trace KY				
77	79.5	70° to C.A.				
79.5	100.2	Biotite gneiss 80° to C.A. Occasional feldspathic stringers to 1" Very rare tiny kyanite? crystals				
		End of hole 100.2				

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

*R. M. Blain*



COMPANY AIROSHAD SILICA CORP.

Page # 1 of 2

PROPERTY Crocan Lake

NUMBERS # 323927  
Claim

PURPOSE OF HOLE

Start July 26/73

Hole 5A-73

Az. 125° Dip -45°

Finish July 27/73

Lat. 21,105.88 N Dep. 19,939.46 E El. 129.3

Tests

BQ Core Length 100'

Footage		Description	Sample No.	Assays.	
From	To				
0	7	BQ Casing			
7	92.9	Garnetiferous biotite gneiss with considerable Kyanite. Details follow.			
7	17	60° to core axis (CA) 1/2" blobby quartz stringers at 9.5 and 9.7			
17	27	60-80° to C.A. 23.3-23.4 quartz 26.1 limonitic fault slip			
27	37	60-90° to C.A.			
37	47	70-90° to C.A. 1/2" quartz at 42' 1/2" quartz at 44.1			
47	57	70-90° to C.A. 47-47.8 80% enkerite 48.3-48.6 50% quartz Kyanite crystals smaller			
57	67	90° to C.A.			
67	77	70-90° to C.A. 68.3-68.4 quartz			
77	79.8	80° to C.A.			
77.2	77.3	quartz			
79.8	80.2	Highly siliceous tr. Ky. Canadian longyear North Bay, Ontario			

DRILLED BY:

LOGGED BY:

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP.

Page # 2 of 2

PROPERTY Crocan Lake

Notes: # 323927

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 26/73

Hole 5A-73

Az. 125° Dip -45°

Finish July 27/73

Lat. 21,105.88 N Dep. 19,939.46 E El. 1129.3

Tests \_\_\_\_\_

BQ Core

Length

100'

Footage		Description	Sample No.	Assays.	
From	To				
80.2	81.3	As above grey			
81.3	82.3	80% quartz			
82.3	83.0	as 80.2-81.3			
83	84.1	80% quartz			
84.1	85.7	as 80.2-81.3			
85.7	86.1	grey			
86.1	87.9	quartz			
87.9	88.6	90% Biotite local KY			
88.6	92.9	Very finely dispersed KY crystals.			
92.9	100	Biotite gneiss, 80° to C.A. Rare small garnets, no KY seen			
		End of hole 100'			

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

*Rm Blair*

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP.

Page # 1 of 2

PROPERTY Grocan Lake

ENCLOS. # 323927  
Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 28/73

Hole 6-73

Az. 175° Dip -45°

Finish July 28/73

Lat. 20,808,56 N

Dep. 19,965.80 E. 1106.5

Tests \_\_\_\_\_

BQ Core Length 104'

Footage		Description	Sample No.	Assays.	
From	To				
0	7	BQ Casing			
7	99.9	Garnetiferous biotite gneiss with considerable kyanite. Details follow.			
7	17	70° to core axis (CA) 1/2" Quartz stringer at 8.2 1/2" " " " 9.4 1/2" " " " 12.5 13.5-13.8 60% quartz 15.6-15.8 quartz 16.0-16.7 80% quartz trace pyrrhotite			
17	27	80° to C.A. 1 quartz at 24.9 coarse blady KY at 18'-20'			
27	37	80° to C.A.			
37	47	80° to C.A. 1/2" quartz at 38.7 40.2-40.4 quartz 1/2" Quartz at 43.1 1/2" Quartz at 43.9			
47	57	80° to C.A. limonitic fault seam at 55.5-56.2			
57	67	70° to C.A. limonitic fault slips from 57.5-60.5 63.3-63.6 Quartz/ankerite			
67	77	70° to C.A. 67.2-67.3 quartz 1/2" Quartz at 70.8			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ARMOURHEAD SILICA CORP.

Page # 2 of 2

PROPERTY Crocan Lake

N.T.S. # 323927

PURPOSE OF HOLE \_\_\_\_\_  
Claim

Start July 28/73

Hole 6-73

Az. 125° Dip -45°

Finish July 28/73

Lat. 20,808.56 N

Dep. 19,965.80 E El. 1106.5

Tests \_\_\_\_\_

BQ Core

Length 104'

Footage From	To	Description	Sample No.	Assays.
		1/4" quartz at 75.8		
		limonitic fault slip at 76.5		
77	87	70° to C.A. 83.5-83.7 quartz		
87	90	70° to C.A. limonitic fault slip at 90'		
90	92	60° to C.A. Very siliceous numerous 1/4" quartz stringers		
92	99.9	60° to C.A. sericitic very tiny KY crystals 97-99.9 numerous sericitic fault slips core shattered (97.3-98 quartz)		
99.9	101.7	Biotite gneiss-haematized, 60° to C.A. no Ky seen.		
101.7	104.0	Dyke-dark green chloritic fine leucoxene throughout. locally epidotized. No KY End of hole 104.0		

Canadian Longyear  
North Bay, Ontario

DESIGNED BY: \_\_\_\_\_

LOGGED BY: *Probleau*

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP.

Page # 1 of 1

PROPERTY Crocan Lake

NxTxS. # 323927  
Circin

PURPOSE OF HOLE

Start July 28/73

Hole 6A-73

Az. Dip -90°

Finish July 29/73

Lat. 20,810.13 N Dep. 19,963.62 B El. 1106.5

Tests BC Core Length 50.5'

Footage		Description	Sample No.	Assays.	
From	To				
0	8	BC casing			
8	34.5	Garnetiferous biotite gneiss Considerable Kyanite—details follow.			
8	18	80° to C.A. 8.1-8.3 quartz			
18	27	Contorted 80°-40° to C.A.			
27	34.5	80° to C.A. 27-27.5 quartz core shattered, probable faults 29.4-29.8 numerous quartz stringers.			
34.5	50.5	biotite gneiss, no garnets no KY 80-90° to C.A. 38.5-39.1 Pale, sericitic no KY			
		End of hole 50.5			

Canadian Longyear  
North Bay, Ontario

DEVELOPED BY:

LOGGED BY:

*Rm Blair*

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP.

Page # 1 of 5

PROPERTY Crocan Lake

No. 340732  
claim

PURPOSE OF HOLE

Start July 31/73

Hole 7-73 (15)

Az. 125° Dip -45°

Finish Aug. 3/73

Lat. 18,607.34 N

Dep. 18,101.56 E El. 1109.7

Tests Dip @ 250' is -42°

Core Length 327.5'

Footage		Description	Sample No.	Assays.	
From	To				
0	3	30 Casing			
3	298.5	Garnetiferous biotite gneiss with abundant kyanite. Details follow.			
3	13	schistosity contorted 60°-40° to core axis (C...) 1" quartz stringer at 4'.4 irregular blebby quartz 6-7 70% quartz 7.3-8.2			
13	23	70° to core axis (C...) 13.6-14.2 70% quartz 15.6-16.2 80% quartz 1" blebby quartz at 22.8			
23	33	70° to core axis 28.1-28.4 50% quartz 30.7-31.2 four stringers 31.7-32.9 90% blebby quartz			
33	43	70° to core axis 34.5-34.8 quartz stringer 1" stringer at 35.8 36.8-37.1 quartz stringer 37.4-37.5 quartz stringer			
43	53	70° to C.A. 43.0-43.3 quartz stringer 1" quartz stringer 45.3 46.2-47.0 quartz 47.2-47.5 80% quartz str. 47.7-48.4 10% quartz (rolling along core axis)			

Canadian Longyear  
North Bay, Ontario

DRILLED BY:

LOGGED BY:

DIAMOND DRILL LOG

COMP. ARROWHEAD SILICA CORP.

Page # 2 of 5

PROPERTY Crocan Lake

Nat'l. # 340732  
claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 31/73

Hole 7-73 (15)

Az. 125° Dip -45°

Finish Aug. 3/73

Lat. 18,607.34 N

Dep. 18,101.56 E El. 1109.7

Tests @ 250' - dip -42°

DD Core

Length 327.5'

Footage		Description	Sample No.	Assays.	
From	To				
		51.2-52.9 quartz stringers			
53	63	70° to C.A. 54.7-54.9 quartz stringers 55.0-55.3 quartz 57.0-57.1 quartz 58.8-59.0 quartz 60.4-60.8 quartz 1" quartz at 62.4			
63	73	70-80° to C.A. 63.1-63.6 50% quartz 66-66.1 quartz stringer 1" quartz at 68.1 70.3-70.4 70% quartz 1" quartz at 71.7			
73	83	70° to C.A. 1" quartz at 73.5 74.6-74.8 quartz 1" blob at 75.8 77-77.1 quartz 77.3-77.5 quartz			
83	93	70° to C.A. 1" quartz at 84.1 blobby quartz at 84.5-84.7 88.0-89.6 40% quartz stringers Kyanite crystals smaller			
93	103	80° to C.A. 93.4-93.5 quartz 95.4-95.5 quartz siliceous fault at 96.0 1" quartz at 97.8 99.1-99.5 quartz 101.7-101.8 quartz			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY AMERICAN SILICA CORP.

Page # 3 of 5

PROPERTY Crocan Lake

National # 340732  
claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 31/73

Hole 7-73 (15) Az. 125° Dip -45°

Finish Aug. 3/73

Lat. 18,607.34 N Dep. 18,101.56 E El. 1109.7

Tests Dip @ 250' is -42°

30 Core Length 327.5'

Footage		Description	Sample No.	Assays.	
From	To				
103	113	80° to C.A. No quartz			
113	123	1" stringer 113.8 70-80 to C.A. 117.7-117.8 quartz			
123	133	70° to C.A. 129.3-129.4 quartz 130.1-130.2 quartz 132.2-132.3 quartz			
133	143	70-80° to C.A.			
143	153	70° to C.A. Linear traces of chalcopyrite at 146.5 70° to C.A.			
153	163	70° to C.A. 156.1-156.2 quartz 1" quartz at 157.3 159.8-159.9			
163	173	70° to C.A.			
173	183	70° to C.A. 1" Quartz at 173.1 179-179.1 quartz			
183	193	70° to C.A. 186.5-188.4 Sericitic sheared lower in NY 188.4-188.8 Dyke lamprophyric type 80° to C.A. Contacts sheared. 188.8-192.4 sheared sericitic as 186.5-188.4			
193	203	80-90° to C.A. sheared & sericitic throughout			

Canadian longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_



DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICO. CO. LTD.

Page # 4 of 5

PROPERTY Crocan Lake

NxTxS. # 340732

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start July 31/73

Hole 7-73 (15)

Az. 125° Dip -45°

Finish Aug 3/73

Lat. 18,607.34 N Dep. 18,101.56 E Bl. 1109.7

Tests Dip @ 250' is -42°

Core Length 377.5'

Footage		Description	Sample No.	Assays.	
From	To				
203	213	70° to C.A. 204-206 intensely sheared probable fault, 3" quartz stringer at 204.6			
213	223	70° to C.A. 216.6-218 intensely sheared faulted. Highly sericitic.			
223	233	70° to C.A. 226.5-226.7 quartz 230.7-230.8 quartz 232-232.5 70° quartz			
233	243	70° to C.A. 233.5-233.8 quartz 236.6-236.7 quartz			
243	253	70° to C.A. 244.3-244.6 chloritic fault slip. 246.3-246.4 quartz stringer 247.3-247.9 siliceous with 2" clot of biotite at 247.5 Common bledy kyanite 251.7- 252.3			
253	263	70-80° to C.A. 257.1'-258.3 1/2" quartz stringers			
263	273	70° to C.A. at 267 1/2" quartz stringer. at 270.7 1/2" quartz stringer			
273	283	70-80° to C.A. 280.6-7 quartz stringer			

Canadian Longyear  
North Bay, Ontario

PREPARED BY:

LOGGED BY:



DIAMOND DRILL LOG

COMPANY ARMOR WELD SILICA CORP.

Page # 1 of 5

PROPERTY Crocan Lake

NECESS. # 340732  
Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 6/73

Hole 8-73

Az. 125° Dip -45°

Finish Aug 8./73

Lat. 18,783.73 N

Dep. 18,154.94 E El. 1097.4

Tests Dip @ 355' is -43°

BQ Core

Length 355.3'

Footage		Description	Sample No.	Assays.	
From	To				
0	5	BC Casings			
5	318	Garnetiferous biotite gneiss with considerable kyanite. Details follow.			
5	15	Contorted 60-20° to core axis (CA) 5.3-6.0 quartz 6.6-6.7 quartz 8.1-8.6 numerous quartz stringers. 10.7-11.0 quartz 11.2-11.5 70% quartz 14.5-15.0 Fault slip along core			
15	25	40-60° to C.A. 16-17 fault slip along core 17.5-17.6 quartz stringer 18.1-18.3 abundant garnets in siliceous matrix traces of pyrite 18.9-19.1 quartz stringers			
25	35	70° to C.A. 25.8-26.0 quartz 29.7-29.8 " 31.8-32.0 "			
35	45	80° to C.A. 37.1-37.2 quartz 37.8-38 " Trace pyrite 38.5-38.6 " 39.5-39.6 "			

Can dian Iron year  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

# DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 2 of 5

PROPERTY Crocan Lake N.T.S. # 340732

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 6/73 Hole 8-73 Az. 125° Dip -45°

Finish Aug. 8/73 Lat. 18,783.73 N Dep. 18,154.94 E El. 1097.4

Tests Dip @ 355' is -43° BQ Core Length 355.3'

Footage		Description	Sample No.	Assays.	
From	To				
		40-41.5 "			
45	55	60-80° to C.A. 46.2-46.3 quartz 51.7-51.9 " 52.9-53.3 " 54.8-55 "			
55	65	80° to C.A. 56.4-56.7 quartz 1" Bleb of quartz at 58.1 1" Bleb of quartz at 63.4 63.8-64.2 quartz minor pyrite.			
65	75	80° to C.A. 65.4-65.5 quartz 65.8-66.1 " 66.3-66.5 Blebby quartz Trace pyrite 67.7-68.1 quartz 69.9-70 " 70.3-70.4 " 1" quartz at 71.4 Blebby quartz 72.2-72.8			
75	85	80° to C.A. 75.2-75.3 quartz 1" quartz at 77.7 1" Quartz at 84.7			
85	95	80° to C.A. 87-87.4 quartz 88.8-89.2 "			
95	105	80° to C.A. 96.8-97.1 70% quartz 99.6-99.7 quartz Junction Longyear North City			

DRILLED BY:

LOGGED BY:

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 3 of 5

PROPERTY Crocan Lake No. 340732

claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 6/73 Hole 8-73 Az. 125° Dip -45°

Finish Aug. 8/73 Lat. 18,783.73 N Dep. 18,154.94 E El. 1097.4

Tests Dip @ 355' is -43° BQ Core Length 353.3'

Footage		Description	Sample No.	Assays.	
From	To				
		1/2" quartz at 102.8			
105	115	80° to C.A. 105.6-105.7 quartz Fault slip 30° to C.A. at 106. 1/2" quartz bleb at 107.3 1/2" quartz bleb at 112.9 114.0-114.4 Quartz trace PY			
115	125	80° to C.A. 120.6-120.7 quartz trace pyrite. 124-124.1 Quartz 124.5-124.6 "			
125	135	80° to C.A. Crystals smaller than before.			
135	145	80° to C.A. Fault slip 15° to C.A. at 135.5			
145	155	80° to C.A. 145.7-145.9 quartz/ankerite with some PY 146.7-146.8 quartz 1/2" Quartz at 148 1/2" " " 153.2			
155	165	80° to C.A.			
165	175	80° to C.A. Local minor PY 171.5-172.5 on fault slip along core.			
175	185	80° to C.A. 179.7-179.8 quartz 182.7-184 Consid. biotite			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ABRONSILICA CORP. Page # 4 of 5

PROPERTY Crocan Lake ~~MINES~~ # 340732

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 6/73 Hole 8-73 Az. 125° Dip -45°

Finish Aug. 8/73 Lat. 18,783.73 N Dep. 18,154.94 E El. 1097.4

Tests Dip @ 355' is -43° BQ Core Length 355.3'

Footage		Description	Sample No.	Assays.	
From	To				
		strongly sheared 60° to C.A.			
		184.5-184.7 80% quartz			
185	195	80° to C.A.			
		189.8-189.3 quartz			
195	205	80° to C.A.			
		1/8" quartz at 195.6			
205	215	80-90° to C.A.			
215	225	80° to C.A.			
225	235	80-90° to C.A.			
235	245	90° to C.A.			
		1/4" quartz at 241.9			
		242.2-242.4 20% quartz stringers			
245	255	80° to C.A.			
		248.3-249.3 20% quartz stringers			
		250.8-250.9 Quartz stringer			
		251.7-253.3 Chloritic			
		Minor KY			
		253.3-253.7 Dyke-dark green soft chloritic (lamprophyre)			
		253.7-255 chloritic as			
		251.7-253.3			
255	265	80° to C.A.			
		255.1-255.2 quartz			
		259.2-295.3 "			
		(small Crystals)			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_ LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 5 of 5

PROPERTY Crocen Lake ~~N.T.S.~~ # 340732

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 6/73 Hole 8-73 Az. 125° Dip -45°

Finish Aug. 8/73 Lat. 18,783.73 N Dep. 18,154.94 E El. 1097.4

Tests Dip @ 355' is -43° DD Core Length 355.3'

Footage		Description	Sample No.	Assays.	
From	To				
265	275	70° to C.A. 268.5-268.8 30% quartz			
275	285	80° to C.A. 278-278.5 Quartz 280.2-280.3 " 280.5-280.6 " 283.5-283.8 " Minor KY Small crystals			
285	295	80° to C.A. small crystals			
295	305	80° to C.A. small crystals			
305	315	80-60° to C.A. 314.6-314.8 Quartz small crystals			
315	318	80° to C.A. 316.3-317.2 40% quartz 317.7-318 quartz ankerite			
318	355.3	Biotite gneiss 80° to C.A. No garnets no kyanite 349.3-349.5 quartz feldspar stringer 353.1-353.8 quartz  End of hole 355.3			

DRILLED BY: Canadian Longyear North Bay, Ontario LOGGED BY: Rm Blasi

# DIAMOND DRILL LOG

COMPANY ARMONIA SILICA CORP. Page # 1 of 3

PROPERTY Crocan Lake Plot # 340732

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 9/73 Hole 9-73 Az. \_\_\_\_\_ Dip - 90°

Finish Aug. 11/73 Lat. 18,606.86 N Dep. 18,311.86 E El. 1098.7

Tests \_\_\_\_\_ BQ Core \_\_\_\_\_ Length 219.2

Footage		Description	Sample No.	Assays.	
From	To				
0	5	BQ Casing			
5		Garnetiferous biotite gneiss with considerable kyanite. Details follow.			
5	15	Contorted, 50°-30° to C.A.			
15	25	40°-50° to C.A. 17.9-18.2 quartz 19.1-20.8 quartz			
25	35	50° to C.A. 26.6-27.7 quartz			
35	45	50° to C.A.			
45	55	50° to C.A.			
55	65	50° to C.A. 1/2" quartz at 57.5, 61.8			
65	75	30° to C.A.			
75	85	60° to C.A.			
85	95	60° to C.A.			
95	105	50-60° to C.A.			
105	115	50° to C.A. 109.4-110.2 quartz 1" blebby quartz at 106.5			

N.B. KY is very coarse at 109.2

DRILLED BY: Canadian Longyear North Bay, Ont. Co.

LOGGED BY:



DIAMOND DRILL LOG

COMPANY MINERAL SILEX CORP. Page # 2 of 3  
 PROPERTY Crook Lake NEQS. # 340732  
 PURPOSE OF HOLE \_\_\_\_\_ Claim

Start AUG. 9/73 Hole 9-73 Az. \_\_\_\_\_ Dip - 90°  
 Finish AUG. 11/73 Lat. 18,606.86 N Dep. 18,311.86 E El. 1098.7  
 Tests \_\_\_\_\_ 30 Core \_\_\_\_\_ Length 219.2

Footage		Description	Sample No.	Assays.	
From	To				
115	125	50° to C.A. 116-116.4 quartz 116.6-116.9 40% quartz N.P. 119-121 sericitic, with fault seam 40° to C.A. 120.6			
125	135	60° to C.A. 130.7-131 quartz			
135	145	contorted 50°? to C.A. 140.6-140.7 quartz 140.9-141 quartz 141-143.5 Intensely sericitic. Probably a fault zone. (small crystals)			
145	155	50° to C.A. 1/2" quartz 153.4 154.4-155 60% quartz 80% to C.A.			
155	165	60-40° to C.A. 155-155.6 Intensely sericitic Strongly sheared 80° to C.A. (small crystals)			
165	175	50° to C.A. 1/2" quartz 167 and 168.3 171.2-172.1 Dyke-dark green chlorite lanprophyre 35° to C.A. 173-173.1 quartz, 173.3-173.4 quartz.			
175	185	50° to C.A. 177-177.2 Two quartz stringers. (small crystals)			

Canadian Longyear  
 North Bay, Ontario

DRILLED BY: \_\_\_\_\_ LOGGED BY: \_\_\_\_\_



DIAMOND DRILL LOG

COMPANY WINDFIELD SILICA CORP. Page # 1 of 6

PROPERTY Crocan Lake IDENTITY # 345897

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 13/73 Hole 10-73 Az. \_\_\_\_\_ Dip - 90°

Finish Aug 17/73 Lat. \_\_\_\_\_ Dep. \_\_\_\_\_ El. \_\_\_\_\_

Tests \_\_\_\_\_ BC Core \_\_\_\_\_ Length 434.2

Footage		Description	Sample No.	Assays.
From	To			
0	2	DD Casing		
2	434.2	Garnetiferous biotite gneiss with considerable Kyanite (KY). Details follow		
2	12	60° to core axis C.A. 3" quartz at 3.6 4.1-4.4 30% quartz 9.8-9.9 quartz. Highly sericitic throughout, the KY crystals being small.		
12	22	60° to C.A.-sericitic 13-13.1 quartz 14.3-14.6 quartz 18-18.3 Two 1/2" quartz stringers 19.3-19.8 30% quartz (tiny crystals)		
22	32	60° to C.A.-sericitic Quartz 24.3-24.4 Quartz 24.7-25.0 Quartz 26.0-26.2 Quartz 31.7-32 60% quartz		
32	42	60° to C.A.-sericitic 39.5-39.6 Quartz 39.8-39.9 Quartz 40.5-40.6 Quartz		
42	52	60-70° to C.A.-sericitic 50.3-50.7 Quartz		

Canadian Longyear  
North Bay, Ontario

DRILLED BY:

LOGGED BY:

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 2 of 6

PROPERTY Crocan Lake ~~747775~~ # 345897

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 13/73 Hole 10-73 Az. \_\_\_\_\_ Dip - 90°

Finish Aug. 17/73 Lat. \_\_\_\_\_ Dep. \_\_\_\_\_ El. \_\_\_\_\_

Tests \_\_\_\_\_ BQ Core \_\_\_\_\_ Length 434.2

Footage		Description	Sample No.	Assays.	
From	To				
52	62	70° to C.A.-sericitic 61.3-61.4 Quartz			
62	72	70° to C.A. less sericitic 62.8-63.8 60% Quartz 64.4-64.7 80% Quartz 70.7-72 Quartz/Feldspar KY-small crystals			
72	82	70-80° to C.A. unsheared 72-72.4 Quartz 75.2-75.3 Quartz 75.4-75.5 Quartz 75.7-75.8 Quartz 76.5-76.7 Quartz 77.2-77.3 Quartz 78.9-79.0 Quartz 79.4-80 Four quartz stringers KY-tiny crystals			
82	92	70° to C.A. 82.7-82.8 Quartz 83.1-83.2 Quartz 85.9-86.3 Quartz 87.5-88.7 Four 1/2" stringers of quartz. 88.7-89.3 60% quartz minor KY 89.5-90 40% quartz 90.6-91 Quartz KY-small crystals			
92	102	70° to C.A. sericitic, sheared. 92.6-92.9 60% Quartz 100.5-102 Four 1/2" quartz stringers. KY-small crystals			

DRILLED BY: Canadian Longyear North Bay, Ontario LOGGED BY: \_\_\_\_\_

**DIAMOND DRILL LOG**

COMPANY FRONTIERS SILICA CORP. Page # 3 of 6

PROPERTY Crocan Lake NETAS # 345897

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 13/73 Hole 10-73 Az. \_\_\_\_\_ Dip - 90°

Finish Aug. 17/73 Lat. \_\_\_\_\_ Dep. \_\_\_\_\_ El. \_\_\_\_\_

Tests \_\_\_\_\_ BQ Core Length 434.2

Footage		Description	Sample No.	Assays.		
From	To					
102	112	70° to C.A. sericitic. 104.5-104.7 quartz 104.8-105.0 40% quartz 106.9-107.1 quartz NY-small crystals				
112	122	70° to C.A. sericitic. 115.5-115.6 quartz 118.6-119.0 quartz 120.2-120.4 quartz 120.6-120.9 quartz				
122	132	70° to C.A. sericitic. 132.4-132.5 quartz 130.7-131.5 Four 1" quartz stringers.				
132	142	70° to C.A. sericitic 135-136.4 Five 1" quartz stringers. 136.4-136.6 Quartz 138-138.2 Quartz 138.5-138.7 Quartz 141-141.1 Quartz 141.4-141.7 Quartz				
142	152	70° to C.A. sericitic. 147-149.2 Intense fault zone. 12" of fault gouge, local brecciated quartz.				
152	162	70° to C.A. sericitic. 157-147.1 quartz				
162	172	70° to C.A. sericitic 1" quartz at 168				

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

DIAMOND DRILL LOG

COMPANY ARROWHEAD SILICA CORP. Page # 4 of 6

PROPERTY Crocan Lake N.Z.P.S. # 345897

Claim

PURPOSE OF HOLE \_\_\_\_\_

Start Aug. 13/73 Hole 10-73 Az. \_\_\_\_\_ Dip - 90°

Finish Aug. 17/73 Lat. \_\_\_\_\_ Dep. \_\_\_\_\_ El. \_\_\_\_\_

Tests \_\_\_\_\_ BQ Core \_\_\_\_\_ Length 434.2

Footage		Description	Sample No.	Assays.		
From	To					
172	182	70° to C.A. sericitic. 176.2-176.3 quartz				
182	192	70° to C.A. sericitic 182.5-182.8 Two" quartz stringers.				
192	202	Contorted 20°-70° to C.A. 195.7-195.8 quartz 20° to C.A.				
202	212	Contorted 10°-60° to C.A. Highly sericitic. Estimated 8-10% IY				
212	222	Contorted, 20-50° to C.A. 217.8-220 quartz vein.				
222	232	60° to C.A. sericitic! 224.4-226.5 sericitic, limeonitic with local blebby quartz. Probable fault zone.				
232	242	40-60° to C.A. sericitic.				
242	252	70° to C.A. sericitic.				
252	262	70° to C.A. sericitic. 252.8-252.9 quartz. 254.6-254.7 quartz 255.3-255.4 quartz 256.1-256.2 quartz 259-259.1 quartz				
262	272	70° to C.A. sericitic 266.5-267 quartz-ankerite.				

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_

LOGGED BY: \_\_\_\_\_

**DIAMOND DRILL LOG**

COMPANY PROBAND SILICA CORP. Page # 5 of 6

PROPERTY Crocan Lake NOTES # 345097

PURPOSE OF HOLE \_\_\_\_\_ Claim

Start Aug. 13/73 Hole 10-73 Az. \_\_\_\_\_ Dip - 90°

Finish Aug. 17/73 Lat. \_\_\_\_\_ Dep. \_\_\_\_\_ El. \_\_\_\_\_

Tests \_\_\_\_\_ BQ Core \_\_\_\_\_ Length 434.2

Footage		Description	Sample No.	Assays.		
From	To					
272	282	70° to C.A. 273.4-273.5 quartz 273.8-274.6 quartz 275.8-276.0 quartz				
282	292	70° to C.A. 282.9-283.4 quartz 286.6-286.7 quartz stringers				
292	302	70° to C.A. 291.2-292.4 quartz 294.5-295.8 quartz 295.9-296.3 quartz (some Y) 296.8-297.5 quartz-carbonate				
302	312	70°-80° to C.A. 302.8-303.6 40% quartz stringers. 309.4-309.5 quartz				
312	322	80° to C.A.				
322	332	80° to C.A. Minor Calcite at 326.2				
332	342	80° to C.A. 332.1-332.2 Quartz				
342	352	80° to C.A.				
352	362	80° to C.A. 357.2-357.3 quartz				
362	372	70°-80° to C.A. sericitic				
372	382	50° to C.A. 373.4-376.0 Intense fault shear 60° to C.A. Highly sericitic.				

DRILLED BY: Canadian Longyear North Bay, Ontario LOGGED BY: \_\_\_\_\_





DIAMOND DRILL LOG

COMPANY FRONTIER SILICA CORP. Page # 1 of 1

PROPERTY Crook Lake NYTS # 340734

PURPOSE OF HOLE \_\_\_\_\_ Claim

Start Aug. 21/73 Hole 11-73 Az. \_\_\_\_\_ Dip - 90°

Finish Aug. 21/73 Lat. 19,107.28 N Dep. 17,155.93 E El. 1050.7

Tests \_\_\_\_\_ BQ Core Length 60'

Footage		Description	Sample No.	Assays.
From	To			
0	4	BQ Casing		
4	13.7	Metasediments-dark grey, soft chloritic, with local minor epidote. Blebby coarse pyrrhotite and pyrite closely associated with short (to 3") quartz blebs, and also disseminated throughout the metasediment to 20'. Trend of schistosity 60% to C.A.		
13.7	20.7	Garnetiferous biotite miciss 60-80° to C.A. Pyrite crystals throughout. Details follow.		
		13.7-20.7 Small crystals grading, to very coarse, semi massive PY at 20.7		
20.7	60	Metasediments as 4-13.7 Pyrrhotite and pyrite throughout, estimated 20% sulphides to 40' then 15% to 58.5 then 15% to 60'		
		End of the hole 60'		

DRILLED BY: Canadian Longyear North Bay, Ontario LOGGED BY: R.M. Blair

DIAMOND DRILL LOG

COMPANY ENLOW'S SILICA CORP. Page # 1 of 1

PROPERTY Crocan Lake ~~TEXTS~~ # 340734

PURPOSE OF HOLE \_\_\_\_\_ Claim

Start Aug 22/73 Hole 12-73 Az. \_\_\_\_\_ Dip - 90 °

Finish Aug 23/73 Lat. 19,137.54 N Dep. 17,118.24 E El. 1048.7

Tests \_\_\_\_\_ BQ Core Length 51.3

Footage		Description	Sample No.	Assays.	
From	To				
0	5	BQ Casing			
5	8.1	Biotite gneiss? 80° to C.A. Core broken up. May in part be boulders. 5-5.5 40% biotite with blebby pyrrhotite and pyrite			
		5.5-6.0 considerable fine IX crystals,			
		6.0-6.5 as 5-5.5			
		6.5-8.1 as 5.5-6.0			
8.1	33.7	Metasediments-dark grey 70-80° to C.A. Pyrrhotite and pyrite throughout in coarse and fine dis- seminations, often associat- ed with local blebs of quartz			
33.7	38.0	Biotite gneiss? as 5-8.1 Pyrite throughout and local blebby pyrite.			
38.0	44	Quartz			
44	51.3	Metasediments? with fine Pyrite locally and rare coarse patches. 47.3-47.6 quartz			
		End of hole 51.3			

Canadian Longyear  
North Bay, Ontario

DRILLED BY: \_\_\_\_\_ LOGGED BY: R.M. Blair





31L11SE0006 2.1563 ANTOINE

900

Recorded Holder	Arrowhead Silica Corporation
Township or Area	Butler and Antoine Townships

Type of survey and number of Assessment days credit per claim	BENEFICIATION STUDIES
<p><b>Geophysical</b></p> <p>Electromagnetic _____ days</p> <p>Magnetometer _____ days</p> <p>Radiometric _____ days</p> <p>Induced polarization _____ days</p> <p>Section 86 (18) <u>see across</u> _____ days</p> <p><b>Geological</b> _____ days</p> <p><b>Geochemical</b> _____ days</p> <p>Man days <input type="checkbox"/>                      Airborne <input type="checkbox"/></p> <p>Special provision <input type="checkbox"/>                      Ground <input checked="" type="checkbox"/></p>	<p><b>Location of the surface samples:</b></p> <p>S. 340761 - 2 - 3</p> <p style="padding-left: 40px;">340743</p> <p style="padding-left: 40px;">340773 - 4</p> <p style="padding-left: 40px;">342726</p> <p>Amount expended on assaying of 185 samples = \$4,625.00.</p> <p>Total assessment days credit allowed = 308</p> <p>The above mining claims may be grouped under Section 85(6) of The Mining Act for the purposes of recording the work credits of <u>308</u> days.</p> <p style="text-align:center;"><i>Leo Bernier</i></p> <p>Approved - September 30, 1975</p>
<p><b>Notice of Intent to be issued:</b></p> <p><input type="checkbox"/> Credits have been reduced because of partial coverage of claims.</p> <p><input type="checkbox"/> Credits have been reduced because of corrections to work dates and figures of applicant.</p> <p><input type="checkbox"/> No credits have been allowed for the following mining claims as they were not sufficiently covered by the survey:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	

The Mining Recorder may reduce the above credits if necessary in order that the total number of approved assessment days recorded on each claim does not exceed the maximum allowed as follows: Geophysical — 80; Geological — 40; Geochemical — 40;

Eddy Twp.-M.778

Butler Twp.-M.693

Olrig Twp.-M.1036

Mattawan Twp.-M.859

THE TOWNSHIP OF

ANTOINE

DISTRICT OF NIPISSING

SUDBURY MINING DIVISION

SCALE : 1-INCH = 40 CHAINS

LEGEND

PATENTED LAND	⊕
CROWN LAND SALE	C.S.
LEASES	⊙
LOCATED LAND	Loc.
LICENSE OF OCCUPATION	L.O.
MINING RIGHTS ONLY	M.R.O.
SURFACE RIGHTS ONLY	S.R.O.
ROADS	—
IMPROVED ROADS	—
KINGS HIGHWAYS	—
RAILWAYS	—
POWER LINES	—
MARSH OR MUSKEG	—
MINES	X
CANCELLED	C.

NOTES

400' Surface rights Reservation around all Lakes and Rivers.

La Cove and Fournau Development.  
Water Power Lease Agreement No. 25.  
All the unalienated part of the bed of the Ottawa River (Ontario side) in the Township of Antoine, including unalienated islands therein, together with the right to raise the water level and flood Crown Land up to elevation 588 feet above mean sea level, Geodetic survey of Canada Datum.

MINING LANDS -  
DATE OF ISSUE  
MAR - 4 1975  
MINISTRY OF NATURAL RESOURCES

PLAN NO.-M.630

ONTARIO  
MINISTRY OF NATURAL RESOURCES  
SURVEYS AND MAPPING BRANCH

QUEBEC

2.1563



31L115E0006 2.1563 ANTOINE

W.023

BUTLER TP.

W.023

W.023

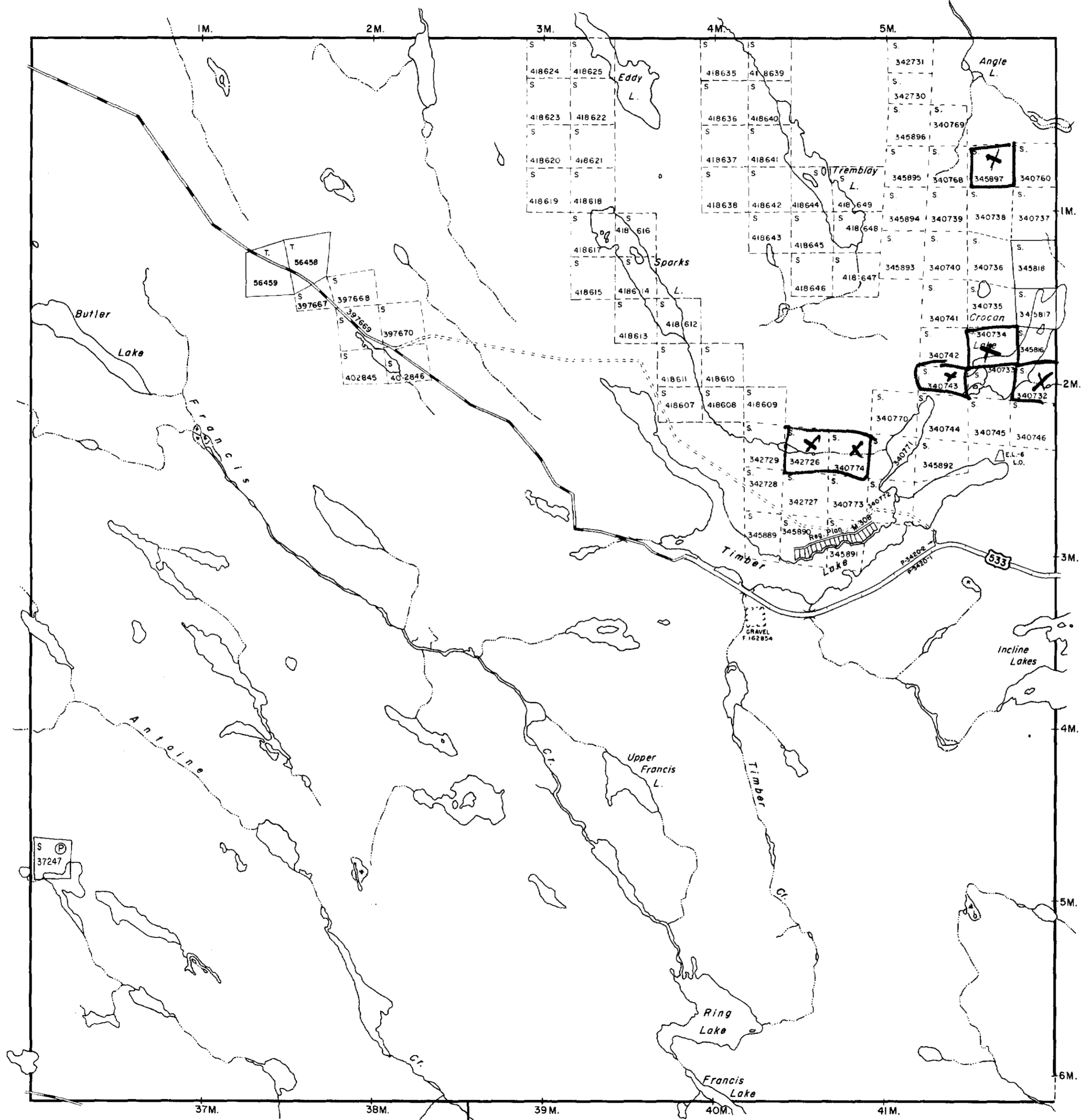
BUTLER TP.

W.023

### EDDY TP. M.778

FRENCH TP. M.818

ANTOINE TP. M.630



### THE TOWNSHIP OF BUTLER

DISTRICT OF NIPISSING

SUDBURY MINING DIVISION

SCALE: 1-INCH=40 CHAINS

#### LEGEND

PATENTED LAND	● or ⊕
CROWN LAND SALE LEASES	⊙
LOCATED LAND	⊙
LICENSE OF OCCUPATION	⊙
MINING RIGHTS ONLY	⊙
SURFACE RIGHTS ONLY	⊙
ROADS	—
IMPROVED ROADS	—
KING'S HIGHWAYS	—
RAILWAYS	—
POWER LINES	—
MARSH OR MUSKOGEE	—
MINES	—
CANCELLED	—
PATENTED S.R.O.	—

#### NOTES

400' surface rights reservation along the shores of all lakes and rivers.

MINING LANDS  
DATE OF ISSUE  
SEP 11 1974  
MINISTRY OF NATURAL RESOURCES

PLAN NO.- M.693

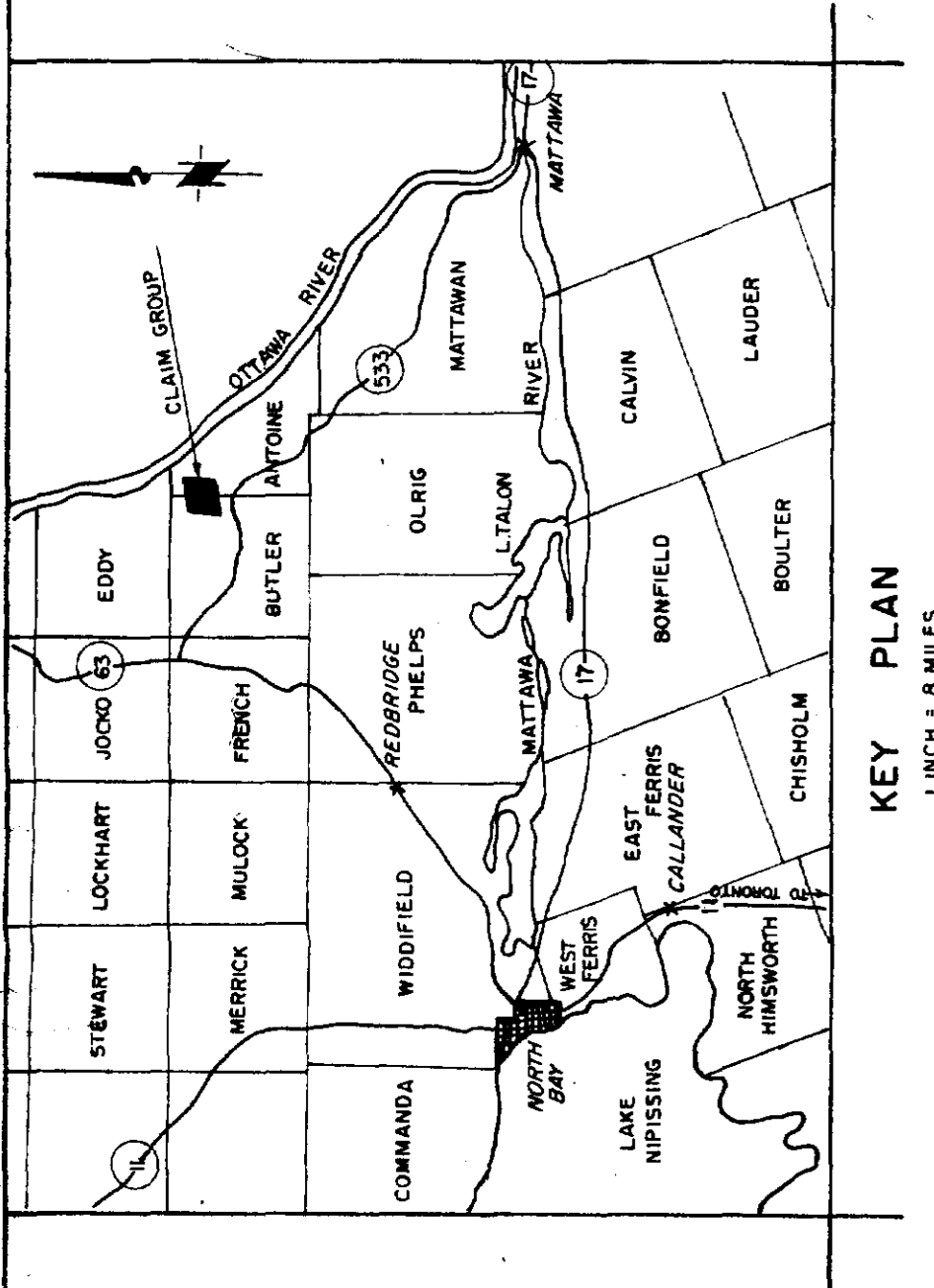
ONTARIO  
MINISTRY OF NATURAL RESOURCES  
SURVEYS AND MAPPING BRANCH

PHELPS TP. M.1057

OLRIG TP. M.1036



31L115E0006 2.1563 ANTOINE



SURFACE KYANITE ASSAYS  
 KYANITE PROPERTY  
 TOWNSHIP OF ANTWERP  
 PARISH OF ORANGE  
 PROVINCE OF MISSISSIPPI  
 SCALE: 1 INCH = 0.5 MILES

NOTE: FIGURE REPRESENTS PER CENTAGE OF MINERAL KYANITE  
 1. E.G. 13.29% KYANITE  
 2. ASSAYS BY C. E. MINERALS - WASHINGTON, GA  
 3. 15 LBS. FRESH ROCK SAMPLES  
 4. TAKEN BY MERIDIAN SERVICES - CALLANDER, ONT.

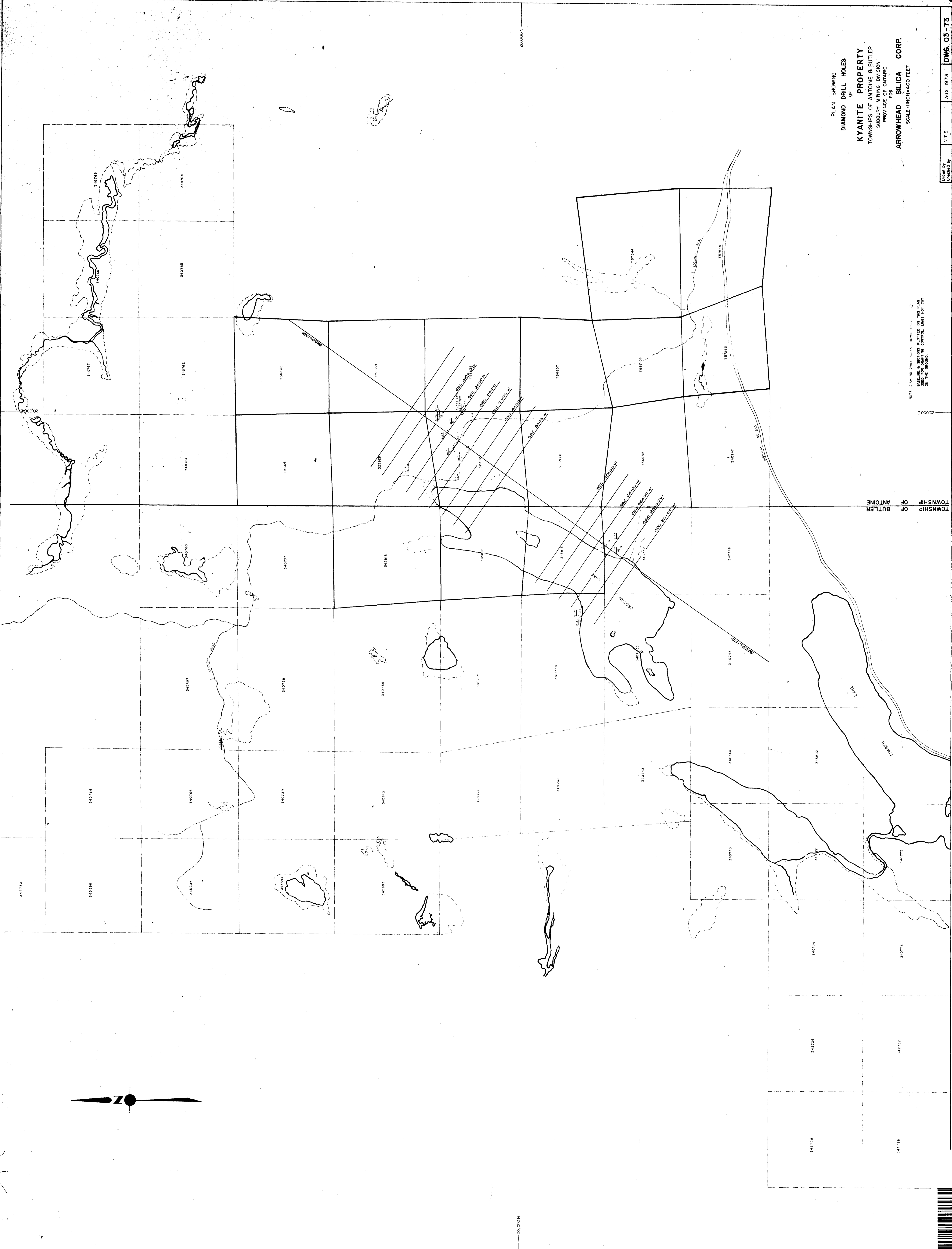
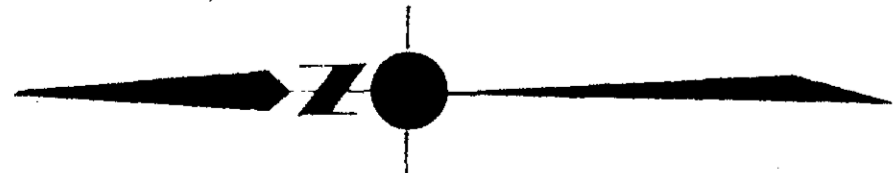
FMB  
 N.T.S.  
 DEC. 1972  
 DWG. 10-73

TWP. OF BUTLER  
TWP. OF ANTWERP

TWP. OF BUTLER  
TWP. OF ANTWERP





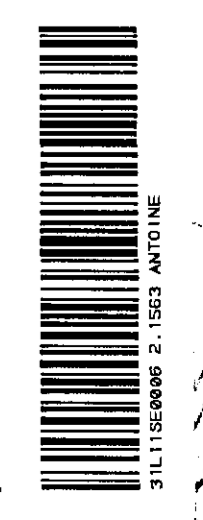


PLAN SHOWING  
DIAMOND DRILL HOLES  
OF  
**KYANITE PROPERTY**  
TOWNSHIPS OF ANTOINE & BUTLER  
SUBURB MINING DIVISION  
PROVINCE OF ONTARIO  
FOR  
**ARROWHEAD SILICA CORP.**  
SCALE: 1 INCH = 400 FEET

NOTE: DRILLING HOLE LOCATIONS SHOWN THIS PLAN ARE APPROXIMATE AND NOT TO BE USED FOR EXACTING CONTROL. USES NOT CUT ON THE GROUND.

TOWNSHIP OF BUTLER  
TOWNSHIP OF ANTOINE

Drawn by: N.T.S.  
Checked by: N.T.S.  
AUG. 1973  
DWG. 03-73





% KYANITE SURFACE  
 11 0.2  
 12 0.4  
 13 0.6  
 14 0.8  
 15 1.0  
 16 1.2  
 17 1.4  
 18 1.6  
 19 1.8  
 20 2.0

% KYANITE SURFACE SAMPLES  
 11 0.2  
 12 0.4  
 13 0.6  
 14 0.8  
 15 1.0  
 16 1.2  
 17 1.4  
 18 1.6  
 19 1.8  
 20 2.0

SURFACE SAMPLE NO.	% KYANITE
340700	0.2
340701	0.4
340702	0.6
340703	0.8
340704	1.0
340705	1.2
340706	1.4
340707	1.6
340708	1.8
340709	2.0
340710	0.2
340711	0.4
340712	0.6
340713	0.8
340714	1.0
340715	1.2
340716	1.4
340717	1.6
340718	1.8
340719	2.0
340720	0.2
340721	0.4
340722	0.6
340723	0.8
340724	1.0
340725	1.2
340726	1.4
340727	1.6
340728	1.8
340729	2.0
340730	0.2
340731	0.4
340732	0.6
340733	0.8
340734	1.0
340735	1.2
340736	1.4
340737	1.6
340738	1.8
340739	2.0
340740	0.2
340741	0.4
340742	0.6
340743	0.8
340744	1.0
340745	1.2
340746	1.4
340747	1.6
340748	1.8
340749	2.0
340750	0.2
340751	0.4
340752	0.6
340753	0.8
340754	1.0
340755	1.2
340756	1.4
340757	1.6
340758	1.8
340759	2.0
340760	0.2
340761	0.4
340762	0.6
340763	0.8
340764	1.0
340765	1.2
340766	1.4
340767	1.6
340768	1.8
340769	2.0
340770	0.2
340771	0.4
340772	0.6
340773	0.8
340774	1.0
340775	1.2
340776	1.4
340777	1.6
340778	1.8
340779	2.0
340780	0.2
340781	0.4
340782	0.6
340783	0.8
340784	1.0
340785	1.2
340786	1.4
340787	1.6
340788	1.8
340789	2.0
340790	0.2
340791	0.4
340792	0.6
340793	0.8
340794	1.0
340795	1.2
340796	1.4
340797	1.6
340798	1.8
340799	2.0
340800	0.2
340801	0.4
340802	0.6
340803	0.8
340804	1.0
340805	1.2
340806	1.4
340807	1.6
340808	1.8
340809	2.0
340810	0.2
340811	0.4
340812	0.6
340813	0.8
340814	1.0
340815	1.2
340816	1.4
340817	1.6
340818	1.8
340819	2.0
340820	0.2
340821	0.4
340822	0.6
340823	0.8
340824	1.0
340825	1.2
340826	1.4
340827	1.6
340828	1.8
340829	2.0
340830	0.2
340831	0.4
340832	0.6
340833	0.8
340834	1.0
340835	1.2
340836	1.4
340837	1.6
340838	1.8
340839	2.0
340840	0.2
340841	0.4
340842	0.6
340843	0.8
340844	1.0
340845	1.2
340846	1.4
340847	1.6
340848	1.8
340849	2.0
340850	0.2
340851	0.4
340852	0.6
340853	0.8
340854	1.0
340855	1.2
340856	1.4
340857	1.6
340858	1.8
340859	2.0
340860	0.2
340861	0.4
340862	0.6
340863	0.8
340864	1.0
340865	1.2
340866	1.4
340867	1.6
340868	1.8
340869	2.0
340870	0.2
340871	0.4
340872	0.6
340873	0.8
340874	1.0
340875	1.2
340876	1.4
340877	1.6
340878	1.8
340879	2.0
340880	0.2
340881	0.4
340882	0.6
340883	0.8
340884	1.0
340885	1.2
340886	1.4
340887	1.6
340888	1.8
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340890	0.2
340891	0.4
340892	0.6
340893	0.8
340894	1.0
340895	1.2
340896	1.4
340897	1.6
340898	1.8
340899	2.0
340900	0.2
340901	0.4
340902	0.6
340903	0.8
340904	1.0
340905	1.2
340906	1.4
340907	1.6
340908	1.8
340909	2.0
340910	0.2
340911	0.4
340912	0.6
340913	0.8
340914	1.0
340915	1.2
340916	1.4
340917	1.6
340918	1.8
340919	2.0
340920	0.2
340921	0.4
340922	0.6
340923	0.8
340924	1.0
340925	1.2
340926	1.4
340927	1.6
340928	1.8
340929	2.0
340930	0.2
340931	0.4
340932	0.6
340933	0.8
340934	1.0
340935	1.2
340936	1.4
340937	1.6
340938	1.8
340939	2.0
340940	0.2
340941	0.4
340942	0.6
340943	0.8
340944	1.0
340945	1.2
340946	1.4
340947	1.6
340948	1.8
340949	2.0
340950	0.2
340951	0.4
340952	0.6
340953	0.8
340954	1.0
340955	1.2
340956	1.4
340957	1.6
340958	1.8
340959	2.0
340960	0.2
340961	0.4
340962	0.6
340963	0.8
340964	1.0
340965	1.2
340966	1.4
340967	1.6
340968	1.8
340969	2.0
340970	0.2
340971	0.4
340972	0.6
340973	0.8
340974	1.0
340975	1.2
340976	1.4
340977	1.6
340978	1.8
340979	2.0
340980	0.2
340981	0.4
340982	0.6
340983	0.8
340984	1.0
340985	1.2
340986	1.4
340987	1.6
340988	1.8
340989	2.0
340990	0.2
340991	0.4
340992	0.6
340993	0.8
340994	1.0
340995	1.2
340996	1.4
340997	1.6
340998	1.8
340999	2.0
341000	0.2

NOTE: X SAMPLE LOCATION  
 SY SAMPLE NUMBER

NOTE: DRAWING IN METRIC UNITS

PLAN / SHOWING  
 SURFACE SAMPLES NOSE & TIMBER  
 LAKE ZONES  
 KYANITE PROPERTY  
 TOWNSHIPS OF ANTOINE & BUTLER  
 SUDBURY MINING DIVISION  
 PROVINCE OF ONTARIO  
 FOR  
 ARROWHEAD SILICA CORP.  
 SCALE: 1 INCH = 400 FEET  
 J.M. Blair, P.Eng.

Drawn By: [Signature]  
 Checked By: [Signature]  
 N.T.S.  
 AUG 1973  
 DWG. 03-73

TOWNSHIP OF BUTLER  
 TOWNSHIP OF ANTOINE

