REPORT ON THE ARGYLE TOWNSHIP PROPERTY
LARDER LAKE MINING DIVISION
FOR
STEWART CARMICHAEL

S.J. Carmichael Consultants
Kirkland Lake, Ontario

JANUARY 1, 1992
NTS 42 A/2
OPAP # OP91-033

REPORT ON THE ARGYLE TOWNSHIP PROPERTY
DISTRICT OF TIMISKAMING, ONTARIO
FOR
TRINITY EXPLORATIONS
BY S.J. CARMICHAEL CONSULTANTS
JANUARY, 1992

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SUMMARY

This report on the Argyle Township property has been prepared by S.J. Carmichael, B.Sc., FGAC, 42 Rand Avenue East, Kirkland Lake Ontario. It is intended to complete the OPAP reporting obligations, of which Mr. Carmichael has applied for, and been accepted for a total sum of $9,970.00 (nine thousand nine-hundred and seventy). Mr. Carmichael's OPAP grant number is OP91-033. The grant was approved on May 1, 1991.

This report will also be submitted to the Ministry of Northern Development and Mines for assessment credits.

The property comprises nine contiguous staked claims with a total area of 360 acres. The claims are located in the southeast portion of Argyle Township, District of Timiskaming, Larder Lake Mining Division, approximately 12 kilometres west of the town of Matachewan.

The property has been worked in the past by New Kelore Mines (c. 1976-1978) who completed preliminary ground geophysics and recommended additional work including diamond drilling which was never completed. Additional work by R.A. MacGregor in 1987 included an airborne magnetometer and EM surveyed followed by ground reconnaissance sampling. The property has never been drilled.

This years program completed under the OPAP grant included line cutting, ground magnetometer, Max Min-II horizontal loop EM, geological mapping including whole rock analysis and petrographic studies.

Although the claims were staked for their kimberlite possibilities, this program was directed more towards possible nickel-copper mineralization associated with the airborne EM anomalies. The results of the program were both positive and negative. The Max Min II survey was unsuccessful in locating the anomalies due to extreme magnetic interference. On the positive side, norite and noritic gabbro was identified with anomalous nickel assays as high as ***0.15% Ni****. The identification on ground of the AEM anomalies remains important and should be pursued in the next phase of exploration. A simple multi-frequency VLF-EM or other low frequency EM (such as Geoprobe) designed to negate the magnetic interference should aid in pin pointing the anomalies.*

Total expenditures this year were $10,176.72.

Report on the Argyle Township Property

Larder Lake Mining Division

For

Stewart Carmichael

Introduction

This report on the Argyle Township mining exploration property has been prepared by S.J. Carmichael Geological Consultants. It is a summary of work completed during the 1991 season via an OPAP grant and is intended to fulfil both OPAP and assessment obligations. An appropriate program and budget has been included for additional work.

Information on the property is derived from the records of the Ministry of Northern Development and Mines and publications by the Ontario Geological Survey. The author of this report outlined the proposed exploration program and completed the magnetometer survey and geological mapping.

All field work was performed between July and October, 1991.

Property Location, Access and Facilities

The claim group is located in the southeast portion of Argyle Township (NTS 42 A/2), District of Timiskaming and within the Larder Lake Mining Division, approximately 12 kilometres west of Matachewan. Access to the property is via regional road 566 to Beaudin Lake. A trail suitable for ATV vehicles leads from just east of Beaudin Lake to the east portion of the property.

Alternative, and easier access is by boat through Powell Lake and into Ashley Lake which borders the south portion of the claims.

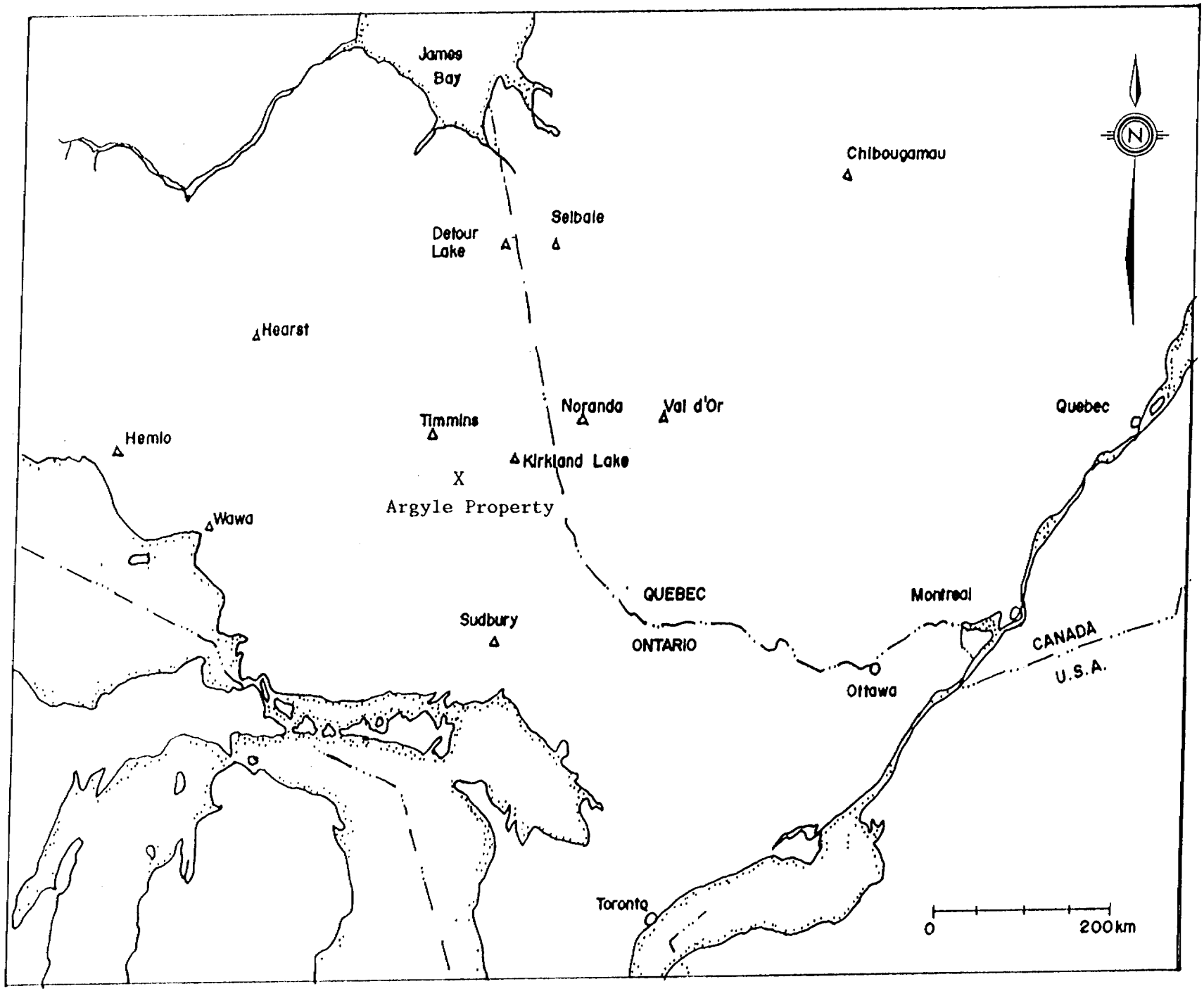


Figure 1 Property Location Map

This is a short 20 minute ride with no portages. Ashley Lake provides an ample source of water for diamond drilling operations. Facilities capable of supporting a mining operation on the property are not present. Both manpower and mining facilities are located in Kirkland Lake, 80 kilometres to the east.

Topography

The topography on the property is quite flat with maximum relief in the order of 10's of feet. The steepest ridge is twenty-foot high esker located in the southeast portion of the property. Two areas of low spruce and cedar swamp trend northwest through the claims and the area around Ashley Lake is swampy. Sandy esker covered by sparse spruce growth covers the west side of Powell Creek.

Land Tenure and Ownership

The Argyle property comprises 9 staked contiguous unsurveyed mining claims with a total area of approximately 360 acres. The claims are held by G. Mullan of Kirkland Lake, Ontario with S. Carmichael holding a 25% interest in the claims. The claim numbers with recorded dates and applied assessment work are listed in the following table:

Claim Number	Recorded Date	Applied Credit	Status
L-1168410	02/04/87	$0.00	requires $400.00 by 02/04/93
L-1168411	02/04/87	0.00	requires $400.00 by 02/04/93
L-1168412	02/04/87	0.00	requires $400.00 by 02/04/93
L-1168413	02/04/87	0.00	requires $400.00 by 02/04/93
L-1168414	02/04/87	0.00	requires $400.00 by 02/04/93
L-1168415	02/04/87	0.00	requires $400.00 by 02/04/93
L-1168416	02/04/87	0.00	requires $400.00 by 02/04/93
L-1168417	02/04/87	0.00	requires $400.00 by 02/04/93
L-1168418	02/04/87	0.00	requires $400.00 by 02/04/93

All claims are in good standing at this time. Assessment credits will have to be applied by February 4, 1993.

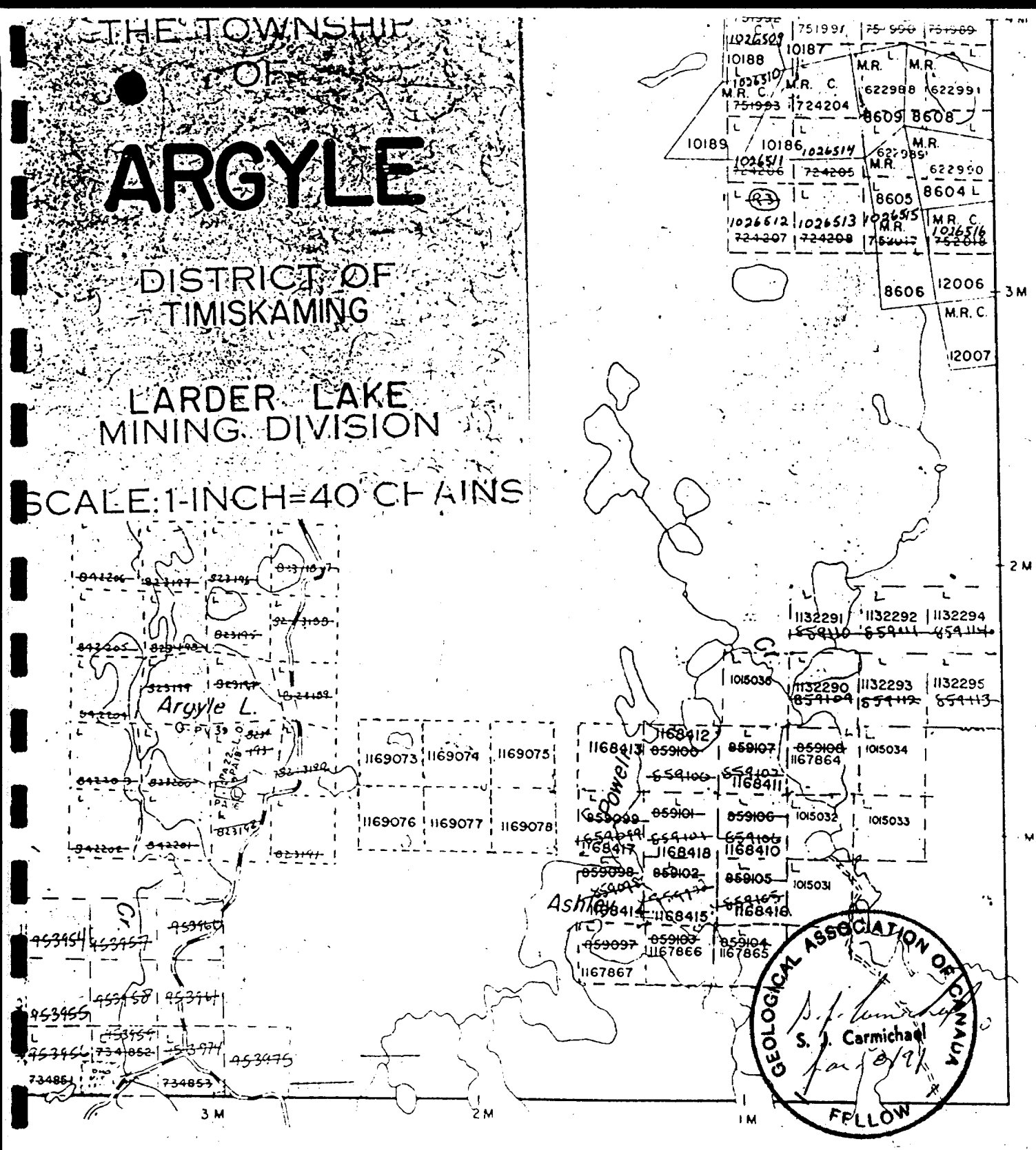
THE TOWNSHIP OF

ARGYLE

DISTRICT OF TIMISKAMING

LARDER LAKE MINING DIVISION

SCALE: 1-INCH=40 CHAINS



Bannockburn Twp.

Raden Twn

Figure 2 Claim Location Map

Property History

Reconnaissance mapping of the area was completed by H.C. Rickaby of the O.D.M. in 1932 at a scale of 1"=3/4 mile. (Map No. 41a, Bannockburn Gold Area). Additional MNDM mapping has not been carried out over the area until the summer of this year when a two-man field crew spent one day in August of the claim group as part of a regional survey.

In 1949, the east portion of the claims were prospected by M. Shahin who located a gold showing on present claim 1168410. Assays as high as $3.50/5.0' were reported. (gold at $32.00/oz.)

In 1974, Argyle Township was flown by an airborne Em and magnetometer survey (Map No. 1018) which clearly showed a circular magnetic feature north of Ashley Lake with three 3-channel Input EM anomalies located within the magnetic feature.

In 1976 New Kelore Mines (work completed by Mid North Engineering) held the ground and completed line cutting and a VLF-EM (EM-16) survey which returned three interesting anomalies. This was followed in 1978 by geological mapping and a Ronka Mark IV HEM survey. The mapping reported that the magnetic feature was caused by an ultramafic to mafic intrusive ranging from peridotite to anorthosite to gabbro intruded into felsic dacite flows and crystal tuff. The HEM survey did not locate any anomalies, however it was reported that the high magnetics may have been interfering with the instrument. Additional work, including I.P. and diamond drilling was recommended bit never completed. New Kelore Mines then allowed the claims to lapse.

The claims were then staked by R.A. MacGregor who completed and airborne magnetometer and EM survey in 1987 followed by a ground reconnaissance bedrock sample program. He also allowed the claims to lapse which were then staked by G. Mullan in early 1991.

Regional Geology

The Argyle claims are underlain by Archean meta-volcanics belonging to the calc-alkaline class. Recent government geological mapping over the area is lacking, however it is thought that the volcanic suite may belong to the Blake River Group. This group is characterised by intermediate to felsic sequences of calc-alkaline chemistry, differing from tholeiitic volcanic type associated with the older Kinojevis mafic to intermediate suite also found in the area to the south. The recently discovered Robertson Township Cu-Zn deposit located 8 miles to the northeast is hosted in a similar calc-alkaline to tholeiitic volcanic suite thought to be part of the Blake River Group.

Property Geology

Geological mapping by this author was completed at a scale of 1:2500 over grid lines cut at 100 meter centres. A total of 14 samples (5 volcanic) were taken for whole rock analysis and 6 samples were submitted for thin section analysis. Two major suites of rock types were noted on the property, those belong to the early volcanics, and those belonging to the intrusive. Late intrusives include diabase and syenitic dikes. These types are listed in the following table:

VOLCANIC SUITE

2a Massive calc-alkaline basaltic flows
3a Andesitic Flows, calc-alkaline, both massive and porphyritic (previously mapped as crystal tuff)
4c Dacite Flows, calc-alkaline

INTRUSIVE SUITE

5b Pyroxenite
5c Peridotite
5d Mica Peridotite (magnetic)
6 Gabbro
6a Norite
7e Diorite +- quartz
7g Tonalite

LATE INTRUSIVES

6c Diabase
7b Syenite

The intrusive body (including tonalite) occupies 80% of the exposed bedrock. Volcanic rocks dominated by calc-alkaline basalt to porphyritic calc-alkaline andesite occupy the extreme east-southeast portion of the claims. These are very fine-grained almost glassy flows, often with a porphyritic texture. Their glassy nature gives the appearance of a crystal tuff but the porphyritic texture indicates flows. One outcrop of calc-alkaline dacite was located, however its composition could only be determined by whole rock analysis. No shearing, faulting, pillow directions or other structural features were found.

The intrusive body consists of a peridotite +- mica-peridotite core roughly 700m x 500m. This unit is highly magnetic, up to 9,000 gammas above background. The peridotite core is surrounded by a narrow 50m wide unit of gabbro +- noritic gabbro which appears to be wider to the east. This unit is in direct contact with the

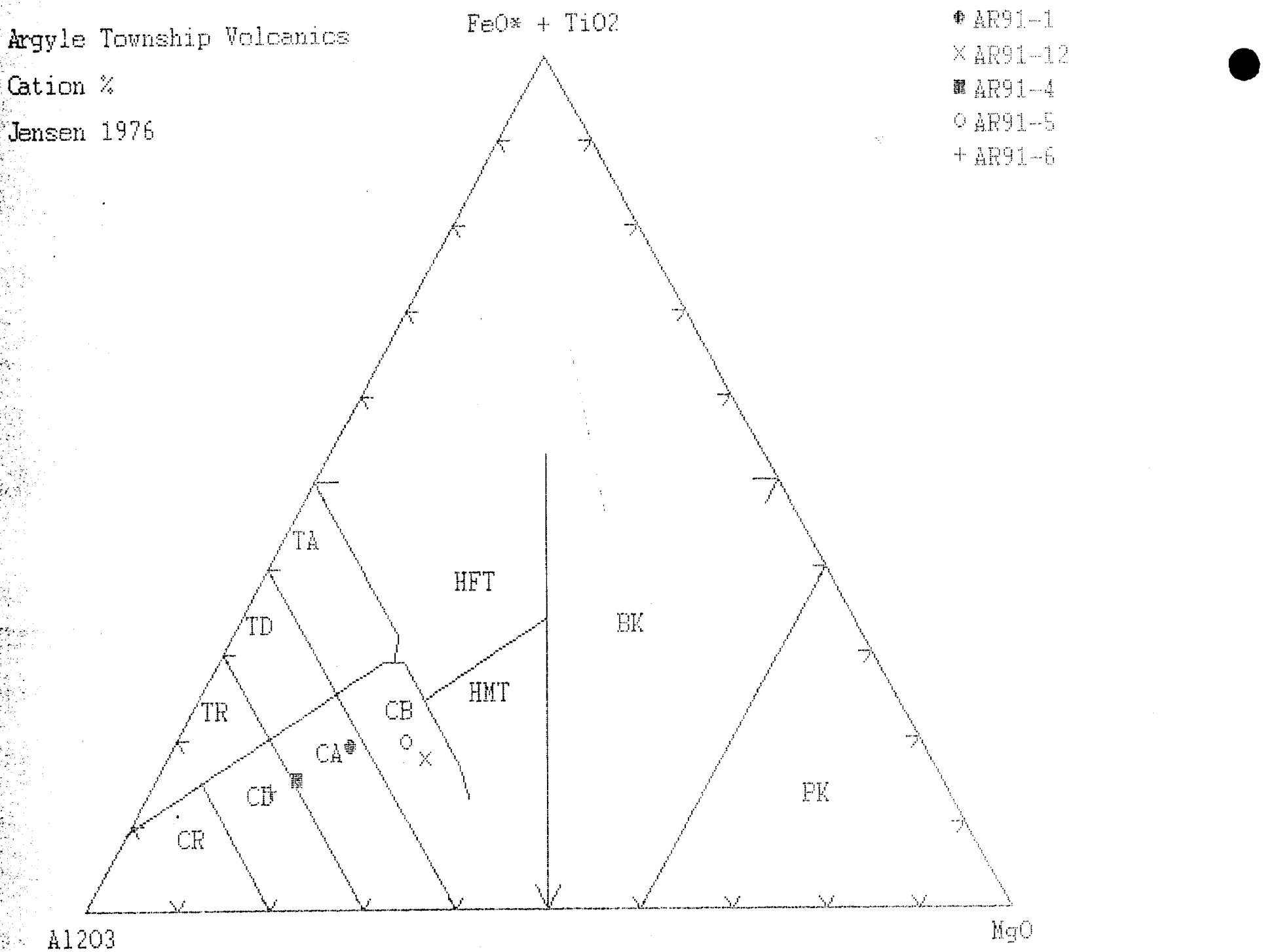


Figure 3 Jenson Cation Plot

volcanics to the east and with tonalite to the north and south. An isolated body of pyroxenite roughly 225m x 100m was found between the gabbro and volcanics over the northeast portion of the property and had been previously mapped as an anorthosite, although described as a pyroxenite. It is not clear whether this pyroxenite body is a separate intrusive body or a fractionated part of the main peridotite-gabbro body. All of the above types have been moderately altered to greenschist or upper greenschist facies.

The entire ultramafic complex has been defined by B. Murk (this report) as being consistent with a fractionated ultramafic body with cumulate zonation. This is exemplified by the cumulate plagioclase mineral assemblages found in norite or noritic gabbro which appears to completely surround the ultramafic core.

Intermediate to felsic intrusive rocks associated with the body are for the most part tonalite with minor diorite to quartz diorite occurring at the gabbro/tonalite or tonalite/volcanic contact. The volcanics show signs of metasomatic alteration, but over a very short distance near the ultramafic contact. The tonalite had been previously mapped as late Kenoran quartz diorite, unrelated to the ultramafics. It is likely that the tonalite is probably directly related to the ultramafic intrusive as the contact with the gabbro appears to be places gradational, going from gabbro to diorite to quartz-diorite to tonalite, often over as short a distance as 25 metres.

All of the above lithologies have been intruded by late north-south trending diabase dikes (Matachewan Swarm) and by syenitic dikes

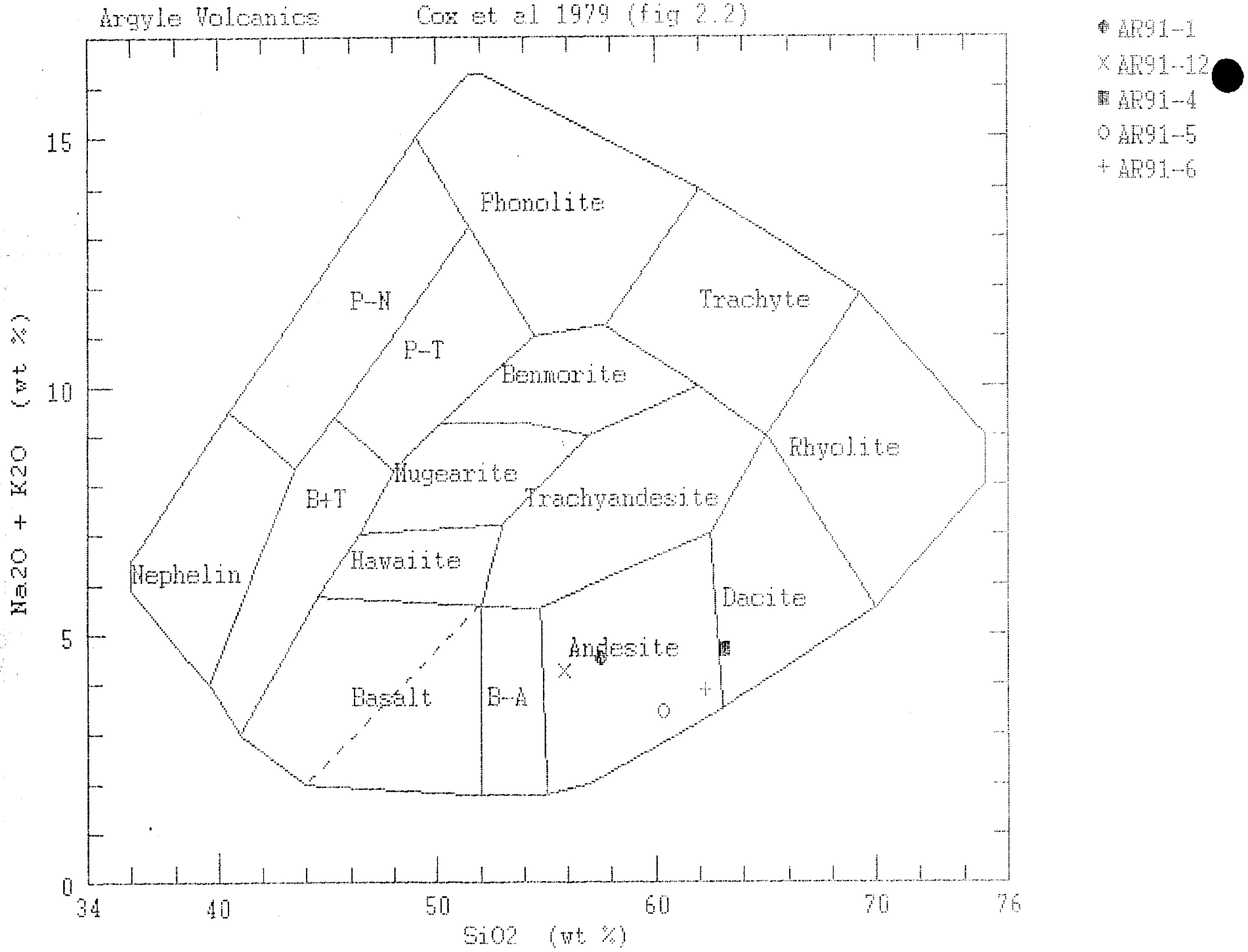

Argyle Volcanics
Cox et al 1979 (fig 2.2)
AR91-1
AR91-12
AR91-4
AR91-5
AR91-6
Phonolite
Trachyte
P-N
P-T
Benmorite
Rhyolite
Mugearite
B+T
Trachyandesite
Hawaiite
Nephelin
Dacite
Andesite
Basalt
B-A
Na2O + K2O (wt %)
SiO2 (wt %)
0
5
10
15
34
40
50
60
70
76

Figure 4

which closely resemble the tonalite and may in fact be related to the tonalite. All of these rock types are described in detail in Appendix B - Petrographic Descriptions. A list of sample numbers and locations follows:

SAMPLE SUMMARY

Sample No.(Field)	Location	Rock Type	Thin Section	Whole Rock	Pt(ppb)	Pd(ppb)	Au(ppb)	Cu(ppm)	Ni(ppm)
210721 AR91-5	0+95W, 1+30S	calc basalt		Yes	<15	<10	7	67	162
210722 AR91-3	1+30W, 2+25N	mica pyroxenit	Yes	Yes	<15	<10	<5	15	468
210723 AR91-1	0+75W, 1+25N	calc andesite		Yes	<15	<10	<5	37	115
210724 AR91-11	4+00W, 3+70N	altered andesite		Yes	<15	<10	19	70	191
210725 AR91-2	0+60W, 2+00N	quartz + pyrite		Yes	<15	<10	244	127	65
210726 AR91-9	2+85W, 2+30N	pyroxenite		Yes	<15	<10	<5	18	480
210727 AR91-8	3+00W, 7+90N	tonalite	Yes	Yes	<15	<10	<5	1	47
210728 AR91-14	5+50W, 3+60S	mica peridotite	Yes	Yes	<15	<10	<5	5	1460
210729 AR91-10	3+50W, 0+75N	norite	Yes	Yes	<15	<10	<5	18	1160
210730 AR91-12	5+00W, 8+20N	calc basalt		Yes	<15	<10	9	3	165
210731 AR91-6	1+70W, 0+15S	calc dacite		Yes	<15	<10	<5	530	79
210732 AR91-13	5+25W, 3+15N	peridotite	Yes	Yes	<15	<10	<5	55	1280
210733 AR91-7	2+10W, 2+75N	pyroxenite	Yes	Yes	<15	<10	8	87	1390
210734 AR91-4	1+00W, 0+20N	calc andesite		Yes	<15	<10	<5	35	64

No areas of significant sulfide mineralization was found during the mapping. One outcrop of dacite located at 1+75W, 0+25S was slightly altered and mineralized with 1% chalcopyrite and trace malachite. A sample assayed 530 ppm Cu, but its width is narrow and may be an isolated pod of mineralization. Both the norite and peridotite samples are elevated in Ni with assays ranging from 1,280 ppm to 1,460 ppm Ni in the peridotite and 1,140 ppm Ni in the norite. Neither of the samples contained significant sulfide mineralization.

No outcrops were mapped which were kimberlite in composition, the closest rock type being the mica peridotite and no garnets were observed in the peridotite.

The gold assay of 244 ppb was from a pit sunk on syenite cut by

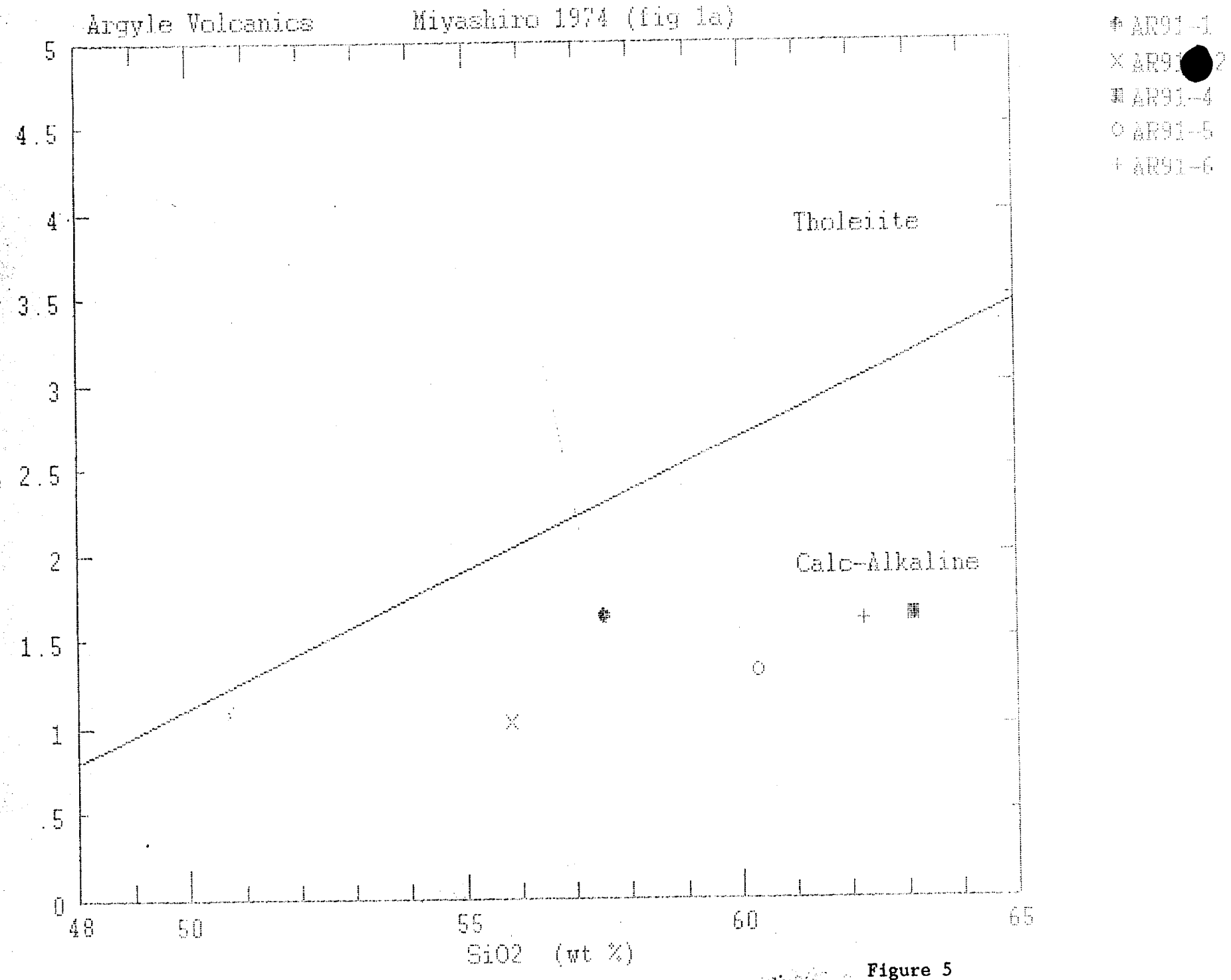

Argyle Volcanics
Miyashiro 1974 (fig 1a)
AR91-1
AR91-2
AR91-4
AR91-5
AR91-6
Tholeiite
Calc-Alkaline
FeO* / MgO
SiO2 (wt %)
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
5
48
50
55
60
65

Figure 5

quartz stringers with up to 2-4% pyrite mineralization. It is not clear whether this is the pit sampled by Shahin in 1949. The pits lie just off of the property and do not appear to be significant.

1990 EXPLORATION PROGRAM

Summary

The 1990 exploration program included line cutting at 100m centres, magnetometer and Max Min II HEM surveys followed by geological mapping, whole rock analysis and petrographic studies. The geological mapping has been detailed previously in this report.

A) Magnetometer Survey

A Geometrics proton precision magnetometer was used with readings taken every 25 metres or 12.5 metres over high magnetic fluctuations. A base station (Line 4+00W, Baseline) was set at 57,135 gammas and was read every hour for diurnal corrections. The readings were then plotted and contoured in Autocad at 500 gamma intervals.

The results clearly show the magnetic peridotite core which is on the average the 5,000 gamma contour. The contouring indicates that two such bodies may exist; one immediately north of the baseline and one below. The gabbro/pyroxenite has a weaker magnetic signature, approximately the 3,000-5,000 gamma interval while the tonalite and calc-alkaline volcanics are both close to background. An interesting sharp magnetic low flanks the northern gabbro/tonalite contact. It is not clear whether this is a dipole effect or a true zone of magnetic depletion. This would be a prime target for gold mineralization if accompanied by an EM response.

The magnetics do not provide adequate information as to the dip of the ultramafic body. It may in fact be either cylindrical or funnel shaped.

B) Max Min II Survey

Two frequencies (1777 Hz, 444 Hz) of Max Min II HEM were completed over the grid using a 100m coil. The contractor for the survey was T. Obradovich of Kirkland Lake.

The results on both frequencies showed such high shoulders over the ultramafics that anomalies could not be determined. Two oblique lines were then cut and read under the same parameters with the same results. These were interpreted by M. Shore at the University of Ottawa who recommended that no targets were defined and that some other EM survey be used that would be less susceptible to magnetic interference.

The AEM 3-channel anomalies remain to be either located or explained.

Conclusions and Recommendations For Further Work

Geological mapping combined with whole rock and petrographic analysis indicates the Argyle claims are underlain by a layered ultramafic body with cumulate zonation. This zonation includes a highly magnetic peridotite/mica-peridotite core followed by a narrow rim of gabbro/norite-gabbro +- pyroxenite and finally a tonalite +- diorite/quartz-diorite unit which extend to the north off the property.

Both the peridotite and gabbro/norite are locally elevated above background in nickel, however no platinum, palladium or copper

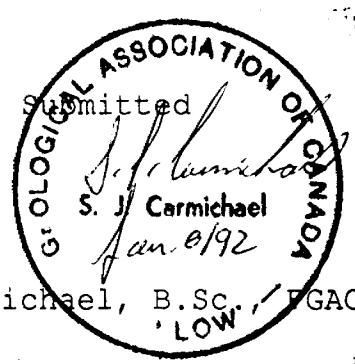
mineralization is associated with the intrusive. In addition, no significant gold mineralization was located on the property.

The magnetometer survey clearly outlined the peridotite/gabbro phases of the intrusive, however the Max Min II survey failed to locate the airborne EM anomalies due to magnetic interference.

Additional work on the property is highly recommended to locate the airborne anomalies. This may be accomplished by a multi-frequency VLF-EM type survey which would negate the effects of magnetite. I.P. is not recommended due to the high magnetite content. It is also recommended that the trenches located on line 4+00W, 4+00N be further investigated and sampled.

The cost of this program is estimated at $2,000.00 including 10km of two frequencies VLF-EM at $200.00/km.

Respectfully Submitted



Stewart Carmichael, B.Sc., FGAC

12,144

Appendix A

CERTIFICATE OF QUALIFICATIONS

I, Stewart J. Carmichael, of the Town of Kirkland Lake, in the District of Timiskaming, in the Province of Ontario, Canada, do hereby certify that:

1) I am a consulting geologist with address 42 Rand Avenue East, Kirkland Lake, Ontario, P2N 1X1.

2) I am a graduate of McMaster University, Hamilton, Ontario, having received the degree of Bachelor of Science, Geology from the Faculty of Science in 1982. I have since practised in the field of mineral exploration continuously since graduation.

3) I am a Fellow of the Geological Association of Canada.

4) I hold a 25% interest in the Argyle claims.

5) In addition to my personal knowledge of the area, I have made use of the records of the Ministry of Natural Resources of Ontario.

6) I conducted both the magnetometer and geological mapping on the property and assisted during the Max Min survey.

Dated this 8 day of January, 1992

Stewart J. Carmichael, B.Sc., FGAC

2.14495

Appendix B

Summary of Expenditures

Direct Costs

a) Labour (S. Carmichael)

Initial property visit to check access, 1 day (June 14)	100.00
Turn off baseline with line cutter, 1 day (June 21)	100.00
Magnetometer Survey, 3 days (July 24-26)	300.00
Geological Mapping, 5 days (Sept. 25-29)	500.00
Assistant on Max Min II Survey, 5 days (August 5-8) (August 26)	500.00
TOTAL	1,500.00

OUTSIDE CONTRACTORS

b) Line Cutting	$1,667.20
c) Max Min II (N-S Survey)	2,328.00
d) Line Cutting and Max Min II (Oblique Lines)	640.00
e) Whole Rock Analysis	374.50
f) Gold, Platinum and Palladium Assays	269.64
g) Thin Sections	89.88
h) Petrographic Report	499.69
TOTAL	$5,868.91

SUPPLIES

a) Flagging Tape	6.01
b) Field Book	6.17
e) Batteries for Magnetometer	20.64
f) Plotting Paper	123.99
g) Plotter Pens	25.35
TOTAL	$182.16

TRAVEL

Travel Expenses, 1,650.0 km x .30/km	$495.00
Fuel & Oil - Outboard Motor	30.65
TOTAL	$525.65

OFFICE

Autocad Work - Max Min II, 3 days	$300.00
Autocad Work - Magnetometer, 4 days	400.00
Autocad Work - Geological Map, 3 days	300.00
Whole Rock entry and diagram plots, 1 day	100.00
Plotting, 7 days (6 copies of each)	700.00
Report, 3 days	300.00
TOTAL	$2,100.00

TOTAL EXPENDITURES	**$10,176.72**
PROPOPSED BUDGET	$9,970.00

GEOLOGICAL ASSOCIATION OF CANADA
S. J. Carmichael
Jan. 8/92
FELLOW

2.12405

Appendix C

Petrographic Descriptions

PETROGRAPHIC DESCRIPTIONS

Submitted by: Geoplastech, Inc.
Petrography by: Barbara Murck

Client: Stewart Carmichael

Locality: Matachewan, Ontario
Project:

Date Completed: November 7, 1991

PETROGRAPHIC DESCRIPTION

SAMPLE No. AR 91-3 (hand sample & thin section)

SUMMARY & TEXTURAL DESCRIPTION

This is a mineralogically complex, highly altered ultramafic rock. It contains abundant coarse, irregular grains of clinopyroxene. The colour of the clinopyroxene is very patchy, ranging from colourless to distinctly brown. Although the crystal outlines are typically pyroxene-like, the brown areas often display clearly amphibole-type cleavages, suggesting pseudomorphous replacement of the original pyroxene by a brown amphibole (refer to descriptions of similar occurrences in several of the following samples). Alternatively, it is possible (but unlikely) that the amphibole is a primary (i.e. igneous) mineral rather than a metamorphic mineral, in which case it is probably kaersutite variety.

The areas between the pyroxenes are extremely heavily altered, and the original igneous textures tend to be poorly preserved. However, a considerable amount of feldspar (probably mainly or exclusively plagioclase) is (or rather, was) present in the protolith, now largely altered to a cloudy, poorly crystalline, epidote-rich assemblage. A colourless to pale green, fibrous mineral is also present in the alteration assemblage; some of this is clearly chlorite, altering an original micaceous mineral (probably biotite or phlogopite, although they are not now preserved in the sample). The remainder of the fibrous material could be either chlorite or serpentine, or a mixture of the two; there is no clear-cut evidence that olivine was present in the original sample, however. There are also some talcose patches. Minor interstitial quartz is also present; judging by the overall mineralogy of the sample, it seems most likely that the quartz is a metamorphic mineral rather than primary.

In summary, then, the original sample seems to have consisted of a colourless clinopyroxene with abundant plagioclase; there may have been some orthopyroxene present as well, although there is no specific evidence for this. Relatively coarse, platy grains of a mica, probably biotite or phlogopite were also common. This would place the sample in the general category of a mica pyroxenite, or possibly even a lamprophyre.

MINERALOGY

≈ ≈30% Amphibole: probably including some relict pyroxene, although it is very difficult to be sure; these are coarse (up to several mm or even cm), irregular grains, some of which partially or totally enclose other heavily altered mineral grains; the colour is very pathcy, most typically brown with a colourless rim; the brown part displays very clear amphibole cleavages; the colourless part might also be amphibole, but the general habit is much more like a pyroxene, so I would

suggest that this represents a brown clinoamphibole pseudomorphously replacing a colourless clinopyroxene; so the patchy colour could be due to either compositional zonation in the original grain (now translated into the replacement grain); or incomplete replacement (i.e. the colourless areas are relict pyroxenes); in addition to the coarse-grained brown to colourless amphiboles, there may be a small amount of colourless, acicular to bladed clinoamphibole (i.e. tremolite) associated with heavy talc alteration.

≈25% Talc: it is extremely difficult (or impossible) to distinguish talc from very fine sericite in thin section, but talc would be much more likely in a rock of this composition; occurs as masses of extremely fine-grained, flaky to fibrous white micaceous material, with no clear preservation of original textures or crystal outlines.

≈≈25% Epidote: including small patches of relict plagioclase; the plagioclase has been almost totally replaced by a cloudy, poorly crystalline, epidote-dominated alteration assemblage; the predominance of epidote in the alteration attests to an originally calcic composition for the plagioclase, which would be expected in a rock of this overall composition; the epidote itself just looks cloudy and slightly brownish, and individual grains are not clearly identifiable (this is a fairly typical occurrence for epidote); although there are suggestions of preserved tabular shapes, the original morphologies of the plagioclase grains are not well preserved.

≈≈15% Chlorite: possibly also including some serpentine; fibrous to platy material, ranging from colourless to pale yellowish-green; much of this is clearly chlorite, pseudomorphously altering an original platy micaceous mineral (probably biotite or phlogopite); some of the original micas were relatively coarse, ranging up to 2 mm or even more; anomalous interference colours, ranging from greyish-green to blue-violet; the remainder of the fibrous material is difficult to identify, it could be either chlorite or serpentine, or possibly a mixture of the two minerals.

2-3% Quartz: primary quartz would be strange (although not impossible) in a rock of this overall composition, but it could have originated through metamorphism, probably of the plagioclase; the quartz is interstitial and irregular in habit, ranging to almost fragmented-looking.

Acc. Opaques: the opaques are mostly extremely fine-grained, and appear to have been exsolved from pyroxenes and micas during alteration; occasional coarser (e.g. 0.2 mm), irregular to square grains are also present; there is probably also some extremely fine-grained semi-transparent rutile, associated with altered micas (biotite).

Tr. Apatite(?): a colourless, high relief, low birefringence mineral with six-sided cross-section; appears to be uniaxial negative; the presence of accessories like apatite

and zircon would attest to a somewhat unusual composition, as far as ultramafics are concerned (and the presence of micas would be consistent with this).

Tr. Zircon(?): extremely fine, square cross-sections.

PETROGRAPHIC DESCRIPTION

SAMPLE No. AR 91-7 (hand sample & thin section)

SUMMARY & TEXTURAL DESCRIPTION

This is a metamorphic rock, dominated by fine, acicular actinolite needles and blades, intergrown with calcite, with minor chlorite. Accessory quartz is also present, as well as remnants of chloritized biotite (or possibly phlogopite). The mineral assemblage isn't particularly diagnostic, i.e. it is difficult to be certain of the exact nature of the protolith. The combination of a Mg-rich actinolite-tremolite amphibole and a carbonate could represent anything from a metamorphosed siliceous carbonate, to an ultramafic (metamorphosed in the presence of a CO_2-rich fluid), or even a skarn-type assemblage. The fact that the carbonate is calcite (it effervesces vigorously in cold HCl) rather than, say, magnesite suggests that the protolith may not have been ultramafic, although this possibility can't be eliminated. The lack of talc, serpentine, brucite, and other characteristic minerals, as well as the presence of actinolite rather than tremolite, also argue against an ultramafic protolith. In the absence of other evidence, it is probably reasonable to rule out a skarn-type assemblage. This leaves the possibility of a siliceous, iron- and magnesium-bearing carbonate as the protolith, or possibly a relatively iron-rich ultramafic protolith. The metamorphic grade is similarly difficult to pinpoint, but it is roughly greenschist facies.

MINERALOGY

≈45% Amphibole: this is a pale green clinoamphibole, in the compositional series actinolite-tremolite; strictly speaking, it falls in the category of actinolite (the magnesium-rich end member tremolite would be colourless), although it is quite pale in colour, indicating a fairly magnesium-rich composition (strength of colour increases with iron content in this series); the actinolite occurs as clusters and masses of needle-like to blade-like grains; some of the masses suggest pseudomorphism after an originally coarser, perhaps prismatic mineral (a calcic pyroxene?), although no remnants or crystal outlines are preserved; other clusters of actinolite are radiating; the actinolite is very closely intergrown with carbonate; colour is pale green to colourless, weakly pleochroic; the blades range up to several mm in length, although much finer grains are more common, ranging down to extremely fine, needle-like to almost fibrous grains.

≈45% Carbonate: effervesces vigorously in cold HCl, indicating calcite rather than magnesite or a dolomite; medium- to fine-grained (grain sizes generally range from 0.5 mm to much finer), granoblastic texture; the carbonate tends to be very closely intergrown with the amphibole; clear and colourless, except for needle-like inclusions of amphibole.

3-5% Chlorite: irregular, patchy clusters of extremely fine, flaky grains, and occasional pseudomorphs after coarser (e.g. 1 mm), platy grains, probably biotite or phlogopite; weakly to moderately pleochroic, pale green to almost colourless, with low, anomalous greyish-green interference colours.

2-3% Opaques: subidiomorphic to idiomorphic, roughly cube-shaped grains, ave. ≈0.2-0.3 mm (although grains up to 1 mm are present); some hematite (and associated minor iron-staining) is present, occurring as thin rims around some of the square grains.

2-3% Quartz: irregular grains, closely intergrown with carbonate and actinolite; the quartz is probably a metamorphic mineral rather than a remnant of a primary mineral.

Tr. Rutile: extremely fine, needle-like to hair-like grains, generally associated with masses of chlorite; the presence of rutile in this association suggests that the chlorite is pseudomorphous after a Ti-bearing original mafic mineral, probably biotite or phlogopite.

Tr. Biotite: or possibly phlogopite; very small (e.g. 0.1 mm) remnants of a brownish-coloured, micaceous mineral, now mostly altered to chlorite; also associated with rutile needles.

PETROGRAPHIC DESCRIPTION

SAMPLE No. AR 91-8 (hand sample & thin section)

SUMMARY & TEXTURAL DESCRIPTION

This is a moderately altered, granitic or tonalitic intrusive rock. The texture is porphyritic, with coarse, tabular feldspar phenocrysts in a medium-fine-grained groundmass of quartz and feldspar. The feldspars (especially the phenocrysts) are generally so heavily altered that it is impossible to determine whether they were predominantly plagioclase or alkali feldspars, although some plagioclase is definitely present. (Note: the pink colour of the feldspars doesn't necessarily mean that alkali feldspar is or was present; altered plagioclases typically exsolve sub-microscopic iron oxides, which can also cause a pinkish colour.) Since there is no specific evidence for the presence of alkali feldspars, I would interpret the rock as a porphyritic tonalite (i.e. predominantly plagioclase-quartz). The original mafic mineral was probably biotite, now totally altered to chlorite. Aside from the chloritization, the alteration assemblage is dominated by the heavy sericite-carbonate alteration of the feldspars.

MINERALOGY

≈35% Quartz: irregular, granular-textured grains, with an average grain size of ≈0.5-0.7 mm; interstitial, i.s. forming the groundmass for the coarse feldspar phenocrysts; the quartz shows some signs of strain, including undulatory extinction, grain boundary migration, and occasionally subgrain boundary development.

≈30% Feldspar: originally more abundant (at least 50% of the rock or more, prior to alteration); there are two groups of feldspars in this sample; the first is the coarse, tabular phenocrysts, which range up to 7 mm in length; these originally accounted for 15-20% of the rock, but they tend to be very heavily altered, mainly to sericite with some carbonate; some of the phenocrysts are plagioclases, but most are unidentifiable; the other type of feldspar is a finer-grained (ave. ≈0.3-0.7 mm), groundmass feldspar, which is closely intergrown with quartz; the groundmass feldspar is much more lightly altered (also predominantly sericitic alteration), and is identifiable as mainly or exclusively plagioclase; it is not possible to optically determine the composition of the feldspar phenocrysts because of the heavy alteration, but the groundmass plagioclases are roughly andesine in composition.

≈20% Sericite/Muscovite: very fine (ave. 0.1 mm and less), flaky to needle-like grains; occurs mainly as closely integrown masses, heavily altering the feldspar phenocrysts; max. grain size ≈0.3 mm.

7-10% Chlorite: irregular masses of very fine (individual grains are generally 0.2 mm or

much less), flaky, platy and occasionally fibrous grains; moderate pleochroism, pale yellow to light emerald green, with anomalous greenish to brown interference colours; the chlorite is probably pseudomorphous after an original biotite, although no identifiable biotite remains in the rock; associated with rutile and other oxides, as well as extremely fine zircon inclusions; there also appears to have been some remobilization of chlorite into veinlets.

5-7% Carbonate: irregular grains, ave. ≈0.5 mm; mainly occurs as part of the assemblage altering feldspars; effervesces in cold HCl, hence it is calcite; most common around the edges of heavily altered feldspars, although it can also be intergrown with sericite in the alteration assemblage.

Acc. Opaques: fine (0.2 mm and less), irregular grains, mainly associated with chlorite; there are some remnants of altered skeletal-textured opaque grains within chlorite masses, probably original ilmenites.

Tr. Rutile: masses of extremely fine, needle-like to flocky-textured grains, enclosed in chlorite; probably the product of exsolution of Ti from biotite as it alters to chlorite.

Tr. Zircon: extremely fine, prismatic grains with square outlines and metamict haloes, enclosed in chlorite masses.

PETROGRAPHIC DESCRIPTION

SAMPLE No. AR 91-10 (hand sample & thin section)

SUMMARY & TEXTURAL DESCRIPTION

This is a heavily altered (i.e. metamorphosed), cumulate-textured ultramafic rock. There may be a contact represented in the thin section: one half of the section is dominated by cumulate olivine with some cumulate pyroxene, abundant interstitial pyroxene and minor interstitial plagioclase (all of these minerals are now totally altered); the other half of the section appears to consist mainly of tabular cumulate plagioclases with interstitial pyroxene (also totally altered). The contact between the two lithologies is irregular, almost cuspate, and runs diagonally across the thin section; it can be seen by holding the thin section up to the light. A relatively olivine-rich transitional zone occurs along the contact itself. If it is not a true contact, then the rock was simply somewhat patchy in the original distribution of minerals.

The olivine- and pyroxene-rich part of the sample is probably best classified as a peridotite; more specifically, it could be anything from a websterite to a lherzolite, or even a harzburgite, although it is difficult to be precise without knowing the original composition of the (now-altered) pyroxenes. The original mineral proportions in that part of the sample were probably roughly 40% olivine, 40% pyroxenes, 10% plagioclase, and 10% other. The more plagioclase-rich portion of the sample is probably best characterized as a norite or gabbronorite; it consisted originally of around 50% cumulate plagioclase, with the remainder dominated by pyroxene. In the transitional areas, where both olivine and plagioclase seem to occur as cumulate minerals, the term "troctolite" might even apply. So this sample is really a mixed bag of differing mineral proportions and varying cumulate and intercumulate minerals, but all falling within the general mineralogical category of olivine-pyroxene-plagioclase, i.e. the gabbro-norite-peridotite family.

As mentioned above, most of the original cumulate and intercumulate minerals have been completely altered and replaced; where the originals are preserved, they occur only as small remnants within the replacing mineral body. Predictably, the olivine has been largely replaced by a serpentine assemblage. The plagioclase has been almost totally replaced by a pseudomorphous epidote-dominated assemblage, which is consistent with the originally calcic composition of the plagioclase. The alteration of the pyroxene is relatively patchy. Most commonly, the pyroxenes appear to have been completely replaced and pseudomorphed by a brown clinoamphibole. The amphibole often preserves the original intercumulate texture and crystal outlines of the pyroxene, while exhibiting very clear, well-developed amphibole cleavages; this suggests direct (i.e. "atom-for-atom") replacement of the pyroxene by the amphibole. The colour of the amphibole is rather uneven, ranging from almost colourless to distinctly brown in different sectors; this could be the result of compositional zonation within individual grains, or possibly of

incomplete replacement in some areas (i.e. the colourless patches might represent remnants of unaltered pyroxene). The origin of the brown colour in the amphibole is unclear; in both pyroxenes and amphiboles, brown colour can be caused by high Ti content, although high Ti would not necessarily be expected in a rock of this composition. There is also some talc in the assemblage altering the pyroxenes, and possibly some pale green fibrous tremolite-actinolite. Minor biotite (or possibly phlogopite?) is also present in the sample. It is quite red in colour, which generally indicates a Ti-rich composition (Fe-rich biotites are more likely to be green). This would be consistent with the presence of a relatively Ti-rich brown amphibole.

MINERALOGY

≈≈40% Amphibole & Relict Pyroxene: there were probably two pyroxenes present in the original rock, an orthopyroxene and a clinopyroxene, although the degree of alteration makes it extremely difficult to determine the relative proportion of the two types; the orthopyroxene apparently occurred both as an interstitial mineral and, occasionally, as a cumulate mineral with nearly euhedral outlines; it appears to have been better preserved than the clinopyroxene; the alteration of the orthopyroxene is mainly dominated by talc, mixed with varying amount of serpentine, and possibly some pale green (nearly colourless), fibrous tremolite-actinolite amphibole; the original outlines of the cumulate orthopyroxene grains are occasionally preserved, as well as some patches of the pyroxene itself; the clinopyroxene, on the other hand, appears to have occurred exclusively as an intercumulate mineral, in large, irregular grains enclosing cumulate olivine, orthopyroxene, and (in the noritic part of the sample) plagioclase grains; as discussed above, the alteration of the clinopyroxene appears to consist of almost total replacement of the pyroxene by a distinctly brown amphibole; the brown colour of the amphibole is patchy, sometimes showing a colourless rim or irregular colourless patches; this could reflect incomplete replacement, but more likely shows compositional zonation; the brown colour could be due to high Ti content in the original pyroxene.

≈≈20% Serpentine: network of fibrous, extremely fine-grained, mostly colourless material, although there are some greenish patches (possibly due to some chlorite?), and a small amount of iron-staining; interference colours range from low, anomalous blue to moderate; the serpentine generally preserves the equant crystal outlines of the original olivines which it replaces.

≈15% Epidote: extremely fine-grained, almost cryptocrystalline, cloudy masses, pseudomorphously replacing plagioclase feldspar; the epidote masses preserve the original outlines of the plagioclase grains; the dominance of epidote in the assemblage altering the plagioclase indicates an originally calcic composition for the feldspar (which would be expected in a rock of this composition).

5-7% Talc: extremely fine, white micaceous material, mostly fibrous, altering pyroxenes; although it could be sericite (the two are essentially indistinguishable when this fine-grained), talc is obviously much more likely in a rock of this composition.

5-7% Opaques: there are several different occurrences of opaque minerals in this sample: (1) most common are very fine (e.g. 50 μ and much less) grains in clusters, enclosed by the brown amphibole which replaces pyroxene; (2) similar grains and some extremely fine needle-like grains, occurring within Ti-rich biotite; the needles might be rutile; both (1) and (2) are probably Ti-rich iron oxides exsolved from the mafic minerals during alteration; (3) remobilized opaque material in fractures associated with serpentinization; (4) occasional examples of fine (0.2 mm), roughly equant grains, which could be unaltered spinels (probably chromites) from the original rock.

$\approx\approx$5% Feldspar: originally much more abundant (probably $\approx$20% of the total rock, prior to alteration); only a small amount of unaltered plagioclase is preserved, mostly in interstitial areas between altered pyroxenes, and as small remnants within heavily altered grains; the original feldspars occurred either as (1) irregular, interstitial grains, enclosing cumulate olivines and occasionally cumulate pyroxenes, or (2) tabular, subhedral to almost euhedral, cumulate grains, generally enclosed by interstitial pyroxene; the outer morphologies of both of these occurrences, as well as some relict twinning, has been very clearly preserved, in spite of the fact that the plagioclase has generally been completely replaced by a epidote.

2-3% Biotite: or possibly phlogopite; irregular, platy grains, often closely associated with brown amphibole; the colour of the biotite is very red, which generally indicates a high Ti content (or, more precisely, a high Ti/Fe ratio); minor chloritization.

2-3% Olivine: small, "island"-like remnants, floating within heavily serpentinized material; the original equant, subhedral to euhedral outlines of the olivine grains are quite clearly preserved, ranging from about 1 to 4 mm in diameter.

Tr.-Acc. (or more?) Chlorite: minor alteration of biotite; there could also be some fibrous chlorite mixed in with the serpentine assemblage; finally, there could be a small amount of extremely fine-grained chlorite in the epidote-dominated assemblage altering the plagioclase.

Tr. Apatite(?): fine to very fine, colourless, tabular grains with hexagonal cross-section and high relief; appears to be uniaxial negative; sometimes displays a metamict halo.

PETROGRAPHIC DESCRIPTION

SAMPLE No. AR 91-13 (hand sample & thin section)

SUMMARY & TEXTURAL DESCRIPTION

This is another example of a heavily altered (i.e. hydrothermally metamorphosed) ultramafic rock. It differs from sample **AR 91-10**, in that the protolith appears to have been dominated by orthopyroxene and olivine, with only minor intercumulate clinopyroxene and plagioclase. This would place it in the general category of a peridotite (or, technically, a plagioclase-bearing harzburgite or olivine websterite)*. The alteration is very heavy, but rather patchy and unevenly distributed, with the result that some relatively coherent pieces of the original minerals have managed to survive the alteration. The orthopyroxene ranges from little-altered to totally altered; where it is heavily altered, the alteration assemblage is talc-dominated, with a fine, acicular mineral that is probably tremolite-actinolite. The olivine tends to be quite heavily serpentinized, with only small island-like remnants of olivine preserved. As in **AR 91-10**, fractures or veinlets filled with secondary opaque iron oxides are associated with the serpentinization. The plagioclase - which was not particularly abundant in the first place - tends to be heavily altered to epidote, although a small amount of unaltered plagioclase is preserved. As in **AR 91-10**, the clinopyroxene (also not very abundant in the original rock) seems to have been heavily replaced by a brown clinoamphibole, although the replacement is less thorough than in **AR 91-10**.

*Note: in the peculiar shorthand language of layered ultramafic intrusives, which may or may not be appropriate in this case, it would probably be referred to as a "BOc with icAP", meaning an "orthopyroxene (bronzite)-olivine cumulate with intercumulate clinopyroxene (augite) and plagioclase".

MINERALOGY

≈45% Pyroxene: apparently two pyroxenes were present in the original rock (and still partially preserved in spite of the heavy alteration); by far the dominant pyroxene is a colourless, low birefringence orthopyroxene, which occurs as coarse (up to 1 cm), irregular, intercumulus grains with enclosed olivines, and occasionally as tabular, apparently cumulate grains; the other pyroxene, much less abundant, is a higher-birefringence clinopyroxene (probably an augite), which occurs exclusively as an intercumulate mineral, and is partially to completely replaced by a brown clinoamphibole; the orthopyroxene is the best preserved of the original minerals, although in some parts of the sample it, too, is heavily altered, to a combination of talc, serpentine and tremolite.

≈20% Serpentine: networks and veinlets of extremely fine-grained, fibrous material;

mostly colourless to faintly yellowish-green, with low, slightly anomalous bluish interference colours; associated with remobilized secondary opaques; sometimes pseudomorphously alters olivine grains, but can also cut across pyroxene grains.

≈≈10% Talc: (note, again, that it is often impossible to distinguish talc from sericite in thin section when they are extremely fine-grained, but talc would be much more reasonable in a rock of this bulk composition); masses of extremely fine, flaky to fibrous white micaceous material; seems to be mainly concentrated within orthopyroxene-rich parts of the sample, and occasionally it seems to be directly pseudomorphing a cumulate (i.e. euhedral) pyroxene grain; associated with colourless acicular amphibole (tremolite) and, to a lesser extent, with serpentine.

≈≈7%(?) Amphibole: the main amphibole is a distinctly brown clinoamphibole, which appears to be patchily replacing interstitial clinopyroxene; in some areas, the replacement is essentially complete, preserving the irregular, intercumulate outlines of the grains; in other areas, the replacement is patchy; interestingly, the original clinopyroxene appears to be almost colourless relative to the distinctly brown replacement mineral, which makes the colour of the amphibole even more puzzling; it is possible that Ca causes brown colour in amphiboles, but not in pyroxenes(?); in addition to the brown amphibole, there also appears to be a very fine-grained, colourless to very pale green, fibrous to acicular clinoamphibole (tremolite), mainly associated with heavy talcose alteration of orthopyroxene.

5-7% Opaques: quite a lot of opaque material is associated with the serpentinization of olivines; this is almost certainly secondary, remobilized iron oxide, occurring in veinlets and in interstitial areas where the serpentinization is particularly intense; there are a few examples of square grains, ave. ≈0.1-0.2 mm, which could be relatively little-altered spinels (probably chromite) from the original rock; some opaque material is also associated with heavily altered biotites and pyroxenes, probably iron(-Ti?) oxides exsolved during alteration.

5-7% Olivine: considerably more abundant (probably at least 20%) prior to alteration; in spite of heavy serpentinization in parts of the sample, a fair amount of olivine managed to escape the alteration, occurring mainly as "island"-like patches within the serpentinized material; the original olivines were quite coarse-grained, averaging at least 1-2 mm, and ranging up to 4 or 5 mm or more; the olivines are, predictably, best preserved where they are totally enclosed by relatively little-altered pyroxene grains.

2-3% Epidote: cloudy, slightly brownish, poorly crystalline material, pseudomorphously altering intercumulate plagioclase; the predominance of plagioclase in this alteration assemblage indicates an originally calcic composition for the plagioclase, which is consistent with what would be expected in an ultramafic rock.

Acc. Plagioclase: only a small amount of plagioclase remains relatively unaltered; the rest has been heavily to totally epidotized; plagioclase - all of it intercumulate - probably accounted for 5% or less of the rock, prior to alteration.

Acc. Chlorite: there is a small amount of chlorite that is clearly distinguishable from the serpentine; very pale green to colourless, extremely fine, flaky to fibrous material, with low, anomalous blue interference colours; it occurs in veinlets or as alteration of platy minerals, probably biotite or phlogopite.

Tr.-Acc. Biotite: or possibly phlogopite; heavily chloritized remnants of a brown micaceous mineral.

PETROGRAPHIC DESCRIPTION

SAMPLE No. AR 91-14 (hand sample & thin section)

SUMMARY & TEXTURAL DESCRIPTION

This sample is similar in many respects to the two preceding samples (**AR 91-10** and **AR 91-13**). It is a heavily altered ultramafic, but considerably more micaceous than either of those samples. For this reason, it should probably be referred to as a mica peridotite. It consists (or rather, the protolith consisted) of cumulate olivines, enclosed by coarse, irregular intercumulate orthopyroxene grains, and unusually coarse, irregular intercumulate biotite (or possibly phlogopite). The subhedral to euhedral, cumulate texture of the olivine grains is reasonably well preserved, even in the most intensely altered parts of the sample. Clinopyroxene - now largely replaced by the brown clinoamphibole described in **AR 91-10** and **AR 91-13** - is also present as an intercumulate mineral, but much less abundant than either orthopyroxene or biotite. There is no particular evidence of the presence of any plagioclase in the original rock.

In terms of the alteration, much of the original olivine has been serpentinized, although the olivine is fairly well preserved where it is enclosed by intercumulate orthopyroxene grains. The serpentinized olivine is also associated with abundant remobilized iron oxide, due to oxidation of the olivine during alteration. Minor talc is present, probably mainly as alteration of orthopyroxenes (which are, however, the least-altered constituent of the rock). The biotites are lightly to moderately (and occasionally completely) chloritized, with associated exsolved opaque material. The minor clinopyroxene, as mentioned above, seems to have been largely replaced by brown clinoamphibole.

MINERALOGY

≈35% Pyroxene: although both orthopyroxene and clinopyroxene were probably present in the original rock, orthopyroxene is (and was originally) by far the dominant pyroxene; no clinopyroxene is now preserved in the rock, as far as I can tell, but orthopyroxene seems to have survived the alteration fairly well; the orthopyroxene is colourless, with fairly low birefringence, occurring as coarse intercumulate grains, partially to totally enclosing cumulate olivines; individual orthopyroxene grains of 1 cm or more are common.

≈30% Serpentine: networks and veinlets of fibrous material, representing heavy to total pseudomorphous alteration of cumulate olivines, with preservation of the original crystal outlines; the serpentine ranges from colourless to faintly yellowish-green, generally with low grey to slightly anomalous bluish interference colours; associated with abundant remobilized opaque material resulting from oxidation of

the olivine.

≈10% Olivine: much more abundant (probably at least 40% of the total rock) prior to alteration; although heavy to total serpentinization is common, the olivine is fairly well preserved where it is enclosed by orthopyroxene; the original olivines were cumulate-textured (i.e. almost euhedral), in a range of grain sizes, averaging 1-2 mm but ranging up to several mm.

≈10% Opaques: by far the majority of opaques in this sample are clearly secondary in origin, i.e. irregular masses and veinlets of material exsolved or produced during alteration; opaque material commonly occurs sandwiched between the cleavage plates in heavily chloritized biotite, as strings and veinlets of oxides associated with serpentinization of olivine, and as blocky, irregular masses of material associated with alteration of pyroxenes; there are a few fine (e.g. 0.3 mm), square opaque grains which might be relatively little-altered opaques (probably chromites) from the protolith.

≈5% Chlorite: fibrous to platy, occurs mainly as alteration of biotite; this is quite a strongly coloured chlorite, with unusual pleochroism from light emerald green to light brown, and anomalous blue to red-violet interference colours; in other parts of the sample, where the chloritization is more intense, the chlorite is colourless, with very low, greyish interference colours; there may also be a small amount of extremely fine-grained, fibrous chlorite intergrown with the serpentine.

3-5% Biotite: or possibly phlogopite; platy, irregular, interstitial grains, partially to totally enclosing cumulate olivine grains; the biotite is unusually coarse-grained (for micas in a rock of this composition, at least), with individual grains ranging up to several mm; colour is fairly strong, with pleochroism from colourless to red- or orange-brown; moderate to heavy chloritization is common; the biotite is also associated with abundant secondary opaques, probably exsolved during alteration.

3-5% Amphibole: a brown clinoamphibole, which appears to have pseudomorphously replaced interstitial clinopyroxene.

Acc. Talc: extremely fine, white micaceous material; seems to occur as incipient alteration around the edges of orthopyroxene grains and occasionally in fractures.

Tr.-Acc. Carbonate: associated with talcose alteration of pyroxene, and with intense chloritization of biotite.

PHOTOMICROGRAPHS

(All photos taken in transmitted light.)

1. **Sample AR 91-3:** replacement of original intercumulate pyroxene by brown clinoamphibole (outlined by dashed line); note the patchy colour zonation in the amphibole: some parts are distinctly brown, others (particularly the rims) are colourless; the cloudy material is intensely epidotized plagioclase; the feathery-looking material is primarily talc; dimensions ≈2.35 x 1.61 mm; plane polarized light.

2. **Sample AR 91-3:** same as **1**, with crossed polarizers.

3. **Sample AR 91-7:** almost colourless (actually very pale green, although it looks essentially colourless in the photo) needles of tremolite-actinolite, closely intergrown with calcite (also colourless); a patch of very fine-grained, pale green chlorite occurs in upper right corner; a small, irregular patch of quartz occurs in upper left corner; dimensions ≈2.35 x 1.61 mm; plane polarized light.

4. **Sample AR 91-7:** same as **3**, with crossed polarizers; the carbonate appears pale pinkish-beige; the tremolite-actinolite needles are mostly blue (a few grains appear yellow or reddish-orange), mostly showing either highly elongated, needle-like habits, or the typical elongated diamond-shaped amphibole cross-section; the chlorite shows anomalous greyish-green interference colours; the quartz shows low first-order grey interference colours.

5. **Sample AR 91-10:** cumulate plagioclase (now cloudy due to intense epidotization; outlined by dashed line), mostly surrounded by patchily-coloured brown amphibole replacing intercumulate (or possibly cumulate?) pyroxene; mineralogically, this rock could be referred to either as a norite, or as an olivine gabbronorite; dimensions ≈2.35 x 1.61 mm; plane polarized light.

6. **Sample AR 91-10:** same as **5**, with crossed polarizers.

7. **Sample AR 91-10:** similar to **5**, with the addition of serpentinized cumulate olivine (bottom); the colourless material is mostly serpentine; the dark, cloudy material is intensely epidotized plagioclase; the brown mineral is amphibole replacing intercumulate pyroxene; dimensions ≈2.35 x 1.61 mm; plane polarized light.

8. **Sample AR 91-10:** same as **7**, with crossed polarizers; the amphibole shows the brightest interference colours; the epidotized plagioclase appears dark, due to the extremely fine grain size of the alteration assemblage; the serpentine shows low anomalous bluish interference colours and the typical fibrous network-like habit (bottom of photo).

9. **Sample AR 91-10:** serpentinized cumulate olivine with occasional small remnant patches of olivine, surrounded by intensely epidotized intercumulate plagioclase;

the colourless material is serpentinized olivine, and the dark, cloudy material is epidotized plagioclase; in a mineralogical classification scheme, a rock with these mineral proportions would be referred to as a troctolite; dimensions ≈2.35 x 1.61 mm; plane polarized light.

10. **Sample AR 91-10:** same as **9**, with crossed polarizers; epidotized plagioclase appears dark; small olivine remnants are bright (e.g. reddish-orange); serpentine is greyish-blue, with fibrous network-like texture.

11. **Sample AR 91-10:** serpentinized cumulate olivine (colourless, bottom of photo), with brown amphibole replacing intercumulate pyroxene, and epidote altering intercumulate plagioclase (dark, cloudy); dimensions ≈2.35 x 1.61 mm; plane polarized light.

12. **Sample AR 91-10:** same as **11**, with crossed polarizers.

13. **Sample AR 91-10:** serpentinized cumulate olivine (colourless, equant crystals) and nearly euhedral cumulate pyroxene (e.g. just below centre of photo), with intensely epidotized intercumulate plagioclase (dark, cloudy); dimensions ≈2.35 x 1.61 mm; plane polarized light.

14. **Sample AR 91-10:** same as **13**, with crossed polarizers.

15. **Sample AR 91-13:** little-altered cumulate pyroxene, probably bronzite orthopyroxene variety (almost colourless, e.g. the euhedral grain just above centre), with heavily epidotized intercumulate plagioclase (dark, cloudy) and serpentine veining (bottom); dimensions ≈2.35 x 1.61 mm; plane polarized light.

16. **Sample AR 91-13:** same as **15**, with crossed polarizers.

17. **Sample AR 91-13:** serpentinized cumulate olivine (above centre), with abundant remnants of olivine; bottom, mixture of pyroxene + olivine + serpentine; dimensions ≈2.35 x 1.61 mm; plane polarized light.

18. **Sample AR 91-13:** same as **17**, with crossed polarizers; the serpentine appears dark to light greyish-blue, with typical fibrous network-like habit; the olivine remnants show the brightest interference colours, mostly bright pinks with orange rims; the pyroxene (probably orthopyroxene) shows lower interference colours, appearing almost white in the photo.

19. **Sample AR 91-14:** serpentinized olivine, with abundant remnants of olivine; the brown intercumulate minerals are brown amphibole (almsot certainly replacing pyroxene), and a brown mica, either biotite or phlogopite; the mica has undergone some bleaching and chloritization; dimensions ≈2.35 x 1.61 mm; plane polarized light.

20. **Sample AR 91-14:** same as **19**, with crossed polarizers; network-like texture of serpentine, with abundant remnants of olivine showing interference colours ranging from dark to very bright in this particular view; the brown amphibole shows yellowish-orange interference colours; the brown mica shows bright colours (mostly pinkish or yellowish), with the mottled or stippled interference typical of micas.

21. **Sample AR 91-14:** similar to **19**, showing serpentinized cumulate olivine grains, with abundant olivine remnants; intercumulate brown amphibole and brown mica (either biotite or phlogopite); the brown mica shows fairly intense chloritization (green alteration); remobilization of opaque material associated with the serpentinization is clearly seen in this view; dimensions $\approx$2.35 x 1.61 mm; plane polarized light.

22. **Sample AR 91-14:** same as **21**, with crossed polarizers.

Appendix D

Whole Rock and Assay Certificates

File Name E:\GEOCHEM\ARGYLE.ROC
1-12-1991 12:04:46

Sample	AR91-10	AR91-14	AR91-8	AR91-9	AR91-2	AR91-11	AR91-1	AR91-3	AR91-5	AR91-12
Northing	7+50W	5+50W	3+00W	2+85W	0+60W	4+00W	0+75W	1+30W	0+95W	3+00W
Easting	[redacted]N	3+60S	7+90N	2+30N	2+00N	3+70N	1+25N	2+25N	1+30S	8+20N
Symbol	1	9	8	7	6	4	3	2	1	12
Sym Colour	1	1	9	7	5	4	3	2	1	7
Rock Type	Norite	Mica Peric	Tonalite	Pyroxenite	Mineralize		Calc-Anoes	MICA PYROX	Calc-Basal	Calc-Basal
SiO_2	42.70	38.00	63.50	51.50	47.10	50.20	57.50	48.90	60.30	55.80
TiO_2	0.17	0.08	0.46	0.17	0.29	0.14	0.65	0.40	0.52	0.72
Al_2O_3	5.35	1.81	15.50	3.12	8.46	20.00	16.50	8.93	12.80	16.20
Fe_2O_3*	11.80	12.90	4.40	9.51	5.38	4.24	7.42	10.20	6.62	7.54
gO	30.00	35.40	3.38	19.00	2.79	7.38	4.08	18.50	4.54	6.60
aO	2.52	0.41	1.23	3.26	4.28	9.90	5.33	3.55	4.06	2.22
Na_2O	0.34	0.09	3.25	0.90	3.99	1.75	3.33	1.64	2.93	3.18
K_2O	0.09	0.10	2.14	0.74	0.33	0.39	1.19	0.03	0.51	1.07
P_2O_5	0.10	0.08	0.14	0.09	0.07	0.06	0.20	0.13	0.18	0.19
otal	93.07	88.87	94.00	94.29	91.19	94.06	96.20	92.28	92.46	93.52
OI	6.25	9.80	3.15	3.75	6.80	3.55	1.95	4.55	5.30	5.25
g #	83.43	84.46	60.34	79.83	58.75	77.51	52.13	78.22	57.59	63.42
	1050	1180	386	620	667	658	974	882	617	293
i	1140	1460	47	480	65	191	115	468	162	165
	[illegible]	[illegible]		[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	53	21	81	80	62	68	128	110	108	136
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
b	-	[illegible]	-	-	-	-	-	-	-	
	87	35	69	85	40	56	75	97	76	119
	5.00	5.00	-	1.00	-	-	-	-	-	-
	[illegible]	[illegible]	17765	6143	2739	[illegible]	9879	[illegible]	[illegible]	3882
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	1019	504	2758	1001	1751	957	3879	2422	3141	4340
	0.30	0.30	0.30	0.90	0.30	0.50	1.00	0.60	1.70	0.90
nsity	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

File Name C:\GEOCHEM\ARGYLE.ROC
1-12-1991 12:05:02

Sample	AR91-6	AR91-13	AR91-7	AR91-4
Northing	4+70W	5+25W	2+10W	1+00W
Easting	5S	3+15N	2+75N	0+20N
Symbol	13	15	10	6
Sym Colour	4	2	15	6
Rock Type	Calc-Dacit	PERIDOTITE	Meta-Pyrox	Calc-Andes
SiO_2	62.20	43.60	46.60	63.10
TiO_2	0.53	0.08	0.30	0.42
Al_2O_3	14.00	2.23	9.56	14.60
Fe_2O_3t	3.60	12.40	10.00	4.60
MgO	2.01	32.50	18.00	2.34
CaO	5.34	1.36	0.75	2.73
Na_2O	0.32	0.08	0.75	2.36
K_2O	3.54	0.02	0.15	2.13
P_2O_5	0.18	0.08	0.11	0.13
Total	91.77	92.35	84.22	92.81
LOI	5.90	6.30	5.80	4.59
Mg #	52.51	83.35	76.01	52.22
Cr	367	1370	689	354
Ni	79	1280	778	64
Co	5	112	79	-
Cu	103	36	74	78
Zn	530	55	87	35
Pb	-	7	9	-
Rb	37	117	113	64
Sr	-	5.00	-	-
Ba	9387	166	1245	1682
Y	185	11	18	419
Zr	48	11	28	17
Nb	23	15	13	136
La	3501	474	1781	2542
Ce	0.80	0.20	0.60	0.80
Density	2.40	2.74	2.37	2.39

ACCURASSAY LABORATORIES

A DIVISION OF BARRINGER LABORATORIES LIMITED, REXDALE, ONTARIO
BOX 426
KIRKLAND LAKE, ONTARIO, CANADA P2N 3J1
TEL.: (705) 567-3361

President: Dr. GEORGE DUNCAN, M.Sc., Ph. D., C. Chem (Ont.), C. Chem (U.K.), M.C.I.C., M.R.S.C., A.R.C.S.T.

44175

Certificate of Analysis

Stewart Carmichail
42 Rand East
Kirkland Lake, Ontario
P2N-1X1

October 24 91

Work Order # : 911280
Project :

SAMPLE NUMBERS Accurassay	Customer	Gold ppb	Gold Oz/T	Platinum ppb	Palladium ppb	
251250	210721	7	<0.001	<15	<10	
251251	210722	<5	<0.001	<15	<10	
251252	210723	<5	<0.001	<15	<10	
251253	210724	19	0.001	<15	<10	
251254	210725	244	0.007	<15	<10	
251255	210726	<5	<0.001	<15	<10	
251256	210727	<5	<0.001	<15	<10	
251257	210728	<5	<0.001	<15	<10	
251258	210729	<5	<0.001	<15	<10	
251259	210730	<5	<0.001	<15	<10	
251259	210730	9	<0.001	<15	<10	Check
251260	210731	<5	<0.001	<15	<10	
251261	210732	<5	<0.001	<15	<10	
251262	210733	8	<0.001	<15	<10	
251263	210734	<5	<0.001	<15	<10	
251263	210734	<5	<0.001	<15	<10	Check

Per: G. Duncan

LF-30

ORIGINAL

BARRINGER LABORATORIES

5735 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9
PHONE: (416) 890-8566
FAX: (416) 890-8575

8-Nov-91

Stewart Carmichael

42 Rand Ave .E.
Kirkland Lake , ON
P2N 1X1

Attn: S.Carmichael
Project:

Received: 6-Nov-91 14:33
PO #: W/O 911280

Job: 911362 Status: Final

Sample	SiO2 ICAP %	Al2O3 ICAP %	Fe2O3 ICAP %	MgO ICAP %	CaO ICAP %	Na2O ICAP %	K2O ICAP %	TiO2 ICAP %	P2O5 ICAP %	LOI FURN %
210721	60.3	12.8	6.62	4.54	4.06	2.93	0.51	0.524	0.18	5.30
210722	48.9	8.93	10.2	18.5	3.55	1.64	0.03	0.404	0.13	4.55
210723	57.5	16.5	7.42	4.08	5.33	3.33	1.19	0.647	0.20	1.95
210724	50.2	20.0	4.20	7.38	9.90	1.75	0.39	0.143	0.06	3.55
210725	67.1	8.46	3.88	2.79	4.28	3.99	0.33	0.292	0.07	6.80
210726	51.5	9.12	9.51	19.0	3.26	0.90	0.74	0.167	0.09	3.75
210727	63.5	15.5	4.40	3.38	1.23	3.25	2.14	0.460	0.14	3.15
210728	38.0	1.81	12.9	35.4	0.41	0.09	0.10	0.084	0.08	9.80
210729	42.7	5.35	11.8	30.0	2.52	0.34	0.09	0.170	0.10	6.25
210730	55.8	16.2	7.54	6.60	2.22	3.18	1.07	0.724	0.19	5.25
210731	62.2	14.0	3.60	2.01	5.34	0.32	3.54	0.584	0.18	5.90
210732	43.6	2.23	12.4	32.5	1.36	0.08	<0.02	0.079	0.08	6.30
210733	46.6	9.56	10.0	16.0	7.71	0.75	0.15	0.297	0.11	5.80
210734	63.1	14.6	4.60	2.54	2.73	2.56	2.13	0.424	0.13	4.50

Sample	SUMOX CALC %	Ag ICAP ppm	Ba ICAP ppm	Be ICAP ppm	Cd ICAP ppm	Co ICAP ppm	Cr ICAP ppm	Cu ICAP ppm	Mo ICAP ppm	Mn ICAP ppm	Ni ICAP ppm	Pb ICAP ppm
210721	97.84	<1	131	0.7	<1	20	617	67	<20	861	162	<5
210722	97.06	<1	36	0.6	<1	49	882	15	<20	1370	468	<5
210723	98.22	<1	499	1.0	<1	14	974	37	<20	829	115	<5
210724	97.68	<1	96	0.5	<1	20	658	70	<20	638	191	<5
210725	98.06	<1	37	0.5	<1	<5	667	127	<20	544	65	<5
210726	98.17	<1	127	0.5	1	54	620	18	<20	1200	480	<5
210727	97.25	<1	491	0.9	<1	<5	386	1	<20	357	47	<5
210728	98.87	<1	37	0.3	5	123	1180	5	<20	1090	1460	7

BARRINGER LABORATORIES

5735 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9
PHONE: (416) 890-8566
FAX: (416) 890-8575

8-Nov-91

Stewart Carmichael

42 Rand Ave .E.
Kirkland Lake , ON
P2N 1X1

Attn: S.Carmichael
Project:

Received: 6-Nov-91 14:33
PO #: W/O 911280

Job: 911362 Status: Final

Sample	SUMOX CALC %	Ag ICAP ppm	Ba ICAP ppm	Be ICAP ppm	Cd ICAP ppm	Co ICAP ppm	Cr ICAP ppm	Cu ICAP ppm	Mo ICAP ppm	Mn ICAP ppm	Ni ICAP ppm	Pb ICAP ppm
210729	99.46	<1	39	0.3	5	99	1050	18	<20	1160	1140	<5
210730	98.82	<1	232	0.9	<1	14	293	3	<20	624	165	<5
210731	97.75	<1	485	0.8	<1	5	367	530	<20	463	79	<5
210732	98.73	<1	17	0.2	5	112	1370	55	<20	1370	1280	7
210733	97.09	<1	50	0.6	<1	89	489	87	<20	1390	778	9
210734	97.40	<1	410	0.8	<1	<5	354	35	<20	491	64	<5

Sample	Sr ICAP ppm	V ICAP ppm	Zn ICAP ppm	Zr ICAP ppm
210721	137.	108	76	106
210722	48.2	110	97	43
210723	196.	128	75	140
210724	287.	68	56	38
210725	96.7	62	40	63
210726	124.	80	85	36
210727	81.9	81	69	64
210728	25.3	21	90	35
210729	70.5	53	87	34
210730	103.	136	119	102
210731	47.5	103	37	123
210732	31.4	36	117	25
210733	64.3	74	113	33
210734	96.5	78	64	136

Abbreviations:

Parameters:

SiO2 : Silica

BARRINGER LABORATORIES

5735 McADAM ROAD
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8-Nov-91

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42 Rand Ave .E.
Kirkland Lake , ON
P2N 1X1

Attn: S.Carmichael
Project:

Received: 6-Nov-91 14:33
PO #: W/O 911280

Job: 911362

Status: Final

Al2O3	: Alumina
Fe2O3	: Ferric Oxide
MgO	: Magnesium Oxide
CaO	: Calcium Oxide
Na2O	: Sodium Monoxide
K2O	: Potassium Monoxide
TiO2	: Titanium dioxide
P2O5	: Phosphorus Pentoxide
LOI	: Loss on Ignition
SUMOX	: Sum of all major and minor oxides
Ag	: Silver
Ba	: Barium
Be	: Beryllium
Cd	: Cadmium
Co	: Cobalt
Cr	: Chromium
Cu	: Copper
Mo	: Molybdenum
Mn	: Manganese
Ni	: Nickel
Pb	: Lead
Sr	: Strontium
V	: Vanadium
Zn	: Zinc
Zr	: Zirconium

Methods:

ICAP	: Inductively coupled argon plasma
FURN	: Furnace
CALC	: Calculation

Ontario

900

Ministry of Northern Development and Mines

Ministère du Développement du Nord et des Mines

Geoscience Approvals Section
Mining Lands Branch
159 Cedar Street, 4th Floor
Sudbury, Ontario
P3E 6A5

Telephone: (705) 670-7264
Fax: (705) 670-7262

Our File: 2.14495
Transaction #: W9280.00026

May 11, 1992

Mining Recorder
Ministry of Northern Development
and Mines
4 Government Road East
Kirkland Lake, Ontario
P2N 1A2

Dear Sir:

RE: APPROVAL OF ASSESSMENT WORK ON MINING CLAIMS L 1168410 ET AL. IN ARGYLE TOWNSHIP.

The Assessment Credits for Geology and Geophysics, sections 12 and 14 of the Mining Act Regulations, as listed on the attached Assessment Work Credit form, have been approved as of May 4, 1992.

Please indicate this approval on the claim record sheets.

If you have any questions please call Clive Stephenson at (705) 670-7251.

Yours sincerely,

Ron C. Gashinski
Senior Manager, Mining Lands Branch
Mines and Minerals Division

CDS/jl
Enclosures:

cc: Assessment Files Office
Toronto, Ontario

Resident Geologist
Kirkland Lake, Ontario

ASSESSMENT WORK CREDIT FORM

FILE NUMBER: 2.14495
DATE: May 11, 1992
TRANSACTION NUMBER: W9280.00026

RECORDED HOLDER: Glenn Mullan
CLIENT NUMBER: 173700
TOWMSHIP: Pacaud.

CLAIM NUMBER	VALUE OF ASSESSMENT WORK DONE ON THIS CLAIM	VALUE APPLIED TO THIS CLAIM	VALUE ASSIGNED FROM THIS CLAIM
L1168410	$ 1494.00	$ 1079.00	$ 415.00
L1168411	$ 1494.00	$ 1079.00	$ 415.00
L1168412	$ 696.00	$ 1079.00	$ 0.00
L1168413	$ 497.00	$ 1079.00	$ 0.00
L1168414	$ 497.00	$ 1079.00	$ 0.00
L1168415	$ 1193.00	$ 1079.00	$ 114.00
L1168416	$ 1394.00	$ 1079.00	$ 315.00
L1168417	$ 1193.00	$ 1079.00	$ 114.00
L1168418	$ 1253.00	$ 1079.00	$ 174.00
TOTALS:	$ 9711.00	$ 9711.00	$ 1547.00

Ministry of Northern Development and Mines

Ontario

Report of Work Conducted After Recording Claim

Mining Act

Transaction Number: DOCUMENT No. W 9280 • 00026 • 00026

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used for correspondence. Questions about this collection should be directed to the Provincial Manager, Mining Lands, Ministry of Northern Development and Mines, Fourth Floor, 159 Cedar Street, Sudbury, Ontario, P3E 6A5, telephone (705) 670-7264.

2.14405

Instructions:
- Please type or print and submit in duplicate.
- Refer to the Mining Act and Regulations for requirements of filing assessment work or consult the Mining Recorder.
- A separate copy of this form must be completed for each Work Group.
- Technical reports and maps must accompany this form in duplicate.
- A sketch, showing the claims the work is assigned to, must accompany this form.

Recorded Holder(s): Glenn Mullan		Client No.: 173700
Address: 76- First Street, Kirkland Lake, Ontario P2N 1N3		Telephone No.: (705) 567-3896
Mining Division: Larder Lake	Township/Area: Argyle Twp	M or G Plan No.: M0203
Dates Work Performed — From: July 4, 1991	To: October, 1991	

Work Performed (Check One Work Group Only)

	Work Group	Type
	Geotechnical Survey	Magnetometer, Max Min II, Geological, Petrographic
	Physical Work, Including Drilling	
	Rehabilitation	
	Other Authorized Work	
	Assays	
	Assignment from Reserve	

RECEIVED
MAR 11 1992
MINING LANDS BRANCH

Total Assessment Work Claimed on the Attached Statement of Costs $ 10,176.72 *ROUNDED UP TO 10179

Note: The Minister may reject for assessment work credit all or part of the assessment work submitted if the recorded holder cannot verify expenditures claimed in the statement of costs within 30 days of a request for verification.

Persons and Survey Company Who Performed the Work (Give Name and Address of Author of Report)

Name	Address
Stewart Carmichael	42 Rand Av. East, Kirkland Lake, Ont. P2N 1X1
FRED KIERNICKI	Box 1143 KIRKLAND LAKE, P2N 3M7
TOM OBRADOVICH	75 Balsam St. KIRKLAND LAKE, ONT P2N 1W7
Assays and Petrographic Study (See report for name & addresses)	

(attach a schedule if necessary)

Certification of Beneficial Interest * See Note No. 1 on reverse side

	Date	Recorded Holder or Agent (Signature)
I certify that at the time the work was performed, the claims covered in this work report were recorded in the current holder's name or held under a beneficial interest by the current recorded holder.	Jan 8/92	*

Certification of Work Report

I certify that I have a personal knowledge of the facts set forth in this Work report, having performed the work or witnessed same during and/or after its completion and annexed report is true.

Name and Address of Person Certifying: Stewart Carmichael, 42 Rand Av. East Kirkland Lake, Ont. P2N 1X1

Telepone No.	Date	Certified By (Signature)
705-567-7286	Jan. 8/92	Stewart Carmichael

For Office Use Only

Total Value Cr. Recorded	Date Recorded	Mining Recorder	Received Stamp
$10,179	JANUARY 16, 1992		RECEIVED 16 JAN PM 3
	Deemed Approval Date: APRIL 15/92	Date Approved	
	Date Notice for Amendments Sent		LARDER LAKE MINING DIVISION

0241 (03/91)

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
1	L-1168410	1	1,130.75 (1)	1,130.75 (1)		
	L-1168411	1	1,130.75 (1)	1,130.75 (1)		
	L-1168412	1	1,130.75 (1)	1,130.75 (1)		
	L-1168413	1	1,130.75 (1)	1,130.75 (1)		
	L-1168414	1	1,130.75 (1)	1,130.75 (1)		
	L-1168415	1	1,130.75 (1)	1,130.75 (1)		
	L-1168416	1	1,130.75 (1)	1,130.75 (1)		
	L-1168417	1	1,130.75 (1)	1,130.75 (1)		
	L-1168418	1	1,130.75 (1)	1,130.75 (1)		
			NOTE (1) ROUNDED UP	TO [redacted]1131		
	9		10,176.72	10,176.72		
	Total Number of Claims		Total Value Work Done	Total Value Work Applied	Total Assigned From	Total Reserve

* ROUNDED UP TO 10179

* ROUNDED UP

0241 (03/91)

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☐ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

I certify that the recorded holder had a beneficial interest in the patented or leased land at the time the work was performed.

Signature

Date

Ontario

Ministry of Northern Development and Mines

[redacted]tère du Développement du Nord et des mines

Statement of Costs for Assessment Credit

État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction

DOCUMENT No.
W 9280 • 00026
00026

Personal information collected on this form is obtained under the authority of the **Mining Act**. This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Minings Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la **Loi sur les mines** et serviront à tenir à jour un registre des concessions minières. Adresser toute quesiton sur la collece de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour Main-d'oeuvre		
	Field Supervision Supervision sur le terrain		3,600.00
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type: Line Cutting	1,667.20	
	Mag Mon II	2,968.00	
	Rock Analysis	1,233.71	5,868.91
Supplies Used Fournitures utilisées	Type: Batteries	20.00	
	Flagging Tape, Field Book	12.18	
	Plotter Pens, Paper	149.34	
			182.16
Equipment Rental Location de matériel	Type		
	Total Direct Costs Total des coûts directs		9,651.07

2. Indirect Costs/Coûts indirects

** **Note:** When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type: Km charge	495.00	
	Outboard Fuel, Oil	30.65	
Food and Lodging Nourriture et hébergement			
Mobilization and Demobilization Mobilisation et démobilisation			
	Sub Total of Indirect Costs Total partiel des coûts indirects		525.65
	Amount Allowable (not greater than 20% of Direct Costs) Montant admissible (n'excédant pas 20 % des coûts directs)		525.65
	Total Value of Assessment Credit (Total of Direct and Allowable Indirect costs) / **Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles)**		10,176.72

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, four or five years after completion is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit	Total Assessment Claimed
× 0.50 =	

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux déposés trois, quatre ou cinq ans après leur achèvement sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation	Évaluation totale demandée
× 0,50 =	

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as Part owner of property (Recorded Holder, Agent, Position in Company) I am authorized

to make this certification

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

Et qu'à titre de _____ je suis autorisé
(titulaire enregistré, représentant, poste occupé dans la compagnie)

à faire cette attestation.

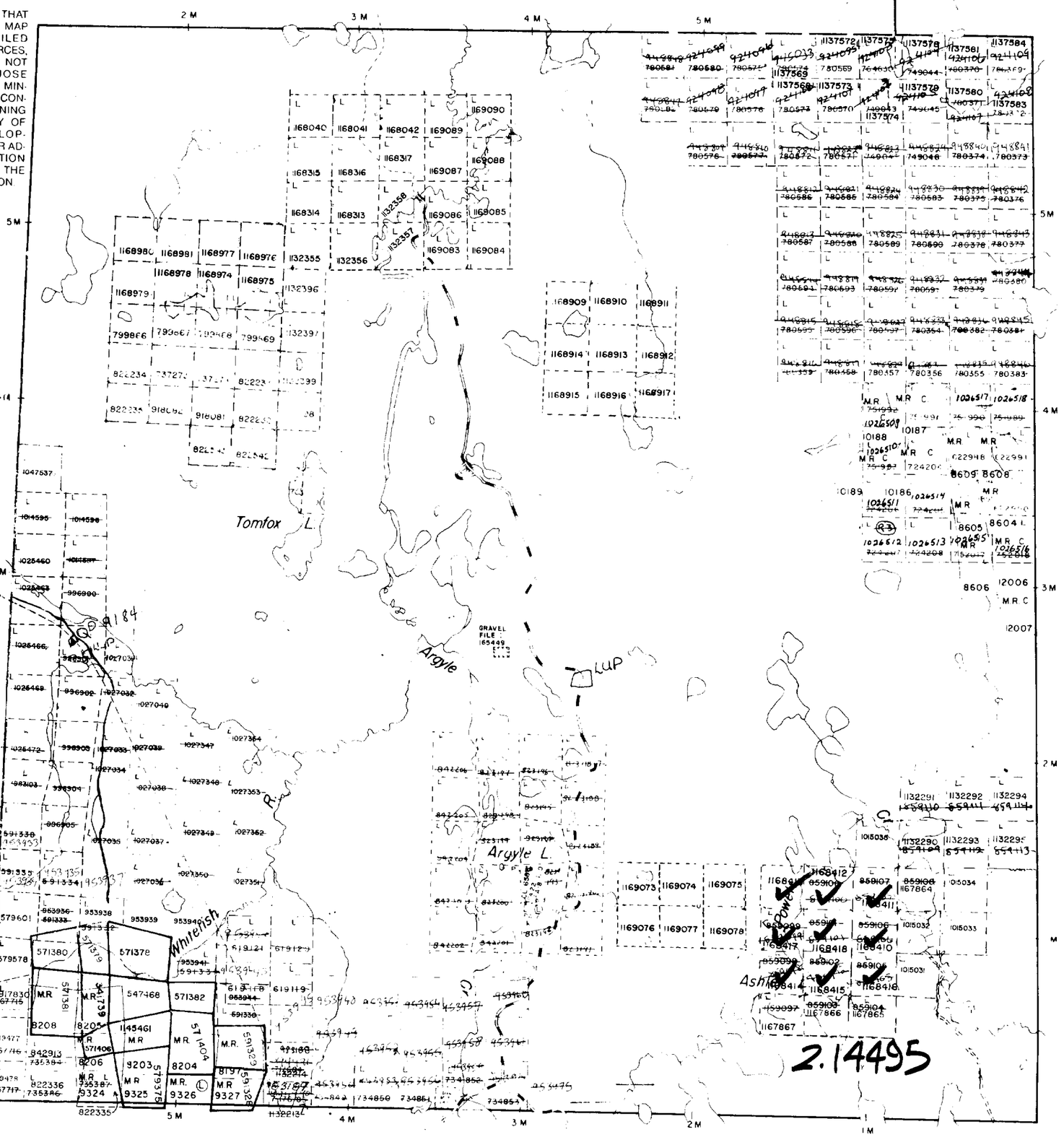
Signature	Date
Stewart Burnichel	Jan. 8/92

0212 (04/91)

Nota : Dans cette formule, lorsqu'il désigne des personnes, le masculin est utilisé au sens neutre.

M-503

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.



THE TOWNSHIP OF
ARGYLE

DISTRICT OF TIMISKAMING

LARDER LAKE MINING DIVISION

SCALE: 1-INCH=40 CHAINS

LEGEND

- PATENTED LAND
- 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 MUSKEG
- MINES
- CANCELLED

NOTES

400' Surface rights reservation along lakes and rivers.

WITHDRAWALS AND RESERVES

(R) Surface and Mining Rights Withdrawn from Staking, section 36/80 order No. W-9-86 O-12/88L OPENS W-8/86.

(R) Surface and Mining Rights Withdrawn from Staking, section 36/80 order No. [illegible]

(R) Surface and Mining Rights Withdrawn from Staking, section 36/80 order No. [illegible]

(R3) AND PART (R1) REOPENED FOR STAKING UNDER ORDER O-90/87 NR

O-L 23-90 NR OPENS PART OF W18/86, NOV 21/90

DATE OF ISSUE
MAR 11 1992
LARDER LAKE
MINING RECORDER'S OFFICE

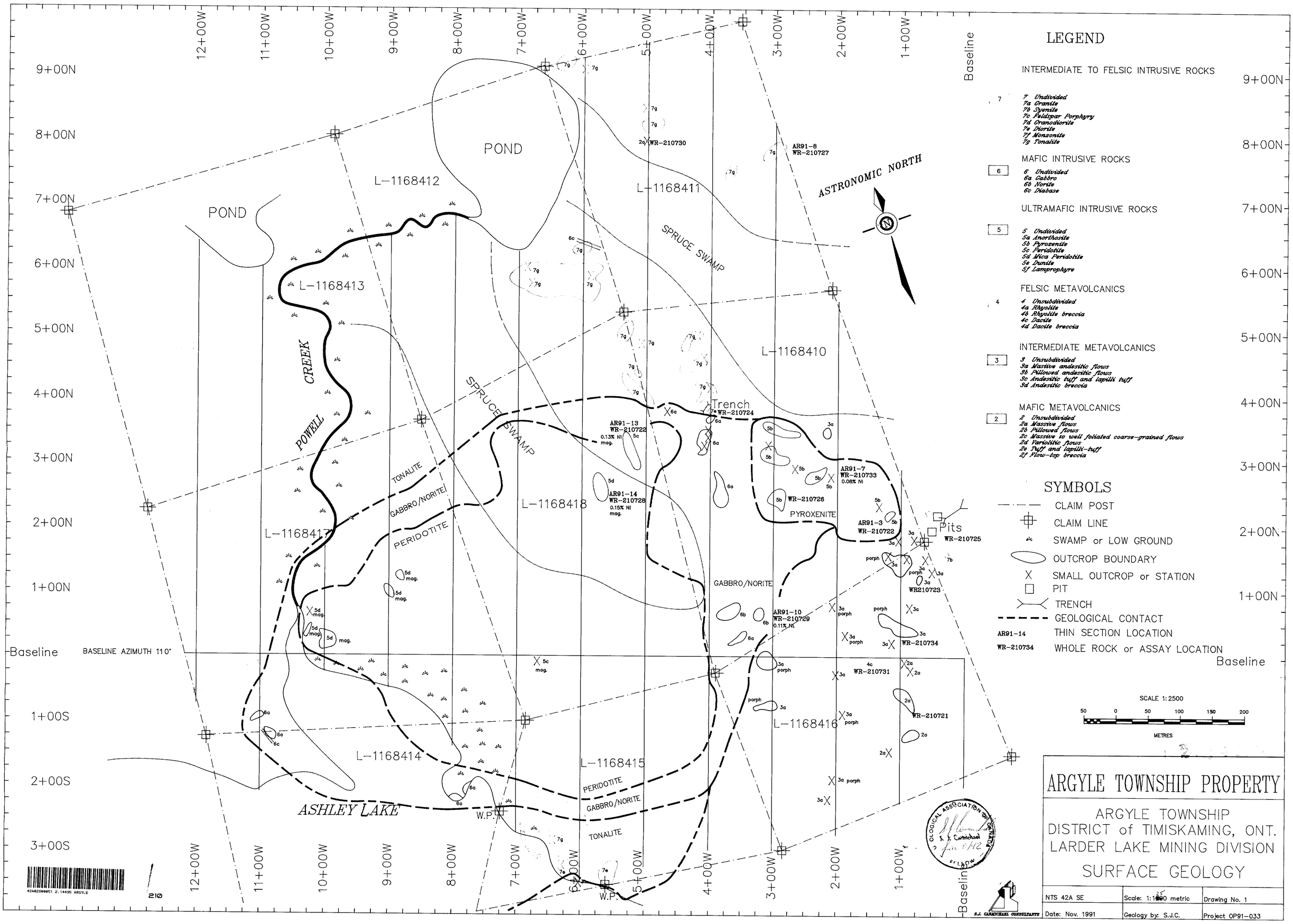
PLAN NO.- M-203

MINISTRY OF NATURAL RESOURCES

2.14495

42A02SW0051 2.14495 ARGYLE

200



LEGEND

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS

7 *Undivided*
7a Granite
7b Syenite
7c Feldspar Porphyry
7d Granodiorite
7e Diorite
7f Monzonite
7g Tonalite

MAFIC INTRUSIVE ROCKS

6 *Undivided*
6a Gabbro
6b Norite
6c Diabase

ULTRAMAFIC INTRUSIVE ROCKS

5 *Undivided*
5a Anorthosite
5b Pyroxenite
5c Peridotite
5d Mica Peridotite
5e Dunite
5f Lamprophyre

FELSIC METAVOLCANICS

4 *Unsubdivided*
4a Rhyolite
4b Rhyolite breccia
4c Dacite
4d Dacite breccia

INTERMEDIATE METAVOLCANICS

3 *Unsubdivided*
3a Massive andesitic flows
3b Pillowed andesitic flows
3c Andesitic tuff and lapilli tuff
3d Andesitic breccia

MAFIC METAVOLCANICS

2 *Unsubdivided*
2a Massive flows
2b Pillowed flows
2c Massive to well foliated coarse-grained flows
2d Variolitic flows
2e Tuff and lapilli-tuff
2f Flow-top breccia

SYMBOLS

- CLAIM POST
- CLAIM LINE
- SWAMP or LOW GROUND
- OUTCROP BOUNDARY
- X SMALL OUTCROP or STATION
- PIT
- TRENCH
- GEOLOGICAL CONTACT
- AR91-14 THIN SECTION LOCATION
- WR-210734 WHOLE ROCK or ASSAY LOCATION

SCALE 1:2500

50 0 50 100 150 200

METRES

ARGYLE TOWNSHIP PROPERTY

ARGYLE TOWNSHIP
DISTRICT of TIMISKAMING, ONT.
LARDER LAKE MINING DIVISION

SURFACE GEOLOGY

NTS 42A SE	Scale: 1:2500 metric	Drawing No. 1
Date: Nov. 1991	Geology by: S.J.C.	Project 0P91-033

S.J. CARMICHAEL CONSULTANTS

GEOLOGICAL ASSOCIATION OF CANADA
S. J. Carmichael
FELLOW

42A02SW0051 2.14495 ARGYLE

210

12+00W 11+00W 10+00W 9+00W 8+00W 7+00W 6+00W 5+00W 4+00W 3+00W 2+00W 1+00W Baseline

9+00N 8+00N 7+00N 6+00N 5+00N 4+00N 3+00N 2+00N 1+00N Baseline 1+00S 2+00S 3+00S

Pond

Pond

Pond

L-1168411

L-1168412

L-1168413

L-1168414

L-1168415

L-1168416

L-1168417

L-1168418

L-1168419

Powell Creek

Ashley Lake

W.P.

W.P.

ASTRONOMIC NORTH

LEGEND

- 10,000 Gamma Contour
- 9,000 Gamma Contour
- 8,000 Gamma Contour
- 7,000 Gamma Contour
- 6,000 Gamma Contour
- 5,000 Gamma Contour
- 4,000 Gamma Contour
- Magnetic Depression

Contour Interval = 500 Gammas

Add 56,000 Gammas To All Readings

Base Station L4+00W, 0+00

SCALE 1:2500

50 0 50 100 150 200

METRES

ARGYLE TOWNSHIP PROPERTY

ARGYLE TOWNSHIP
LARDER LAKE MINING DIVISION
MAGNETOMETER SURVEY

Date: November, 1991	Scale: 1:2500 Metric	Drawing No. 2
NTS 42 A/2	Survey by: S. Carmichael	Project: OP91-033

S.J. CARMICHAEL CONSULTANTS

GEOLOGICAL ASSOCIATION OF CANADA
S. J. Carmichael
FELLOW

42A02NW0051 2.14495 ARGYLE

220

12+00W 11+00W 10+00W 9+00W 8+00W 7+00W 6+00W 5+00W 4+00W 3+00W 2+00W 1+00W Baseline

9+00N
8+00N
7+00N
6+00N
5+00N
4+00N
3+00N
2+00N
1+00N
Baseline
1+00S
2+00S
3+00S

Pond
Pond
Pond
Creek
Powell
Ashley Lake

L-1168412
L-1168413
L-1168417
L-1168418
L-1168414
L-1168415
L-1168410
L-1168411
L-1168416

W.P.
W.P.

ASTRONOMIC NORTH

LEGEND

\+ IN PHASE − QUADRATURE

+10 −10
+8 −8
+4 −2
−1 −1
−6 +3
−12 +8
−5 0
0 4
0 0

Scale 1cm=4%

CONDUCTOR AXIS

TX - RX SEPARATION = 100 METRES

SCALE 1:2500

50 0 50 100 150 200
METRES

ARGYLE TOWNSHIP PROPERTY

ARGYLE TOWNSHIP
LARDER LAKE MINING DIVISION
MAX MIN II SURVEY
444 Hz.

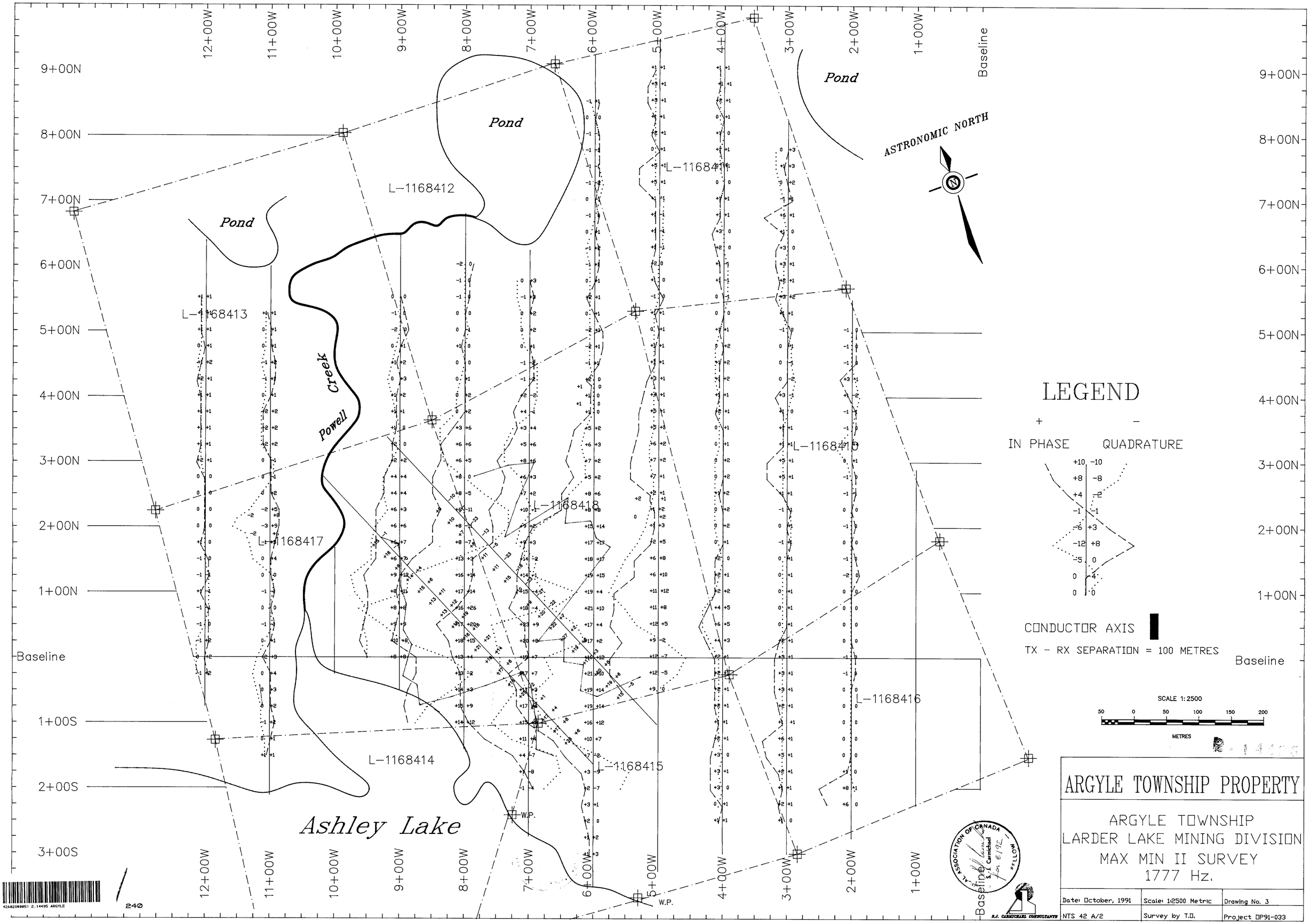
Date: October, 1991	Scale: 1:2500 Metric	Drawing No. 3 of 7
NTS 42 A/2	Survey by: T.D.	Project: DP91-033

GEOLOGICAL ASSOCIATION OF CANADA
S.J. Carmichael
FELLOW

S.J. CARMICHAEL CONSULTANTS

42A02SW0051 2.14495 ARGYLE

230


12+00W
11+00W
10+00W
9+00W
8+00W
7+00W
6+00W
5+00W
4+00W
3+00W
2+00W
1+00W
Baseline
9+00N
8+00N
7+00N
6+00N
5+00N
4+00N
3+00N
2+00N
1+00N
Baseline
1+00S
2+00S
3+00S
Pond
Pond
Pond
Creek
Powell
Ashley Lake
L-1168412
L-1168413
L-1168414
L-1168415
L-1168416
L-1168417
L-1168418
L-1168419
W.P.
W.P.
ASTRONOMIC NORTH
LEGEND
+
-
IN PHASE
QUADRATURE
+10 -10
+8 -8
+4 -4
-1 -1
-6 +3
-12 +8
-5 0
0 4
0 0
CONDUCTOR AXIS
TX - RX SEPARATION = 100 METRES
SCALE 1:2500
50 0 50 100 150 200
METRES
ARGYLE TOWNSHIP PROPERTY
ARGYLE TOWNSHIP
LARDER LAKE MINING DIVISION
MAX MIN II SURVEY
1777 Hz.
Date: October, 1991
Scale: 1:2500 Metric
Drawing No. 3
NTS 42 A/2
Survey by T.D.
Project DP91-033
S.J. CARMICHAEL CONSULTANTS
ASSOCIATION OF CANADA
S.J. Carmichael
Jan. 8/92
FELLOW
240