Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

January 30, 2003

Ecology and Environment, Inc.
2101 4th Ave
Suite 1900
Seattle, WA 98121

Attn: Jeff Fowlow

Project Name: Vermiclulite NW/ WR Grace
Project Number: TDD# 10170014 Case# 124969-510
P. O. Number: Not Available

Lab/Cor Batch Number: 021520

Conditions Enclosed please find results for samples submitted to our laboratory on December 19, 2002. A list of samples received follows, with limitation or rejection criteria noted where applicable.

Lab/Cor Sample No.	Client Sample No.	Limitation/Rejection Criteria
021520-01	02434353	No special conditions were noted
021520-02	02434363	No special conditions were noted
021520-03	02434366	No special conditions were noted
021520-04	02434372	No special conditions were noted
021520-05	02434376	No special conditions were noted
021520-06	02434379	No special conditions were noted

Method Preparation and analysis of the above samples was conducted in accordance with the Niosh method 7402 for the identification of asbestos. The samples were collapsed with dimethylformamide (DMF) / acetic acid, carbon coated at high vacuum with a thin layer of carbon, placed on 200 mesh copper grids and allowed to dissolve in DMF / acetone until cleared of filter debris.

TEM analysis was performed using a Philips 410 transmission electron microscope equipped with an EDAX PV9800 X-ray analyzer. The air samples were scanned at a magnification of approximately 990X using an accelerating voltage of 100 KV. The magnification was increased to about 10,000X for structure sizing.

Counting Rules

Minimum Aspect Ratio	Minimum Length	Minimum Width	Minimum Required Analytical Sensitivity	Stopping Rules
3:1	5 µm	0.25 µm	NA	100 Fibers

Disclaimer This test report relates only to the items tested in this report. Interpretation of these results is the sole responsibility of the client.

If further clarification of these results is needed, please do not hesitate to call me. Thank you for allowing the staff at Lab/Cor, Inc. the opportunity to provide you with analytical services.

Sincerely,

John Harris
Laboratory Director

7619 6th Avenue NW, Seattle, WA 98117 (206) 781-0155 (206) 789-8424 (FAX)

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: January 30, 2003

Client Information	
Project Name:	Vermiclulite NW/ WR Grace
Project No.:	TDD# 10170014
	Case# 124969-510
P. O. No.:	Not Available
Sample Type:	Air

Tracking Information			
Login:	Dec 19, 2002	*By:*	PA
Prep:	Dec 19, 2002	*By:*	PA
Verified:	Dec 19, 2002	*By:*	PA
Reviewed:	Dec 27, 2002	*By:*	DW
Final Review:	Jan 30, 2003	*By:*	JH

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE

Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concen-tration (Fibs/cc)	95% Confidence Interval (Fibs/cc)	Fiber Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (Fibs/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm²)	Area Analyzed (mm²)	Analyst	Analysis Date
021520-01	02434353	Personal Monitor # 6	ASBESTOS	<0.004	0 - 0.016	0	0	0.004	225.3	40	385	0.4026	DW	12/27/02
		Jed Background # 2	NON-ASBESTOS	0.017	0.005 - 0.043	4								
Test			OTHER FIBERS											
			Winchite	<0.004	0 - 0.016	0								
			Richterite	<0.004	0 - 0.016	0								
			TOTAL	0.017	0.005 - 0.043	4								
021520-02	02434363	Personal Monitor # 2	ASBESTOS	<0.006	0 - 0.023	0	0	0.006	155.6	40	385	0.4026	DW	12/27/02
		Keven	NON-ASBESTOS	0.018	0.004 - 0.054	3								
Test			OTHER FIBERS											
			Winchite	<0.006	0 - 0.023	0								
			Richterite	<0.006	0 - 0.023	0								
			TOTAL	0.018	0.004 - 0.054	3								
021520-03	02434366	Personal Monitor # 5	ASBESTOS	<0.007	0 - 0.025	0	0	0.007	140.3	40	385	0.4026	DW	12/27/02
		Jed	NON-ASBESTOS	0.020	0.004 - 0.060	3								
Test			OTHER FIBERS											
			Winchite	<0.007	0 - 0.025	0								
			Richterite	<0.007	0 - 0.025	0								
			TOTAL	0.020	0.004 - 0.060	3								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: January 30, 2003

Client Information	
Project Name:	Vermiclulite NW/ WR Grace
Project No.:	TDD# 10170014 Case# 124969-510
P. O. No.:	Not Available
Sample Type:	Air

Tracking Information		
Login:	Dec 19, 2002	*By:* PA
Prep:	Dec 19, 2002	*By:* PA
Verified:	Dec 19, 2002	*By:* PA
Reviewed:	Dec 27, 2002	*By:* DW
Final Review:	Jan 30, 2003	*By:* JH

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE

Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concen-tration (Fibs/cc)	95% Confidence Interval (Fibs/cc)	Fiber Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (Fibs/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm²)	Area Analyzed (mm²)	Analyst	Analysis Date
021520-04	02434372	Personal Monitor # 4 Jed	ASBESTOS	<0.011	0 - 0.040	0	0	0.011	88.1	40	385	0.4026	DW	12/27/02
Test			NON-ASBESTOS	0.011	0.000 - 0.060	1								
			OTHER FIBERS											
			Winchite	<0.011	0 - 0.040	0								
			Richterite	<0.011	0 - 0.040	0								
			TOTAL	0.011	0.000 - 0.060	1								
021520-05	02434376	Personal Monitor # 3 Keven	ASBESTOS	0.018	0.006 - 0.071	2	20	0.009	108.4	40	385	0.3926	DW	12/27/02
Test			NON-ASBESTOS	0.072	0.014 - 0.103	5								
			OTHER FIBERS											
			Winchite	0.027	0.006 - 0.079	3								
			Richterite	<0.009	0 - 0.033	0								
			TOTAL	0.117	0.050 - 0.178	10								
021520-06	02434379	Personal Monitor # 5 Doc	ASBESTOS	<0.011	0 - 0.039	0	0	0.011	90.9	40	385	0.4026	DW	12/27/02
Test			NON-ASBESTOS	0.021	0.003 - 0.076	2								
			OTHER FIBERS											
			Winchite	<0.011	0 - 0.039	0								
			Richterite	<0.011	0 - 0.039	0								
			TOTAL	0.021	0.003 - 0.076	2								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434353
Description: Personal Monitor # 6 Jed Background # 2

Lab/Cor Sample No.: 021520-01
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
A	1	B 44	NSD**																
	2	B 34	NSD																
	3	B 24	NSD																
	4	B 14	NSD																
	5	B 4	NSD																
	6	C 4	NSD																
	7	C 14	NSD																
	8	C 24	NSD																
	9	C 34	NSD																
	10	C 44	1	Fiber	35	4							✓			P, S, K			
	11	C 43	NSD																
	12	C 33	NSD																
	13	C 23	NSD																
	14	C 13	1	Fiber	30	1							✓			P, S, K			
	15	C 3	1	Fiber	10	1.5							✓			Mg, Al, Si, K			
	16	B 3	NSD																
	17	B 13	NSD																
	18	B 23	NSD																
	19	B 33	NSD																
	20	B 42	NSD																
	21	B 32	NSD																
	22	B 22	NSD					✓											
	23	B 12	NSD																
	24	B 2	1	Fiber	25	0.75							✓			P, S, K			
	25	C 2	NSD																
	26	C 12	NSD																
B	27	D 10	NSD																
	28	D 20	NSD																
	29	D 30	NSD																
	30	D 40	NSD																
	31	D 41	NSD																

**NSD – No Structures Detected

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434353
Description: Personal Monitor # 6 Jed Background # 2

Lab/Cor Sample No.: 021520-01
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
	32	D 31	NSD																
	33	D 21	NSD																
	34	D 11	NSD																
	35	D 1	NSD																
	36	D 11	NSD																
	37	D 21	NSD																
	38	C 14	NSD																
	39	C 24	NSD																
	40	C 34	NSD																
	40						0	0	0	0	0	0	4						

**NSD – No Structures Detected

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434363
Description: Personal Monitor # 2 Keven

Lab/Cor Sample No.: 021520-02
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
A	1	B 44	NSD**																
	2	B 34	NSD																
	3	B 24	NSD																
	4	B 14	NSD																
	5	B 4	NSD																
	6	C 4	NSD																
	7	C 14	NSD																
	8	C 24	NSD																
	9	C 34	NSD																
	10	C 44	1	Fiber	25	5							✓			Al, Si, K			
	11	C 43	1	Fiber	40	0.5							✓			P, S, K			
	12	C 33	NSD																
	13	C 23																	
	14	C 13	NSD																
	15	C 3	NSD																
	16	B 3	NSD																
	17	B 13	NSD																
	18	B 23	NSD																
	19	B 33	NSD																
	20	B 43	NSD																
	21	B 42	NSD																
	22	B 32	NSD																
	23	B 22	NSD																
	24	B 12	1	Fiber	25	5							✓			Si			
	25	B 2	NSD																
	26	C 2	NSD																
	27	C 12	NSD																
B	28	B 10	NSD																
	29	B 20	NSD																
	30	A 30	NSD																
	31	A 20	NSD																

**NSD – No Structures Detected

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434363
Description: Personal Monitor # 2 Keven

Lab/Cor Sample No.: 021520-02
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
	32	A 10	NSD																
	33	A 1	NSD																
	34	A 11	NSD																
	35	A 21	NSD																
	36	A 31	NSD																
	37	A 41	NSD																
	38	A 42	NSD																
	39	A 32	NSD																
	40	A 22	NSD																
	40						0	0	0	0	0	0	3						

**NSD – No Structures Detected

02152000.TEM

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434366
Description: Personal Monitor # 5 Jed

Lab/Cor Sample No.: 021520-03
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
A	1	B 44	NSD**																
	2	B 34	NSD																
	3	B 24	NSD																
	4	B 14	NSD																
	5	B 4	NSD																
	6	C 4	NSD																
	7	C 14	NSD																
	8	C 24	NSD																
	9	C 34	NSD																
	10	C 44	NSD																
	11	C 43	NSD																
	12	C 33	NSD																
	13	C 23	NSD																
	14	C 13	NSD																
	15	C 3	NSD																
	16	B 3	1	Fiber	12	0.5							✓			P, S, K			
	17	B 13	NSD																
	18	B 23	NSD																
	19	B 33	NSD																
	20	B 43	NSD																
	21	B 42	NSD																
	22	B 32	NSD																
	23	B 22	NSD																
	24	B 12	NSD																
	25	B 2	NSD																
	26	C 2	NSD																
	27	C 12	NSD																
B	28	A 41	NSD																
	29	A 31	NSD																
	30	A 21	NSD																
	31	A 11	NSD																

**NSD – No Structures Detected

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434366
Description: Personal Monitor # 5 Jed

Lab/Cor Sample No.: 021520-03
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
	32	A 1	NSD																
	33	D 1	NSD																
	34	D 11	NSD																
	35	D 21	NSD																
	36	D 22	NSD																
	37	D 12	NSD																
	38	D 2	1	Fiber	5	0.4							✓			Ca			
			2	Fiber	5.5	0.5							✓			Ca			
	39	A 2	NSD																
	40	A 12	NSD																
	40						0	0	0	0	0	0	3						

**NSD – No Structures Detected

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434372
Description: Personal Monitor # 4 Jed

Lab/Cor Sample No.: 021520-04
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
A	1	B 34	NSD**																
	2	B 24	NSD																
	3	B 14	NSD																
	4	B 4	NSD																
	5	C 4	NSD																
	6	C 14	NSD																
	7	C 24	NSD																
	8	C 34	NSD																
	9	C 44	NSD																
	10	C 43	NSD																
	11	C 33	NSD																
	12	C 23	NSD																
	13	C 13	NSD																
	14	C 3	NSD																
	15	B 3	NSD																
	16	B 13	NSD																
	17	B 23	NSD																
	18	B 33	NSD																
	19	B 43	NSD																
	20	B 42	NSD																
	21	B 22	1	Fiber	25	0.75							✓			P, S, K			
	22	B 12	NSD																
	23	B 2	NSD																
	24	C 2	NSD																
	25	C 12	NSD																
	26	C 22	NSD																
	27	C 32	NSD																
B	28	B 41	NSD																
	29	B 31	NSD																
	30	B 21	NSD																
	31	B 11	NSD																

**NSD – No Structures Detected

02152000.TEM

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434372
Description: Personal Monitor # 4 Jed

Lab/Cor Sample No.: 021520-04
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
	32	B 1	NSD																
	33	C 1	NSD																
	34	C 11	NSD																
	35	C 22	NSD																
	36	C 12	NSD																
	37	C 2	NSD																
	38	B 2	NSD																
	39	B 12	NSD																
	40	B 22	NSD																
	40						0	0	0	0	0	0	1						

**NSD – No Structures Detected

02152000.TEM

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520 | *Report Date:* Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434376
Description: Personal Monitor # 3 Keven

Lab/Cor Sample No.: 021520-05
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
A	1	B 44	1	Fiber	30	3							✓		12974	Na, Mg, Si, K, Ca, Fe	UNKNOWN		
			2	Fiber	9	0.5							✓		12975	Na, Mg, Si, K, Ca, Fe	WINCHITE		
	2	B 34	NSD**																
	3	B 24	1	Fiber	15	4							✓			Si			
	4	B 14	1	Fiber	46	1			✓					2779	12976	Na, Mg, Si, K, Ca, Fe	ZONE AXIS [2 0 1]	DW	1/27/03
	5	B 4	NSD																
	6	C 4	NSD																
	7	C 14	NSD																
	8	C 24	NSD																
	9	C 34	NSD																
	10	C 44	NSD																
	11	C 43	1	Fiber	5.5	0.5							✓			Ti			
	12	C 33	1	Fiber	5.5	0.75							✓	2780	12977	Na, Mg, Si, K, Ca, Fe	ZONE AXIS [1 0 1] WINCHITE	DW	1/27/03
	13	C 23	NSD																
	14	C 13	NSD																
	15	C 3	NSD																
	16	B 3	NSD																
	17	B 13	NSD																
	18	B 23	NSD																
	19	B 33	NSD																
	20	B 43	NSD																
	21	B 42	NSD																
	22	B 32	1	Fiber	6	0.5							✓			Al, Si, K			
			2	Fiber	9	1							✓			Al, Si, K			
	23	B 22	NSD																
	24	B 12	NSD																
	25	B 2	NSD																
	26	C 2	NSD																
	27	C 12	NSD																

**NSD – No Structures Detected

02152000.TEM

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 021520

Report Date: Jan 30, 2003

Client: Ecology and Environment, Inc.
Project Name: Vermiclulite NW/ WR Grace
Sample No.: 02434379
Description: Personal Monitor # 5 Doc

Lab/Cor Sample No.: 021520-06
Analyst: DW
Analysis Date: Dec 27, 2002

TEM ASBESTOS FIBER COUNT – RAW DATA

Grid	GO No.	Grid Coord-inates	Struc-ture No.	Structure Type	Average Length	Average Width	Asbestos						Non-Asbes-tos	Neg. No.	EDS No.	Elements	Comments	Confirmation	
							Ch	Am	Ac	An	Tr	Cr						By	Date
	32	B 41	NSD																
	33	B 31	NSD																
	34	B 21	1	Fiber	13	0.4							✓			P, S, K			
	35	B 11	NSD																
	36	B 1	NSD																
	37	C 1	NSD																
	38	C 11	NSD																
	39	C 21	NSD																
	40	C 31	NSD																
	40						0	0	0	0	0	0	2						

**NSD – No Structures Detected

Ch – Chrysotile Ac – Actinolite Tr – Tremolite Am – Amosite An – Anthophyllite Cr – Crocidolite

GRID MAP

A69	A68	A67	A66	A65	A64	A63	A62	A61	A60	B60	B61	B62	B63	B64	B65	B66	B67	B68	B69
A59	A58	A57	A56	A55	A54	A53	A52	A51	A50	B50	B51	B52	B53	B54	B55	B56	B57	B58	B59
A49	A48	A47	A46	A45	A44	A43	A42	A41	A40	B40	B41	B42	B43	B44	B45	B46	B47	B48	B49
A39	A38	A37	A36	A35	A34	A33	A32	A31	A30	B30	B31	B32	B33	B34	B35	B36	B37	B38	B39
A29	A28	A27	A26	A25	A24	A23	A22	A21	A20	B20	B21	B22	B23	B24	B25	B26	B27	B28	B29
A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19
A9	A8	A7	A6	A5	A4	A3	A2	A1			B1	B2	B3	B4	B5	B6	B7	B8	B9
D9	D8	D7	D6	D5	D4	D3	D2	D1			C1	C2	C3	C4	C5	C6	C7	C8	C9
D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29
D39	D38	D37	D36	D35	D34	D33	D32	D31	D30	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39
D49	D48	D47	D46	D45	D44	D43	D42	D41	D40	C40	C41	C42	C43	C44	C45	C46	C47	C48	C49
D59	D58	D57	D56	D55	D54	D53	D52	D51	D50	C50	C51	C52	C53	C54	C55	C56	C57	C58	C59
D69	D68	D67	D66	D65	D64	D63	D62	D61	D60	C60	C61	C62	C63	C64	C65	C66	C67	C68	C69

To be used as a reference for grid coordinates from each raw data sheet.

INTE-% :
LABEL = 021520-05 1/1 12974
27-DEC-:2 15:22:59
63.475 LIVE SECONDS

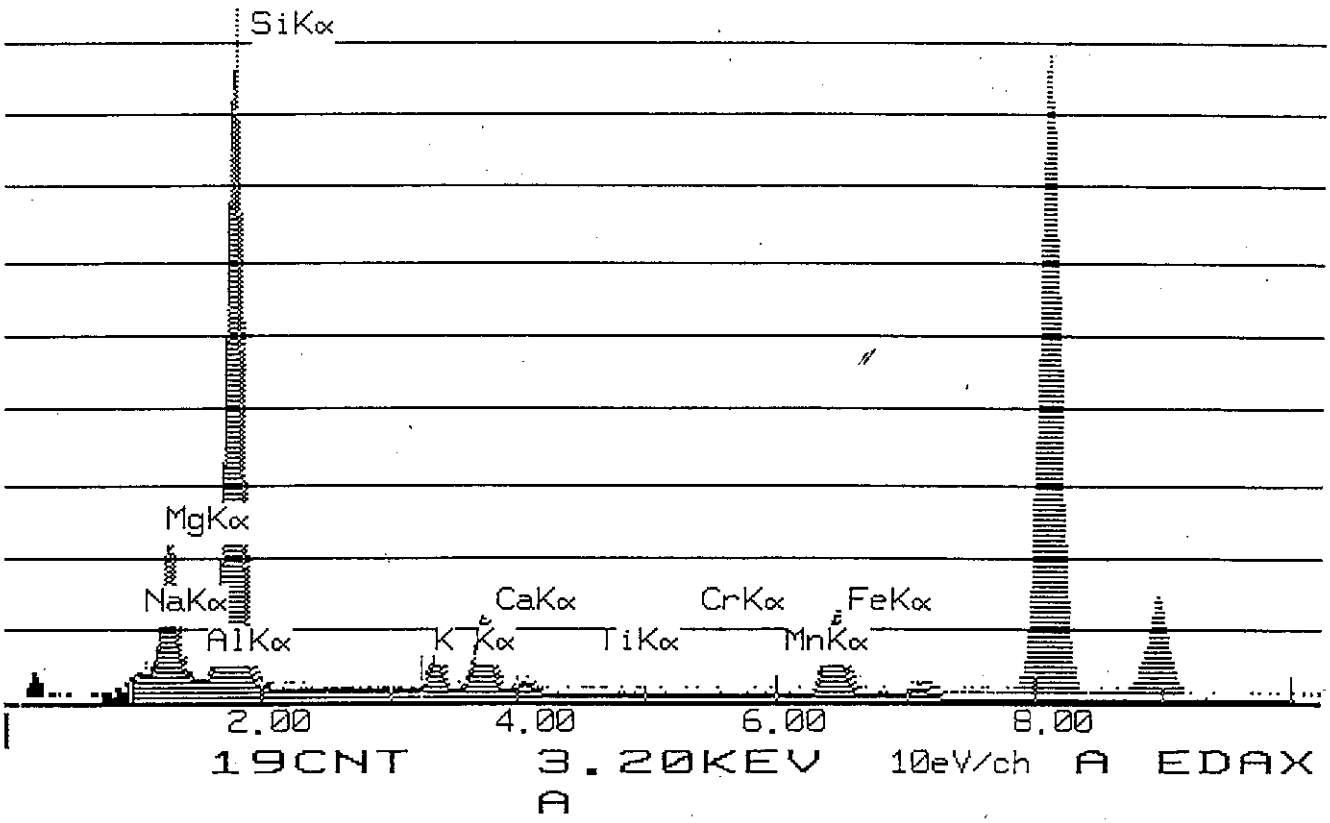
ELEM	CPS	WT % ELEM	WT % OXIDE
NAK	1.203	0.643	0.866
MGK	34.077	10.659	17.674
SIK	156.724	30.682	65.640
K K	9.736	1.721	2.074
CAK	22.056	3.929	5.497
CRK	0.599	0.120	0.175
MNK	0.677	0.141	0.182
FEK	26.073	5.521	7.893
TOTAL			100.000

USED PEIF: USER

Bb-dust

unknown carbonate amphibole

27-DEC-02 15:23:37 SUPER QUANT
RATE= 144CPS TIME= 63LSEC
FS= 1091/ 1091 PRST= 200LSEC
A =021520-05 1/1 12974



	Wt Percent		ions	T site	Leftover	C site	Leftover	B site	Leftover	A site	Leftover
SiO2	65.64	Si+4	8.0000	8.0000							
Al2O3	0	Al+3	0.0000	0.0000	0.0000						
TiO2	0	Ti+4	0.0000	0.0000	0.0000						
Cr2O3	0.175	Cr+3	0.0523			0.0523	0.0000				
Fe(total)O	7.893	Fe+3	0.4175			0.4175	0.0000				
MgO	17.674	Mg+2	3.6156			3.6156	0.0000				
MnO	0.182	Fe+2	0.5174			0.5174	0.0000				
CaO	5.497	Mn+2	0.0932			0.0932	0.0000				
Na2O	0.866	Ca+2	0.8716					0.8716	0.0000		
K2O	2.074	Na+	0.3472					0.3472	0.0000	0.0000	0.0000
		K+	0.4050							0.4050	0.0000
Total	100.001		Excess	T site	0.0000	C site	0.0000	B site	0	A site	0
			Total	8		4.6961		1.2188		0.4050	0.0000
			%Fill	100		93.9218		60.9408			

Prefix	none
Name	unknown subcalcic-amphibole
Modifier	Potassian
Group	Calcic Amphibole

Sample # 021520-05-1-1

Values		Satisfied Conditions
(Ca,Na)@B	1.22	(Ca,Na)@B >= 1 and Na@B < 0.5
Na@B	0.35	Ca@B <= 1
Ca@B	0.87	
(Na,K)@A	0.40	

Mineral Analysis Program (Version 5.0)

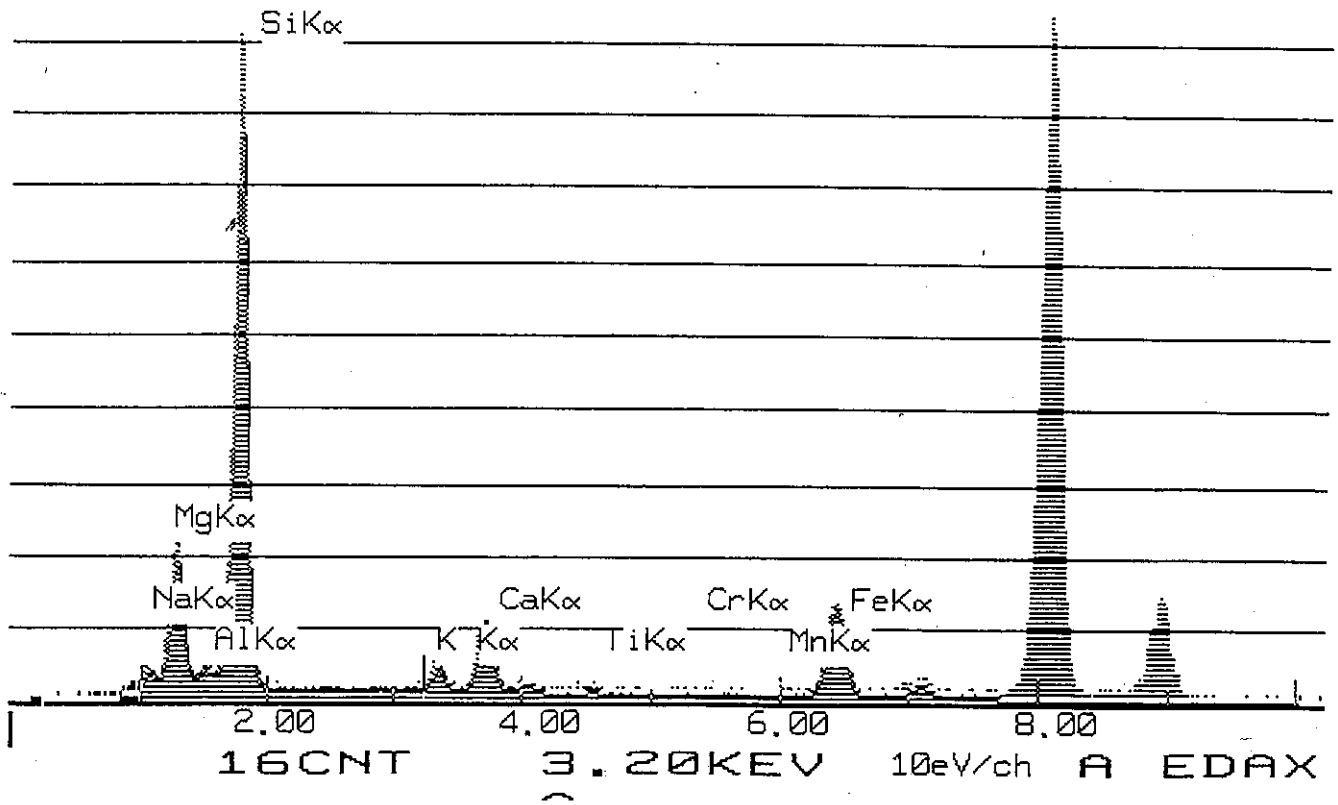
INTE-% :
LABEL = 021520-05 1/2 12975
27-DEC-:2 15:29:29
132.833 LIVE SECONDS

Be Anal
Nitrite

ELEM	CPS	WT % ELEM	WT % OXIDE
NAK	2.158	2.464	3.321
MGK	15.561	10.406	17.255
ALK	1.604	0.819	1.547
SIK	69.516	29.096	62.247
K K	2.944	1.113	1.340
CAK	9.297	3.541	4.954
TIK	0.211	0.088	0.146
FEK	14.198	6.427	9.189
TOTAL			100.000

USED PEIF: USER

27-DEC-02 15:30:05 SUPER QUANT
RATE= 1288CPS TIME= 133LSEC
FS= 1057/ 1057 PRST= 200LSEC
A =021520-05 1/2 12975



	Wt Percent		ions	T site	Leftover	C site	Leftover	B site	Leftover	A site	Leftover
SiO2	62.247	Si+4	8.0000	8.0000							
Al2O3	1.547	Al+3	0.2699	0.0000	0.2699						
TiO2	0.146	Ti+4	0.0472	0.0000	0.0472						
Cr2O3	0	Cr+3	0.0000			0.0000	0.0000				
Fe(total)O	9.189	Fe+3	0.4705			0.4705	0.0000				
MgO	17.255	Mg+2	3.5131			3.5131	0.0000				
MnO	0	Fe+2	0.5615			0.5615	0.0000				
CaO	4.954	Mn+2	0.0000			0.0000	0.0000				
Na2O	3.321	Ca+2	0.7578					0.7578	0.0000		
K2O	1.34	Na+	0.9260					0.9260	0.0000	0.0000	0.0000
		K+	0.2567							0.2567	0.0000
Total	99.999		Excess	T site	0.3171	C site	0.0000	B site	0	A site	0
			Total	8		4.8621		1.6837		0.2567	0.0000
			%Fill	100		97.2426		84.1874			

Prefix	none
Name	winchite
Modifier	Potassian
Group	Sodic-Calcic Amphibole

Sample # 021520-05-1-2

Values		Satisfied Conditions
(Ca,Na)@B	1.68	(Ca,Na)@B >= 1 and 0.5 <= Na@B < 1.5
Na@B	0.93	(Na,K)@A < 0.5
Na,K)@A	0.26	(Mg/(Mg+Fe2))>= 0.5
Mg/(Mg+Fe2)	0.86	Si > 7.5
Si	8.00	

Mineral Analysis Program (Version 5.0)

INTE-% :
LABEL = 021520-05 4/1 12976
27-DEC-:2 16:23:26
25.351 LIVE SECONDS

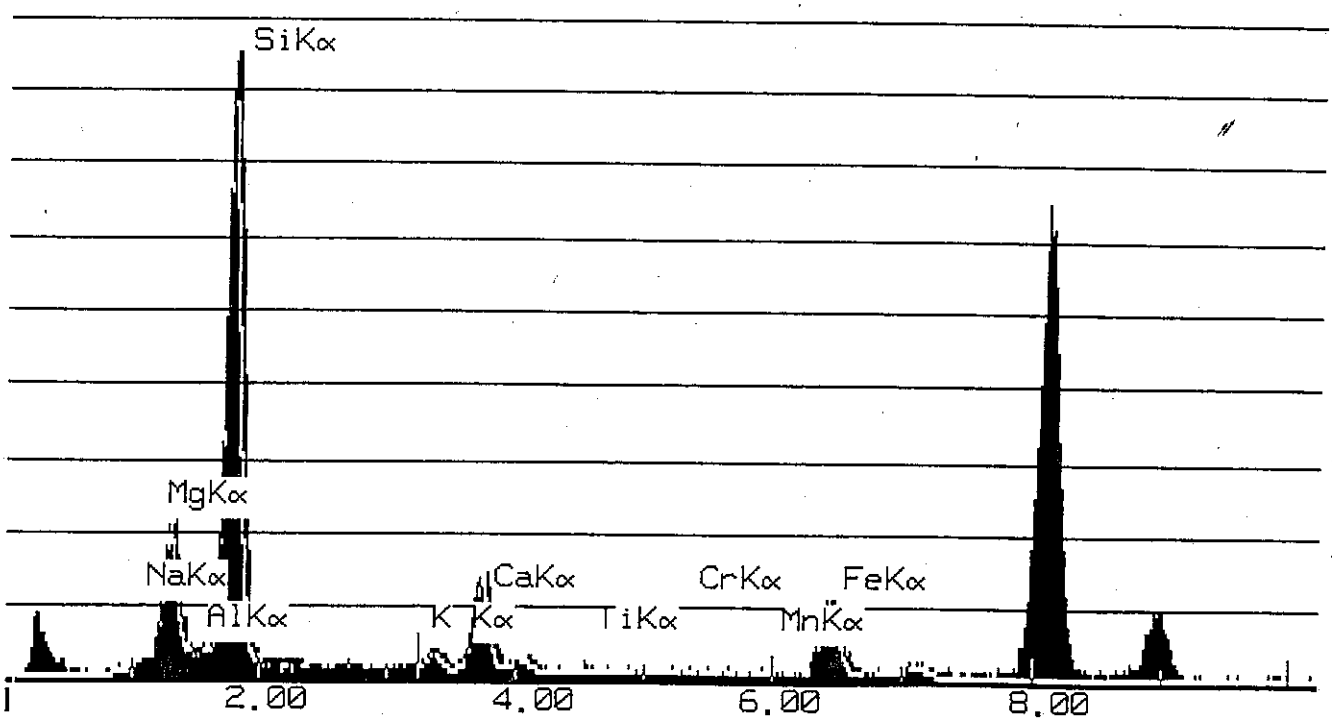
BG Auto
Actinolite

ELEM	CPS	WT % ELEM	WT % OXIDE
NAK	2.359	0.440	0.594
MGK	92.936	10.167	16.858
SIK	450.402	30.839	65.975
K K	13.964	0.863	1.040
CAK	81.615	5.085	7.114
TIK	2.170	0.148	0.246
CRK	1.933	0.135	0.197
MNK	1.538	0.112	0.144
FEK	73.963	5.477	7.831

TOTAL			100.000

USED PEIF: USER

27-DEC-02 16:24:06 SUPER QUANT
RATE=35326CPS TIME= 25LSEC
FS= 1291/ 1291 PRST= 200LSEC
A =021520-05 4/1 12976



	Wt Percent		ions	T site	Leftover	C site	Leftover	B site	Leftover	A site	Leftover
SiO2	65.975	Si+4	8.0000	8.0000							
Al2O3	0	Al+3	0.0000	0.0000	0.0000						
TiO2	0.246	Ti+4	0.0877	0.0000	0.0877						
Cr2O3	0.197	Cr+3	0.0539			0.0539	0.0000				
Fe(total)O	7.831	Fe+3	0.0629			0.0629	0.0000				
MgO	16.858	Mg+2	3.4605			3.4605	0.0000				
MnO	0.144	Fe+2	0.9045			0.9045	0.0000				
CaO	7.114	Mn+2	0.0873			0.0873	0.0000				
Na2O	0.594	Ca+2	1.1014					1.1014	0.0000		
K2O	1.04	Na+	0.2749					0.2749	0.0000	0.0000	0.0000
		K+	0.2296							0.2296	0.0000
Total	99.999		Excess	T site	0.0877	C site	0.0000	B site	0	A site	0
			Total	8		4.6567		1.3763		0.2296	0.0000
			%Fill	100		93.1339		68.8154			

Prefix none

Name probable actinolite Ca values below optimal levels

Modifier none

Group Calcic Amphibole

Sample # 021520-05-

Values		Satisfied Conditions
(Ca,Na)@B	1.38	(Ca,Na)@B >= 1 and Na@B < 0.5
Na@B	0.27	1 < Ca@B < 1.5 and (Na,K)@A < 0.5
Ca@B	1.10	(Mg/(Mg+Fe2))>= 0.5
(Na,K)@A	0.23	Si > 7.5
Mg/(Mg+Fe2)	0.79	(Mg/(Mg+Fe2))< 0.9
Si	8.00	

Mineral Analysis Program (Version 5.0)

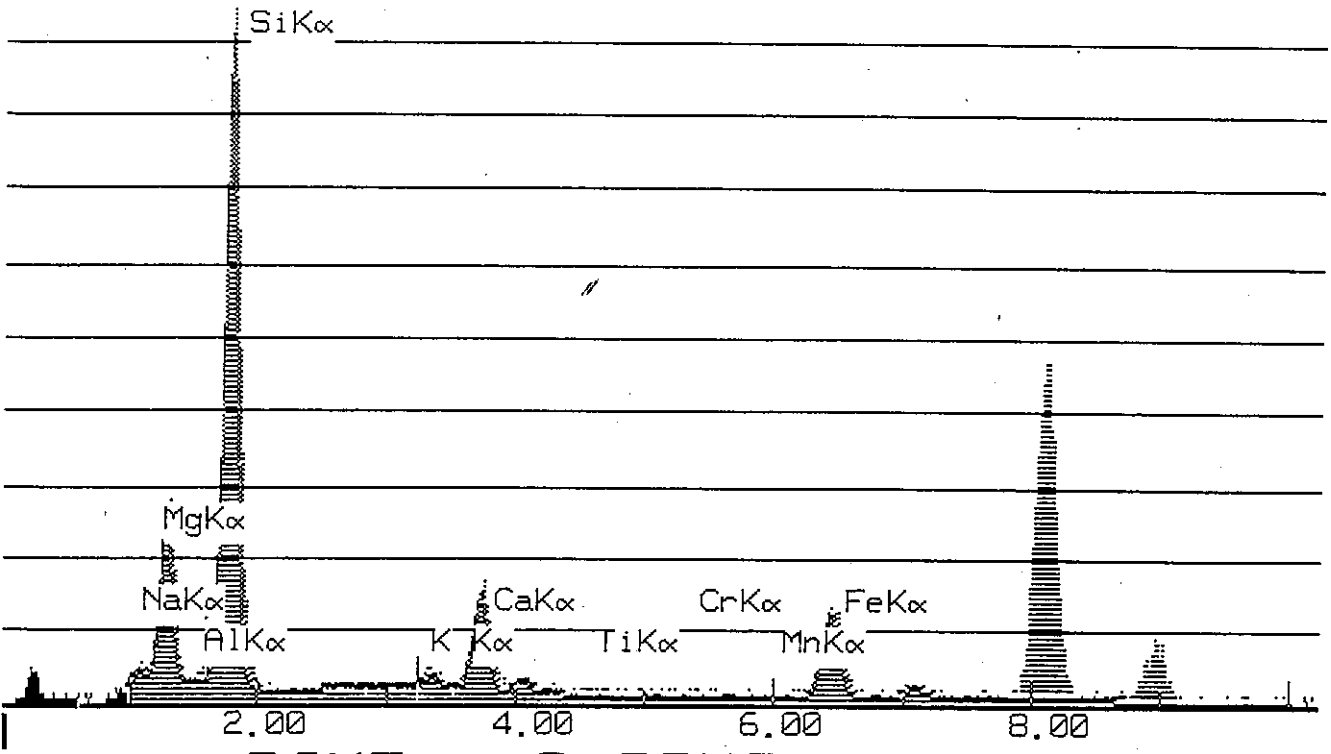
INTE-% :
LABEL = 021520-05 12/1 12977
27-DEC-:2 16:05:47
56.909 LIVE SECONDS

ELEM	CPS	WT % ELEM	WT % OXIDE
NAK	2.292	1.702	2.294
MGK	26.217	11.404	18.909
ALK	1.142	0.379	0.717
SIK	108.190	29.453	63.012
K K	1.898	0.467	0.562
CAK	18.363	4.549	6.364
TIK	0.246	0.067	0.111
CRK	0.299	0.083	0.121
MNK	0.404	0.117	0.151
FEK	18.433	5.427	7.760
TOTAL			100.000

USED PEIF: USER

BG-Qtz
1. Unchit

27-DEC-02 16:06:42 SUPER QUANT
RATE=43420CPS TIME= 57LSEC
FS= 639/ 639 PRST= 200LSEC
A =021520-05 12/1 12977



9CNT 3.20KEV 10eV/ch A EDAX
A

	Wt Percent		ions	T site	Leftover	C site	Leftover	B site	Leftover	A site	Leftover
SiO2	63.012	Si+4	8.0000	8.0000							
Al2O3	0.717	Al+3	0.1349	0.0000	0.1349						
TiO2	0.111	Ti+4	0.0398	0.0000	0.0398						
Cr2O3	0.121	Cr+3	0.0278			0.0278	0.0000				
Fe(total)O	7.76	Fe+3	0.3949			0.3949	0.0000				
MgO	18.909	Mg+2	3.8063			3.8063	0.0000				
MnO	0.151	Fe+2	0.4720			0.4720	0.0000				
CaO	6.364	Mn+2	0.0493			0.0493	0.0000				
Na2O	2.294	Ca+2	0.9477					0.9477	0.0000		
K2O	0.562	Na+	0.6470					0.6470	0.0000	0.0000	0.0000
		K+	0.1197							0.1197	0.0000
Total	100.001		Excess	T site	0.1746	C site	0.0000	B site	0	A site	0
			Total	8		4.9250		1.5946		0.1197	0.0000
			%Fill	100		98.4994		79.7319			

Prefix	none
Name	winchite
Modifier	none
Group	Sodic-Calcic Amphibole

Sample # 021520-05-12-1

Values		Satisfied Conditions
(Ca,Na)@B	1.59	(Ca,Na)@B >= 1 and 0.5 <= Na@B < 1.5
Na@B	0.65	(Na,K)@A < 0.5
Na,K)@A	0.12	(Mg/(Mg+Fe2))>= 0.5
Mg/(Mg+Fe2)	0.89	Si > 7.5
Si	8.00	

Mineral Analysis Program (Version 5.0)

INTE-% :
LABEL = 021520-05 34/1 12978
27-DEC-:2 16:15:17
88.312 LIVE SECONDS

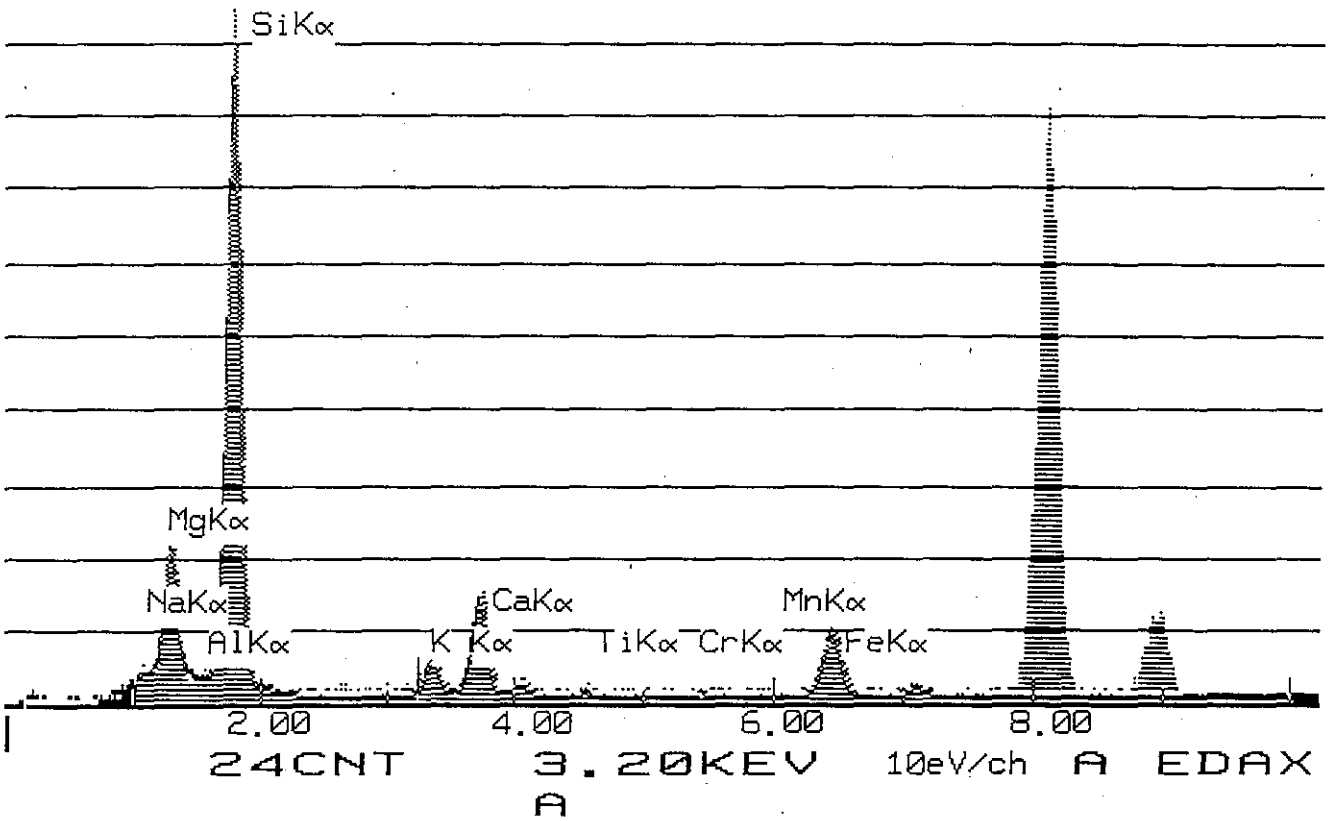
ELEM	CPS	WT % ELEM	WT % OXIDE
NAK	0.382	0.287	0.387
MGK	23.247	10.232	16.966
SIK	112.352	30.951	66.214
K K	7.066	1.758	2.118
CAK	19.114	4.791	6.704
TIK	1.110	0.304	0.507
CRK	1.212	0.341	0.498
MNK	0.725	0.212	0.273
FEK	14.868	4.430	6.333
TOTAL			100.000

USED PEIF: USER

Bi-Acet

Acetate

27-DEC-02 16:16:01 SUPER QUANT
RATE= 103CPS TIME= 88LSEC
FS= 1041/ 1041 PRST= 200LSEC
A =021520-05 34/1 12978



	Wt Percent		ions	T site	Leftover	C site	Leftover	B site	Leftover	A site	Leftover
SiO2	66.214	Si+4	8.0000	8.0000							
Al2O3	0	Al+3	0.0000	0.0000	0.0000						
TiO2	0.507	Ti+4	0.1154	0.0000	0.1154						
Cr2O3	0.498	Cr+3	0.0863			0.0863	0.0000				
Fe(total)O	6.333	Fe+3	0.0388			0.0388	0.0000				
MgO	16.966	Mg+2	3.4810			3.4810	0.0000				
MnO	0.273	Fe+2	0.7670			0.7670	0.0000				
CaO	6.704	Mn+2	0.1037			0.1037	0.0000				
Na2O	0.387	Ca+2	1.0444					1.0444	0.0000		
K2O	2.118	Na+	0.2249					0.2249	0.0000	0.0000	0.0000
		K+	0.4131							0.4131	0.0000
Total	100		Excess	T site	0.1154	C site	0.0000	B site	0	A site	0
			Total	8		4.5922		1.2692		0.4131	0.0000
			%Fill	100		91.8435		63.4601			

Prefix none

Name probable actinolite Ca values below optimal levels

Modifier Potassian

Group Calcic Amphibole

Sample # 021520-05-34-1

Values		Satisfied Conditions
(Ca,Na)@B	1.27	(Ca,Na)@B >= 1 and Na@B < 0.5
Na@B	0.22	1 < Ca@B < 1.5 and (Na,K)@A < 0.5
Ca@B	1.04	(Mg/(Mg+Fe2))>= 0.5
(Na,K)@A	0.41	Si > 7.5
Mg/(Mg+Fe2)	0.82	(Mg/(Mg+Fe2))< 0.9
Si	8.00	

Mineral Analysis Program (Version 5.0)

INTE-% :
LABEL = 021502-05 39/1 12979
27-DEC-:2 16:20:09
64.421 LIVE SECONDS

BG Cert

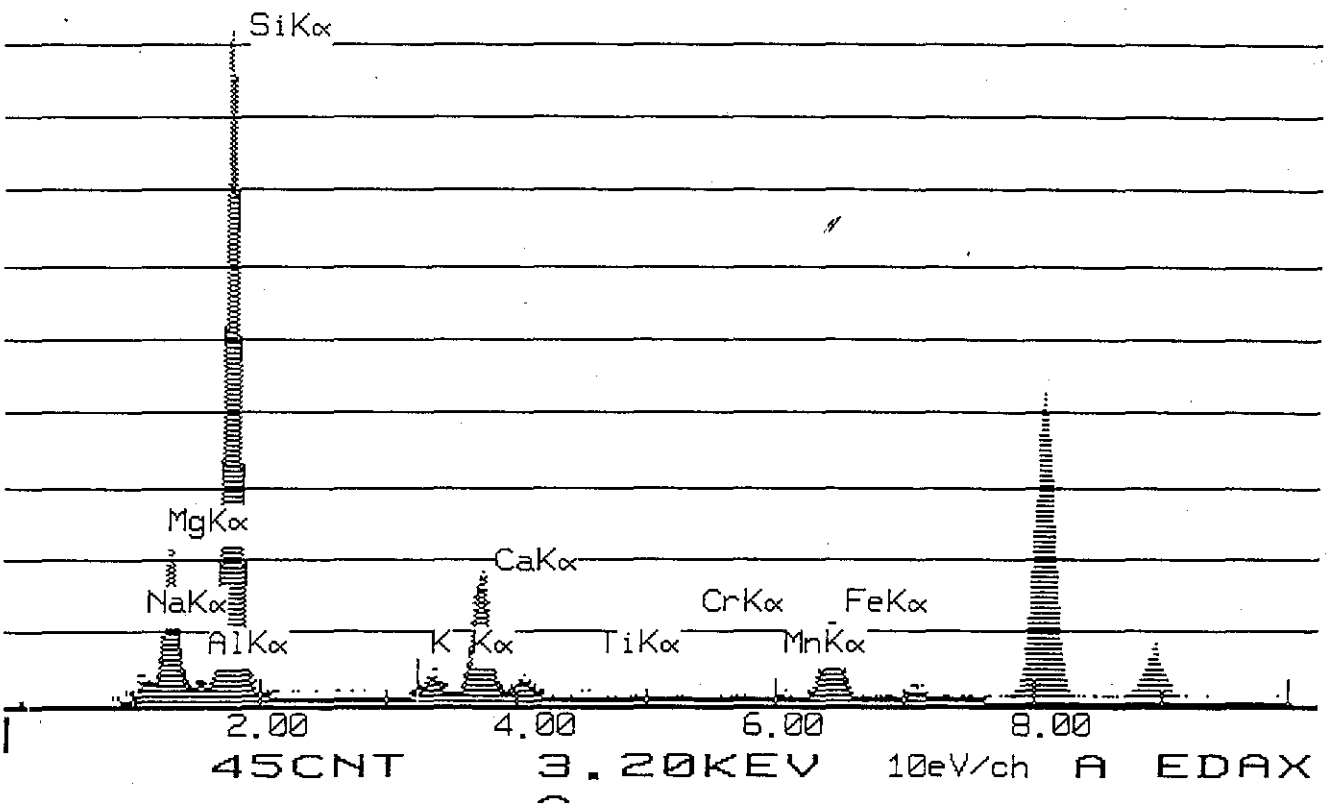
Nuchite

ELEM	CPS	WT % ELEM	WT % OXIDE
NAK	7.070	1.840	2.481
MGK	68.658	10.469	17.359
ALK	2.080	0.242	0.458
SIK	314.570	30.022	64.227
K K	10.897	0.939	1.131
CAK	64.373	5.590	7.822
FEK	44.194	4.562	6.522

TOTAL			100.000

USED PEIF: USER

27-DEC-02 16:20:46 SUPER QUANT
RATE= 1351CPS TIME= 64LSEC
FS= 2080/ 2080 PRST= 200LSEC
A =021502-05 39/1 12979



	Wt Percent		ions	T site	Leftover	C site	Leftover	B site	Leftover	A site	Leftover
SiO2	64.227	Si+4	8.0000	8.0000							
Al2O3	0.458	Al+3	0.1212	0.0000	0.1212						
TiO2	0	Ti+4	0.0000	0.0000	0.0000						
Cr2O3	0	Cr+3	0.0000			0.0000	0.0000				
Fe(total)O	6.522	Fe+3	0.0379			0.0379	0.0000				
MgO	17.359	Mg+2	3.5822			3.5822	0.0000				
MnO	0	Fe+2	0.7910			0.7910	0.0000				
CaO	7.822	Mn+2	0.0000			0.0000	0.0000				
Na2O	2.481	Ca+2	1.2089					1.2089	0.0000		
K2O	1.131	Na+	0.7637					0.7637	0.0000	0.0000	0.0000
		K+	0.2458							0.2458	0.0000
Total	100		Excess	T site	0.1212	C site	0.0000	B site	0	A site	0
			Total	8		4.5322		1.9726		0.2458	0.0000
			%Fill	100		90.6445		98.6312			

Prefix none
Name winchite
Modifier none
Group Sodic-Calcic Amphibole

Sample # 021520-05-39-1

Values		Satisfied Conditions
(Ca,Na)@B	1.97	(Ca,Na)@B >= 1 and 0.5 <= Na@B < 1.5
Na@B	0.76	(Na,K)@A < 0.5
Na,K)@A	0.25	(Mg/(Mg+Fe2))>= 0.5
Mg/(Mg+Fe2)	0.82	Si > 7.5
Si	8.00	

Mineral Analysis Program (Version 5.0)

CRISP2

File Edit View Area Calculate Fourier CIP ELD Options Window Help

2779.tif [2048x1600x8bit]

Neg# 2779; Sample # 021520-05; 4/1

ELD pn 2779.tif

Lattice

Refls	h	k
1	1	0
2	0	1
3	1	1

a= 9.071Å
b= 2.660Å
γ=82.098
NR=

Unbend

Refine Auto Cent.

Display: Map, Shape, ZoomX, ZoomY, Marks

Phase Identification from d-spacing (2779.tif)

Lattice 1				Lattice 2			
U	0.1113 1/Å	±	1.0 %	U	0.1113 1/Å	±	2.0 %
V	0.3795 1/Å	±	0.4 %	V	0.3795 1/Å	±	2.0 %
U^V	97.902 °	±	0.5 °	U^V	97.902 °	±	2.0 °
				1^2	90.000 °	±	2.0 °

2 matches (1 phases)

Find Save... Clear list Close

0 2 0 1 -1 -2 [4 0 2] 0.484 0.001 0.001

; File : \\TIGGER\SUPERDBC\Rhubarb Images\Images\Nikon Cam P

; U1 V1 [Zone axes] U^Verr Uerr Verr

Actinolite : Lattice=Monoclinic , Base-centered (C)

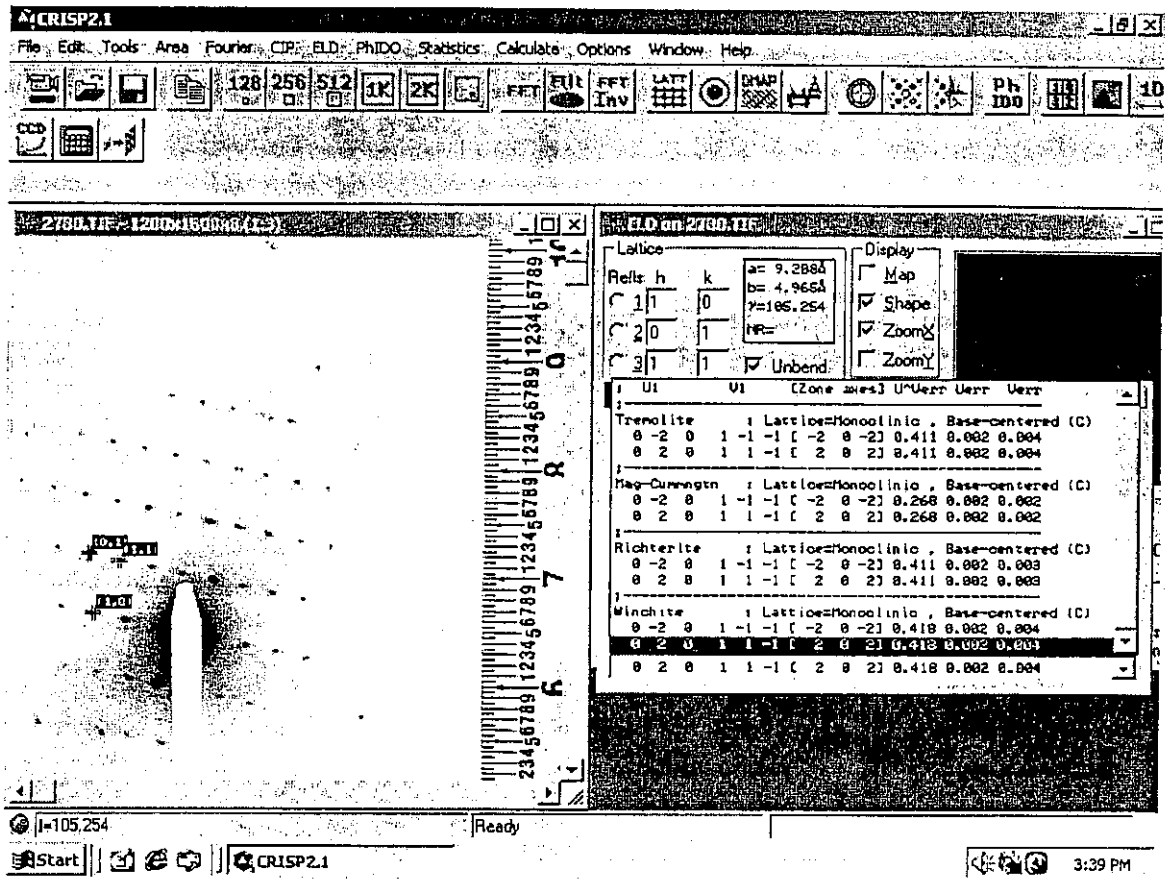
0 -2 0 1 1 -2 [-4 0 -2] 0.484 0.001 0.001

0 2 0 1 -1 -2 [4 0 2] 0.484 0.001 0.001

ACTNOLITE [2 0 1

[933,0] Y=241 Ready

Start CRISP2 4:24 PM



WINCHITE

[101]