

# WESTERN MINERALS, INC.

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## THE NEW HAMPSHIRE MAGMA SERIES, PETROGRAPHIC SUITE

### Introduction

This is a particularly well documented suite representing the four plutonic stages of the New Hampshire Series - the Bethlehem Gneiss, Kinsman Quartz Monzonite, Salsuding Quartz Diorite and the better known Concord Granite.

Dr. John B. Lyons, Professor and Head, Dept. of Earth Sciences, Dartmouth college, has spent a considerable part of his professional life on these rocks and, has over the years, directed many theses at the masters and more recently at the doctors level. The accumulated information is enormous. Dr. Lyons provided maps and recommendations for collecting sites, including precise locations of specimens which have been chemically analyzed. Because there are frequently several petrographic facies on a given outcrop, Dr. Lyons also provided a set of specimens to take into the field to be sure that we collected the right facies when the interest was in representing a chemical analysis. This precaution proved to be invaluable. We are very grateful to Dr. Lyons for his assistance, and for providing the analyses which are as yet unpublished. They are from a variety of sources.

The collecting area is in southwestern New Hampshire from just west of Concord northwest thru the Lake Sunapee area on the following quadrangles: Mascoma, Sunapee, Mt. Kearsarge, Penacook, Hillsboro and Concord.

### References

Lyons, J.B., and Livingston, D.E., 1977, Rb-Sr age of the New Hampshire Plutonic Series; G.S.A. Bull. v 88, p. 1808-12.

### Sample Descriptions and Locations

Dr. Lyons' numbers are included where we feel certain that the specimen collected is from the place he obtained his specimen. The numbers are given to enable anyone interested to correlate with numbers published in the literature and in forthcoming papers.

1. Bethlehem gneiss, Lyons No. S-5-74. 0.6 mi W of Exit 12A on S lave of I89, Sunapee Quad.
2. Bethlehem gneiss, Lyons No. S-11-73. S end of Rest Area on northbound lane on I 89, just E of Cranbery Pond, 3+ mi. No of Exit 12A, Sunapee Quad.
3. Coarse facies, Bethlehem gneiss, Lyons No. S-1-73, on access road  $\frac{1}{2}$  mi. W of Exit 12A, I 89, Sunapee Quad.
4. Finer grained facies of Bethlehem gneiss, Lyons S-2-73; same locality as 3.
5. Concord granite, Lyons S-2-74.  $\frac{1}{2}$  mi. S of Exit 12, I 89 on West side of southbound lane, Sunapee Quad.
6. Bethlehem gneiss, Lyons M-10-73. 1 mi. S of Exit 14, northbound lane, I 89, Mascoma Quad. A leucocratic facies about  $\frac{1}{4}$  mi. N. near base of pluton was uncollectable.
7. Kinsman garnet gneiss with large K-feldspar porphyroblasts. Lyons No. 37-66. This is a cataclastic rock which appears to be coarse grained. 0.6 mi. E of Mt. Sunapee-Chandlerville P.O. (SW part Lake Sunapee) .15 mi. S of Edgemont on W side Lake Sunapee. SW cor. E cen. Rec., Sunapee Quad.

8. Leucocratic facies, Kinsman quartz monzonite at specimen locality 7.
9. Kinsman quartz monzonite, Lyons No. MK-49-69. 0.3 mi. N. of Bradford Junction at SW cor. of Todd Lake, SW rec. Mt. Kearsarge quad.
10. Spaulding sillimanite-bearing granite, about  $\frac{1}{4}$  mi. N of Diamond, extreme NE cor. Hillsboro quad. The granite at this outcrop at the side of the road is the presumed equivalent of Lyons No. H- 1-71 or 1-72, both of which are from outcrops on top of the hill.
11. Hypersthene quartz diorite, Spaulding stage. Lyons Co-3-71, NW cor. Concord sheet on ramp of Exit 8 on I 89, E across from highway 103. Smaller than average specimen in some suites.
12. Spotted Spaulding granite (?), Lyons 2-71. On highway 202, 1 mi. E of W edge of Concord quad. This is not the major facies at this occurrence. It occurs as an irregular sill. The spotted aspect extends thru a variety of more mafic facies. Hand specimen provided by Dr. Lyons was imperative to the selection of the correct facies.
13. Ferrohypersthene garnet biotite tonalite, Spaulding stage. 1.25 mi. S. of Salisbury on highway 127, W. cen. Rec., Penacook Quad. Lyons No. 247-77. Some specimens are not as fresh as they should be.
14. Aplite, Concord granite, Lyons No. 108-74. 1.1 mi. E of I 89 on highway 11, W side of W. Cen. Rec. Mt. Kearsarge Quad.
15. Muscovite granite, Concord granite. Quite coarse grained facies. Lyons No. 106-74 on SW exit access road leading to highway 11 east, W side W cen. Rec., Mt. Kearsarge Quad.
16. Two-mica granite, Concord granite. Relatively coarse facies. Lyons No. 107-74. About 150 ft. W of specimen 15 on access road, locality 15.
17. Kinsman quartz monzonite, Lyons MK 42-69, just E of Exit 10, I89 big cut. When we originally attempted to collect this specimen, a man in blue took exception to our stopping in the cut. No sample had been collected, so we obtained an alternate which proved to be much too weathered. Dr. Lyons kindly arranged to have the specimen collected for us because this is a beautiful rock. W edge, Cen. Rec., Mt. Kearsarge Quad.
18. Kinsman quartz monzonite, Lyons No. 37-73.  $2\frac{1}{2}$  mi. W of exit 9, I 89, on S lane S side of highway. Large fresh blocks collected in great haste. Cen. Rec. Mt. Kearsarge Quad.
19. Dark facies, Concord granite stage, Lyons No. 193-2. SW cor. Lake Massagecum, NW cor. N. Cen. Rec. Hillsboro Quad. *100550secum*
20. Hornblende gabbro-diorite, Spaulding stage. Lyons No. 29-72 on highway 127, W flank of Emerson Hill (name not on Topog map)  $1\frac{1}{4}$  mi. E of Dam and Bridge at West Hiplinton, NW rec. Concord Quad.
21. Garnet-rich Kinsman stage. Note that garnets are partly replaced by biotite. Similar to specimen 9. There are pods, boudins, of garnet but not collectable. Big cut  $\frac{1}{4}$  mi. W of Bradford. There are analyses of the garnets at this locality. SW Rec. Mt. Kearsarge Quad. *no plinton*

Summary of facies collected:

Bethlehem Gneiss

Specimen #	1.	Lyons	No. S-5-74,	Sunapee Quad.	
"	2.	"	No. S-11-73	Sunapee Quad.	Chemical Analysis, Rb-Sr analysis.
"	3.	"	No. S-1-73	Sunapee Quad.	Chemical Analysis
"	4.	"	No. S-2-73	Sunapee Quad.	Chemical Analysis
"	6.	"	No. M-10-73	Mascoma Quad.	Chemical Analysis

Kinsman Quartz Monzonite

Specimen #	7.	Lyons	No. S-37-66	Sunapee Quad.	Chemical Analysis Rb-Sr analysis.
"	8.	"			
"	9.	Lyons	No. MK-49-69	Mt. Kearsarge Quad.,	Chemical Analysis
"	17.	Lyons	No. MK-42-69	Mt. Kearsarge Quad.,	Chemical Analysis
"	18.	"	No. MK-37-73,	Mt. Kearsarge Quad.,	Chemical Analysis, Rb-Sr analysis.
"	21.				

Spaulding Quartz Diorite

Specimen #	10.	Possibly similar to Lyons H-1-71 or H-1-72. These analyses are included for reference.			
"	11.	Lyons	No. Co-3-71	Concord Quad.,	Chemical Analysis, Rb-Sr analysis.
"	12.	Lyons	No. Co-2-71	Concord Quad.	Chemical Analysis, Rb-Sr analysis.
"	13.	"	No. P-247-77	Penacock Quad.	
"	20.	"	No. Co-29-72	Concord Quad.	Chemical Analysis

Concord Granite

Specimen #	5.	Lyons	No. S-2-74	Sunapee Quad.	Chemical Analysis, Rb-Sr analysis
"	14.	"	No. MK-108-74	Mt. Kearsarge Quad.,	Chemical Analysis, Rb-Sr analysis
"	15.	"	No. MK-106-74,	Mt. Kearsarge Quad.,	
"	16.	"	No. MK-107-74,	Mt. Kearsarge Quad.,	Chemical Analysis, Rb-Sr analysis
"	19.	"	No. Co-193-2	Concord Quad.,	Chemical Analysis

CHEMICAL ANALYSES

Specimen No.	2	3	4	5	6	7	9	similar to 10	
Lyons No.	S-11-73	S-1-73	S-2-73	S-2-74	M-10-73	37-66	MK-49-69	H-1-71	H-1-72
SiO <sub>2</sub>	66.8	68.36	63.9	73.8	52.6	62.8	58.53	72.0	73.5
TiO <sub>2</sub>	.71	.66	1.12	.07	1.15	1.3	1.64	.21	.17
Al <sub>2</sub> O <sub>3</sub>	15.33	15.43	16.5	15.2	21.77	16.5	16.84	14.6	14.6
Fe <sub>2</sub> O <sub>3</sub>	*	*	*	.29	*	.91	*	.76	.32
FeO	4.29	3.45	6.22	.68	6.51	5.1	7.93	1.1	1.1
MgO	1.19	1.19	1.80	.15	1.75	1.9	2.28	.41	.26
CaO	2.28	3.31	3.50	.65	2.65	3.2	3.63	1.1	.68
Na <sub>2</sub> O	3.00	3.25	3.01	3.5	3.66	2.9	3.29	3.2	2.9
K <sub>2</sub> O	4.15	2.22	3.11	4.7	5.90	3.2	2.94	5.4	5.5
H <sub>2</sub> O+	1.00	1.20	.92	.72	1.01	1.2	**	.72	.94
H <sub>2</sub> O-	1.06	.61	.77	.14	1.81	.12	**	.12	.08
P <sub>2</sub> O <sub>5</sub>	.29	.04	.29	.19	.30	.27	n.d.	.18	.22
MnO				.03		.07	.11	.04	.02
CO <sub>2</sub>				.01		.02		.01	.01

\* total Fe as FeO    \*\* Water free basis

Specimen No.	11	12	14	16	17	18	19	20	21
Lyons No.	Co-3-71	Co-2-71	108.74	107.74	MK-42-69	37.73	193.72	29.72	MK-46-69
SiO <sub>2</sub>	71.6	68.5	75.1	73.6	65.3	69.3	69.9	49.5	44.02
TiO <sub>2</sub>	.28	.43	.01	.03	1.07	.29	.24	.12	2.69
Al <sub>2</sub> O <sub>3</sub>	14.8	15.0	14.9	15.3	15.2	16.9	16.6	18.7	18.42
Fe <sub>2</sub> O <sub>3</sub>	1.1	1.4	.11	.22	*	.95	*	1.1	*
FeO	1.7	2.9	.24	.60	4.49*	2.0	2.00*	6.8	16.06*
MgO	.58	1.1	.04	.11	1.48	.97	.70	10.9	4.22
CaO	2.0	3.3	.24	.57	2.42	3.7	3.16	9.8	.23
Na <sub>2</sub> O	3.1	3.9	4.3	3.9	2.4	4.0	4.47	1.4	4.37
K <sub>2</sub> O	4.6	2.6	4.4	4.1	4.04	1.5	1.42	.58	2.60
H <sub>2</sub> O+	.64	.76	.72	1.1	**	.80	.31	1.0	2.55 total
H <sub>2</sub> O-	.24	.14	.02	.02	**	.12	—	.41	
P <sub>2</sub> O <sub>5</sub>	.11	.15	.13	.16		.09		.04	
MnO	.07	.12	.04	.02	.06	.02	.05	.15	
CO <sub>2</sub>	.04	.01	.01	.01		.01		.01	

Dr. Lyons considers these to be first class analyses. They come from a variety of sources. As they are not published, we are vague about the sources because we do not want this descriptive sheet to constitute publication. They are provided as a service to you.