The New Hampshire magma Series Petrographic Suite

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(1978, revised by Kurt Hollocher 2023)

Introduction

This is a particularly well documented suite representing the four traditional plutonic stages of the New Hampshire Series – the Bethlehem Gneiss, Kinsman Quartz Monzonite (actually usually tonalite to granite), Spaulding Quartz Diorite (gabbro to tonalite), and the Concord Granite (granodiorite and granite).

Dr. John B. Lyons, Professor and Head, Department of Earth Sciences, Dartmouth College, 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 doctorate level. The accumulated information is enormous. 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, 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 Lyons for his assistance, and for providing the analyses which are as yet unpublished.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 southwestern New Hampshire from just west of Concord, NH, through the Lake Sunapee area in the following quadrangles: Mascoma, Sunapee, Mt. Kearsarge, Penacook, Hillsboro, and Concord.

References

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Sample descriptions and locations, Western Minerals set

This set contains 20 samples, sample 8 was not included. Dr. John 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 them with numbers published in the literature and in forthcoming papers.

NHM-1 Bethlehem gniess, Lyons No. 5-5-74. 0.6 miles W of Exit 12A on S lane of I-89, Sunapee Quadrangle.

NHM-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+ miles North of Exit 12A, Sunapee Quadrangle.

NHM-3 Coarse facies, Bethlehem gneiss, Lyons No. S-1-73, on access road ½ mile. W of Exit 12A, I-89, Sunapee Quadrangle.

NHM-4 Finer-grained facies of Bethlehem gneiss, Lyons 5-2-73; same locality as 3.

NHM-5 Concord granite, Lyons S-2-74. miles S of Exit 12, I-89 on W side of southbound lane, Sunapee Quadrangle.

NHM-6 Bethlehem gneiss, Lyons M-10-73. 1 mile S of Exit 14, northbound lane, I-89, Mascoma Quadrangle. A leucocratic facies about 4 miles N, near base of pluton was uncollectable.

NHM-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 miles E of Mt. Sunapee-Chandlerville Post Office (SW part Lake Sunapee). 0.15 miles S of Edgemont on W side Lake Sunapee, SW corner of the east-center rectangle, Sunapee Quadrangle.

NHM-9 Kinsman quartz monzonite, Lyons No. MK-49-69. 0.3 miles. N of Bradford Junction at SW corner of Todd Lake, SW rectangle, Mt. Kearsarge quadrangle.

NHM-10 Spaulding sillimanite-bearing granite, about 4 miles N of Diamond, extreme NE corner of Hillsboro quadrangle. The granite at this outcrop at the side of the road is the presumed equivalent of Lyons No. H-1-71 or H-1-72, both of which are from outcrops on top of the hill.

NHM-11 Hypersthene quartz diorite, Spaulding stage. Lyons No. Co-3-71, NW corner of the Concord sheet on ramp of Exit 8 on I-89, E across from highway 103. Smaller than average specimen in some suites.

NHM-12 Spotted Spaulding granite (?), Lyons No. 2-71. On highway 202, 1 mile E of W edge of Concord quadrangle. This is not the major facies at this occurrence. It occurs as an irregular sill. The spotted aspect extends through a variety of more mafic facies. Hand specimen provided by Dr. Lyons was imperative to the selection of the correct facies.

NHM-13 Ferrohypersthene garnet biotite tonalite, Spaulding stage. 1.25 miles S of Salisbury on highway 127, W center rectangle of the Penacook Quadrangle. Lyons No. 247-77. Some specimens are not as fresh as they should be.

NHM-14 Aplite, Concord granite, Lyons No. 108-74. 1.1 miles E of I-89 on highway 11, W side of the west-center rectangle, Mt. Kearsarge Quadrangle.

NHM-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 of the W-center rectangle, Mt. Kearsarge Quadrangle.

NHM-16 Two-mica granite, Concord granite. Relatively coarse facies. Lyons No. 107-74. About 150 feet W of specimen 15 on access road, locality 15.

NHM-17 Kinsman quartz monzonite. Lyons MK 42-69, just E of Exit 10, I-89 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 of the center rectangle, Mt. Kearsarge Quadrangle.

NHM-18 Kinsman quartz monzonite. Lyons No. 37-73. 2.5 miles W of exit 9, I-89, on S lane, S side of highway. Large fresh blocks collected in great haste. Cen. Rec. Mt. Kearsarge Quadrangle.

NHM-19 Dark facies, Concord granite stage. Lyons No. 193-2. SW corner of Lake Massagecum, NW corner of the N-center rectangle, Hillsboro Quadrangle.

NHM-20 Hornblende gabbro-diorite, Spaulding stage. Lyons No. 29-72 on highway 127, W flank of Emerson Hill (name not on topographic map) 1.25 miles. E of Dam and Bridge at West Hiplinton, NW rectangle, Concord Quadrangle.

NHM-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 4 miles. W of Bradford. There are analyses of the garnets at this locality. SW rectangle, Mt. Kearsarge Quadrangle.

Chemical analyses in Table 1 are considered by Dr. Lyons to be first-class. 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.

Table 1. Chemical analyses.

Sample No.	2	3	4	5	6	7	9	Similar to 10	
Lyons No.	S-11-99	S-1-73	S-2-73	S-2-74	M-10-73	37-66	MK-49-69	H-1-71	H-1-72
SiO_2	66.80	68.36	63.90	73.80	52.60	62.80	58.53	72.00	73.50
TiO_2	0.71	0.66	1.12	0.07	1.15	1.30	1.64	0.21	0.17
Al_2O_3	15.33	15.43	16.51	15.20	21.77	16.50	16.84	14.60	14.60
Fe_2O_3	*	*	*	0.29	*	0.91	*	0.76	0.32
FeO	4.29	3.45	6.22	0.68	6.51	5.10	7.93	1.10	1.10
MnO				0.03		0.07	0.11	0.04	0.02
MgO	1.19	1.19	1.80	0.15	1.75	1.90	2.28	0.41	0.26
CaO	2.28	3.31	3.50	0.65	2.65	3.20	3.63	1.10	0.68
Na_2O	3.00	3.25	3.01	3.50	3.66	2.90	3.29	3.20	2.90
K_2O	4.15	2.22	3.11	4.70	5.90	3.20	2.94	5.40	5.50
P_2O_5	0.29	0.04	0.29	0.19	0.30	0.27		0.18	0.22
H_2O+	1.00	1.20	0.92	0.72	1.01	1.20	**	0.72	0.94
H_2O-	1.06	0.61	0.77	0.14	1.81	0.12	**	0.12	0.08
CO_2				0.01		0.02		0.01	0.01
Total	100.10	99.72	101.15	100.13	99.11	99.49	97.19	99.85	100.30

* Total Fe as FeO.

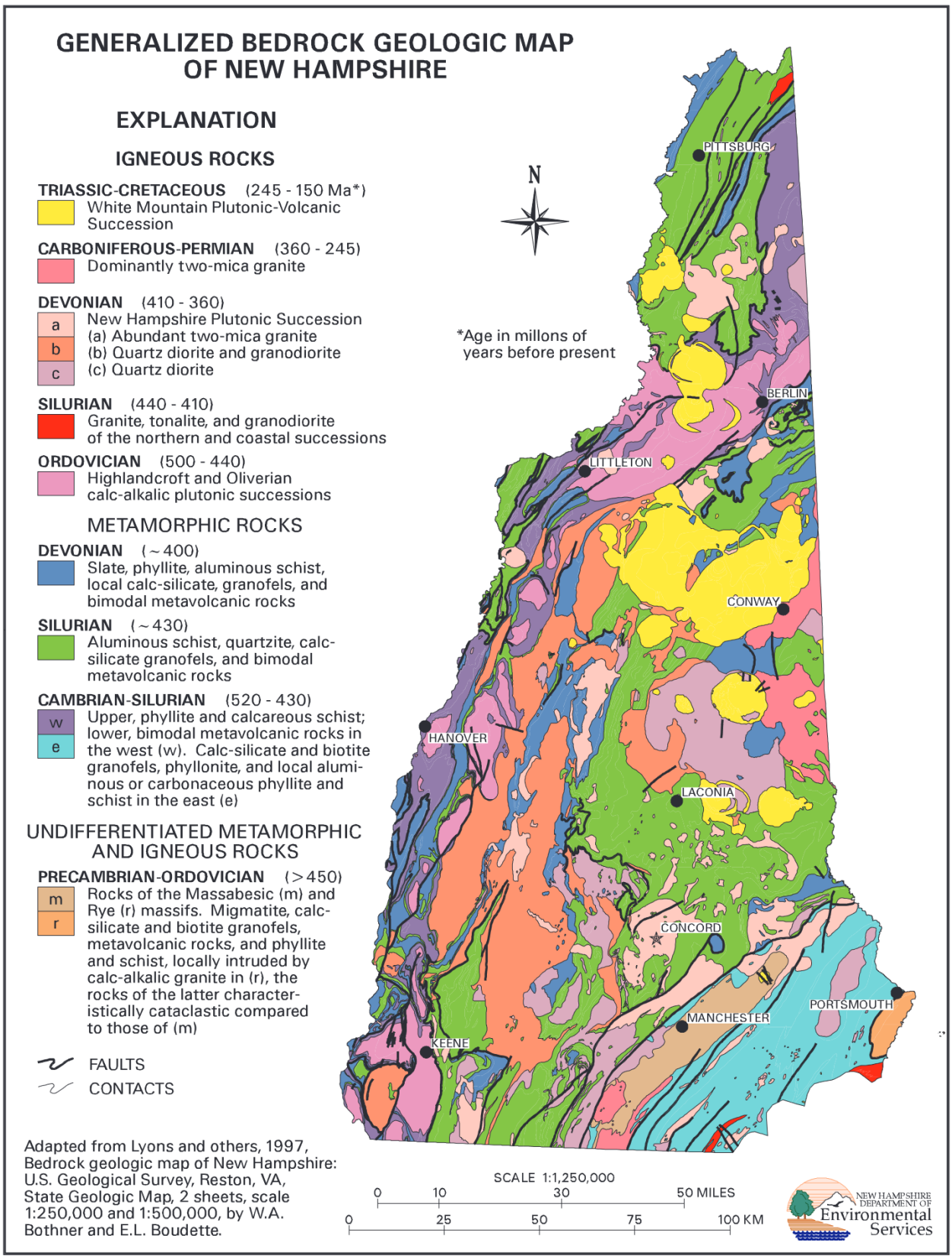
** Water-free basis.

Table 1, continued.

Sample 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_2	71.60	68.50	75.10	73.60	65.30	69.30	69.90	49.50	44.02
TiO_2	0.28	0.43	0.01	0.03	1.07	0.29	0.24	0.12	2.69
Al_2O_3	14.80	15.00	14.90	15.30	15.20	16.90	16.60	18.70	18.42
Fe_2O_3	1.10	1.40	0.11	0.22	*	0.95	*	1.10	*
FeO	1.70	2.90	0.24	0.60	4.49	2.00	2.00	6.80	16.06
MnO	0.07	0.12	0.04	0.02	0.06	0.02	0.05	0.15	
MgO	0.58	1.10	0.04	0.11	1.48	0.97	0.70	10.90	4.22
CaO	2.00	3.30	0.24	0.57	2.42	3.70	3.16	9.80	0.23
Na_2O	3.10	3.90	4.30	3.90	2.40	4.00	4.47	1.20	4.37
K_2O	4.60	2.60	4.40	4.10	4.04	1.50	1.42	0.58	2.60
P_2O_5	0.11	0.15	0.13	0.16		0.09		0.04	
H_2O+	0.64	0.76	0.72	1.10	**	0.80	0.31	1.00	2.55 total
H_2O-	0.24	0.14	0.02	0.02	**	0.12		0.41	
CO_2	0.04	0.01	0.01	0.01		0.01		0.01	
Total	100.86	100.31	100.26	99.74	96.46	100.65	98.85	100.31	95.16

* Total Fe as FeO.

** Water-free basis.



In the Devonian igneous rocks: 2-mica granite (a) is mostly the Concord type, quartz diorite and granodiorite (b) is mostly Bethlehem Gneiss and Kinsman, and quartz diorite (c) is Spaulding.