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**GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8498**

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to Carboniferous igneous rocks of the Cobequid Highlands,
Nova Scotia**

G. Pe-Piper, D.J.W. Piper, and A. Imperial

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Preface

This data release consists of 3726 electron microprobe chemical analyses of minerals from 233 rock samples collected in joint projects between the Geological Survey of Canada and Saint Mary's University under former Mineral Development Agreements in the 1980's and 1990's. The data will be of use to those making comparisons between other rocks in the Appalachians of Atlantic Canada and the Neoproterozoic to Carboniferous rocks of the Cobequid Highlands of Nova Scotia.

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Abstract

This Open File provides a data table (as an Excel file) of more than 3,000 mineral chemistry analyses determined by electron microprobe from representative samples of mostly igneous rocks from the Cobequid Highlands, Nova Scotia, as well as a few analyses from sedimentary and low grade metamorphic rocks. The ages of the analysed samples range from Neoproterozoic to Carboniferous. Minerals analysed include both primary (magmatic) and secondary (hydrothermal or low grade metamorphic) minerals. Most analyses are from amphibole, biotite, clinopyroxene, plagioclase, K-feldspar, titanite, rutile, allanite, orthopyroxene, zircon, apatite, garnet and Fe and Fe-Ti oxides. The secondary/hydrothermal/metamorphic mineral analyses include mostly biotite, chlorite, actinolite, epidote, albite, muscovite, garnet, pyrite and Fe and Fe-Ti oxides.

Introduction

The Cobequid Highlands of Nova Scotia (Fig. 1) constitute a horst that originally developed in the latest Devonian. This horst exposes Late Neoproterozoic rocks of the Avalon terrane on the northern side of the Cobequid fault. Geologically, the Cobequid Highlands are important for several reasons: a) The Neoproterozoic units consist of a wide range of volcanic and plutonic rocks, the tectonic setting of which can be well defined; b) these Neoproterozoic rocks form a geographic link between the Avalon terrane in southern New Brunswick and the Avalonian rocks of the Antigonish Highlands and southern Cape Breton Island; c) the latest Devonian-early Carboniferous plutons were emplaced in a deforming shear zone on the southeastern margin of the evolving Maritimes Basin; and (d) a 1.5 km thick early Carboniferous basalt succession overlies several kilometres of latest Devonian rhyolite (Pe-Piper and Piper 2003) suggesting enhanced melting related to a small mantle plume.

In the 1980's and 90's, Dr D.J.W. Piper of the Geological Survey of Canada and Dr. Georgia Pe-Piper of Saint Mary's University collaborated on studies of igneous rocks of the Cobequid Highlands. These studies included: detailed mapping of important geographic locations; structural analysis of key outcrops along the Cobequid Shear Zone; petrographic and geochemical analysis of many plutonic and igneous complexes; detailed chemical mineralogy surveys of igneous bodies to understand their petrogenesis or to produce more detailed geological maps. Some data presented in this report may also have appeared in the published reports and papers that have come out of studies on the various units or igneous complexes, as listed in Table 1 and the Bibliography, but the majority of the analyses have not been published.

The mineral data presented in this Open File were acquired between 1983 and 2000. A few analyses from rocks collected in 1983 and 1984 (i.e. some of those with sample numbers <2100) were made using the Cambridge Instruments Microscan 5 electron microprobe at Dalhousie University (Clarke 1976), with an Ortec 159 eV energy-dispersive system. Natural minerals and synthetic oxide standards were used for calibration, and the data were reduced using the EDATA program. Most analyses were obtained using a JEOL 733 electron microprobe equipped with an Oxford Link eXL energy-dispersion system (Clarke, 1995). Resolution of the energy-dispersion detector was 137 eV at 5.9 keV. Operating conditions were accelerating voltage of 15 keV, a beam current 5 nA, and a beam diameter ~ 1 μ m. The instrument was calibrated on cobalt metal (\pm

0.5%), and accuracy for major elements was ± 1.5 to 2.0% relative. Natural minerals were used as standards: for many analyses they included jadeite or sanidine for Si and Al, Kakanui kaersutite for Ti, Mg, Ca, Na, and K, Mn₂O for Mn, Kakanui garnet or chalcopyrite for Fe; and a fluorapatite for F. Raw data were corrected using the Link or Tracor Northern ZAF matrix-correction programs.

Elements are reported as oxides as in the original software. The data were assembled from several spreadsheets dating from the 1980's to the present, so that there is some variability in conventions, for example, numbering multiple analyses from a single sample and recording the location of analyses in a crystal.

Organisation of this open file

This open file includes two Excel tables, both available in digital form and Table 1 is also presented as a printed table in the pdf. Each table has a second tab with abbreviations used.

Table 1 lists details of the 233 rock samples with electron microprobe analyses compiled in this document. These details include: field lithology, UTM location (zone 20, NAD83), locality name, rock unit abbreviation, mineral or minerals that were analysed, any field or petrographic notes, and literature references to the particular geologic unit. Further information on most localities is available at <https://novascotia.ca/natr/meb/download/dp148.asp>. Note that collection of most samples predated GPS and they were located from orthophoto maps and pacing. The positions of samples with numbers <200 are particularly approximate.

Table 2 contains the 3,726 electron microprobe mineral analyses from these 233 samples. These mineral analyses include only major and minor elements. In some cases the type of the grain (megacrysts, phenocrysts, microphenocrysts, groundmass, exsolution lamellae, etc), the location of the analysis on the grain (core, intermediate, rim), and the colour of the grain under plane polarised light, may also be given. A key to the abbreviations used in all these details is provided in a separate tab, together with information on chemical classification of micas, plagioclase, calcic amphiboles and Fe-oxides.

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Table 1. List of samples from the Cobequid Highlands project with electron microprobe mineral analyses.

Sample Number	Station	Sample lithology	UTM X Easting	UTM Y Northing	Locality name	Rock unit	Minerals analysed	Notes	References
33		rhyodacite (cataclastite) or sandstone	413000	5034400	Lynn Rd	JEFFG	ms, bt, chl	Cl-rich bt, ms, chl, ab, rounded crystals of qz, py with reaction rims. Ms follows foliation, bt follows fractures that cross-cut the rock fabric	Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
45		basalt	412998	5032950	Lynn Rd	JEFFG	Kfs, sanidine, bt, chl	Abundant Kfs, as rounded crystals or in veins (?oriented fragments), ab, chl, bt, and qz masses	
56		felsic + mafic intimately mixed in veins and pods,	412998	5032950	Lynn Rd	JEFFG	bt, chl	Bt, chl	
84		amygdaloidal basalt	484500	5050400	Spidell Hill	JEFFG	ep, chl, phen, bt	Chl, ep, ab, qz, ep in various forms	n/a
99		diabase (float)	482851	5050024	Spidell Hill	?Cdyke	cpx	Cpx, bt, chl	
101		mafic	475732	5053365	Central New Annan - Miller Brook	?Cdyke	cpx		n/a
103		hornblende diorite (some bt)	475732	5053365	Central New Annan - Miller Brook	?Cdyke	chl, mica, cpx	Magmatic bt altering to green bt intermixed with chl, qz, pl	
108		mafic (flow texture) sheared	475732	5053365	Central New Annan - Miller Brook	?Cdyke	amph, ep, mica, pl, sanidine, chl	Secondary bt, hb, bt, qz, pl, opaque minerals, large patches of cal, chl, py	
111		felsic tuff	395942	5035240	Jeffers Brk	JEFFG	phen, bt	Qz, ab, bt, ms, ep, ap, Kfs. Shards consist of ab or ms ± qz + ab. Shards with perlitic cracks are entirely ab. Veinlets of Kfs	MacDonald (1984); Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
114		"agglomerate"	395942	5035240	Jeffers Brk	JEFFG	ab		
118		"agglomerate", felsic tuff	395942	5035240	Jeffers Brk	JEFFG	ep, mica, chl, phen	Felsic part: chl, ep, qz, ab, bt, Kfs. Mafic: ab, bt, ep, ms, chl. Ab in vein	
120		felsic tuff	395942	5035240	Jeffers Brk	JEFFG	ep, chl, phen, bt	Dusty ms, bt, chl, ep, ab, qz, cal patches, ap prisms	
128		felsic tuff	395942	5035240	Jeffers Brk	JEFFG	ep, phen	Ms, ep, ab, qz, ap	
148		volcanic	367358	5028736	Fowler Brk	JEFFG	amph, feld, mica, chl, phen	Pl, Kfs, amph, chl, ?secondary bt, cal, ?ep	
159		phyllite	396036	5035310	Jeffers Brk	JEFFG	pl		
182	8301814	diorite	397589	5036013	Jeffers Brk	JEFFG	amph, Kfs		Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
188	8303803	basaltic andesite	413049	5033327	Lynn Rd	JEFFG	act, ep, Kfs, chl, bt	Stretched Kfs, small amount of bt, rounded act, chl, ab, ep, and ep veins	
215	8626802	rhyolite	395912	5036186	Henry Brk	JEFFG	pl, ab	Brecciated fine grained rhyolite	
236	8304601	basalt	394535	5037051	Hanna Brk	JEFFG	cpx	Common both fresh and altered cpx phenocrysts and microphenocrysts	
300	8303902	cleaved rhyodacite	412619	5036409	U Harr Riv.	JEFFG	bt, chl		
309	8303905	altered mafic	412610	5036488	U Harr Riv.	JEFFG	ep	Qz: dusty colourless with needles; chl, ep	
355	8302014	hybrid	396434	5036657	Henry Brk	JBP	ab, Kfs	Qz: clean crystals; clean patches in the dusty patches are ab, but some dusty patches are Kfs; some chl; veins: Kfs, Ab	Pe-Piper (1988); Pe-Piper & Piper (2018)
356	8302015	felsic igneous rock	396498	5036726	Henry Brk	JBP	bt, sanidine	Granite or rhyolite. Kfs, qz, ab, bt: magmatic and secondary, chl	
363	8302018	leucogranite	396612	5036958	Henry Brk	JEFFG	feld, ms	All matrix appears to be ab; small prisms are qz; ms + chl occur in the mafic stringers	Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
395	8304021	microgranite	413214	5035139	Lynn Rd	JEFFG	amph, bt, chl, cpx	?cleaved. Qz, Kfs, bt, act, chl, ep. Amph alters to colourless ep. Veins of Cl-rich brownish bt	
439	8301503	fine tuff	396191	5035436	Jeffers Brk	JEFFG	bt, chl, Kfs, ms, phen	Very fine grained; Ab, qz, chl, bt, secondary bt, Kfs, ms	
442	8301505	diabase dyke	396246	5035462	Jeffers Brk	Cdyke	?kaersutite, ap, bt, chl, ms, phen	Colourless to bluish act; green chl; colourless to yellowish ep; green-brown masses of bt + chl; brown, pleochroic primary hornblende; dusty masses of ep with colourless patches of act; ms,	Pe-Piper (1988); Pe-Piper & Piper (2018)
444	8301506	mafic	396291	5035457	Jeffers Brk	JEFFG	act, bt, chl, cpx	Act, cpx, bt	MacDonald (1984); Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
450	8301511	rhyodacite	396503	5035565	Jeffers Brk	JBP	chl	Very fine grained; Ab, Kfs, ap, chl; looked for bt but not found	Pe-Piper (1988); Pe-Piper & Piper (2018)
506	8304708	diorite	390520	5034302	Kirkhill	JBP	act, amph, ab, bt, ep	Coarse grained. Ab, act, ap, ep, hb, bt	

Table 1. List of samples from the Cobequid Highlands project with electron microprobe mineral analyses.

Sample Number	Station	Sample lithology	UTM X Easting	UTM Y Northing	Locality name	Rock unit	Minerals analysed	Notes	References
541	8300515	sheared granite	367181	5029092	Fowler Brk	RBFM	Kfs	Qz, Kfs, ab	Piper, 1994, 1996
599	8300609	rhyolite/microgranite	397693	5036104	Jeffers Brk	JEFFG	aln, ep, bt, chl, feld, ms, phen	Porphyritic; aln altering to ep; clean phenocrysts are qz; phenocrysts with narrow rim of chl or ep are ab, bt, ms	MacDonald (1984); Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
659	8301025	spotted tuff	398781	5035915	Jeffers Brk	JEFFG	bt	With folds	
661	8301026	basalt	398721	5035915	Jeffers Brk	JEFFG	amph, bt	Act is colourless to green and occurs as well formed crystals; bt is brown and occurs either as patches on act or along foliation. chl also present. Similar to the spotted tuff.	
668	8301029	basalt	398646	5035887	Jeffers Brk	JEFFG	cpx, unknown mineral	Cuts spotted tuff. Hb, cpx relics, ep, chl	
706	8301113	mafic	396833	5035489	Jeffers Brk	JEFFG	cpx, pl, chl, bt	Dyke. Dusty act or colourless to green; hornblende; cpx; plagioclase; bt and secondary bt (bluish); ap, qz, chl	
764	8300906	mafic	396201	5035513	Jeffers Brk powerlines	JEFFG	chl, bt	Cleaved. act, secondary bt in brown-green masses, chl, ep, qz, ab	
812	8303506	rhyodacite	412589	5035185	Harrington Rvr	JEFFG	ab, bt,	Sill or lava. qz, ab, cal, bt. Mafic stringers consist of chl, ab, qz, ep	
818	8303511	dacite	412611	5035059	Harrington Rvr	JEFFG	chl	Cleaved	Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
821	8303514	dacite	412610	5035007	Harrington Rvr	JEFFG	pl	Flow banding. Abundant ab, some qz, cal	
823	8303515	rhyodacite	412607	5034984	Harrington Rvr	JEFFG	bt, feld	Abundant ab, some clean crystals of qz, ap and secondary bt	
881	8303611	mafic	413602	5036225	Lynn Rd	JEFFG	act, bt, chl, cpx	Cleaved similar to 1006, 1007. Pl, cpx, act, and bt partially altered to chl	
945	8301316	mafic	397566	5035975	Jeffers Brk	JEFFG	ep, ms, phen, cpx	Magmatic minerals: Qz, pl, cpx; secondary minerals: qz, chl, ms, ep	MacDonald (1984); Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
950	8301902	andesite	398617	5035911	Jeffers Brk	JBP	chl, Kfs, bt	Abundant opaque minerals; green, fine grained bt; chl; Kfs, nice looking crystals of qz; ab, ep, amph	Pe-Piper (1988); Pe-Piper & Piper (2018)
1006	8303308	mafic	415465	5031944	North Rvr	Cdyke	cpx	Massive coarse grained. Crystals look altered with small clean cpx relics	Boner (1985); Pe-Piper (1991)
1013	8303309	mafic	415456	5031983	North Rvr	GRFM	grt, chl	Sill or flow cataclastite. Difficult to analyse bt. It is intermixed with chl; very common large crystals of Kfs; large crystals of ab, qz, some ep. Nice crystals of chl are also found	
1014	8303313	marble	415449	5032039	North Rvr	GRFM	grt	Small quarry. Zoned grt and qz, cal, opaque minerals	
1017	8303312	basalt	415454	5032020	North Rvr	GRFM	bt, ms, phen	Cal, qz, grt, bt (bluish, brown), chl, ms (colourless, dusty), bt (bluish, brownish), pl	
1017b	8304502	marble	394457	5037057	Hanna Brk	JEFFG	?axinite, act, amph, cpx, grt	Cl-rich act; zoned grt, cal, qz, amph (magmatic, act), ep (colourless or lemon yellow), bt (brown to greenish), dusty masses probably altered cpx, cal, Cl-rich amph	
1018	8303312	rhyolite	415454	5032020	North Rvr	GRFM	bt	Qz matrix with cal patches and veinlets, some bt and act	Boner (1985); Pe-Piper (1991)
1073	8301625	diorite	396753	5037656	Henry Brk	JBP	amph, Kfs, spn	Act, brown-green hornblende, large crystals of titanite, ep	Pe-Piper (1988); Pe-Piper & Piper (2018)
1076	8301628	diabase	396348	5037477	Henry Brk	Cdyke	cpx	Fresh cpx	
1107	8302608	cleaved mafic	397470	5036428	Jeffers-Henry Brk woods road	?JEFFG	cpx	Magmatic cpx	
1112	8302611	diorite	397642	5036474	Jeffers-Henry Brk woods road	JBP	ep, amph,		
1132	8301408	mafic diorite	399097	5036649	Upper NE Jeffers Brk	JBP	cpx	Abundant cpx, hb	
1159		mafic	395942	5035240	Jeffers Brk agglomerate	JEFFG	ab, ep, spn, bt	Dyke lamprophyre. bt (brown-green, brown colourless, green), ab, ttn, Kfs, opaques (FeTi oxides), ep	MacDonald (1984); Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
1160		rhyolite	395942	5035240	Jeffers Brk agglomerate	JEFFG	ab, ep, chl	Colourless to lemon yellow ep, ab, chl patches and veins, qz, ap	
1162		mafic	395942	5035240	Jeffers Brk agglomerate	JEFFG	act, ab, bt, ep, Kfs, chl	Act, bt, chl	
1163		andesite	395942	5035240	Jeffers Brk agglomerate	JEFFG	chl	Dyke cleaved. A lot of small Kfs crystals, green masses and veinlets of chl, ep, ab	
1165		diabase	395942	5035240	Jeffers Brk agglomerate	JEFFG	act, hb, chl, bt	Dyke. Brown, blue, green-brown bt; colourless to green act; brown hb, Cl-rich bt (large amounts of bt)	

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Sample Number	Station	Sample lithology	UTM X Easting	UTM Y Northing	Locality name	Rock unit	Minerals analysed	Notes	References
1169		mafic	395942	5035240	Jeffers Brk agglomerate	JEFFG	ab, ep, chl, bt	Dyke. Abundant bt, chl, ab	
1176		rhyodacite	395942	5035240	Jeffers Brk agglomerate	JEFFG	chl, bt	Clast. ep veins, brown-green bt masses or prisms, various shades of green chl, ep, ab, ap	
1178		rhyolite	395942	5035240	Jeffers Brk agglomerate	JEFFG	bt, spn, chl	Block. ep, chl, ms, bt, ab, bt, ttn, qz	
1179		felsic tuff	395942	5035240	Jeffers Brk agglomerate	JEFFG	phengite, chl	Clast. ms, ab, chl patches on ms, ep	
1248		diabase	455270	5051193	Wentworth station	Cdyke	cpx	Dyke. Abundant cpx as phenocrysts, microphenocrysts and in the groundmass	n/a
1347	8400805	mafic diorite	398635	5036237	Jeffers Brk	JBP	amph, chl, cpx, ep, krs, pl, cpx	Cpx, krs, Na-rich amph, chl, ep	Pe-Piper (1988); Pe-Piper & Piper (2018)
1595	8401301	diorite	351043	5023259	Soldier Brk	CCP	amph, bt,		
1598	8401303	diorite	351073	5023294	Soldier Brk	CCP	?unknown mineral, amph, bt, ep		Pe-Piper (1996)
1700	8401304	diorite	351119	5023364	Soldier Brk	CCP	amph, bt?		
1817	9302714	rhyolite	442874	5038765	Portapique Rvr	Uncertain	?hem, bt, chl, ep, hem, Ti-mag	Opaques + bt (F, Cl). Stringers within the rock (op, bt). Bt occurs interstitially and as inclusions in feldspar crystals	n/a
1819	9302716	diabase	442997	5038620	Portapique Rvr	Uncertain	cpx	Dyke margin. Abundant cpx as phenocrysts, microphenocrysts and groundmass often brownish	n/a
1840	8301613	granite/granodiorite	396811	5037383	Henry Brk	JBP	bt	Fresh bt	Pe-Piper (1988); Pe-Piper & Piper (2018)
1851	8400503	gabbro	400639	5037660	Brown Brook	Uncertain	pl, cpx	Large phenocrysts of cpx and feldspar (labradorite)	Piper et al. (1993)
1950		diorite	397642	5036474	Jeffers woods road	JBP	sd, sulphide, amph, chl, bt, cpx,	Bt, hb	
1965	8400714	diorite	397894	5036254	Jeffers Brk	JBP	ilm, mag, rt, sulphide, spn, amph, cpx	Hb altering to cpx	
1993		diorite	397776	5036433	Jeffers woods road	JBP	amph		Pe-Piper (1988); Pe-Piper & Piper (2018)
1995		diorite	397789	5036448	Jeffers woods road	JBP	amph	Hb , bt	
2050	8401124	granite	351261	5023831	Soldier Brk	CCP	aln, ep		Pe-Piper (1996)
2084	8301019	porphyritic dacite	398958	5035906	Jeffers Brook	JEFFG	cpx, pl	Massive porphyritic similar to 1963. Common phenocrysts and microphenocrysts of cpx and pl (andesine)	MacDonald (1984); Pe-Piper & Turner (1988a); Pe-Piper & Piper (1989)
2110	8500433	thermally metamorphosed rock	396108	5038419	Henry Brk Powerlines	JBP	bt		
2294	8500320	diorite	399003	5036577	U Jeffers Brk	JBP	amph	Pegmatitic hb	Pe-Piper (1988); Pe-Piper & Piper (2018)
2648		diorite	468842	5039285	Frog Lake W quarry	FRLP	amph, ?sulphide, sd, ?unknown mineral, cpx		
2649		diorite	468842	5039285	Frog Lake W quarry	FRLP	amph		
2653	8625903	diorite	469017	5039221	Frog Lake	FRLP	amph, ?cpy, ?py, sulphide, amph, ilm	Pegmatitic texture	
2656	8625903	diabase	469017	5039221	Frog Lake	FRLP	amph		
2946	8611508	diorite	472029	5040004	Chig Rvr Rds	FRLP	bt, chl, ilm, mag, py, sd, spn, pl, unknown mineral, amph	Medium grained	
2947	8611508	diabase	472029	5040004	Chig Rvr Rds	FRLP	amph, bt, ?act, ?bt, chl, pl, cal, qz, spn, titanite, ilm, cpx		
2969	8631505	diorite	470538	5039861	Frog Lake	uncertain	ilm, mag, pl, bt, unknown mineral, amph		
2984	8631514	granite	469776	5038743	Frog Lake	uncertain	bt, pl, Kfs		
2996	8631518	diorite	469065	5039144	Frog Lake	uncertain	pl, qz, Kfs, amph, bt, cpx	Coarse grained	Hubley (1987), Pe-Piper et al. (1995, 1996a, 2010)

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Sample Number	Station	Sample lithology	UTM X Easting	UTM Y Northing	Locality name	Rock unit	Minerals analysed	Notes	References
3104		granite	467997	5039592	Frog Lake	FRLP	pl		
3119	8625711	granite	472958	5039406	Chiganois Rvr	FRLP	pl, Kfs	Dyke similar to 2815	
3134		layered body	469065	5039144	Frog Lake E quarry	FRLP	pl, amph,		
3135		layered body	469065	5039144	Frog Lake E quarry	FRLP	pl, amph,		
3136		pegmatite	468842	5039285	Frog Lake W quarry	FRLP	pl	Dyke	
3137		diorite	469065	5039144	Frog Lake E quarry	FRLP	amph		
3138		mafic looking diorite	469065	5039144	Frog Lake E quarry	FRLP	pl, hem, ilm, mag, amph, cpx		
3150		mafic	468842	5039285	Frog Lake W quarry	FRLP	amph, bt, ilm, mag, pl		
3395	8617112	granite	430673	5047010	Bulmer Brk	WHP	qz, pl		Pe-Piper et al. (1994, 1996a)
3590		diorite	397816	5036479	Jeffers woods Rd	JBP	bt,	Block in granodiorite	
3701		diorite	397949	5036650	Jeffers woods Rd	JBP	pl, bt	Coarse grained with enclaves	
3709		tonalite veins in granodiorite	397975	5036706	Jeffers woods Rd	JBP	pl, Kfs, unknown minerals, bt		Pe-Piper (1988); Pe-Piper & Piper (2018)
3715		diorite	398132	5036822	Jeffers woods Rd	JBP	qz, pl, bt, chl?, ilm,	Vesicular block	
3740	8622703	granite	408694	5031975	McCallum Gulch	WMRP	pl, qz	?chilled margin	Pe-Piper (1996)
4027	8626408	metasediment	369245	5029349	Fowler Brk	JEFFG	bt, hb		Pe-Piper & Turner, 1988a
4029	8621801	diorite	410360	5031626	McCallum Brk Rd	WMRP	cpx, bt	Coarse grained	Pe-Piper (1996)
4212	8712207	?amphibolite	348485	5023538	Lt Baldrock Brk	CCP	rt		Pe-Piper (1996)
4630	8801006	pink granite	455818	5048389	Higgins Brk	HLBLP	hb, opaque, mag	Fine-medium grained. Mag and Ti-mag (up to 6% TiO ₂) with exsolutions lamellae and patches of ilm	
4633	8801010	pink granite	455642	5048270	Higgins Brk	HLBLP	hb, unknown mineral	Fine-medium grained	
4634	8801010	pink granite	455642	5048270	Higgins Brk	HLBLP	hb, opaque, cpx	Coarse-grained qz-rich	Zeeman (1992); Koukouvelas & Pe-Piper (1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).
4636	8801012	pink granite	455400	5048118	Higgins Brk	HLBLP	hb, amph	Coarse grained	
4641	9300721	pink granite	452932	5046282	Higgins Mtn powerlines	FOLP	chl, ep	Fine-medium grained	
4645	8800901	granite	464597	5042948	Rory Pond Rd	HLBLP	bt	Qz, bt, Kfs	
4669	8800505	granodiorite	437439	5036398	Gamble Lake	PHP	hb		
4672	8800509	pink granite	437758	5036675	Gamble Lake	PHP	pl, chl, aln	Fine-grained	
4674	8800510	diorite	437780	5036608	Gamble Lake	PHP	spn, feld, amph, bt	Megacrystic	
4678	8800512	granite	437805	5036533	Gamble Lake	PHP	aln, feld, pl, Kfs, hb	Concentration of feldspar megacrysts	
4681	8800521	granite	437475	5036547	Gamble Lake	PHP	Kfs, zm, pl, ilm, hb, bt, amph	Coarse with half digested xenoliths	
4685	8800524	granite	437495	5036810	Gamble Lake	PHP	red mineral, pl, Kfs, spn, hb, amph	Rapakivi texture	Selway (1991); Pe-Piper & Piper (1998a); Pe-Piper et al. (1998)
4688	8800528	granodiorite	437371	5037129	Gamble Lake	PHP	hb	Coarse grained hybrid	

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Sample Number	Station	Sample lithology	UTM X Easting	UTM Y Northing	Locality name	Rock unit	Minerals analysed	Notes	References
4689	8800529	granite	437371	5037132	Gamble Lake	PHP	feld, Kfs, spn, amph, hb, chl, bt	Rapakivi texture	
4696	8800538	pink-orange granite	437240	5037998	Gamble Lake	PHP	pl	Coarse grained	
4697	8800538	felsic	437240	5037998	Gamble Lake	PHP	Kfs, pl, Ti-mag, mag, bt	Porphyritic volcanic	
4699	8800114	orange granite	433870	5034781	SW Economy Lake	WYVP	pl, Kfs, ilm, bt	Lineated fresh coarse grained	Pe-Piper et al. (1992)
4701	8800119	orange granite	433539	5034590	SW Economy Lake	PHP	aln, pl, Kfs, bt	Lineated very coarse grained	
4717	8800146	granodiorite	434939	5034501	SW Economy Lake	PHP	feld, pl, amph, bt	Feldspar phenocrysts	
4728	8800301	dacite	438642	5037476	Bass Rvr	PHP	pl, Kfs	Megacrystic porphyritic	
4735	8800311	granite	438494	5037055	Bass Rvr	PHP	chl	Coarse grained	
4737	8800328	rhyolite	438587	5037021	Bass Rvr	PHP	feld	Rapakivi texture	Selway (1991); Pe-Piper & Piper (1998a); Pe-Piper et al. (1998)
4751	8800208	diorite	424455	5034052	Gerrish Mtn Rd	PHP	cpx	Coarse grained with pl	
4752	8800209	diorite	424317	5034048	Gerrish Mtn Rd	PHP	cpx	Coarse grained with pl	
4779	8800427	diorite	438944	5035831	E of Bass Rvr	PHP	hb, opx	Mylonite	
4810	8800755	granodiorite	438175	5035779	SW Gamble Lake	PHP	amph, bt	Medium grained	
4818	8402140	granite	405977	5032789	Moose Rvr Rd	WMRP	bt, chl, hem, Ti-mag,	In contact with dyke (bt, op); veinlets made up of bt and opaque minerals	
4819	8402140	black vein in granite	405977	5032789	Moose Rvr Rd	WMRP	?hem, chl, unknown mineral	Bt altering to chl. Bt (greenish, brownish). Veinlets made up of bt and opaque minerals	Clerk (1987); Pe-Piper et al. (1991, 2017)
4863	9000214	red granite	437553	5036075	Rd W Bass Rvr	PHP	feld, aln, zrn, chl, pl, spn, Kfs, bt	Rapakivi texture. The opaque minerals are mostly ilm with variable Mn content and hematite	
4869	9000225	granite	437158	5036643	Rd W Bass Rvr	PHP	chl	Fine grained with rare pegmatitic patches	Selway (1991); Pe-Piper & Piper (1998a); Pe-Piper et al. (1998)
5048	9100105	granite/diorite	464011	5044539	Rory Pond Rd	FOLP	amph, bt, chl, ab, pl, Kfs, spn,	Contact granite/diorite	
5052	9100123	diorite intruded by granite	463791	5044494	Rory Pond Rd	FOLP	bt, spn, pl,	Xenolith	
5055	9100114	diorite	463973	5044535	Rory Pond Rd	HLBLP	bt, cpx, hem, pl		
5056	9100113	granodiorite	463975	5044528	Rory Pond Rd	FOLP	bt	Float (contact between diorite and granodiorite)	
5057	9100132	diorite	463584	5044982	Rory Pond Rd	FOLP	amph, pl, chl, ab, Kfs	Invaded by granitic veins	Zeeman (1992); Koukouvelas & Pe-Piper (1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).
5059	9100134	gabbro	463537	5045023	Rory Pond Rd	HLBLP	act, bt, chl, cpx, ep, Kfs, pl		
5061	9100141	diorite	463681	5044877	Rory Pond Rd	FOLP	act, cpx, hem, hb, ilm, mag, pl		
5062	9100141	granite/diorite	463681	5044877	Rory Pond Rd	FOLP	amph, bt	Contact	
5122	9100142	diorite	463727	5044846	Rory Pond Rd	FOLP	hb, amph, bt, ab, Kfs, pl,	Porphyritic	
6059	9300307	basalt	470753	5050934	Whirley Brk	FLB	cpx, pl	Feldspar-phyric	
6066	9300318	basalt	470809	5050337	Whirley Brk	FLB	chl, pl	Medium grained vesicular	
6069	9300326	basalt	470847	5049804	Whirley Brk	FLB	chl, cpx, ep, pl	Massive	Piper et al. (1999); Dessureau et al. (2000)
6083	9300411	rhyolite	470832	5049284	Whirley Brk	FLR	chl, ms, py, spn, ?aln, ?rt, Kfs	With qz veins	

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6384	9410210	diorite	459661	5046017	Hart Lake Rd	FOLP	?mica, ?opx, bt, cpx, hem, hb, ilm, opx, pigeonite, pl	Medium grained felsic pods	
6390	9410269	gabbro	459622	5046341	Hart Lake Rd	FOLP	amph, cpx, mag, pl, Kfs,	Fine grained	
6419	9410526	hornblende gabbo	451203	5049916	East Roaring Rvr	HLBLP	amph, pl, orth	Coarse grained	Zeeman (1992); Koukouvelas & Pe-Piper (1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).
6477	9411001	diorite	463005	5044797	Rory Pond Rd	HLBLP	pl, cpx	Fine-medium grained	
6490	9411068	pink-grey granite	461724	5043853	Rory Pond Rd	HLBLP	amph	Medium grained	
6518	9400218	hornblende gabbro	460683	5044932	Hart Lake	FOLP	Kfs, amph		
6534	9400507	basalt	484652	5045644	W FergusonBrk	DBFM	cpx,		
6562	9400742	basalt	472199	5050211	French Rvr	DBFM	chl, cpx, ilm, pl		Dessureau et al. (2000); Piper & Pe-Piper (2001)
6563	9400747	basalt	472216	5050135	French Rvr	DBFM	pl	Porphyritic	
6565	9400751	basalt	472367	5049495	French Rvr	DBFM	cpx, pl, spn		
6597	9401104	quartz diorite	504233	5043125	Mount Thom	EHP	pl	Medium grained	
6598	9401104	quartz diorite	504233	5043125	Mount Thom	EHP	pl	Medium grained	
6599	9401104	quartz diorite	504233	5043125	Mount Thom	EHP	ep	Medium grained	
6601	9401105	mafic diorite	504371	5043077	Mount Thom	EHP	pl	Medium grained	
6602	9401116	pink granite	504737	5043088	Mount Thom	EHP	pl	Coarse grained float	
6606	9401125	granodiorite	504243	5042626	Mount Thom	EHP	mag, ms	Gneissic texture	
6610	9401129	mafic diorite	504174	5042455	Mount Thom	EHP	amph, ms, pl, ep,	Fine grained	
6615	9401208	diorite	500061	5042760	Glen Road	EHP	pl	Medium grained foliated	
6616	9401208	quartz diorite	500061	5042760	Glen Road	EHP	ms	Medium grained feldspar xenocrysts	Hilton (1998); Pe-Piper et al. (2002)
6617	9401208	quartz diorite	500061	5042760	Glen Road	EHP	pl, amph	Medium grained foliated	
6619	9401210	quartz diorite	500035	5042807	Glen Road	EHP	pl, amph	Coarse grained	
6621	9401215	granodiorite	500001	5042874	Glen Road	EHP	aln, amph, ap, zrn, pl	Medium grained	
6622	9401213	mafic diorite	500008	5042855	Glen Road	EHP	pl		
6623	9401213	quartz diorite	500008	5042855	Glen Road	EHP	pl, bt		
6625	9401214	granite	500006	5042864	Glen Road	EHP	limonite, mag, sd	Medium grained vuggy, float	
6626	9401213	mafic diorite	500008	5042855	Glen Road	EHP	Kfs, pl,	Medium grained float	
6633	9401233	quartz diorite	499729	5042528	Glen Road	EHP	ilm, py	Gneissic texture	
6682	9402108	grey rhyolite	478104	5046855	Silica Mtn	BBFM	pl		Piper et al. (1999)
6686	9402115	purple-grey granite	475289	5045536	Up E Chiganois Rvr	HLBLP	astp, opaque	Fine-medium grained	
6775	9411914	diorite	455474	5048159	Higgins Brk	HLBLP	amph, cpx, ep, pl	Fine-medium grained	Zeeman (1992); Koukouvelas & Pe-Piper (1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).

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6808	9412306	pink granite	456736	5045835	Folly Lake	HLBLP	chl	Medium grained	(1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).
6970	9415728	pink-red granite	463591	5046879	Snare Lake	HLBLP	chl	Medium granite	
6971	9415754	orange granite	464686	5046521	Snare Lake	HLBLP	amph	Medium grained	
6987	9415927	diorite	502919	5043476	Mt. Thom	EHP	aln, ep, goethite, limonite, pl, py, amph, chl, seri,	Medium-coarse grained	Hilton (1998); Pe-Piper et al. (2002)
6996	9416030	hornblende diorite	501420	5045045	Mt Thom	EHP	amph	Coarse grained	
7035	9301659	quartzite	436700	5036839	Rd W of Bass Rvr	PHP	zrn, and, tour, stau		Selway (1991); Pe-Piper & Piper (1998a); Pe-Piper et al. (1998)
7040	9301208	mylonite	429605	5033486	Newton Lake	PHP	tour		
7054	9313311	leucogranite	404635	5031959	Rd W of West Moose Rvr	WMPRP	opx	Riebeckite	Pe-Piper et al. (1991, 2004, 2017)
7406	9416131	diorite	496829	5045194	Salmon Rvr	EHP	ap, feld, spn	Coarse grained	Hilton (1998); Pe-Piper et al. (2002)
7411	9416137	diorite	498392	5045278	Rd N of Juniper Brk	SECARBP	spn		
7629	9500861	red-orange granite	469631	5044685	Guyon Brk	HLBLP	pl, orth	Medium-coarse grained	Zeeman (1992); Koukouvelas & Pe-Piper (1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).
7630	9500860	red-orange granite	469691	5044704	Guyon Brk	HLBLP	pl, orth	Medium-fine grained	
7658	9502512	red-orange granite	468260	5045537	Shatter Lake Brk	HLBLP	al, chl, Ti, pl, bt	Medium grained	Piper et al. (1999)
7704	9505020	microgranite	471248	5047455	French Rvr	BBin	?ab, ?ep, sanidine		
7705		diorite			French Rvr	BBin	amph, ap, chl, cpx, hb, ilm, mag, mica, pl	Medium grained porphyritic	
7709	9505130	green rhyolite	480607	5053196	L Baileys Brk	JEFFG		Porphyritic	Piper & Pe-Piper (2001)
7710	9505207	granite	450747	5040441	Headwaters Great Village Rvr	FOLP	amph, mag	Porphyritic with diorite xenoliths. Mag with or without TiO ₂ . Some mag crystals may contain exsolution patterns (lamellae) of ilm	Zeeman (1992); Koukouvelas & Pe-Piper (1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).
7712	9505309	quartz diorite	469032	5049055	Byers Brk area	HLBLP	chl, cpx, ilm, pl	Medium-coarse grained	
7720	9505346	basalt	468160	5050437	Byers Brk area	DBFM	chl, pl,	Vesicular	Dessureau et al. (2000)
7723	9505601	basalt	499847	5052012	Diamond Brk	DBFM	cpx, pl	Coarse grained	
7729	9505624	basalt	499202	5052418	Diamond Brk	DBFM	cpx	Massive	
7732	9505723	basalt	497582	5053281	W Branch Rvr John	DBFM	Kfs, pl		
8085	9602234	orange granite	470804	5046120	Rd to John Lake	HLBLP	?chl, act, bt, ilm		Doucette (1996)
8141	9605603	foliated gabbro	402173	5025593	Clarke Head	CHI	bt, cpx, grt, mag, opaque, spn, zrn, hbl, pl,	Gibbons & Murphy locality. Foliated some felsic veins, rare garnets	Gibbons & Murphy (1995); Gibbons et al. (1996)
8205	9503604	basalt	483182	5048560	NW of Ferguson Brk	DBFM	cpx, pl	Massive	Dessureau et al. (2000)
8206	9503607	basalt	483118	5048240	NW of Ferguson Brk	DBFM	cpx, pl	Massive medium-coarse grained	
8207	9503610	basalt	483029	5047991	NW of Ferguson Brk	DBFM	cpx	Massive grey	
8208	9402262	basalt	484784	5047533	W Ferguson Brk	DBFM	cpx, ms, opx, pl	Massive grey	
8209	9402261	basalt	484763	5047451	W Ferguson Brk	DBFM	cpx, pl, chl,	Massive grey	
8211	9402259	basalt	484771	5047207	W Ferguson Brk	DBFM	opx, cpx	With subspherical blebs of fine grained basalt (reaction rim)	

Table 1. List of samples from the Cobequid Highlands project with electron microprobe mineral analyses.

Sample Number	Station	Sample lithology	UTM X Easting	UTM Y Northing	Locality name	Rock unit	Minerals analysed	Notes	References	
8212	9402251	basalt	484801	5046917	W Ferguson Brk	DBFM	cpx	Massive grey feldspar megacrysts		
8236	9800108	magnetite deposit	421770	5028385	Gerrish Mtn mag mine	MMD	mag		Bond (1999)	
8237	9800109	magnetite deposit	421770	5028385	Gerrish Mtn mag mine	MMD	mag			
8241	9800110	magnetite deposit	421770	5028385	Gerrish Mtn mag mine	MMD	cal, hem, ?hem, mag,			
8242	9800111	magnetite deposit	421770	5028385	Gerrish Mtn mag mine	MMD	cal, hem, mag			
8246	9800112	magnetite deposit	421770	5028385	Gerrish Mtn mag mine	MMD	cpy, ?hem, mag,			
8247	9800113	magnetite deposit	421770	5028385	Gerrish Mtn mag mine	MMD	hem, mag			
8252	9800109	magnetite deposit	438900	5034740	Bass River, mag prospect	CMD	?hem, mag, py			
8253	9800110	magnetite deposit	438900	5034740	Bass River, mag prospect	CMD	mag, py			
8254	9800111	magnetite deposit	438900	5034740	Bass River, mag prospect	CMD	hem, mag, py,			
8257	9800112	magnetite deposit	438900	5034740	Bass River, mag prospect	CMD	mag, py			
8262	9800113	magnetite deposit	438900	5034740	Bass River, mag prospect	CMD	amph, chl, ilm			
8282	9800113	magnetite deposit	438900	5034740	Bass River, mag prospect	CMD	hem, mag, py,			
2-5-2*	M2-5	sheared mafic	457700	5040600	Folly River	FRF	ab, labradorite, cpx			Pe-Piper & Murphy (1989)
6-2-2	M6-2	mafic volcanic	464853	5040446	Debert River	FRF	amph, labradorite, cpx			
6-2-3	M6-2	mafic volcanic	464853	5040446	Debert River	FRF	cpx			
9-6-6	M9-6		460300	5040600	E. Folly River	FRF	ep, pl			
10-4-7	M10-4	mafic volcanic	464853	5040446	Debert River	FRF	and, ep, labradorite, cpx			
28-6-2	M28-6	fine very red granite (-syenogranite)	453135	5045587	Village Brk	HLBLP	hb, chl, unknown mineral		Zeeman (1992); Koukouvelas & Pe-Piper (1995, 1996); Doucette (1996); Pe-Piper et al. (1996b); Pe-Piper (1998, 2007); Pe-Piper & Piper (1998b); Murphy et al. (1998, 2001); Koukouvelas et al. (2002).	
29-8-2	M28-8	granite/diorite mixing	440900	5048100	Trib. of Mountain Brk	FOLP	hb, bt			
31-9-2	M31-9	med diorite	453094	5043662	Village Brk	FOLP	amph			
35-7-1	M35-7	granite	449984	5048870	Roaring River	HLBLP	amph, opx, mag	Coarse grained. Independent crystals of ilm altering either to TiO ₂ minerals or gaining Mn. Ti-mag phenocrysts with mag rims and incipient exsolution of ilm.		
35-8-2	M35-8	diorite	449000	5048600	Roaring River	HLBLP	amph	Porphyritic		

* from sample 2-5-2 on, samples were collected by J.B. Murphy (Locations of Eastern Cobequids in the archiving system of G. Pe-Piper).

Note that positions for sample numbers <200 are approximate

Most samples predate GPS and were located from orthophoto maps and pacing.

MINERAL ABBREVIATIONS after Whitney and Evans (2010)

ROCK UNIT ABBREVIATIONS given in Abbreviations tab

ROCK UNIT ABBREVIATIONS

BBin: Byers Brook Fm intrusions
CCP: Cape Chignecto Pluton
Cdyke: Hypabyssal intrusions of likely Carboniferous age
CHI: Clarke Head intrusions
CMD: Carboniferous Magnetite Deposit
DBFM: Diamond Brook Fm
EHP: Eastern Neoproterozoic Plutons
FLB: Fountain Lake basalt
FLR: Fountain Lake Rhyolite
FOLP: Folly Lake Pluton
FRLP: Frog Lake Pluton (Neoproterozoic)
GRFM: Greville River Fm (Horton Group)
HLBLP: Hart Lake-Byers Lake Pluton
JBP: Jeffers Brook Pluton (Neoproterozoic)
JEFFG: Jeffers Group (Neoproterozoic)
MMO: Mesozoic Magnetite Deposit
PHP: Pleasant Hills Pluton
RBFM: Rapid Brook Fm (Horton Group)
SECARBP: Southeastern Carboniferous plutons
WHP: Western Neoproterozoic Plutons
WMRP: West Moose River Pluton
WYVP: Wyvern Pluton

Abbreviations for mineral names and other mineral characteristics

Mineral names (Whitney and Evans, 2010)

Ab: Albite
Act: Actinolite
Aln: Allanite
Amph: Amphibole
Ap: Apatite
Bt: Biotite
Cal: Calcite
Ccp: Chalcopyrite
Chl: Chlorite
Cpx: Clinopyroxene
Ep: Epidote
Gt: Garnet
Gth: Goethite
Hb: Hornblende
Hm: Hematite
Ilm: Ilmenite
Kfs: K-Feldspar
Krs: Kaersutite
Lm: Limonite
Mag: Magnetite
Mix: Mixture of minerals
Ms: Muscovite
Opx: Orthopyroxene
Pgt: Pigeonite
Pl: Plagioclase
Py: Pyrite
Qz: Quartz
SBt: Secondary biotite
Spn: Sphene
Ttn: Titanite
Ti-Mag: Ti-magnetite
Zrn: Zircon

Mineral colour

bl: blue
br: brown
cl: clear or colorless
d: dark
dcol: dark color
dt: dusty
fdus: faint dusty crystal
fcol: faint color
gr: green
l: light

Table 2: Abbreviations tab

or: orange
pk: pink
yl: yellow

Mineral types

a: altered core
aggr: aggregate
asph: away from spherule
BA: bad analysis
csph: close to spherule
grd: groundmass
lb: light band
lsph: large spherule
meg: megacryst
mph: microphenocryst
ovg: overgrown
ph: phenocryst
pt: patch
sct: scattered
vn: vein
vs: very small
xtal: crystal

Textures

b: bent
ex: exsolution
fr: fracture
host: host mineral crystal
l: large or light
lame: in the form of a lamella
ovg: overgrowth
s: small
z: zoning

Position

c: core
i: intermediate
icl: inclusion
r: rim
rlc: relic

Notes

We have established various ranges of element concentrations for some mineral groups for consistency and clarity:

1. Micas:

Biotite (Bt): $\text{TiO}_2 > 2 \text{ wt}\%$

Table 2: Abbreviations tab

Secondary biotite (SBt): $\text{TiO}_2 < 2 \text{ wt}\%$

2. Plagioclase:

Albite (Ab): $\text{CaO} < 2 \text{ wt}\%$

Oligoclase (Olig): $\text{CaO} \geq 2 \text{ wt}\%$

Andesine (And): $\text{CaO} \geq 7 \text{ wt}\%$

Labradorite (Lab): $\text{CaO} \geq 10 \text{ wt}\%$

Bytownite (Byt): $\text{CaO} \geq 13 \text{ wt}\%$

Anorthite (An): $\text{CaO} \geq 18 \text{ wt}\%$

3. Fe-oxides:

Magnetite (Mag): $\text{FeO} \geq 90 \text{ wt}\%$

Ti-Magnetite (Ti-Mag): $\text{TiO}_2 \geq 2 \text{ wt}\%$

Hematite (Hm): $\text{FeO} < 90 \text{ wt}\%$

Goethite (Gth): $\text{FeO} \geq 75 \text{ wt}\%$ and $< 80 \text{ wt}\%$

Limonite (Lm): $\text{FeO} < 75 \text{ wt}\%$

4. Calcic Amphiboles:

Hornblende (Hb): $\text{Al}_2\text{O}_3 > 5 \text{ wt}\%$

Actinolite (Act): $\text{Al}_2\text{O}_3 < 5 \text{ wt}\%$