APPENDICES

APPENDIX A

LOCATIONS, OCCURRENCES AND LITHOLOGIES OF THE MAE THA BASALT SAMPLES

Sample no.	Grid reference	Occurrence and lithology	Remarks
MT 1/A MT 1/B MT 1/C MT 1/D MT 1/E MT 1/F	705178	Core samples penetrated in 50 m - deep drill hole, made up of at least six flows. These samples are representatives of individual flows. - MT 1/A (depth 6.20-6.35 m) is dark gray, massive, fine-grained and non-foliated, with sporadic olive gray patches. Fractures are partly infilled with carbonate and Fe-Ti oxide/hydroxide minerals. - MT 1/B (depth 12.10-12.30 m) is dark gray, massive, fine-grained and non-foliated, with rare grayish olive patches. - MT 1/C (depth 23.20-23.37 m) is dark gray, massive, fine-grained and non-foliated, with sporadic olive gray patches and dark greenish to black clinopyroxene and opaque. - MT 1/D (depth 29.45-29.57 m) is dark gray, slightly vesicular, fine-grained and non-foliated with rare grayish olive patches. Fractures are partly infilled with carbonate mineral. - MT 1/E (depth 34.34-34.60 m) is dark gray, slightly vesicular and fine-grained, with olivine aggregates (sizes up to 3 cm across). Vesicles are partly coated with carbonate mineral. - MT 1/F (depth 48.46-48.63 m) is dark gray, massive and fine-grained, with white	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.

		xenoliths (sizes up to 1 cm across).	
MT 2/2	663178	*In situ* float on Pha Kog Hin Foo volcano: dark gray, fine-grained and slightly vesicular, with olivine aggregates (sizes up to 1 cm across). Vesicles are partly infilled with carbonate and zeolitic minerals.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 3/1	663177	*In situ* float on Pha Kog Hin Foo volcano: dark gray, fine-grained and slightly vesicular, with olivine aggregates (sizes up to 0.5 cm across).	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 4	629156	*In situ* float immediately close to the railway under a bridge and underlain by pyroclastic rock: dark gray and fine-grained. Vesicles are partly infilled with carbonate and zeolitic minerals.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 5/1 MT 5/2	661044	Outcrop of at least two flows with columnar joints and platy joints (346°/12°NE) and baked contact. Thicknesses of the upper and lower flows are 4 and >3 m, respectively. Both have dark gray color, and are massive, fine-grained and non-foliated, with rare olive gray patches.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 7	591098	Float rock: dark gray, massive, fine-grained and non-foliated, with occasional olive gray patches and dark greenish to black clinopyroxene and opaque. Olivine phenocrysts up to 0.3 cm across.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.

MT 8/2	611143	*In situ* float: dark gray, massive, fine-grained and non-foliated. Vesicles are partly infilled with carbonate mineral. Olivine phenocrysts up to 0.3 cm across.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 9	627145	Outcrop sample from the Mae Tha reservoir spillway: dark gray, fine-grained, with olivine aggregates (sizes up to 0.5 cm across). Vesicles are partly infilled with carbonate and zeolitic minerals.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 10/2	624158	Roadcut outcrop: dark gray, non-foliated, massive and fine-grained, with rare dark greenish to black clinopyroxene and opaque. Olivine aggregates up to 1 cm across.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 11/2	622159	Roadcut outcrop: dark gray color, massive and fine-grained, with olivine aggregates (sizes up to 1.5 cm across).	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 13	736175	Float rock along the railway southwest of Mae Moh railway station. The rock has medium dark gray color, and are massive, fine-grained and non-foliated. Olivine aggregates up to 0.5 cm across.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 14/1 MT 14/2	736179	Outcrop along the railway southwest of Mae Moh railway station. MT 14/1 is from a middle part of the pillow lava which is dark gray, massive, fine-grained and non-foliated, with phenocrysts of olivine (sizes up to 0.3 cm.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.

		across) and white xenoliths. MT 14/2 is from chill margin of the pillow lava. The sample is dark gray to grayish black, vesicular, glassy and non-foliated.	
MT 15	667199	Outcrop sample from Pha Kog Jum Pa Daed volcano: dark gray, massive, fine-grained and non-foliated, with Permo-Triassic (?) volcanic xenoliths (sizes up to 1 cm across). The rock has olivine phenocrysts (sizes up to 0.3 cm across) with occasional dark greenish to black clinopyroxene and opaque.	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 17/2	667200	*In situ* float on the top of Pha Kog Jum Pa Daed volcano: medium dark gray, fine-grained, non-foliated and slightly vesicular, with Permo-Triassic (?) volcanic xenoliths (sizes up to 1.5 cm across).	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 18	665202	Outcrop sample: dark gray, massive, fine-grained and non-foliated, with occasional dark greenish to black clinopyroxene and opaque. Olivine phenocrysts up to 0.2 cm across..	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 19	663198	Outcrop sample from Pha Kog Jum Pa Daed volcano: dark gray, massive, fine-grained and non-foliated, with Permo-Triassic (?) volcanic xenoliths (sizes up to 0.5 cm across).	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 20	663197	*In situ* float on Pha Kog Jum Pa Daed volcano: dark gray, fine-	Topographic map sheet 4945 IV (Changwat

		grained and slightly vesicular with Permo-Triassic (?) volcanic xenoliths (sizes up to 1 cm across). The rock has olivine phenocrysts up to 0.3 cm across, with rare dark greenish to black clinopyroxene and opaque.	Lampang) at a scale of 1:50,000.
MT 21	665195	Outcrop sample from Pha Kog Jum Pa Daed volcano: dark gray, massive, fine-grained and non-foliated, with olivine aggregates (sizes up to 1 cm across).	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 22	665196	Outcrop sample from Pha Kog Jum Pa Daed volcano: dark gray, fine-grained, non-foliated and slightly vesicular with Permo-Triassic (?) volcanic xenoliths (sizes up to 4 cm across).	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 23/1	669196	Float rock. Dark gray, massive, fine-grained and non-foliated. Olivine phenocrysts up to 0.3 cm across.	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 24	700186	*In situ* float. Dark gray, massive, fine-grained and non-foliated , with occasional olive gray patches. Vesicles and fractures are partially infilled with carbonate and zeolitic minerals.	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 25	713162	*In situ* float. Dark gray, massive, fine-grained and non-foliated. Vesicles are partially infilled with carbonate and zeolitic minerals.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.

MT 26	719145	*In situ* float. Medium dark gray, massive, fine-grained and non-foliated, with rare grayish olive patches and dark greenish to black clinopyroxene and opaque.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 27	719145	Outcrop from the cliff with the thickness of flow > 4 m. Dark gray, massive, fine-grained and non-foliated, with rare dark greenish to black clinopyroxene and opaque. Olivine phenocrysts up to 0.2 cm across.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.
MT 29/2	680188	*In situ* float. Dark gray, non-foliated and massive. Vesicles are partially infilled with carbonate mineral. Olivine phenocrysts up to 0.2 cm across.	Topographic map sheet 4945 IV (Changwat Lampang) at a scale of 1:50,000.
MT 30F1 MT 30F2 MT 30F3	703210	Roadcut outcrop of at least three flows with columnar and platy joints (110°/24°SE, 238°/18°SE). Thicknesses of the upper, central, and lower flows are >3, 2 and >4 m, respectively. MT 30F1 and MT 30F2 are dark gray, massive, fine-grained and non-foliated, with sporadic olive gray patches. MT 30F3 is dark gray, slightly vesicular, fine-grained and non-foliated. Vesicles are partly infilled with carbonate mineral.	Topographic map sheet 4945 III (Amphoe Mae Tha) at a scale of 1:50,000.

APPENDIX B

SUMMARIZED PETROGRAPHIC FEATURES OF MAE THA BASALTS

Sample	Phenocrysts/microphenocrysts	Groundmass	Remarks
MT 1/A	Olivine + Plagioclase Olivine phenocrysts/microphenocrysts are more dominant relative to plagioclase phenocrysts/microphenocrysts. All largely form as isolated crystals; a few as olivine glomerocrysts, and as olivine-plagioclase cumulocrysts. Olivine: anhedral to subhedral, with sizes up to 0.78 mm. Commonly shows corroded outlines; a few show weak sieve texture. Some have opaque inclusions (chromian spinel ?). Plagioclase: anhedral to euhedral, with sizes up to 0.31 mm across, and may have clinopyroxene inclusions.	Hypocrystalline, consisting largely of felty plagioclase laths (subhedral-euhedral) with subordinate olivine (anhedral), pink clinopyroxene (anhedral-subhedral) and slightly devitrified light brown glass, and minor Fe-Ti oxide (anhedral to subhedral, mainly ilmenite). The subordinate and trace constituents are interstitial to plagioclase laths.	Moderately phyric. Fractures and vesicles are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is slightly replaced by sericite and clay mineral. Olivine is slightly to highly altered to iddingsite and chlorite/serpentine with minor iron oxide/hydroxide minerals.
MT 1/B	Olivine + Plagioclase + Fe-Ti oxide The most abundant microphenocrysts are olivine and plagioclase (olivine > plagioclase), while rare microphenocrysts are Fe-Ti oxide. Largely form as isolated	Holocrystalline, consisting mainly of felted plagioclase laths (subhedral-euhedral) with subordinate olivine (anhedral) and pink clinopyroxene (anhedral-subhedral), and minor Fe-Ti oxide (anhedral-subhedral,	Slightly microphyric. Vesicles and fractures are infilled in part with carbonate, chlorite and iron oxide/hydroxide minerals. Olivine is slightly to highly

	crystals; some as olivine and plagioclase glomerocrysts, and as olivine-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 0.42 mm across. Commonly shows corroded features. Plagioclase: subhedral to euhedral, with sizes up to 0.21 mm across, and may have clinopyroxene and opaque inclusions. Some show corroded outlines. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.16 mm across.	mainly ilmenite).	altered to iddingsite, chlorite/serpentine and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral.
MT 1/C	Olivine + Plagioclase + Clinopyroxene + Fe-Ti oxide The most abundant phenocrysts/microphenocrysts are olivine (microphenocrysts > phenocrysts). The subordinate phenocrysts/microphenocrysts are plagioclase but clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Mostly form as isolated crystals; a few as olivine glomerocrysts and olivine-plagioclase cumulocrysts. Olivine: anhedral to subhedral, with sizes up to 0.66 mm across, and commonly displays corroded outlines. Plagioclase: anhedral to euhedral, with sizes	Hypocrystalline, made up largely of felty plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral) and trace slightly devitrified yellowish brown glass, and intergranular Fe-Ti oxide (anhedral-euhedral, mainly magnetite).	Moderately microphyric. Vesicles and fractures are infilled in part with chlorite and iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly to highly replaced by iddingsite, chlorite/serpentine and iron oxide/hydroxide minerals.

	up to 0.52 mm across, and may have clinopyroxene and opaque inclusions. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.21 mm across, and may contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.26 mm across.		
MT 1/D	Olivine + Plagioclase + Clinopyroxene + Fe-Ti oxide The most abundant microphenocrysts are olivine. The subordinate microphenocrysts are plagioclase and Fe-Ti oxide but clinopyroxene microphenocrysts are rare. Olivine: anhedral to subhedral, with sizes up to 0.36 mm across. Corroded outlines are common. Occurs either as isolated crystals or as olivine glomerocrysts; a few as olivine-plagioclase cumulocrysts and may contain opaque inclusions (chromian spinel ?). Plagioclase: subhedral to euhedral, with sizes up to 0.42 mm across, and may have clinopyroxene and opaque inclusions. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.21 mm across, and may contain opaque inclusions. A few show corroded outlines. Fe-Ti oxide: anhedral to subhedral, with	Hypocrystalline, consisting of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral) and olivine (anhedral-subhedral), and minor intergranular Fe-Ti oxide (anhedral-subhedral) and slightly devitrified yellowish brown glass.	Moderately microphyric. Vesicles and fractures are infilled in part with carbonate and iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite and clay mineral. Olivine is moderately to highly altered to iddingsite and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.

	sizes up to 0.21 mm across, mainly ilmenite.		
MT 1/E	Olivine + Clinopyroxene + Fe-Ti oxide The most abundant phenocrysts/microphenocrysts are olivine but the other microphenocrysts are rare. Olivine: anhedral to subhedral, with sizes up to 2.08 mm across. Commonly displays corroded outlines; a few show weak sieve texture. Largely forms as isolated crystals; some as glomerocrysts and may have opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.21 mm across, and may contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.13 mm across.	Hypocrystalline, consisting of plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral) and brown glass, and rare quenched crystals (plagioclase and clinopyroxene ?) and intergranular Fe-Ti oxide (anhedral-subhedral).	Slightly phyric. Tiny vesicles and fractures are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral. Olivine is slightly altered to iddingsite and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.
MT 1/F	Olivine + Clinopyroxene+ Fe-Ti oxide The most abundant phenocrysts/microphenocrysts are olivine (microphenocrysts >> phenocrysts); clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Olivine: anhedral to subhedral, with sizes up to 0.52 mm across. Commonly shows corroded outlines; a few show weak sieve texture. Largely forms as isolated crystals; a	Holocrystalline, made up largely of felted plagioclase laths (subhedral-euhedral) and pink clinopyroxene (anhedral-subhedral) with subordinate olivine (anhedral), and minor intergranular Fe-Ti oxide (anhedral-subhedral, mainly magnetite).	Moderately microphyric and slightly vesicular. Vesicles and fractures are infilled in part with carbonate and iron oxide/ hydroxide. Plagioclase is slightly replaced by sericite, clay mineral and iron oxide/hydroxide minerals. Olivine is slightly to highly replaced by chlorite/serpentine, iddingsite and

	few as glomerocrysts. Clinopyroxene: pink, subhedral to euhedral and zoned, with sizes up to 0.30 mm across. May have opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.21 mm across.		iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.
MT 2/2	Olivine + Plagioclase Olivine is the most abundant phenocrysts/microphenocrysts, while plagioclase microphenocrysts are subordinate to olivine phenocrysts/microphenocrysts. Olivine: anhedral to euhedral, with sizes up to 0.52 mm across. Commonly displays corroded outlines; some show sieve features, and largely forms as isolated crystals; some as olivine-plagioclase cumulocrysts. Inclusions of chromian spinel (?) are common. Plagioclase: subhedral to euhedral, with sizes up to 0.26 mm across, and may have clinopyroxene and Fe-Ti oxide inclusions. Largely forms as isolated crystals; a few as glomerocrysts.	Hypocrystalline, consisting largely of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), dark brown glass and quenched crystals (plagioclase and clinopyroxene ?), and accessory Fe-Ti oxide (anhedral). The subordinate and trace constituents are interstitial to plagioclase laths.	Moderately phyric. Fractures and vesicles are partly infilled with chlorite and iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly replaced by chlorite/serpentine and iron oxide/hydroxide minerals.
MT 3/1	Olivine + Plagioclase Olivine microphenocrysts are more dominant	Hypocrystalline, made up largely of felty plagioclase laths (subhedral) with subordinate	Moderately phyric. Vesicles and fractures are infilled in part with

	relative to plagioclase microphenocrysts. Olivine: subhedral to euhedral, with sizes up to 1 mm across. Commonly displays corroded features and largely forms as isolated crystals; some as olivine glomerocrysts and olivine-plagioclase cumulocrysts. Inclusions of chromian spinel (?) are common. Plagioclase: anhedral to euhedral, with sizes up to 0.39 mm across. Largely forms as isolated crystals; a few as glomerocrysts.	olivine (anhedral), pink clinopyroxene (anhedral-subhedral), brown glass and quenched crystals (plagioclase and clinopyroxene ?), and trace intergranular Fe-Ti oxide (anhedral-subhedral).	carbonate, iron oxide/hydroxide minerals and chlorite. Plagioclase is very slightly replaced by sericite, clay mineral and iron oxide/hydroxide minerals. Olivine is very slightly altered to chlorite/serpentine and iron oxide/hydroxide minerals.
MT 4	Olivine + Plagioclase + Clinopyroxene + Fe-Ti oxide The most predominant phenocrysts/microphenocrysts are olivine and plagioclase (olivine > plagioclase); clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Largely form as isolated crystals; a few as olivine glomerocrysts and olivine-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 2.86 mm across. Commonly shows corroded outlines and may have chromian spinel inclusions. Plagioclase: anhedral to euhedral, with sizes up to 0.26 mm across, and may have	Hypocrystalline, consisting largely of felty plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), brown glass and quenched crystals (plagioclase and clinopyroxene ?) and Fe-Ti oxide (anhedral-subhedral, mainly ilmenite).	Highly microphyric. Vesicles are infilled in part with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly replaced by sericite and clay minerals. Olivine is very slightly altered to iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.

	clinopyroxene inclusions. Some show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.39 mm across, mainly chromian spinel and magnetite.		
MT 5/1	Olivine + Plagioclase + Clinopyroxene Olivine phenocrysts/microphenocrysts predominate over plagioclase microphenocrysts but clinopyroxene microphenocrysts are rare. Largely form as isolated crystals; some as olivine glomerocrysts, and olivine-plagioclase and clinopyroxene-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 0.65 mm across. Commonly shows corroded outlines. Some have opaque inclusions (chromian spinel ?) Plagioclase: subhedral to euhedral, with sizes up to 0.21 mm across, and may have Fe-Ti oxide inclusions. Some show corroded outlines and stellate pattern. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions.	Hypocrystalline, composed largely of plagioclase laths (subhedral-euhedral), with subordinate pink clinopyroxene (anhedral), olivine (anhedral), slightly devitrified brown glass and Fe-Ti oxide (anhedral).	Highly microphyric and slightly seriate-textured. Fractures are partly infilled with chlorite, iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide minerals. Olivine is slightly altered to chlorite/serpentine and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.

MT 5/2	Olivine + Plagioclase + Clinopyroxene Olivine phenocrysts/microphenocrysts predominate over plagioclase and clinopyroxene microphenocrysts. Largely form as isolated crystals; some as olivine glomerocrysts and olivine-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 0.42 mm across. Some have opaque inclusions (chromian spinel ?). Commonly shows corroded outlines; a few show weak sieve texture. Plagioclase: anhedral to euhedral, with sizes up to 0.39 mm across. Some show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.16 mm across, and may contain opaque inclusions.	Hypocrystalline, consisting largely of felty plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral), olivine (anhedral), brown glass and quenched crystals (plagioclase and clinopyroxene ?), and trace Fe-Ti oxide (anhedral). The subordinate and trace constituents are interstitial to plagioclase laths.	Moderately microphyric. Plagioclase is slightly replaced by sericite and clay mineral. Olivine is very slightly altered to iddingsite and iron oxide/hydroxide minerals.
MT 6/2	Olivine + Plagioclase + Clinopyroxene Olivine phenocrysts/microphenocrysts predominate over plagioclase and clinopyroxene microphenocrysts. Largely form as isolated crystals; some as olivine and plagioclase glomerocrysts. Olivine: anhedral to euhedral, with sizes up to 2.34 mm across. Commonly shows corroded outlines; a few show sieve texture.	Hypocrystalline, consisting mainly of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), brown glass and quenched crystals (plagioclase and clinopyroxene ?), and minor Fe-Ti oxide (anhedral-subhedral, mainly ilmenite). Clinopyroxene bears subophitic relationship to plagioclase in part.	Moderately microphyric. Vesicles and fractures are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral. Olivine is slightly altered to iddingsite, Fe-Ti oxide and chlorite/serpentine.

	Plagioclase: anhedral to euhedral, with sizes up to 0.21 mm across. Some show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions.		Clinopyroxene is very slightly replaced by chlorite.
MT 7	Olivine + Plagioclase + Clinopyroxene + Fe-Ti oxide Olivine is the most abundant phenocrysts/microphenocrysts, whereas the other microphenocrysts are rare. Largely form as isolated crystals; a few as olivine and clinopyroxene glomerocrysts, and as olivine-clinopyroxene cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 0.5 mm across. Commonly exhibits corroded outlines and some show sieve texture. Plagioclase: anhedral to euhedral, with sizes up to 0.18 mm across. Clinopyroxene: pink, subhedral and zoned, with sizes up to 0.5 mm across. May have opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.39 mm across.	Hypocrystalline, made up largely of plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral) and Fe-Ti oxide, and trace slightly devitrified yellowish brown glass. The subordinate and minor constituents are interstitial to plagioclase laths.	Moderately phyric. Fractures are infilled in part with carbonate and iron oxide/hydroxide minerals. Corroded Fe-Ti oxide megacrysts are sporadically present. Plagioclase is slightly replaced by sericite and clay mineral. Olivine is very slightly to slightly altered to iddingsite and chlorite/serpentine. Clinopyroxene is very slightly altered to chlorite.
MT 8	Olivine + Clinopyroxene + Fe-Ti oxide	Hypocrystalline, consisting largely of	Moderately microphyric with

	Olivine, the most abundant phenocrysts/microphenocrysts, occurs mainly as microphenocrysts. Clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Olivine: anhedral to subhedral, with sizes up to 2.08 mm across. Commonly shows corroded outlines. Largely occurs as isolated crystals; a few occur as glomerocrysts and may contain opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.88 mm across, and may contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.13 mm across.	plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), brown glass, and minor Fe-Ti oxide (anhedral-subhedral).	some large phenocrysts. Vesicles are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay minerals. Olivine is slightly to moderately altered to iddingsite, chlorite/serpentine and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.
MT 9	Olivine + Clinopyroxene + Fe-Ti oxide Olivine phenocrysts/microphenocrysts (largely microphenocrysts) are predominant over the other microphenocrysts. Mostly form as isolated crystals; a few as olivine and clinopyroxene glomerocrysts. Olivine: anhedral to subhedral, with sizes up to 2.08 mm across. Commonly shows corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm. May contain opaque inclusions; some show stellate	Hypocrystalline, made up largely of plagioclase laths (subhedral-euhedral) and pink clinopyroxene (anhedral-subhedral) with subordinate olivine (anhedral), brown glass, and trace quenched crystals (plagioclase and clinopyroxene ?) and Fe-Ti oxide (anhedral-subhedral, mainly magnetite). The subordinate and trace constituents are interstitial to plagioclase laths.	Moderately microphyric. Vesicles and fractures are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay minerals. Olivine is slightly to moderately replaced by chlorite/serpentine, iron oxide/hydroxide minerals and iddingsite.

	pattern. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.10 mm across.		
MT 10/2	Olivine + Clinopyroxene + Fe-Ti oxide Olivine, the most abundant phenocrysts/microphenocrysts, occurs mainly as microphenocrysts. Clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Olivine: anhedral to subhedral, with sizes up to 2.62 mm across. Commonly displays corroded outlines. Largely forms as isolated crystals; a few as glomerocrysts and may contain opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.16 mm across, and may contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.13 mm across.	Hypocrystalline, made up largely of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), and trace slightly devitrified brown glass, and Fe-Ti oxide (anhedral-euhedral, mainly magnetite).	Moderately microphyric and has Permo-Triassic (?) volcanic and quartz xenoliths. Vesicles and fractures are infilled in part with chlorite, carbonate and iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly to moderately replaced by chlorite/serpentine and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.
MT 11	Olivine + Clinopyroxene + Fe-Ti oxide Olivine phenocrysts/microphenocrysts are abundant but clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Olivine: anhedral to subhedral, with sizes up to 2.34 mm across. Commonly shows corroded outlines. Occurs either as isolated	Hypocrystalline, made up largely of felted plagioclase laths (subhedral-euhedral) and pink clinopyroxene (anhedral-subhedral) with subordinate olivine (anhedral-subhedral), brown glass and quenched crystals (plagioclase and clinopyroxene ?), and minor Fe-Ti oxide (subhedral-anhedral, mainly	Moderately phyric, with predominant microphenocrysts. Tiny vesicles and fractures are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay

	crystals or as glomerocrysts, and occasionally has opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.16 mm. May contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.10 mm across.	magnetite).	mineral. Olivine is slightly replaced by chlorite/serpentine.
MT 13	Olivine + Plagioclase + Clinopyroxene The most abundant phenocrysts/microphenocrysts are olivine and plagioclase. Clinopyroxene microphenocrysts are rare. Largely form as isolated crystals; some as olivine and plagioclase glomerocrysts, and as olivine-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 0.74 mm across. Commonly shows corroded outlines; a few show sieve texture. May contain opaque inclusions (chromian spinel ?). Plagioclase: anhedral to euhedral, with sizes up to 0.42 mm across, and may have clinopyroxene inclusions. Some show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may	Hypocrystalline, composed mainly of felted plagioclase laths (subhedral, some show stellate pattern) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), slightly devitrified light brown glass, quenched crystals (plagioclase and clinopyroxene ?), and rare Fe-Ti oxide. Clinopyroxene is either intergranular or subophitic to plagioclase laths.	Moderately microphyric. Vesicles and fractures are partly infilled with chlorite, carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral. Olivine is very slightly altered to chlorite/serpentine and iddingsite. Clinopyroxene is very slightly replaced by chlorite.

	contain opaque inclusions.		
MT 14/1	Olivine + Plagioclase + Clinopyroxene Olivine phenocrysts/microphenocrysts are predominant over plagioclase and clinopyroxene microphenocrysts. Largely form as isolated crystals; a few as olivine and plagioclase glomerocrysts, and as olivine-plagioclase and olivine-clinopyroxene cumulocrysts. Olivine: anhedral to subhedral, with sizes up to 0.91 mm across, and occasionally contains opaque inclusions (chromian spinel ?). Largely shows corroded outlines. Plagioclase: anhedral to euhedral, with sizes up to 0.18 mm across, and may have clinopyroxene and opaque inclusions. A few show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.16 mm across, and may contain opaque inclusions.	Hypocrystalline, composed mainly of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), Fe-Ti oxide (anhedral-subhedral, mainly ilmenite), dark brown glass and quenched crystals (plagioclase and clinopyroxene ?).	Moderately microphyric. Vesicles and fractures are infilled in part with zeolite, chlorite and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral. Olivine is very slightly altered to chlorite/serpentine and iddingsite with trace iron oxide/hydroxide patches.
MT 14/2	Olivine + Plagioclase + Clinopyroxene Olivine microphenocrysts predominate over plagioclase microphenocrysts but clinopyroxene microphenocrysts are rare. Largely form as isolated crystals; a few as olivine glomerocrysts.	Hyaline, made up largely of yellowish brown glass with subordinate quenched crystals (plagioclase and clinopyroxene ?).	Vitrophyric, with quartz megacrysts. Vesicles are infilled in part with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly to slightly altered to sericite and

	Olivine: anhedral to euhedral, with sizes up to 0.18 mm across, and occasionally contains opaque inclusions (chromian spinel ?). Commonly shows corroded outlines; a few show sieve texture. Plagioclase: subhedral to euhedral, with sizes up to 0.21 mm across, and may have clinopyroxene inclusions. Some show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.16 mm across, and may contain opaque inclusions.		clay mineral. Olivine is very slightly altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide minerals.
MT 15	Olivine + Clinopyroxene + Fe-Ti oxide Olivine phenocrysts/microphenocrysts are abundant but the other microphenocrysts are rare. Olivine: anhedral to euhedral. Occurs mainly as microphenocrysts; a few as phenocrysts with sizes up to 0.78 mm across. Commonly shows corroded outlines, and largely forms as isolated crystals; a few forms as glomerocrysts. Some contain opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions. Largely forms as isolated crystals; a few forms as	Holocrystalline and fine-grained, consisting mainly of plagioclase laths (subhedral-euhedral) and pink clinopyroxene (anhedral-subhedral) with subordinate olivine (anhedral) and minor Fe-Ti oxide (anhedral-subhedral, mainly magnetite).	Moderately microphyric, with some Permo-Triassic (?) volcanic xenoliths. Fractures are partly infilled with iron oxide/hydroxide minerals. Olivine is slightly to moderately altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite and clay mineral. Clinopyroxene is very slightly replaced by chlorite.

	glomerocrysts. A few show corroded outlines. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.10 mm across.		
MT 16	Olivine + Clinopyroxene + Fe-Ti oxide The most predominant phenocrysts/microphenocrysts are olivine (microphenocrysts > phenocrysts); clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Largely form as isolated crystals; a few as olivine glomerocrysts. Olivine: anhedral to euhedral, with sizes up to 0.74 mm across. Commonly shows corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.13 mm across.	Hypocrystalline and fine-grained, made up mainly of felted plagioclase laths (subhedral-euhedral) and pink clinopyroxene (anhedral) with subordinate olivine (anhedral), and trace slightly devitrified light brown glass and Fe-Ti oxide (anhedral-subhedral).	Moderately microphyric and slightly vesicular. Fractures are partly infilled with iron oxide/hydroxide minerals. Olivine is slightly to highly altered to iddingsite, chlorite/serpentine and iron oxide/hydroxide minerals.
MT 17	Olivine + Clinopyroxene + Fe-Ti oxide The most predominant phenocrysts/microphenocrysts are olivine but clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Largely form as isolated crystals; a few as olivine	Holocrystalline and fine-grained, made up mainly of felty plagioclase laths (subhedral-euhedral) and olivine (anhedral-subhedral), with subordinate pink clinopyroxene (anhedral) and occasional Fe-Ti oxide (anhedral-subhedral, mainly magnetite).	Moderately microphyric and slightly vesicular, with some Permo-Triassic (?) volcanic xenoliths. Vesicles are infilled in part with chlorite and iron oxide/hydroxide minerals.

	glomerocrysts. Olivine: anhedral to euhedral, with sizes up to 0.92 mm across. Commonly displays corroded outlines and may contain opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.16 mm, and may contain opaque inclusions. Largely occurs as isolated crystals; a few occur as glomerocrysts. A few show corroded outlines. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.13 mm across.		Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly to highly replaced by iddingsite and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.
MT 18	Olivine + Clinopyroxene + Fe-Ti oxide Olivine is the most abundant phenocrysts/microphenocrysts (mainly as microphenocrysts) but the other microphenocrysts are rare. Olivine: anhedral to subhedral, with sizes up to 1.05 mm across. Commonly shows corroded outlines. Largely occurs as isolated crystals; a few occur as glomerocrysts and some contain opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm, and may contain opaque inclusions. Largely occurs as isolated crystals; a few occur as glomerocrysts.	Holocrystalline and fine-grained, consisting largely of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral) and olivine (anhedral), and minor Fe-Ti oxide (anhedral-subhedral, mainly magnetite). The subordinate and minor constituents are intergranular to plagioclase laths.	Highly microphyric, with some Permo-Triassic (?) volcanic xenoliths. Tiny fractures and vesicles are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral. Olivine is slightly to very slightly replaced by chlorite/serpentine and iddingsite.

	Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.10 mm across.		
MT 19	Olivine + Clinopyroxene + Fe-Ti oxide The most predominant phenocrysts/microphenocrysts are olivine (microphenocrysts > phenocrysts); clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Largely form as isolated crystals; a few as olivine glomerocrysts. Olivine: anhedral to euhedral, with sizes up to 1.05 mm across. Commonly displays corroded outlines; a few show sieve texture, and may contain opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.16 mm across.	Holocrystalline, made up largely of plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral) and olivine (anhedral-subhedral), and minor Fe-Ti oxide (anhedral-subhedral, mainly magnetite). Plagioclase laths show preferred orientation.	Moderately microphyric, with some Permo-Triassic (?) volcanic xenoliths. Vesicles and fractures are infilled in part with chlorite and iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly to highly replaced by iddingsite, iron oxide/hydroxide minerals and chlorite/serpentine. Clinopyroxene is very slightly replaced by chlorite.
MT 20	Olivine + Clinopyroxene + Fe-Ti oxide Olivine microphenocrysts/phenocrysts are much more abundant relative to clinopyroxene and Fe-Ti oxide microphenocrysts. Olivine: anhedral to euhedral, with sizes up	Holocrystalline and fine-grained, made up mainly of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral) and olivine (anhedral), and minor Fe-Ti oxide (anhedral-subhedral, mainly magnetite).	Moderately microphyric and slightly vesicular. Vesicles and fractures are infilled in part with chlorite and iron oxide/hydroxide minerals. Plagioclase is very slightly to slightly altered to

	to 0.78 mm across. Commonly shows corroded outlines. Occurs as isolated crystals; a few as glomerocrysts and may have opaque inclusions (chromian spinel ?). Clinopyroxene: pink, subhedral, with sizes up to 0.21 mm across, and occasionally have opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.16 mm across.		sericite, clay mineral and iron oxide/hydroxide minerals. Olivine is slightly to moderately altered to iddingsite, iron oxide/hydroxide minerals and chlorite/serpentine.
MT 21	Olivine + Clinopyroxene + Fe-Ti oxide Olivine is the most abundant phenocrysts/microphenocrysts (mainly as microphenocrysts); clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Largely form as isolated crystals; a few as olivine and clinopyroxene glomerocrysts. Olivine: anhedral to euhedral, with sizes up to 0.52 mm across. Commonly shows corroded outlines; a few show sieve texture and may contain opaque inclusions (chromian spinel ?). Clinopyroxene: pink, anhedral to subhedral and zoned, with sizes up to 0.13 mm across. Some show stellate pattern and may have opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.13 mm across.	Hypocrystalline, consisting largely of plagioclase laths (subhedral-euhedral) and pink clinopyroxene (anhedral-subhedral) with subordinate olivine (anhedral-subhedral) and trace yellowish brown glass and Fe-Ti oxide (anhedral-euhedral, mainly magnetite). Plagioclase laths align in parallel/subparallel manner.	Highly microphyric, with some Permo-Triassic (?) volcanic xenoliths. Tiny fractures are infilled in part with iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite, clay mineral and iron oxide/hydroxide minerals. Olivine is slightly to moderately altered to iddingsite, chlorite/serpentine and iron oxide/hydroxide minerals. Clinopyroxene is very slightly altered to chlorite.

MT 22	Olivine + Clinopyroxene + Fe-Ti oxide Olivine microphenocrysts are much more abundant relative to clinopyroxene and Fe-Ti oxide microphenocrysts. Olivine: anhedral to subhedral, with sizes up to 1.31 mm across. Commonly displays corroded outlines and may contain opaque inclusions (chromian spinel ?). Largely forms as isolated crystals; some as glomerocrysts. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.21 mm across, and occasionally contains opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.10 mm across.	Hypocrystalline and fine-grained, made up largely of felted plagioclase laths (subhedral-euhedral) and pink clinopyroxene (anhedral-subhedral) with subordinate olivine (anhedral-subhedral), trace slightly devitrified brown glass, and minor Fe-Ti oxide (anhedral-subhedral, mainly magnetite).	Moderately microphyric and slightly vesicular, with some Permo-Triassic (?) volcanic xenoliths. Vesicles and fractures are infilled in part with chlorite and iron oxide/hydroxide minerals. Olivine is slightly to highly altered to iddingsite, iron oxide/hydroxide minerals and chlorite/serpentine. Plagioclase is slightly altered to sericite and clay mineral. Clinopyroxene is very slightly replaced by chlorite.
MT 23	Olivine + Clinopyroxene + Fe-Ti oxide Olivine microphenocrysts are much more abundant relative to the other microphenocrysts. Olivine: anhedral to euhedral, with sizes up to 0.65 mm across. Commonly shows corroded outlines and may contain opaque inclusions (chromian spinel ?). Largely forms as isolated crystals; a few as glomerocrysts. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.11 mm across, and	Hypocrystalline and fine grained. Consisting largely of plagioclase laths (subhedral-euhedral) with subordinate olivine (anhedral) and pink clinopyroxene (anhedral-subhedral), and trace light yellowish brown glass and Fe-Ti oxide (anhedral-subhedral, mainly magnetite).	Moderately microphyric, with some Permo-Triassic (?) volcanic xenoliths. Fractures are infilled in part with carbonate mineral, chlorite and iron oxide/hydroxide minerals. Plagioclase is slightly replaced by sericite and clay mineral. Olivine is very slightly to slightly altered to chlorite/ serpentine, iddingsite and iron oxide/hydroxide minerals.

	occasionally contains opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.13 mm across.		
MT 24	Olivine + Plagioclase + Clinopyroxene + Fe-Ti oxide Olivine and plagioclase are the most abundant microphenocrysts (olivine > plagioclase); clinopyroxene and Fe-Ti oxide microphenocrysts are rare. Largely form as isolated crystals; a few as olivine and plagioclase glomerocrysts, and as olivine-plagioclase, olivine-clinopyroxene, and plagioclase-clinopyroxene cumulocrysts. Olivine: subhedral to euhedral, with sizes up to 0.65 mm across. Commonly displays corroded outlines and weak sieve features; some have opaque inclusions (chromian spinel ?). Plagioclase: subhedral, with sizes up to 0.39 mm across, and may have clinopyroxene inclusions. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may have opaque inclusions. Fe-Ti oxide: anhedral to subhedral, with sizes up to 0.30 mm across.	Hypocrystalline, consisting largely of felty plagioclase laths (subhedral-euhedral) with subordinate olivine (anhedral) and pink clinopyroxene (anhedral), slightly devitrified brown glass and quenched crystals (plagioclase and clinopyroxene ?), and trace Fe-Ti oxide (anhedral-subhedral). The subordinate and trace constituents are interstitial to plagioclase laths, except for clinopyroxenes which are largely subophitic to plagioclase laths.	Moderately microphyric, with some Permo-Triassic (?) volcanic xenoliths. Fractures are partly infilled with carbonate, zeolite and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay minerals. Olivine is slightly altered to chlorite/serpentine with trace iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.

MT 25	Olivine + Plagioclase + Clinopyroxene Olivine microphenocrysts predominate over plagioclase microphenocrysts but clinopyroxene microphenocrysts are rare. Olivine: anhedral to euhedral, with sizes up to 0.78 mm across. Commonly displays corroded outlines and weak sieve features. Largely forms as isolated crystals; some as glomerocrysts and olivine-plagioclase cumulocrysts. Inclusions of chromian spinels (?) are common. Plagioclase: subhedral, with sizes up to 0.26 mm across, and may have clinopyroxene and opaque inclusions. Some show corroded outlines and largely forms as isolated crystals. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions.	Hypocrystalline, consisting largely of plagioclase laths (subhedral-euhedral) with subordinate olivine (anhedral), pink clinopyroxene (anhedral-subhedral), slightly devitrified brown glass, quenched crystals (plagioclase and clinopyroxene ?), and trace Fe-Ti oxide.	Moderately microphyric. Plagioclase is slightly altered to sericite and clay minerals. Olivine is slightly to highly altered to iddingsite and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.
MT 26	Olivine + Plagioclase + Clinopyroxene Olivine microphenocrysts predominate over plagioclase and clinopyroxene microphenocrysts. All largely form as isolated crystals; some as olivine glomerocrysts and as olivine-plagioclase cumulocrysts. Olivine: anhedral to subhedral, with sizes up	Hypocrystalline, made up largely of felted plagioclase laths (subhedral-euhedral) with subordinate olivine (anhedral), pink clinopyroxene (anhedral), light brown glass and quenched crystals (plagioclase and clinopyroxene ?), and minor Fe-Ti oxide (anhedral-subhedral, mainly ilmenite).	Moderately microphyric. Tiny vesicles and fractures are infilled in part with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite, clay mineral and iron oxide/hydroxide minerals. Olivine is slightly to

	to 0.65 mm across, and commonly displays corroded outlines. Plagioclase: anhedral to euhedral, with sizes up to 0.31 mm across, and may have clinopyroxene inclusions. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions.		moderately replaced by iddingsite, chlorite/serpentine, and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.
MT 27	Olivine + Plagioclase + Clinopyroxene Olivine microphenocrysts/phenocrysts predominate over plagioclase microphenocrysts but clinopyroxene microphenocrysts are rare. All largely form as isolated crystals; some as olivine and plagioclase glomerocrysts, and as olivine-plagioclase cumulocrysts. Olivine: anhedral to subhedral, with sizes up to 0.78 mm across. Commonly displays corroded outlines and some have opaque inclusions (chromian spinel ?). Plagioclase: anhedral to euhedral, with sizes up to 0.31 mm across, and may have clinopyroxene and opaque inclusions. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.13 mm across, and may contain opaque inclusions.	Hypocrystalline, made up largely of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), brown glass and quenched crystals (plagioclase and clinopyroxene ?), and minor Fe-Ti oxide (anhedral-euhedral, mainly ilmenite). Clinopyroxene bears subophitic relationship to plagioclase in part.	Moderately microphyric. Fractures and vesicles are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral. Olivine is slightly pseudomorphed by chlorite/serpentine and iron oxide/hydroxide minerals.

MT 29	Olivine + Plagioclase + Clinopyroxene Olivine microphenocrysts/phenocrysts (largely microphenocrysts) predominate over the other microphenocrysts. All largely form as isolated crystals; some as olivine and plagioclase glomerocrysts. Olivine: anhedral to subhedral, with sizes up to 1.30 mm across. Some have opaque inclusions (chromian spinel ?). Commonly displays corroded outlines; a few display weak sieve texture. Plagioclase: anhedral to euhedral, with sizes up to 0.26 mm across, and may have clinopyroxene inclusions. Some show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.10 mm across, and may contain opaque inclusions.	Hypocrystalline, consisting largely of plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), slightly devitrified brown glass and quenched crystals (plagioclase and clinopyroxene ?), and minor Fe-Ti oxide (anhedral-subhedral, mainly ilmenite).	Moderately microphyric. Fractures are infilled in part with carbonate, zeolite and iron oxide/hydroxide minerals. Plagioclase is slightly replaced by sericite, clay mineral and iron oxide/hydroxide minerals. Olivine is very slightly altered to iron oxide/hydroxide minerals with trace chlorite/serpentine. Clinopyroxene is very slightly replaced by chlorite.
MT 30F1	Olivine + Plagioclase Olivine microphenocrysts/phenocrysts predominate over plagioclase microphenocrysts. All largely form as isolated crystals; some as olivine glomerocrysts and as olivine-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 1.04 mm across. Some have opaque	Hypocrystalline, consisting mainly of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), slightly devitrified yellowish brown glass, quenched crystals (plagioclase and clinopyroxene ?) and Fe-Ti oxide (anhedral-subhedral).	Moderately microphyric. Tiny vesicles and fractures are partly infilled with carbonate and iron oxide/hydroxide minerals. Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly replaced by chlorite/serpentine and iron oxide/hydroxide minerals.

	inclusions (chromian spinel ?). Commonly displays corroded outlines; a few display weak sieve texture. Plagioclase: anhedral to euhedral, with sizes up to 0.52 mm across, and may have clinopyroxene and opaque inclusions. Some show corroded outlines.		
MT 30F2	Olivine + Plagioclase + Clinopyroxene Olivine and plagioclase are the most abundant microphenocrysts (olivine > plagioclase) but clinopyroxene microphenocrysts are rare. All largely form as isolated crystals; some as olivine and plagioclase glomerocrysts, and as olivine-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 2.86 mm across. Commonly displays corroded outlines. Some have opaque inclusions (chromian spinel ?). Plagioclase: anhedral to euhedral, with sizes up to 0.31 mm across, and may have clinopyroxene inclusions. Some show corroded outlines. Clinopyroxene: pink, anhedral to subhedral, with sizes up to 0.21 mm across, and may contain opaque inclusions.	Hypocrystalline, consisting largely of plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), brown glass and quenched crystals (plagioclase and clinopyroxene ?), and minor Fe-Ti oxide (anhedral-subhedral).	Moderately phyric. Fractures and vesicles are infilled in part with carbonate and iron oxide/hydroxide minerals. Plagioclase is very slightly altered to sericite and clay mineral. Olivine is very slightly altered to chlorite/serpentine and iron oxide/hydroxide minerals. Clinopyroxene is very slightly replaced by chlorite.

MT 30F3	Olivine + Plagioclase The most abundant microphenocrysts/phenocrysts are olivine with subordinate plagioclase microphenocrysts. All largely form as isolated crystals; some as olivine glomerocrysts and as olivine-plagioclase cumulocrysts. Olivine: anhedral to euhedral, with sizes up to 1.56 mm across. Some have opaque inclusions (chromian spinel ?). Commonly displays corroded outlines and weak sieve texture. Plagioclase: anhedral to euhedral, with sizes up to 0.31 mm across, and may have clinopyroxene inclusions. Some show corroded outlines.	Hypocrystalline, made up largely of felted plagioclase laths (subhedral-euhedral) with subordinate pink clinopyroxene (anhedral-subhedral), olivine (anhedral), light brown glass and quenched crystals (plagioclase and clinopyroxene ?), and rare Fe-Ti oxide (anhedral-subhedral, mainly ilmenite). The subordinate and rare constituents are interstitial to plagioclase laths, except for clinopyroxenes which are partly subophitic to plagioclase laths.	Moderately microphyric and slightly vesicular. Plagioclase is very slightly replaced by sericite and clay mineral. Olivine is very slightly altered to iddingsite, chlorite/serpentine and iron oxide/hydroxide minerals.

APPENDIX C

Electron-probe analyses of olivine phenocrysts/microphenocrysts in the representatives of Mae Tha basalt.

Sample no.	MT 2	MT 2	MT 14	MT 14	MT15
Anal. no.	1	2	1	2	1
SiO_2	39.29	39.30	40.13	39.93	39.58
FeO	20.55	20.63	14.03	18.59	17.97
MnO	0.36	0.30	-	0.22	0.45
MgO	39.26	39.21	44.29	41.16	40.96
CaO	0.40	0.40	0.24	0.40	0.35
Total	99.86	99.84	98.69	100.30	99.31
Numbers of cations on the basis of 4 oxygens					
Si	1.014	1.014	1.014	1.015	1.015
Fe^{2+}	0.443	0.445	0.297	0.395	0.385
Mn	0.008	0.007	-	0.005	0.010
Mg	1.510	1.509	1.669	1.560	1.566
Ca	0.011	0.011	0.007	0.011	0.010
Total cat.	2.986	2.986	2.986	2.985	2.985
$Mg/(Mg+Fe^{2+})$	0.77	0.77	0.85	0.80	0.80

- = below detection limit

APPENDIX D

Major- and minor-oxide compositions, and CIPW norms of 35 Mae Tha basalts. These oxides are recalculated to 100 % on the basis of loss on ignition free. Also reported are ignition loss, original sum and some selected useful parameters.

Sample No.	MT 1/A	MT 1/B	MT 1/C	MT 1/D	MT 1/E	MT 1/F	MT 2/2
Major oxides (wt %)							
SiO_2	50.92	51.23	49.68	50.37	47.49	46.59	50.53
TiO_2	2.28	2.28	2.27	2.28	2.27	2.31	2.23
Al_2O_3	17.11	17.11	16.85	17.03	15.49	14.77	16.81
Fe_2O_3	2.75	3.81	2.98	3.76	4.12	3.86	2.51
FeO	5.67	4.54	5.78	4.67	5.69	6.35	5.83
MnO	0.15	0.15	0.15	0.15	0.18	0.17	0.14
MgO	6.02	5.80	6.75	5.98	8.69	9.27	6.90
CaO	7.40	7.36	7.25	7.65	9.09	9.34	7.32
Na_2O	3.59	4.14	5.22	4.34	2.88	4.21	3.64
K_2O	3.35	2.81	2.30	3.01	3.27	2.41	3.34
P_2O_5	0.75	0.77	0.78	0.77	0.84	0.72	0.75
Original Sum	100.78	100.83	100.17	99.93	100.05	100.24	99.54
Ignition loss	2.35	2.04	1.04	1.99	3.90	0.11	1.94
mg #	0.61	0.60	0.63	0.61	0.66	0.66	0.64
FeO*/MgO	1.35	1.65	1.61	1.59	1.46	1.63	1.53
K_2O/Na_2O	0.93	0.68	0.44	0.69	1.14	0.57	0.92
CIPW norms							
Or	19.84	16.64	13.60	17.82	19.32	14.24	19.76
Ab	28.11	33.22	27.90	27.76	15.14	13.01	25.97
An	20.62	19.74	15.73	18.05	19.63	14.24	19.64
Ne	1.20	0.96	8.77	4.83	4.99	12.25	2.59
Di wo	4.88	5.12	6.56	6.43	8.57	11.64	5.13
Di en	3.41	4.05	4.67	5.04	6.56	8.63	3.60
Di fs	1.05	0.48	1.30	0.67	1.09	1.85	1.08
Ol fo	8.14	7.31	8.54	6.94	10.62	10.18	9.55
Ol fa	2.78	0.96	2.61	1.02	1.95	2.41	3.18
Mt	3.99	5.52	4.32	5.45	5.97	5.60	3.64
He	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Il	4.33	4.33	4.31	4.33	4.31	4.38	4.24
Ap	1.64	1.68	1.70	1.67	1.84	1.57	1.63
$\frac{100An}{Ab+An}$	42.31	37.27	36.05	39.40	56.46	52.26	43.06
D.I.	49.15	50.82	50.27	50.41	39.45	39.50	48.32

mg # = Mg^{2+} / (Mg^{2+} + Fe^{2+}) assuming Fe_2O_3/FeO = 0.20,
FeO* = Total iron as FeO and D.I. = Differentiation Index.

Sample No.	MT3/1	MT 4	MT 5/1	MT 5/2	MT 7	MT 8/2	MT 9
Major oxides (wt %)							
SiO_2	50.62	49.19	49.73	49.61	48.73	46.90	47.50
TiO_2	2.23	2.23	2.36	2.34	2.22	2.26	2.34
Al_2O_3	16.79	15.78	16.98	16.95	15.24	15.30	15.87
Fe_2O_3	2.63	2.04	2.53	2.27	3.25	2.94	3.13
FeO	5.77	6.56	5.64	5.82	5.08	6.64	6.40
MnO	0.14	0.15	0.16	0.17	0.21	0.20	0.17
MgO	6.92	9.10	7.17	7.22	8.21	8.85	7.88
CaO	7.54	8.30	7.84	8.16	10.35	9.34	9.38
Na_2O	3.27	3.06	3.09	3.13	4.64	3.56	3.19
K_2O	3.33	2.83	3.68	3.54	1.39	3.17	3.27
P_2O_5	0.75	0.76	0.82	0.81	0.68	0.85	0.87
Original Sum	101.23	100.67	100.74	100.26	99.54	100.56	99.79
Ignition loss	2.82	3.41	3.14	3.52	3.91	3.35	3.53
mg #	0.64	0.70	0.66	0.66	0.68	0.67	0.64
FeO*/MgO	1.62	1.54	1.65	1.61	1.59	1.46	1.63
K_2O/Na_2O	1.02	0.92	1.19	1.13	0.30	0.89	1.03
CIPW norms							
Or	19.71	16.72	21.76	20.91	8.23	18.74	19.36
Ab	26.68	21.57	21.53	20.71	22.62	10.13	13.33
An	21.22	20.91	21.52	21.71	16.59	16.36	19.29
Ne	0.53	2.34	2.51	3.12	9.01	10.81	7.38
Di wo	4.92	6.60	5.25	5.86	12.85	10.43	9.25
Di en	3.48	4.62	3.78	4.14	9.86	7.38	6.56
Di fs	1.01	1.41	0.98	1.20	1.62	2.12	1.86
Ol fo	9.67	12.69	9.91	9.73	7.47	10.32	9.21
Ol fa	3.09	4.28	2.84	3.12	1.35	3.28	2.89
Mt	3.82	2.95	3.67	3.30	4.72	4.27	4.53
He	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Il	4.23	4.24	4.48	4.44	4.21	4.30	4.44
Ap	1.64	1.66	1.79	1.76	1.48	1.86	1.91
$\frac{100An}{Ab+An}$	44.30	49.22	49.99	51.18	42.31	61.76	59.14
D.I.	46.92	40.63	45.80	44.74	39.86	39.68	40.07

mg # = Mg^{2+} / (Mg^{2+} + Fe^{2+}) assuming $Fe_2O_3/FeO = 0.20$,
FeO* = Total iron as FeO and D.I. = Differentiation Index.

Sample No.	MT 10/2	MT 11/2	MT 13	MT 14/1	MT 14/2	MT 15	MT 17/2
Major oxides (wt %)							
SiO_2	46.93	46.72	50.18	49.38	49.00	46.36	46.92
TiO_2	2.26	2.25	2.23	2.28	2.26	2.31	2.31
Al_2O_3	15.40	15.39	16.79	16.80	16.54	14.69	14.63
Fe_2O_3	3.92	3.03	1.53	1.74	1.59	3.78	6.84
FeO	5.94	6.65	6.78	6.71	7.05	6.35	3.53
MnO	0.18	0.18	0.15	0.16	0.15	0.17	0.17
MgO	9.19	8.25	7.08	7.18	7.13	9.40	9.09
CaO	8.57	10.46	7.57	7.95	7.38	9.30	9.47
Na_2O	3.92	2.86	3.71	3.48	4.70	4.06	3.64
K_2O	2.83	3.35	3.25	3.41	3.40	2.87	2.71
P_2O_5	0.85	0.87	0.73	0.90	0.79	0.71	0.69
Original Sum	99.50	99.61	100.49	100.96	99.51	98.81	100.45
Ignition loss	2.15	3.82	1.52	2.65	0.79	0.38	1.14
mg #	0.67	0.65	0.65	0.65	0.64	0.67	0.66
FeO*/MgO	1.53	1.62	1.54	1.65	1.61	1.59	1.46
K_2O/Na_2O	0.72	1.17	0.88	0.98	0.72	0.71	0.74
CIPW norms							
Or	16.77	19.82	19.24	20.16	20.13	17.00	16.02
Ab	14.72	7.63	23.09	20.25	17.01	9.33	15.53
An	15.99	19.20	19.52	20.12	13.94	13.31	15.57
Ne	9.99	8.97	4.47	4.96	12.31	13.56	8.23
Di wo	8.98	11.53	5.75	5.89	7.54	11.96	11.41
Di en	6.79	8.07	3.72	3.87	4.83	8.87	9.84
Di fs	1.26	2.47	1.63	1.60	2.21	1.90	0.00
Ol fo	11.33	8.78	9.79	9.86	9.10	10.24	9.03
Ol fa	2.32	2.96	4.74	4.50	4.60	2.42	0.00
Mt	5.69	4.39	2.21	2.52	2.31	5.48	5.26
He	0.00	0.00	0.00	0.00	0.00	0.00	3.21
Il	4.29	4.28	4.24	4.33	4.29	4.38	4.38
Ap	1.86	1.89	1.59	1.95	1.72	1.55	1.52
$\frac{100An}{Ab+An}$	52.07	71.56	45.81	49.84	45.04	58.79	50.06
D.I.	41.48	36.42	46.80	45.37	49.45	39.89	39.78

mg # = $Mg^{2+} / (Mg^{2+} + Fe^{2+})$ assuming $Fe_2O_3/FeO = 0.20$,
FeO* = Total iron as FeO and D.I. = Differentiation Index.

Sample No.	MT 18	MT 19	MT 20	MT 21	MT 22	MT 23/1	MT 24
Major oxides (wt %)							
SiO_2	46.63	46.19	46.26	46.34	46.12	46.51	49.99
TiO_2	2.28	2.33	2.33	2.32	2.32	2.30	2.21
Al_2O_3	14.72	14.74	14.61	14.32	14.23	14.60	16.73
Fe_2O_3	3.20	4.16	3.67	2.76	3.46	4.47	1.83
FeO	6.92	6.30	6.67	7.38	6.77	5.77	6.47
MnO	0.17	0.18	0.18	0.17	0.17	0.17	0.14
MgO	9.39	9.04	9.35	10.01	10.18	9.44	7.10
CaO	9.63	9.38	9.45	9.35	9.43	9.38	7.84
Na_2O	3.76	4.10	4.07	3.88	3.89	3.96	3.65
K_2O	2.61	2.83	2.66	2.77	2.73	2.69	3.29
P_2O_5	0.70	0.74	0.74	0.70	0.70	0.71	0.74
Original Sum	98.81	101.78	98.92	98.60	99.10	99.39	100.81
Ignition loss	0.38	3.11	0.32	0.37	0.42	0.25	1.84
mg #	0.67	0.65	0.66	0.68	0.68	0.67	0.65
FeO*/MgO	1.63	1.53	1.62	1.54	1.65	1.61	1.59
K_2O/Na_2O	0.69	0.69	0.65	0.71	0.70	0.68	0.90
CIPW norms							
Or	15.44	16.72	15.72	16.38	16.12	15.93	19.48
Ab	10.90	9.76	10.12	8.35	8.45	11.83	22.07
An	15.54	13.40	13.74	13.46	13.27	14.04	19.51
Ne	11.31	13.51	13.14	13.24	13.25	11.75	4.75
Di wo	11.74	12.04	12.03	12.02	12.29	11.84	6.29
Di en	8.34	8.98	8.76	8.39	8.98	9.20	4.18
Di fs	2.35	1.84	2.13	2.60	2.13	1.33	1.64
Ol fo	10.59	9.53	10.23	11.64	11.54	10.08	9.50
Ol fa	3.29	2.15	2.75	3.98	3.03	1.61	4.11
Mt	4.64	6.03	5.32	4.00	5.01	6.48	2.65
He	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Il	4.32	4.43	4.43	4.41	4.41	4.37	4.20
Ap	1.53	1.62	1.62	1.53	1.53	1.54	1.61
$\frac{100An}{Ab+An}$	58.77	57.86	57.59	61.71	61.10	54.27	46.92
D.I.	37.65	39.99	38.98	37.97	37.82	39.51	46.30

mg # = $Mg^{2+} / (Mg^{2+} + Fe^{2+})$ assuming $Fe_2O_3/FeO = 0.20$,
FeO* = Total iron as FeO and D.I. = Differentiation Index.

Sample No.	MT 25	MT 26	MT 27	MT 29/2	MT 30F1	MT 30F2	MT 30F3
Major oxides (wt %)							
SiO_2	49.81	48.96	48.76	49.80	49.99	50.11	50.20
TiO_2	2.23	2.24	2.31	2.19	2.22	2.23	2.25
Al_2O_3	16.64	16.46	16.46	16.60	16.70	16.78	16.80
Fe_2O_3	1.63	1.95	1.65	2.84	2.69	2.54	1.67
FeO	6.84	6.61	6.90	5.82	5.87	5.94	6.67
MnO	0.15	0.18	0.15	0.15	0.14	0.14	0.14
MgO	7.55	7.28	7.42	7.21	6.92	7.02	6.98
CaO	7.57	8.59	7.86	7.72	7.71	7.65	7.55
Na_2O	3.55	3.59	4.03	3.64	3.72	3.86	3.96
K_2O	3.24	3.37	3.63	3.27	3.29	3.03	3.05
P_2O_5	0.78	0.78	0.81	0.76	0.74	0.72	0.73
Original Sum	100.65	99.72	99.53	99.71	100.30	100.55	100.68
Ignition loss	2.65	3.04	2.13	2.12	2.20	1.72	1.93
mg #	0.66	0.65	0.65	0.64	0.64	0.64	0.64
FeO*/MgO	1.46	1.63	1.53	1.62	1.54	1.65	1.61
K_2O/Na_2O	0.91	0.94	0.90	0.90	0.88	0.78	0.77
CIPW norms							
Or	19.19	19.94	21.50	19.33	19.48	17.89	18.03
Ab	22.35	16.73	15.01	23.27	23.55	25.19	24.31
An	19.84	18.79	16.02	19.27	19.09	19.49	19.02
Ne	4.15	7.37	10.35	4.05	4.28	4.01	4.96
Di wo	5.50	8.04	7.62	6.09	6.18	5.95	5.93
Di en	3.62	5.35	4.99	4.34	4.34	4.16	3.86
Di fs	1.49	2.09	2.09	1.20	1.29	1.28	1.64
Ol fo	10.68	9.00	9.50	9.59	9.07	9.37	9.51
Ol fa	4.86	3.89	4.38	2.93	2.98	3.17	4.46
Mt	2.37	2.83	2.40	4.12	3.90	3.68	2.42
He	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Il	4.25	4.26	4.39	4.17	4.22	4.23	4.27
Ap	1.69	1.69	1.77	1.66	1.62	1.57	1.59
$\frac{100An}{Ab+An}$	47.03	52.90	51.63	45.30	44.77	43.62	43.90
D.I.	45.69	44.04	46.86	46.65	47.31	47.09	47.30

mg # = $Mg^{2+} / (Mg^{2+} + Fe^{2+})$ assuming $Fe_2O_3/FeO = 0.20$,
FeO* = Total iron as FeO and D.I. = Differentiation Index.

APPENDIX E

Trace and rare-earth element compositions and some selected element ratios for the Mae Tha basaltic rocks.

Sample No.	MT 1/A	MT 1/B	MT 1/C	MT 1/D	MT 1/E	MT 1/F	MT 2/2
Trace elements (ppm)							
Ba	790	817	838	838	963	1096	851
Rb	81	97	51	83	171	104	76
Sr	908	1147	906	1361	1511	1081	959
Nb	68	nd	nd	nd	nd	nd	nd
Zr	232	253	252	241	264	225	215
Y	42	47	40	21	82	58	29
Cr	144	128	139	154	233	233	144
Ni	132	108	116	109	187	174	102
V	183	121	203	136	183	206	106
Rare-earth elements (ppm)							
La	35	nd	nd	nd	nd	nd	nd
Ce	69	nd	nd	nd	nd	nd	nd
Nd	32	nd	nd	nd	nd	nd	nd
Th	5.1	nd	nd	nd	nd	nd	nd
Sm	6.7	nd	nd	nd	nd	nd	nd
Eu	2.3	nd	nd	nd	nd	nd	nd
Tb	1.1	nd	nd	nd	nd	nd	nd
Yb	2.0	nd	nd	nd	nd	nd	nd
Lu	0.3	nd	nd	nd	nd	nd	nd
U	< 1	nd	nd	nd	nd	nd	nd
Selected element ratios							
Ti/V	74.69	112.97	67.04	100.51	74.37	67.23	126.12
Ti/Y	32.45	290.83	340.22	650.89	165.96	238.77	461.00
P/K	0.12	0.14	0.18	0.13	0.14	0.16	0.12
Zr/K	0.008	0.011	0.013	0.010	0.010	0.011	0.008
Zr/P	0.071	0.075	0.074	0.072	0.072	0.072	0.066
Ba/Sr	0.87	0.71	0.92	0.62	0.64	1.01	0.89
Ba/P	0.24	0.24	0.25	0.25	0.26	0.35	0.26
Ba/K	0.028	0.035	0.044	0.034	0.035	0.055	0.031
Zr/Ba	0.29	0.31	0.30	0.29	0.27	0.21	0.25
Y/Zr	0.18	0.19	0.16	0.09	0.31	0.26	0.13
Rb/K	0.003	0.004	0.003	0.003	0.006	0.005	0.003
Rb/Sr	0.089	0.085	0.056	0.061	0.113	0.096	0.079
Zr/Nb	3.41	nd	nd	nd	nd	nd	nd
Nb/Y	1.62	nd	nd	nd	nd	nd	nd
$(La/Sm)_n$	3.18	nd	nd	nd	nd	nd	nd
$(Sm/Yb)_n$	3.63	nd	nd	nd	nd	nd	nd
$(La/Yb)_n$	11.56	nd	nd	nd	nd	nd	nd

$(La/Sm)_n$, $(Sm/Yb)_n$ and $(La/Yb)_n$ = chondrite-normalized values for La/Sm, Sm/Yb and La/Yb, respectively.
nd = not determined.

Sample No.	MT 3/1	MT 4	MT 5/1	MT 5/2	MT 7	MT 8/2	MT 9
Trace elements (ppm)							
Ba	1055	995	1238	1440	805	1030	1067
Rb	70	74	91	91	30	87	92
Sr	1042	2445	1066	1571	879	1690	1039
Nb	nd	nd	nd	nd	nd	nd	nd
Zr	225	312	250	270	204	270	256
Y	38	58	43	37	31	21	36
Cr	137	273	130	145	329	226	182
Ni	104	198	112	118	251	178	158
V	184	176	173	207	176	163	228
Rare-earth elements (ppm)							
La	nd	nd	nd	nd	nd	nd	nd
Ce	nd	nd	nd	nd	nd	nd	nd
Nd	nd	nd	nd	nd	nd	nd	nd
Th	nd	nd	nd	nd	nd	nd	nd
Sm	nd	nd	nd	nd	nd	nd	nd
Eu	nd	nd	nd	nd	nd	nd	nd
Tb	nd	nd	nd	nd	nd	nd	nd
Yb	nd	nd	nd	nd	nd	nd	nd
Lu	nd	nd	nd	nd	nd	nd	nd
U	nd	nd	nd	nd	nd	nd	nd
Selected element ratios							
Ti/V	72.66	75.96	81.78	67.77	75.62	83.12	61.53
Ti/Y	351.82	230.50	329.03	379.15	429.33	645.19	389.68
P/K	0.12	0.14	0.12	0.12	0.26	0.14	0.14
Zr/K	0.008	0.013	0.008	0.009	0.018	0.010	0.009
Zr/P	0.069	0.094	0.070	0.076	0.069	0.073	0.067
Ba/Sr	1.01	0.41	1.16	0.92	0.92	0.61	1.03
Ba/P	0.32	0.30	0.35	0.41	0.27	0.28	0.28
Ba/K	0.038	0.042	0.041	0.049	0.070	0.039	0.039
Zr/Ba	0.21	0.31	0.20	0.19	0.25	0.26	0.24
Y/Zr	0.17	0.19	0.17	0.14	0.1	0.08	0.14
Rb/K	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Rb/Sr	0.067	0.030	0.085	0.058	0.034	0.051	0.089
Zr/Nb	nd	nd	nd	nd	nd	nd	nd
Nb/Y	nd	nd	nd	nd	nd	nd	nd
$(La/Sm)_n$	nd	nd	nd	nd	nd	nd	nd
$(Sm/Yb)_n$	nd	nd	nd	nd	nd	nd	nd
$(La/Yb)_n$	nd	nd	nd	nd	nd	nd	nd

$(La/Sm)_n$, $(Sm/Yb)_n$ and $(La/Yb)_n$ = chondrite - normalized values for La/Sm, Sm/Yb and La/Yb, respectively.
nd = not determined.

Sample No.	MT 10/2	MT 11/2	MT 13	MT 14/1	MT 14/2	MT 15	MT 17/2
Trace elements (ppm)							
Ba	872	1070	667	749	792	940	953
Rb	107	100	85	76	91	96	167
Sr	970	986	1726	904	914	206	761
Nb	nd	nd	nd	nd	nd	nd	nd
Zr	268	259	26	219	215	197	193
Y	41	41	32	38	44	33	104
Cr	224	173	147	132	140	216	208
Ni	181	153	101	90	116	172	170
V	270	287	186	234	175	200	242
Rare-earth elements (ppm)							
La	nd	nd	nd	nd	nd	nd	nd
Ce	nd	nd	nd	nd	nd	nd	nd
Nd	nd	nd	nd	nd	nd	nd	nd
Th	nd	nd	nd	nd	nd	nd	nd
Sm	nd	nd	nd	nd	nd	nd	nd
Eu	nd	nd	nd	nd	nd	nd	nd
Tb	nd	nd	nd	nd	nd	nd	nd
Yb	nd	nd	nd	nd	nd	nd	nd
Lu	nd	nd	nd	nd	nd	nd	nd
U	nd	nd	nd	nd	nd	nd	nd
Selected element ratios							
Ti/V	50.18	47.00	71.88	58.41	77.42	69.24	57.23
Ti/Y	330.46	329.00	417.78	395.71	307.93	419.66	133.16
P/K	0.16	0.14	0.12	0.14	0.12	0.13	0.13
Zr/K	0.011	0.009	0.001	0.008	0.008	0.008	0.009
Zr/P	0.072	0.068	0.008	0.056	0.062	0.064	0.064
Ba/Sr	0.90	1.09	0.39	0.83	0.87	4.56	1.25
Ba/P	0.24	0.28	0.21	0.19	0.23	0.30	0.32
Ba/K	0.037	0.038	0.025	0.026	0.028	0.039	0.042
Zr/Ba	0.31	0.24	0.04	0.29	0.27	0.21	0.20
Y/Zr	0.15	0.16	1.23	0.17	0.20	0.17	0.54
Rb/K	0.005	0.004	0.003	0.003	0.003	0.004	0.007
Rb/Sr	0.110	0.101	0.049	0.084	0.100	0.466	0.219
Zr/Nb	nd	nd	nd	nd	nd	nd	nd
Nb/Y	nd	nd	nd	nd	nd	nd	nd
$(La/Sm)_n$	nd	nd	nd	nd	nd	nd	nd
$(Sm/Yb)_n$	nd	nd	nd	nd	nd	nd	nd
$(La/Yb)_n$	nd	nd	nd	nd	nd	nd	nd

$(La/Sm)_n$, $(Sm/Yb)_n$ and $(La/Yb)_n$ = chondrite - normalized values for La/Sm, Sm/Yb and La/Yb, respectively.
nd = not determined.

Sample No.	MT 18	MT 19	MT 20	MT 21	MT 22	MT 23/1	MT 24
Trace elements (ppm)							
Ba	1010	1046	1018	923	997	959	668
Rb	101	96	92	86	89	85	72
Sr	783	821	805	768	808	785	1693
Nb	nd	nd	nd	nd	60	nd	nd
Zr	200	205	202	181	202	189	248
Y	36	30	49	36	42	38	39
Cr	219	189	196	267	247	213	143
Ni	177	152	162	208	189	177	118
V	226	148	161	307	291	332	254
Rare-earth elements (ppm)							
La	nd	nd	nd	nd	37	nd	nd
Ce	nd	nd	nd	nd	73	nd	nd
Nd	nd	nd	nd	nd	35	nd	nd
Th	nd	nd	nd	nd	4.9	nd	nd
Sm	nd	nd	nd	nd	6.7	nd	nd
Eu	nd	nd	nd	nd	2.0	nd	nd
Tb	nd	nd	nd	nd	0.7	nd	nd
Yb	nd	nd	nd	nd	1.9	nd	nd
Lu	nd	nd	nd	nd	0.3	nd	nd
U	nd	nd	nd	nd	< 1	nd	nd
Selected element ratios							
Ti/V	60.48	94.38	86.76	45.30	47.80	41.53	52.16
Ti/Y	379.69	465.62	285.07	386.35	331.16	362.86	339.72
P/K	0.14	0.14	0.15	0.13	0.13	0.14	0.12
Zr/K	0.009	0.009	0.009	0.008	0.009	0.008	0.009
Zr/P	0.065	0.063	0.063	0.059	0.066	0.061	0.077
Ba/Sr	1.29	1.27	1.26	1.20	1.23	1.22	0.39
Ba/P	0.33	0.32	0.32	0.30	0.33	0.31	0.21
Ba/K	0.047	0.045	0.046	0.040	0.044	0.043	0.024
Zr/Ba	0.20	0.20	0.20	0.20	0.20	0.20	0.37
Y/Zr	0.18	0.15	0.24	0.20	0.21	0.20	0.16
Rb/K	0.005	0.004	0.004	0.004	0.004	0.004	0.003
Rb/Sr	0.129	0.117	0.114	0.112	0.110	0.108	0.043
Zr/Nb	nd	nd	nd	nd	3.37	nd	nd
Nb/Y	nd	nd	nd	nd	1.43	nd	nd
$(La/Sm)_n$	nd	nd	nd	nd	3.37	nd	nd
$(Sm/Yb)_n$	nd	nd	nd	nd	3.82	nd	nd
$(La/Yb)_n$	nd	nd	nd	nd	12.86	nd	nd

$(La/Sm)_n$, $(Sm/Yb)_n$ and $(La/Yb)_n$ = chondrite - normalized values for La/Sm, Sm/Yb and La/Yb, respectively.
nd = not determined.

Sample No.	MT 25	MT 26	MT 27	MT 29/2	MT 30F1	MT 30F2	MT 30F3
Trace elements (ppm)							
Ba	719	704	803	799	742	734	718
Rb	65	70	78	77	105	11	101
Sr	1068	983	908	157	1167	1692	1425
Nb	nd	nd	70	nd	64	nd	nd
Zr	217	231	246	229	229	256	245
Y	33	41	40	38	46	37	36
Cr	145	137	149	151	132	153	149
Ni	109	101	114	104	105	107	116
V	296	312	285	193	194	155	125
Rare-earth elements (ppm)							
La	nd	nd	39	nd	33	nd	nd
Ce	nd	nd	79	nd	66	nd	nd
Nd	nd	nd	37	nd	31	nd	nd
Th	nd	nd	5.2	nd	4.7	nd	nd
Sm	nd	nd	7.2	nd	6.4	nd	nd
Eu	nd	nd	2.5	nd	1.8	nd	nd
Tb	nd	nd	1.0	nd	0.9	nd	nd
Yb	nd	nd	2.1	nd	1.9	nd	nd
Lu	nd	nd	0.3	nd	0.3	nd	nd
U	nd	nd	< 1	nd	1	nd	nd
Selected element ratios							
Ti/V	45.17	43.04	48.59	68.03	68.60	86.25	107.91
Ti/Y	405.12	327.54	346.22	345.51	289.33	361.33	374.69
P/K	0.13	0.12	0.12	0.12	0.12	0.12	0.13
Zr/K	0.008	0.008	0.008	0.008	0.008	0.010	0.010
Zr/P	0.064	0.068	0.070	0.069	0.071	0.081	0.077
Ba/Sr	0.67	0.72	0.88	5.09	0.64	0.43	0.50
Ba/P	0.21	0.21	0.23	0.24	0.23	0.23	0.23
Ba/K	0.027	0.025	0.027	0.029	0.027	0.029	0.028
Zr/Ba	0.30	0.33	0.31	0.29	0.31	0.35	0.34
Y/Zr	0.15	0.18	0.16	0.17	0.20	0.14	0.15
Rb/K	0.002	0.003	0.003	0.003	0.004	0.001	0.004
Rb/Sr	0.061	0.071	0.086	0.490	0.090	0.007	0.071
Zr/Nb	nd	nd	3.51	nd	3.58	nd	nd
Nb/Y	nd	nd	1.75	nd	1.39	nd	nd
$(La/Sm)_n$	nd	nd	3.30	nd	3.14	nd	nd
$(Sm/Yb)_n$	nd	nd	3.71	nd	3.65	nd	nd
$(La/Yb)_n$	nd	nd	12.26	nd	11.47	nd	nd

$(La/Sm)_n$, $(Sm/Yb)_n$ and $(La/Yb)_n$ = chondrite - normalized values for La/Sm, Sm/Yb and La/Yb, respectively.
nd = not determined.

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