APPENDICES

APPENDIX A

LOCATIONS, OCCURRENCES AND LITHOLOGIES OF THE STUDIED BASALT SAMPLES

Sample no.	Grid reference	Occurrence and lithology	Remark
TB 1-1 TB 1-2 TB 1-5 TB 1-6	108779	*In situ* float, underlain by Permian sediments. Porphyritic, with phenocrysts up to 5 mm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
T 2.1 TB 2-1 TB 2-2 TB 2-4	103784	*In situ* float. Porphyritic, with plagioclase phenocrysts.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
T 3.1 TB 3-1 TB 3-2	089778	*In situ* float. Porphyritic, with plagioclase phenocrysts.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 4-1 TB 4-2	080774	Outcrop with columnar joint (axis of column: 30N 55E). Vesicular and porphyritic, with phenocrysts up to 3 mm across. Thickness of flow > 2 m.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 5-2	058777	*In situ* float. Highly porphyritic, with plagioclase phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 6-1 TB 6-2	069770	*In situ* float. Highly porphyritic, with plagioclase phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 7	045751	Outcrop: massive, slightly porphyritic and vesicular, with flow bands. Thickness of flow > 2 m.	Topographic map sheet 4948 II (Amphoe Pa Daed) at a scale of 1:50,000.
TB 8	051751	*In situ* float. Aphyric and moderately vesicular.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 9	062778	*In situ* float. Highly porphyritic, with phenocrysts up to 4 mm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 10	080774	Outcrop with columnar joint (axis of column: 30N	Topographic map sheet 5048 III (Amphoe Thoeng)

		55E). Vesicular and porphyritic, with phenocrysts up to 3 mm across. Thickness of flow > 2 m.	at a scale of 1:50,000.
TB 11-1 TB 11-2 TB 11-3	O79771 to 079774	Outcrop with columnar joint; vesicles flattened normal to columnar block. Thickness of flow > 3 m.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 12	099766	*In situ* float. Porphyritic, with plagioclase phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 13	044713	*In situ* float. Porphyritic and vesicular, with plagioclase and clinopyroxene phenocrysts up to 1 cm across.	Topographic map sheet 4948 II (Amphoe Pa Daed) at a scale of 1:50,000.
TB 14	044718	*In situ* float. Slightly porphyritic, with plagioclase phenocrysts up to 5 mm across.	Topographic map sheet 4948 II (Amphoe Pa Daed) at a scale of 1:50,000.
TB 15	090740	*In situ* float. Slightly porphyritic.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 16	085741	Outcrop of a single flow with columnar joint (> 0.5 mm in diameter) and platy joint (N71E 2NW) at small waterfall. Thickness of flow > 8 m. Slightly porphyritic, with plagioclase and clinopyroxene phenocrysts.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 17	092742	Outcrop of a single flow with columnar joint and platy joint at small waterfall. Thickness of flow > 8 m. Slightly porphyritic.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 18-1 TB 18-2 TB 18-3	103733	Outcrop of at least two flows with columnar joint. and platy joint (N5E 12NW). Thicknesses of the upper and lower flows are > 5 and > 3 m, respectively. Both are porphyritic, with plagioclase phenocrysts up to 1 cm across. The upper part of individual flows is	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.

		vesicular, whereas the lower part is massive. Vesicles are flattened subparallel to platy joint. The lower flow contains Permo-Triassic tuff fragments.	
TB 19	095734	Outcrop of a single flow with a thickness of > 10 m, and columnar and platy (N60W 50NE) joints. Vesicular and porphyritic, with plagioclase and clinopyroxene phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 20	089733	*In situ* float. Porphyritic, with plagioclase and clinopyroxene phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 21	095692	*In situ* float. Vesicular and porphyritic, with plagioclase phenocrysts up to 2 mm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 22	090687	*In situ* float. Vesicular and porphyritic, with plagioclase phenocrysts up to 2 mm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 23	050633	*In situ* float. Porphyritic.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 24	058681	*In situ* float. Porphyritic, with plagioclase, clinopyroxene and olivine phenocrysts up to 5 mm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 25	056680	*In situ* float, underlain by Permian sediments. Porphyritic, with phenocrysts of plagioclase and clinopyroxene up to 2 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 26	075673	*In situ* float.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 27	072673	Outcrop: porphyritic, with plagioclase, clinopyroxene and olivine phenocrysts up to 1.5 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.

TB 28	067667	Outcrop: vesicular and porphyritic, with phenocrysts of plagioclase, clinopyxene and olivine (up to 1 cm across) and xenoliths.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 29	058673	*In situ* float.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 30	990710	Outcrop with abundant plagioclase phenocrysts up to 3 cm across.	Topographic map sheet 4948 II (Amphoe Pa Daed) at a scale of 1:50,000.
TB 31	043719	*In situ* float. Porphyritic, with plagioclase phenocrysts up to 0.5 cm across.	Topographic map sheet 4948 II (Amphoe Pa Daed) at a scale of 1:50,000.
TB 32	086704	*In situ* float, underlain by Permo-Triassic tuff. Porphyritic, with phenocrysts of plagioclase and clinopyroxene up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 33	143827	*In situ* float. Vesicular and porphyritic, with plagioclase and clinopyroxene phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 34	142826	*In situ* float. Vesicular and porphyritic, with plagioclase and clinopyroxene phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 35	143853	*In situ* float. Vesicular and porphyritic, with plagioclase phenocrysts up to 2 cm across.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 36	135846	*In situ* float. Vesicular and porphyritic, with plagioclase and clinopyroxene phenocrysts up to 1 cm across.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 37	123848	Outcrop with columnar joint (axis of column: 72S80W). Slightly to moderately vesicular, and highly porphyritic, with plagioclase phenocrysts up to 2 cm across.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 38-1 TB 38-2	112854	*In situ* float. Porphyritic, with plagioclase and clino-	Topographic map sheet 5048 IV (Amphoe Phaya

		pyroxene phenocrysts up to 0.5 cm across.	Meng Rai) at a scale of 1:50,000.
TB 39	090837	*In situ* float. Highly porphyritic, with plagioclase and clinopyroxene phenocrysts up to 1 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 40	087824	*In situ* float. Slightly porphyritic.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 41	131846	Outcrop with columnar joint (axis of column: 72S&0W). Slightly to moderately vesicular, and highly porphyritic, with plagioclase phenocrysts up to 2 cm across.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 42	145869	*In situ* float. Aphyric.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 43	138873	*In situ* float. Slightly porphyritic, with plagioclase phenocrysts.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 44	076782	*In situ* float. Porphyritic with plagioclase and clinopyroxene phenocrysts up to 2 cm across.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 45	085776	Outcrop with columnar joint and flow bands. Slightly porphyritic.	Topographic map sheet 5048 III (Amphoe Thoeng) at a scale of 1:50,000.
TB 46	042737	*In situ* float. Porphyritic, with plagioclase phenocrysts up to 2 cm across and rare xenoliths.	Topographic map sheet 4948 II (Amphoe Pa Daed) at a scale of 1:50,000.
TB 47	137880	Outcrop with columnar joint and flow bands. Vesicular and slightly porphyritic, with plagioclase phenocrysts up to 1 cm across.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 48	135880	Outcrop with columnar joint and flow bands. Vesicular and slightly porphyritic, with plagioclase phenocrysts up to 1 cm across.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.

TB 49	126885	Outcrop: aphyric.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.
TB 50	118893	Outcrop: aphyric and slightly vesicular.	Topographic map sheet 5048 IV (Amphoe Phaya Meng Rai) at a scale of 1:50,000.

APPENDIX B

SUMMARIZED PETROGRAPHIC FEATURES OF THE STUDIED THOENG THOLEIITIC BASALTS

Sample no.	Phenocryst and microphenocryst	Groundmass	Remark
TB 1-1	Plagioclase + olivine + Fe-Ti oxide Commonly form as isolated crystals; a few olivines as glomerocrysts. Corroded outline and sieve texture are common. Plagioclase: anhedral, with sizes up to 1 mm across, and may have olivine and clinopyroxene inclusions. Olivine: anhedral to euhedral, with sizes up to 0.25 mm across, and may have opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up largely of plagioclase laths with subordinate olivine (anhedral) and clinopyroxene (anhedral), and trace Fe-Ti oxide (anhedral). The subordinate and trace constituents are intergranular to plagioclase laths.	Porphyritic. Veinlets of chlorite, iron oxide/hydroxide and calcite are scarce. Plagioclase is slightly altered to sericite and clay mineral. Olivine is moderately altered to chlorite/serpentine.
TB 1-2	Plagioclase + olivine Anhedral to subhedral, commonly display disequilibrium features, largely form as isolated crystals; a few as cumulocrysts. Plagioclase: sizes up to 2 mm across. Olivine: sizes up to 1 mm across.	Holocrystalline, consisting largely of plagioclase laths with subordinate olivine (anhedral) and clinopyroxene (anhedral), and accessory Fe-Ti oxide (anhedral). The subordinate and trace constituents are intergranular to plagioclase laths.	Seriate-textured. Fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Fe-Ti oxide megacrysts are rarely present. Plagioclase is slightly altered to sericite and clay mineral. Olivine is highly replaced by chlorite/serpentine and iron oxide /hydroxide.

TB 1-5	Plagioclase + olivine + Fe-Ti oxide Anhedral to subhedral, and commonly form as isolated crystals. Plagioclase: sizes up to 2 mm across and largely shows disequilibrium features. Olivine: sizes up to 1 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up mainly of plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and rare Fe-Ti oxide.	Porphyritic. Fractures may be infilled with chlorite and iron oxide/hydroxide. Olivine is partly altered to chlorite/serpentine and iron oxide/hydroxide.
TB 1-6	Plagioclase + olivine + Fe-Ti oxide Subhedral, with corroded outline and sieve texture. Largely occur as isolated crystals; a few as cumulocrysts. Plagioclase: sizes up to 0.25 mm across. Olivine: sizes up to 0.5 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and minor intergranular Fe-Ti oxide (anhedral).	Slightly seriate-textured. Vesicles and fractures may be infilled with calcite, chlorite and iron oxide/hydroxide. Olivine is partly altered to chlorite/serpentine and iddingsite. Plagioclase is slightly altered to sericite and clay mineral.
T 2.1	Plagioclase + olivine + Fe-Ti oxide Commonly show corroded and sieve texture. Plagioclase: subhedral, with sizes up to 1.5 mm. Mostly occurs as isolated crystals. Olivine: subhedral to euhedral, with sizes up to 1 mm across. Occurs either as isolated crystals or as glomerocrysts. A few have opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up mainly of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and minor intergranular Fe-Ti oxide (anhedral).	Porphyritic. Megacrysts of apatite, and quartz with fibrous reaction coronas are rarely present. Plagioclase is slightly altered to sericite and clay mineral. Olivine is partly replaced by chlorite/serpentine and iddingsite. Fractures may be infilled with iron oxide/hydroxide, zeolite and chlorite.
TB 2-1	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide	Pilotaxitic, made up largely of plagioclase laths with subordinate clinopyroxene (an-	Porphyritic. Fractures may be infilled with chlorite, calcite and

	Commonly exhibit corroded outlines and sieve texture. Largely occur as isolated crystals; a few as plagioclase-olivine cumulocrysts and plagioclase glomerocrysts. Plagioclase: anhedral, with sizes up to 1 mm across. Clinopyroxene: anhedral. Olivine: anhedral - subhedral, with sizes up to 0.5 mm across and may have opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	hedral), olivine (anhedral), and accessory Fe-Ti oxide. The subordinate and minor constituents are intergranular to plagioclase laths.	iron oxide/hydroxide. Corroded Fe-Ti oxide megacrysts are sporadically present. Plagioclase is slightly replaced by sericite, clay mineral and calcite. Olivine is moderately altered to chlorite/serpentine and iddingsite. Clinopyroxene is slightly altered to chlorite.
TB 2-2	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 1 mm across; corroded outlines and sieve texture are common. Largely form as isolated crystals; a few as clinopyroxene glomerocrysts and plagioclase-clinopyroxene cumulocrysts. Plagioclase: anhedral, and may contain apatite and opaque inclusions. Olivine: anhedral, and commonly has opaque inclusions. Clinopyroxene: anhedral to subhedral, with zonal patterns. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, consisting largely of plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and minor Fe-Ti oxide (anhedral). These subordinate and minor constituents are intergranular to plagioclase laths.	Slightly seriate-textured. Corroded Fe-Ti oxide megacrysts are rarely present. Plagioclase is slightly altered to sericite and clay mineral. Olivine is highly replaced by chlorite/serpentine and iddingsite. Clinopyroxene is slightly altered to chlorite.
TB 2-4	Plagioclase +olivine + clinopyroxene + Fe-Ti oxide. Commonly exhibit disequilibrium features.	Holocrystalline, consisting largely of felty plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral),	Slightly porphyritic. Fractures may be infilled with chlorite, calcite and iron oxide/hydroxide.

	Largely form as isolated crystals; a few as plagioclase-olivine and plagioclase-clinopyroxene cumulocrysts. Plagioclase: subhedral, with sizes up to 0.5 mm. Olivine: subhedral, with sizes up to 1.5 mm across. Clinopyroxene: anhedral, with sizes up to 0.25 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	and trace Fe-Ti oxide (anhedral). These subordinate and trace constituents are intergranular to plagioclase laths.	Plagioclase is partly altered to sericite and clay mineral.
T 3.1	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 1 mm across; corroded outline and sieve texture are common. Largely form as isolated crystals; a few as plagioclase glomerocrysts, and plagioclase-olivine and plagioclase-clinopyroxene cumulocrysts. Plagioclase: anhedral-subhedral. Olivine: anhedral-subhedral; some have opaque inclusions. Clinopyroxene: anhedral. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, consisting largely of felty plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and trace Fe-Ti oxide (anhedral). These subordinate and trace constituents are intergranular to plagioclase laths.	Slightly seriate-textured. Tiny fractures and vesicles may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is slightly replaced by sericite and clay mineral. Olivine is largely altered to chlorite/serpentine.
TB 3-1	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 1 mm across; corroded outline and sieve texture are common. Largely form as isolated crystals; a few as plagio-	Holocrystalline, consisting largely of felty plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and trace Fe-Ti oxide (anhedral). These subordinate and trace constituents are in-	Slightly seriate-textured. Tiny fractures and vesicles may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is slightly replaced by sericite and clay

	clase glomerocrysts, and plagioclase-olivine and plagioclase-clinopyroxene cumulocrysts. Plagioclase: anhedral-subhedral. Olivine: anhedral-subhedral; some have opaque inclusions. Clinopyroxene: anhedral. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	tergranular to plagioclase laths.	mineral. Olivine is largely altered to chlorite/serpentine.
TB 3-2	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 1 mm across; corroded outline and sieve texture are common. Largely form as isolated crystals; a few as plagioclase glomerocrysts, and plagioclase-olivine and plagioclase-clinopyroxene cumulocrysts. Plagioclase: anhedral-subhedral. Olivine: anhedral-subhedral; some have opaque inclusions. Clinopyroxene: anhedral. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, consisting largely of felty plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and tracé Fe-Ti oxide (anhedral). These subordinate and trace constituents are intergranular to plagioclase laths.	Slightly seriate-textured. Tiny fractures and vesicles may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is slightly replaced by sericite and clay mineral. Olivine is largely altered to chlorite/serpentine.
TB 4-1	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 0.5 mm across; corroded outlines and sieve texture are common. Mainly occur as isolated crystals; a few as plagioclase glomerocrysts, and plagioclase+oli-	Hypocrystalline, made up mainly of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral), and devitrified glass, and minor interstitial Fe-Ti oxide (anhedral).	Seriate-textured. Vesicles may be infilled with zeolite, chlorite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly altered to chlorite/serpen-

	vine/clinopyroxene ± Fe-Ti oxide cumulocrysts. Plagioclase: subhedral, and may have clinopyroxene and opaque inclusions. Zonal patterns are common. Olivine: anhedral-euhedral, some contain opaque inclusions. Clinopyroxene: anhedral; a few show zonal patterns. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.		tine.
TB 4-2	Plagioclase + olivine Sizes up to 0.25 mm across and largely form as isolated crystals; some as cumulocrysts. Plagioclase: corroded and sieve-textured, subhedral. A few have clinopyroxene inclusions. Olivine: anhedral-euhedral.	Hyalopilitic and pilotaxitic, composed largely of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), clinopyroxene (anhedral) and devitrified glass, and trace interstitial Fe-Ti oxide (anhedral).	Porphyritic. Fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is highly altered to chlorite/serpentine and iddingsite.
TB 5-2	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Disequilibrium features are common. Plagioclase and olivine commonly form as isolated crystals; a few as plagioclase-clinopyroxene cumulocrysts. Plagioclase: anhedral, with sizes up to 0.5 mm across. Olivine: subhedral-anhedral, with sizes up to 1 mm across.	Pilotaxitic, made up mainly of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and trace intergranular Fe-Ti oxide.	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite and calcite. Plagioclase is slightly replaced by calcite and clay mineral. Olivine is partly altered to chlorite/serpentine, iron oxide/hydroxide and calcite.

	Clinopyroxene: anhedral, with sizes up to 0.5 mm across, and rare. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.		
TB 6-1	Plagioclase + olivine + Fe-Ti oxide Corroded outline and sieve features are common. Largely occur as isolated crystals; some as cumulocrysts.	Pilotaxitic, made up mainly of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and trace intergranular Fe-Ti oxide.	Porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is moderately replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 6-2	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide. Corroded outline and sieve texture are common. Plagioclase: subhedral, with sizes up to 2 mm across. Commonly occurs as isolated crystals. Olivine: subhedral, with sizes up to 1 mm across. Largely forms as isolated crystals. Clinopyroxene: anhedral, and commonly present as clinopyroxene-plagioclase cumulocrysts. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, consisting largely of felty plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and trace Fe-Ti oxide (anhedral). These subordinate and trace constituents are intergranular to plagioclase laths.	Highly porphyritic. Fractures may be infilled with iron oxide/hydroxide, chlorite and calcite. Plagioclase is slightly altered to sericite and clay mineral. Olivine is partly altered to chlorite/serpentine and iddingsite.
TB 7	Plagioclase + olivine Largely occur as isolated crystals; a few as	Hypocrystalline, consisting largely of plagioclase laths with subordinate clinopy-	Seriate-textured. Vesicles and fractures may be infilled with

	glomerocrysts and cumulocrysts. Plagioclase: anhedral, with corroded and sieve features; sizes up to 0.5 mm across. Olivine: anhedral, with sizes up to 0.25 mm across.	roxene (anhedral), olivine (anhedral) and devitrified glass, and minor Fe-Ti oxide. Clinopyroxene bears either subophitic or intergranular to plagioclase. The others are interstitial to plagioclase.	chlorite, calcite and iron oxide/ hydroxide. Plagioclase is slightly altered to clay mineral, sericite and iron oxide/hydroxide. Olivine is partly replaced by chlorite/ serpentine, iddingsite and iron oxide/hydroxide. Clinopyroxene is slightly altered to chlorite and iron oxide/hydroxide. Fe-Ti oxide is partly altered to hematite/ iron hydroxide.
TB 8	Plagioclase + olivine Sizes up to 0.5 mm; corroded outline and sieve texture are common. Occur either as isolated crystals or as glomerocrysts. Plagioclase: anhedral, with zonal patterns. Olivine: subhedral-euhedral, and may have opaque inclusions.	Hypocrystalline, made up largely of felted plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (subhedral) and devitrified glass, and minor interstitial Fe-Ti oxide (anhedral).	Slightly porphyritic, and contains basaltic xenoliths and quartz megacrysts with fibrous clinopyroxene reaction rims in trace amounts. Vesicles and fractures may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is partially altered to sericite and clay mineral. Olivine is partly replaced by chlorite/serpentine. Fe-Ti oxide is partly altered to hematite and iron hydroxide.
TB 9	Plagioclase + olivine + Fe-Ti oxide Largely show disequilibrium features and form as isolated crystals; a few as glomerocrysts and cumulocrysts. Plagioclase: anhedral-subhedral, sizes up to 0.5 mm across. Olivine: anhedral-euhedral, sizes up to	Holocrystalline, consisting mainly of felted plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and trace intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Tiny fractures may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is moderately replaced by chlorite/ serpentine, iddingsite and iron

	1 mm across and may have opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.		oxide/hydroxide.
TB 10	Plagioclase + olivine Commonly display corroded outline and sieve feature. Largely occur as isolated crystals; a few as glomerocrysts and cumulocrysts. Plagioclase: anhedral-subhedral, with sizes up to 1 mm across. Olivine: anhedral-subhedral, with sizes up to 0.5 mm across.	Hyalopilitic and pilotaxitic, consisting mainly of plagioclase laths with subordinate clinopyroxene (anhedral), olivine (anhedral) and devitrified dark brown glass, and minor Fe-Ti oxide (anhedral).	Porphyritic. Vesicles and fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is partly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is commonly replaced by chlorite/ serpentine, iddingsite and iron oxide/hydroxide.
TB 11-1	Plagioclase + olivine Commonly display corroded outline and sieve feature. Plagioclase: subhedral, with sizes up to 1 mm across. Largely forms as isolated crystals; a few as cumulocrysts. Olivine: anhedral-subhedral, with sizes up to 0.5 mm across; many occur as cumulocrysts.	Hypocrystalline, made up mainly of felted plagioclase laths with subordinate intergranular clinopyroxene (anhedral), olivine (anhedral) and intersertal devitrified glass, and minor interstitial Fe-Ti oxide (anhedral).	Porphyritic. Vesicles and fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is partly altered to sericite, clay mineral, calcite and iron oxide/hydroxide. Olivine is commonly replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide. Fe-Ti oxide is highly replaced by hematite/iron hydroxide.
TB 11-2	Plagioclase + olivine Plagioclase: subhedral, with disequilibrium features and sizes up to 0.5 mm across. May occur as isolated crystals, glomerocrysts and cumulocrysts.	Hyalopilitic and pilotaxitic, consisting mainly of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (subhedral-anhedral) and devitrified glass, and trace interstitial Fe-Ti oxide.	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/ hydroxide. Plagioclase is slightly altered to sericite, clay mineral,

	Olivine: anhedral, with sizes up to 0.5 mm across. Forms either as glomerocrysts or as cumulocrysts.		calcite and iron oxide/hydroxide. Fe-Ti oxide is highly replaced by hematite/iron hydroxide.
TB 11-3	Plagioclase + olivine Sizes up to 0.5 mm across. Commonly occur as isolated crystals; some as plagioclase glomerocrysts and plagioclase-olivine cumulocrysts. Plagioclase: subhedral. Olivine: anhedral.	Hyalopilitic and pilotaxitic, consisting mainly of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (subhedral-anhedral) and devitrified glass, and trace interstitial Fe-Ti oxide.	Microporphyritic. Fractures and vesicles may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is highly replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 12	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Corroded outline and sieve texture are common. Largely form as isolated crystals; a few as olivine glomerocrysts and plagioclase-olivine cumulocrysts. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up largely of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and accessory intergranular Fe-Ti oxide (anhedral).	Moderately to highly porphyritic. Vesicles and fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is slightly altered to sericite and clay mineral. Olivine is highly replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 13	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Anhedral, with sizes up to 1 mm across. Corroded outline and sieve texture are common. Largely form as isolated crystals; a few as olivine glomerocrysts and cumulocrysts. Many plagioclases contain olivine	Pilotaxitic-hyalopilitic, consisting mainly of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral) and devitrified glass, and rare interstitial Fe-Ti oxide (anhedral).	Strongly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is partly replaced by sericite, clay mineral and iron oxide/hydroxide. Olivine is largely altered

	and opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.		to chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 14	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Corroded outline and sieve texture are common. Largely form as isolated crystals; a few as olivine glomerocrysts and plagioclase-olivine/clinopyroxene cumulocrysts. Plagioclase: anhedral-subhedral, with sizes up to 1 mm across; many have opaque and olivine inclusions. Olivine: anhedral-euhedral, with sizes up to 0.5 mm across; many have opaque inclusions. Clinopyroxene: anhedral, with sizes up to 1 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Hypocrystalline, composed mainly of felty plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral) and devitrified glass, and minor interstitial Fe-Ti oxide (anhedral).	Moderately porphyritic. Vesicles and fractures may be infilled with chlorite, zeolite, calcite and iron oxide/hydroxide. Plagioclase is slightly replaced by sericite and clay mineral. Olivine is commonly altered to iddingsite and iron oxide/hydroxide.
TB 15	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Plagioclase and olivine show disequilibrium features, and form as isolated crystals and glomerocrysts. Plagioclase: subhedral, with sizes up to 1 mm across, and may have olivine and opaque inclusions. Olivine: anhedral-euhedral, with sizes up to 1 mm across, and may contain opaque inclusions.	Pilotaxitic, consisting mainly of plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and minor Fe-Ti oxide (anhedral). Clinopyroxene bears subophitic relationship to plagioclase in part.	Porphyritic. Fractures may be infilled with chlorite and iron oxide/hydroxide. Olivine is partly altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide. Clinopyroxene is slightly altered to chlorite.

	Clinopyroxene: anhedral. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.		
TB 16	Plagioclase + olivine + Fe-Ti oxide Sizes up to 1 mm across. Plagioclase: anhedral, with corroded outline and sieve texture. Occurs as isolated crystals and contains olivine and opaque inclusions. Olivine: anhedral-subhedral, and forms as isolated crystals and glomerocrysts. Opaque inclusions are common. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up largely of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and minor intergranular Fe-Ti oxide.	Porphyritic. Vesicles and fractures may be infilled with chlorite and calcite. Plagioclase is slightly replaced by sericite, clay mineral, iron oxide/hydroxide, and calcite. Olivine is higly altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 17	Plagioclase + olivine + Fe-Ti oxide Commonly display disequilibrium features. Plagioclase: anhedral-subhedral, with sizes up to 1 mm across. Mostly forms as isolated crystals; a few as glomerocrysts and cumulocrysts. Olivine: subhedral, with sizes up to 0.5 mm across. Largely forms either as isolated crystals or as glomerocrysts; a few as cumulocrysts. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, composed largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral), and trace intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is commonly replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 18-1	Plagioclase + olivine Plagioclase: anhedral-subhedral, with sizes	Hypocrystalline, made up largely of plagioclase laths with subordinate clinopy-	Slightly to moderately porphyritic. Vesicles and fractures may

	up to 0.75 mm across. Occurs either as isolated crystals or as glomerocrysts with disequilibrium features and zonal patterns. Olivine: anhedral, with sizes up to 0.5 mm across, disequilibrium features, zonal patterns and opaque inclusions.	roxene (anhedral), olivine (anhedral-euhedral) and devitrified glass, and trace Fe-Ti oxide (anhedral). Clinopyroxene mainly bears intergranular to plagioclase laths; the rest is subophitic to plagioclase laths. Olivine, Fe-Ti oxide and glass are interstitial to plagioclases.	be infilled with iron oxide/hydroxide and chlorite. Plagioclase is moderately replaced by sericite and clay mineral. Olivine is commonly altered to iddingsite, chlorite/serpentine and iron oxide/hydroxide. Fe-Ti oxide is commonly pseudomorphed by hematite/iron hydroxide.
TB 18-2	Plagioclase + olivine Sieve texture and corroded outline are common. Largely occur as isolated crystals and plagioclase glomerocrysts; a few as plagioclase-olivine cumulocrysts. Plagioclase: anhedral-subhedral, with sizes up to 1 mm across. Olivine: subhedral, with sizes up to 0.5 mm across; many contain opaque inclusions.	Hypocrystalline, made up largely of plagioclase laths with subordinate clinopyroxene (anhedral), olivine (anhedral-subhedral) and devitrified glass, and trace Fe-Ti oxide (anhedral). Clinopyroxene mainly bears intergranular to plagioclase laths; bears intergranular to plagioclase laths; Olivine, Fe-Ti oxide and glass are interstitial to plagioclases.	Slightly porphyritic. Vesicles and fractures may be infilled with calcite, chlorite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is highly replaced by chlorite/serpentine, iron oxide/hydroxide and iddingsite. Fe-Ti oxide is largely replaced by hematite/iron hydroxide.
TB 18-3	Plagioclase + olivine Commonly corroded and sieve-textured. Plagioclase: anhedral-subhedral, with sizes up to 0.5 mm and olivine inclusions. Mainly forms as isolated crystals; a few as glomerocrysts and cumulocrysts. Olivine: subhedral-euhedral, with sizes up to 1 mm across.	Hypocrystalline, made up largely of plagioclase laths with subordinate clinopyroxene (anhedral), olivine (anhedral-subhedral) and devitrified glass, and trace Fe-Ti oxide. Clinopyroxene mainly bears intergranular to plagioclase laths; the rest is subophitic to plagioclase laths. Olivine, Fe-Ti oxide and glass are interstitial to plagioclases.	Slightly porphyritic. Vesicles and fractures may be infilled with iron oxide/hydroxide. Plagioclase is partly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is partly altered to chlorite/serpentine.

TB 19	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Commonly form as isolated crystals; a few olivines and clinopyroxenes as glomerocrysts. Corroded outline and sieve texture are common. Plagioclase: anhedral, with sizes up to 2 mm across, and displays zonal patterns. Olivine: anhedral to euhedral, with sizes up to 0.5 mm across, and may contain opaque inclusions. Clinopyroxene: anhedral to subhedral, with sizes up to 0.25 mm across, and shows hour-glass zoning. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up largely of plagioclase laths with subordinate olivine (anhedral-subhedral) and clinopyroxene (anhedral), and trace Fe-Ti oxide. The subordinate and trace constituents are intergranular to plagioclase laths.	Slightly porphyritic. Fe-Ti oxide megacrysts are occasionally present. Olivine is slightly altered to serpentine/chlorite, iddingsite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral.
TB 20	Plagioclase + olivine + Fe-Ti oxide Plagioclase: anhedral-subhedral, with sizes up to 1 mm across. Corroded outline and sieve texture are common. Largely forms as isolated crystals; a few as olivine-plagioclase cumulocrysts. Olivine: anhedral, with sizes up to 0.75 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up mainly of felted plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and minor intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is slightly replaced by sericite, clay mineral and iron oxide/hydroxide. Olivine is highly pseudomorphed by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 21	Plagioclase + olivine + Fe-Ti oxide Anhedral-subhedral, with sizes up to 1 mm across. Commonly show corroded outlines	Holocrystalline, made up mainly of felted plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite and iron oxide/hy-

	and sieve texture and occur as isolated crystals; a few olivines as glomerocrysts. Plagioclase: zoned, and may contain olivine, clinopyroxene and opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	(anhedral), and minor intergranular Fe-Ti oxide (anhedral).	droxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is moderately altered to chlorite/serpentine. iron oxide/hydroxide.
TB 22	Plagioclase + olivine +Fe-Ti oxide Sizes up to 1 mm across with corroded outline and sieve texture. Plagioclase: subhedral; occurs as isolated crystals and cumulocrysts. Zoning is common. Olivine: anhedral-euhedral. Largely form as isolated crystals; a few as glomerocrysts and cumulocrysts. Opaque inclusions are rare. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, consisting largely of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral), and minor intergranular Fe-Ti oxide (anhedral).	Porphyritic. Fractures may be replaced by chlorite and iron oxide/hydroxide. Olivine is partially altered to chlorite/serpentine and iron oxide/hydroxide.
TB 23	Plagioclase + olivine + Fe-Ti oxide Corroded outline and sieve texture are common. Largely form as isolated crystals; a few as plagioclase glomerocrysts and plagioclase-olivine cumulocrysts. Plagioclase: anhedral, with sizes up to 2 mm across. Zonal patterns and inclusions of olivine, clinopyroxene and opaque are common. Olivine: anhedral-euhedral, with sizes up to 1 mm across. May contain opaque inclusions.	Holocrystalline, made up mainly of felted plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral-euhedral), and trace intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Fractures may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is partially replaced by sericite and clay mineral. Olivine is partly altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide.

	Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.		iron oxide/hydroxide.
TB 24	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Corroded outline and sieve texture are common. Largely form as isolated crystals; a few as plagioclase-olivine cumulocrysts. Plagioclase: anhedral and zoned, with sizes up to 1 mm across. Olivine: subhedral, with sizes up to 1.5 mm across. Clinopyroxene: anhedral, with sizes up to 0.5 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Hypocrystalline, consisting of felted plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral) and devitrified glass, and rare interstitial Fe-Ti oxide (anhedral).	Highly porphyritic. Anhedral quartz megacrysts with fibrous clinopyroxene reaction coronas are rarely present. Vesicles and fractures may be infilled with iron oxide/hydroxide, calcite and chlorite/serpentine. Plagioclase is moderately replaced by sericite, clay mineral and iron oxide/hydroxide. Olivine is commonly altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide. Fe-Ti oxide is highly replaced by hematite/iron hydroxide.
TB 25	Plagioclase + olivine + Fe-Ti oxide Commonly display corroded outline and sieve texture. Plagioclase: zoned and anhedral, with sizes up to 1 mm across. Largely occurs as isolated crystals. Olivine: anhedral, with sizes up to 0.25 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up mainly of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and sporadic intergranular Fe-Ti oxide (anhedral).	Moderately porphyritic. Anhedral quartz with fibrous clinopyroxene reaction rim (bordered by glass rind) are rarely existent. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is partly altered to sericite and clay mineral. Olivine is highly replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide.

TB 26	Plagioclase + olivine + Fe-Ti oxide Corroded and sieve-textured. Commonly form as isolated crystals; a few as glomerocrysts and cumulocrysts. Plagioclase: zoned and subhedral, with sizes up to 1 mm across. Olivine: anhedral-euhedral, with sizes up to 1 mm across. Largely has opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up mainly of plagioclase laths with subordinate intergranular clinopyroxene and olivine (subhedral-anhedral), and trace intergranular Fe-Ti oxide.	Seriate-textured. Vesicles and fractures may be infilled with chlorite and iron oxide/hydroxide. Olivine is partly altered to chlorite/serpentine and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral.
TB 27	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Plagioclase: subhedral, with sizes up to 1 mm across. Commonly shows disequilibrium features and occurs as isolated crystals. Zoning and inclusions of clinopyroxene and opaque are common. Olivine: anhedral, with sizes up to 0.5 mm across. Clinopyroxene: anhedral, with sizes up to 0.5 mm across. Occurs as isolated crystals with corroded and sieve features. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up mainly of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and trace intergranular Fe-Ti oxide.	Moderately to highly porphyritic. Vesicles and fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is highly replaced by chlorite/serpentine and iron oxide/hydroxide.
TB 28	Plagioclase + olivine + clinopyroxene Corroded and sieve features are common. Occur as isolated crystals, plagioclase glomerocrysts and plagioclase-clinopyroxene cumulocrysts. Plagioclase mostly has	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and minor intergranular Fe-Ti oxide (anhedral).	Strongly porphyritic. Anhedral quartz with fibrous clinopyroxene reaction rim (bordered by glass rind) is rare. Vesicles and fractures may be infilled with chlorite

	olivine and opaque inclusions.		and iron oxide/hydroxide. Plagioclase is moderately altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is highly replaced by chlorite/serpentine, iddingsite and iron oxide /hydroxide.
TB 29	Plagioclase + olivine + Fe-Ti oxide Commonly show corroded outline and sieve texture. Plagioclase: anhedral-subhedral, with sizes up to 1 mm across. Largely forms as isolated crystals; a few as glomerocrysts. Olivine: anhedral, with sizes up to 1 mm across. Commonly occurs as isolated crystals. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up mainly of plagioclase laths with subordinate clinopyroxene (anhedral) and olivine (anhedral), and minor Fe-Ti oxide (anhedral). Clinopyroxene bears subophitic and intergranular relationships to plagioclase laths. Olivine and Fe-Ti oxide are intergranular to plagioclase laths.	Moderately porphyritic. Quartz megacrysts with fibrous clinopyroxene reaction coronas (bordered by glass rinds) are rarely present. Vesicles and fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is partly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is largely replaced by iddingsite and Fe-Ti oxide/hydroxide.
TB 30	Plagioclase + olivine + clinopyroxene Plagioclase: anhedral-subhedral, with sizes up to 1 mm across. Commonly shows disequilibrium features and occurs as isolated crystals and glomerocrysts. Zonal patterns and inclusions of olivine and opaque are common. Olivine: anhedral, with sizes up to 0.5 mm across. Commonly displays disequilibrium features and forms as isolated crystals; a few as plagioclase-olivine cumulocrysts.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and minor intergranular Fe-Ti oxide.	Remarkably porphyritic. Vesicles and fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is partly replaced by sericite, clay mineral and iron oxide/hydroxide. Olivine is commonly altered to chlorite/serpentine, iron oxide/hydroxide and iddingsite.

	Clinopyroxene: anhedral-euhedral, with sizes up to 0.1 mm across. Occurs as isolated crystals, glomerocrysts and plagioclase-clinopyroxene cumulocrysts.		
TB 31	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 1 mm across, may form as isolated crystals, glomerocrysts (plagioclase and olivine) and cumulocrysts (plagioclase+ olivine+clinopyroxene), and commonly show corroded features and sieve texture. Plagioclase: anhedral-subhedral, and may contain olivine and opaque inclusions. Olivine: subhedral-anhedral, and may have opaque inclusions. Clinopyroxene: anhedral-euhedral, and may show hour-glass zoning and have olivine inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, consisting largely of plagioclase laths with subordinate olivine (anhedral) and clinopyroxene (anhedral), and accessory Fe-Ti oxide (anhedral). The subordinate and trace constituents are intergranular to plagioclase laths.	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/ hydroxide. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is partly replaced by chlorite/ serpentine, iddingsite and Fe-Ti oxide/hydroxide. Fe-Ti oxide is scarcely present as megacrysts.
TB 32	Plagioclase + olivine + Fe-Ti oxide Commonly show sieve and corroded features, and occur as isolated crystals; olivine may be rarely present as glomerocrysts. Plagioclase: anhedral, with sizes up to 1 mm across, commonly zoned, and may have apatite and opaque inclusions. Olivine: anhedral, with sizes up to 0.25 mm	Holocrystalline, composed mainly of felted plagioclase laths with subordinate olivine (anhedral) and clinopyroxene (anhedral), and minor Fe-Ti oxide (anhedral). The subordinate and minor constituents are intergranular to plagioclase laths.	Seriate-textured. Apatite is rarely present as megacrysts (anhedral), with sizes up to 1.5 mm across. In addition, Fe-Ti oxide and quartz megacrysts are existent in trace amount. Quartz megacrysts always show fibrous clinopyroxene reaction coronas. Plagioclase is slightly altered to sericite

	across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.		and clay mineral, whereas olivine is partly replaced by chlorite/serpentine, iddingsite and Fe-Ti oxide. Vesicles and fractures may be infilled with chlorite/serpentine and iron oxide/hydroxide.
TB 33	Plagioclase + olivine Sizes up tp 0.5 mm across and commonly show corroded and sieve textures. Mostly form as isolated crystals; a few as cumulocrysts. Plagioclase is subhedral, while olivine is anhedral.	Pilotaxitic-hyalopilitic, composed mainly of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral) and devitrified glass, and rare intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is partly replaced by chlorite, iddingsite and iron oxide/hydroxide.
TB 34	Plagioclase + olivine + Fe-Ti oxide Sizes up to 0.5 mm, commonly with sieve and corroded features. Largely form as isolated crystals; a few as glomerocrysts and cumulocrysts. Plagioclase: subhedral, with clinopyroxene and olivine inclusions. Olivine: anhedral-subhedral, with opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up mainly of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral-subhedral), and minor intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is partly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is partly replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 35	Plagioclase + olivine +Fe-Ti oxide Largely form as isolated crystals with dis-	Pilotaxitic-hyalopilitic, made up largely of plagioclase laths with subordinate clinopy-	Remarkably porphyritic. Fractures may be infilled with chlo-

	equilibrium features; a few as plagioclase glomerocrysts. Plagioclase: subhedral-anhedral, with sizes up to 2 mm across. Olivine: subhedral, with sizes up to 0.5 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	roxene (anhedral), olivine (anhedral-subhedral) and devitrified glass, and rare Fe-Ti oxide (anhedral). Clinopyroxene is either intergranular or subophitic to plagioclase laths. The others are interstitial to plagioclases.	rite, calcite and iron oxide/hydroxide. Plagioclase is partly altered to sericite, clay mineral, and Fe-Ti oxide. Olivine is totally pseudomorphed by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 36	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Plagioclase and olivine commonly show corroded features and sieve texture. Largely occur as isolated crystals; a few as glomerocrysts and plagioclase-olivine cumulocrysts. Plagioclase: subhedral, with sizes up to 1 mm across; some have olivine inclusions. Olivine: anhedral-subhedral, with sizes up to 0.5 mm across. Clinopyroxene: anhedral, with sizes up to 0.5 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral), and minor intergranular Fe-Ti oxide (anhedral).	Strongly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is partly replaced by sericite, clay mineral and iron oxide/hydroxide. Olivine is largely altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 37	Plagioclase + olivine Rounded edges, embayment and sieve texture are common. Plagioclase: subhedral-euhedral, with sizes up to 3 mm across. Mainly forms as isolated crystals.	Hypocrystalline, consisting mainly of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral-euhedral) and devitrified glass, and accessory intergranular Fe-Ti oxide (anhedral).	Strikingly porphyritic. Fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is partly altered to chlorite/serpen-

	Olivine: anhedral-euhedral, with sizes up to 0.5 mm across. Occurs as glomerocrysts.		tine, iddingsite and iron oxide/hydroxide.
TB 38-1	Plagioclase + olivine + Fe-Ti oxide Corroded and sieve texture are commom. Plagioclase: euhedral-anhedral, with sizes up to 1 mm across and zonal pattern. Commonly forms as isolated crystals and contains Fe-Ti oxide and clinopyroxene inclusions. Olivine: anhedral-subhedral, with sizes up to 0.5 mm across. Occurs as isolated crystals and glomerocrysts, and contains clinopyroxene inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, made up largely of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and trace Fe-Ti oxide (anhedral).	Porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite, chlorite and clay mineral. Olivine is largely replaced by chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 38-2	Plagioclase + olivine Corroded outline and sieve texture are common. Plagioclase: anhedral-euhedral, with sizes up to 2 mm across. Largely forms as isolated crystals; a few as glomerocrysts. Olivine: anhedral-subhedral.	Hypocrystalline, consisting mainly of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral-euhedral) and devitrified glass, and accessory intergranular Fe-Ti oxide (anhedral).	Strikingly porphyritic. Vesicles and fractures may be infilled with chlorite, iron oxide/hydroxide and calcite. Plagioclase is partly altered to sericite and clay mineral. Olivine is largely altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 39	Plagioclase + olivine Plagioclase: anhedral, with sizes up to 3 mm across and disequilibrium features. Largely occurs as isolated crystals with zonal patterns.	Hypocrystalline, consisting of felted plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine and devitrified glass, and minor intergranular Fe-Ti oxide (anhedral).	Strongly porphyritic. Fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is partly altered to sericite and clay mineral. Olivine

	Olivine: subhedral, with sizes up to 0.1 mm across.		is totally replaced by chlorite/serpentine, iddingsite and iron oxide /hydroxide.
TB 40	Plagioclase + olivine + Fe-Ti oxide Commonly show disequilibrium features and form as isolated crystals; a few as glomerocrysts. Plagioclase: anhedral, with sizes up to 1 mm across and zonal patterns; some contain opaque, clinopyroxene and olivine inclusions. Olivine: subhedral-anhedral, with sizes up to 0.5 mm across; some contain opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral), and minor intergranular Fe-Ti oxide (subhedral).	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/ hydroxide. Plagioclase is moderately altered to sericite and clay mineral. Olivine is highly altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 41	Plagioclase + olivine Corroded and sieve features are common. Plagioclase: subhedral, with sizes up to 3 mm across. Occurs either as isolated crystals or as glomerocrysts. Olivine: subhedral, with sizes up to 0.25 mm across. Largely forms as cumulocrysts; a few as glomerocrysts.	Hypocrystalline, consisting of felted plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (subhedral-euhedral) and devitrified glass, and accessory intergranular Fe-Ti oxide (anhedral).	Strongly porphyritic. Vesicles and fractures may be infilled with calcite, chlorite and iron oxide/ hydroxide. Plagioclase is partly altered to sericite and clay mineral. Fe-Ti oxide is largely replaced by iron oxide/hydroxide.
TB 42	Plagioclase + olivine Commonly corroded and sieve-textured. Form as isolated crystals and glomerocrysts.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral), and minor intergranular Fe-Ti	Slightly porphyritic. Fractures may be infilled with chorite, calcite, iron oxide/hydroxide and clay mineral. Plagioclase is part-

	Plagioclase: subhedral, with sizes up to 0.25 mm across and zonal patterns. A few have olivine and opaque inclusions. Olivine: subhedral, with sizes up to 0.75 mm across and contains opaque inclusions.	oxide (anhedral).	ly replaced by sericite and clay mineral. Olivine is largely altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide.
TB 43	Plagioclase + olivine + Fe-Ti oxide Plagioclase is commonly corroded and sieve textured, and commonly forms as isolated crystals with opaque, clinopyroxene and olivine inclusions; A few as glomerocrysts and plagioclase-olivine cumulocrysts. Their sizes are up to 1 mm across. Olivine also displays disequilibrium features. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral), and minor intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide.
TB 44	Plagioclase + olivine + Fe-Ti oxide Disequilibrium features are common. Mostly form as isolated crystals; a few are plagioclase glomerocrysts. Plagioclase: anhedral-subhedral, with sizes up to 3 mm across, and may contain clinopyroxene and olivine inclusions. Olivine: anhedral, with sizes up to 0.5 mm across. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Hypocrystalline, consisting of felted plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine and devitrified glass, and minor intergranular Fe-Ti oxide (anhedral).	Strongly porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is highly altered to chlorite/serpentine, iddingsite and iron and oxide/hydroxide.
TB 45	Plagioclase + olivine	Pilotaxitic-hyalopilitic, consisting of pla-	Porphyritic. Fractures may be in-

	Commonly show disequilibrium features and occur as isolated crystals; a few as glomerocrysts and cumulocrysts. Plagioclase: anhedral-subhedral, with sizes up to 0.75 mm across. Olivine: anhedral-subhedral, with sizes up to 0.5 mm across.	gioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (anhedral-subhedral) and devitrified glass, and trace Fe-Ti oxide (anhedral).	filled with chlorite and iron oxide/hydroxide. Plagioclase is slightly replaced by sericite, clay mineral and iron oxide/hydroxide. Olivine is slightly altered to chlorite/serpentine. Fe-Ti oxide is highly replaced by hematite and iron hydroxide.
TB 46	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 1 mm across and commonly show corroded outline and sieve texture. Largely form as isolated crystals; a few as glomerocrysts, and plagioclase-olivine and plagioclase-clinopyroxene cumulocrysts. Plagioclase: subhedral, and may contain olivine, clinopyroxene and opaque inclusions. Olivine: anhedral-euhedral. Clinopyroxene: anhedral. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Pilotaxitic, consisting largely of plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (subhedral), and minor intergranular Fe-Ti oxide (subhedral).	Slightly porphyritic, with rare xenoliths. Fractures may be infilled with iron oxide/hydroxide. Plagioclase is slightly altered to sericite, clay mineral and iron oxide/hydroxide. Olivine is moderately altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide. Clinopyroxene is slightly altered to chlorite and iron oxide/hydroxide.
TB 47	Plagioclase + olivine + clinopyroxene Sizes up to 0.5 mm. Plagioclase and olivine commonly show disequilibrium features. Plagioclase: subhedral, with sizes up to 0.5 mm across, and occurs as plagioclase-olivine cumulocrysts.	Hypocrystalline, composed mainly of felty plagioclase laths with subordinate clinopyroxene (anhedral), olivine (subhedral) and devitrified glass, and trace Fe-Ti oxide. Clinoproxene is intergranular and subophitic to plagioclase laths. The others occur as interstitial minerals to pla-	Slightly porphyritic. Vesicles and fractures may be infilled with calcite, chlorite and iron oxide/hydroxide. Plagioclase is slightly altered to sericite and clay mineral. Olivine is slightly altered to chlorite/serpentine, id-

	Olivine: subhedral, with sizes up to 0.5 mm across. Largely forms as isolated crystals with opaque inclusions. Clinopyroxene: anhedral, with sizes up to 0.5 mm.	gioclases.	dingsite and iron oxide/hydroxide. Clinopyroxene is slightly altered to chlorite and iron oxide/hydroxide.
TB 48	Plagioclase + olivine Anhedral-subhedral, and commonly show disequilibrium features and form as isolated crystals, glomerocrysts and cumulocrysts. Plagioclase: sizes up to 0.25 mm across. Olivine: sizes up to 1 mm across.	Pilotaxitic-hyalopilitic, consisting of plagioclase laths with subordinate interstitial clinopyroxene (anhedral), olivine (subhedral) and devitrified glass, and minor intergranular Fe-Ti oxide (anhedral).	Moderately porphyritic. Vesicles and fractures may be infilled with chlorite, calcite and iron oxide/hydroxide. Olivine is partly altered to chlorite/serpentine, iddingsite and iron oxide/hydroxide. Plagioclase is partly altered to sericite and clay mineral. Fe-Ti oxide is altered to hematite/iron hydroxide.
TB 49	Plagioclase + olivine + clinopyroxene + Fe-Ti oxide Sizes up to 0.5 mm across and commonly display disequilibrium features. Plagioclase and olivine mostly form as isolated crystals; a few as olivine glomerocrysts and plagioclase-olivine cumulocrysts. Plagioclase: subhedral, and has olivine and opaque inclusions. Olivine: anhedral-euhedral, and commonly contains opaque inclusions. Clinopyroxene: anhedral. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral), and minor intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic, and rarely contains Fe-Ti oxide megacrysts Vesicles and fractures may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is moderately altered to sericite and clay mineral. Olivine is commonly replaced by chlorite/serpentine and iron oxide/hydroxide.

TB 50	Plagioclase + olivine + Fe-Ti oxide Corroded and sieve features are common. Largely form as isolated crystals; a few as glomerocrysts and cumulocrysts. Plagioclase: subhedral, with sizes up to 1 mm across and zonal patterns. Olivine: anhedral-subhedral, with sizes up to 0.25 mm, and may have opaque inclusions. Fe-Ti oxide: small subhedral-euhedral, with sizes of groundmass constituents.	Holocrystalline, made up largely of felty plagioclase laths with subordinate intergranular clinopyroxene (anhedral) and olivine (anhedral-subhedral), and minor intergranular Fe-Ti oxide (anhedral).	Slightly porphyritic. Vesicles and fractures may be infilled with chlorite and iron oxide/hydroxide. Plagioclase is moderately altered to sericite and clay mineral. Olivine is partly replaced by chlorite/serpentine and iron oxide/hydroxide.

APPENDIX C

Major- and minor- oxide compositions, and CIPW norms of 65 Thoeng basaltic lavas. These oxides are recalculated to 100 % on the basis of loss on ignition free. Also reported are ignition loss, original sum, and some useful parameters.

	TB 1-1	TB 1-2	TB 1-5	TB 1-6	T 2.1	TB 2-1	TB 2-2	TB 2-4
Major and minor oxides (wt %)								
SiO_2	48.90	49.23	48.82	49.13	48.88	49.98	49.25	48.88
TiO_2	1.80	1.71	1.81	1.65	1.79	1.81	1.72	1.79
Al_2O_3	16.87	17.23	16.82	17.09	16.83	16.95	17.12	16.73
Fe_2O_3	3.02	2.01	2.89	3.60	3.05	2.86	3.66	2.95
FeO	9.30	9.81	9.43	8.48	9.11	9.34	8.23	9.48
MnO	0.20	0.20	0.20	0.20	0.19	0.20	0.19	0.20
MgO	7.78	7.05	7.45	7.39	8.14	7.29	7.52	7.51
CaO	8.77	8.84	8.93	9.32	8.98	8.80	8.49	8.75
Na_2O	1.84	2.43	2.14	1.77	1.53	2.24	2.06	2.20
K_2O	1.06	1.06	1.06	0.97	1.05	1.07	1.27	1.04
P_2O_5	0.45	0.44	0.45	0.41	0.43	0.47	0.49	0.46
Original Sum	98.91	99.21	99.14	99.08	99.18	99.13	99.13	99.18
Ignition loss	0.88	0.18	0.30	0.93	1.46	0.47	1.03	0.60
mg #	0.54	0.52	0.52	0.53	0.55	0.52	0.54	0.52
FeO*/MgO	1.54	1.65	1.61	1.59	1.46	1.63	1.53	1.62
K_2O/Na_2O	0.58	0.44	0.50	0.55	0.69	0.48	0.62	0.47
CIPW norms (%)								
Q	0.76	0.00	0.00	2.21	1.64	0.00	1.03	0.00
Or	6.28	6.27	6.28	5.73	6.23	6.35	7.54	6.18
Ab	15.52	20.57	18.13	14.98	12.97	18.93	17.40	18.60
An	34.61	32.90	33.07	35.76	35.88	32.97	33.65	32.63
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di wo	2.63	3.48	3.62	3.39	2.59	3.33	2.35	3.40
Di en	1.55	1.88	2.08	2.06	1.56	1.91	1.46	1.95
Di fs	0.95	1.48	1.37	1.14	0.89	1.27	0.74	1.29
Hy en	17.91	11.88	15.19	16.41	18.78	15.11	17.35	15.41
Hy fs	11.03	9.36	10.03	9.09	10.70	10.07	8.84	10.17
Ol fo	0.00	2.70	0.94	0.00	0.00	0.85	0.00	0.98
Ol fa	0.00	2.35	0.69	0.00	0.00	0.62	0.00	0.72
Mt	4.38	2.91	4.20	5.21	4.42	4.14	5.31	4.28
Il	3.41	3.24	3.44	3.14	3.40	3.45	3.27	3.39
Ap	0.98	0.97	0.97	0.89	0.94	1.02	1.07	1.00
$\frac{100An}{Ab+An}$	69.04	61.53	64.59	70.48	73.45	63.53	65.92	63.69
D.I.	22.56	26.84	24.41	22.92	20.84	25.28	25.97	24.78

	T 3.1	TB 3-1	TB 3-2	TB 4-1	TB 4-2	TB 5-2	TB 6-1	TB 6-2
Major and minor oxides (wt %)								
SiO_2	48.94	49.23	49.11	49.14	52.78	49.73	49.44	49.63
TiO_2	1.77	1.76	1.78	1.64	1.30	1.71	1.72	1.72
Al_2O_3	17.06	17.22	17.11	17.03	16.74	16.85	16.70	16.55
Fe_2O_3	3.67	3.45	2.57	2.83	4.21	5.15	5.31	4.10
FeO	8.52	8.71	9.52	8.80	7.39	8.04	8.04	9.00
MnO	0.20	0.21	0.20	0.19	0.26	0.25	0.24	0.21
MgO	8.18	7.67	7.94	7.11	5.16	6.25	6.30	6.45
CaO	8.55	8.68	8.49	9.42	8.84	9.82	9.81	9.71
Na_2O	1.59	1.60	1.79	2.29	1.80	1.33	1.54	1.66
K_2O	1.10	1.04	1.06	1.16	1.27	0.66	0.66	0.68
P_2O_5	0.41	0.42	0.42	0.39	0.22	0.23	0.25	0.26
Original Sum	98.80	98.91	99.06	99.29	99.23	98.90	98.85	99.17
Ignition loss	1.18	0.99	0.95	1.05	1.05	1.59	1.27	0.55
mg #	0.55	0.54	0.54	0.53	0.45	0.47	0.47	0.48
FeO*/MgO	1.44	1.54	1.49	1.60	2.17	2.03	2.03	1.97
K_2O/Na_2O	0.69	0.65	0.59	0.51	0.71	0.50	0.43	0.42
CIPW norms (%)								
Q	2.24	2.92	0.70	0.00	9.38	7.99	6.81	5.05
Or	6.48	6.16	6.27	6.86	7.53	3.89	3.88	4.08
Ab	13.42	13.55	15.16	19.36	15.24	11.20	12.99	14.05
An	36.12	36.66	35.46	32.71	33.79	38.04	36.69	35.61
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di wo	1.64	1.66	1.77	4.91	3.67	3.92	4.40	4.62
Di en	1.03	1.01	1.02	2.84	2.11	2.42	2.74	2.65
Di fs	0.51	0.56	0.66	1.83	1.38	1.26	1.39	1.76
Hy en	19.43	18.17	18.83	12.41	10.80	13.20	13.01	13.47
Hy fs	9.55	10.07	12.11	8.01	7.05	6.87	6.58	8.92
Ol fo	0.00	0.00	0.00	1.76	0.00	0.00	0.00	0.00
Ol fa	0.00	0.00	0.00	1.26	0.00	0.00	0.00	0.00
Mt	5.32	5.01	3.72	4.10	6.10	7.47	7.70	5.94
Il	3.37	3.34	3.39	3.11	2.48	3.24	3.27	3.28
Ap	0.89	0.91	0.91	0.84	0.49	0.49	0.54	0.58
$\frac{100An}{Ab+An}$	72.91	73.01	70.05	62.82	68.92	77.25	73.85	71.71
D.I.	22.14	22.63	22.13	26.22	32.15	23.08	23.68	23.18

	TB 7	TB 8	TB 9	TB 10	TB 11-1	TB 11-2	TB 11-3	TB 12
Major and minor oxides (wt %)								
SiO_2	50.83	54.80	48.19	52.44	53.17	53.38	52.94	48.92
TiO_2	1.17	1.18	1.69	1.35	1.25	1.23	1.24	1.73
Al_2O_3	16.42	16.64	16.67	16.38	16.66	16.50	16.35	16.60
Fe_2O_3	2.78	1.98	4.41	2.81	2.76	2.91	2.54	4.39
FeO	8.65	7.32	8.30	8.34	7.86	7.76	8.10	8.60
MnO	0.18	0.16	0.20	0.17	0.18	0.17	0.17	0.22
MgO	7.39	5.25	7.67	5.68	5.23	5.47	5.53	6.68
CaO	10.25	7.90	8.98	8.68	8.64	8.39	8.59	9.53
Na_2O	1.97	2.67	2.66	2.56	2.65	2.54	2.86	2.36
K_2O	0.26	1.85	0.92	1.34	1.38	1.43	1.44	0.71
P_2O_5	0.10	0.23	0.32	0.25	0.23	0.23	0.24	0.26
Original Sum	98.79	98.74	98.64	98.72	98.91	98.96	98.66	98.98
Ignition loss	0.50	0.57	0.75	0.81	1.54	1.55	1.24	1.71
mg #	0.54	0.51	0.53	0.48	0.47	0.48	0.49	0.49
FeO*/MgO	1.51	1.73	1.60	1.91	1.98	1.90	1.88	1.88
K_2O/Na_2O	0.13	0.69	0.35	0.52	0.52	0.56	0.50	0.30
CIPW norms (%)								
Q	3.41	5.53	0.00	3.58	4.62	5.35	2.65	1.12
Or	1.56	10.97	5.44	7.91	8.14	8.44	8.50	4.20
Ab	16.68	22.56	22.45	21.67	22.39	21.43	24.20	19.98
An	35.12	27.92	30.82	29.20	29.45	29.37	27.48	32.55
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di wo	6.32	4.15	4.97	5.20	5.05	4.56	5.75	5.53
Di en	3.65	2.26	3.15	2.82	2.72	2.52	3.09	3.31
Di fs	2.37	1.75	1.50	2.20	2.16	1.87	2.47	1.92
Hy en	14.81	10.86	10.34	11.38	10.35	11.16	10.74	13.40
Hy fs	9.60	8.40	4.94	8.88	8.24	8.26	8.57	7.78
Ol fo	0.00	0.00	3.99	0.00	0.00	0.00	0.00	0.00
Ol fa	0.00	0.00	2.11	0.00	0.00	0.00	0.00	0.00
Mt	4.03	2.87	6.40	4.07	4.01	4.21	3.68	6.37
Il	2.22	2.25	3.20	2.56	2.38	2.34	2.36	3.28
Ap	0.22	0.51	0.69	0.54	0.49	0.49	0.52	0.56
$\frac{100An}{Ab+An}$	67.80	55.31	57.86	57.40	56.81	57.81	53.17	61.96
D.I.	21.65	39.06	27.89	33.16	35.15	35.22	35.35	25.30

	TB 13	TB 14	TB 15	TB 16	TB 17	TB 18-1	TB 18-2	TB 18-3
Major and minor oxides (wt %)								
SiO_2	49.30	51.70	48.77	49.07	48.74	50.21	49.39	49.75
TiO_2	1.68	1.56	1.65	1.72	1.98	1.47	1.78	1.42
Al_2O_3	16.92	16.99	16.33	16.50	16.73	16.59	16.54	16.57
Fe_2O_3	5.01	2.00	4.34	4.19	4.81	3.72	4.31	3.43
FeO	7.41	8.56	8.24	7.85	8.34	8.40	7.60	8.41
MnO	0.18	0.18	0.19	0.18	0.20	0.17	0.20	0.17
MgO	6.65	5.66	7.66	7.45	6.46	6.89	7.10	7.41
CaO	9.09	8.95	9.37	9.26	8.83	9.45	9.54	9.75
Na_2O	2.68	3.01	2.45	2.69	2.71	2.33	2.74	2.21
K_2O	0.82	1.15	0.73	0.80	0.91	0.58	0.61	0.70
P_2O_5	0.27	0.24	0.27	0.29	0.30	0.18	0.18	0.17
Original Sum	98.93	99.15	98.54	98.72	98.88	98.70	98.95	98.63
Ignition loss	1.18	0.86	0.98	1.15	1.80	0.39	0.53	0.30
mg #	0.50	0.49	0.53	0.53	0.48	0.51	0.52	0.53
FeO*/MgO	1.79	1.83	1.59	1.56	1.96	1.71	1.62	1.55
K_2O/Na_2O	0.31	0.38	0.30	0.30	0.34	0.25	0.22	0.32
CIPW norms (%)								
Q	1.19	0.33	0.00	0.00	0.30	2.46	0.24	0.94
Or	4.84	6.80	4.30	4.73	5.36	3.43	3.61	4.15
Ab	22.65	25.45	20.70	22.69	22.90	19.69	23.19	18.65
An	31.68	29.40	31.37	30.57	30.77	33.06	30.98	33.18
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di wo	4.97	5.68	5.67	5.71	4.72	5.33	6.39	5.93
Di en	3.24	3.00	3.58	3.67	2.91	3.17	4.13	3.57
Di fs	1.37	2.50	1.72	1.66	1.52	1.88	1.82	2.04
Hy en	13.38	11.14	14.67	13.12	13.23	14.05	13.63	14.96
Hy fs	5.65	9.31	7.02	5.94	6.91	8.34	6.00	8.53
Ol fo	0.00	0.00	0.62	1.29	0.00	0.00	0.00	0.00
Ol fa	0.00	0.00	0.33	0.64	0.00	0.00	0.00	0.00
Mt	7.25	2.89	6.30	6.08	6.98	5.40	6.25	4.97
Il	3.19	2.96	3.14	3.27	3.76	2.80	3.38	2.71
Ap	0.58	0.53	0.58	0.63	0.65	0.40	0.40	0.38
$\frac{100An}{Ab+An}$	58.31	53.60	60.25	57.40	57.33	62.67	57.19	64.02
D.I.	26.68	32.58	25.00	27.42	28.56	25.58	27.04	23.74

	TB 19	TB 20	TB 21	TB 22	TB 23	TB 24	TB 25	TB 26
Major and minor oxides (wt %)								
SiO_2	48.69	48.67	48.77	48.74	48.55	49.83	50.21	48.38
TiO_2	1.85	1.97	1.49	1.47	1.52	1.67	1.75	1.66
Al_2O_3	17.13	16.72	17.22	16.96	16.98	16.50	17.23	17.34
Fe_2O_3	2.84	5.72	2.37	2.88	2.95	4.23	3.30	3.38
FeO	7.39	7.59	8.75	8.63	9.45	7.57	8.54	8.58
MnO	0.17	0.20	0.17	0.20	0.19	0.18	0.26	0.18
MgO	7.16	6.43	8.10	8.01	7.25	6.82	4.74	7.42
CaO	8.75	8.83	9.36	9.15	9.04	9.44	9.56	9.14
Na_2O	3.23	2.62	2.40	2.58	2.63	2.52	2.98	2.70
K_2O	2.25	0.94	1.05	1.03	1.14	0.97	1.13	0.85
P_2O_5	0.53	0.30	0.33	0.34	0.29	0.28	0.31	0.36
Original Sum	98.83	98.85	98.58	98.65	98.65	98.48	98.70	98.55
Ignition loss	1.58	2.39	1.34	0.55	0.67	0.40	1.69	0.87
mg #	0.56	0.47	0.57	0.56	0.52	0.52	0.42	0.53
FeO*/MgO	1.39	1.98	1.34	1.40	1.67	1.67	2.43	1.57
K_2O/Na_2O	0.70	0.36	0.44	0.40	0.43	0.38	0.38	0.31
CIPW norms (%)								
Q	0.00	1.54	0.00	0.00	0.00	1.23	0.31	0.00
Or	13.32	5.58	6.20	6.09	6.76	5.73	6.71	5.03
Ab	23.39	22.17	20.25	21.80	22.25	21.28	25.18	22.84
An	25.55	31.02	33.07	31.62	31.10	30.81	30.24	32.63
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di wo	6.15	4.61	4.78	4.94	5.05	6.03	6.42	4.44
Di en	3.90	3.07	2.85	2.98	2.84	3.84	3.31	2.68
Di fs	1.85	1.20	1.68	1.70	2.00	1.79	2.94	1.52
Hy en	0.00	13.00	9.34	8.69	6.97	13.21	8.54	9.18
Hy fs	0.00	5.10	5.52	4.95	4.91	6.17	7.58	5.22
Ol fo	9.79	0.00	5.65	5.85	5.81	0.00	0.00	4.69
Ol fa	5.13	0.00	3.68	3.68	4.51	0.00	0.00	2.94
Mt	4.12	8.30	3.43	4.18	4.28	6.14	4.78	4.90
Il	3.52	3.74	2.83	2.79	2.89	3.18	3.33	3.15
Ap	1.17	0.66	0.72	0.73	0.62	0.60	0.68	0.78
$\frac{100An}{Ab+An}$	52.21	58.32	62.02	59.19	58.29	59.15	54.57	58.82
D.I.	38.82	29.29	26.45	27.89	29.01	28.24	32.20	27.87

	TB 27	TB 28	TB 29	TB 30	TB 31	TB 32	TB 33	TB 34
Major and minor oxides (wt %)								
SiO_2	49.04	52.04	51.66	53.46	49.26	51.06	51.24	49.17
TiO_2	1.83	1.53	1.58	1.31	1.73	1.58	1.62	1.71
Al_2O_3	16.77	16.32	16.51	16.19	18.20	18.40	16.04	16.67
Fe_2O_3	3.65	4.21	4.09	2.37	3.06	2.27	2.63	3.63
FeO	8.53	6.68	7.35	8.13	7.49	7.05	8.74	9.29
MnO	0.19	0.17	0.15	0.19	0.23	0.27	0.16	0.23
MgO	5.71	5.80	5.81	5.47	5.14	4.52	5.99	6.50
CaO	9.74	8.47	8.71	8.19	8.35	8.24	10.09	9.33
Na_2O	3.08	3.11	2.74	2.94	3.62	3.68	2.41	2.54
K_2O	1.16	1.43	1.17	1.49	2.30	2.43	0.85	0.68
P_2O_5	0.31	0.25	0.24	0.25	0.62	0.50	0.23	0.25
Original Sum	98.96	99.24	99.09	98.70	98.86	98.96	98.64	96.80
Ignition loss	0.91	1.06	1.35	0.89	1.15	1.48	2.44	0.83
mg #	0.46	0.50	0.48	0.49	0.47	0.47	0.49	0.48
FeO*/MgO	2.07	1.81	1.90	1.88	1.99	2.01	1.85	1.93
K_2O/Na_2O	0.38	0.46	0.43	0.51	0.64	0.66	0.35	0.27
CIPW norms (%)								
Q	0.00	2.42	3.67	3.19	0.00	0.00	2.69	0.18
Or	6.88	8.43	6.90	8.83	13.62	14.38	5.04	4.01
Ab	26.03	26.26	23.17	24.89	27.25	30.69	20.38	21.49
An	28.45	26.33	29.26	26.52	26.54	26.46	30.38	32.04
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	0.00	0.00	0.00	0.00	1.83	0.24	0.00	0.00
Di wo	7.55	5.95	5.25	5.30	4.69	4.79	7.67	5.34
Di en	4.26	3.81	3.22	2.82	2.67	2.58	4.18	2.98
Di fs	2.97	1.73	1.72	2.30	1.82	2.04	3.21	2.14
Hy en	4.38	10.68	11.31	10.85	0.00	0.00	10.79	13.27
Hy fs	3.06	4.85	6.05	8.85	0.00	0.00	8.27	9.52
Ol fo	3.95	0.00	0.00	0.00	7.12	6.11	0.00	0.00
Ol fa	3.04	0.00	0.00	0.00	5.37	5.33	0.00	0.00
Mt	5.29	6.10	5.93	3.44	4.44	3.29	3.81	5.26
Il	3.47	2.90	2.99	2.49	3.29	3.00	3.08	3.25
Ap	0.67	0.56	0.51	0.54	1.36	1.10	0.50	0.55
$\frac{100An}{Ab+An}$	52.22	50.07	55.81	51.59	49.34	46.30	59.85	59.85
D.I.	32.91	37.11	33.74	36.91	42.70	45.31	28.11	25.68

	TB 35	TB 36	TB 37	TB 38-1	TB 38-2	TB 39	TB 40	TB 41
Major oxides (wt %)								
SiO_2	48.98	48.61	49.32	48.49	49.12	49.01	48.94	49.71
TiO_2	2.16	2.18	2.23	2.22	2.28	2.31	1.69	2.28
Al_2O_3	16.92	16.45	16.84	16.59	17.04	16.98	16.24	16.83
Fe_2O_3	4.44	6.43	2.47	4.54	2.67	3.09	4.69	2.62
FeO	8.36	7.18	9.47	8.57	9.71	9.63	7.38	9.46
MnO	0.19	0.24	0.16	0.21	0.20	0.19	0.26	0.18
MgO	5.97	5.92	6.14	6.39	4.89	4.76	7.04	5.85
CaO	9.11	8.93	9.05	8.87	9.67	9.63	9.40	9.07
Na_2O	2.59	2.71	3.12	2.76	3.24	3.13	2.89	2.74
K_2O	0.94	1.02	0.87	1.02	0.84	0.90	1.10	0.92
P_2O_5	0.34	0.34	0.34	0.35	0.35	0.36	0.39	0.35
Original Sum	98.88	98.98	98.61	98.81	98.68	98.77	99.08	98.71
Ignition loss	2.45	1.40	1.02	1.56	4.31	3.66	1.77	1.68
mg #	0.46	0.45	0.48	0.47	0.42	0.41	0.52	0.47
FeO*/MgO	2.07	2.19	1.90	1.98	2.48	2.61	1.65	2.02
K_2O/Na_2O	0.36	0.38	0.28	0.37	0.26	0.29	0.38	0.34
CIPW norms (%)								
Q	1.34	2.41	0.00	0.00	0.00	0.00	0.00	0.22
Or	5.58	6.06	5.15	6.02	4.95	5.35	6.50	5.43
Ab	21.91	22.87	26.33	23.29	27.40	26.48	24.41	23.17
An	31.71	29.67	29.34	29.84	29.43	29.56	28.05	30.86
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di wo	4.79	5.28	5.67	5.07	6.91	6.74	6.81	5.05
Di en	2.89	3.67	3.08	3.10	3.39	3.34	4.46	2.71
Di fs	1.64	1.17	2.39	1.68	3.39	3.26	1.87	2.17
Hy en	12.04	11.14	7.37	11.85	4.90	6.02	9.14	11.93
Hy fs	6.81	3.54	5.73	6.44	4.90	5.89	3.82	9.58
Ol fo	0.00	0.00	3.43	0.71	2.75	1.78	2.80	0.00
Ol fa	0.00	0.00	2.95	0.43	3.03	1.92	1.29	0.00
Mt	6.44	9.32	3.58	6.59	3.87	4.48	6.79	3.80
Il	4.10	4.15	4.24	4.22	4.33	4.39	3.20	4.33
Ap	0.75	0.74	0.74	0.76	0.76	0.78	0.85	0.76
$\frac{100An}{Ab+An}$	59.14	56.47	52.70	56.16	51.79	52.75	62.82	68.92
D.I.	28.83	31.34	31.48	29.31	32.35	31.83	30.91	28.82

	TB 42	TB 43	TB 44	TB 45	TB 46	TB 47	TB 48	TB 49	TB 50
Major and minor oxides (wt %)									
SiO_2	47.93	49.24	48.06	53.23	49.95	49.62	49.73	48.91	47.97
TiO_2	1.36	1.58	1.67	1.28	1.51	1.61	1.63	1.68	1.75
Al_2O_3	16.73	15.80	17.02	16.65	16.50	16.79	16.81	17.55	17.10
Fe_2O_3	3.01	4.82	3.94	2.37	3.12	2.91	3.22	3.45	5.92
FeO	9.04	7.63	7.62	8.41	8.85	9.00	8.77	7.41	5.45
MnO	0.18	0.18	0.18	0.17	0.17	0.19	0.18	0.17	0.18
MgO	8.49	8.84	7.72	5.31	7.19	7.30	7.11	6.66	7.85
CaO	9.80	8.67	9.40	8.60	9.28	9.35	9.48	9.06	9.42
Na_2O	2.35	2.26	2.67	2.44	2.45	2.50	2.22	2.81	2.51
K_2O	0.87	0.69	1.29	1.32	0.76	0.54	0.64	1.79	1.44
P_2O_5	0.24	0.29	0.42	0.21	0.21	0.19	0.21	0.50	0.41
Original Sum	98.84	99.61	100.10	98.77	98.62	98.77	98.75	98.67	98.90
Ignition loss	1.23	1.65	2.65	1.26	0.23	0.50	0.47	1.37	2.24
mg #	0.56	0.57	0.55	0.47	0.52	0.53	0.52	0.53	0.56
FeO*/MgO	1.38	1.35	1.45	1.98	1.62	1.59	1.64	1.58	1.37
K_2O/Na_2O	0.37	0.31	0.48	0.54	0.31	0.22	0.29	0.64	0.57
CIPW norms (%)									
Q	0.00	1.12	0.00	5.16	0.30	0.00	1.46	0.00	0.00
Or	5.15	4.11	7.65	7.83	4.51	3.19	3.79	10.58	8.50
Ab	19.83	19.07	22.55	20.63	20.70	21.16	18.75	23.71	21.22
An	32.50	30.90	30.61	30.54	31.72	32.94	33.97	29.97	31.10
Lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di wo	6.17	4.36	5.67	4.58	5.46	5.15	4.94	5.04	5.53
Di en	3.71	2.97	3.68	2.37	3.17	2.98	2.90	3.15	4.34
Di fs	2.13	1.04	1.59	2.08	2.03	1.93	1.80	1.57	0.56
Hy en	7.01	19.13	5.84	10.91	14.79	14.87	14.89	4.95	11.27
Hy fs	4.02	6.70	2.52	9.59	9.45	9.62	9.28	2.47	1.46
Ol fo	7.36	0.00	6.84	0.00	0.00	0.27	0.00	5.99	2.82
Ol fa	4.66	0.00	3.25	0.00	0.00	0.19	0.00	3.29	0.40
Mt	4.37	6.99	5.71	3.44	4.52	4.22	4.66	5.01	8.58
Il	2.59	3.01	3.18	2.44	2.88	3.05	3.09	3.18	3.32
Ap	0.51	0.62	0.92	0.45	0.47	0.42	0.47	1.10	0.90
$\frac{100An}{Ab+An}$	62.11	61.84	57.58	59.68	60.51	60.89	64.43	55.83	59.44
D.I.	24.98	24.30	30.20	33.62	25.51	24.35	24.00	35.29	29.72

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

APPENDIX D

Trace- and rare-earth element compositions and some selected element ratios for Thoeng basaltic rocks.

	TB 1-1	TB 1-2	TB 1-5	TB 1-6	T 2.1	TB 2-1	TB 2-2	TB 2-4
Trace elements (ppm)								
Ba	164	299	306	246	202	253	303	232
Rb	17	17	18	15	18	17	22	16
Sr	359	429	338	295	339	357	314	344
Y	-	-	-	-	-	-	-	-
Zr	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-
Ni	119	97	115	87	118	110	90	111
Cr	-	-	-	-	-	-	-	-
Nb	-	-	-	-	-	-	-	-
Th	-	-	-	-	-	-	-	-
La	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-
Nd	-	-	-	-	-	-	-	-
Sm	-	-	-	-	-	-	-	-
Eu	-	-	-	-	-	-	-	-
Tb	-	-	-	-	-	-	-	-
Yb	-	-	-	-	-	-	-	-
Lu	-	-	-	-	-	-	-	-
Ti/V	-	-	-	-	-	-	-	-
Ti/Y	-	-	-			-	-	-
P/K	0.22	0.22	0.22	0.22	0.22	0.23	0.20	0.23
Zr/Y	-	-	-	-	-	-	-	-
Ba/K	0.018	0.034	0.035	0.030	0.023	0.028	0.029	0.027
Zr/Ba	-	-	-	-	-	-	-	-
Zr/Nb	-	-	-	-	-	-	-	-
Nb/Y	-	-	-	-	-	-	-	-
Rb/K	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Rb/Sr	0.047	0.039	0.053	0.051	0.053	0.047	0.070	0.046
$(La/Sm)_n$	-	-	-	-	-	-	-	-
$(Sm/Yb)_n$	-	-	-	-	-	-	-	-
$(La/Yb)_n$	-	-	-	-	-	-	-	-

	T 3.1	TB 3-1	TB 3-2	TB 4-1	TB 4-2	TB 5-2	TB 6-1	TB 6-2
Trace elements (ppm)								
Ba	310	147	245	235	177	59	30	59
Rb	19	10	19	21	30	13	13	11
Sr	319	240	330	190	224	224	211	213
Y	-	-	-	-	-	-	-	-
Zr	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-
Ni	93	102	95	61	56	105	113	84
Cr	-	-	-	-	-	-	-	-
Nb	-	-	-	-	-	-	-	-
Th	-	-	-	-	-	-	-	-
La	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-
Nd	-	-	-	-	-	-	-	-
Sm	-	-	-	-	-	-	-	-
Eu	-	-	-	-	-	-	-	-
Tb	-	-	-	-	-	-	-	-
Yb	-	-	-	-	-	-	-	-
Lu	-	-	-	-	-	-	-	-
Ti/V	-	-	-	-	-	-	-	-
Ti/Y	-	-	-	-	-	-	-	-
P/K	0.20	0.21	0.21	0.18	0.09	0.18	0.20	0.20
Zr/Y	-	-	-	-	-	-	-	-
Ba/K	0.03	0.02	0.03	0.02	0.02	0.01	0.01	0.01
Zr/Ba	-	-	-	-	-	-	-	-
Zr/Nb	-	-	-	-	-	-	-	-
Nb/Y	-	-	-	-	-	-	-	-
Rb/K	0.002	0.001	0.002	0.002	0.003	0.002	0.002	0.002
Rb/Sr	0.059	0.042	0.057	0.110	0.134	0.058	0.062	0.052
$(La/Sm)_n$	-	-	-	-	-	-	-	-
$(Sm/Yb)_n$	-	-	-	-	-	-	-	-
$(La/Yb)_n$	-	-	-	-	-	-	-	-

	TB 7	TB 8	TB 9	TB 10	TB 11-1	TB 11-2	TB 11-3	TB 12
Trace elements (ppm)								
Ba	46	260	230	221	206	234	237	163
Rb	10	10	17	43	35	44	48	11
Sr	331	414	815	403	424	477	372	490
Y	26	27	33	37	31	27	33	31
Zr	54	132	126	115	122	128	122	104
V	225	221	274	148	197	195	217	272
Ni	124	62	107	80	67	70	76	113
Cr	174	151	195	164	137	148	155	174
Nb	-	-	-	14	-	-	-	-
Th	-	-	-	3.5	-	-	-	-
La	-	-	-	13	-	-	-	-
Ce	-	-	-	27	-	-	-	-
Nd	-	-	-	15	-	-	-	-
Sm	-	-	-	3.7	-	-	-	-
Eu	-	-	-	1.1	-	-	-	-
Tb	-	-	-	0.8	-	-	-	-
Yb	-	-	-	2.6	-	-	-	-
Lu	-	-	-	0.4	-	-	-	-
Ti/V	31.17	32.00	36.97	54.67	38.03	37.81	34.25	38.12
Ti/Y	269.73	261.96	306.96	218.70	241.69	273.06	225.23	334.50
P/K	0.20	0.07	0.18	0.10	0.09	0.08	0.09	0.19
Zr/Y	2.08	4.89	3.82	3.11	3.94	4.74	3.70	3.35
Ba/K	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.03
Zr/Ba	1.17	0.51	0.55	0.52	0.59	0.55	0.51	0.64
Zr/Nb	-	-	-	8.21	-	-	-	-
Nb/Y	-	-	-	0.38	-	-	-	-
Rb/K	0.004	0.0006	0.002	0.004	0.003	0.004	0.004	0.002
Rb/Sr	0.030	0.024	0.021	0.107	0.083	0.092	0.129	0.022
$(La/Sm)_n$	-	-	-	2.14	-	-	-	-
$(Sm/Yb)_n$	-	-	-	1.54	-	-	-	-
$(La/Yb)_n$	-	-	-	3.30	-	-	-	-

	TB 13	TB 14	TB 15	TB 16	TB 17	TB 18-1	TB 18-2	TB 18-3
Trace elements (ppm)								
Ba	180	197	114	174	224	100	119	134
Rb	29	44	26	31	37	19	15	24
Sr	470	478	432	625	525	418	315	453
Y	30	34	31	33	36	28	46	27
Zr	111	116	92	137	107	68	83	89
V	220	228	305	183	239	152	252	229
Ni	112	73	117	111	56	136	137	129
Cr	147	118	219	230	106	192	162	193
Nb	-	-	-	-	-	-	-	-
Th	-	-	-	-	-	-	-	-
La	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-
Nd	-	-	-	-	-	-	-	-
Sm	-	-	-	-	-	-	-	-
Eu	-	-	-	-	-	-	-	-
Tb	-	-	-	-	-	-	-	-
Yb	-	-	-	-	-	-	-	-
Lu	-	-	-	-	-	-	-	-
Ti/V	45.77	41.01	32.43	56.34	49.66	57.97	42.34	37.17
Ti/Y	335.66	275.02	319.04	312.41	329.67	314.68	231.94	315.24
P/K	0.17	0.11	0.19	0.20	0.17	0.16	0.16	0.13
Zr/Y	3.70	3.41	2.97	4.15	2.97	2.43	1.80	3.30
Ba/K	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.02
Zr/Ba	0.62	0.59	0.81	0.79	0.48	0.68	0.70	0.66
Zr/Nb	-	-	-	-	-	-	-	-
Nb/Y	-	-	-	-	-	-	-	-
Rb/K	0.004	0.004	0.004	0.005	0.004	0.004	0.003	0.004
Rb/Sr	0.062	0.092	0.060	0.050	0.070	0.045	0.048	0.053
$(La/Sm)_n$	-	-	-	-	-	-	-	-
$(Sm/Yb)_n$	-	-	-	-	-	-	-	-
$(La/Yb)_n$	-	-	-	-	-	-	-	-

	TB 19	TB 20	TB 21	TB 22	TB 23	TB 24	TB 25	TB 26
Trace elements (ppm)								
Ba	392	184	227	239	182	154	156	262
Rb	59	29	35	35	40	54	82	29
Sr	616	397	500	500	434	380	474	475
Y	24	32	28	28	26	34	29	23
Zr	174	106	122	121	123	130	116	116
V	150	333	226	295	279	345	211	206
Ni	68	95	121	141	102	103	75	91
Cr	151	96	228	233	163	140	97	150
Nb	-	-	-	-	-	-	-	-
Th	-	-	-	-	-	-	-	-
La	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-
Nd	-	-	-	-	-	-	-	-
Sm	-	-	-	-	-	-	-	-
Eu	-	-	-	-	-	-	-	-
Tb	-	-	-	-	-	-	-	-
Yb	-	-	-	-	-	-	-	-
Lu	-	-	-	-	-	-	-	-
Ti/V	73.93	35.46	39.52	29.87	32.66	29.01	49.71	48.30
Ti/Y	462.04	369.01	318.97	314.68	350.42	294.41	361.71	432.61
P/K	0.12	0.17	0.17	0.17	0.13	0.15	0.14	0.22
Zr/Y	7.25	3.31	4.36	4.32	4.73	3.82	4.00	5.04
Ba/K	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.04
Zr/Ba	0.44	0.58	0.54	0.51	0.68	0.84	0.74	0.44
Zr/Nb	-	-	-	-	-	-	-	-
Nb/Y	-	-	-	-	-	-	-	-
Rb/K	0.003	0.004	0.004	0.004	0.004	0.007	0.009	0.004
Rb/Sr	0.096	0.073	0.070	0.070	0.092	0.142	0.173	0.061
$(La/Sm)_n$	-	-	-	-	-	-	-	-
$(Sm/Yb)_n$	-	-	-	-	-	-	-	-
$(La/Yb)_n$	-	-	-	-	-	-	-	-

	TB 27	TB 28	TB 29	TB 30	TB 31	TB 32	TB 33	TB 34
Trace elements (ppm)								
Ba	213	261	161	244	644	630	131	127
Rb	77	75	59	68	65	58	43	25
Sr	440	409	342	357	671	720	418	358
Y	34	39	33	29	41	30	26	32
Zr	111	113	105	111	195	214	119	99
V	246	160	216	156	128	151	292	255
Ni	87	71	84	110	41	55	84	119
Cr	89	116	115	136	61	85	115	177
Nb	-	-	-	-	36	-	-	-
Th	-	-	-	-	2.6	-	-	-
La	-	-	-	-	26	-	-	-
Ce	-	-	-	-	53	-	-	-
Nd	-	-	-	-	24	-	-	-
Sm	-	-	-	-	4.8	-	-	-
Eu	-	-	-	-	1.6	-	-	-
Tb	-	-	-	-	1.0	-	-	-
Yb	-	-	-	-	2.1	-	-	-
Lu	-	-	-	-	0.3	-	-	-
Ti/V	44.59	57.32	43.84	50.33	81.01	62.72	33.25	40.19
Ti/Y	322.62	235.15	286.99	270.76	252.92	315.68	373.47	320.30
P/K	0.14	0.09	0.11	0.09	0.14	0.11	0.14	0.19
Zr/Y	3.26	2.90	3.18	3.83	4.76	7.13	4.58	3.09
Ba/K	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02
Zr/Ba	0.52	0.43	0.65	0.45	0.30	0.34	0.91	0.78
Zr/Nb	-	-	-	-	5.42	-	-	-
Nb/Y	-	-	-	-	0.88	-	-	-
Rb/K	0.008	0.006	0.006	0.005	0.003	0.003	0.006	0.004
Rb/Sr	0.175	0.183	0.172	0.190	0.097	0.080	0.103	0.070
$(La/Sm)_n$	-	-	-	-	3.30	-	-	-
$(Sm/Yb)_n$	-	-	-	-	2.48	-	-	-
$(La/Yb)_n$	-	-	-	-	8.18	-	-	-

	TB 35	TB 36	TB 37	TB 38-1	TB 38-2	TB 39	TB 40	TB 41
Trace elements (ppm)								
Ba	156	273	112	197	140	144	187	213
Rb	31	51	55	35	53	20	37	16
Sr	383	381	465	405	475	466	391	451
Y	32	35	33	21	34	34	34	33
Zr	121	130	145	117	135	147	139	150
V	320	289	246	261	295	295	280	276
Ni	59	86	65	75	82	67	129	72
Cr	86	122	47	102	47	38	204	48
Nb	-	-	-	-	-	16	-	-
Th	-	-	-	-	-	1.3	-	-
La	-	-	-	-	-	13	-	-
Ce	-	-	-	-	-	29	-	-
Nd	-	-	-	-	-	18	-	-
Sm	-	-	-	-	-	4.9	-	-
Eu	-	-	-	-	-	1.7	-	-
Tb	-	-	-	-	-	0.9	-	-
Yb	-	-	-	-	-	2.2	-	-
Lu	-	-	-	-	-	0.3	-	-
Ti/V	40.46	45.21	54.34	50.98	46.33	46.94	36.18	49.52
Ti/Y	404.59	373.34	405.05	633.65	401.95	407.24	297.94	414.13
P/K	0.19	0.18	0.21	0.18	0.22	0.21	0.19	0.20
Zr/Y	3.78	3.71	4.39	5.57	3.97	4.32	4.09	4.55
Ba/K	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.03
Zr/Ba	0.78	0.48	1.29	0.59	0.96	1.02	0.74	0.70
Zr/Nb	-	-	-	-	-	9.19	-	-
Nb/Y	-	-	-	-	-	0.47	-	-
Rb/K	0.004	0.006	0.008	0.004	0.008	0.003	0.004	0.002
Rb/Sr	0.081	0.134	0.118	0.086	0.112	0.043	0.095	0.035
$(La/Sm)_n$	-	-	-	-	-	1.61	-	-
$(Sm/Yb)_n$	-	-	-	-	-	2.42	-	-
$(La/Yb)_n$	-	-	-	-	-	3.90	-	-

	TB 42	TB 43	TB 44	TB 45	TB 46	TB 47	TB 48	TB 49	TB 50
Trace elements (ppm)									
Ba	205	165	348	239	115	119	75	405	324
Rb	44	12	56	42	32	24	27	80	40
Sr	396	427	555	293	317	350	322	585	540
Y	32	26	29	28	29	19	21	32	23
Zr	83	94	145	110	101	58	72	146	145
V	253	259	271	163	184	210	195	217	183
Ni	116	175	98	68	133	152	127	73	110
Cr	183	282	148	151	158	218	219	125	154
Nb	-	-	-	-	-	-	-	-	24
Th	-	-	-	-	-	-	-	-	1.4
La	-	-	-	-	-	-	-	-	17
Ce	-	-	-	-	-	-	-	-	36
Nd	-	-	-	-	-	-	-	-	19
Sm	-	-	-	-	-	-	-	-	4.0
Eu	-	-	-	-	-	-	-	-	1.3
Tb	-	-	-	-	-	-	-	-	0.8
Yb	-	-	-	-	-	-	-	-	2.1
Lu	-	-	-	-	-	-	-	-	0.3
Ti/V	32.22	36.57	36.94	47.07	49.19	45.95	50.10	46.41	57.32
Ti/Y	254.74	364.25	345.17	274.01	312.10	507.91	465.25	314.68	456.06
P/K	0.15	0.22	0.17	0.08	0.15	0.18	0.17	0.15	0.15
Zr/Y	2.59	3.62	5.00	3.93	3.48	3.05	3.43	4.56	6.30
Ba/K	0.03	0.03	0.03	0.02	0.02	0.03	0.01	0.03	0.03
Zr/Ba	0.40	0.57	0.42	0.46	0.88	0.49	0.96	0.36	0.45
Zr/Nb	-	-	-	-	-	-	-	-	6.04
Nb/Y	-	-	-	-	-	-	-	-	1.04
Rb/K	0.006	0.002	0.005	0.004	0.005	0.005	0.005	0.005	0.003
Rb/Sr	0.111	0.028	0.101	0.143	0.101	0.069	0.084	0.137	0.074
$(La/Sm)_n$	-	-	-	-	-	-	-	-	2.59
$(Sm/Yb)_n$	-	-	-	-	-	-	-	-	2.06
$(La/Yb)_n$	-	-	-	-	-	-	-	-	5.35

$(La/Sm)_n$, $(Sm/Yb)_n$ and $(La/Yb)_n$ = chondrite - normalized values for La/Sm, Sm/Yb and La/Yb, respectively.

- = not determined.

APPENDIX E

Pearce element ratios for Thoeng basaltic rocks.

	TB 1-1	TB 1-2	TB 1-5	TB 1-6	T 2.1	TB 2-1	TB 2-2	TB 2-4
Normalized by Ti atom								
Si / Ti	36.12	38.28	35.86	39.59	36.31	35.98	38.07	36.31
Al / Ti	14.69	15.79	14.56	16.23	14.73	15.06	15.60	14.65
Fe^{3+} / Ti	1.68	1.18	1.60	2.18	1.70	1.58	2.13	1.65
Fe^{2+} / Ti	5.74	6.38	5.79	5.71	5.66	5.74	5.32	5.89
Mn / Ti	0.13	0.13	0.12	0.14	0.12	0.12	0.12	0.13
Mg / Ti	8.57	8.17	8.16	8.88	9.01	7.98	8.66	8.32
Ca / Ti	6.94	7.36	7.03	8.05	7.15	6.93	7.03	6.96
K / Ti	1.00	1.05	0.99	1.00	0.99	1.00	1.25	0.99
Na / Ti	2.64	3.66	3.05	2.77	2.20	3.19	3.09	3.17
P / Ti	0.28	0.29	0.28	0.28	0.27	0.29	0.32	0.29
Normalized by K atom								
Si / K	36.16	36.40	36.10	39.70	36.69	35.88	30.40	36.84
Ti / K	1.00	0.95	1.01	1.00	1.01	1.00	0.80	1.01
Al / K	14.70	15.02	14.66	16.28	14.81	15.02	12.46	14.86
Fe^{3+} / K	1.68	1.12	1.61	2.19	1.71	1.58	1.70	1.67
Fe^{2+} / K	5.75	6.07	5.83	5.73	5.69	5.72	4.25	5.98
Mn / K	0.13	0.13	0.13	0.14	0.12	0.12	0.10	0.13
Mg / K	8.58	7.77	8.21	8.90	9.06	7.96	6.92	8.44
Ca / K	6.95	7.00	7.08	8.07	7.18	6.91	5.61	7.07
Na / K	2.64	3.48	3.07	2.77	2.21	3.18	2.47	3.21
P / K	0.28	0.28	0.28	0.28	0.27	0.29	0.26	0.29
Normalized by P atom								
Si / P	128.34	132.15	128.14	141.53	134.25	123.09	118.71	125.51
Ti / P	3.55	3.45	3.57	3.58	3.70	3.42	3.12	3.46
Al / P	52.19	54.52	52.04	58.03	54.48	51.53	48.64	50.63
Fe^{3+} / P	5.96	4.06	5.71	7.80	6.30	5.41	6.64	5.70
Fe^{2+} / P	20.41	22.02	20.70	20.43	20.93	19.63	16.59	20.36
Mn / P	0.44	0.45	0.44	0.49	0.44	0.43	0.39	0.44
Mg / P	30.44	28.21	29.15	31.74	33.33	27.31	27.02	28.74
Ca / p	24.66	25.43	25.11	28.77	26.43	23.70	21.93	24.07
K / P	3.55	3.63	3.55	3.56	3.68	3.43	3.91	3.41
Na / P	9.36	12.65	10.89	9.89	8.15	10.92	9.63	10.95

	T 3.1	TB 3-1	TB 3-2	TB 4-1	TB 4-2	TB 5-2	TB 6-1	TB 6-2
Normalized by Ti atom								
Si / Ti	36.76	37.19	36.68	39.84	53.98	38.66	38.22	38.36
Al / Ti	15.10	15.33	15.06	16.27	20.18	15.44	15.22	15.08
Fe^{3+} / Ti	2.07	1.96	1.44	1.73	3.24	3.01	3.09	2.38
Fe^{2+} / Ti	5.35	5.50	5.32	5.97	6.32	5.23	5.20	5.82
Mn / Ti	0.13	0.13	0.13	0.13	0.23	0.16	0.16	0.14
Mg / Ti	9.16	8.64	8.84	8.59	7.87	7.24	7.26	7.43
Ca / Ti	6.88	7.03	6.79	8.18	9.69	8.18	8.13	8.04
K / Ti	1.05	1.00	1.01	1.20	1.66	0.65	0.65	0.67
Na / Ti	2.32	2.34	2.59	3.60	3.57	2.01	2.31	2.49
P / Ti	0.26	0.27	0.27	0.27	0.19	0.15	0.16	0.17
Normalized by K atom								
Si / K	34.87	37.10	36.32	33.21	32.58	59.06	58.71	57.21
Ti / K	0.95	1.00	0.99	0.83	0.60	1.53	1.54	1.49
Al / K	14.33	15.30	14.91	13.56	12.18	23.59	23.37	22.49
Fe^{3+} / K	1.97	1.96	1.43	1.44	1.96	4.60	4.75	3.56
Fe^{2+} / K	5.08	5.49	5.27	4.97	3.81	7.99	7.98	8.68
Mn / K	0.12	0.13	0.13	0.11	0.14	0.25	0.24	0.21
Mg / K	8.69	8.62	8.75	7.16	4.75	11.06	11.15	11.08
Ca / K	6.53	7.01	6.73	6.82	5.85	12.50	12.48	11.99
Na / K	2.20	2.34	2.57	3.00	2.15	3.06	3.55	3.71
P / K	0.25	0.27	0.26	0.22	0.11	0.23	0.25	0.25
Normalized by P atom								
Si / P	140.95	138.41	138.08	148.86	283.30	255.33	233.59	225.40
Ti / P	3.83	3.72	3.76	3.74	5.25	6.60	6.11	5.88
Al / P	57.91	57.07	56.70	60.81	105.91	101.97	93.00	88.59
Fe^{3+} / P	7.95	7.30	5.44	6.45	17.01	19.90	18.88	14.01
Fe^{2+} / P	20.52	20.48	20.03	22.29	33.17	34.52	31.77	34.18
Mn / P	0.49	0.50	0.48	0.49	1.18	1.09	0.96	0.81
Mg / P	35.12	32.15	33.28	32.11	41.28	47.84	44.37	43.67
Ca / p	26.39	26.15	25.58	30.58	50.84	54.02	49.66	47.25
K / P	4.04	3.73	3.80	4.48	8.70	4.32	3.98	3.94
Na / P	8.88	8.72	9.76	13.45	18.73	13.24	14.11	14.62

	TB 7	TB 8	TB 9	TB 10	TB 11-1	TB 11-2	TB 11-3	TB 12
Normalized by Ti atom								
Si / Ti	57.76	61.74	37.91	51.64	56.55	58.24	56.75	37.59
Al / Ti	21.99	22.11	15.46	19.01	20.89	21.02	20.66	15.04
Fe^{3+} / Ti	2.38	1.68	2.61	2.08	2.21	2.36	2.05	2.54
Fe^{2+} / Ti	8.22	6.90	5.46	6.87	6.99	7.01	7.26	5.53
Mn / Ti	0.17	0.15	0.13	0.14	0.16	0.16	0.15	0.14
Mg / Ti	12.52	8.82	8.99	8.34	8.29	8.81	8.84	7.65
Ca / Ti	12.47	9.54	7.57	9.16	9.85	9.72	9.87	7.85
K / Ti	0.38	2.66	0.92	1.68	1.87	1.97	1.97	0.70
Na / Ti	4.34	5.83	4.06	4.89	5.47	5.32	5.95	3.52
P / Ti	0.10	0.22	0.21	0.21	0.21	0.21	0.22	0.17
Normalized by K atom								
Si / K	153.26	23.22	41.06	30.68	30.20	29.53	28.81	54.01
Ti / K	2.65	0.38	1.08	0.59	0.53	0.51	0.51	1.44
Al / K	58.36	8.31	16.74	11.29	11.15	10.66	10.49	21.60
Fe^{3+} / K	6.31	0.63	2.83	1.24	1.18	1.20	1.04	3.65
Fe^{2+} / K	21.81	2.59	5.91	4.08	3.73	3.56	3.69	7.95
Mn / K	0.46	0.06	0.14	0.08	0.09	0.08	0.08	0.21
Mg / K	33.22	3.32	9.74	4.95	4.43	4.47	4.49	10.99
Ca / K	33.08	3.59	8.20	5.44	5.26	4.93	5.01	11.27
Na / K	11.52	2.19	4.39	2.90	2.92	2.70	3.02	5.05
P / K	0.26	0.08	0.23	0.12	0.11	0.11	0.11	0.24
Normalized by P atom								
Si / P	600.62	281.31	177.89	247.84	272.95	276.82	260.28	222.29
Ti / P	10.40	4.56	4.69	4.80	4.83	4.75	4.59	5.91
Al / P	228.69	100.74	72.53	91.25	100.81	99.92	94.77	88.91
Fe^{3+} / P	24.72	7.65	12.25	9.99	10.66	11.21	9.40	15.01
Fe^{2+} / P	85.48	31.43	25.62	32.96	33.75	33.34	33.31	32.72
Mn / P	1.80	0.70	0.62	0.68	0.78	0.74	0.71	0.85
Mg / P	130.17	40.18	42.21	40.02	40.02	41.89	40.54	45.25
Ca / p	129.65	43.45	35.52	43.96	47.53	46.19	45.26	46.40
K / P	3.92	12.12	4.33	8.08	9.04	9.37	9.03	4.12
Na / P	45.14	26.58	19.04	23.46	26.38	25.30	27.27	20.79

	TB 13	TB 14	TB 15	TB 16	TB 17	TB 18-1	TB 18-2	TB 18-3
Normalized by Ti atom								
Si / Ti	39.02	44.06	39.30	37.93	32.73	45.41	36.89	46.58
Al / Ti	15.78	17.07	15.51	15.03	13.24	17.69	14.56	18.29
Fe^{3+} / Ti	2.98	1.28	2.63	2.44	2.43	2.53	2.42	2.42
Fe^{2+} / Ti	4.90	6.10	5.55	5.07	4.68	6.35	4.75	6.58
Mn / Ti	0.12	0.13	0.13	0.12	0.11	0.13	0.13	0.13
Mg / Ti	7.85	7.19	9.20	8.58	6.47	9.29	7.90	10.34
Ca / Ti	7.71	8.17	8.09	7.67	6.35	9.16	7.63	9.78
K / Ti	0.83	1.25	0.75	0.79	0.78	0.67	0.58	0.84
Na / Ti	4.11	4.97	3.83	4.03	3.53	4.09	3.97	4.01
P / Ti	0.18	0.17	0.18	0.19	0.17	0.14	0.11	0.13
Normalized by K atom								
Si / K	47.13	35.24	52.37	48.08	41.98	67.85	63.46	55.71
Ti / K	1.21	0.80	1.33	1.27	1.28	1.49	1.72	1.20
Al / K	19.06	13.65	20.67	19.06	16.99	26.43	25.05	21.87
Fe^{3+} / K	3.60	1.03	3.51	3.09	3.12	3.78	4.17	2.89
Fe^{2+} / K	5.92	4.88	7.40	6.43	6.01	9.49	8.17	7.88
Mn / K	0.15	0.10	0.17	0.15	0.15	0.19	0.22	0.16
Mg / K	9.48	5.75	12.26	10.88	8.29	13.88	13.60	12.37
Ca / K	9.31	6.54	10.78	9.72	8.15	13.68	13.14	11.70
Na / K	4.97	3.98	5.10	5.11	4.53	6.11	6.83	4.80
P / K	0.22	0.14	0.25	0.24	0.22	0.21	0.20	0.16
Normalized by P atom								
Si / P	215.64	254.39	213.41	199.87	191.93	329.46	324.18	345.59
Ti / P	5.53	5.77	5.43	5.27	5.86	7.25	8.79	7.42
Al / P	87.23	98.54	84.23	79.22	77.65	128.31	127.96	135.67
Fe^{3+} / P	16.49	7.41	14.29	12.84	14.25	18.37	21.29	17.93
Fe^{2+} / P	27.11	35.23	30.16	26.74	27.47	46.10	41.72	48.86
Mn / P	0.67	0.75	0.70	0.62	0.67	0.95	1.11	1.00
Mg / P	43.36	41.52	49.97	45.24	37.92	67.39	69.47	76.73
Ca / p	42.60	47.19	43.93	40.41	37.26	66.44	67.09	72.57
K / P	4.58	7.22	4.08	4.16	4.57	4.86	5.11	6.20
Na / P	22.73	28.72	20.79	21.25	20.69	29.65	34.87	29.77

	TB 19	TB 20	TB 21	TB 22	TB 23	TB 24	TB 25	TB 26
Normalized by Ti atom								
Si / Ti	34.99	32.85	43.51	44.08	42.47	39.66	38.14	38.75
Al / Ti	14.51	13.30	18.10	18.08	17.51	15.48	15.43	16.37
Fe^{3+} / Ti	1.54	2.91	1.59	1.96	1.94	2.54	1.89	2.04
Fe^{2+} / Ti	4.44	4.28	6.53	6.53	6.91	5.03	5.43	5.75
Mn / Ti	0.10	0.11	0.13	0.15	0.14	0.12	0.17	0.12
Mg / Ti	7.67	6.47	10.77	10.80	9.45	8.09	5.37	8.86
Ca / Ti	6.74	6.39	8.95	8.87	8.47	8.05	7.78	7.84
K / Ti	2.06	0.81	1.20	1.19	1.27	0.99	1.10	0.87
Na / Ti	4.50	3.43	4.15	4.52	4.46	3.89	4.39	4.19
P / Ti	0.32	0.17	0.25	0.26	0.21	0.19	0.20	0.24
Normalized by K atom								
Si / K	16.96	40.59	36.40	37.09	33.38	40.26	34.83	44.61
Ti / K	0.48	1.24	0.84	0.84	0.79	1.01	0.91	1.15
Al / K	7.03	16.43	15.14	15.21	13.76	15.71	14.09	18.85
Fe^{3+} / K	0.74	3.59	1.33	1.65	1.53	2.58	1.72	2.35
Fe^{2+} / K	2.15	5.29	5.46	5.49	5.43	5.11	4.95	6.62
Mn / K	0.05	0.14	0.11	0.13	0.11	0.12	0.15	0.14
Mg / K	3.72	7.99	9.01	9.09	7.43	8.21	4.90	10.20
Ca / K	3.27	7.89	7.49	7.46	6.66	8.17	7.11	9.03
Na / K	2.18	4.24	3.47	3.81	3.51	3.95	4.01	4.83
P / K	0.16	0.21	0.21	0.22	0.17	0.19	0.18	0.28
Normalized by P atom								
Si / P	108.50	191.66	174.50	169.29	197.79	210.10	191.29	158.72
Ti / P	3.10	5.83	4.01	3.84	4.66	5.30	5.01	4.10
Al / P	44.99	77.59	72.60	69.44	81.53	82.02	77.37	67.05
Fe^{3+} / P	4.76	16.95	6.38	7.53	9.04	13.46	9.46	8.34
Fe^{2+} / P	13.77	24.99	26.19	25.07	32.20	26.66	27.21	23.54
Mn / P	0.32	0.67	0.52	0.59	0.66	0.64	0.84	0.50
Mg / P	23.78	37.74	43.21	41.47	44.03	42.87	26.92	36.29
Ca / p	20.89	37.25	35.89	34.05	39.46	42.66	39.03	32.13
K / P	6.40	4.72	4.79	4.56	5.93	5.22	5.49	3.56
Na / P	13.96	20.00	16.65	17.38	20.78	20.61	22.01	17.18

	TB 27	TB 28	TB 29	TB 30	TB 31	TB 32	TB 33	TB 34
Normalized by Ti atom								
Si / Ti	35.63	45.22	43.47	54.26	37.85	42.97	42.04	38.23
Al / Ti	14.36	16.72	16.37	19.38	16.48	18.25	15.52	15.28
Fe^{3+} / Ti	2.00	2.75	2.59	1.81	1.77	1.43	1.62	2.12
Fe^{2+} / Ti	5.18	4.85	5.17	6.90	4.81	4.96	6.00	6.04
Mn / Ti	0.12	0.13	0.11	0.16	0.15	0.19	0.11	0.15
Mg / Ti	6.18	7.51	7.29	8.28	5.89	5.67	7.33	7.53
Ca / Ti	7.58	7.89	7.85	8.91	6.88	7.43	8.87	7.77
K / Ti	1.08	1.59	1.26	1.93	2.25	2.61	0.89	0.67
Na / Ti	4.34	5.24	4.47	5.79	5.39	6.00	3.84	3.83
P / Ti	0.19	0.18	0.17	0.21	0.40	0.36	0.16	0.16
Normalized by K atom								
Si / K	33.14	28.52	34.61	28.12	16.79	16.47	47.24	56.68
Ti / K	0.93	0.63	0.80	0.52	0.44	0.38	1.12	1.48
Al / K	13.36	10.54	13.04	10.05	7.31	7.00	17.44	22.65
Fe^{3+} / K	1.86	1.74	2.06	0.94	0.78	0.55	1.83	3.14
Fe^{2+} / K	4.82	3.06	4.12	3.58	2.13	1.90	6.74	8.96
Mn / K	0.11	0.08	0.09	0.08	0.07	0.07	0.13	0.22
Mg / K	5.75	4.74	5.80	4.29	2.61	2.17	8.23	11.17
Ca / K	7.05	4.97	6.25	4.62	3.05	2.85	9.97	11.52
Na / K	4.04	3.31	3.56	3.00	2.39	2.30	4.31	5.68
P / K	0.18	0.12	0.14	0.11	0.18	0.14	0.18	0.24
Normalized by P atom								
Si / P	186.78	245.80	254.19	252.51	93.84	120.53	262.99	232.40
Ti / P	5.24	5.44	5.85	4.65	2.48	2.81	6.26	6.08
Al / P	75.29	90.86	95.75	90.19	40.87	51.19	97.06	92.87
Fe^{3+} / P	10.46	14.96	15.14	8.42	4.39	4.01	10.16	12.88
Fe^{2+} / P	27.17	26.39	30.25	32.12	11.93	13.92	37.52	36.72
Mn / P	0.61	0.68	0.63	0.76	0.37	0.54	0.70	0.92
Mg / P	32.42	40.84	42.62	38.51	14.60	15.90	45.84	45.80
Ca / p	39.75	42.87	45.92	41.45	17.04	20.84	55.50	47.25
K / P	5.64	8.62	7.34	8.98	5.59	7.32	5.57	4.10
Na / P	22.75	28.48	26.14	26.93	13.37	16.84	23.99	23.28

	TB 35	TB 36	TB 37	TB 38-1	TB 38-2	TB 39	TB 40	TB 41
Normalized by Ti atom								
Si / Ti	30.15	29.65	29.40	29.01	28.64	28.21	38.50	28.99
Al / Ti	12.28	11.83	11.83	11.71	11.71	11.52	15.06	11.57
Fe^{3+} / Ti	2.06	2.95	1.11	2.05	1.17	1.34	2.78	1.15
Fe^{2+} / Ti	4.30	3.66	4.72	4.29	4.74	4.64	4.86	4.61
Mn / Ti	0.10	0.12	0.08	0.11	0.10	0.09	0.17	0.09
Mg / Ti	5.48	5.38	5.46	5.70	4.25	4.08	8.26	5.08
Ca / Ti	6.00	5.84	5.78	5.69	6.04	5.94	7.92	5.67
K / Ti	0.74	0.79	0.66	0.78	0.62	0.66	1.10	0.68
Na / Ti	3.09	3.20	3.61	3.20	3.66	3.49	4.41	3.10
P / Ti	0.18	0.18	0.17	0.18	0.17	0.18	0.26	0.17
Normalized by K atom								
Si / K	40.84	37.35	44.43	37.26	45.83	42.68	34.88	42.35
Ti / K	1.35	1.26	1.51	1.28	1.60	1.51	0.91	1.46
Al / K	16.63	14.90	17.88	15.03	18.74	17.43	13.64	16.90
Fe^{3+} / K	2.79	3.72	1.67	2.63	1.87	2.03	2.52	1.68
Fe^{2+} / K	5.83	4.61	7.14	5.51	7.58	7.01	4.40	6.74
Mn / K	0.13	0.16	0.12	0.14	0.16	0.14	0.16	0.13
Mg / K	7.42	6.78	8.25	7.32	6.80	6.18	7.48	7.43
Ca / K	8.13	7.35	8.74	7.30	9.67	8.99	7.18	8.28
Na / K	4.19	4.04	5.45	4.11	5.86	5.29	3.99	4.53
P / K	0.24	0.22	0.26	0.23	0.28	0.27	0.24	0.25
Normalized by P atom								
Si / P	170.10	168.86	171.29	163.95	165.76	160.81	148.18	167.71
Ti / P	5.64	5.70	5.83	5.65	5.79	5.70	3.85	5.71
Al / P	69.26	67.36	68.94	66.12	67.79	65.67	57.96	66.93
Fe^{3+} / P	11.60	16.81	6.46	11.58	6.78	7.63	10.69	6.65
Fe^{2+} / P	24.28	20.86	27.51	24.23	27.41	26.43	18.69	26.69
Mn / P	0.56	0.71	0.47	0.60	0.57	0.53	0.67	0.51
Mg / P	30.91	30.66	31.79	32.21	24.60	23.28	31.78	29.42
Ca / p	33.86	33.24	33.68	32.13	34.97	33.86	30.50	32.79
K / P	4.16	4.52	3.85	4.40	3.62	3.77	4.25	3.96
Na / P	17.44	18.25	21.01	18.09	21.21	19.91	16.97	17.92

	TB 42	TB 43	TB 44	TB 45	TB 46	TB 47	TB 48	TB 49	TB 50
Normalized by Ti atom									
Si / Ti	46.86	41.44	38.25	55.28	43.98	40.97	40.55	38.71	36.44
Al / Ti	19.28	15.67	15.97	20.39	17.12	16.34	16.16	16.37	15.31
Fe^{3+} / Ti	2.21	3.05	2.36	1.85	2.07	1.81	1.98	2.05	3.38
Fe^{2+} / Ti	7.39	5.37	5.07	7.30	6.52	6.22	5.98	4.901	3.46
Mn / Ti	0.15	0.13	0.12	0.15	0.13	0.13	0.12	0.11	0.12
Mg / Ti	12.37	11.09	9.16	8.22	9.44	8.99	8.64	7.86	8.89
Ca / Ti	10.27	7.82	8.02	9.57	8.76	8.27	8.28	7.68	7.67
K / Ti	1.09	0.74	1.31	1.75	0.85	0.57	0.67	1.81	1.40
Na / Ti	4.45	3.69	4.12	4.91	4.18	4.00	3.51	4.31	3.70
P / Ti	0.20	0.21	0.28	0.18	0.16	0.13	0.15	0.34	0.26
Normalized by K atom									
Si / K	43.18	55.95	29.20	31.61	51.50	72.03	60.89	21.42	26.11
Ti / K	0.92	1.35	0.76	0.57	1.17	1.76	1.50	0.55	0.72
Al / K	17.77	21.16	12.19	11.66	20.05	28.73	24.27	9.06	10.97
Fe^{3+} / K	2.04	4.12	1.80	1.06	2.42	3.18	2.97	1.14	2.42
Fe^{2+} / K	6.81	7.25	3.87	4.18	7.63	10.93	8.98	2.71	2.48
Mn / K	0.14	0.17	0.09	0.09	0.15	0.23	0.19	0.06	0.08
Mg / K	11.40	14.97	6.99	4.70	11.05	15.80	12.98	4.34	6.37
Ca / K	9.46	10.55	6.12	5.47	10.25	14.54	12.44	4.25	5.49
Na / K	4.11	4.98	3.15	2.81	4.90	7.04	5.27	2.39	2.65
P / K	0.18	0.28	0.22	0.11	0.18	0.23	0.22	0.19	0.19
Normalized by P atom									
Si / P	235.84	200.54	135.12	299.48	280.84	308.39	279.61	115.52	138.22
Ti / P	5.03	4.84	3.53	5.42	6.39	7.53	6.90	2.98	3.79
Al / P	97.03	75.83	56.41	110.48	109.35	123.00	111.43	48.86	58.08
Fe^{3+} / P	11.15	14.77	8.34	10.03	13.20	13.61	13.63	6.13	12.84
Fe^{2+} / P	37.20	25.98	17.92	39.57	41.61	46.78	41.25	14.64	13.13
Mn / P	0.75	0.62	0.43	0.81	0.81	1.00	0.86	0.34	0.44
Mg / P	62.27	53.66	32.36	44.53	60.26	67.63	59.60	23.45	33.72
Ca / p	51.67	37.83	28.32	51.84	55.91	62.27	57.13	22.93	29.08
K / P	5.46	3.58	4.63	9.47	5.45	4.28	4.59	5.39	5.29
Na / P	22.42	17.84	14.56	26.62	26.71	30.13	24.21	12.87	14.02

CURRICULUM VITAE

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