

163-990A-1R-02 (Piece 10, 51-56 cm)

OBSERVER: LOT

WHERE SAMPLED: Clast in Eocene? conglomerate.

ROCK NAME: Altered gabbro.

GRAIN SIZE: 1-3 mm

TEXTURE: Gabbroic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
Plagioclase		45	1-3.0	Tabular.	Zoned crystals.	
Clinopyroxene		30	0.5-2.0		Subhedral to anhedral.	
Oxide		5	0.5-1.0		Anhedral.	With trellis lamellae of ilmenite.
Mesostasis		20	0.5-1.0			
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Sericite	30	Replacing plagioclase.				Plagioclase most altered in centers of grains.
Clay	10	Replacing clinopyroxene.				Mostly along grain margins.
Carbonate	2	In mesostasis.				
Chlorite	10	In mesostasis.				
Amphibole	10	?				Pale green, actinolitic.
Sphene	4	Replacing titanomagnetite.				Trellis lamellae of ilmenite preserved.
White mica	1	Replacing plagioclase.				

COMMENTS: A highly altered rock, probably of basement origin.

163-990A-5R-04 (Piece 2, 52-53 cm)

OBSERVER: DAY

WHERE SAMPLED: Unit I

ROCK NAME: Moderately magnetite-plagioclase-clinopyroxene-phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, intergranular, glomerocrystic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1.5	1.5	0.5-1		Subhedral, tabular.	Many are heavily resorbed, strongly zoned and contain melt inclusions.
Clinopyroxene	0.4	0.4	0.2-0.8	Augite.	Anhedral.	Fractured.
Fe-Ti oxide	4.7	4.7	0.05-0.5	Magnetite/ Ti-magnetite.	Anhedral to euhedral.	Appear to form phenocrysts, in terms of size. Show exsolution as cross-hatched lamellae of ilmenite.
GROUNDMASS						
Plagioclase	46.9	46.9	0.1-0.2		Laths.	
Clinopyroxene	33.0	33.0	0.05-0.1	Augite.	Anhedral, equant.	
Olivine	0	0.8	0.1		Subhedral.	Due to complete alteration, it is difficult to distinguish olivine pseudomorphs.
Mesostasis	0	12.7				50% is replaced by brown clays.
SECONDARY MINERALOGY	PERCENT	REPLACING/ FILLING				COMMENTS
Clays	15.5	Mesostasis and olivine.				Rare blebs of native copper.
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	0.2		3	Massive brown clay and native copper.	Spherical.	Has a 0.1 mm rim of Fe-rich mesostasis.

COMMENTS: Rock is moderately altered. This is an intergranular basalt. Plagioclase and augite phenocrysts are usually associated in glomerocrysts. Mode estimated by counting 1000 points.

SITE 990

163-990A-6R-01 (Piece 2C, 50-51 cm)

OBSERVER: DAY

WHERE SAMPLED: Unit 1

ROCK NAME: Moderately plagioclase-clinopyroxene phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, intergranular.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	3	3	0.6-2.0		Subhedral.	Commonly clustered into glomerocrysts. Frequently strongly zoned and show resorption and overgrowth. Partly altered to brown clays along fractures, rims and melt inclusions.
Clinopyroxene	0.1	0.1	0.2-0.5		Anhedral.	
GROUNDMASS						
Plagioclase	40	40	0.05-0.15		Laths.	
Clinopyroxene	33	33	0.02-0.06		Equant.	Intergranular between plagioclase.
Olivine	0	5			Subhedral.	Replaced by brown clays and iron oxyhydroxides.
Fe-Ti oxides	4	4	0.05-0.2	Magnetite.	Anhedral to euhedral.	Commonly interstitial, rare skeletal grains. Some exsolution textures.
Mesostasis	0	10				Mostly replaced by green clays.
SECONDARY MINERALOGY						
	PERCENT	REPLACING/ FILLING				COMMENTS
Clays	10	Mesostasis.				Minor iron oxyhydroxides (~1%).
Clays	5	Olivine.				Very crude estimate; alteration precludes an accurate assessment.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	<1		0.6	None. Thin lining of brown clay.	Spherical.	Filling removed during preparation(?).

COMMENTS: Rock is moderately altered.

163-990A-6R-02 (Piece 2A, 39-40 cm)

OBSERVER: DAY

WHERE SAMPLED: Unit 2

ROCK NAME: Sparsely plagioclase-clinopyroxene phyric basalt.

GRAIN SIZE: Microcrystalline.

TEXTURE: Intergranular, subophitic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	<2	<2	< 3		Anhedral.	Several large tabular crystals are the only phenocrysts.
Clinopyroxene	<1	<1	< 1.2	Augite.	Subhedral, equant.	Subophitic with plagioclase.
GROUNDMASS						
Plagioclase	25	45	< 1.2		Subhedral, acicular, Laths.	Intergranular with clinopyroxene. Partially to strongly altered to clay minerals.
Clinopyroxene	20	40	< 0.4		Anhedral, subhedral.	Intergranular with plagioclase. Partially to strongly altered to clay minerals and iron oxyhydroxides.
Olivine	tr					
Magnetite	5	5	< 0.8		Euhedral, subhedral, Skeletal.	Ferric oxide rims.
Mesostasis	0	8				
SECONDARY MINERALOGY						
	PERCENT	REPLACING/ FILLING				COMMENTS
Clay	~35	Mesostasis and silicates.				Dark yellow to brownish patches with "polygon" shape of variable sizes distributed unevenly through much of the thin-section, which may be highly devitrified basaltic glass.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	22		up to 20	Open, or with brown/green linings/fill.	Irregular.	A large irregular-shaped "void" goes through much of the thin section. Large (0.5 mm) speck of native copper at rim of cavity.

COMMENTS: Rock is moderately altered. There is no clear size division (seriate texture) for the plagioclase crystals, although several large plagioclase crystals are considered as phenocrysts. No zoning is observed in the plagioclase crystals.

163-990A-9R-02 (Piece 5A, 86-90 cm)

OBSERVER: DUN

WHERE SAMPLED: Banded part of Unit 2.

ROCK NAME: Highly plagioclase-olivine phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Intergranular, glomeroporphyritic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	0	<1	1-2		Euhedral.	Rare, euhedral pseudomorphs, now replaced by clays.
Plagioclase	10	10	0.5-1	An40-45.	Tabular, subhedral.	Slightly rounded, partially resolved, occasionally zoned; trains of fine melt inclusions; fractured.
GROUNDMASS						
Plagioclase	28	30	0.1-.2		Lath-like.	Diverse, locally flow-aligned.
Clinopyroxene	22	25	0.1-.2		Granular.	Fresh to partially altered bands with common ferric staining.
Fe-Ti oxide	5	5	0.2	Magnetite.	Subhedral.	Intergranular, with clinopyroxene. Exsolution lamellae.
Mesostasis	0	30			Intersertal.	Devitrified and replaced with clays and iron oxyhydroxides; segregated into bands.
SECONDARY MINERALOGY						
Clays	<1	REPLACING/ FILLING Olivine.				COMMENTS
Clays	30	Mesostasis.				

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	1		up to 3	Brown clay linings, fill.	Spherical.	Blebs of native copper.

COMMENTS: Rock is moderately altered. Vague flow-banding defined by local segregations of mesostasis and alignment of groundmass plagioclase.

163-990A-10R-01 (Piece 2, 6-9 cm)

OBSERVER: ARN

WHERE SAMPLED: Unit 2, banded section.

ROCK NAME: Highly plagioclase-olivine phyric basalt.

GRAIN SIZE: Large phenocrysts in microcrystalline groundmass.

TEXTURE: Glomeroporphyritic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	10	10	0.1-3.0		Subhedral.	Glomerophytic; clusters of distorted, highly zoned grains; clay-filled fractures.
Olivine	0	<1	0.8		Euhedral.	One large grain altered to almost black clay.
GROUNDMASS						
Plagioclase	40	45	0.1-0.2		Subhedral laths.	Stained by oxides.
Clinopyroxene	20	25	0.1		Anhedral equant.	Slight alteration to clay.
Iron oxides	3-5	3-5	0.1-0.2		Equant skeletal.	Surrounded by zones of red staining.
Mesostasis	0	12				
SECONDARY MINERALOGY						
Clay	25	REPLACING/ FILLING Mesostasis, olivine.				COMMENTS
Copper	<1	In mesostasis.				Fills fractures in plagioclase.
VESICLES/ CAVITIES						
Vesicles			SIZE (mm)	FILLING	SHAPE	COMMENTS
						Several holes in the thin section could have been vesicles.

COMMENTS: Rock is moderately altered. Some plagioclase "phenocrysts" are probably xenocrysts. There are at least two generations; rounded, unzoned cores are overgrown by strongly zoned subhedral grains. All grains are fractured, many are bent. The bands are concentrations of mesostasis (up to 40%). Inclined and subvertical bands are more diffuse but are similar in character to the horizontal bands.

SITE 990

163-990A-13R-01 (Piece 5C, 78-80 cm)

OBSERVER: DAM

WHERE SAMPLED: Altered top of Unit 3A.

ROCK NAME: Highly altered, vesicular, brecciated flow top.

GRAIN SIZE: Fine-grained.

TEXTURE: Brecciated.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	0	3?	0.1-0.4		Subhedral.	Totally altered to clay and iron oxyhydroxides.
Clinopyroxene	2	3?	0.1-0.5	Augite.	Equant.	Partly altered to clay.
GROUNDMASS						
Groundmass	0	90?				The groundmass is completely altered to brown-white clay minerals and iron oxyhydroxides. Proportion of minerals are therefore unknown.
SECONDARY MINERALOGY						
Clays	PERCENT 90	REPLACING/ FILLING Everything.				COMMENTS Brown-white clays (with iron oxyhydroxides) completely replace all phases except traces of clinopyroxene.
VESICLES/CAVITIES						
Vesicles	PERCENT 30	LOCATION	SIZE (mm) up to 8	FILLING Open or blue clay.	SHAPE Irregular	COMMENTS Discontinuous blue clay margins on some vesicles.

COMMENTS: Rock comprises a breccia of angular basaltic clasts (up to 10 mm) in a matrix of brown clay. Clasts are highly altered, but retain some igneous textures with clay pseudomorphs after augite and plagioclase (~50%).

163-990A-13R-02 (Piece 10A, 86-88 cm)

OBSERVER: DAY

WHERE SAMPLED: Unit 3.

ROCK NAME: Moderately plagioclase-clinopyroxene-olivine phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: No primary texture preserved.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	0	~2	up to 1		Subhedral, anhedral.	Completely altered with pseudomorphs seen locally as glomerocrysts.
Clinopyroxene	< 1	< 1	up to 0.4		Subhedral, anhedral.	Variably altered, remnants seen as parts of glomerocrysts with plagioclase.
Olivine	0	Tr?				
GROUNDMASS						
Clinopyroxene	< 2	30?	up to 0.2		Euhedral, subhedral.	Disseminated throughout the thin section.
Plagioclase	~ 10	~40?	up to 0.2		Subhedral, skeletal.	Partially or completely altered with recognizable pseudomorphs.
SECONDARY MINERALOGY						
Clays	PERCENT 90	REPLACING/ FILLING				COMMENTS Yellowish-brownish-whitish clays mixed with oxides/hydroxides replacing almost everything in the rock except for groundmass clinopyroxene.
VESICLES/CAVITIES						
Vesicles	PERCENT	LOCATION In the rock.	SIZE (mm) up to 3	FILLING Open.	SHAPE Irregular.	COMMENTS The irregular shapes may result from leaching of existing vesicles during alteration.

COMMENTS: The rock is very highly altered, with everything replaced with clays or oxides/hydroxides except for groundmass clinopyroxene grains.

163-990A-13R-03 (Piece 10, 109-110 cm)

OBSERVER: JFA

WHERE SAMPLED: Unit 3A.

ROCK NAME: Highly plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Microcrystalline.

TEXTURE: Glomeroporphyritic, seriate, nearly holocrystalline.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	10-15	10-15	to 2		Euhedral blocky to subhedral elongate.	Larger crystals more blocky and euhedral in shape with alteration developed at cracks and grain edges. Alteration in interior may represent alteration of resorbed plagioclase. Both kinds commonly in glomerocrysts with clinopyroxene.
Olivine	0	7	to 1		Euhedral.	Altered to greenish clays and iron oxyhydroxides with skirt of fine magnetite on margins-resorption before alteration(?). Sector zoning common; 2V=55 degrees, positive; wide range in sizes.
Clinopyroxene	2-3	2-3	to 1.2	Augite.	Euhedral to anhedral.	
GROUNDMASS						
Clinopyroxene	35-40	35-40	< 0.01		Anhedral.	Most are fresh, but a small proportion is altered.
Plagioclase	25-30	25-3	<0.2		Elongate, skeletal.	Seriate in nature.
Magnetite	3-5	3-5	to 0.03		Euhedral to Subhedral.	Unusually large amount of oxide phase. Some grains appear to have a surface tarnish-slight alteration(?).
Mesostasis	0	10				Unclear if this represents altered olivine, clinopyroxene, or quenched mesostasis.
SECONDARY MINERALOGY						
Clays	PERCENT 20-25	REPLACING/ FILLING Vesicles, olivine, plagioclase.				COMMENTS Replaces mesostasis as well.
VESICLES/ CAVITIES						
Vesicles	PERCENT 5-7	LOCATION Patchily throughout.	SIZE (mm) to 2	FILLING Greenish brown clays.	SHAPE Irregular.	COMMENTS Notably asymmetric in shape.

COMMENTS: Groundmass is very finely crystalline. Rock is moderately altered.

163-990A-14R-02 (Piece 6B, 105-106 cm)

OBSERVER: DAY

WHERE SAMPLED: In Unit 3A

ROCK NAME: Highly plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Fine, microcrystalline.

TEXTURE: Glomeroporphyritic, seriate.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	12-14	12-14	up to 3		Anhedral to subhedral.	Commonly form glomerocrysts of deformed (bent/kinked), resorbed stubby grains. Some grains are strongly concentrically zoned. Some clay alteration along fractures. Melt inclusions altered to brown clay.
Olivine	0	2-4	up to 1		Anhedral to euhedral.	Almost completely altered to reddish/brownish clays and iron hydroxides. Some olivines include plagioclase chadacrysts.
Clinopyroxene	1	1	up to 1	Augite.	Anhedral to subhedral.	Some form subophitic intergrowth with plagioclase laths.
GROUNDMASS						
Plagioclase	40	40	up to 0.3		Subhedral laths.	Commonly as individual laths in seriate texture.
Clinopyroxene	35	40	up to 0.2		Equant, subhedral to anhedral.	Intergranular. Some altered brown clay and/or iron hydroxides along grain boundaries.
Fe-Ti oxides	2-3	1-2	up to 0.05	Magnetite.	Anhedral, interstitial.	Appears to represent both interstitial crystallization products and secondary alteration. Some show exsolution lamellae.
Mesostasis	0	5			Irregular.	Altered to brown clay and/or iron oxyhydroxides.
SECONDARY MINERALOGY						
Clays	PERCENT 15	REPLACING/ FILLING Mesostasis, olivine, and partly augite.				COMMENTS Reddish and brownish clays and hydroxides.
VESICLES/ CAVITIES						
Vesicles	PERCENT 1-2	LOCATION	SIZE (mm) 8	FILLING Open.	SHAPE Subrounded.	COMMENTS One big vesicle, or plucking during preparation(?), in section.

COMMENTS: Rock is moderately altered. Groundmass is fine and nearly or completely holocrystalline. Plagioclase phenocrysts seem to have experienced some deformation, i.e. they may represent xenocrysts or deformed cumulates.

SITE 990

163-990A-16R-01 (Piece 1B, 17-18 cm)

OBSERVER: DAY

WHERE SAMPLED: Altered flow top of Unit 4.

ROCK NAME: Highly plagioclase-clinopyroxene-olivine phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, intergranular, intersertal.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	6	7	1-2.5	Augite.	Subhedral laths.	Fractured and partially altered.
Clinopyroxene	1.5	2	up to 0.5		Subhedral, equant.	Partly altered to clays along rims.
Olivine	0	2	up to 0.2		Euhedral to rounded.	Totally altered to brown clays and iron oxyhydroxides.
GROUNDMASS						
Plagioclase	10	45?	up to 0.5	Magnetite (?).	Laths.	Seriate. Partly altered along margins to clay and iron oxyhydroxides.
Clinopyroxene	10	40?	up to 0.1		Equant.	Partly to totally altered to clays and iron oxyhydroxides.
Olivine	0	5?	up to 0.1		?	Completely altered to clays and iron oxyhydroxides.
Fe-Ti oxides	1	2	up to 0.05			Rims of iron oxyhydroxides. Most are altered.
Mesostasis	0	10?				Totally altered and highly oxidized (stained red).
SECONDARY MINERALOGY		REPLACING/ FILLING		COMMENTS		
Clays	70	Silicates and mesostasis.		Ubiquitous throughout sample.		
Iron oxyhydroxides	?	Silicates and oxides.				
VESICLES/ CAVITIES						
Vesicles	10	Disseminated.	SIZE (mm) up to 3	FILLING Open or clay lined/filled.	SHAPE Subspherical.	COMMENTS Filling of massive clay appears to be plucked out during preparation. Remnants have thin concentric lining with massive interior.

COMMENTS: Highly altered rock from flow top. Fragmental with patches of contrasting textures. One patch (1 cm across) has relatively large plagioclase laths. Grain size is highly variable (seriate texture). Cross-cut by a (0.5 mm) thin clay and iron oxyhydroxide vein. Opaque, red halo around large vesicle on one edge of section.

163-990A-16R-03 (Piece 5, 109-110 cm)

OBSERVER: DAY

WHERE SAMPLED: Unit 4

ROCK NAME: Moderately plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Fine-grained, microcrystalline.

TEXTURE: Glomeroporphyritic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	3	3	< 2.4		Subhedral, euhedral.	As individual laths/aggregates, or as glomerocrysts with clinopyroxene. Partially altered to brown clay.
Olivine	0	<1	< 1.3		Euhedral, subhedral.	Completely altered to reddish/brownish clays (oxide/hydroxides?).
Clinopyroxene	0.5	0.5	< 0.7		Subhedral, equant.	As glomerocrysts with plagioclase, or as individual grains.
GROUNDMASS						
Plagioclase	35	40	< 1.2	Magnetite	Subhedral, acicular.	As individual laths, or as spherulitic aggregates with clinopyroxene.
Clinopyroxene	30	35	< 0.8		Anhedral, Equant.	As individual grains, or aggregates with plagioclase.
Olivine	0	2	< 0.4		Anhedral, irregular.	Completely altered to reddish/brownish shapes clay and intergrown oxyhydroxides.
Magnetite	2	2	< 0.08		Subhedral, anhedral, skeletal.	
Mesostasis	0	7				Patchy distribution. Altered to brown clay.
SECONDARY MINERALOGY		REPLACING/ FILLING		COMMENTS		
Clays	20	Mesostasis, olivine, and plagioclase.		Brownish-yellowish, may come from devitrified glass(?).		
VESICLES/ CAVITIES						
Vesicles	25	In the rock.	SIZE (mm) < 6	FILLING Open, gray clay rims, brown clay filling.	SHAPE Subspherical.	COMMENTS Blebs of native copper.

COMMENTS: Rock is moderately altered. Olivine, both phenocrysts and ground mass, shows good pseudomorphs, and has zoned alteration patterns with reddish cores and yellowish rims. Large grains of magnetite show clear exsolution patterns.

163-990A-17R-04 (Piece 1A, 5-6 cm)

OBSERVER: DAY

WHERE SAMPLED: Unit 5.

ROCK NAME: Moderately plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Glomeroporphyritic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	5	5	< 2.8		Euhedral, subhedral, anhedral.	As individual grains, or as glomerocrysts together with clinopyroxene. Commonly have rims of fine-grained groundmass.
Clinopyroxene	2	2	< 1.4		Subhedral, anhedral.	As individual grains or as glomerocrysts together with plagioclase.
Olivine	0	3	< 1.5		Anhedral, skeletal.	Completely altered to oxides/hydroxides or replaced by clays.
GROUNDMASS						
Plagioclase	35	40	< 1.2		Quench needles or acicular.	Commonly as individual grains, but some as spherulitic aggregates with clinopyroxene.
Clinopyroxene	30	30	< 0.4		Anhedral, equant.	Individually, or as aggregates with plagioclase, spherulitic or subophitic.
Olivine	0	5	< 0.4		Euhedral, subhedral, anhedral.	All completely altered to brown clay and trace of native copper. Pseudomorphs are often well-developed.
Magnetite	2	2	< 0.08		Subhedral, anhedral, skeletal.	
Mesostasis	0	13				
SECONDARY MINERALOGY						
Clays	PERCENT 25	REPLACING/ FILLING Mesostasis, olivine, plagioclase.				COMMENTS Also some oxides, iron oxyhydroxides and minor native copper.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	<0.5	In the rock.				Almost none in this thin section.

COMMENTS: Rock is moderately altered. All olivine grains, both phenocrysts and microlites in ground mass, are completely altered. Pseudomorphs are preserved. Some mesostasis consists of mixture of fine-grained magnetite and brownish clay.

163-990A-17R-06 (Piece 14B, 121-122 cm)

OBSERVER: DAM

WHERE SAMPLED: In vesicular, layered flow top of Unit 5.

ROCK NAME: Plagioclase-clinopyroxene-olivine? phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, breccia.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace	?	?	?		Almost totally altered.
Clinopyroxene	1	?	?	?		Highly altered.
GROUNDMASS						
Plagioclase	Trace	?	?			Pseudomorphically replaced by brown clays.
Clinopyroxene	Trace	?	?			Almost totally replaced by brown clays.
Fe-Ti oxides	<1	?				Rims of clay and iron oxyhydroxides.
Mesostasis, olivine	0	?				Totally replaced by clays.
SECONDARY MINERALOGY						
Clays	PERCENT 98	REPLACING/ FILLING Everything.				COMMENTS All of rock extensively recrystallized to clay minerals.
VESICLES/ CAVITIES						
Vesicles	PERCENT 15-20	LOCATION Throughout.	SIZE (mm) up to 6	FILLING Open.	SHAPE Irregular.	COMMENTS Blue clay lining.

COMMENTS: Fine-grained basalt with porphyritic and intersertal texture. Very highly to totally altered to clay minerals. Subdivided into 5-mm blocks by desiccation cracks. Plagioclase pseudomorphed by white clay. Represents a near-totally altered flow top.

SITE 990

163-990A-18R-04 (Piece 1C, 62-63 cm)

OBSERVER: DAY

WHERE SAMPLED: In Unit 6.

ROCK NAME: Sparsely plagioclase-clinopyroxene-phyric olivine basalt.

GRAIN SIZE: Fine, microcrystalline.

TEXTURE: Porphyritic, seriate, intergranular.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1-2	1-2	up to 2		Anhedral to subhedral laths.	Some are strongly concentrically zoned. Commonly fractured. Altered to brownish clays along fractures.
Clinopyroxene	0.5-1	0.5-1	up to 0.5	Augite.	Subhedral, equant.	
GROUNDMASS						
Plagioclase	40	48	up to 0.4		Subhedral laths.	Some skeletal grains. Slightly altered to greenish clays. Most grains are 0.1 to 0.2 mm.
Clinopyroxene	40	42	up to 0.1		Anhedral, equant.	Partly altered to greenish clays.
Olivine	0	4	up to 0.2		Subhedral.	Due to total alteration of mesostasis, it is difficult to distinguish olivine pseudomorphs from clay-filled vesicles.
Fe-Ti oxides	1-2	1-2	up to 0.05	Magnetite.	Anhedral.	Interstitial to the silicates.
Mesostasis	0	4				Totally altered interstitial material with trace of native copper.
SECONDARY MINERALOGY						
Clays	PERCENT 18	REPLACING/ FILLING				COMMENTS Mesostasis, olivine, partly plagioclase.
VESICLES/CAVITIES						
Vesicles	PERCENT 10-12	LOCATION Random.	SIZE (mm) up to 6	FILLING Open or clay filled.	SHAPE Subrounded.	COMMENTS Vesicles larger than 1 mm are open. Smaller vesicles have a more irregular shape and are filled with brownish clays.

COMMENTS: Rock is moderately altered. Alteration is most intense within discontinuous wisps of mesostasis-rich groundmass, and surrounding vesicles. Rock is described as plagioclase-clinopyroxene-phyric olivine basalt because olivine microphenocrysts are significant in the groundmass. Cross-cut by two fine (0.1 mm) brown clay veins.

163-990A-19R-01 (Piece 8, 68-70 cm)

OBSERVER: DAM

WHERE SAMPLED: Altered top of Unit 7.

ROCK NAME: Moderately plagioclase-olivine phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Glomeroporphyritic, intersertal, variolitic(?)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	3	7	up to 2.5		Laths?	Highly altered (clay and iron oxyhydroxides), leaving irregular, rounded unaltered cores.
Olivine	0	2?	up to 0.4?		?	Totally altered to clays and iron oxyhydroxides.
GROUNDMASS						
Plagioclase	4	45?	up to 0.2		Laths?	Highly altered to clays.
Clinopyroxene	20	35?	up to 0.1		Equant.	Partly altered to brown clays.
Olivine	0	??	?	?		Totally altered.
Fe-Ti oxide	1	1	up to 0.05	Magnetite?	Anhedral.	Rims of iron oxyhydroxides.
Mesostasis	0	?				Totally altered.
SECONDARY MINERALOGY						
Clays	PERCENT 65	REPLACING/ FILLING				COMMENTS Brown clay with iron oxyhydroxides.
Zeolites	5	Silicates, zeolites, and mesostasis. Vesicles.				
VESICLES/CAVITIES						
Vesicles	PERCENT 30	LOCATION	SIZE (mm) up to 4	FILLING Clay or zeolite.	SHAPE Irregular to subspherical.	COMMENTS Clay lined with either massive clay filling or filled by platy zeolite.

COMMENTS: Highly altered, vesicular flow top.

163-990A-19R-04 (Piece 6, 106-107 cm)

OBSERVER: JFA

WHERE SAMPLED: Unit 7.

ROCK NAME: Moderately olivine-clinopyroxene-plagioclase phyric basalt.

GRAIN SIZE: Microcrystalline.

TEXTURE: Porphyritic, holocrystalline.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	0	3-5	to 0.2		Euhedral.	Totally altered to green clays, sometimes with red oxide staining. These are most appropriately called microphenocrysts.
Clinopyroxene Plagioclase	Trace Trace	Trace Trace	0.4 up to 0.4		Euhedral. Subhedral.	Single large crystal in clinopyroxene-plagioclase clot. Few slightly larger crystals.
GROUNDMASS						
Plagioclase	30	40-45	to 0.35		Elongate skeletal.	Partially altered to green clays. Sometimes forms rare crystal clots with clinopyroxene.
Clinopyroxene	30	45-50	to 0.2 mm		Anhedral.	Partially altered to green clays, perhaps a little more than the plagioclase.
Magnetite	3	3	to 0.1		Skeletal.	Abundant.
SECONDARY MINERALOGY						
Green Clay	PERCENT 30-40	REPLACING/ FILLING Clinopyroxene, plagioclase, olivine.				COMMENTS Patchily distributed throughout rock. Contains some reddish ferric iron staining and iron oxyhydroxides.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
None						

COMMENTS: Rock was described in hand specimen as an aphyric olivine basalt, appropriate because of the small size of the olivine microphenocrysts. Groundmass is remarkably holocrystalline. Rock is moderately altered and remarkably lacking in vesicles.

163-990A-20R-02 (Piece 1, 38-39 cm)

OBSERVER: DAY

WHERE SAMPLED: Altered top of flow Unit 8

ROCK NAME: Highly plagioclase-clinopyroxene-olivine phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, seriate, intergranular.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	6	8	up to 3		Subhedral laths.	Altered along margins and fractures.
Clinopyroxene	1	1	up to 1		Subhedral, equant.	
Olivine	0	3	up to 1.5		Subhedral, rounded.	Pseudomorphed by clay minerals and iron oxyhydroxides.
GROUNDMASS						
Plagioclase	40	45	up to 0.4		Laths.	Partly altered along grain boundaries to clays and iron oxyhydroxides.
Clinopyroxene	30	32	up to 0.2		Equant.	Ferric iron-staining along margins.
Olivine	0	4	up to 0.3		Subhedral, rounded.	Totally altered to clays and iron oxyhydroxides.
Fe-Ti oxides	2	2	up to 0.05		Anhedral to skeletal.	Rims of iron oxyhydroxides.
Mesostasis	0	18				Totally altered.
SECONDARY MINERALOGY						
Clays	PERCENT 35	REPLACING/ FILLING Mesostasis, olivine, partly plagioclase.				COMMENTS Clays and iron oxyhydroxides.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	25	Random.	up to 7	Open.	Irregular.	Brown clay lining.

COMMENTS: Moderately to highly altered, oxidized vesicular flow top.

SITE 990

163-990A-20R-04 (Piece 1A, 19-20 cm)

OBSERVER: FIT

WHERE SAMPLED: Center of Unit 8.

ROCK NAME: Highly plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Fine- to medium -grained (up to 1.5 mm).

TEXTURE: Intergranular, subophitic.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	10	10	4		Subhedral, tabular.	Some in glomerophyric clusters
Olivine	0	<1	1		Euhedral, equant.	Completely altered.
Augite	<1	<1	1		Anhedral.	In glomerocrysts with plagioclase.
GROUNDMASS						
Plagioclase	36	40	to 1.5		Laths.	Partially altered to brown clays along fractures.
Clinopyroxene	36	38	to 1.5	Augite.	Oikocrysts.	Encloses plagioclase laths.
Olivine	0	1	<0.5		Subhedral.	Completely altered.
Fe-Ti oxides	3	3	to 0.2	Magnetite.	Subhedral to skeletal.	Common rims of iron oxyhydroxides.
Mesostasis	0	16	to 0.5		Interstitial.	Completely altered to green-brown clay and iron oxyhydroxides.
SECONDARY MINERALOGY						
	PERCENT	REPLACING/ FILLING				COMMENTS
Clays	24	Mesostasis, olivines and plagioclase.				
Clays	1	Lining vesicles.				

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	5		to 5	Clay-lined.	Rounded.	

COMMENTS: Rock is moderately altered.

163-990A-21R-04 (Piece 5, 115-116 cm)

OBSERVER: ARN

WHERE SAMPLED: Unit 9.

ROCK NAME: Sparsely plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Intergranular to intersertal.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Olivine	0	<1	up to 0.5		Euhedral.	Altered to iron oxyhydroxides, oxides and clay.
Plagioclase	<1	<1	up to 1.0		Anhedral.	Sparse grains with irregular margins, little larger than groundmass plagioclase grains, but classed as phenocrysts because textural relationships with surrounding grains indicate that they crystallized early.
Clinopyroxene	<1	<1		Augite.	Subhedral, equant.	Sparse fractured grains; little zoning.
GROUNDMASS						
Plagioclase	40	45	up to 0.8		Euhedral, elongate laths.	
Clinopyroxene	30	32	up to 0.4	Augite.	Anhedral, equant.	Colorless, moderately zoned.
Olivine	0	1-3	up to 0.3		Euhedral.	Replaced by iron oxyhydroxides, oxides and clays.
Magnetite	1-3	1-3	up to 0.1		Subhedral to anhedral.	Non-skeletal to highly skeletal.
Mesostasis	0	15				
SECONDARY MINERALOGY						
	PERCENT	REPLACING/ FILLING				COMMENTS
Clays	20-30	Mesostasis and silicates.				
Copper	<<1					Disseminated in clays replacing mesostasis.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)	FILLING	SHAPE	COMMENTS
Vesicles	5	Disseminated.	0.2-1.0	Open.	Spherical to irregular.	

COMMENTS: Rock is moderately altered.

163-990A-22R-01 (Piece 3, 33-37 cm)

OBSERVER: DAY

WHERE SAMPLED: In Unit 10

ROCK NAME: Highly plagioclase-clinopyroxene phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, intergranular.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	8	8	0.4-4.0		Tabular, laths, subhedral.	Strong concentric zoning, commonly stubby, fractured, and resorbed. Cluster in glomerocrysts. Partly altered to brown clays or iron staining along fractures.
Clinopyroxene	2	2	0.6-1.2	Augite.	Anhedral, equant.	
GROUNDMASS						
Plagioclase	35	40	0.02-0.1		Laths.	
Clinopyroxene	36	37	0.02-0.05	Augite.	Anhedral, equant.	
Fe-Ti oxides	3	3	0.02-0.05	Magnetite.	Subhedral to skeletal.	
Olivine	0	1	0.04-0.1		Euhedral.	Pseudomorphs replaced by brown and reddish clays. Occur in small clusters and may be microphenocrysts.
Mesostasis	10	10				
SECONDARY MINERALOGY						
Clays	11	REPLACING/ FILLING Mesostasis and olivine.				COMMENTS Greenish-yellow and blue-green colors.
VESICLES/CAVITIES						
Vesicles	25	LOCATION Throughout.	SIZE (mm) up to 8	FILLING Lined by blue and green clays.	SHAPE Subspheric to irregular.	COMMENTS Lobate margins common.

COMMENTS: Rock is moderately altered. Clusters of glomerocrysts are either pure plagioclase or plagioclase-augite intergrowths. It is difficult to be confident about the presence of olivine pseudomorphs.

163-990A-22R-05 (Piece 5A, 92-93 cm)

OBSERVER: DAY

WHERE SAMPLED: In Unit 11.

ROCK NAME: Moderately plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, intergranular to subophitic, seriate.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	5.1	5.1	0.3-2.0		Anhedral to subhedral.	Largest phenocrysts (>0.8 mm) are often strongly resorbed, and zoned (concentrically). Occur as glomerocrystic clusters. Smaller phenocrysts (<0.8 mm) tend to be lath-shaped and grade into groundmass plagioclase.
Olivine	0	3.1	0.2-0.6		Subhedral to euhedral.	Distributed through rock. Altered to dark brown or reddish clays and iron oxyhydroxides.
Clinopyroxene	0.2	0.2	0.8		Anhedral.	Occur in plagioclase-rich glomerocrysts.
GROUNDMASS						
Plagioclase	40	42.8	0.1-0.5		Laths.	Commonly subophitically intergrown with augite. Partly altered to clays along grain boundaries.
Clinopyroxene	38.8	38.8	0.1-0.3	Augite.	Anhedral, equant.	Some with rims of iron oxyhydroxides.
Fe-Ti oxides	3.3	3.3	0.1-0.2	Ti-magnetite.	Euhedral to anhedral, interstitial.	Common exsolution lamellae.
Mesostasis	0	6.1				Altered to greenish clays interstitial to clinopyroxene and plagioclase.
SECONDARY MINERALOGY						
Clays	15	REPLACING/ FILLING Mesostasis, olivine, plagioclase.				COMMENTS Brown, red and green colors.
VESICLES/CAVITIES						
Vesicles	0.3	LOCATION Groundmass.	SIZE (mm) 1-2	FILLING Open or filled with brown-green clays.	SHAPE Irregular.	COMMENTS Filling probably plucked out.

COMMENTS: Rock is moderately altered. Many olivines are microphenocrysts. Mode based on counting 1000 points.

163-990A-23R-04 (Piece 10A, 119-120 cm)

OBSERVER: DAY

WHERE SAMPLED: In Unit 12

ROCK NAME: Highly plagioclase-olivine-clinopyroxene phyric basalt.

GRAIN SIZE: Fine-grained.

TEXTURE: Porphyritic, intersertal, intergranular.

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)	COMPOSITION	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	15	15	up to 3		Anhedral to subhedral laths. Subhedral.	Commonly strongly zoned, resorbed and fractured. Cluster in glomerocrysts with clinopyroxene.
Olivine	0	3-4	up to 1			Altered to green clay and iron oxyhydroxide pseudomorphs. Mode is difficult to estimate.
Clinopyroxene	1	1	up to 0.8	Augite.	Subhedral, equant.	Commonly in glomerocrysts with plagioclase.
GROUNDMASS						
Plagioclase	32	35	up to 0.5		Laths.	Seriate.
Clinopyroxene	32	32	up to 0.2	Augite.	Anhedral, equant.	Intergranular to plagioclase.
Olivine	0	3	0.2			Completely altered to brownish clays, hence difficult to distinguish from altered mesostasis. The mode is uncertain.
Fe-Ti oxide	1-2	1-2	up to 0.1	Magnetite.	Euhedral, skeletal to anhedral.	Common rims of iron oxyhydroxides.
Mesostasis	10					Totally altered to clays and iron hydroxides.
SECONDARY MINERALOGY						
Clays	PERCENT 19	REPLACING/ FILLING Mesostasis, olivine and plagioclase.				COMMENTS Brown to orange brown clays.
VESICLES/CAVITIES						
Vesicles	PERCENT 20	LOCATION Random.	SIZE (mm) up to 10	FILLING Open or filled with green, brown, blue clays.	SHAPE Irregular.	COMMENTS Commonly lined with blue-green clays.

COMMENTS: Rock is moderately altered with several highly altered patches. Mesostasis and olivine are completely altered while alteration of plagioclase and augite is restricted to grain boundaries and fractures. Extensive ferric iron staining.