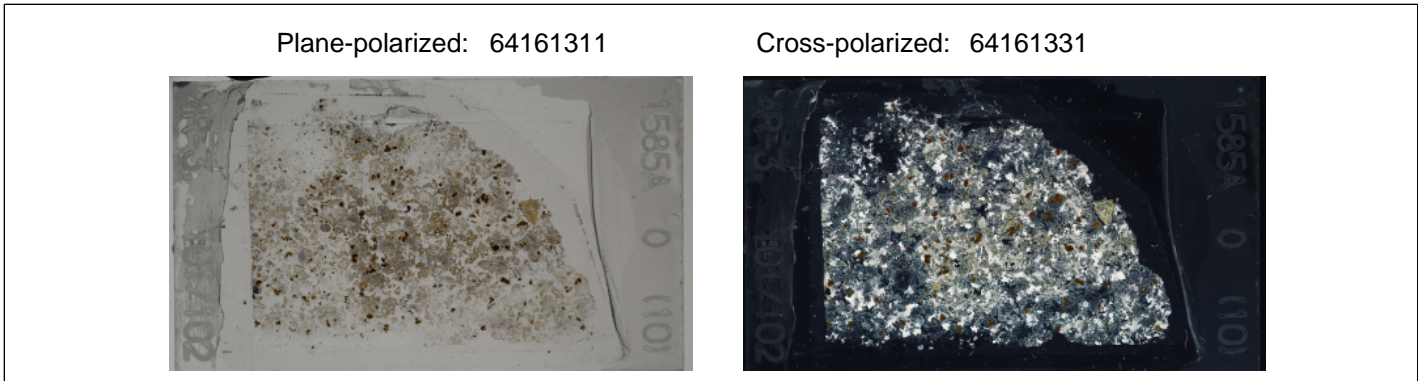


THIN SECTION LABEL ID: **397T-U1585A-4R-3-W 101/102-TSB-TS 10** Thin section no.: 10  
 Observer: RB Unit/subunit:  
 Thin section summary: microfossil bearing volcanic clastic, with vesicles and interstitial spaces filled with carbonate and zeolite.



**Sediments and Sedimentary Rock**

Complete lithology name: lapillistone

**Framework grain abundance**  
 D=dominant; A=abundant; C=common; R=rare; Tr=trace

Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals		Glauconite	
Lithic grains		Zeolite	C
Chert		Undifferentiated calcareous bioclasts	R

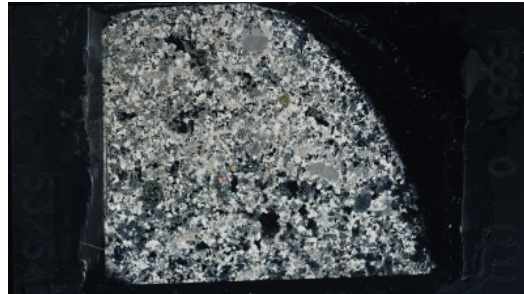
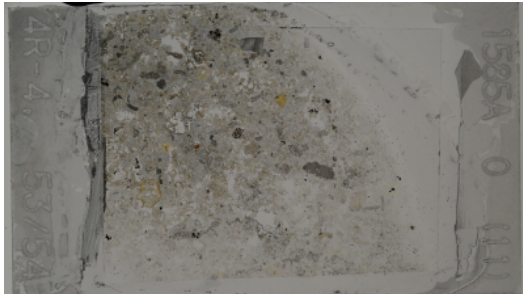
Dominant Cement: carbonate

Volcanic glass roundness: sub-rounded      Lithic grain roundness: sub-rounded

THIN SECTION LABEL ID: **397T-U1585A-4R-4-W 53/54-TSB-TS 11** Thin section no.: 11  
 Observer: RB Unit/subunit:  
 Thin section summary: microfossiliferous (bryozans and forams?) lapillistone with carbonate cement. some fragments of pyroxene and plagioclase are present.

Plane-polarized: 64161351

Cross-polarized: 64161371



### Sediments and Sedimentary Rock

**Complete lithology name:** lapillistone

### Framework grain abundance

D=dominant; A=abundant; C=common; R=rare; Tr=trace

Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals	R	Glaucconite	
Lithic grains		Zeolite	
Chert		Undifferentiated calcareous bioclasts	C

**Dominant Cement:** carbonate

**Volcanic glass roundness:** sub-rounded **Lithic grain roundness:** sub-rounded

THIN SECTION LABEL ID: **397T-U1585A-4R-CC-W 2/4-TSB-TS 12**

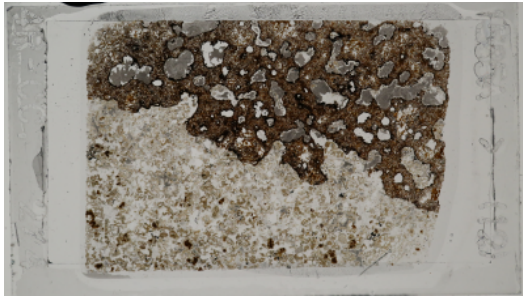
Thin section no.: 12

Observer: WN/MW

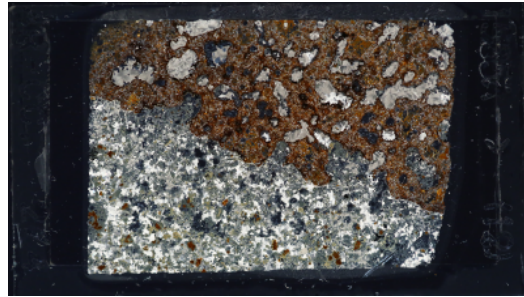
Unit/subunit:

Thin section summary: Domain 1 consists of a vesicular basalt fragment dominated by altered glass with skeletal plagioclase crystals throughout the glass. Vesicles are filled with clay and calcite. Domain 2 consists of A mix of altered lithic clasts and biogenic carbonate. lithic clasts has altered plagioclase needles with Fe-oxyhydroxides. biogenic carbonate portion have microfossils (forams?). Some of these shells have the original morphology preserved..

Plane-polarized: 64161511



Cross-polarized: 64161531



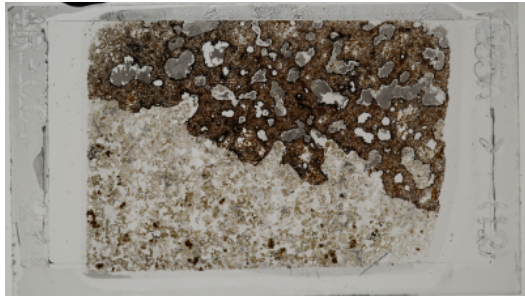
**Framework grain abundance**

D=dominant; A=abundant; C=common; R=rare; Tr=trace

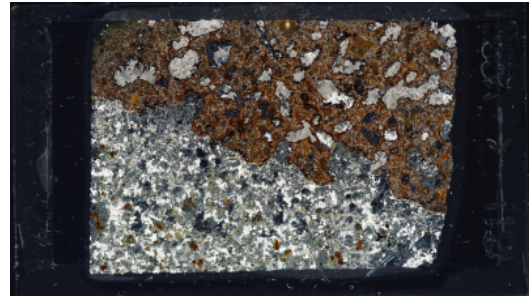
**Dominant  
Cement:** carbonate

THIN SECTION LABEL ID: **397T-U1585A-4R-CC-W 2/4-TSB-TS 12** Thin section no.: 12  
 Observer: WN/MW Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Domain 1 consists of a vesicular basalt fragment dominated by altered glass with skeletal plagioclase crystals throughout the glass. Vesicles are filled with clay and calcite. Domain 2 consists of A mix of altered lithic clasts and biogenic carbonate. lithic clasts has altered plagioclase needles with Fe-oxyhydroxides. biogenic carbonate portion have microfossils (forams?). Some of these shells have the original morphology preserved..

Plane-polarized: 64161511



Cross-polarized: 64161531



**Igneous Petrology**

**Lithology:** highly **plagioclase phyric basalt**  
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** cryptocrystalline  
**Major texture:** dendritic or skeletal **Minor Texture:** hypohyaline

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	30	10	20	0.1	0.3	euhedral	elongate	Skeletal plag with hollow centers
Glass	45		45	N/A	N/A	N/A	N/A	

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	25	5	20	0.5	3	subrounded	Vesicles are mostly filled. Shape varies from spherical to elongate

THIN SECTION LABEL ID: **397T-U1585A-5R-1-W 11/14-TSB-TS 13**

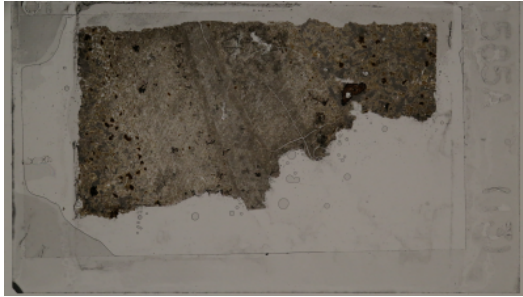
Thin section no.: 13

Observer: RB

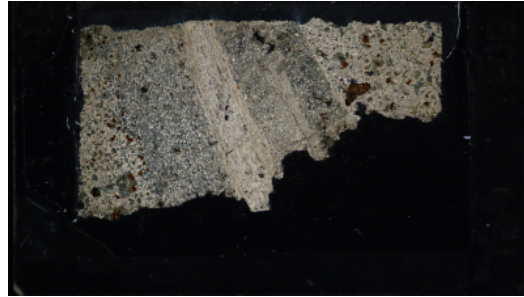
Unit/subunit:

Thin section summary: carbonaceous tuff with bioclasts.

Plane-polarized: 64235791



Cross-polarized: 64235811



### Sediments and Sedimentary Rock

**Complete lithology name:** carbonaceous coarse tuff

Texture	%	Constituent	%
Gravel texture:		Volcaniclastic:	
Sand texture:		Carbonate:	30
Silt texture:		Siliclastic:	
Clay texture:		Biogenic silica:	

### Framework grain abundance

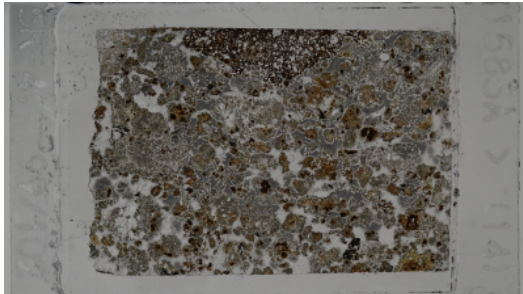
D=dominant; A=abundant; C=common; R=rare; Tr=trace

Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals	R	Glauconite	
Lithic grains	R	Zeolite	
Chert		Undifferentiated calcareous bioclasts	C

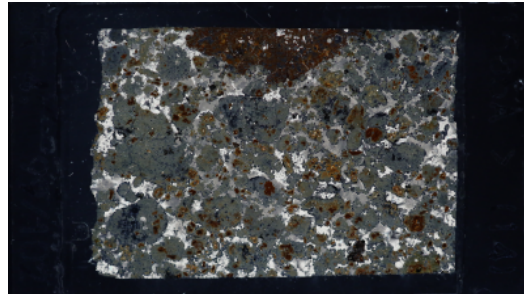
**Dominant Cement:** carbonate

THIN SECTION LABEL ID: **397T-U1585A-5R-4-W 99/102-TSB-TS 14** Thin section no.: 14  
 Observer: RB Unit/subunit:  
 Thin section summary: vesicules in lapilli filled with zeolite, carbonate. cemented with dolomitic and clayey carbonate cement. bioclasts and biogenic carbonate common

Plane-polarized: 64228541



Cross-polarized: 64228561



### Sediments and Sedimentary Rock

Complete lithology name: lapillistone

Texture	%	Constituent	%
Gravel texture:		Volcaniclastic:	
Sand texture:		Carbonate:	20
Silt texture:		Siliclastic:	
Clay texture:		Biogenic silica:	

### Framework grain abundance

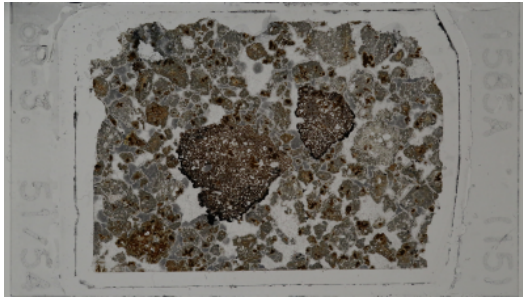
D=dominant; A=abundant; C=common; R=rare; Tr=trace

Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals	C	Glauconite	
Lithic grains		Zeolite	
Chert		Undifferentiated calcareous bioclasts	C

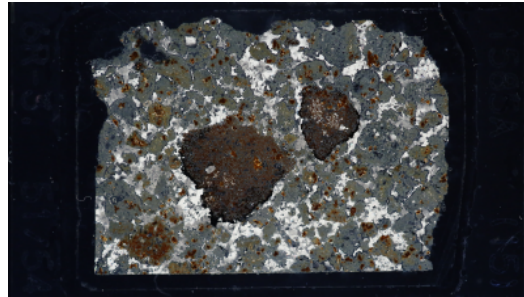
Dominant Cement: carbonate

THIN SECTION LABEL ID: **397T-U1585A-6R-3-W 51/54-TSB-TS 15** Thin section no.: 15  
 Observer: RB Unit/subunit:  
 Thin section summary: vesicular lapilli and altered basaltic clasts in carbonate cement. the carbonate cement appears to be biogenic. at places carbonate looks clayey and dolomitized. vesicles in the altered basaltic clasts are filled with carbonates/zeolites/clay. Within the altered basaltic clast, the groundmass is altered to brownish unidentifiable minerals.

Plane-polarized: 64228581



Cross-polarized: 64228601



### Sediments and Sedimentary Rock

**Complete lithology name:** lappilistone with altered volcanic clasts

Texture	%	Constituent	%
Gravel texture:		Volcaniclastic:	
Sand texture:		Carbonate:	20
Silt texture:		Siliclastic:	
Clay texture:		Biogenic silica:	

### Framework grain abundance

D=dominant; A=abundant; C=common; R=rare; Tr=trace

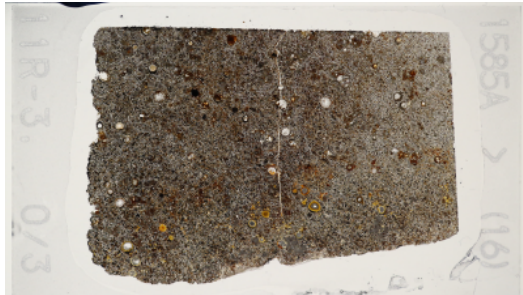
Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals	R	Glauconite	
Lithic grains		Zeolite	C
Chert		Undifferentiated calcareous bioclasts	

**Dominant Cement:** carbonate

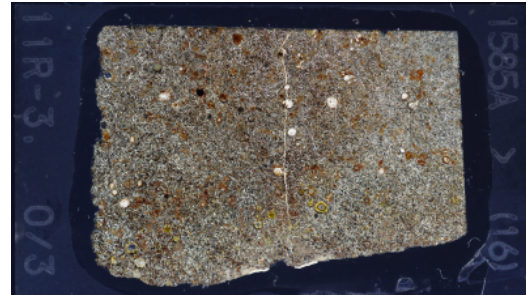
**Volcanic glass roundness:** sub-rounded      **Lithic grain roundness:** sub-rounded

THIN SECTION LABEL ID: **397T-U1585A-11R-3-W 0/3-TSB-TS 16** Thin section no.: 16  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly olivine-phyric basalt with strong intersertal textures. Olivine is completely replaced by clay minerals. Abundant groundmass plagioclase has skeletal textures. Glass is completely replaced.

Plane-polarized: 64191511



Cross-polarized: 64191531



### Igneous Petrology

**Lithology:** highly **olivine phyric basalt**  
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** cryptocrystalline  
**Major texture:** intersertal **Minor Texture:** dendritic or skeletal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	15		15	0.3	0.8	subhedral	subhedral	Completely replaced by clay. Often appears in small clusters. Some iddingsite along fractures.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	40	35	5	0.2	0.6	euhedral	elongate	skeletal plag with hollow centers.
Fe-Ti oxide	5		15			euhedral	equant	N/A
Glass	40		40	N/A	N/A	N/A	N/A	

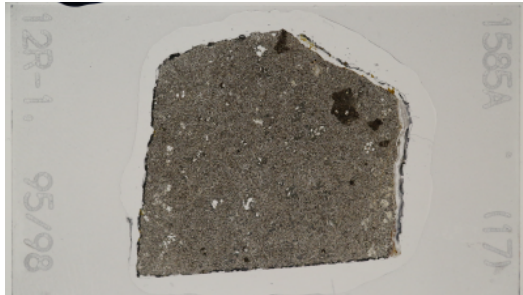
  

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	4		4	0.5	1.2	rounded	completely filled, sometimes with more than one secondary mineral.

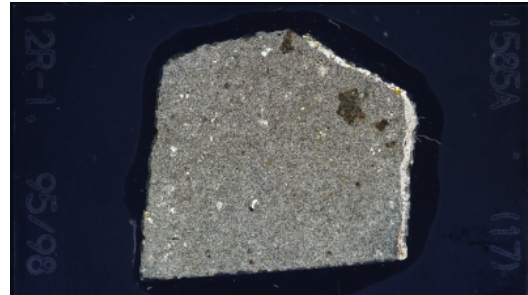


THIN SECTION LABEL ID: **397T-U1585A-12R-1-W 95/98-TSB-TS 17** Thin section no.: 17  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately olivine-phyric basalt with strong interstitial textures. Olivine is completely replaced by clay minerals and calcite. Abundant groundmass plagioclase has skeletal textures. Mesostasis is completely replaced.

Plane-polarized: 64191551



Cross-polarized: 64191571



### Igneous Petrology

**Lithology:** moderately **olivine phyric basalt**  
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** fine-grained  
**Major texture:** intersertal **Minor Texture:** dendritic or skeletal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	8		8	0.3	1	subhedral	subhedral	completely replaced by clay and/or calcite

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	40	15	25	0.1	0.5	euhedral	elongate	skeletal plag, partially altered
Fe-Ti oxide	3		8	0.02	0.05	euhedral	equant	N/A
Mesostasis	49		49	N/A	N/A	N/A	N/A	

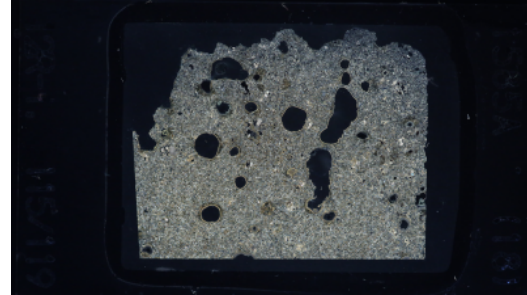
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	3		3	0.3	1	rounded	completely filled with calcite or clay

THIN SECTION LABEL ID: **397T-U1585A-12R-1-W 115/119-TSB-TS 18** Thin section no.: 18  
 Observer: MT Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Sparsely plagioclase-olivine phyric basaltic clast. Dominantly composed of altered plagioclase (48%) and mesostasis (50%). Empty vesicles are common and can be up to 6 mm in size. Calcite appear to fill some vesicles partially. Twinning in plagioclase is faint. Olivine is completely replaced by calcite

Plane-polarized: 64228621



Cross-polarized: 64228641



### Igneous Petrology

**Lithology:** sparsely **plagioclase-olivine phyric basalt**  
**Grain size distribution:** inequigranular **Groundmass grain size (avg.):** microcrystalline  
**Major texture:** intersertal **Minor Texture:** aphanitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2		2	0.5	1	subhedral	subhedral	All olivine phenocrysts altered to calcite
Plagioclase	3		3	0.5	1	anhedral	elongate	All plag show alteration. Twinning is faint

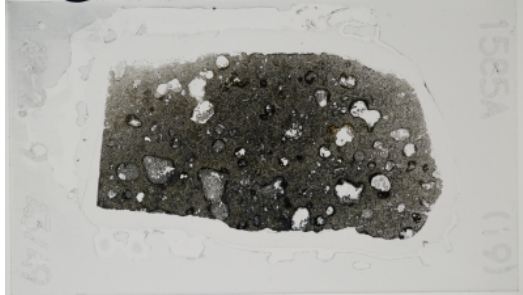
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	45		45	0.04	0.5	anhedral	elongate	Randomly oriented slender grains. All grains show alteration
Fe-Ti oxide			2					N/A
Mesostasis	50	20	30	N/A	N/A	N/A	N/A	

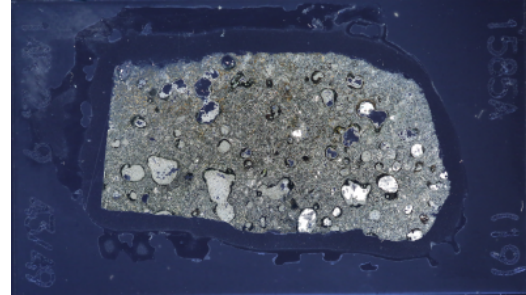
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	4	4		0.4	6	rounded	Some vesicles are irregularly shaped. Calcite appear to partially fill some vesicles

THIN SECTION LABEL ID: **397T-U1585A-14R-2-W 43/49-TSB-TS 19** Thin section no.: 19  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately olivine-phyric vesicular basalt. Highly altered. Olivine is completely replaced by at least 2 secondary minerals. Groundmass plagioclase has skeletal habits and is moderately altered. Vesicles are dominantly filled with calcite. Mesostasis is significantly altered to red and brown clay minerals.

Plane-polarized: 64210091



Cross-polarized: 64210111



### Igneous Petrology

**Lithology:** moderately **olivine phyric basalt**  
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** microcrystalline  
**Major texture:** dendritic or skeletal **Minor Texture:** hypocrySTALLINE

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	6		6	0.5	1	subhedral	subhedral	Completely replaced by calcite and a green clay

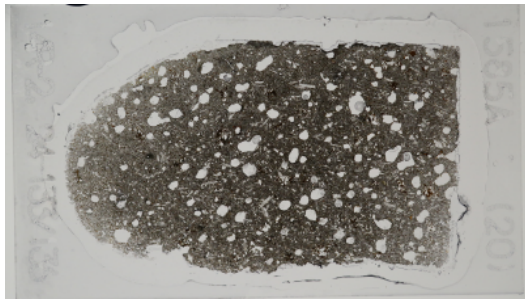
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	40	30	10	0.2	0.8	euhedral	elongate	Skeletal grains, partially altered with a range of sizes
Fe-Ti oxide	3		6	0.2	0.3	euhedral	equant	N/A
Mesostasis	26		26	N/A	N/A	N/A	N/A	highly altered to orange and green

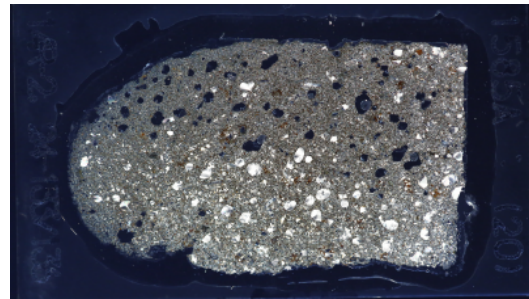
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	25		25	1	4	subrounded	Most were filled with calcite but some centers lost material during TS creation

THIN SECTION LABEL ID: **397T-U1585A-14R-2-W 133/136-TSB-TS 20** Thin section no.: 20  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately olivine-plag phyric basalt with significant alteration. Hypocrystalline groundmass. Olivine is altered to both iddingsite and calcite. Plag phenocrysts show moderate alteration. Cpx is only present as groundmass phase. Vesicles are both completely empty and completely filled. Groundmass oxides have dendritic habits, and groundmass plag has skeletal textures with small, hollow cores.

Plane-polarized: 64210161



Cross-polarized: 64210181



### Igneous Petrology

**Lithology:** moderately **olivine-plagioclase phyric basalt**  
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** fine-grained  
**Major texture:** dendritic or skeletal **Minor Texture:** hypocrystalline

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	3		3	0.3	0.8	subhedral	subhedral	Completely altered. Contains calcite cores and iddingsite rims
Plagioclase	5	3	2	0.4	1	subhedral	elongate	Plag phenocrysts have moderate alteration, sometimes to sericite, sometimes to another clay.

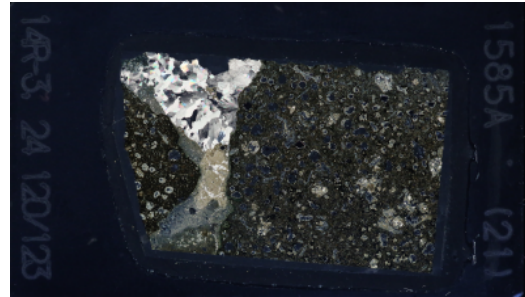
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	30	25	5	0.05	0.3	euhedral	elongate	abundant skeletal plag, partially altered
Clinopyroxene	11	8	3	0.02	0.1	subhedral	equant	
Fe-Ti oxide	7		3	0.01	0.03	euhedral	equant	N/A
Mesostasis	30		30	N/A	N/A	N/A	N/A	

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	15	10	5	0.5	1.8	subrounded	Range in shape and filling

THIN SECTION LABEL ID: **397T-U1585A-14R-3-W 120/123-TSB-TS 21** Thin section no.: 21  
 Observer: RB Unit/subunit:  
 Thin section summary: vesicular altered basalt. vesicles are largely empty lined with fibrous chlorite or calcite. All plagioclase and pyroxenes are sericitized and chloritized. groundmass plagioclase are also similarly altered. the fine grained groundmass/mesostasis has been completely altered.

Plane-polarized: 64228661

Cross-polarized: 64228681



### Sediments and Sedimentary Rock

Complete lithology name: Domain 2(carbonate-clay vein)

Texture	%	Constituent	%
Gravel texture:		Volcaniclastic:	
Sand texture:		Carbonate:	ccccccccc c
Silt texture:		Siliclastic:	
Clay texture:		Biogenic silica:	

### Framework grain abundance

D=dominant; A=abundant; C=common; R=rare; Tr=trace

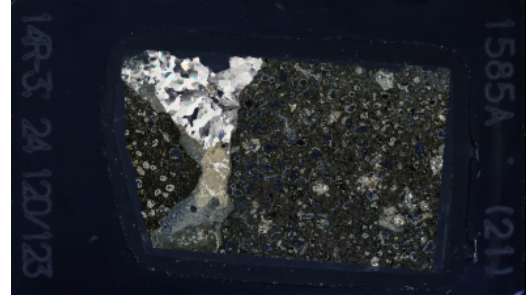
Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals	C	Glauconite	
Lithic grains		Zeolite	
Chert		Undifferentiated calcareous bioclasts	

THIN SECTION LABEL ID: **397T-U1585A-14R-3-W 120/123-TSB-TS 21** Thin section no.: 21  
 Observer: RB Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: vesicular altered basalt. vesicles are largely empty lined with fibrous chlorite or calcite. All plagioclase and pyroxenes are sericitized and chloritized. groundmass plagioclase are also similarly altered. the fine grained groundmass/mesostasis has been completely altered.

Plane-polarized: 64228661



Cross-polarized: 64228681



### Igneous Petrology

**Lithology:** highly

plagioclase-augite phyric basalt  
lava flow

**Grain size distribution:** seriate

**Groundmass grain size (avg.):** medium-grained

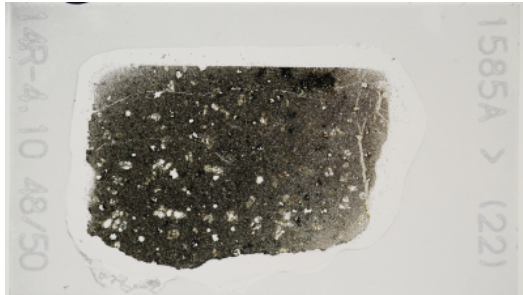
**Major texture:** porphyritic

**Minor Texture:** glomeroporphyritic

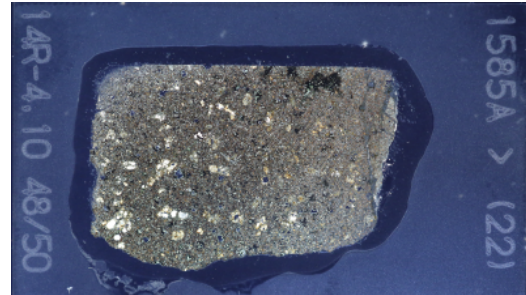
Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	10	0	10	0.5	1.4	subhedral	elongate	altered and skeletal
Clinopyroxene	2		2	0.1	1	subhedral	subequant	altered
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	30		30	0.05	0.5	subhedral	elongate	altered and skeletal.
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments	
Vesicle	2	2		0.01	1	rounded	largely empty, lined with chlorite/calcite	

THIN SECTION LABEL ID: **397T-U1585A-14R-4-W 48/50-TSB-TS 22** Thin section no.: 22  
 Observer: DH Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately olivine-phyric basalt with strong intersertal textures. Olivine is completely replaced by clay minerals and calcite. Abundant groundmass plagioclase has skeletal textures. Mesostasis is completely replaced.

Plane-polarized: 64210201



Cross-polarized: 64210221



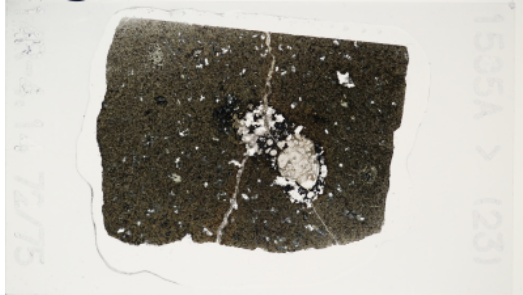
### Igneous Petrology

**Lithology:** moderately **olivine phyric basalt**  
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** fine-grained  
**Major texture:** intersertal **Minor Texture:** dendritic or skeletal

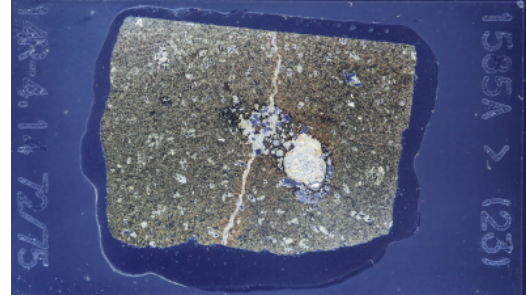
Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	7		7	0.3	1.2	subhedral	subhedral	Completely replaced by clay and/or calcite
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	40	10	30	0.1	0.6	euhedral	elongate	skeletal plag, mostly altered
Clinopyroxene	4	1	3	0.1	0.2	anhedral	equant	
Fe-Ti oxide			7					N/A
Mesostasis	42	3	39	N/A	N/A	N/A	N/A	
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments	
Vesicle	3	3		0.1	0.6	angular	vesicles lined with secondary alteration.	

THIN SECTION LABEL ID: **397T-U1585A-14R-4-W 72/75-TSB-TS 23** Thin section no.: 23  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately olivine-phyric basalt with microcrystalline groundmass. Olivine is completely replaced to the point that grain boundaries, at times, are difficult to see. Groundmass consists of skeletal plag, blocky cpx, and highly altered glass. Groundmass plag and cpx are also altered.

Plane-polarized: 64210241



Cross-polarized: 64210261



### Igneous Petrology

**Lithology:** moderately **olivine phyric basalt**  
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** microcrystalline  
**Major texture:** porphyritic **Minor Texture:** dendritic or skeletal

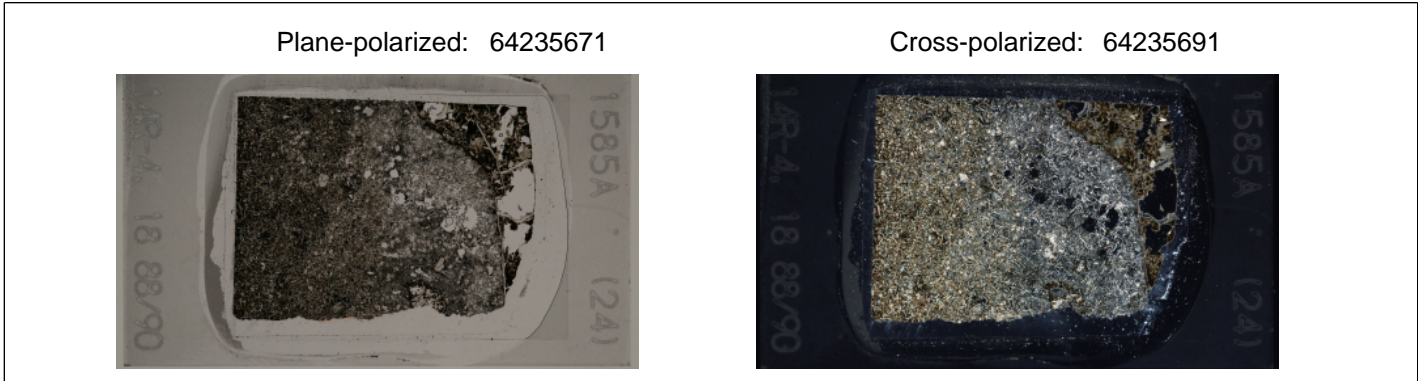
Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	6		6	0.5	1.6	subhedral	subhedral	Completely replaced by zeolite and/or calcite. No iddingsite
Plagioclase	1		1	0.3	0.5	subhedral	elongate	significant alteration to sericite

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	30	5	25	0.05	0.2	euhedral	elongate	skeletal center with altered mesostasis
Clinopyroxene	20		20	0.02	0.06	subhedral	equant	
Fe-Ti oxide	2		6	0.01	0.03	euhedral	equant	N/A
Glass	35		35	N/A	N/A	N/A	N/A	all reddish in color with tiny oxides inside

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	4		4	0.1	0.4	subangular	highly irregular vesicles - potentially from diktytaxitic plag



THIN SECTION LABEL ID: **397T-U1585A-14R-4-W 88/90-TSB-TS 24** Thin section no.: 24  
 Observer: MT Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately olivine-plagioclase phyric basalt clast with an overall aphanitic texture. Groundmass consists of altered olivine, plagioclase and mesostasis. Groundmass alteration intensity varies across the sample. There s an occurrence of scattered subhedral Fe-Ti oxides.



### Igneous Petrology

**Lithology:** moderately **olivine-plagioclase phyric basalt**

**Grain size distribution:** seriate **Groundmass grain size (avg.):** microcrystalline

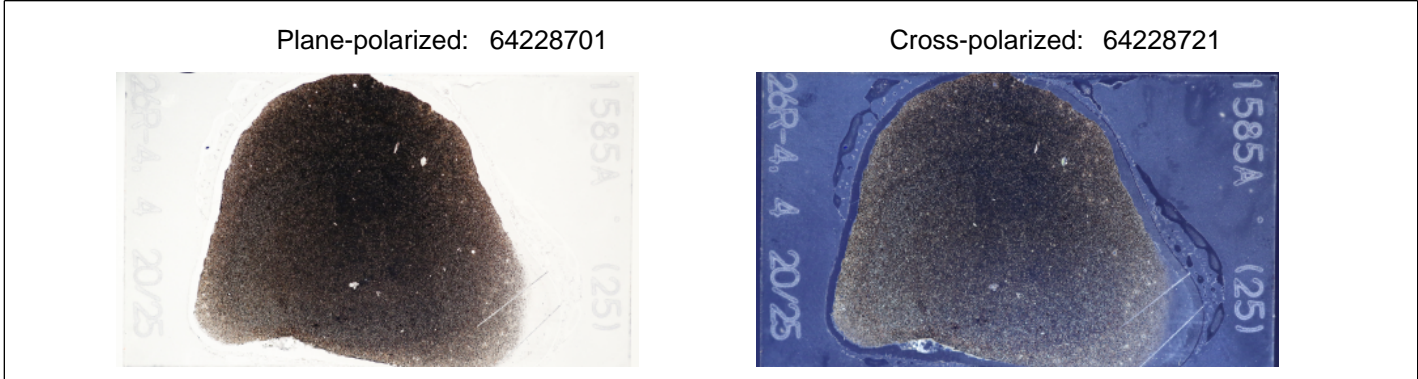
**Major texture:** aphanitic **Minor Texture:**

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	3		3	0.3	0.8	anhedral	anhedral	All olivine phenocrysts have been altered to calcite
Plagioclase	2		2	0.3	1	anhedral	elongate	

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	3		3	0.1	0.3	anhedral	equant	
Plagioclase	40		40	0.1	0.3	anhedral	elongate	
Fe-Ti oxide	3		3	0.01	0.1	subhedral	equant	N/A
Mesostasis	49	22	27	N/A	N/A	N/A	N/A	

THIN SECTION LABEL ID: **397T-U1585A-26R-4-W 20/25-TSB-TS 25** Thin section no.: 25  
 Observer: DH Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Aphyric basalt with microcrystalline groundmass. The larger plagioclase microphenocrysts have nearly been completely replaced. A single olivine microphenocryst was about half altered to iddingsite. The mesostasis has been completely altered and there are a minor amount of oxide minerals present.



**Igneous Petrology**

**Lithology:** aphyric basalt

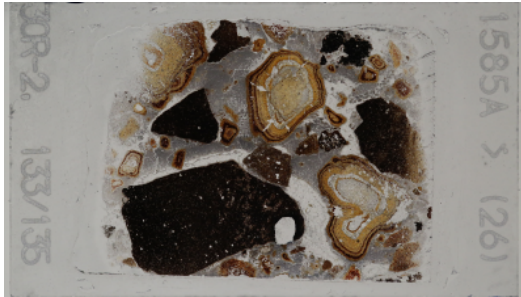
**Grain size distribution:** bimodal **Groundmass grain size (avg.):** microcrystalline

**Major texture:** microlitic **Minor Texture:** intersertal

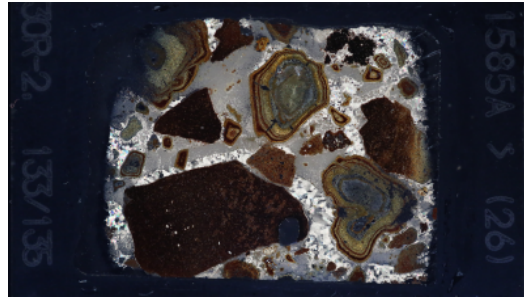
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2		2	0.2	0.3	subhedral	equant	
Plagioclase	70	10	60	0.1	0.5	euhedral	elongate	Plagioclase is being altered.
Fe-Ti oxide	1			0.1	0.2	euhedral	equant	N/A
Mesostasis	27		27	N/A	N/A	N/A	N/A	highly alterd

THIN SECTION LABEL ID: **397T-U1585A-30R-2-W 133/135-TSB-TS 26** Thin section no.: 26  
 Observer: RB Unit/subunit:  
 Thin section summary: Altered basaltic clasts and lapilli of varying sizes and angularity in carbonaceous clay matrix. altered basaltic clasts are aphyric with < 1mm altered needles of plagioclase. groundmass is altered to brownish unidentifiable minerals. layered lapilli have altered glass layers with varying degree of altered plagioclase crystals.

Plane-polarized: 64228741



Cross-polarized: 64228761



### Sediments and Sedimentary Rock

**Complete lithology name:** lapillistone with volcanic clasts

Texture	%	Constituent	%
Gravel texture:		Volcaniclastic:	
Sand texture:		Carbonate:	10
Silt texture:		Siliclastic:	
Clay texture:		Biogenic silica:	

### Framework grain abundance

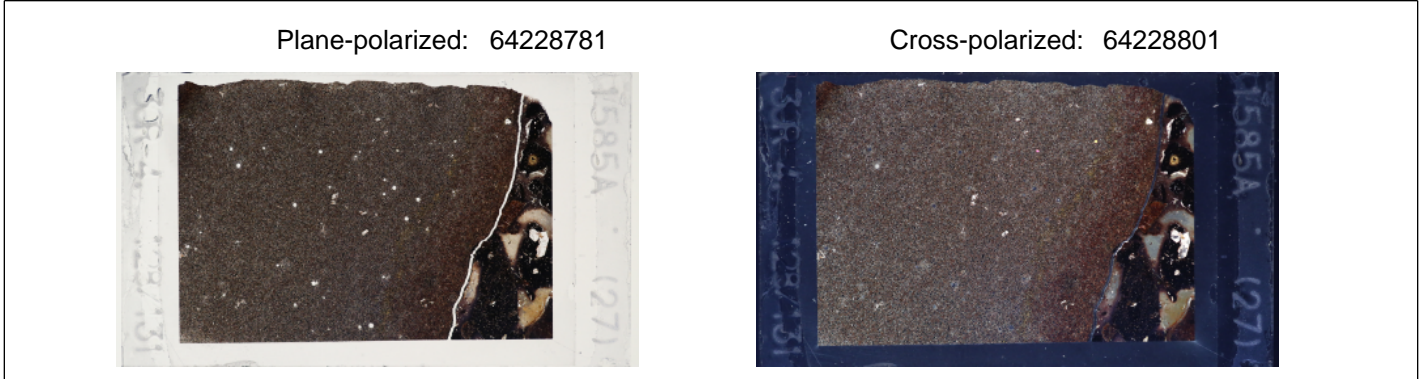
D=dominant; A=abundant; C=common; R=rare; Tr=trace

Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals	C	Glauconite	
Lithic grains	C	Zeolite	
Chert		Undifferentiated calcareous bioclasts	

**Dominant Cement:** carbonate

**Volcanic glass roundness:** sub-angular      **Lithic grain roundness:** sub-angular

THIN SECTION LABEL ID: **397T-U1585A-30R-4-W 128/131-TSB-TS 27** Thin section no.: 27  
 Observer: DH Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Aphyric basalt with microcrystalline groundmass. The larger plagioclase microphenocrysts have been completely replaced. The rims of olivine microphenocrysts were altered with their core intact. The mesostasis has been completely altered and there are a minor amount of oxide minerals present.



### Igneous Petrology

**Lithology:** aphyric basalt

**Grain size distribution:** bimodal **Groundmass grain size (avg.):** microcrystalline

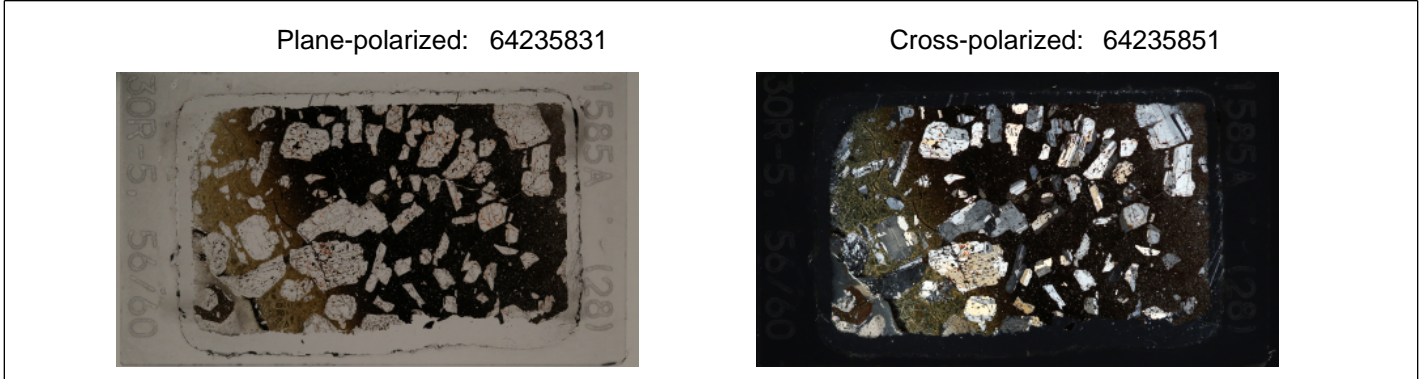
**Major texture:** microlitic **Minor Texture:** intersertal

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	1.5	0.5	1	0.05	0.3	subhedral	equant	The rims of the microphenocrysts olivines are altered with their cores intact.
Plagioclase	16	8	8	0.1	0.8	euhedral	elongate	Plagioclase microphenocrysts are all completely altered.
Fe-Ti oxide	3			0.1	0.1	subhedral	equant	N/A
Mesostasis	78.5		78.5	N/A	N/A	N/A	N/A	

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	1	1		0.2	0.2	rounded	

THIN SECTION LABEL ID: **397T-U1585A-30R-5-W 56/60-TSB-TS 28** Thin section no.: 28  
 Observer: DH Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly plagioclase phyric basalt. There is a glassy rim that has been completely altered. The alteration progressively lessens as the distance from the rim increased. The plagioclase phenocrysts are mostly unaltered but contain an abundant amount of altered oxides or inclusions.



**Igneous Petrology**

**Lithology:** highly plagioclase phyric basalt

**Grain size distribution:** bimodal **Groundmass grain size (avg.):** microcrystalline

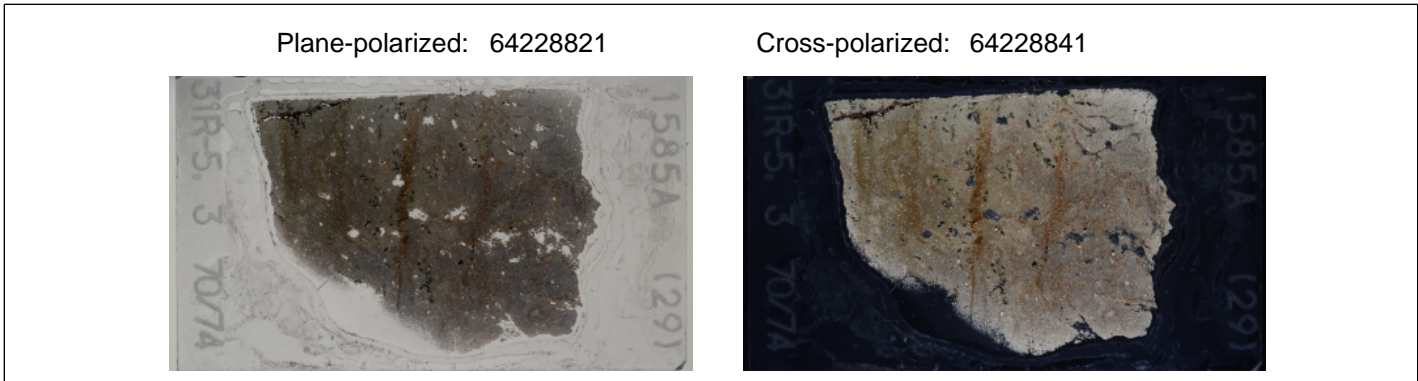
**Major texture:** microlitic **Minor Texture:** trachytic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	30	30		0.8	4	subhedral	tabular	Plagioclase phenocrysts have abundant oxides and inclusions

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	4	2	2	0.1	0.2	euhedral	elongate	
Fe-Ti oxide	4			0.1	0.1	subhedral	equant	N/A
Mesostasis	42		42	N/A	N/A	N/A	N/A	
Glass	20		20	N/A	N/A	N/A	N/A	The glass rim has been completely altered. There are some small plagioclase crystals.

THIN SECTION LABEL ID: **397T-U1585A-31R-5-W 70/74-TSB-TS 29** Thin section no.: 29  
 Observer: RB Unit/subunit:  
 Thin section summary: Fine mixture of clay and carbonate. indications for the presence of nanno and microfossils.



**Sediments and Sedimentary Rock**

Complete lithology name: Carbonaceous clay

Texture	%	Constituent	%
Gravel texture:		Volcaniclastic:	
Sand texture:		Carbonate:	20
Silt texture:		Siliclastic:	
Clay texture:	100	Biogenic silica:	

**Framework grain abundance**

D=dominant; A=abundant; C=common; R=rare; Tr=trace

Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	C
Feldspar		Mica	
Clay minerals	A	Glauconite	
Lithic grains		Zeolite	
Chert		Undifferentiated calcareous bioclasts	

Dominant Cement: clay

THIN SECTION LABEL ID: **397T-U1585A-31R-5-W 111/115-TSB-TS 30** Thin section no.: 30  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Sparsely olivine phyric massive basalt with crystal-rich fine-grained groundmass. All phases are partially to completely altered. Ti-rich cpx is only partially altered. Oxide-rich groundmass consists of mostly equant oxide grains as inclusions in olivine and cpx. Mesostasis is completely chloritized. Tiny, crystallites are visible in the altered mesostasis.

Plane-polarized: 64228861



Cross-polarized: 64228881



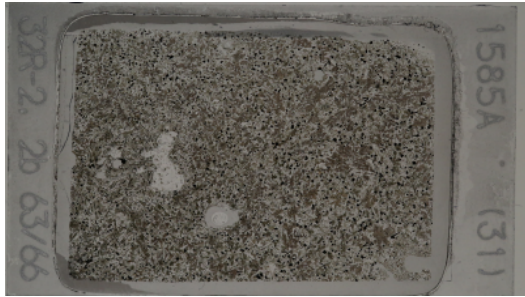
### Igneous Petrology

**Lithology:** sparsely **olivine phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** subophitic **Minor Texture:** intersertal

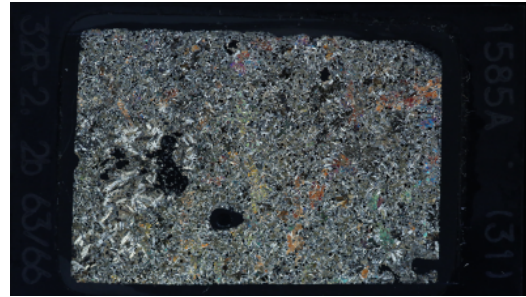
Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	1		1	1	1.2	subhedral	subhedral	seriate texture with groundmass olivine
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	13		13	0.2	0.5	subhedral	equant	olivine is completely replaced by chlorite (?). Grains were probably once euhedral. Often occur in clusters, which would look like one larger grain in hand sample.
Plagioclase	35	20	15	0.6	1.6	subhedral	elongate	Most are very slender laths with altered centers. It is unclear if these are slender crystals (1) with zoned centers, and the interior zone is altered while the exterior zoned survived, (2) alteration along cleavage planes running through the center of the crystal, or (3) skeletal crystals with hollow centers filled with mesostasis material that has subsequently altered.
Clinopyroxene	16	12	4	0.1	1	subhedral	elongate	
Fe-Ti oxide	7		1	0.01	0.1	euhedral	equant	N/A
Mesostasis	25		25	N/A	N/A	N/A	N/A	Mesostasis may have been glassy at one point, but it is all chloritized now. Thin, randomly oriented microlites are visible through alteration patches. Heterogenous abundance through thin section - some portions are more crystal rich than others, which affects the abundance of mesostasis.
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments	
Vesicle	3		3	0.2	1	subangular	Vesicles are odd-shaped due to diktytaxitic texture.	

THIN SECTION LABEL ID: **397T-U1585A-32R-2-W 63/66-TSB-TS 31** Thin section no.: 31  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx phyric with very sparse (<1%) plag phenocrysts. Seriate texture, though most cpx are phenocrysts and most plag are groundmass. Olivine is present in modest quantities in the groundmass, but it is completely chloritized. Mesostasis is also completely chloritized. Subophitic textures with most plag showing slender, elongate forms. The centers of all plag crystals are altered. More blocky crystals suggest a zoned core whereas more slender crystals look to be skeletal with altered mesostasis centers.

Plane-polarized: 64228901



Cross-polarized: 64228921



### Igneous Petrology

Lithology: highly

Ti-rich augite phyric basalt massive lava flow

Grain size distribution:

Groundmass grain size (avg.): fine-grained

Major texture: subophitic

Minor Texture: intersertal

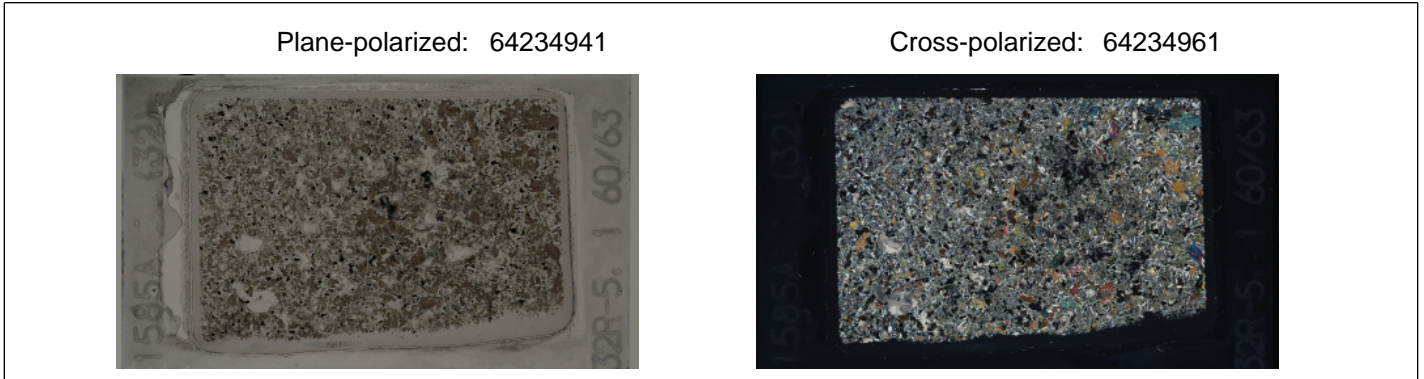
Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	0.5	0.5		1	1	subhedral	equant	rare (<1%) blocky plag phenocrysts. with mild to moderate seritization.
Clinopyroxene	17	17		1	3	subhedral	subequant	Mostly fresh Ti-cpx. Subophitic texture around plag. Grain sizes grade to groundmass without distinguishing groundmass vs phenocryst pyroxene (i.e. seriate texture)

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2		2	0.4	0.6	subhedral	equant	Olivine is completely chloritized. Mesostasis is also chloritized, and only sometimes is the relief difference such that olivine can be distinguished.
Plagioclase	29	20	9	0.4	1	euheral	elongate	Most have altered centers. Some look like skeletal plag whereas more block groundmass plag show interior zoning. Alteration of the interior zone looks different (less intense) than the slender laths suspected of being skeletal crystals. Skeletal crystals have identical alteration as the mesostasis.
Clinopyroxene	13	5	8	0.8	1	subhedral	elongate	
Fe-Ti oxide	7			0.01	0.3	euheral	equant	N/A
Mesostasis	30		30	N/A	N/A	N/A	N/A	Chloritized

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	2	1	1	0.8	1.4	subangular	Vesicles are lined with chlorite or a zeolite. Irregular shaped from intersertal texture.



<b>THIN SECTION LABEL ID:</b>	<b>397T-U1585A-32R-5-W 60/63-TSB-TS 32</b>	Thin section no.:	32
Observer:	WN	Piece no.:	
Thin section thickness:		Unit/subunit:	
Thin section summary:	Highly Ti-cpx phyric with very sparse (<1%) plag phenocrysts. Seriate texture, though most cpx are phenocrysts and most plag are groundmass. Some subophitic cpx as well as whole, euhedral phenocrysts in the groundmass. Olivine is present in modest quantities in the groundmass, but it is completely chloritized. Mesostasis is also completely altered to chlorite and calcite. Most plag showing slender, elongate forms. Plag is less altered, and the grains a little less thin. Zoning is visible in more blocky grains.		



### Igneous Petrology

<b>Lithology:</b>	highly	<b>Ti-rich augite phyric basalt massive lava flow</b>
<b>Grain size distribution:</b>		<b>Groundmass grain size (avg.):</b> fine-grained
<b>Major texture:</b>	subophitic	<b>Minor Texture:</b> intersertal

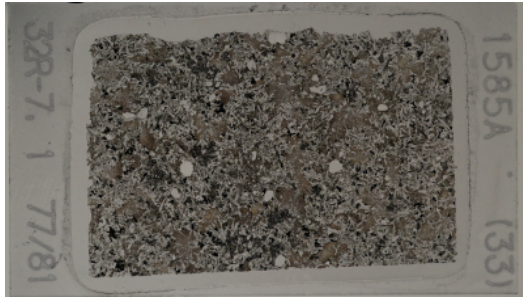
Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Clinopyroxene	15	13	2	1	3	subhedral	subequant	Mosly fresh Ti-cpx. Contains both subhedral subophitic grains and more euhedral grains with small inclusions.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	4		4	0.2	0.5	subhedral	equant	completely replaced by chlorite and sometimes calcite
Plagioclase	19	15	4	0.3	1.2	euhedral	elongate	Plag are not as slender/needle-like in this sample. Less altered with preserved zoning.
Clinopyroxene	12	10	2	0.2	0.8	subhedral	equant	
Fe-Ti oxide	5			0.01	0.4	subhedral	equant	N/A
Mesostasis	41		41	N/A	N/A	N/A	N/A	

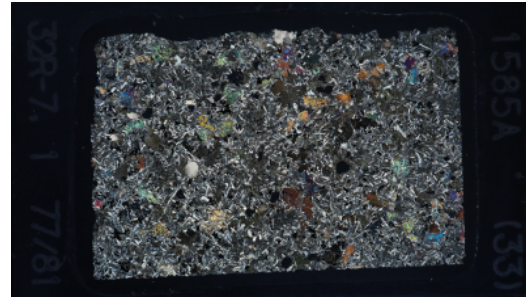
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	4		4	0.5	2	subangular	Vesicles are filled with calcite, but lined with zeolite/chlorite and pyrite.

THIN SECTION LABEL ID: **397T-U1585A-32R-7-W 77/81-TSB-TS 33** Thin section no.: 33  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx phyric with fine-grained plag-rich groundmass. Sparse groundmass olivine is present but replaced by chlorite and calcite. Mesostasis is completely altered. Subophitic and intersertal textures. Vesicles vary from round and filled to irregular and lined.

Plane-polarized: 64234981



Cross-polarized: 64235001



### Igneous Petrology

Lithology: highly

Ti-rich augite phyric basalt  
massive lava flow

Grain size distribution:

Groundmass grain size (avg.): fine-grained

Major texture: subophitic

Minor Texture: intersertal

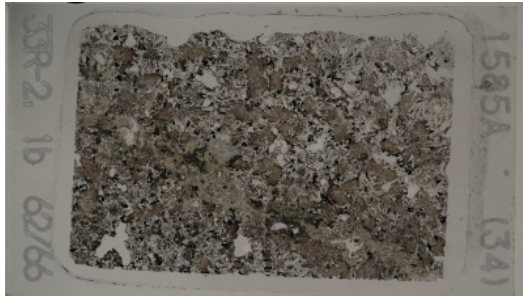
Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Clinopyroxene	25	22	3	1.4	3	subhedral	subequant	Mostly fresh. Highly fractured.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2		2	0.3	0.6	subhedral	equant	completely replaced by iddingsite then by calcite.
Plagioclase	37	15	22	0.3	1.1	euhedral	elongate	Moderate alteration. Some zoning but more intact cores.
Fe-Ti oxide	8			0.02	0.5	subhedral	equant	N/A
Mesostasis	22		22	N/A	N/A	N/A	N/A	significantly altered, though microlites are visible in some patches.

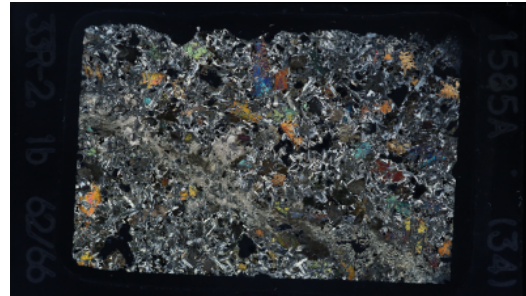
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	6	3	3	0.3	1.2	subrounded	Larger vesicles are completely filled. Some are more round while others are more irregular due to crystal boundaries.

THIN SECTION LABEL ID: **397T-U1585A-33R-2-W 62/66-TSB-TS 34** Thin section no.: 34  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx phyric with very sparse (<1%) plag phenocrysts. Seriate texture, though most cpx are phenocrysts and most plag are groundmass. Some subophitic cpx. Sparse olivine is present it is completely chloritized. Mesostasis is also completely altered to chlorite and calcite. Most plag are tabular rather than slender. Plag is less altered, and the grains a little less thin. Zoning is visible in more blocky grains. This samples shows irregular vesicles created from diktytaxitic texture; some are filled while others only lined. Large patches of plag are replaced by zeolite (?).

Plane-polarized: 64235021



Cross-polarized: 64235041

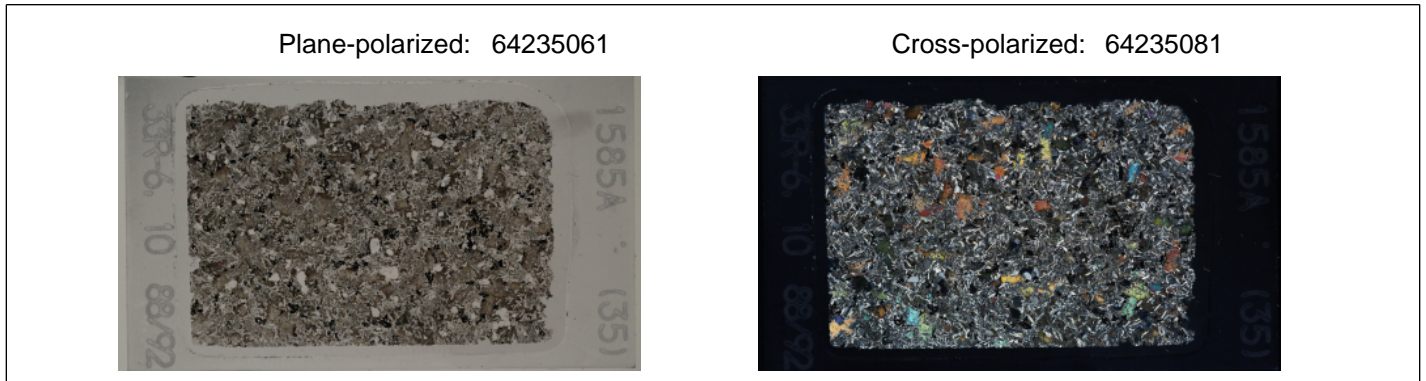


### Igneous Petrology

**Lithology:** highly **augite-plagioclase phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** intersertal **Minor Texture:** diktytaxitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	3	3			1.3	subhedral	tabular	reasonably fresh with minor inclusions of minerals. Seriate texture with groundmass plag.
Clinopyroxene	23	20	3	1	4	subhedral	subequant	Moderately fresh. Some subophtic textures.
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	4		4	0.4	0.6	subhedral	equant	completely replaced and difficult to distinguish
Plagioclase	25	17	8	0.7	1	euhedral	tabular	Tabular crystals with moderate alteration. Diktytaxitic texture and responsible for irregular vesicles
Fe-Ti oxide	6			0.2	1.1	subhedral	subequant	N/A
Mesostasis	25		25	N/A	N/A	N/A	N/A	significant alteration
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments	
Vesicle	14	8	6	0.5	2.2	subangular	Diktytaxitic texture creates irregular vesicle shapes.	

THIN SECTION LABEL ID: **397T-U1585A-33R-6-W 88/92-TSB-TS 35** Thin section no.: 35  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx-plag phyric with very sparse altered olivine phenocrysts. Plag show seriate textures with compositional zoning, and alteration is especially prevalent in zoned interiors. Cpx shows mild subophitic textures but not as strongly as in cores immediately above this one. Diktytaxitic texture creates a moderate vesicularity with irregular vesicle shapes. Some are empty while others are lined with fibrous zeolite. Calcite commonly fills the vesicles. Patchy mesostasis is shows significant alteration, but evidence for microlites persists.



### Igneous Petrology

**Lithology:** highly **augite-plagioclase phyric basalt massive lava flow**

**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained

**Major texture:** hypocrystalline **Minor Texture:** diktytaxitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	0.5		0.5	1	1	subhedral	subhedral	completely replaced. Faint iddingsite rims remain, but center is calcite.
Plagioclase	5	3	2	1	1.2	subhedral	tabular	Seriate texture - grains at the coarser end are large enough to be considered groundmass. Moderate to high sericite alteration is present, especially in the core of the phenocrysts. Shape ranges from somewhat slender to more tabular/blocky. Mild subophitic texture with cpx.
Clinopyroxene	9	7	2	1	1.3	subhedral	subequant	Mildly altered, blocky Ti-cpx with mild subophitic textures (not as strong as previous TS 30-34). Small inclusions present.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2		2	0.5	0.8	subhedral	equant	completely replaced
Plagioclase	34	24	10	0.5	1	euohedral	tabular	Tabular crystals with moderate alteration. Diktytaxitic texture and responsible for irregular vesicles. Zoning visible, and most of the alteration is in the zoned center.
Fe-Ti oxide	8		0.5	0.2	0.8	subhedral	subequant	N/A
Mesostasis	30		30	N/A	N/A	N/A	N/A	Altered but numerous microlites visible in most mesostasis patches. Heterogenously distributed throughout TS

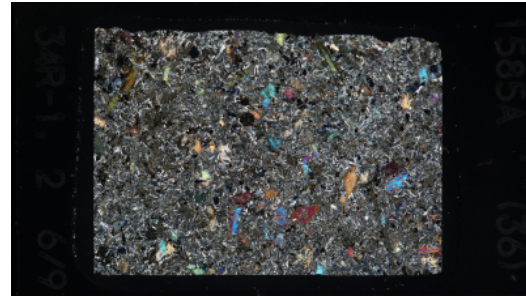
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	12	5	7	0.5	2	subangular	Diktytaxitic texture creates irregular vesicles. Larger vesicles are usually filled whereas smaller are empty. Vesicle fill is dominantly carbonate but fibrous zeolite is visible lining some vesicle walls.

THIN SECTION LABEL ID: **397T-U1585A-34R-1-W 6/9-TSB-TS 36** Thin section no.: 36  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx-plag phyric. Plag show seriate textures with compositional zoning, and alteration is especially prevalent in zoned interiors. Cpx shows mild subophitic textures. Diktytaxitic texture creates a moderate vesicularity with irregular vesicle shapes. Most are filled with fibrous zeolite or calcite. Patchy mesostasis is shows significant alteration but evidence for microlites persists. Sparse groundmass cpx is associated with some mesostasis patches.

Plane-polarized: 64235101



Cross-polarized: 64235121



### Igneous Petrology

**Lithology:** moderately

**Ti-rich augite phyric basalt massive lava flow**

**Grain size distribution:**

**Groundmass grain size (avg.):** fine-grained

**Major texture:** hypocrySTALLINE

**Minor Texture:** diktytaxitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	5	2	3	1	1.6	subhedral	tabular	Seriate texture. Abundant alteration in zoned core.
Clinopyroxene	8	7	1	1	1.6	subhedral	subequant	Mildly altered with inclusions. Subophitic. Subtle zoning visible.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	3		3	0.1	0.7	subhedral	equant	Completely replaced by iddingsite and calcite
Plagioclase	40	15	25	0.4	1	subhedral	tabular	Most crystals are elongate tabs with zonation and twinning. All have a degree of sericite alteration, with cores sustaining the highest degree of alteration.
Clinopyroxene	2	2		0.02	0.06	subhedral	equant	
Fe-Ti oxide	6			0.1	0.8	subhedral	subequant	N/A
Mesostasis	27		27	N/A	N/A	N/A	N/A	

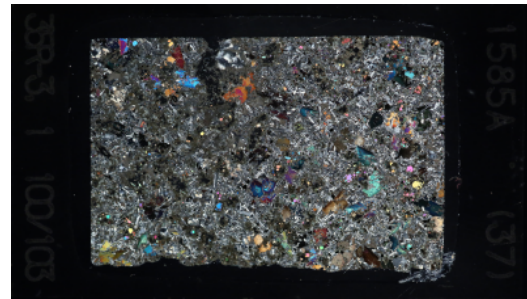
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	9		9	0.5	1.6	subangular	Diktytaxitic texture creates irregular vesicle shapes. Most are filled with zeolite or calcite

THIN SECTION LABEL ID: **397T-U1585A-35R-3-W 100/103-TSB-TS 37** Thin section no.: 37  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx-olivine phyric. Plag and olivine show seriate textures with most crystals falling in groundmass sizes. Olivine cores are fresh while rims and fractures show alteration (chlorite?). Cpx shows mild subophitic textures and is subtly zoned. Diktytaxitic texture creates a moderate vesicularity with irregular vesicle shapes. Most are filled with fibrous zeolite or calcite. Patchy mesostasis is shows complete alteration.

Plane-polarized: 64235141



Cross-polarized: 64235161



### Igneous Petrology

**Lithology:** highly **augite-olivine phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** Hypocrystalline **Minor Texture:** diktytaxitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2		2	1	1.6	euhedral	euhedral	Fresh cores with thin alteration rims
Plagioclase	2	1	1	1	1.2	subhedral	tabular	seriate texture. Cores sustain the highest degree of alteration.
Clinopyroxene	20	20		1	3.4	subhedral	subequant	Mildly altered. Subtle zoning visible. Subophitic

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	9	7	2	0.3	1	euhedral	equant	Fresh cores with thin to moderate alteration rims. Alteration is also visible along grain fractures.
Plagioclase	35	10	25	0.4	1	subhedral	tabular	Significant alteration. Patches of the thin section are more altered than others.
Fe-Ti oxide	5		2	0.04	0.4	subhedral	subequant	N/A
Mesostasis	23		23	N/A	N/A	N/A	N/A	Significantly altered. Present in irregular patches in the thin section.

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	4		4	0.5	1.3	subrounded	Diktytaxitic texture creates somewhat irregular vesicles - most are a little round.

THIN SECTION LABEL ID: **397T-U1585A-35R-4-W 85/88-TSB-TS 38** Thin section no.: 38  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx-olivine phyrlic. Plag and olivine show seriate textures with most crystals falling in groundmass sizes. Olivine is completely replaced by serpentine and chlorite. Cpx shows mild subophitic textures and is subtly zoned. Sparse vesicles are more rounded - not a strong diktytaxitic texture. Most are filled with fibrous zeolite or calcite. Patchy mesostasis is altered but microlites are still visible.

Plane-polarized: 64235181



Cross-polarized: 64235201



### Igneous Petrology

**Lithology:** highly **augite-olivine-plagioclase phyrlic basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** hypocrystalline **Minor Texture:** intersertal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	3		3	1	1.5	subhedral	subhedral	completely replaced by serpentine
Plagioclase	2	1	1	1	1.2	subhedral	tabular	Contains both continuous and oscillatory zoning. Cores show the most alteration. Seriate texture
Clinopyroxene	15	15		1.5	2.6	subhedral	subequant	Fresh. No inclusions. Subophitic.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	13		13	0.2	1	subhedral	equant	Completely replaced by serpentine and chlorite. Often round in loose clusters.
Plagioclase	32	12	20	0.4	1	subhedral	tabular	Significant alteration. Sometimes restricted to the cores while other times it replaces the whole crystal.
Clinopyroxene	1	1		0.02	0.07	subhedral	equant	
Fe-Ti oxide	4		3	0.05	0.5	subhedral	subequant	N/A
Mesostasis	28		28	N/A	N/A	N/A	N/A	Altered but microlites still visible

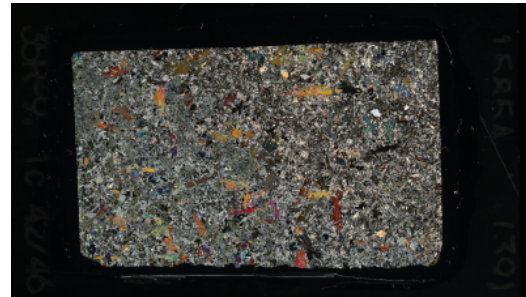
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	2		2	0.4	0.8	subrounded	Line with one mineral and filled with a second mineral (calcite then zeolite?)

THIN SECTION LABEL ID: **397T-U1585A-35R-9-W 42/46-TSB-TS 39** Thin section no.: 39  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Contact between coarser massive flow and finer-grained basaltic vein. Vein contains Ti-cpx, some as phenocrysts but also some as groundmass. Slender crystals have a skeletal and mildly subophitic texture. No olivine present. Groundmass plagioclase is finer grained than in the massive flow but highly altered. Mesostasis is also highly altered. Small, blocky groundmass oxides have skeletal textures. Massive flow is highly Ti-cpx-olivine-plagioclase phyric. Plagioclase and olivine have seriate textures with most phenocrysts categorized as groundmass. Olivine is moderately abundant in the groundmass but is completely replaced by chlorite. Plagioclase is significantly replaced. Mesostasis is completely altered but contains microlite vestiges.

Plane-polarized: 64235221



Cross-polarized: 64235241



**Igneous Petrology**

**Lithology:** moderately **augite phyric basalt vein**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** porphyritic **Minor Texture:** aphanitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Clinopyroxene	7	7		1	3.2	subhedral	subequant	Large skeletal grains.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	30	15	15	0.3	0.8	subhedral	tabular	Almost completely altered to sericite
Clinopyroxene	10	10		0.05	1	subhedral	subequant	
Fe-Ti oxide	7			0.01	0.3	subhedral	subequant	N/A
Mesostasis	40		40	N/A	N/A	N/A	N/A	Significantly altered but microlites are still visible

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	6		6	0.1	0.8	subrounded	filled with calcite except where plucked

**Igneous Petrology**

**Lithology:** highly **augite-olivine-plagioclase phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):**  
**Major texture:** hypocrystalline **Minor Texture:** subophitic



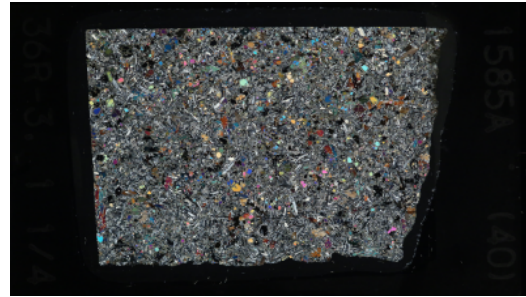
<b>Phenocrysts</b>	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	1		1	1	1.2	subhedral	subhedral	Completely replaced by chlorite. Seriate texture with most grains categorized as groundmass based on size.
Plagioclase	1		1	1	1.2	subhedral	elongate	Each crystal is almost completely altered. Seriate texture with most grains categorized as groundmass based on size.
Clinopyroxene	18	18		1.5	3.5			Fresh. subophitic textures. Poikilitic with both plag and olivine oikocrysts.
<b>Groundmass</b>	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	12		12	0.2	1	subhedral	equant	Completely replaced by chlorite
Plagioclase	15		15	0.4	1			Most plag is partially to completely altered to sericite
Fe-Ti oxide	5		1	0.02	0.2		equant	N/A
Mesostasis	36		36	N/A	N/A	N/A	N/A	Significantly altered but microlites still visible
<b>Vesicle</b>	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments	
Vesicle	2		2		1.3		filled with calcite	

THIN SECTION LABEL ID: **397T-U1585A-36R-3-W 1/4-TSB-TS 40** Thin section no.: 40  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx phyric with sparse olivine and plag phenocryst. Olivine and plag have seriate textures with most crystals considered groundmass. Fresh olivine cores are rimmed by chlorite; a few portions of the TS have completely replace olivine, but that is sparse. Olivine can be found as clusters or individual crystals. Plag is moderately altered to sericite. Mesostasis is altered but retains microcrystals of plag, cpx, and oxides. Oxides are blocky (not skeletal). Sparse subround vesicles are lined by zeolites.

Plane-polarized: 64235261



Cross-polarized: 64235281



### Igneous Petrology

**Lithology:** highly **augite-olivine-plagioclase phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** hypocrystalline **Minor Texture:** subophitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	1	1		1	1.2	euhedral	euhedral	Fresh cores with thin chlorite alteration rims
Plagioclase	1	0.5	0.5	1	1.2	subhedral	elongate	Seriate texture. Contains both continuous and discontinuous zoned crystals
Clinopyroxene	16	16		1	3	subhedral	subequant	Poikilitic around both plag and olivine. Fresh

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	15	10	5	0.2	1	euhedral	equant	Fresh cores with rims of chlorite. Sometimes crystals are solo whereas other times they are in clusters
Plagioclase	27	12	15	0.3	1	subhedral	tabular	Seriate texture. Plag is partially altered to sericite.
Clinopyroxene	3	3		0.04	1	subhedral	subequant	
Fe-Ti oxide	4			0.05	0.3	subhedral	equant	N/A
Mesostasis	31		31	N/A	N/A	N/A	N/A	Small oxide and plag microlite needles are visible

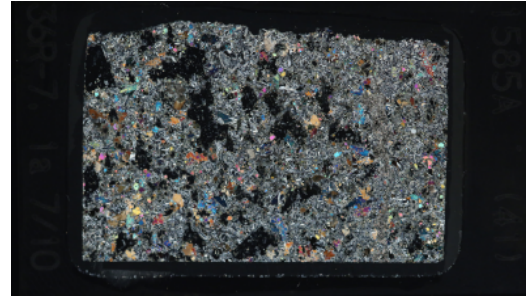
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	2	1	1	0.8	1.2	subrounded	vesicles are lined with radial zeolite

THIN SECTION LABEL ID: **397T-U1585A-36R-7-W 7/10-TSB-TS 41** Thin section no.: 41  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx phyric with sparse olivine and plag phenocryst. Olivine and plag have seriate textures with most crystals considered groundmass. Cpx is a little finer, and the average crystal size straddles the phenocrysts-groundmass divide. Variable alteration across the thin section. Veins of alteration create zones of highly altered crystals and groundmass. This material was more susceptible to plucking during thin section processing. Fresh olivine cores are rimmed by chlorite; a few portions of the TS have completely replaced olivine, but that is sparse. Plag is moderately to highly altered to sericite. Oxides are blocky (not skeletal). Sparse subround vesicles are lined by zeolites.

Plane-polarized: 64235711



Cross-polarized: 64235731



### Igneous Petrology

**Lithology:** highly **augite-olivine-plagioclase phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** hypocrystalline **Minor Texture:** subophitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	1	1		1	1.2	euhedral	euhedral	Fresh cores with chlorite rims. Some small ol are completely altered. Seriate texture.
Plagioclase	1	0.5	0.5	1	1.2	subhedral	elongate	Seriate texture. Contains both continuous and discontinuous zoned crystals
Clinopyroxene	10	10		1	2.2	subhedral	subequant	Not as many very large phenocrysts. Fresh. Poikilitic with ol and plag oikocrysts

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	21	15	6	0.3	1	euhedral	equant	Fresh cores with chlorite rims. Some small ol are completely replaced. Seriate texture.
Plagioclase	27	17	10	0.3	1	subhedral	tabular	Seriate texture. Elongate tabs. Plag is partially altered to sericite.
Clinopyroxene	10	10		0.04	1	subhedral	subequant	
Fe-Ti oxide	4			0.02	0.6	subhedral	subequant	N/A
Mesostasis	25		25	N/A	N/A	N/A	N/A	

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	1	0.5	0.5	0.5	1	subrounded	vesicles are lined with radial zeolite

THIN SECTION LABEL ID: **397T-U1585A-37R-5-W 124/127-TSB-TS 42** Thin section no.: 42  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Highly Ti-cpx phyric with sparse olivine and plag phenocryst. Olivine and plag have seriate textures with most crystals considered groundmass. Fresh olivine cores are rimmed by chlorite; a few portions of the TS have completely replace olivine, but that is sparse. Plag is moderately altered to sericite. Mesostasis is altered. Oxides are blocky (not skeletal). Sparse subround vesicles are lined by zeolites. Band of higher alteration on one side of the TS but otherwise texturally equivalent.

Plane-polarized: 64235301



Cross-polarized: 64235321



### Igneous Petrology

**Lithology:** highly **augite-olivine-plagioclase phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** hypocrystalline **Minor Texture:** subophitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2	2		1	1.4	euhedral	euhedral	Fresh cores. Larger grains with alteration on rims and along fractures. Seriate texture
Plagioclase	2	1	1	1	1.2	subhedral	elongate	Seriate texture. Contains both continuous and discontinuous zoned crystals
Clinopyroxene	19	19		1	2.2	subhedral	subequant	Poikilitic with both plag and olivine. Fresh

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	21	15	6	0.2	1	euhedral	equant	Fresh cores with chlorite rims. Seriate texture. Some form small clusters.
Plagioclase	29	12	17	0.3	1	subhedral	tabular	Seriate texture. Elongate tabs. Plag is partially altered to sericite.
Clinopyroxene	4	4		0.2	1	subhedral	subequant	
Fe-Ti oxide	4			0.02	0.2	subhedral	equant	N/A
Mesostasis	18		18	N/A	N/A	N/A	N/A	

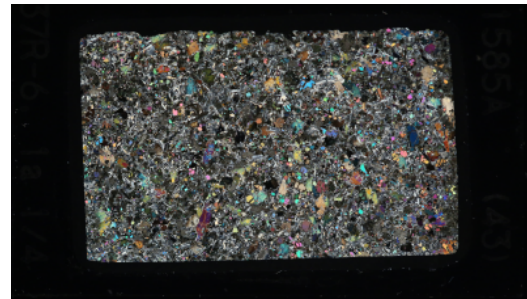
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	1	0.5	0.5	0.7	1	subrounded	vesicles are lined with radial zeolite

THIN SECTION LABEL ID: **397T-U1585A-37R-6-W 1/4-TSB-TS 43** Thin section no.: 43  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately Ti-cpx phyric with sparse olivine phenocrysts. Olivine and plag have seriate textures with most crystals considered groundmass. Fresh olivine cores are rimmed by chlorite; a few portions of the TS have completely replaced olivine. Plag is moderately altered to sericite. Sparse mesostasis is altered. Oxides are blocky (not skeletal). Sparse subround vesicles are lined by zeolites.

Plane-polarized: 64235341



Cross-polarized: 64235361



### Igneous Petrology

**Lithology:** moderately **augite-olivine phyric basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** hypocrystalline **Minor Texture:** subophitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2	2		1	2.2	euhedral	euhedral	Fresh cores. Seriate texture. Chlorite rim alteration is common; sometimes replaces entire crystal.
Clinopyroxene	8	8		1	1.4	subhedral	subequant	Poikilitic with olivine and plag. Seriate texture with more groundmass cpx than "normal"

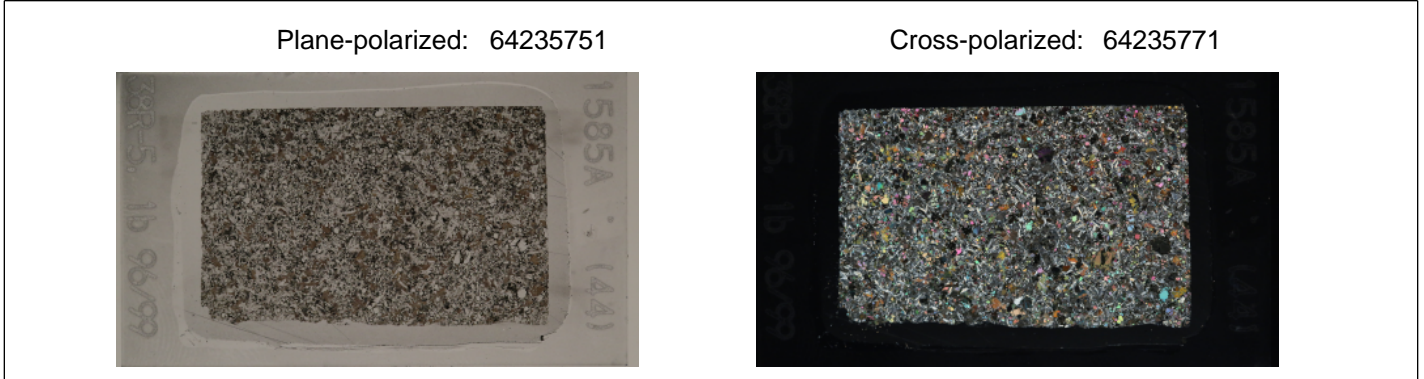
  

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	33	25	8	0.2	1	subhedral	equant	Mostly fresh cores with chlorite rims. More complete alteration than see in many other TS with fresh olivine. Seriate texture
Plagioclase	29	15	14	0.2	1	subhedral	tabular	Seriate texture. Elongate tabs. Zoning sometimes present.
Clinopyroxene	10	10		0.2	1	subhedral	subequant	
Fe-Ti oxide	3			0.02	0.2	subhedral	equant	N/A
Mesostasis	10		10	N/A	N/A	N/A	N/A	

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	5	1	4	0.5	1.2	subrounded	Lined with zeolite. Sometimes filled with calcite.

THIN SECTION LABEL ID: **397T-U1585A-38R-5-W 96/99-TSB-TS 44** Thin section no.: 44  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Sparsely olivine-Ti-cpx phyric massive flow. Most of the crystal cargo is groundmass. The largest crystals are olivine. Olivine is partially (rims and fractures) to completely altered to chlorite. Cpx is fresh. Plag is moderately altered. Sparse altered mesostasis present. Sparse vesicles are irregular and lined to filled with zeolite and calcite.



### Igneous Petrology

**Lithology:** sparsely **olivine-augite phyric basalt massive lava flow**

**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained

**Major texture:** hypocrystalline **Minor Texture:** subophitic

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2	2		1	3	euhedral	euhedral	Fresh cores in some grains. Alteration on rims and fractures. Some completely replaced. Seriate texture.
Clinopyroxene	2	2		1	1.2	subhedral	subequant	Poikilitic with plag and olivine oikocrysts. Most cpx is groundmass-sized

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	35	27	8	0.3	1	euhedral	equant	Mostly fresh cores with chlorite rims. More complete alteration than see in many other TS with fresh olivine. Seriate texture
Plagioclase	25	8	17	0.2	1	subhedral	tabular	Seriate texture. Elongate tabs. Zoning sometimes present.
Clinopyroxene	13	13		0.3	1	subhedral	subequant	
Fe-Ti oxide	8			0.02	0.12	subhedral	subequant	N/A
Mesostasis	9		9	N/A	N/A	N/A	N/A	

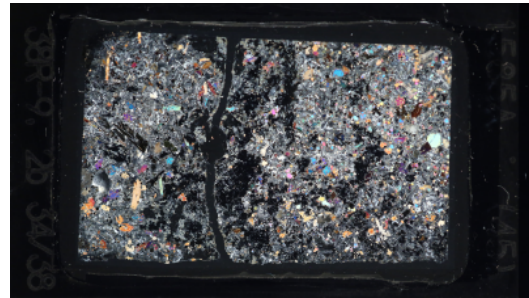
Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	6		6	0.3	1	subangular	Lined or filled with zeolite

THIN SECTION LABEL ID: **397T-U1585A-38R-9-W 34/38-TSB-TS 45** Thin section no.: 45  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Thin section poorly made with large patches missing. Domain 1 is moderately phyrlic in olivine and Ti-cpx. Ti-Cpx if fresh but quite jagged due to missing patches. Olivine is fresh with only minor alteration rims. Groundmass plag, where in tact, look mostly fresh. However, altered plag and mesostatis become difficult to distinguish due to thin and missing rock. Groundmass oxides are small and blocky. Domain 2: olivine-free Ti-cpx phyrlic vein with highly altered groundmass and plag. Large radiating secondary minerals are common. Skeletal groundmass oxides are scattered through entire vein except for in cpx. Again, full description suffers from missing portions of TS.

Plane-polarized: 64235381



Cross-polarized: 64235401



### Igneous Petrology

**Lithology:** moderately **augite-olivine phyrlic basalt massive lava flow**  
**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained  
**Major texture:** hypocrystalline **Minor Texture:** dendritic or skeletal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2.5	2	0.5	1	2.4	subhedral	subhedral	Fresh cores with minimal rim alteration. Seriate texture with most grains <1 mm.
Clinopyroxene	3	3			1.3			Seriate texture. Fresh.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	18	15	3	0.06	1	subhedral	equant	Very fresh with only small rims of chlorite alteration.
Plagioclase	35	20	15		1	anhedral		Seriate texture. Grain boundaries not always well defined
Clinopyroxene	10	10		0.3				
Fe-Ti oxide	7		0.5	0.3	0.12		equant	N/A
Mesostasis	25		25	N/A	N/A	N/A	N/A	

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle							Only one filled vesicle. Too much TS was polished away, so its difficult to evaluate

## Igneous Petrology

**Lithology:** moderately **augite phyric vein massive lava flow**

**Grain size distribution:** **Groundmass grain size (avg.):** fine-grained

**Major texture:** hypocrystalline **Minor Texture:** radial

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Clinopyroxene	10	10		1	3.6	subhedral	subequant	Seriate texture. Skeletal Ti-cpx with plag or alteration in empty spaces.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	35	8	27	0.2	0.8	subhedral	tabular	Seriate texture where visible. Significant alteration makes it difficult to determine plag from something else.
Clinopyroxene	6	6		0.04	1	subhedral	subequant	
Fe-Ti oxide	3			0.04	0.3	subhedral	subequant	N/A
Mesostasis	36		36	N/A	N/A	N/A	N/A	abundant radiating crystals with microlites

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	8		8		1.8	subrounded	Only one large vesicle, completely filled with radiating material.

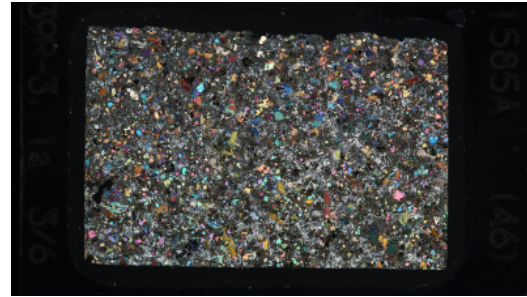


THIN SECTION LABEL ID: **397T-U1585A-39R-3-W 3/6-TSB-TS 46** Thin section no.: 46  
 Observer: WN Piece no.:  
 Thin section thickness: Unit/subunit:  
 Thin section summary: Moderately Ti-cpx-olivine phyric massive basalt. All phases have seriate textures. Olivine is more abundant than Ti-cpx but is mostly a groundmass phase. Ti-cpx has some subophitic crystals though most are blocky. Olivine has thin rims of chlorite with fresh cores. All plag is groundmass-sized and is significantly altered. Mesostasis is also altered and contains microphenocrysts of oxides and cpx. Groundmass oxides are blocky.

Plane-polarized: 64235421



Cross-polarized: 64235441



### Igneous Petrology

Lithology: moderately

**augite-olivine phyric basalt  
massive lava flow**

Grain size distribution:

Groundmass grain size (avg.): fine-grained

Major texture: hypocrySTALLINE

Minor Texture: intersertal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	2.5	2	0.5	1	1.8	subhedral	subhedral	Fresh cores. Altered rims
Clinopyroxene	4	4		1	3.2	subhedral	subequant	Seriate texture. Some subophitic grains but not all. Overall on the blocky side as opposed to being long and slender.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Olivine	22	18	4	0.04	1	subhedral	equant	Fresh cores with replaced rims
Plagioclase	27	5	22	0.2	0.8	subhedral	tabular	Seriate texture. Some discontinuous zoning visible thorough alteration.
Clinopyroxene	10	10		0.2	1	subhedral	subequant	
Fe-Ti oxide	6		0.5	0.04	0.2	subhedral	subequant	N/A
Mesostasis	25		25	N/A	N/A	N/A	N/A	difficult to distinguish between altered plag and altered mesostasis

Vesicle	Original (%)	Empty (%)	Filled (%)	Size min. (mm)	Size max. (mm)	Shape	Comments
Vesicle	3		3	0.4	2.6	subrounded	varies from roughly circular to rather elongate.