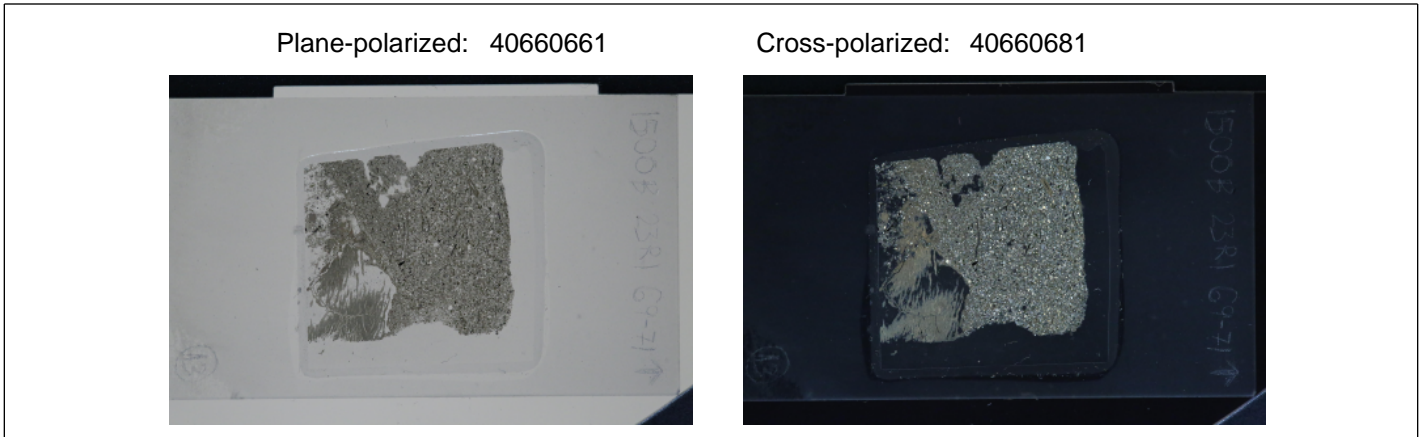


THIN SECTION LABEL ID: **367-U1500B-23R-1-W 69/71-TSB-TS\_13** Thin section no.: 13  
 Observer: B. Johnson Unit/subunit: IV  
 Thin section summary: Coarse-grained, poorly sorted bioclast-rich silty sandstone with subangular quartz, feldspar, mica, clay minerals, and foraminifera tests. The framework grains are supported in a glauconite, clay, and carbonate mud dominated matrix (25%).



### Sediments and Sedimentary Rock

**Sample domain name:** sediment clasts                      **Domain rel. abundance:** 75  
**Lithology:** bioclast rich silty sandstone

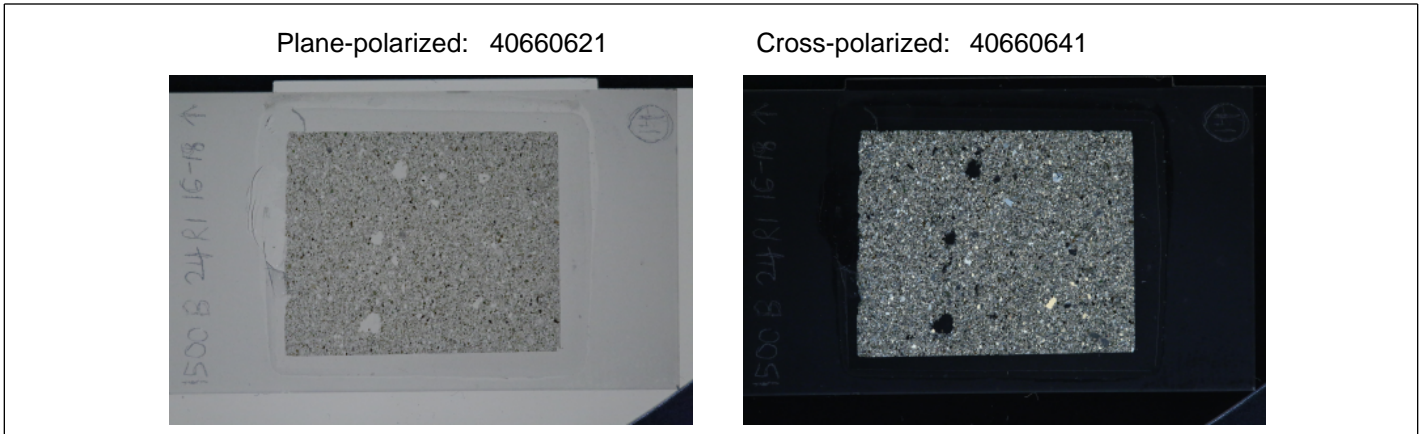
TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture	0	Siliciclastics	75	Mineral grains	subangular
Sand texture	50	Detrital carbonate	25		
Silt texture	35	Biogenic carbonate	0		
Clay texture	15	Biogenic silica	0		

### Framework grain abundance

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

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

THIN SECTION LABEL ID: **367-U1500B-24R-1-W 16/18-TSB-TS\_14** Thin section no.: 14  
 Observer: B. Johnson Unit/subunit: IV  
 Thin section summary: Coarse-grained, poorly sorted sandstone with bioclasts with subangular quartz, feldspar, mica, glauconite, and foraminifera tests. The framework grains are supported in a well-developed carbonate cement (25%).



### Sediments and Sedimentary Rock

**Sample domain name:** sediment clasts **Domain rel. abundance:** 75  
**Lithology:** sandstone with bioclasts

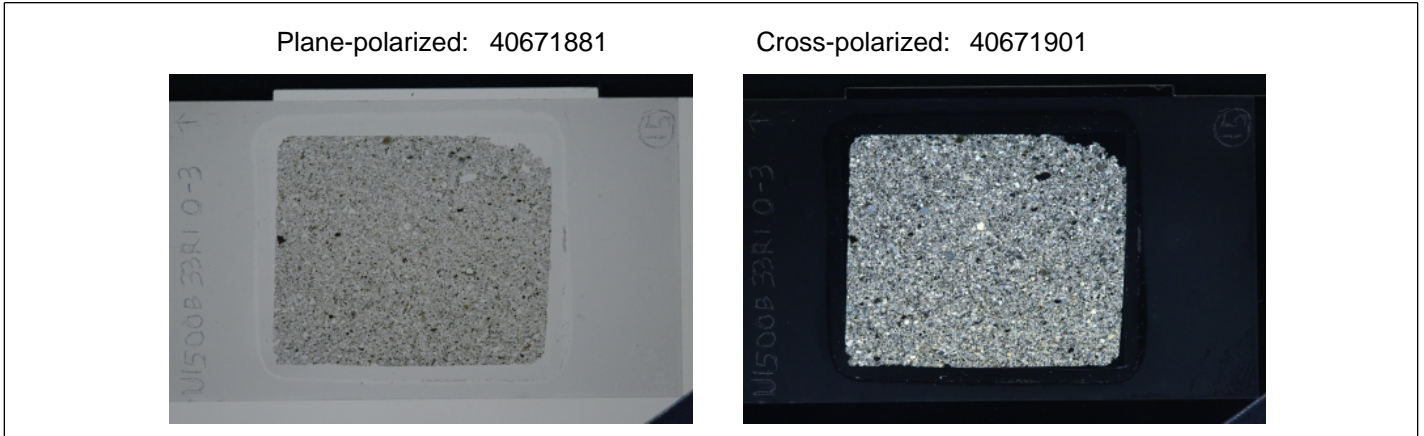
TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture		Siliciclastics	65	Mineral grains	subangular
Sand texture	80	Detrital carbonate	35		
Silt texture	15	Biogenic carbonate	0		
Clay texture	5	Biogenic silica	0		

### Framework grain abundance

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

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

THIN SECTION LABEL ID: **367-U1500B-33R-1-TSB-TS\_15** Thin section no.: 15  
 Observer: B. Johnson Unit/subunit: IV  
 Thin section summary: Coarse-grained, poorly sorted silty sandstone with subangular quartz, plagioclase, potassium feldspar, mica, glauconite, sedimentary lithic fragments, and foraminifera tests. The framework grains are supported in a well-developed carbonate cement (30%).



### Sediments and Sedimentary Rock

Sample domain name: sediment clasts Domain rel. abundance: 70

Lithology: silty sandstone

TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture	0	Siliciclastics	90	Mineral grains	subangular
Sand texture	60	Detrital carbonate			
Silt texture	35	Biogenic carbonate	10		
Clay texture	5	Biogenic silica			

### Framework grain abundance

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

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

THIN SECTION LABEL ID: **367-U1500B-48R-2-W 90/92-TSB-TS\_16** Thin section no.: 16  
 Observer: B. Johnson Unit/subunit: VB  
 Thin section summary: Fine-grained silt-rich chalk with sand-sized bioclastic debris (foraminifera tests?). The silt and sand grains are supported in a pervasive microcrystalline matrix of calcium carbonate, which makes up 80% of the thin section.

Plane-polarized: 40730551

Cross-polarized: 40730571



### Sediments and Sedimentary Rock

Sample domain name: sediment clasts

Domain rel. abundance: 20

Lithology: sandy siltstone

TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture		Siliciclastics	35	Mineral grains	sub-rounded
Sand texture	15	Detrital carbonate	0		
Silt texture	45	Biogenic carbonate	65		
Clay texture	40	Biogenic silica	0		

### Sediments and Sedimentary Rock

Sample domain name: carbonate matrix

Domain rel. abundance: 80

Lithology:

TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture		Siliciclastics	50	Mineral grains	
Sand texture		Detrital carbonate			
Silt texture		Biogenic carbonate	50		
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	C	Calcite (allogenic)	D
Feldspar		Mica	Tr
Clay minerals	C	Glauconite	
Lithic grains		Foraminifera	D
Chert		Undifferentiated calcareous bioclasts	C

### Framework grain abundance

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

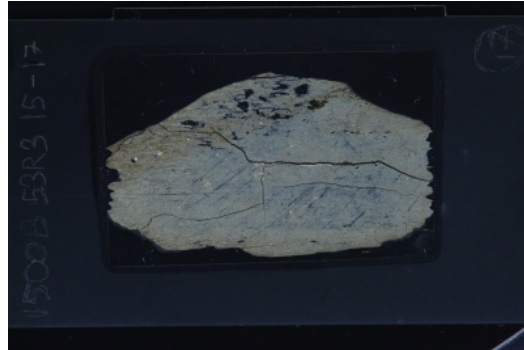
Component	Rel. abundance	Component	Rel. abundance
Quartz		Calcite (allogenic)	
Feldspar		Mica	
Clay minerals	D	Glauconite	
Lithic grains		Foraminifera	
Chert		Undifferentiated calcareous bioclasts	

THIN SECTION LABEL ID: **367-U1500B-53R-3-W 15/17-TSB-TS\_17** Thin section no.: 17  
 Observer: B. Johnson Unit/subunit: VI  
 Thin section summary: Calcareous-rich silty claystone that is well sorted. The dominate grain types include quartz, clay minerals, and carbonate mud. Framboidal pyrite is typically observed within organic lamina or as fillings of foraminifera tests.

Plane-polarized: 40730511



Cross-polarized: 40730531



### Sediments and Sedimentary Rock

Sample domain name: sediment clasts

Domain rel. abundance: 100

Lithology: calcareous rich silty claystone

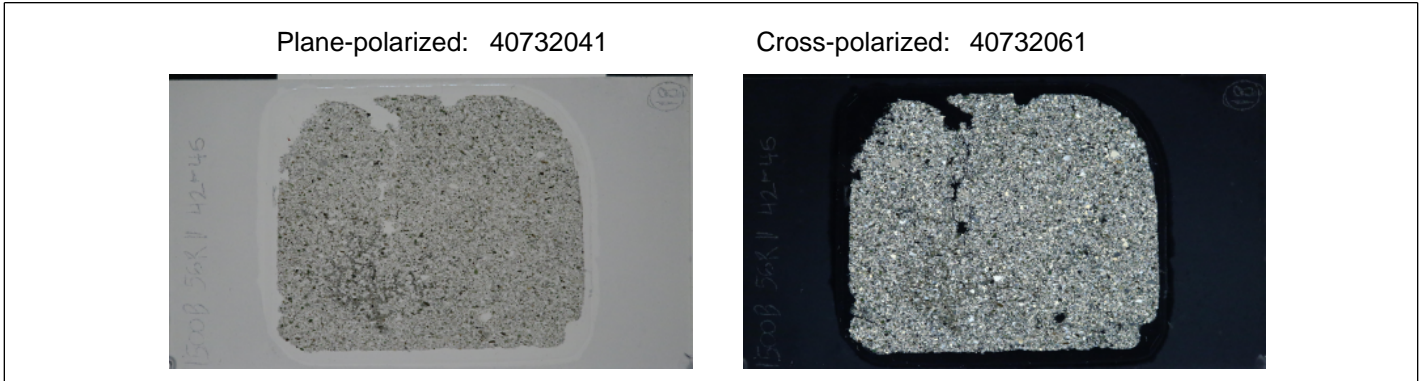
TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture		Siliciclastics	75	Mineral grains	sub-rounded
Sand texture	15	Detrital carbonate	5		
Silt texture	25	Biogenic carbonate	20		
Clay texture	60	Biogenic silica	0		

### Framework grain abundance

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

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

THIN SECTION LABEL ID: **367-U1500B-56R-1-W 42/46-TSB-TS\_18** Thin section no.: 18  
 Observer: B. Johnson Unit/subunit: VI  
 Thin section summary: Coarse- to fine-grained, poorly sorted sandstone with subangular grains of quartz, plagioclase, potassium feldspar, mica, glauconite, sedimentary lithic fragments, and foraminifera tests. A well-developed carbonate cement, which comprises 25% of the thin section, is observed in the interstitial space between the framework grains.



**Sediments and Sedimentary Rock**  
 Sample domain name: carbonate matrix                      Domain rel. abundance: 25  
 Lithology:

**Sediments and Sedimentary Rock**  
 Sample domain name: sediment clasts                      Domain rel. abundance: 75  
 Lithology: sandstone

TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture		Siliciclastics	85	Mineral grains	subangular
Sand texture	80	Detrital carbonate	5		
Silt texture	15	Biogenic carbonate	10		
Clay texture	5	Biogenic silica	0		

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

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

**Framework grain abundance**

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

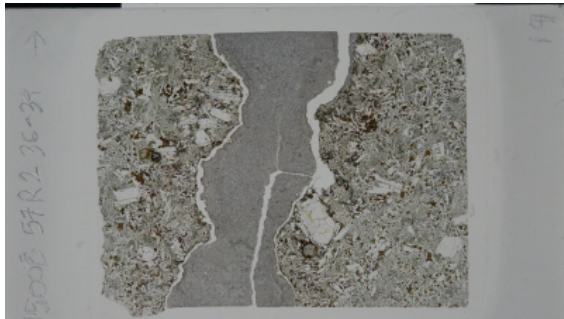
Component	Rel. abundance	Component	Rel. abundance
Quartz	A	Calcite (allogenic)	C
Feldspar	A	Mica	C
Clay minerals		Glauconite	A
Lithic grains	A	Foraminifera	C
Chert	A	Undifferentiated calcareous bioclasts	R



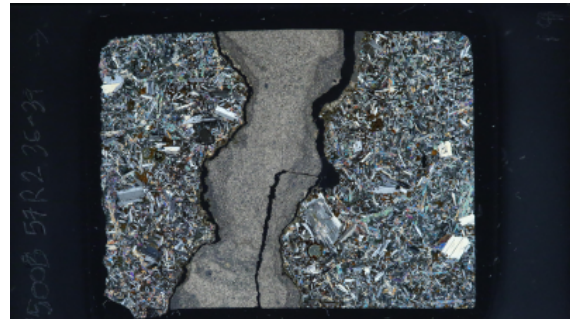
THIN SECTION LABEL ID: **367-U1500B-57R-2-W 36/39-TSB-TS\_19** Thin section no.: 19  
 Observer: X.L. Huang Piece no.:  
 Unit/subunit: 1a

Thin section summary: The porphyritic basalt shows subophitic and intersertal textures. A vein composed of dominant clay minerals with minor calcite is present in middle part of the thin section. The width of vein is range from 0.5 cm to 1.2 cm, and approximately one-fourth of the thin section. The sample is slightly vesiculated with round vesicle shapes. Plagioclase is the only phenocryst with the size of 1 to 4 mm and abundances of <5%. The large plagioclase phenocrysts are mostly stubby euhedral crystals sometimes zoned. The small plagioclase phenocrysts are mostly prismatic subhedral crystals. Some large plagioclase phenocrysts are partially altered to calcite. The groundmass is mostly holocrystalline and is composed primarily of plagioclase, clinopyroxene, and Fe-Ti oxide. Plagioclase mostly occurs as narrow, elongated prismatic crystals in subophitic relationships with clinopyroxene. Plagioclase is the most common crystalline phase, comprising 50 % of the groundmass, whereas clinopyroxene comprises 40 % of the groundmass. The groundmass is slightly altered to calcite or chlorite, and the glass is mostly altered to chlorite.

Plane-polarized: 40732001



Cross-polarized: 40732021



### Igneous Petrology

**Lithology:** sparsely plagioclase phyric basalt **Groundmass grain size (avg.):** medium-grained  
**Texture:** porphyritic **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	5	4	1	1	4	subhedral	tabular	

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	50	50	0	0.04	1	subhedral	elongate	
Clinopyroxene	40	30	10	0.2	2.3	subhedral	elongate	
Fe-Ti oxide	2	2	0	0.02	0.2	subhedral	subequant	
Glass	3	0	3	N/A	N/A	N/A	N/A	altered to chlorite

### Igneous Petrology

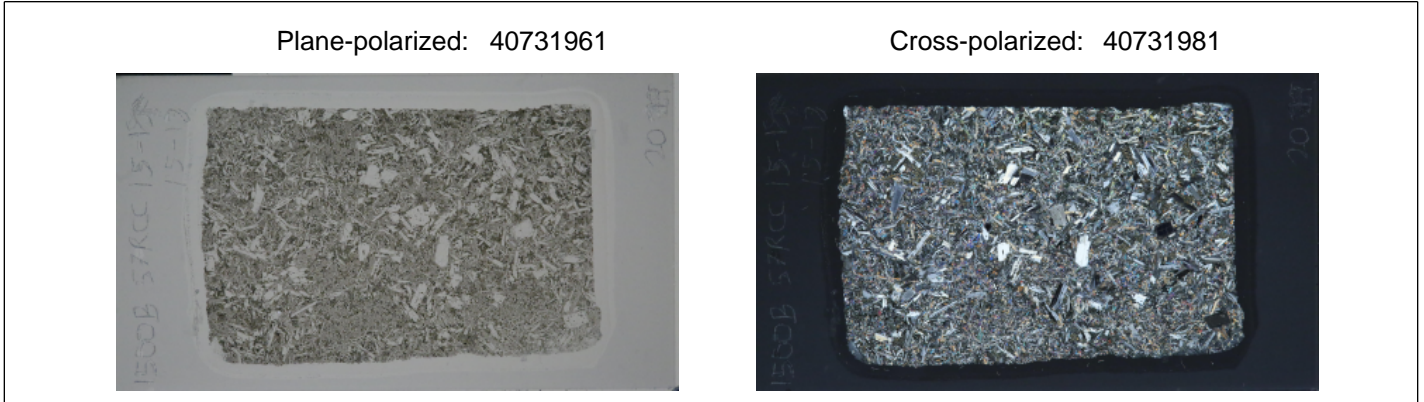
**Lithology:** reddish claystone Vein **Groundmass grain size (avg.):** fine-grained  
**Texture:** granular **Grain size distribution:** equigranular

**Veins and Halos**

<b>Vein type:</b>	uniform vein	<b>Vein boundary:</b>	sharp boundary or contact
<b>Avg. thickness (cm):</b>	1	<b>Vein texture:</b>	
<b>Vein comments:</b>	neptunian		

THIN SECTION LABEL ID: **367-U1500B-57R-CC-W 15/18-TSB-TS\_20** Thin section no.: 20  
 Observer: X.L. Huang Piece no.:  
 Unit/subunit: 1a

Thin section summary: The porphyritic basalt shows subophitic and intersertal textures. Plagioclase is the only phenocryst between 1 to 2.8 mm and abundances of <5%. The plagioclase phenocrysts are stubby or elongated prismatic subhedral crystals. The plagioclase are mostly zoned. The groundmass is hypocrySTALLINE and is composed primarily of plagioclase, clinopyroxene, and Fe-Ti oxide. Plagioclase mostly occurs as narrow, elongated prismatic crystals in subophitic relationships with clinopyroxene. Clinopyroxene mostly occurs as narrow, elongated prismatic crystals and sometimes poikilitic. Plagioclase is the most common crystalline phase, comprising 50% of the groundmass, whereas clinopyroxene comprises 40% of the groundmass. Some clinopyroxenes are altered to chlorite. The glass is altered to chlorite.



**Igneous Petrology**

**Lithology:** sparsely plagioclase phyric basalt      **Groundmass grain size (avg.):** fine-grained

**Texture:** porphyritic      **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	5	5	0	1	2.8	subhedral	tabular	

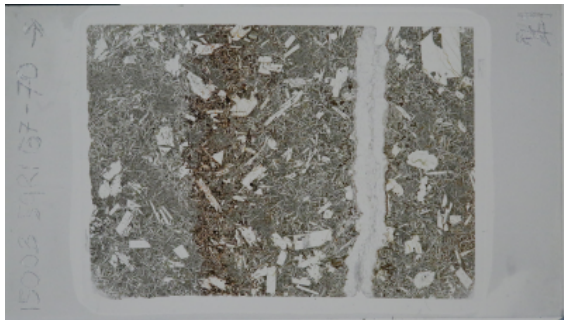
  

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	50	50	0	0.02	1	subhedral	elongate	
Clinopyroxene	40	33	7	0.04	1	subhedral	elongate	
Fe-Ti oxide	3	3	0	0.02	0.4	subhedral	subequant	
Glass	2	0	2	N/A	N/A	N/A	N/A	altered to chlorite

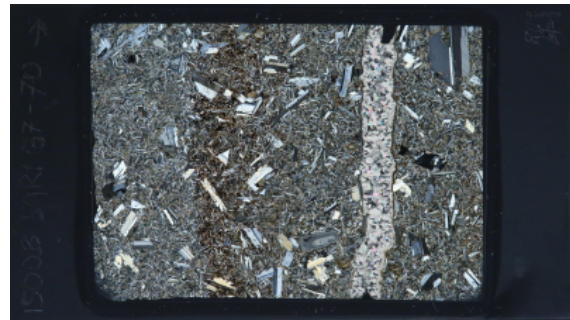
THIN SECTION LABEL ID: **367-U1500B-59R-1-W 67/70-TSB-TS\_21** Thin section no.: 21  
 Observer: X.L. Huang Piece no.:  
 Unit/subunit: 1b

Thin section summary: The porphyritic basalt shows subophitic and intersertal textures. A calcite vein is present in middle part of the thin section. The width of the vein is about 3 mm. Plagioclase is the only phenocryst between 1 to 5 mm and abundances of <5%. The plagioclase phenocrysts are stubby or elongated prismatic subhedral crystals. The plagioclase are mostly zoned. The groundmass is hypocrySTALLINE and is composed primarily of plagioclase, clinopyroxene, and Fe-Ti oxide. Plagioclase mostly occurs as narrow, elongated prismatic crystals in subophitic relationships with clinopyroxene. Clinopyroxene occurs as narrow, elongated prismatic crystals. Plagioclase is the most common crystalline phase, comprising 50% of the groundmass, whereas clinopyroxene comprises 40% of the groundmass. Some clinopyroxenes are altered to chlorite. The glass is altered to chlorite.

Plane-polarized: 40731921



Cross-polarized: 40731941



### Igneous Petrology

**Lithology:** sparsely plagioclase phyric basalt **Groundmass grain size (avg.):** fine-grained  
**Texture:** porphyritic **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	10	10	0	1	5	subhedral	tabular	

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	45	45	0	0.04	1	subhedral	elongate	
Clinopyroxene	40	25	15	0.02	0.5	subhedral	elongate	
Fe-Ti oxide	2	2	0	0.02	0.1	subhedral	subequant	
Glass	3	0	3	N/A	N/A	N/A	N/A	altered to chlorite

### Veins and Halos

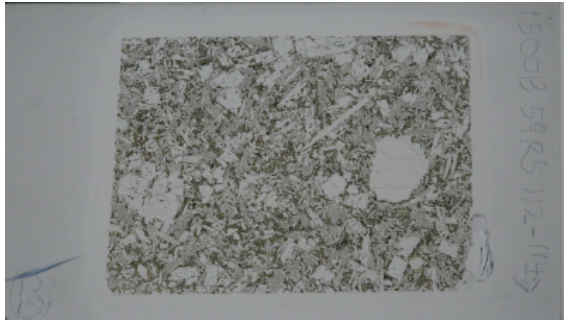
**Vein type:** uniform vein **Vein boundary:** sharp boundary or contact  
**Avg. thickness (cm):** 0.3 **Vein texture:** polycrystalline

Vein fill composition	Percentage
Calcium carbonate	100

THIN SECTION LABEL ID: **367-U1500B-59R-5-W 112/114-TSB-TS\_22** Thin section no.: 22  
 Observer: X.L. Huang Piece no.:  
 Unit/subunit: 1b

Thin section summary: The porphyritic basalt shows subophitic and intersertal textures. Plagioclase is the only phenocryst between 1 to 8 mm and abundances of <15%. The plagioclase phenocrysts are stubby euhedral to subhedral or elongated prismatic subhedral crystals. The plagioclase are mostly zoned. The groundmass is hypocrySTALLINE and is composed primarily of plagioclase, clinopyroxene, and Fe-Ti oxide. Plagioclase mostly occurs as narrow, elongated prismatic crystals in subophitic relationships with clinopyroxene. Plagioclase is the most common crystalline phase, comprising 40% of the groundmass, whereas clinopyroxene comprises 35% of the groundmass. Some groundmass clinopyroxene are altered to chlorite. The glass is altered to chlorite.

Plane-polarized: 40731881



Cross-polarized: 40731901



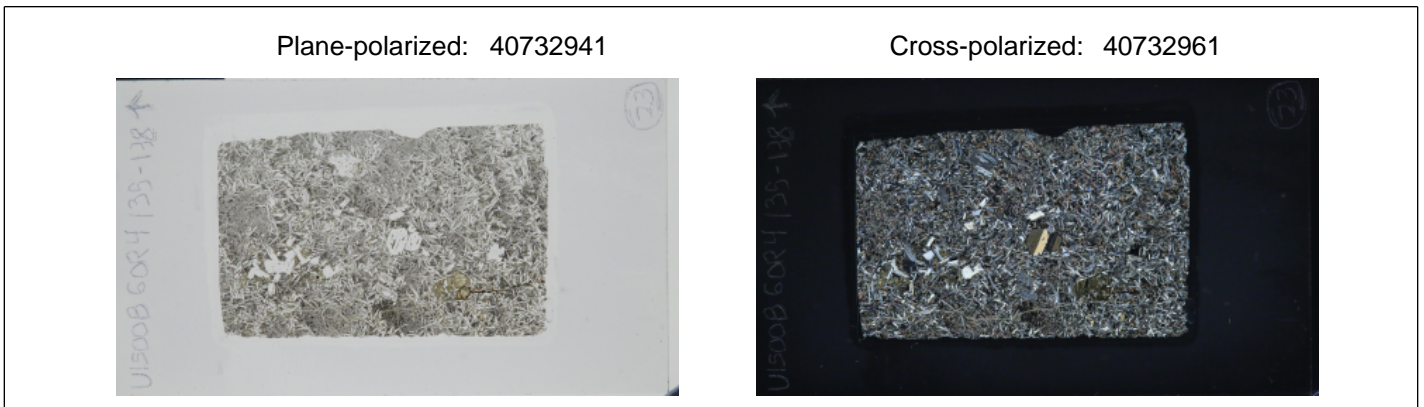
### Igneous Petrology

**Lithology:** sparsely plagioclase phyric basalt **Groundmass grain size (avg.):** fine-grained  
**Texture:** porphyritic **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	15	15	0	1	8	subhedral	tabular	
Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	40	40	0	0.04	1	subhedral	elongate	
Clinopyroxene	35	30	5	0.04	1	subhedral	elongate	
Fe-Ti oxide	3	3	0	0.02	0.4	subhedral	subequant	
Glass	8	0	8	N/A	N/A	N/A	N/A	altered to chlorite

THIN SECTION LABEL ID: **367-U1500B-60R-4-W 135/138-TSB-TS\_23** Thin section no.: 23  
 Observer: X.L. Huang Piece no.:  
 Unit/subunit: 1d

Thin section summary: The porphyritic basalt shows intersertal textures. A fine calcite vein is present in the thin section. Plagioclase is the dominant phenocryst between 1 to 2.4 mm and abundances of <5%. Olivine is the subsidiary phenocryst between 0.4 to 2.5 mm, an euhedral crystal and has been altered to serpentine and chlorite. The plagioclase phenocrysts are mostly stubby euhedral to subhedral crystals, and sometimes zoned. Some plagioclase phenocrysts are as skeletal in the central part. The groundmass is fine-grained hypocrystalline and is composed primarily of plagioclase, clinopyroxene, and Fe-Ti oxide. Plagioclase mostly occurs as narrow, elongated prismatic crystals. Clinopyroxene occurs as narrow, elongated prismatic crystals. The groundmass occurs as intersertal with glass and other cryptocrystalline material between plagioclase laths. Plagioclase is the most common crystalline phase, comprising 45% of the groundmass, whereas clinopyroxene comprises 40% of the groundmass. Some clinopyroxene are altered to chlorite. The glass is altered to chlorite.



### Igneous Petrology

**Lithology:** sparsely plagioclase phyric basalt      **Groundmass grain size (avg.):** fine-grained

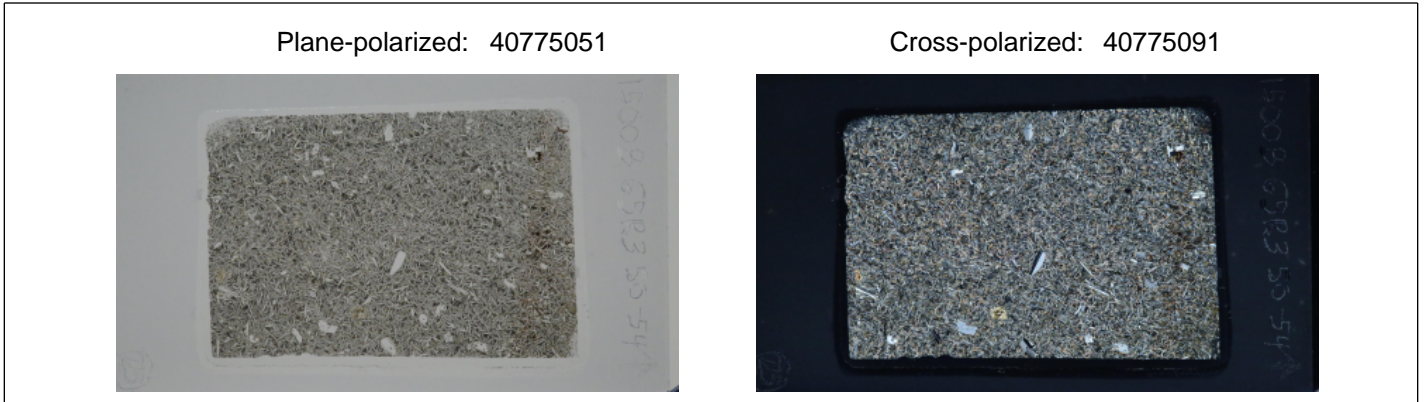
**Texture:** porphyritic      **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	4	4	0	1	2.4	subhedral	tabular	
Olivine	1	0	1	0.3	3	euhedral	euhedral	

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	45	45	0	0.04	1	subhedral	elongate	
Clinopyroxene	40	40	10	0.02	0.5	subhedral	elongate	
Fe-Ti oxide	2	2	0	0.01	0.1	subhedral	subequant	
Glass	8	0	8	N/A	N/A	N/A	N/A	altered to chlorite

THIN SECTION LABEL ID: **367-U1500B-65R-3-W 50/54-TSB-TS\_25** Thin section no.: 25  
 Observer: A. Luna Piece no.:  
 Unit/subunit: 1e  
 Thin section summary: Subophitic moderately plagioclase phyric seriate basalt with some olivine. Background consists of CPX partially surrounding plagioclase and filling in spaces, with very minor oxides interserially. Minor to no alteration throughout slide.



### Igneous Petrology

**Lithology:** moderately plagioclase phyric basalt      **Groundmass grain size (avg.):** microcrystalline

**Texture:** porphyritic      **Grain size distribution:** seriate

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	8	8	0	1	2.25	euhedral	elongate	
Olivine	2	1	1	0.5	1.5	euhedral	euhedral	Olivine is being consumed and destroyed.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	50	50	0	0.01	0.5	euhedral	elongate	
Clinopyroxene	40	30	5	0.01	0.2	anhedral	elongate	
Olivine	5	4	1	0.01	0.25	subhedral	equant	
Fe-Ti oxide	1	1	0			interstitial	equant	
Glass	0	0	0	N/A	N/A	N/A	N/A	

### Alteration

**Alteration intensity:** absent/fresh      **Total alteration (%):**      **Recrystallization extent:** absent

**Vesicle abundance (%):** 1      **Vesicle shape:** rounded      **Vesicle distribution:** very sparse

**Vesicle min. size (mm):** 0.25      **Vesicle max. size (mm):** 0.25      **Vesicle mode size (mm):** 0.25

Vesicle fill composition	Percent
Total vesicle fill	100
Calcium carbonate	100

THIN SECTION LABEL ID: **367-U1500B-66R-3-W 37/40-TSB-TS\_26**

Thin section no.: 26

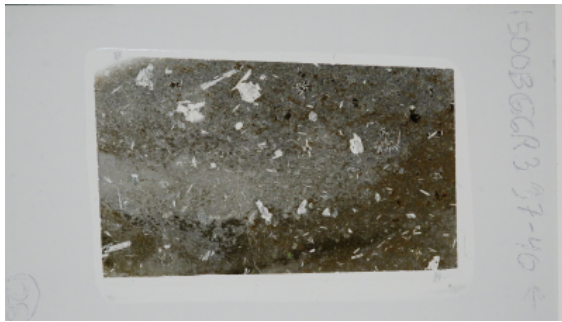
Observer: A. Luna

Piece no.:

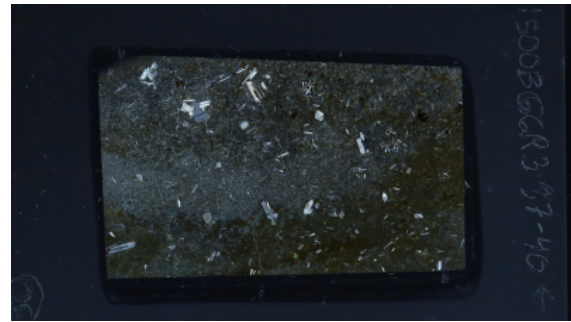
Unit/subunit: 1e

Thin section summary: Highly altered moderately olivine-plagioclase phyric basalt. Most of the olivine has been altered to iddingsite and magnetite with possible serpentine in some sections. CPX in the background has been completely altered and replaced by iron oxide and a green mineral that is possibly chlorite. Plagioclase background shows evidence of rapid quenching.

Plane-polarized: 40775011



Cross-polarized: 40775031



## Igneous Petrology

**Lithology:** moderately plagioclase phyric basalt

**Groundmass grain size (avg.):** microcrystalline

**Texture:** porphyritic

**Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	10	8	2	1	1.75	subhedral	elongate	Plag is being altered highly
Olivine	5	0	5					

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	50	25	25	0.01	0.5	euohedral	elongate	
Clinopyroxene	38	0	38					
Glass	0	0	0	N/A	N/A	N/A	N/A	

## Alteration

**Alteration intensity:** high

**Total alteration (%):** 50

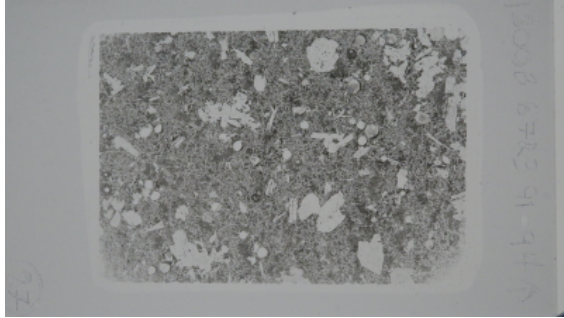
**Recrystallization extent:** strong

Alteration mineral	Percent	Comments
Chlorite	5	chlorite appears to be infilling areas that are not vesicles but are voids possibly due to dissolution
Oxide, hematite	10	
Other	5	olivine crystals appear to have been replaced by either iddingsite or hematite

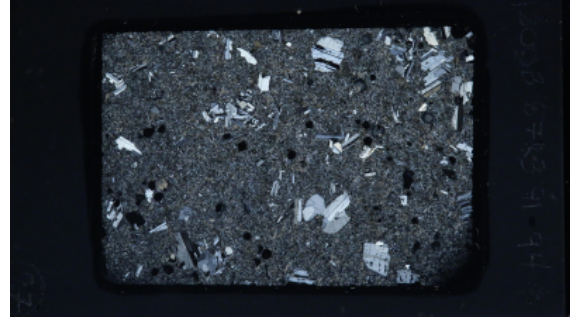


THIN SECTION LABEL ID: **367-U1500B-67R-3-W 91/94-TSB-TS\_27** Thin section no.: 27  
 Observer: A. Luna Piece no.:  
 Unit/subunit: 1e  
 Thin section summary: Subophitic highly plagioclase phyric basalt with vesicles. Background is mostly plagioclase with CPX infilling partially around the mineral grains. Alteration is minor.

Plane-polarized: 40774971



Cross-polarized: 40774991



### Igneous Petrology

**Lithology:** highly plagioclase phyric basalt **Groundmass grain size (avg.):** microcrystalline  
**Texture:** porphyritic **Grain size distribution:** seriate

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	20	20	0	0.5	5.25	euhedral	elongate	

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	50	50	0	0.01	1.8	euhedral	elongate	
Clinopyroxene	30	25	5	0.01	0.2	anhedral	elongate	
Glass	0	0	0	N/A	N/A	N/A	N/A	

### Alteration

**Alteration intensity:** slight **Total alteration (%):** 5 **Recrystallization extent:** weak  
**Vesicle abundance (%):** 8 **Vesicle shape:** rounded **Vesicle distribution:** Abundantly distributed across the slide  
**Vesicle min. size (mm):** 0.75 **Vesicle max. size (mm):** 1.33 **Vesicle mode size (mm):** 1

Vesicle fill composition	Percent
Total vesicle fill	50
Calcium carbonate	10

**Vesicle comment:** Vesicles are filled with a clay mineral, unable to determine the type. 50% are filled, of those 75% are filled with something other than calcite.

THIN SECTION LABEL ID: **367-U1500B-68R-1-W 29/32-TSB-TS\_28** Thin section no.: 28  
 Observer: A. Luna Piece no.:  
 Unit/subunit: 1e  
 Thin section summary: Subophitic highly plagioclase phyric basalt with minor olivine. Moderately altered with clay within two veins that are indistinct, and iron oxide halo radiating from the veins over the entire slide. Few of the vesicles are filled with zeolites, calcite and clay.

Plane-polarized: 40774931



Cross-polarized: 40774951



**Igneous Petrology**

**Lithology:** highly plagioclase phyric basalt **Groundmass grain size (avg.):** microcrystalline  
**Texture:** porphyritic **Grain size distribution:** seriate

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	15	13	2	0.75	5.5	euhedral	elongate	
Olivine	1	0	1					

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	54	34	20	0.01	0.75	euhedral	elongate	
Clinopyroxene	30	15	20	0.01	0.2	anhedral	elongate	
Fe-Ti oxide	1	1	0	0.01	0.05	interstitial	subequant	
Glass	0	0	0	N/A	N/A	N/A	N/A	

**Alteration**

**Alteration intensity:** moderate **Total alteration (%):** 49 **Recrystallization extent:** strong

Alteration mineral	Percent	Comments
Calcium carbonate	10	
Chlorite	10	
Oxide, hematite	1	
Zeolite	20	

**Vesicle abundance (%):** 10 **Vesicle shape:** rounded **Vesicle distribution:**  
**Vesicle min. size (mm):** 0.1 **Vesicle max. size (mm):** 2 **Vesicle mode size (mm):** 1

Vesicle fill composition	Percent
Total vesicle fill	100
Calcium carbonate	45
Fe-oxide	10
Zeolite	45

### Veins and Halos

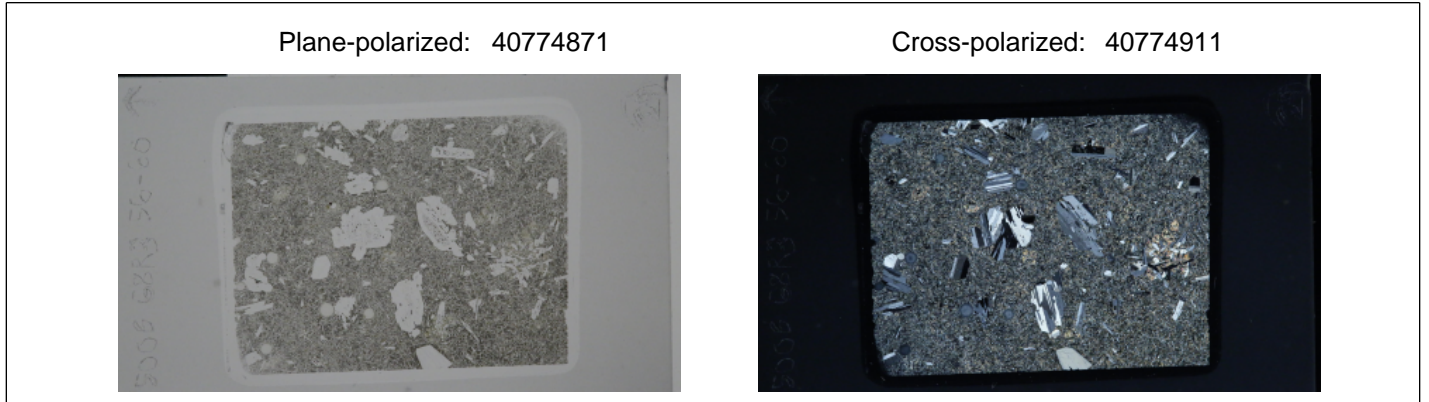
**Vein type:** uniform vein                      **Vein boundary:** sharp boundary or contact  
**Avg. thickness (cm):** 0.05                      **Vein texture:** massive  
**Vein comments:** filled with claystone

### Veins and Halos

**Vein type:** uniform vein                      **Vein boundary:** sharp boundary or contact  
**Avg. thickness (cm):** 0.025                      **Vein texture:** massive

Vein fill composition	Percentage
Calcium carbonate	100

THIN SECTION LABEL ID: **367-U1500B-68R-3-W 56/60-TSB-TS\_29** Thin section no.: 29  
 Observer: A. Luna Piece no.:  
 Unit/subunit: 1e  
 Thin section summary: Highly olivine-plagioclase phyric basalt. Olivine is equant with slight magmatic alteration but the slide overall has good crystals. CPX is subophitic about the background plagioclase with alteration of the background glass to clay. Vesicles are filled with clay and little zeolite processes can be seen.



### Igneous Petrology

**Lithology:** highly olivine-plagioclase phyric basalt      **Groundmass grain size (avg.):** microcrystalline

**Texture:** porphyritic      **Grain size distribution:** seriate

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	20	20	0	0.75	5	euhedral	elongate	
Olivine	5	3	2	0.1	5.5	euhedral	euhedral	Olivine is being consumed and destroyed magmatically.

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	36	30	6	0.01	0.75	euhedral	elongate	
Clinopyroxene	33	15	18	0.01	0.1	anhedral	elongate	
Olivine	5	4	1	0.01	0.25	subhedral	equant	
Fe-Ti oxide	1	1	0	0.01	0.01	interstitial	subequant	
Glass	25	0	25	N/A	N/A	N/A	N/A	glass has been replaced by a clay.

### Alteration

**Alteration intensity:** moderate      **Total alteration (%):** 5      **Recrystallization extent:** weak

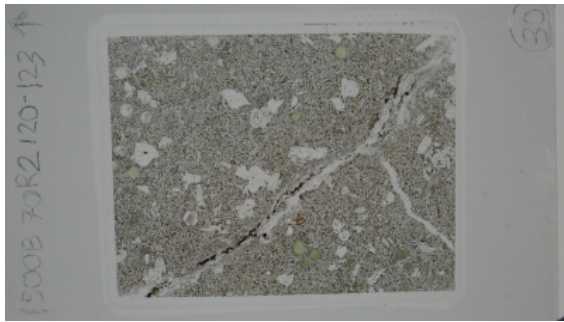
Alteration mineral	Percent	Comments
Calcium carbonate	2	
Clay, brown	10	glass has been replaced by brown clay

**Vesicle abundance (%):** 7      **Vesicle shape:** rounded      **Vesicle distribution:** sparse  
**Vesicle min. size (mm):** 0.1      **Vesicle max. size (mm):** 1.2      **Vesicle mode size (mm):** 0.75

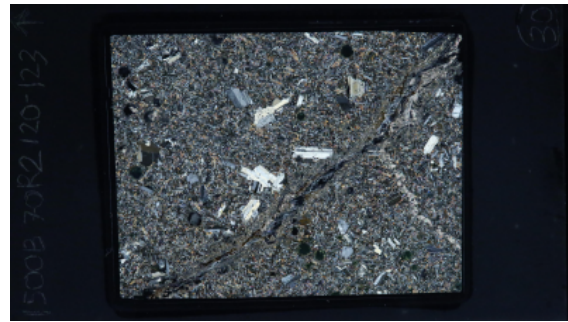
Vesicle fill composition	Percent
Total vesicle fill	100
Calcium carbonate	100

THIN SECTION LABEL ID: **367-U1500B-70R-2-W 120/124-TSB-TS\_30** Thin section no.: 30  
 Observer: A. Luna Piece no.:  
 Unit/subunit: 1e  
 Thin section summary: Highly plagioclase phyric basalt with remnant olivine that has been mostly destroyed. Plagioclase and CPX are in near pristine condition. Vescicles are filled with calcite, and a green amorphous mineral that is being replaced by a zeolite. A vein bisects the slide from corner to corner and is filled with mostly calcite although there are two types of clay, one a sediment, the other is insitu weathering.

Plane-polarized: 40780541



Cross-polarized: 40780561



### Igneous Petrology

**Lithology:** highly plagioclase phyric basalt **Groundmass grain size (avg.):** microcrystalline  
**Texture:** porphyritic **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	20	18	2	0.5	3.25	euhedral	elongate	
Olivine	2	1	1	0.25	0.25	euhedral	euhedral	

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	34	29	5	0.01	0.5	euhedral	elongate	
Clinopyroxene	30	25	5	0.01	0.1	anhedral	elongate	
Fe-Ti oxide	1	1	0	0.01	0.01	interstitial	subequant	
Glass	0	0	0	N/A	N/A	N/A	N/A	

### Alteration

**Alteration intensity:** slight **Total alteration (%):** **Recrystallization extent:** weak

Alteration mineral	Percent	Comments
Calcium carbonate	1	
Chlorite	2	chlorite appears to be infilling areas that are not vesicles but are voids possibly due to dissolution
Clay, other	5	clay mineral located within the vein crossing the slide
Zeolite	15	zeolites appear to be replacing green chlorite within the vesicles and forming acicular radiating laths
Other		olivine crystals have been replaced by iddingsite

**Vesicle abundance (%):** 10      **Vesicle shape:** rounded      **Vesicle distribution:** moderate

**Vesicle min. size (mm):** 0.1      **Vesicle max. size (mm):** 1.2      **Vesicle mode size (mm):** 0.75

Vesicle fill composition	Percent
Total vesicle fill	95
Calcium carbonate	25
Zeolite	75

## Veins and Halos

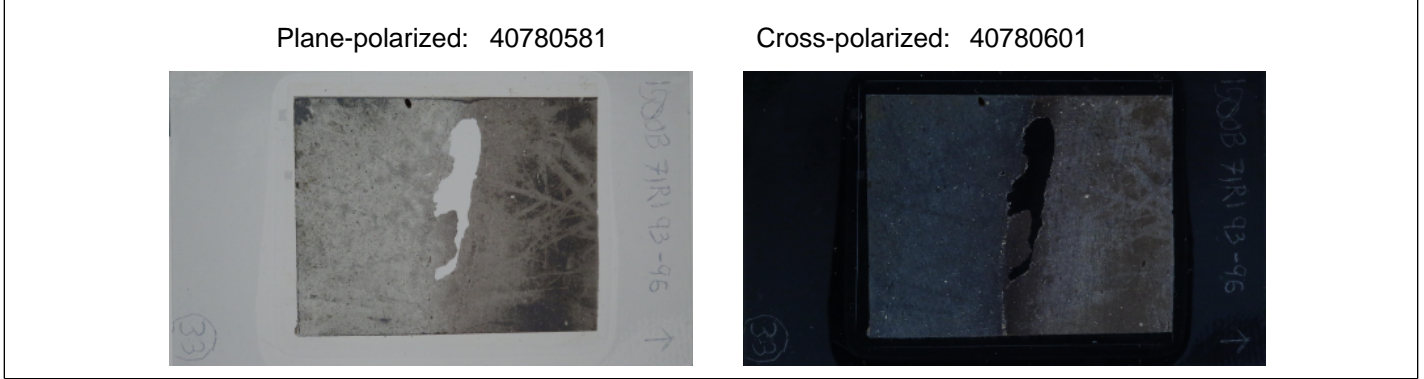
**Vein type:** composite vein      **Vein boundary:** diffuse boundary or contact

**Avg. thickness (cm):** 2      **Vein texture:** polycrystalline

Vein fill composition	Percentage
Calcium carbonate	50
Fe oxide	15

**Vein comments:** filled with clays from sediment as well as a diagenic clay, calcite and iron oxide

THIN SECTION LABEL ID: **367-U1500B-71R-1-W 93/96-TSB-TS\_33** Thin section no.: 33  
 Observer: B. Johnson Unit/subunit: VIII  
 Thin section summary: Well sorted claystone that shows the contact between two claystone intervals of different color (gray and reddish brown). Both intervals contain similar mineral grains, which include quartz, feldspar, and abundant clay minerals. Discrete blebs of organic matter are observed throughout the thin section, where framboidal pyrite can also be seen with reflected light.



### Sediments and Sedimentary Rock

**Sample domain name:** sediment clasts                      **Domain rel. abundance:** 100  
**Lithology:** claystone

TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture		Siliciclastics	100	Mineral grains	sub-rounded
Sand texture	3	Detrital carbonate			
Silt texture	7	Biogenic carbonate			
Clay texture	90	Biogenic silica			

### Framework grain abundance

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

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



THIN SECTION LABEL ID: **367-U1500B-71R-1-W 96/99-TSB-TS\_32** Thin section no.: 32  
 Observer: B. Johnson Unit/subunit: VIII  
 Thin section summary: Moderately sorted, silty claystone that has undergone significant dolomitization (recrystallization of dolomite). The dolomite occurs as well-developed, rhombic-shaped minerals that are, on average, 0.15 mm in size.

Plane-polarized: 40780621



Cross-polarized: 40780661



**Sediments and Sedimentary Rock**

Sample domain name: carbonate matrix

Domain rel. abundance: 50

Lithology:

**Sediments and Sedimentary Rock**

Sample domain name: sediment clasts

Domain rel. abundance:

Lithology: silty claystone

TEXTURE	Percent	CONSTITUENT	Percent	GRAIN ROUNDNESS	
Gravel texture		Siliciclastics	100	Mineral grains	sub-rounded
Sand texture	5	Detrital carbonate			
Silt texture	35	Biogenic carbonate			
Clay texture	60	Biogenic silica			

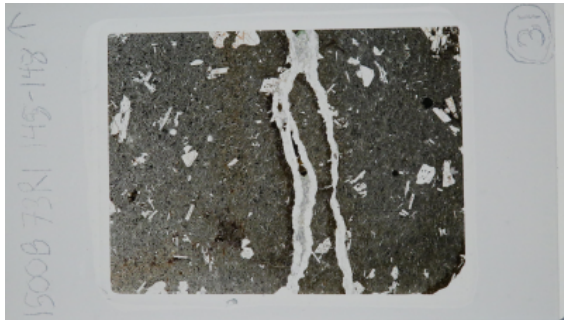
**Framework grain abundance**

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

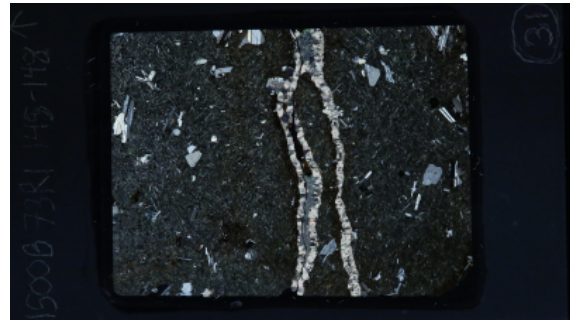
Component	Rel. abundance	Component	Rel. abundance
Quartz	A	Calcite (allogenic)	
Feldspar	C	Mica	
Clay minerals	D	Glauconite	
Lithic grains		Foraminifera	
Chert		Undifferentiated calcareous bioclasts	

THIN SECTION LABEL ID: **367-U1500B-73R-1-W 145/148-TSB-TS\_31** Thin section no.: 31  
 Observer: A. Luna Piece no.:  
 Unit/subunit: 1e  
 Thin section summary: Moderately plagioclase phyric basalt with minor remnant olivine and no CPX within the background matrix. Alteration is minor with some iron oxide throughout the slide, but all reflective oxides have been replaced. Calcite in the veins are being replaced in some areas with zeolites, and the few vesicles are filled with acicular radiating zeolites. Two network veins bisect the slide through the short width and are filled with calcite, zeolites, neptunite, and some chlorite.

Plane-polarized: 40780501



Cross-polarized: 40780521



### Igneous Petrology

**Lithology:** moderately plagioclase phyric basalt **Groundmass grain size (avg.):** microcrystalline  
**Texture:** porphyritic **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	8	8		0.5	4	euhedral	elongate	
Olivine	1	0	1					

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	75	70	5	0.01	0.1	euhedral	elongate	
Fe-Ti oxide	1	0	1					
Glass	0	0	0	N/A	N/A	N/A	N/A	

### Alteration

**Alteration intensity:** moderate **Total alteration (%):** 6 **Recrystallization extent:** weak

Alteration mineral	Percent	Comments
Calcium carbonate	1	
Oxide, hematite	1	
Zeolite	5	zeolites are replacing calcite within the vein
Other		two small olivine crystals were nearly completely replaced

**Vesicle abundance (%):** 1      **Vesicle shape:** rounded      **Vesicle distribution:** sparse

**Vesicle min. size (mm):** 0.5      **Vesicle max. size (mm):** 0.5      **Vesicle mode size (mm):** 0.5

Vesicle fill composition	Percent
Total vesicle fill	100
Zeolite	100

## Veins and Halos

**Vein type:** composite vein      **Vein boundary:** sharp boundary or contact

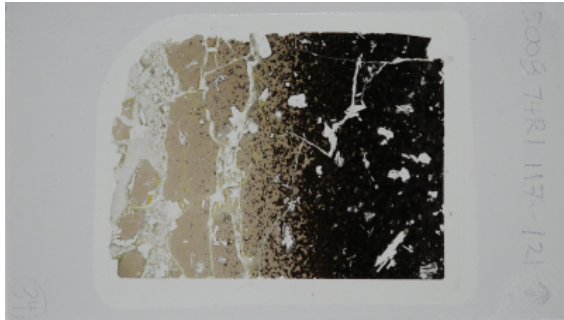
**Avg. thickness (cm):** 1.75      **Vein texture:** polycrystalline

Vein fill composition	Percentage
Calcium carbonate	70
Chlorite	5
Zeolite	20

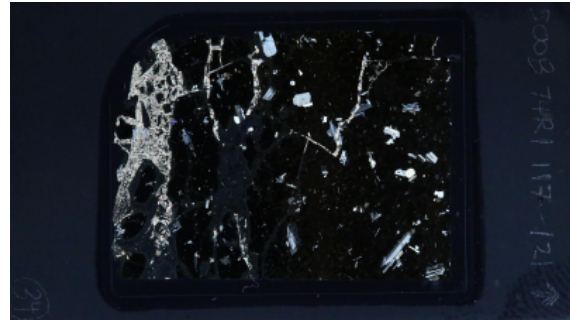
**Vein comments:** filled with calcite, zeolites, neptunite, and minor chlorite

THIN SECTION LABEL ID: **367-U1500B-74R-1-W 117/121-TSB-TS\_34** Thin section no.: 34  
 Observer: A. Luna Piece no.:  
 Unit/subunit: 1b  
 Thin section summary: Sparsely porphyritic basalt with 30% glass. A vein composed of dominant calcite and some zeolite minerals with minor calcite is present in glassy part of the thin section. The width of vein is range from 2.24 mm, and approximately 1/20th of the thin section. The sample is nonvesiculated. Plagioclase is the only phenocryst with the size of 0.32 to 3.8 mm and abundances of ~4%. The large plagioclase phenocrysts are mostly euhedral crystals typically zoned. The small plagioclase phenocrysts are mostly prismatic euhedral crystals. Larger plagioclase crystals show incomplete filling within the interior and swallow tail tendencies. Two domains of groundmass exist, a glass groundmass and a plagioclase holocrystalline groundmass.

Plane-polarized: 40798261



Cross-polarized: 40798301



### Igneous Petrology

**Lithology:** sparsely plagioclase phyric basalt **Groundmass grain size (avg.):** glass  
**Texture:** hypohyaline **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	4	4	0	0.232	3.18	Euhedral	elongate	Swallow tails, reaction rims, blank spots within xls indicate rapid cooling of glass and plagioclase

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	5	5	0	0.16	0.2	euhedral	elongate	Seen only as very fine-grained acicular halos around larger plag xls
Glass	90	76	14	N/A	N/A	N/A	N/A	

### Igneous Petrology

**Lithology:** sparsely plagioclase phyric basalt **Groundmass grain size (avg.):** cryptocrystalline  
**Texture:** porphyritic **Grain size distribution:** bimodal

Phenocrysts	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	4	4	0	0.32	3.8	Euhedral	elongate	swallow tails and incomplete zone fill in some minerals

Groundmass	Original (%)	Present (%)	Replaced (%)	Size min. (mm)	Size max. (mm)	Shape	Habit	Comments
Plagioclase	96	96	0	0.16	0.2	euhedral	elongate	
Glass	0	0	0	N/A	N/A	N/A	N/A	glass has been converted into plagioclase laths within the background.

<b>Igneous Petrology</b>			
<b>Lithology:</b>	calcite vein	<b>Groundmass grain size (avg.):</b>	microcrystalline
<b>Texture:</b>	granular	<b>Grain size distribution:</b>	equigranular

<b>Alteration</b>			
<b>Alteration intensity:</b>	slight	<b>Total alteration (%):</b>	6
		<b>Recrystallization extent:</b>	absent

<b>Veins and Halos</b>									
<b>Vein type:</b>	composite vein	<b>Vein boundary:</b>	diffuse boundary or contact						
<b>Avg. thickness (cm):</b>	2.24	<b>Vein texture:</b>	polycrystalline						
		<table border="1"> <thead> <tr> <th>Vein fill composition</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Calcium carbonate</td> <td>75</td> </tr> <tr> <td>Zeolite</td> <td>25</td> </tr> </tbody> </table>		Vein fill composition	Percentage	Calcium carbonate	75	Zeolite	25
Vein fill composition	Percentage								
Calcium carbonate	75								
Zeolite	25								
<b>Vein comments:</b>	altered glass is involved within the calcite vein.								