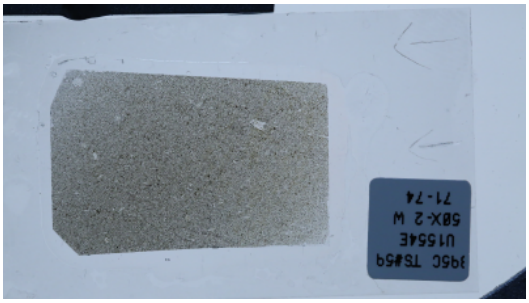
THIN SECTION LABEL ID: **395C-U1554E-50X-2-W 71/74-TSB-TS 59**

Observer: Tao Wu, Nicky White, Deb Eason, Gabriel Pasquet Piece no.:

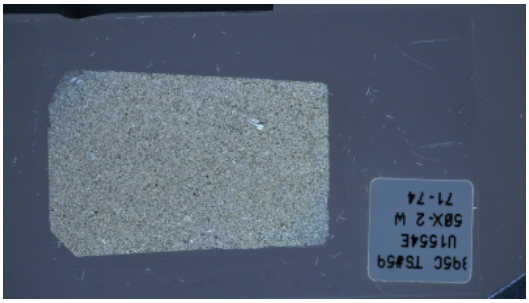
Lithology: sparsely plagioclase phyric basalt

Thin section summary: (Likely DROPSTONE) Porphyritic, with <5% subhedral-euhedral plagioclase phenocrysts (up to 1.3 mm). No zone texture evident. Fine-grained (~0.1mm) holocrystalline groundmass consisting of cpx (50%), plagioclase (30%) and Fe-Ti oxides (20%). Slightly alteration to clay, but most minerals are still fresh.

Plane-polarized:



Cross-polarized:



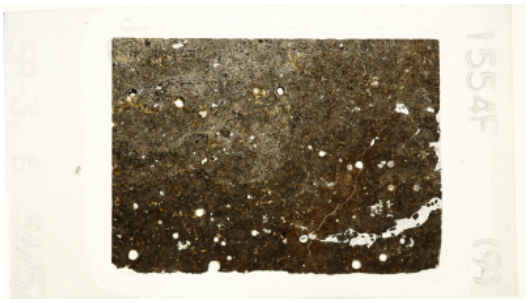
THIN SECTION LABEL ID: **395C-U1554F-5R-3-W 54/57-TSB-TS 9**

Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

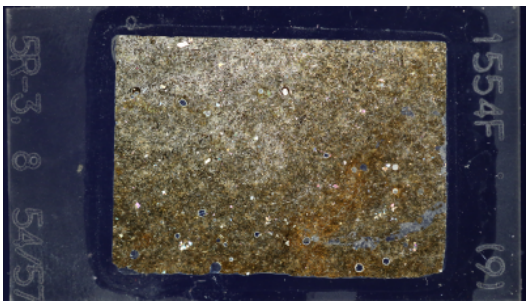
Lithology: sparsely olivine phyric basalt

Thin section summary: Intersertal texture. Bottom left-hand corner of section contains plag-enriched bands, a smaller proportion of opaque oxides, and abundant relatively large olivine phenocrysts (up to 1 mm). Olivine crystals with spinel inclusions commonly aggregated together. Domain is likely to be an altered part of this section. Groundmass largely altered to FeO/OH and saponite. Other half of section dominated by opaque and isotropic material. Plagioclase only present as faint acicular laths. Groundmass mostly opaque with abundance of cpx mesostasis. Vesicles display complex mineral fills and textures.

Plane-polarized:



Cross-polarized:




**Igneous Petrology**

**Groundmass:** Olivine, opaque oxides, cpx mesostasis.

**Alteration:** Moderate to high. Groundmass altered to FeO/OH and saponite with celadonite patches. Vesicles show complex filling textures and mineral fills of FeO/OH, saponite, calcite, celadonite, and possible zeolites. Olivine weakly altered to saponite. Saponite/celadonite filled veinlet.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 5 | 0.02 | 1 | 0.3 | subhedral | subequant | |
| Plagioclase | 7 | 0.02 | 0.6 | 0.2 | subhedral | elongate | Unimodal grain distribution (no small tabular skeletal grains); plag-rich bands |

THIN SECTION LABEL ID: **395C-U1554F-7R-2-W 132/135-TSB-TS 10**

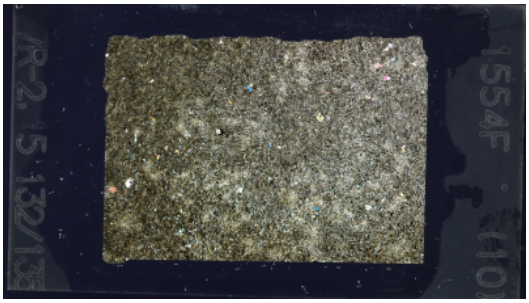
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Intersertal texture. This section contains olivine glomerocrysts and phenocrysts. Aggregated olivine crystals with spinel inclusions. Plagioclase crystals are small and occur in aligned flow bands of variable orientation suggestive of non-laminar flow in absence of olivine synneusis. Groundmass weakly altered to saponite and celadonite in patches.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Edges of section have mostly opaque groundmass. Olivine throughout. Disseminated magnetite.

**Alteration:** Low to moderate. Groundmass altered in patches to celadonite and saponite with very minor chlorite, also to an iddingsite material in places. Calcite vesicle fills. Olivine phenocrysts weakly altered to FeO/OH and saponite.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 5 | 0.03 | 0.55 | 0.2 | subhedral | subequant | Glomerocrysts common |
| Plagioclase | 10 | 0.04 | 0.6 | 0.3 | subhedral | elongate | Small, fairly uniform needles/spindly laths; no tabular skeletal grains |

THIN SECTION LABEL ID: **395C-U1554F-10R-1-W 38/41-TSB-TS 11**

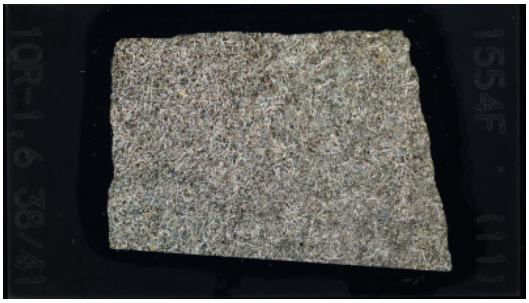
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Small aggregated olivine phenocrysts sometimes altered to saponite. Groundmass shows intergranular and intersertal texture. Space between plagioclases occupied by cpx microcrystals, mesostasis, altered cpx mesostasis, opaque oxides, and altered glass. Top half of section contains significanty reduced crystal load compared to bottom half. Top half has more tabular skeletal grains and reduced amount of opaque oxides/altered glass. No obvious alignment of plagioclase. Change across section is gradational. Bottom half has relatively large plagioclase crystals, many of which are aligned. Small amount of tabular hopper plagioclase. More interstitial cpx in bottom half of section. Weakly altered.

Plane-polarized:


Cross-polarized:




**Igneous Petrology**

**Groundmass:** Olivine, opaque oxides, cpx mesostasis, interstitial cpx at base of section.

**Alteration:** Low. Groundmass weakly altered to saponite, FeO/OH, and minor celadonite. Olivine phenocrysts altered to saponite and minor chlorite. Few vesicles filled with yellow to green celadonite.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 7 | 0.03 | 0.21 | 0.12 | subhedral | subequant | |
| Plagioclase | 35 | 0.04 | 1.3 | 0.6 | subhedral | elongate | Few areas of small tabular skeletal grains; some larger grains with undulose extinction |
| Clinopyroxene | 2 | | | | | | Interstitial, mesostasis; more at bottom of section |

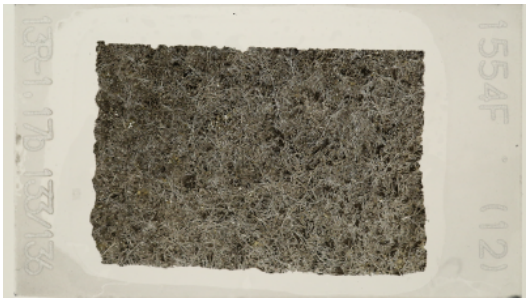
THIN SECTION LABEL ID: **395C-U1554F-13R-1-W 133/136-TSB-TS 12**

Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

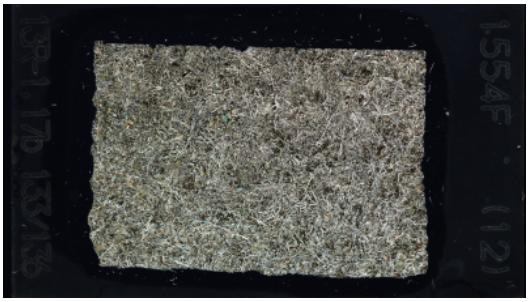
Lithology: sparsely olivine phyric basalt

Thin section summary: Small and sparse olivine phenocrysts, larger ones contain spinel inclusions and are altered to saponite. Groundmass has intersertal texture. Two types of plagioclase: acicular to tabular skeletal elongated laths; small tabular skeletal grains. Acicular/elongated grains are more abundant with frequent snowflake geometries. Olivine variably replaced by celadonite and chlorite. Low alteration of groundmass to saponite and FeO/OH. Cpx mesostasis within interstitial spaces sometimes forming distinguishable cpx.

Plane-polarized:



Cross-polarized:



**Igneous Petrology**

**Groundmass:** Olivine, opaque oxides, dendritic magnetite, pyrite, cpx mesostasis, plagioclase.

**Alteration:** Low. Groundmass altered to saponite and FeO/OH. Olivine phenocrysts altered to saponite and chlorite. Saponite, celadonite, and FeO/OH phases fill vesicles.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 3 | 0.04 | 0.3 | 0.2 | subhedral | subequant | Some melt inclusions |
| Plagioclase | 25 | 0.06 | 3 | 0.4 | subhedral | elongate | Bow-tie pl-textures common; occasional larger grains with undulose extinction |

THIN SECTION LABEL ID: **395C-U1554F-14R-3-W 59/62-TSB-TS 13**

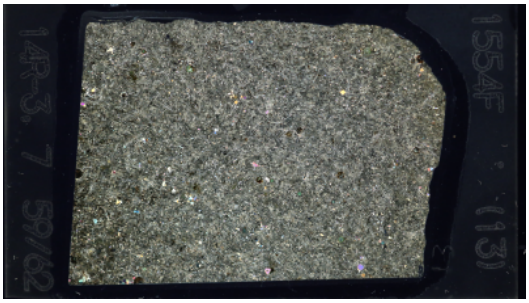
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Small aggregated olivine phenocrysts with spinel inclusions. Groundmass has intersertal texture. Small acicular plagioclase laths surrounded by mesostasis. Green celadonite, saponite and FeO/OH alteration of groundmass. Vesicles show complex mineral and textural filling.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Cpx mesostasis. Opaque oxides, disseminated magnetite. Olivine.

**Alteration:** Moderate. Groundmass moderately altered to saponite, FeO/OH and green celadonite. Olivine variably altered to saponite. Layered and zoned vesicles, with FeO/OH, saponite, green to pale green celadonite, and pyrite. Celadonite veinlet.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 5 | 0.04 | 0.5 | 0.2 | subhedral | subequant | |
| Plagioclase | 10 | 0.04 | 1 | 0.5 | subhedral | elongate | Some bow-tie/star structures |

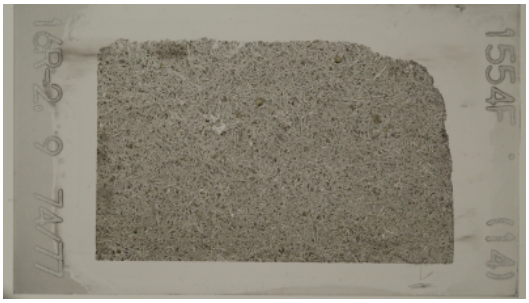
THIN SECTION LABEL ID: **395C-U1554F-16R-2-W 74/77-TSB-TS 14**

Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

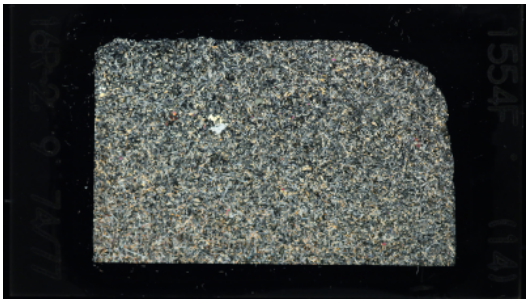
Lithology: sparsely olivine phyric basalt

Thin section summary: A single large (1.6 mm) olivine phenocryst. Olivine shows some replacement to saponite and chlorite along cracks. Groundmass is crystallized with intergranular texture, with low alteration to saponite. Abundant plagioclase laths surrounded by smaller cpx crystals that infill interstitial spaces to produce subophitic texture. Sparse opaque oxides. Lack of mesostasis implies slower rate of cooling.

Plane-polarized:



Cross-polarized:



**Igneous Petrology**

**Groundmass:** Interstitial cpx, sparse olivine, numerous magnetite, plagioclase.

**Alteration:** Low. Groundmass altered to saponite in places. Olivine shows minor replacement to saponite and minor chlorite. Saponite vesicles.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 6 | 0.08 | 1.6 | 0.5 | subhedral | subequant | |
| Plagioclase | 40 | 0.1 | 2.25 | 0.75 | subhedral | elongate | Some large plagioclase laths; most show skeletal habit; a lot of disseminated plag; subophitic texture |
| Clinopyroxene | 10 | 0.02 | 0.6 | 0.1 | subhedral | | Subophitic, interstitial |

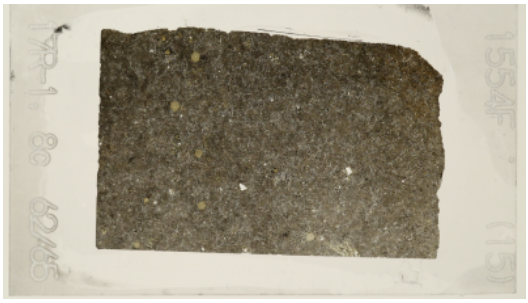
THIN SECTION LABEL ID: **395C-U1554F-17R-1-W 62/65-TSB-TS 15**

Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Sparse olivine phenocrysts partially altered to saponite and chlorite. One large (~2 mm) altered olivine phenocryst to saponite. Groundmass has intersertal texture altered to FeO/OH and saponite in places. Small plagioclase laths and olivines within groundmass surrounded by feathery gry cpx mesostasis. Vesicles filled with saponite and some celadonite.

Plane-polarized:



Cross-polarized:

**Igneous Petrology**

**Groundmass:** Cpx mesostasis (gray, feathery mesostasis texture), Opaque oxides. Minor olivine, plagioclase.

**Alteration:** Moderate. Groundmass altered to FeO/OH and saponite. Vesicles with saponite and some celadonite. Olivine phenocrysts altered into saponite and minor chlorite. Pyrite in olivine relicts.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 3 | 0.04 | 0.3 | 0.15 | subhedral | subequant | |
| Plagioclase | 20 | 0.04 | 0.8 | 0.3 | subhedral | elongate | Local alignment of acicular plag laths |

THIN SECTION LABEL ID: **395C-U1554F-18R-4-W 16/19-TSB-TS 16**

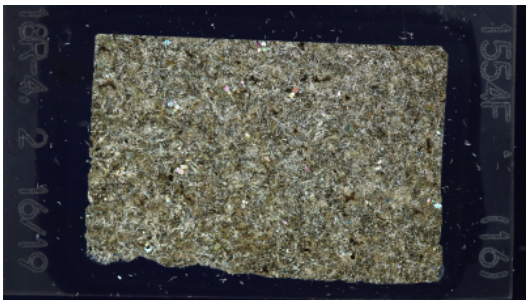
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Small aggregated olivine phenocrysts with spinel inclusions. Groundmass has intersertal texture. Acicular plagioclase laths within matrix of mesostasis cpx, olivine, and plagioclase. Opaque-rich section which was probably rapidly cooled. Right-hand margin is more aphyric. Saponite, green celadonite, and FeO/OH alteration present throughout the groundmass. Olivines partially replaced by saponite and chlorite along cracks.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Cpx mesostasis, gray alteration material. Opaque oxides, olivine, plagioclase.

**Alteration:** Moderate to high. Groundmass altered moderately to saponite and green celadonite throughout. Some development of iddingsite material in goundmass. Vesicles infilled and layered with FeO/OH, saponite, and green celadonite. Olivine altered to saponite, FeO/OH, and chlorite, often localized along cracks.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 4 | 0.04 | 0.6 | 0.25 | subhedral | subequant | |
| Plagioclase | 25 | 0.04 | 1.2 | 0.4 | subhedral | elongate | Conical fan-like geometry, bow ties; no overall alignment |

THIN SECTION LABEL ID: **395C-U1554F-20R-2-W 87/90-TSB-TS 17**

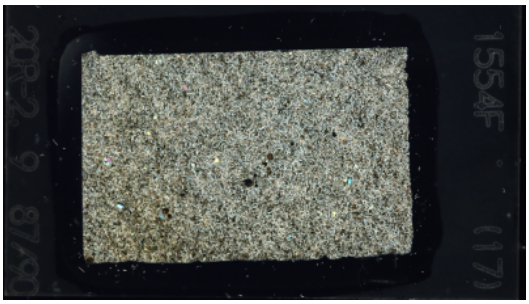
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Sparse (<5%) olivine phenocrysts with occasional spinel inclusions. Groundmass has intersertal texture and weakly altered to clay, celadonite, and FeO/OH. Small mostly acicular (but also tabular and prismatic) plagioclase crystals in groundmass matrix of poorly developed intersitial cpx and opaque/isotropic material which is probably altered glass. Reasonably abundant interstitial cpx.

Plane-polarized:


Cross-polarized:




**Igneous Petrology**

**Groundmass:** Interstitial cpx, mesostasis, opaque oxides, olivine, plagioclase.

**Alteration:** Low to moderate. Olivine rims altered to saponite in places. Groundmass altered weakly to green celadonite, clays and FeO/OHs. Saponite, green celadonite, calcite and FeO/OH filled vesicles.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 3 | 0.04 | 0.6 | 0.2 | subhedral | subequant | |
| Plagioclase | 30 | 0.06 | 0.75 | 0.4 | subhedral | elongate | Dominantly acicular elongate crystals |
| Clinopyroxene | 3 | | | | anhedral | | Interstitial, mesostasis |

THIN SECTION LABEL ID: **395C-U1554F-23R-1-W 121/124-TSB-TS 18**

Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Relatively large plagioclases which decrease in average size from top to base of section. Olivine phenocrysts are rare, but numerous olivine microphenocrysts within groundmass. Olivine often grouped within zones. Significant matching gradation in abundance of opaque material which is mixture of altered glass and oxide minerals. Base of section (where plagioclase laths are smaller) contains interstitial cpx, which decreases in abundance up section. Groundmass weakly altered to clay, FeO/OH and green celadonite. Green to yellow celadonite and saponite vesicles, evidence of one chloritized olivine.

Plane-polarized:


Cross-polarized:


**Igneous Petrology**

**Groundmass:** Opaque oxides, interstitial cpx, olivine, plagioclase.

**Alteration:** Low to moderate. Groundmass altered to clays, FeO/OHs and some green celadonite. Vesicles filled with green and yellow celadonite, FeO/OH and saponite. Chloritized olivine phenocryst.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 1 | 0.03 | 0.6 | 0.1 | subhedral | subequant | |
| Plagioclase | 27 | 0.06 | 2.5 | 0.5 | subhedral | elongate | Larger laths |
| Clinopyroxene | 3 | | | | anhedral | | Interstitial (more in bottom of section), mesostasis |

THIN SECTION LABEL ID: **395C-U1554F-25R-1-W 125/128-TSB-TS 19**

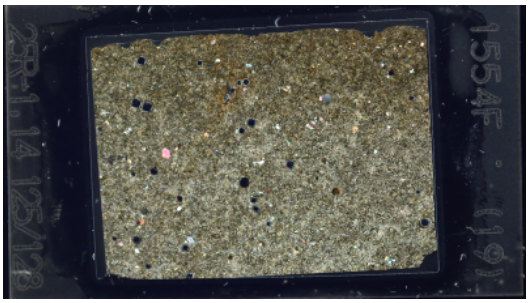
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Small aggregated olivine phenocrysts with spinel inclusions. Groundmass has intersertal texture. Very small plagioclase laths in groundmass that mostly consists of cpx mesostasis, altered glass and olivine. 5-mm-wide margin on right-hand side is aphyric. Abundant vesicles. Combination of low plagioclase phyric content, vesicularity, and opaque content (i.e. altered glass) implies rapid cooling. Moderate to high alteration to palagonite material (FeO/OH) and clay. Vesicles show layered filling by celadonite, saponite, FeO/OH and possible zeolite.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Cpx mesostasis, opaque oxides, olivine, plagioclase.

**Alteration:** Moderate to high. Groundmass strongly altered to clay and FeO/OH (palagonite material). Vesicles show linings of saponite and zeolite (phillipsite), FeO/OH, and yellow and green celadonite. Olivines partially altered to saponite and FeO/OH.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 5 | 0.02 | 1 | 0.25 | subhedral | subequant | Several glomerocrysts; swallowtail forms common |
| Plagioclase | 7 | 0.025 | 0.9 | 0.2 | subhedral | elongate | |

THIN SECTION LABEL ID: **395C-U1554F-27R-3-W 30/33-TSB-TS 20**

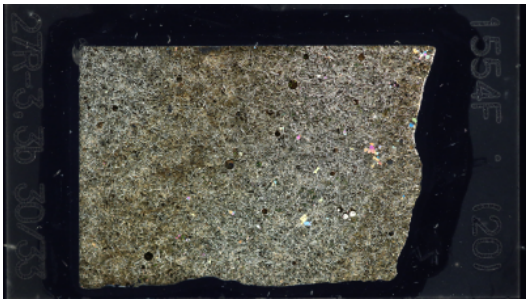
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Small aggregated olivine phenocrysts with spinel inclusions. Groundmass has intersertal texture. Moderately sized acicular plagioclase laths within matrix of cpx mesostasis, and altered glass/opaque oxides. Groundmass altered to celadonite and iddingsite material. Vesicles contain a range of alteration minerals.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Cpx mesostasis, olivine, plagioclase, opaque oxides/altered glass.

**Alteration:** Moderate to high. Groundmass altered to clays, caladonite, and FeO/OH. Green celadonite, saponite, calcite and FeO/OH fills in vesicles. Olivine rims altered to iddingsite material.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 2 | 0.04 | 0.8 | 0.12 | subhedral | subequant | |
| Plagioclase | 25 | 0.025 | 0.6 | 0.3 | subhedral | elongate | |

THIN SECTION LABEL ID: **395C-U1554F-28R-3-W 23/26-TSB-TS 21**

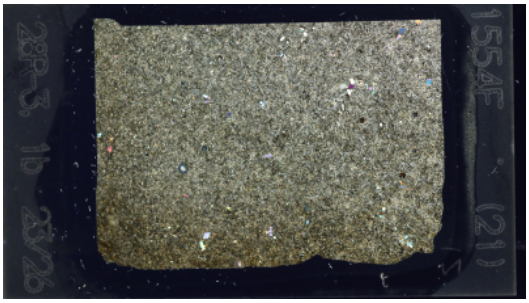
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Small aggregated olivine phenocrysts with spinel inclusions. One large grain has zoned texture. Small tubular olivines within groundmass suggestive of rapid cooling. Groundmass has intersertal texture and is altered to saponite and FeO/OHs. Small skeletal plagioclase laths within mesostasis/glassy groundmass consistent with rapid cooling. No optically distinguishable cpx. Olivine phenocrysts are moderately abundant and relatively large, altered along cracks to saponite and chlorite. Plag too small to reach phenocryst size and is present in groundmass alone. Vesicles have range of mineral fills.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Cpx mesostasis, altered glass, olivine, opaque oxides.

**Alteration:** Moderate. Groundmass altered to saponite and FeO/OH. Olivine phenocrysts altered along cracks to saponite and chlorite. Vesicles filled with saponite, calcite and some green celadonite.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 5 | 0.05 | 0.8 | 0.2 | subhedral | subequant | Some grain clustering |
| Plagioclase | 7 | 0.05 | 0.5 | 0.2 | subhedral | elongate | |

THIN SECTION LABEL ID: **395C-U1554F-31R-1-W 49/52-TSB-TS 22**

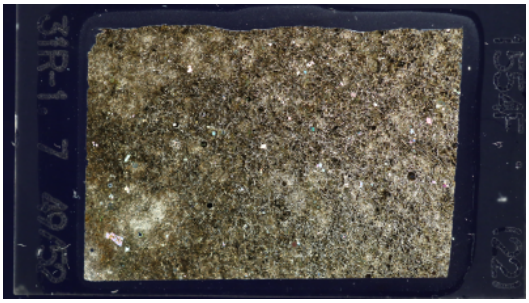
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Small aggregated olivine phenocrysts, locally altered to saponite and chlorite. Groundmass has intersertal texture and is moderately to highly altered to clays and FeO/OH. Base of section contains large olivine phenocrysts altered to saponite set within glassy groundmass. Mostly isotropic groundmass contains mesostasis, altered glass, and minor olivine. Upper part of section contains greater abundance of plagioclase which occurs as small blades/acicular needles with no particular orientation. Olivine phenocrysts have spinel inclusions. Vesicles filled with saponite, celadonite, FeO/OH, and zeolite.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Cpx mesostasis, altered glass, olivine, opaque oxides, plagioclase.

**Alteration:** Moderate to high. Groundmass altered to FeO/OH, clays, and yellow celadonite. Olivine weakly altered to saponite and chlorite. Vesicles filled with saponite, FeO/OH, yellow and green celadonite, and some with radial zeolite (phillipsite). Large amount of altered glass.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 4 | 0.04 | 1.6 | 0.25 | subhedral | subequant | |
| Plagioclase | 7 | 0.04 | 0.6 | 0.3 | subhedral | elongate | |

THIN SECTION LABEL ID: **395C-U1554F-32R-3-W 28/31-TSB-TS 23**

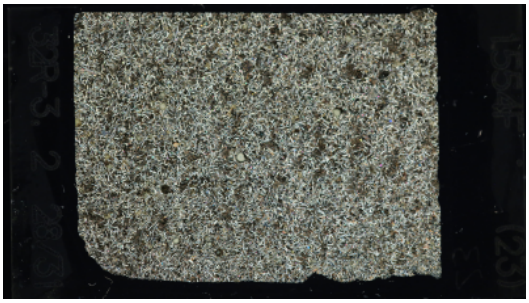
Observer: Callum Pearman, Gabriel Pasquet, Tao Wu, David McNamara Piece no.:

Lithology: sparsely olivine phyric basalt

Thin section summary: Abundant plagioclase of variable morphology within highly altered (clay and FeO/OH) groundmass consisting of mesostasis, minor olivine, altered glass, and oxides. Olivine phenocrysts partially or completely altered to saponite and chlorite. Goundmass contains some almost resolvable interstitial cpx. Large plagioclase crystals are quite common, with poor habit and undulose extinction. Saponite-filled vesicles.

Plane-polarized:

Cross-polarized:



**Igneous Petrology**

**Groundmass:** Cpx mesostasis almost interstitial, olivine, opaque oxides/altered glass.

**Alteration:** Moderate. Groundmass altered to FeO/OH and clay with some disseminated magnetite (sometimes deindritic). Olivine partially or completely altered to saponite and chlorite. Vesicles infilled with saponite and minor FeO/OH and celadonite.

| Mineral | % | Size min. (mm) | Size max. (mm) | Size ave. (mm) | Shape | Habit | Comments |
|---|---|---|---|---|---|---|---|
| Olivine | 1 | 0.04 | 0.2 | 0.1 | subhedral | subequant | |
| Plagioclase | 35 | 0.1 | 1.75 | 0.4 | subhedral | elongate | Larger grains with no clear habit, undulose extinction |
| Clinopyroxene | 1 | | | | | | Some marginal interstitial cpx |

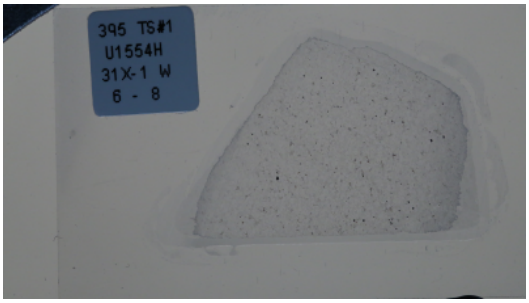
THIN SECTION LABEL ID: **395-U1554H-31X-1-W 6/8-TSB-TS01**

Observer: SH Piece no.:

Lithology: quartzite

Thin section summary: DROPSTONE. Clean quartzite, very high quartz content, well sorted, with some mica that is probably metamorphosed clay alteration of detrital feldspar, some chert. The original grain boundaries of the quartz are largely (entirely?) obliterated by recrystallization but there are some dust rims around the (rounded) feldspar grains.

Plane-polarized:




Cross-polarized: