

Whole section

Massive interior of Unit (13)

Slightly reddish light gray

massive interior

Aphyric  
0.1-2 olivine  
1mm max. alters.

Vesicles  
See Section 1

Vein  
88-93cm  
39-43cm  
1mm wide



granulite  
caliche

vein 70.5-72.5cm  
stepped  
1mm wide  
78-85

66-103cm  
vein network  
irregular orientation  
max 5mm  
typically 1mm  
caliche

← inferred  
base of  
Unit (13)

Inferred top of Unit (14)

Massive interior of Unit (14)

Light reddish gray

May be part of Unit 13

but: fracture 24.5-30 cm 070° sub-vertical

① difference in texture (more massive)

② small pieces in bottom of Section 2 may represent basal scoriaceous zone.

fracture 31-37 cm 80°-110°



Vesicles  
0-20 cm  
3%  
Low sphericity  
Subangular  
10 mm max  
0.5 mm modal  
20/cm<sup>2</sup>  
100% filled.

19-29 cm  
irregular vein network  
<0.5 mm wide  
steeply dipping

Vesicles  
20-145 cm  
0.5%  
highly elongate  
Subangular  
40 mm max  
1 mm modal  
0.5/cm<sup>2</sup>  
90%

fracture 80°-184°

fracture 80°-366°



Some part of Unit 13  
Composite vein network

84-94 cm 1 mm wide vein network 85°-130°

85.5-94 cm 1 mm wide vein network 80°-105°

highly elongate

107-111 cm vein 1 mm thick 70°-214

113.5-115.5 cm vein 1 mm thick 60°-332°

3x veins network 117 to 120 cm all 1 mm thick straight 70°-222

3x veins network (very similar in appearance to previous block) 70°-132

vein 134-136 cm 70°-160 1 mm wide

vein 133.5-144 cm 85°-105° 1 mm wide

Inferred base of Unit (14)

Inte d top of Unit (15)

- ① Vesicles in piece 1 filled with soil.
- ② Mn oxide filling vesicles in pieces 2, 3 and 4 may indicate subaerial weathering
- ③ Unit much more vesicular than Unit (14)

Aphyric basalt

Dusky red to 81 cm.

Light reddish gray from 81-143 cm.

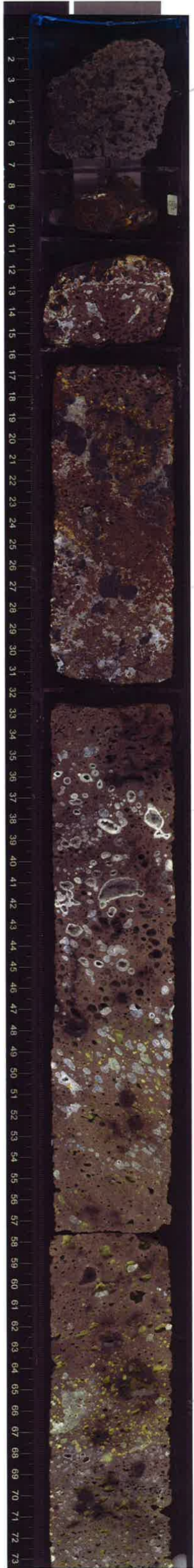
Vesicles

0-55 cm

25%  
 moderate sphericity  
 Subrounded  
 20 mm max.  
 5 mm modal.  
 80% filled  
 2/cm<sup>2</sup>

55-89 cm

15%  
 moderate sphericity  
 Subrounded.  
 17 mm max.  
 2 mm. modal.  
 10/cm<sup>2</sup>  
 20% filled

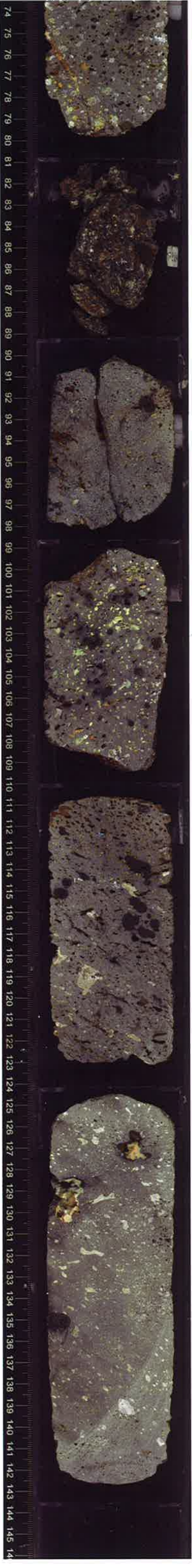


brecciated  
 in vesicles  
Vesicles  
 89-144 cm  
 10%  
 elongate  
 subangular  
 20 mm max  
 3 mm modal.  
 10/cm<sup>2</sup>  
 50% filled

Fe Mn oxide

colored in vesicles

green clay in vesicles



vein 75cm - 80cm  
 90° → 252  
 3mm wide

- highly altered

91-98cm  
 fracture  
 250° sub vertical

green clay in vesicles

Ferruginous oxide

vein 120 to 123 cm  
 80° → 2° 2mm wide

- highly altered

UNIT 16

START OF CONTACT NOT RECOVERED. BOUNDARY UNCLEAR.

THIS PIECE - UNCLEAR WHETHER IS UNIT 15, 16 OR ISOLATED CHUNK. ASSIGNED TO UNIT 16 BASED ON COLOUR

UNIT 16

Piece k-7a  
0-base  
slant - 92.5 on 2A

LAVA FLOW.  
BOUNDARIES NOT RECOVERED.

PHENOCRYSTS

0% PHENOCRYSTS.  
BASALT  
APHYRIC

29-29  
single vein  
irreg. steep dip - 220°

31-36cm  
aligned  
vesicles  
90° → 170°

highly  
aligned

2 joint  
w/ non-  
orth.

moderately  
aligned



Interval a  
0-8cm  
MOTTLED  
BROWN-GRAY  
FINE GRAINED  
0.1MM  
APHYRIC  
AMYGDALOIDAL  
10% VESICLES.  
MODERATE  
SUB ROUNDED.  
MAX 1MM  
MOD. 0.3MM

Interval b  
8-31cm  
BROWN-GRAY  
FINE-G  
0.1MM  
APHYRIC  
VESICULAR  
2-4%  
10% VESICLES  
LOW  
SUB ROUNDED.  
15MM MAX  
1MM MOD.

Interval c  
31-63cm  
LGT DRAB-GRAY  
FINE-G  
0.1MM  
APHYRIC  
AMYGDALOIDAL

46-86.5  
50% VESICLES.  
ELONGATE  
SUB ROUNDED,  
32MM  
2MM

Interval d  
63-92.5 on 2A  
MED GREY  
FINE GRAINED  
APHYRIC  
MASSIVE

89-93  
duglo  
joint  
steep dip.  
182

96-97  
vein  
network  
broad  
vein,  
straight  
single

118-135  
vein  
isol. 200°



80-93cm

groundmass  
magmatic  
foliation  
80 → 172°

moderately  
aligned  
95-110cm  
g/mass  
magmatic  
foliation  
80 → 165° ALL INTERVAL D

vein 110-111cm  
1mm wide  
straight  
80 → 192°

vein 113cm  
2mm  
straight  
85 → 018

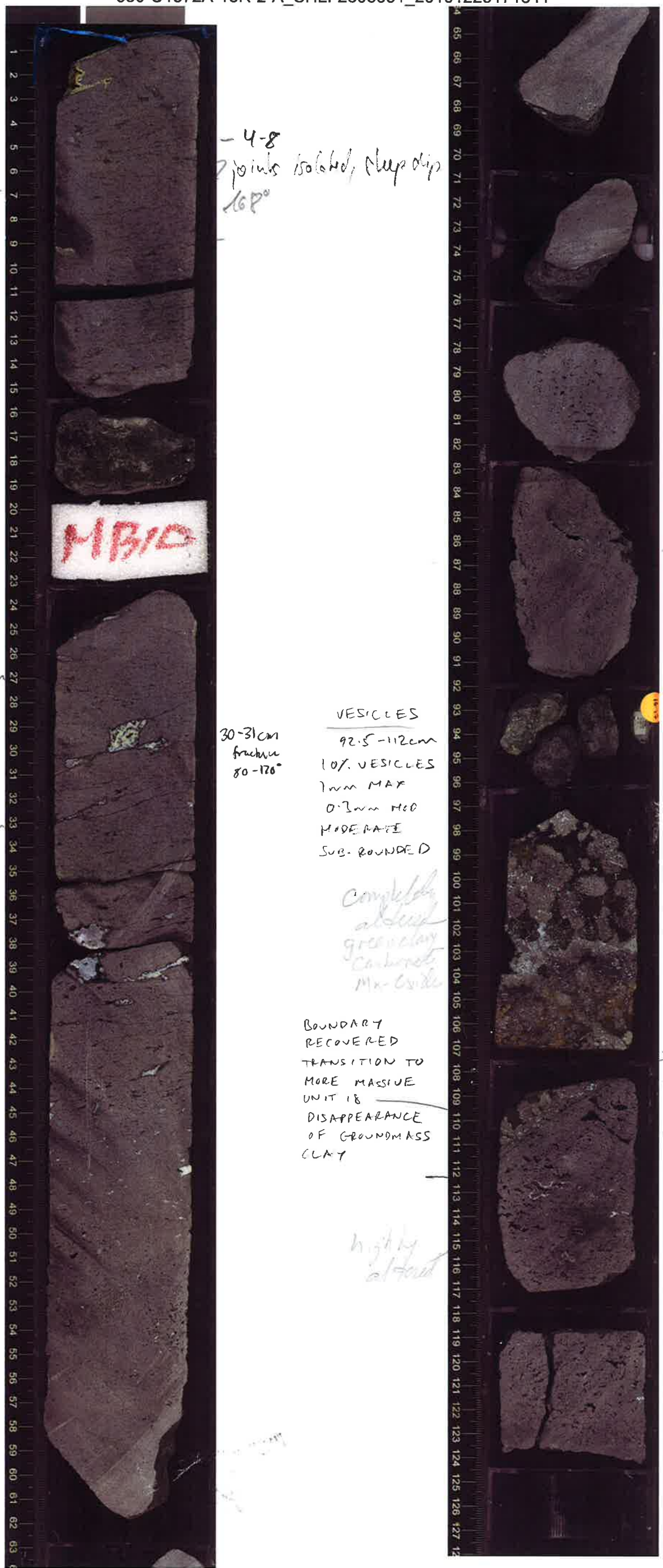
113-128cm  
g/mass  
magmatic  
foliation  
80 → 190

129-120  
fracture  
stepped  
80 → 190

UNIT 16  
PIECE 1-7

UNIT 17  
PIECE 8-9

330-U1372A-13R-2-A\_SHLF2696531\_20101225171841



moderate alteration  
0-15cm groundmass foliation  
80-170°

- 4-8 joints isolated, steep dip  
160°

**MB/D**

27-33  
2 veins, isol.  
steeply dipping  
24-45cm groundmass foliation  
80-170°

30-31cm fracture  
80-170°

VESICLES  
92.5-112cm  
10% VESICLES  
1mm MAX  
0.3mm MOD  
MODERATE  
SUB-ROUNDED

completely altered  
green clay  
carbonate  
Mx-Guide

BOUNDARY RECOVERED  
TRANSITION TO MORE MASSIVE UNIT 18  
DISAPPEARANCE OF GROUNDMASS CLAY

highly altered

92.5-97.5  
10% VESICLES  
ELONGATE  
SUBANGULAR  
20mm MAX  
0.5mm MOD.

highly altered

BOUNDARY NOT RECOVERED

BASE OF UNIT 16  
92.5-112

UNIT 17  
APHYRIC BASALT BRECCIA  
BRECCIA  
POSSIBLY HIGHLY ALTERED  
HYALOCLASTITE, GLASS  
COMPLETELY REPLACED BY  
CLAY MINERALS  
PHENOCRYSTS  
APHYRIC  
0% PHENO.  
TEXTURE  
FINE GRAINED 0.1mm  
MOTTLE GREEN-BLACK-GRAY-ORANGE  
VOLCANIC ATTRIBUTES  
BLOCKY CLAST  
50% CLAST  
20mm MAX  
MODERATE SUBANGULAR CLASTS  
ALTERED GROUNDMASS POSSIBLY  
ORIGINALLY GLASS

UNIT 18  
BOUNDARY AT 112cm  
112-124cm  
LAVA FLOW, VESICULAR  
0% PHENOCRYSTS, APHYRIC  
TEXTURE  
MEDIUM GRAY  
FINE GRAINED 0.1mm  
VESICLES  
10%  
10mm MAX  
0.3mm MOD  
ELONGATE  
SUBANGULAR

BOTTOM CONTACT NOT RECOVERED

UNIT 18  
PIECE 9-11

Piece 1a - 5

UNIT 19

green clay

0-44

APHYRIC BASKET BRECCIA

HIGHLY ALTERED POSSIBLE HYALACLASTITE

black clay

PHENOCRYSTS,

APHYRIC 0% PHEN.

TEXTURE

MOTTLED GREEN FINE GRAINED 0.1MM COMPLETELY ALTERED GLASS? APHYRIC

VOLCANIC AGGREGATES

BLOCKY CLASTS - IRREGULAR 400%

10MM MOD. MODERATE SUBANGULAR

ALTERED GROUNDMASS, POSSIBLY GLASS.

VESICLES

79% VESICLES MAX 3MM MOD 0.5MM LOW SUBANGULAR

TRANSITIONAL TO UNIT 20 POSSIBLE THAT BRECCIAS TOP TO UNIT 20.

44cm UNIT 20

44 - base ~ 139cm -> 97cm on SA.

PHENOCRYSTS

44 - 60cm on SA

APHYRIC 0%

black clay

TEXTURE

MED-GRAY FINE-GRAINED 0.1MM APHYRIC

TOP PART 3cm W/ WEIRD BANDING FEATURES

WEIRD 'DEVITRIFICATION' SPOTS, SPHERULITES? LUMY FEATURE? OCCUR 2-4cm ALTERATION?

Highly altered

36-41 contact, non-oriented

Interval a

44-60.5 109% VESICLES ENLOWING SUB-ANGULAR

45MM MAX 0.5MM MOD.

Interval b

60.5 - 150 on 4a 59% 22 MAX 1mm MOD. LOW SPH. SUB-ROUNDED



highly altered

Piece - 10

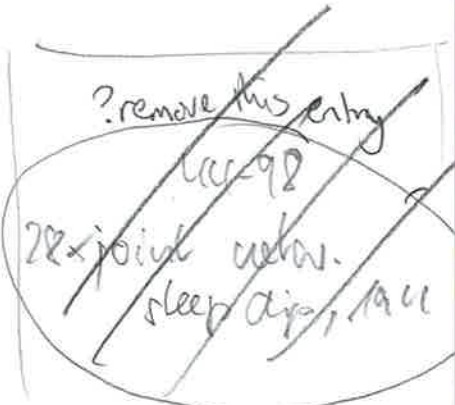
0-3.5cm  
fracture straight  
85 → 314

4-8cm  
fracture  
straight  
70-122°

all highly  
altered

16-26cm  
groundmass  
foliation  
80 → 355°

30.5-35.5cm  
groundmass  
foliation  
steeply dipping  
→ 350°



42-56cm  
groundmass foliation  
85 → 194°

53.5-54cm  
fracture  
85 → 006°

55-56.5  
85 → 016°

67-68  
band of vesicles  
184



Interval c  
15-122  
2%  
LOW  
SUB-ROUNDED  
30mm  
0.5mm

104-105  
1 vein, 162

107-125  
7 joints  
non-oriented

41.5-42.5cm  
fracture  
80 → 186°

Interval d  
122-60  
on 5A  
1%  
LOW  
SUB-ROUNDED  
7mm MAX  
0.5mm MAX



68-78cm  
magmatic foliation  
85 → 008°

89-90cm  
fracture  
85 → 186°

UNIT 20  
1-8

330-U1372A-13R-5-A\_SHLF2696621\_20101225125256

5-7  
poor, steep dip  
165

highly  
altered



base of  
Unit (20)

UNIT (21)  
Interval a  
10% vesicles  
12mm max  
1mm min  
LOW  
Rounded,



← 50cm, 97cm

OLIVINES  
3%  
4.5mm max  
1mm min  
SUBHEDRAL  
COMPLETELY RETICED

← OLIVINE CUMULATE  
INDICATES BASE OF  
FLOW.

← olivines ~ 80% altered  
moderately altered

← VESICLE ABUNDANCE  
INCREASES  
INDICATING BASE  
OF FLOW.



(Continued)

drilling debris

OXIDISED BASALT (TOP)

• 0-4 cm

PHENOCRYSTS

OLIVINE

1%  
MAX: 0.5mm, MODE 0.5mm  
SUBHEDRAL, COMPLETELY ALTERED

FELDSPAR

3%, FRESH  
ANHEDRAL

▷ OXIDISED BASALT  
TEXTURE

ORANGE-BROWN  
FINE-GRAINED  
COMASS: 0.3mm  
↳ FP LAMIN IN COMASS

• 4cm - 126cm

OLIVINE PORPHYRITIC  
BASALT

PHENOCRYSTS

OLIVINE

5%  
MAX 6mm  
MODE 3mm  
SUBHEDRAL,  
MODERATELY ALTERED

FELDSPAR

1%  
MAX 1mm,  
MODE 0.5mm  
SUBHEDRAL  
FRESH

▷ OLIVINE  
PORPHYRITIC  
BASALT

TEXTURE

MEDIUM TO DARK GRAY  
FINE-GRAINED  
COMASS 0.1mm

[Grandmas has  
magmatic foliation]

→ exerts strong control  
on fracture & vein  
orientation



0-9cm  
OXIDISED  
BASALT  
VESICLES

5%  
MODERATE  
SPHERICITY  
SUBANGULAR  
2mm MAX  
0.2mm MODE

17-24cm  
fracture zone  
steeply dipping → 184°

also  
14-23cm  
joint, steeply dipping → 090°

30-42cm  
6x fractures

4-126cm  
OLIVINE  
PORPHYRITIC  
BASALT  
VESICLES

7%  
MODERATE  
SPHERICITY  
SUBROUNDED

vein 44-47cm  
65 → 310°  
0.5mm

49-58cm  
fracture zone (4x)  
steeply dipping → 190°

49-56cm fracture  
20 → 244°

fracture zone (x6)  
61.5-74cm  
steeply dipping → 174°

74.5-75cm  
vein 1mm, curved, steeply dipping



77-81cm  
vein network, branching & recombining  
max 1mm  
mode 0.5mm  
steeply dipping

80 → 005°  
81.5-82cm  
vein 2mm  
vein 84-84.5cm 1mm wide 75-174°  
vein 86-87cm 1mm 80 → 165°

87.5-95cm  
fracture network  
steeply dipping

95.5-106cm  
fracture network  
steeply dipping

98.5-99.5  
vein network  
branching & recombining  
max 2mm wide  
steeply dipping

107-110cm  
fracture network  
90 → 088°

113.5-114.5cm  
vein 0.5mm wide  
90 → 160°

CONTACT  
UNIT 21  
126cm  
NOT  
RECOVERED

UNIT 22  
BASALT  
BRECCIA  
PHENOCRYSTS

OLIVINE

5%  
MAX 2mm MODE 0.5mm  
EUBHEDRAL, COMPLETELY  
ALTERED

▷ BASALT BRECCIA  
TEXTURE

MOTTLED DARK GREEN,  
BLACK, REDDISH GRAY  
FINE GRAINED, 0.1mm  
PORPHYRITIC

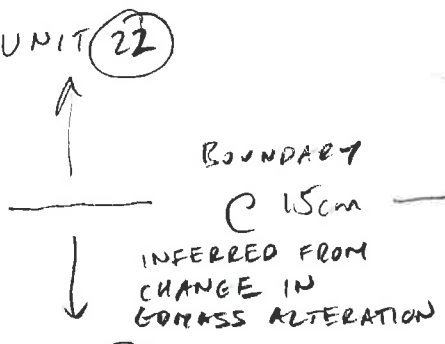
VOLCANIC ATTRIBUTES

IRREGULAR CLASTS  
40% PARTICLES  
LIRREGULAR  
SUBANGULAR

MUTTERED COMASS,  
POSSIBLY FORMERLY GLASS

UNIT (22)  
PIECE 1.

UNIT (22):  
BASALT BRECCIA



lava flow

Highly  
Olivine-Phyric  
Basalt

10% Olivines  
Altered  
8mm max  
3mm mod

Fine grained  
0.1mm  
fracture  
+1-43cm  
85 → 202°

greenish gray

53-57cm  
(on opposite  
side to cut  
surface)  
fracture 25 → 218°

UNIT 22  
DASALT BRECCIA  
VESICLES  
R1A 126cm -  
R2A 15cm  
7%  
MODERATE  
SPHERICITY  
SUBROUNDED  
1mm MAX  
0.2mm MODAL

Vesicles

15-134 cm  
15%  
40mm max.  
5mm modal  
3/cm<sup>2</sup>  
95% filled.  
moderate sphericity  
rounded

134cm -  
Section 3, 2cm.  
3%  
Low sphericity  
angular  
15mm max.  
1mm modal  
20/cm<sup>2</sup>  
1% filled



Vein 100.5-103cm  
0.5mm wide  
80 → 200°

Vein 101.5-108.5cm  
1mm wide  
74 → 222°

UNIT (23)

TOP UNIT (24)

UNIT (23)

UNIT (24)

Volcanic Breccia  
Aphyric basalt

TOP UNIT (25)

UNIT (25)

Aphyric Basalt

Vesicles

2-15 cm.

1%  
moderate sphericity  
rounded

1 mm max  
0.5 mm modal  
3/cm<sup>2</sup>  
100% filled

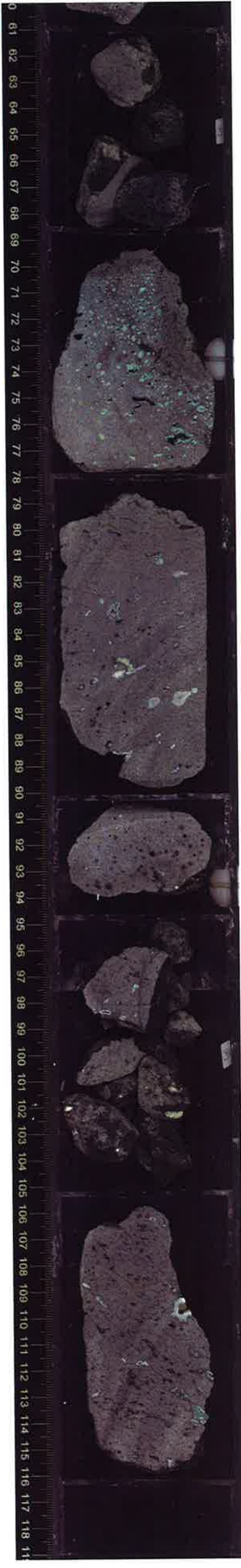
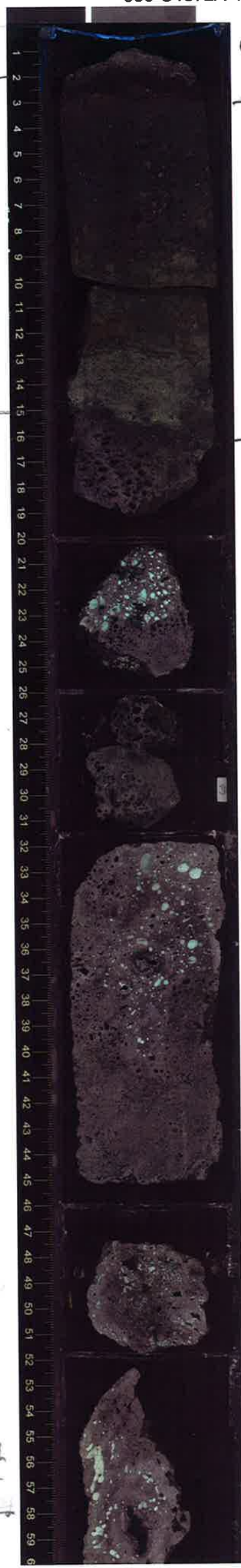
15-74 cm  
10%

moderate sphericity  
rounded

9 mm max  
3 mm modal  
0% filled.  
5/cm<sup>2</sup> lined with  
pale green  
clay

74-116 cm  
2%  
elongate  
angular  
20 mm max.  
5 mm modal  
1/cm<sup>2</sup>

90% filled.



0-32.5cm  
vein  
1mm wide  
subvertical  $\rightarrow 70^\circ$   
0-7cm  
vein  
0.5mm wide  
 $80 \rightarrow 122^\circ$

20-21cm  
fracture  
irregular  
steeply  
dipping

Calcite



Vesicles

29-39 cm

15% in part  
elongate  
subangular  
5mm max.

0.5mm mode  
50/cm<sup>2</sup>  
100% filled

Fe-oxide  
in vesicles

39 cm - Section 3,  
59 cm.

0.5%  
mod spherulite  
Subangular  
0.5mm max  
0.2mm mode  
10/cm<sup>2</sup>  
100% filled

vein 35-37cm  
0.5mm wide  
contains pyrite  
 $45 \rightarrow 116^\circ$

37.5-44cm  
vein  
0.5mm wide  
contains pyrite  
straight  
 $70 \rightarrow 244^\circ$

49-57cm  
vein  
0.5mm  
curved  
steeply dipping

62.5-63.5cm  
vein  
1mm wide  
straight  
 $85 \rightarrow 190^\circ$



61-72cm  
vein  
0.5mm wide  
straight  
 $80 \rightarrow 118^\circ$

73-79cm  
fractured

80-87cm  
vein  
0.5mm wide  
straight  
subvertical  $\rightarrow 100^\circ$

110-117cm  
vein  
branched  $70-294^\circ$   
0.5mm wide

114.5-116.5cm vein 0.5mm wide  
 $80 \rightarrow 080$  straight

121-126cm  
vein  
0.5mm wide  
 $80 \rightarrow 250$

5-27cm  
vein  
0.5mm  
irregular  
steeply dipping

9-11cm  
vein  
0.5mm  
straight  
80-79°

All veins  
steeply dipping  
80-79°

27.5-32cm  
vein  
1mm  
straight  
68-73°

40-41cm  
fracture  
irregular  
steeply  
dipping

fracture  
88-71°

49-60cm  
vein  
0.5mm  
60-70°  
straight

Vesicles

59-86 cm

5% in two  
patches.

low sphericity  
angular

20mm max

0.5mm mode

50/cm<sup>2</sup>

100% filled

86-115 cm

0.5%

mod. sphericity  
subrounded

0.5mm max

0.2mm mode

10/cm<sup>2</sup>

100% filled

115-118 cm

Fe<sub>2</sub>O<sub>3</sub>  
hydrated  
veinlets

5% in small  
patch

mod. sphericity

subrounded

max. 3mm

mode 0.5mm

20/cm<sup>2</sup>

1% filled

calcite  
Fe-oxides  
veinlets

96-101cm  
fracture  
40-70°

102-105cm  
fracture  
60-71°

115-120  
fracture  
irregular  
steeply dipping

122-129cm  
fracture

Vesicles

118-137

0.5%

mod. sphericity  
rounded

5mm max.

2mm mode

0.1/cm<sup>2</sup>

80% filled

UNIT (25)

Aphyric basalt

base of  
thick flow

0.01% of phenos.

1 mm max.

0.5 mm nodal.

equant / euhedral.  
altered. *slightly  
altered*

Vesicles 0.5%

0 - 46 cm

elongate  
subrounded.

8 mm max  
1 mm nodal.

0.5/cm<sup>2</sup>  
100% filled

*completely  
altered  
breccia*

UNIT (26)

Aphyric basalt

lava flow  
(pillows?)

No phenocrysts  
or micropheocrysts

Vesicles

46 - 126 cm

1% low sphericity  
angular

20 mm max  
2 mm nodal

5/cm<sup>2</sup>  
100% filled

patchy; vertical  
vesicle frams in places



79-92  
pink, straight  
slightly dipping

*Calcite*

23-26

veins, straight  
isolated 184°

(piece eventually  
rotated)

102-105  
curved vein,  
slightly dipping

straight vein,  
non-orient.

only replaced (piece  
rotated?)  
by Fe-oxides  
Moderately  
altered  
margin  
Fe-oxides

46-47 micropheocryst  
oriented, non-

UNIT (27)

VOLCANIC  
BRECCIA

35  
straight (Hyalodactyls?)  
pink

Aphyric.

No phenos. or  
micropheos.

fragments  
in breccia  
moderately  
altered

66-71  
vertical  
vesicle  
frams.  
filled w/  
Fe-oxides



medium gray

↓  
light reddish gray

Vesicles

126 cm -

Section 2 99 cms

1% (in clast)

low sphericity  
subrounded

8 mm max.

2 mm nodal.

3/cm<sup>2</sup>

5% filled.

UNIT 27  
(continued)

Completely  
altered  
breccia

moderately  
altered  
fragments  
in breccia

marginal  
fragments  
highly altered  
Grade to  
mod. alteration  
in interiors

60-70  
pink,  
curved, non-oriented



moderately  
altered  
interior

joint  
network,  
non-oriented

fractured

119.5 -  
129  
vein irregular  
steeply dip,

moderately  
altered

highly altered rim

UNIT 28  
aphyric basalt

lava flow  
(pillows?)

fine grained  
no phenocrysts  
or microphenocrysts

medium gray

Vesicles

Calcic + Fe-oxyl  
vein

99 cm -  
Section 3, 21 cm

10%  
high spherulites  
rounded

6 mm max  
3 mm modal  
0.5/cm<sup>2</sup>  
100% filled.

variable  
calcic  
Fe-oxyl

MB10

