What is the Workflow for Hard Rock Visual Core Description and How Will it Benefit from CoreWall?

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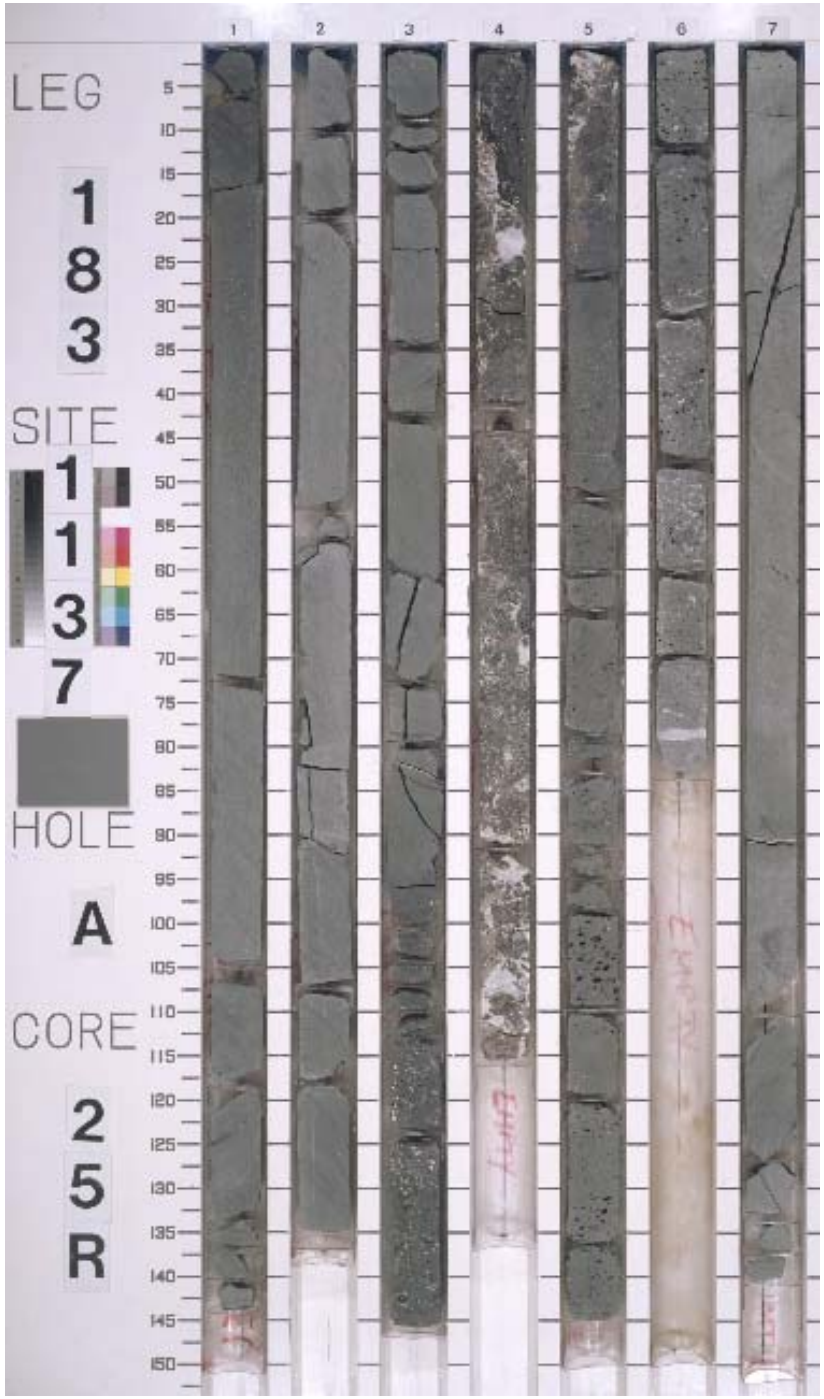


Hard Rock Cores

Igneous and Metamorphic.

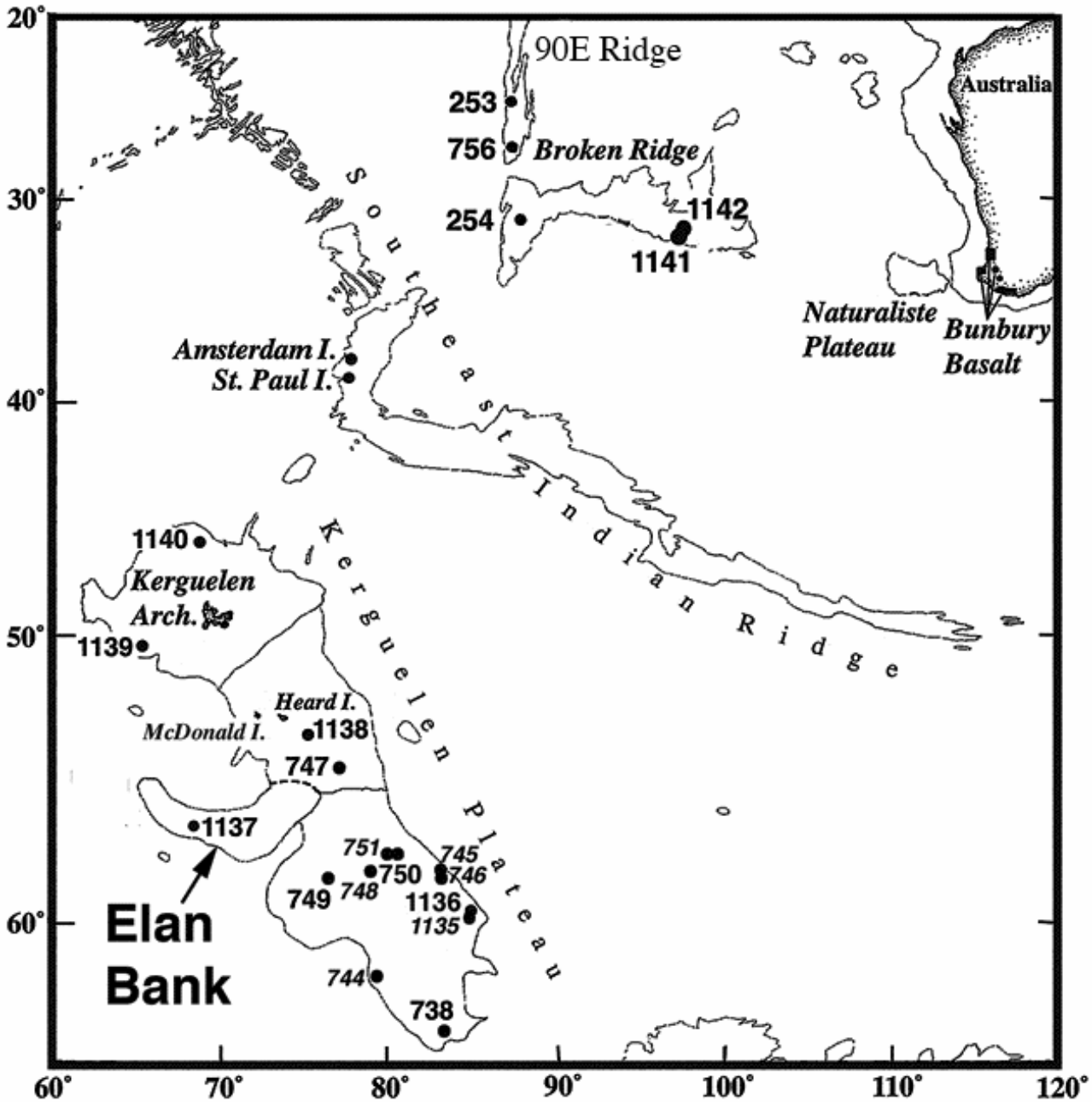
Igneous: lava, hyperbyssal, cumulate.

Metamorphic: schist, gneiss, etc.

Volcaniclastic: hyaloclastite; lapilli tuff, scoraceous tuff.

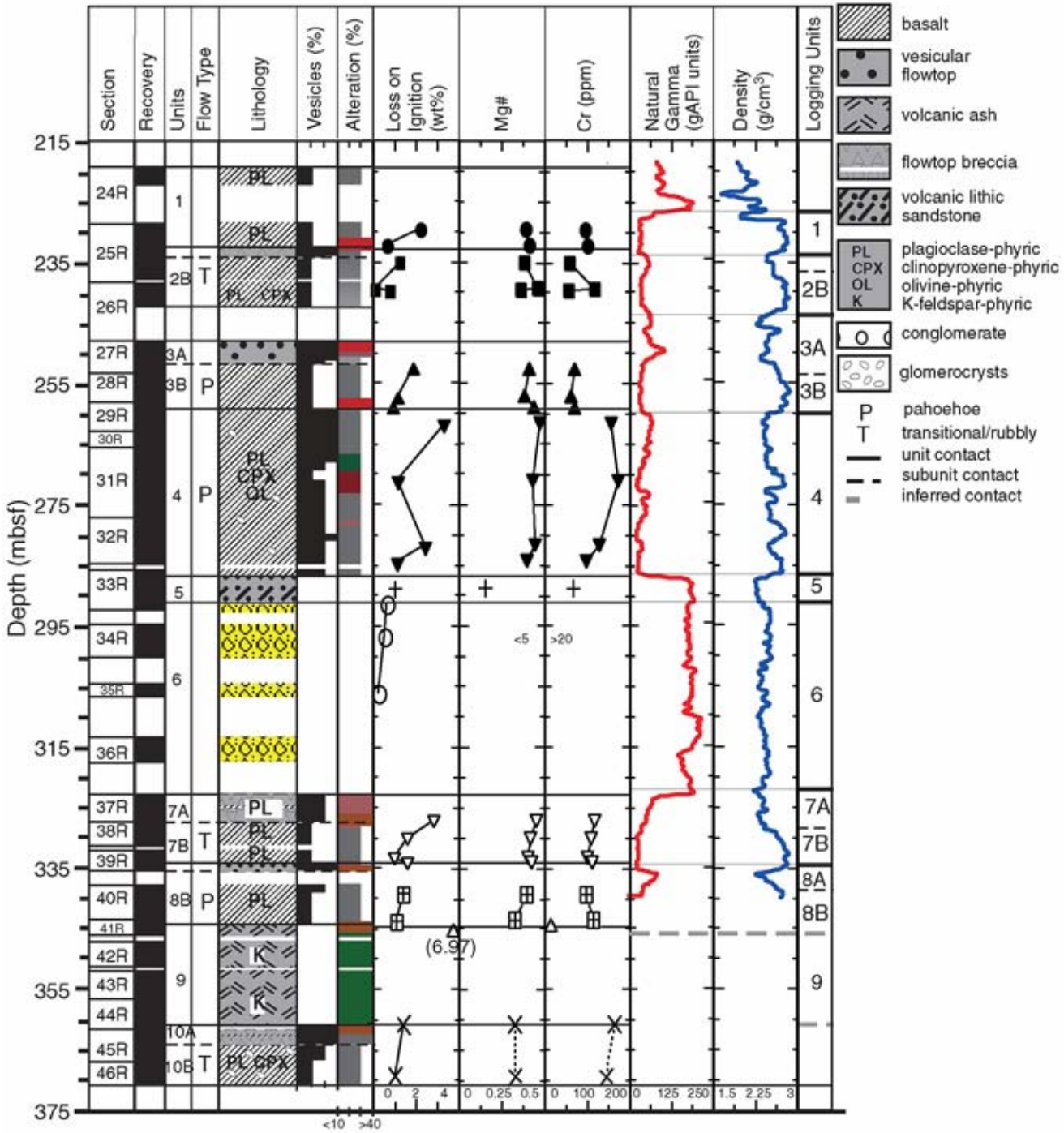
Examples from ODP Leg 183 (Kerguelen Plateau) and Leg 197 (Emperor Seamounts).

ODP Leg 183, Kerguelen Plateau: Site 1137

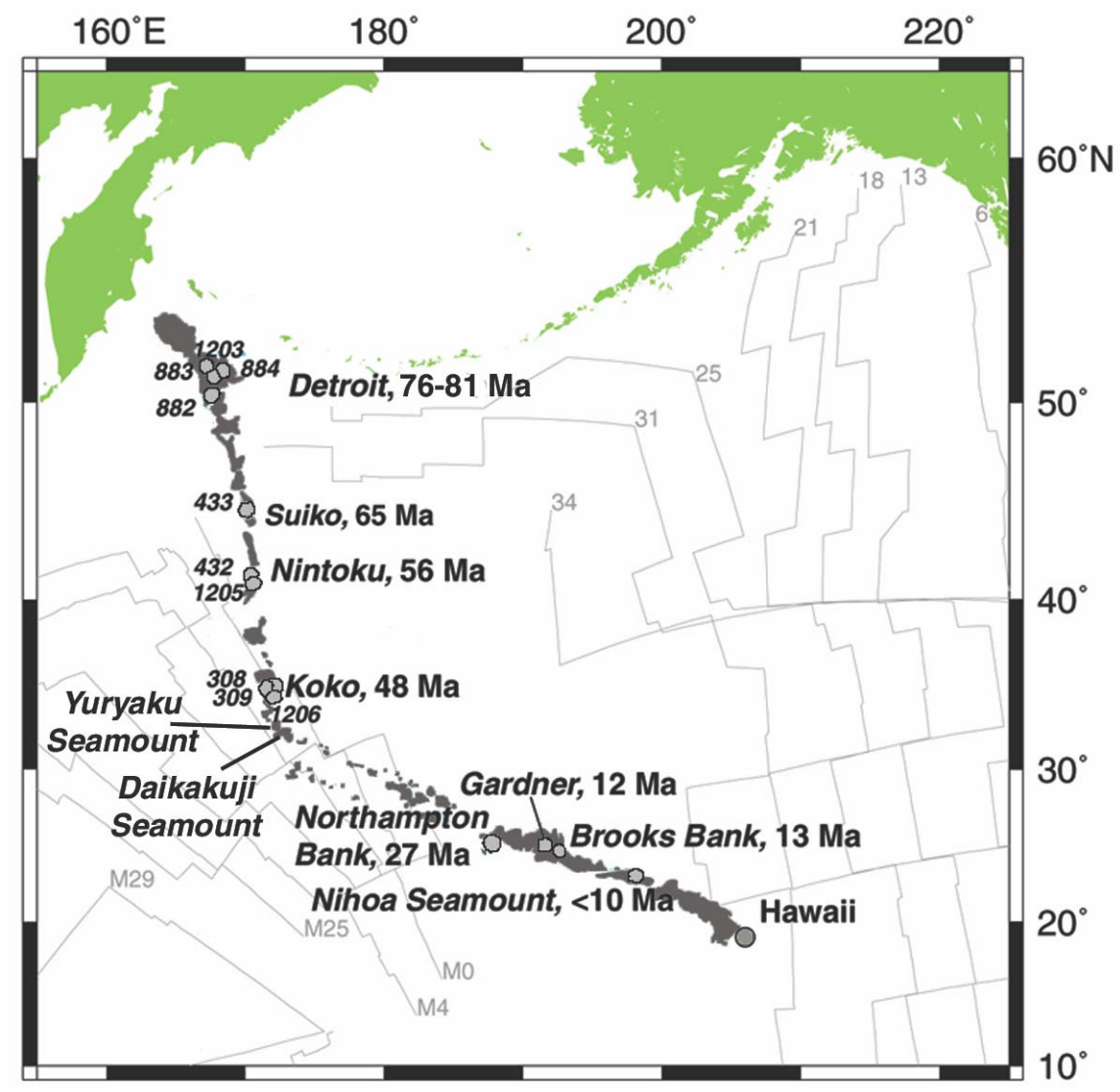


ODP Leg 183, Kerguelen Plateau: Site 1137

>100 m of lava flows and interbedded volcaniclastic sediments in basement sequence.

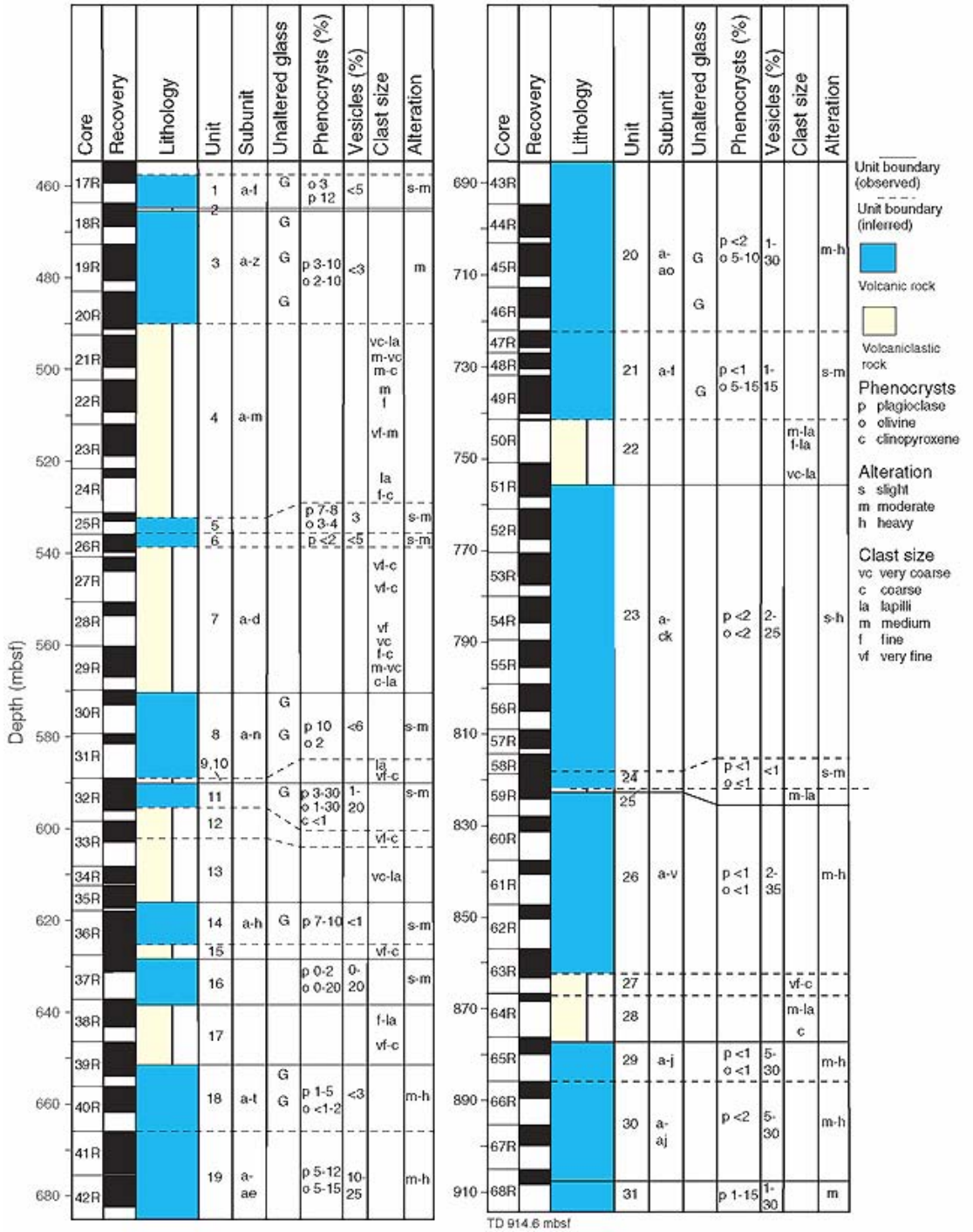


ODP Leg 197, Site 1203: Detroit Seamount



ODP Leg 197, Site 1203: Detroit Seamount

~450 m of interbedded volcaniclastics and lava flows in basement sequence.



Hard Rock Cores

Data to be Captured:

Crystallinity

Grain Size & Shape

Mineralogy (type & abundance)

Alteration (% of total alteration)

Secondary minerals (type & abundance)

Structure (fracture orientation)

Veins: size and fill

Phenocryst type & abundance

Groundmass mineralogy (type & abundance)

Texture (subophitic, variolitic, granoblastic, foliated)

Foliation (gneissose, schistose)

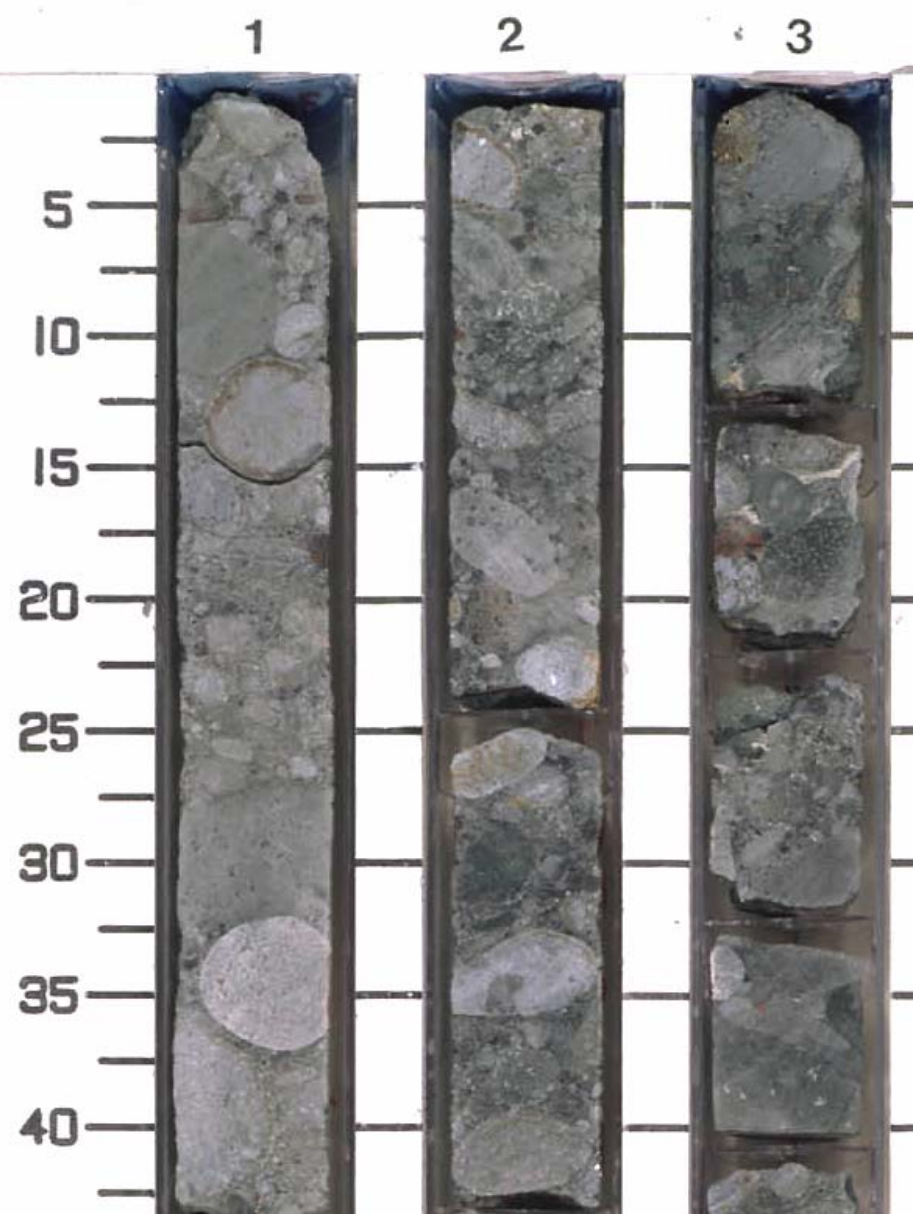
Vesicles: size, shape, abundance, type

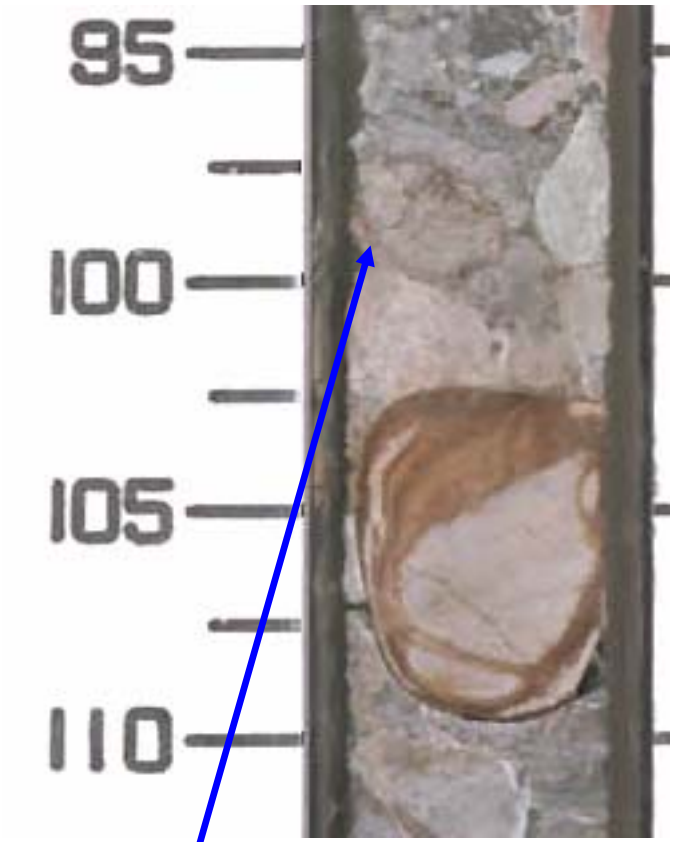
Volcaniclastic deposits: scoria, ash, tuff, lapilli

Unit boundaries

Geochemistry

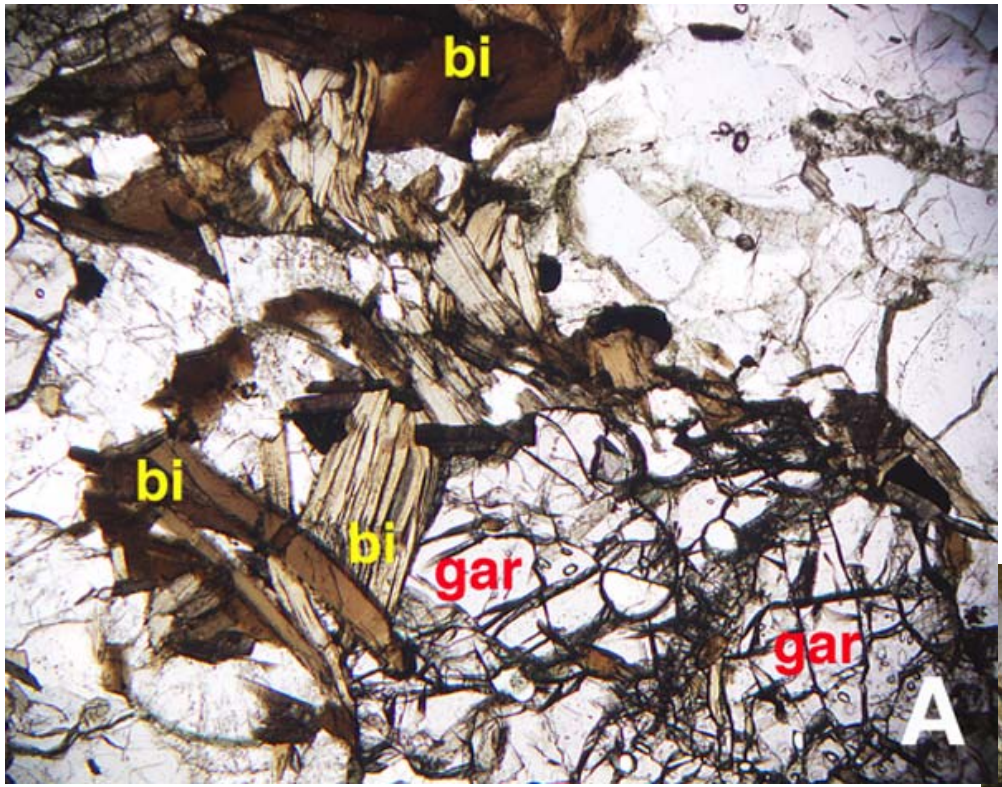
ODP Leg 183, Site 1137: Conglomerate





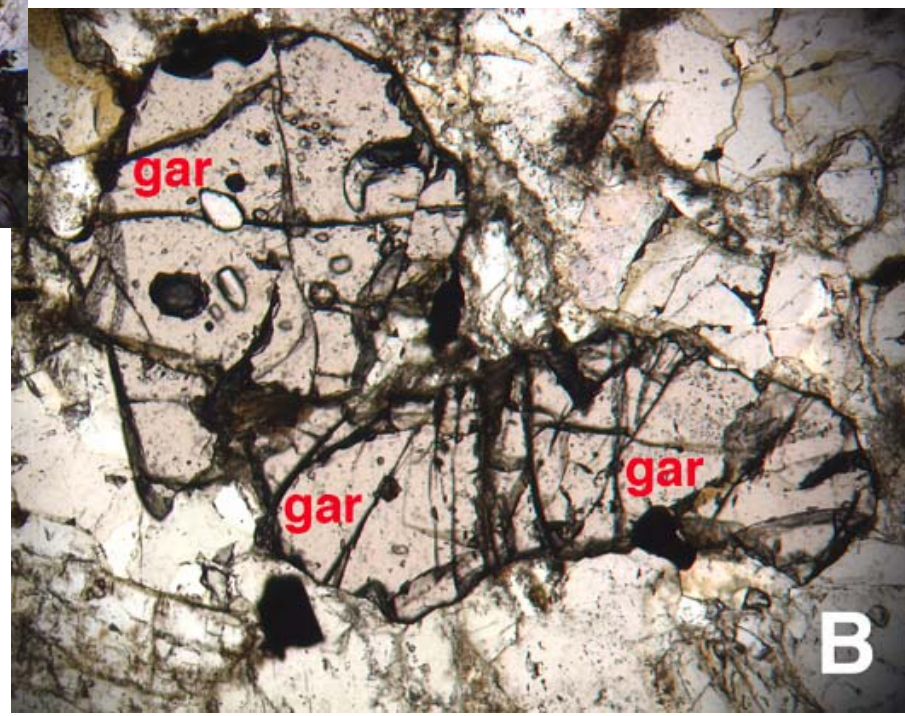
Gneiss

ODP Leg 183, Site 1137: Conglomerate



FOV = 2.5 mm

Garnet-Biotite Gneiss



FOV = 1.25 mm

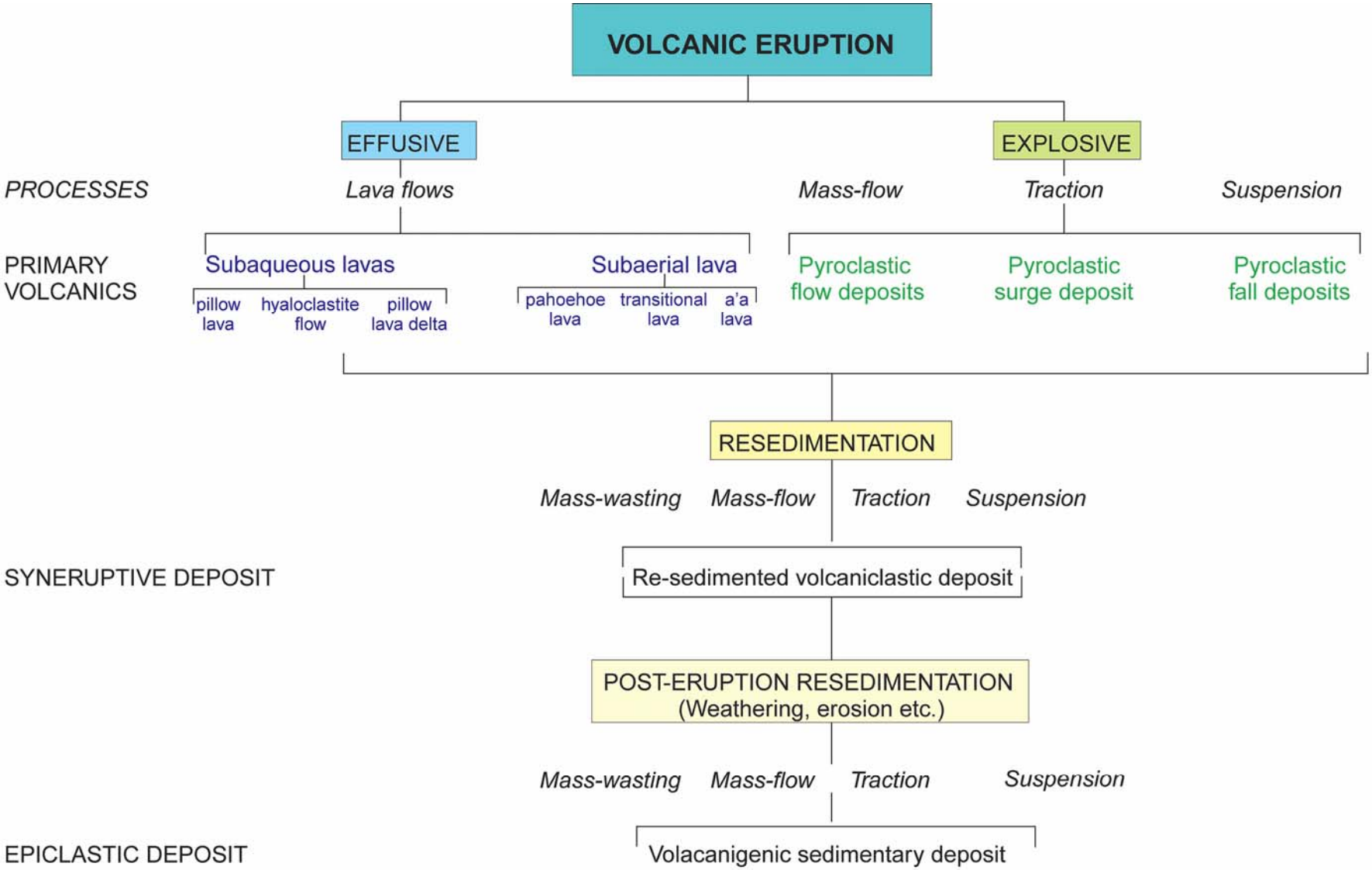
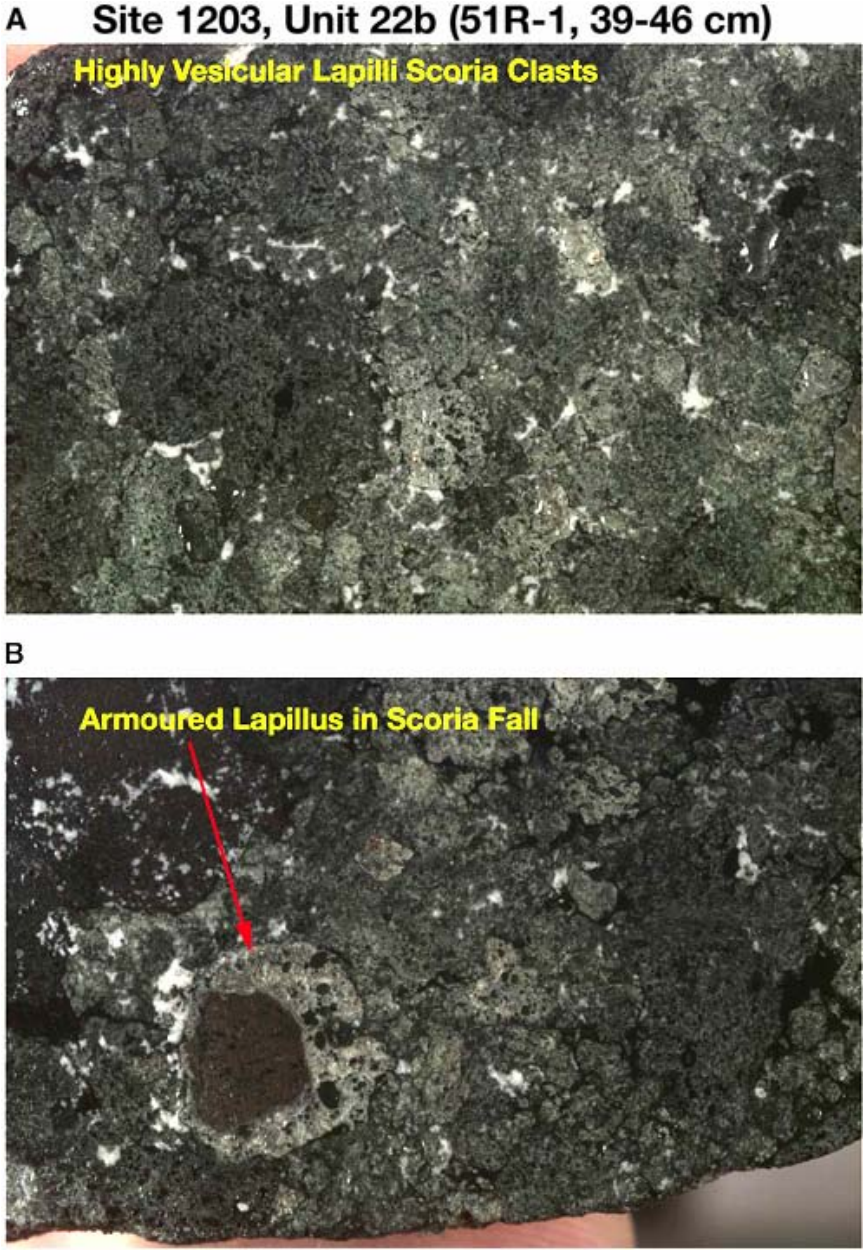
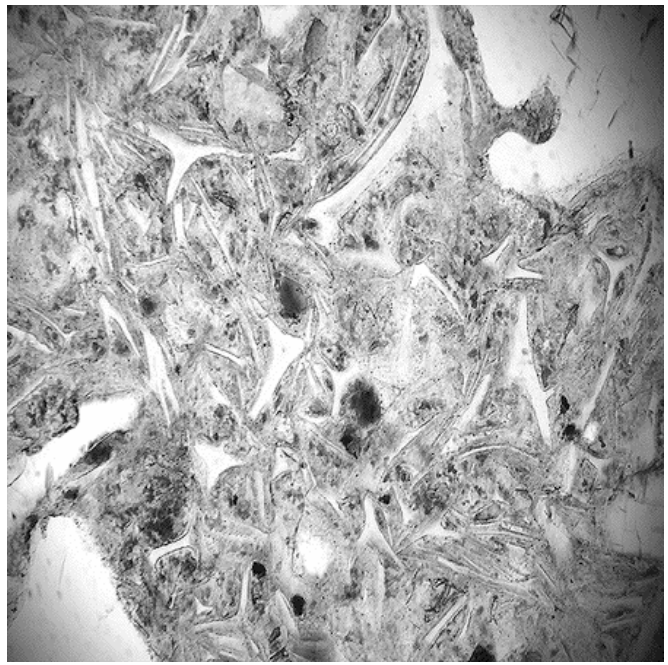


Figure 197-EXP-D-2. Generic classifaction of volcanic deposits. Words in italic font refer to processes. Modified after McPhie et al. (1993).

Volcaniclastic Deposits

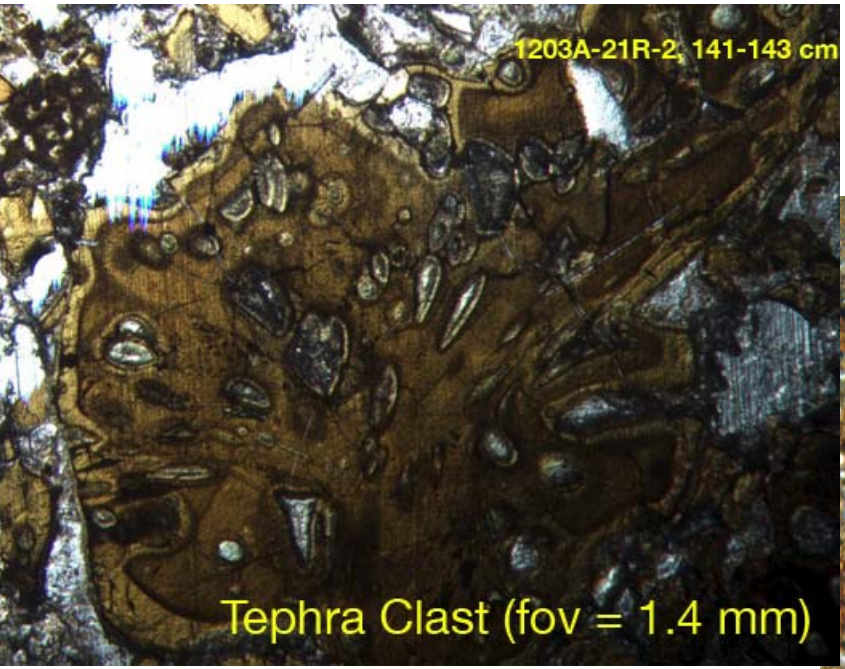


Lapilli tuff; Glass Shards (crystal-vitric tuff).



(FOV = 1.25 mm)

Volcaniclastic Deposits



Basaltic Tephra Deposits

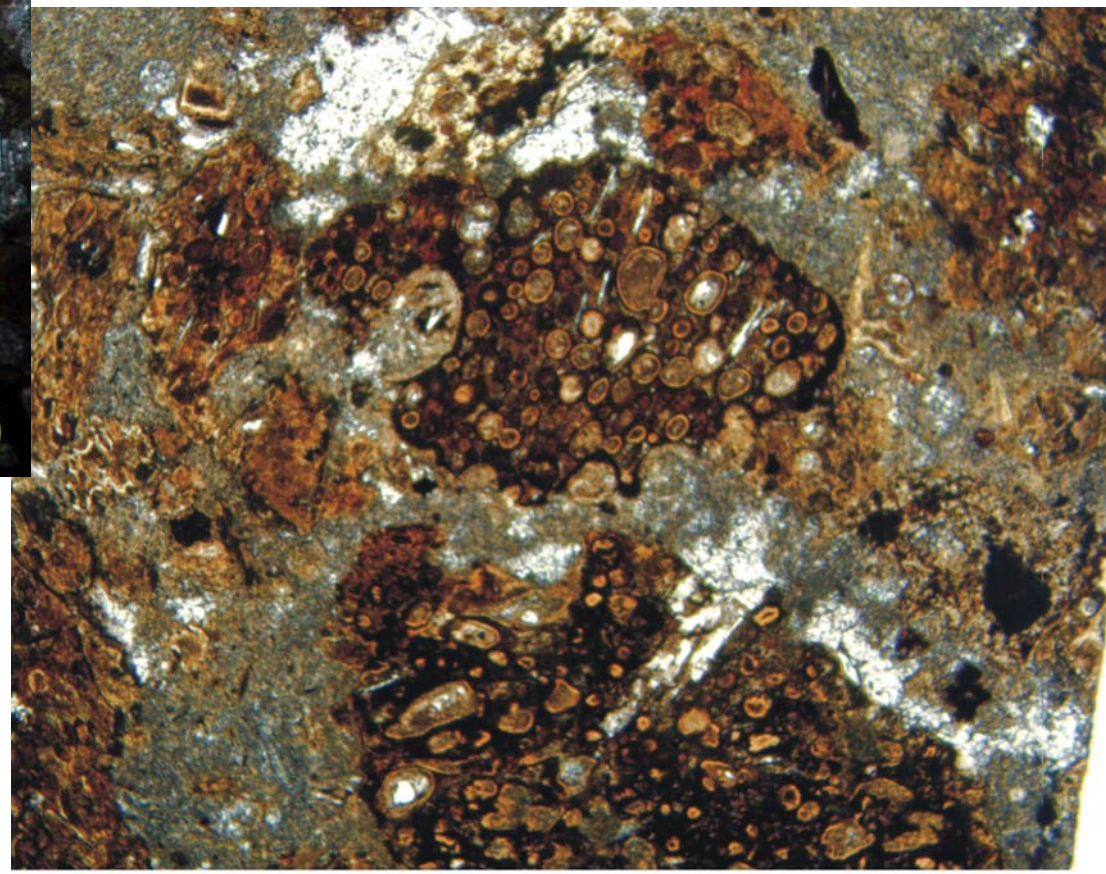


Figure 1203A- E-VPET1. Highly vesicular cuspate basalt tephra clasts in Unit 9 (1203A-32R-1, 74-77cm). Field of view is 5.5 mm. (Photograph 1203-128).

Basalt Lava

Pahoehoe and A’a

Basalt Lava

Table T2. Distinguishing characteristics of basalt lava types.

Lava type	Must have	Commonly has	Commonly lacks	Must not have
Pahoehoe subtypes: p-type pahoehoe, spongy pahoehoe	Smooth (continuous) flow top and base; glassy marginal selvage (0.2–1.5 cm thick); vesicular upper crust (15%–60% vesicles); lower vesicular crust (10%–50% vesicles)	0.3- to 80-m flow thicknesses; inflation features (e.g., tumuli); thick massive interior (0%–5% vesicles); compound flow lobes; segregation structures (e.g., vesicle cylinders)	Angular and stretched vesicles	Autobrecciation
Pillow lava	Smooth (continuous) flow top and base; glassy marginal selvage (0.2–1.5 cm thick)	Concentric microvesicular zones; pipe vesicles; compound flow lobes; intercalated with hyaloclastite	Macroscopic vesicular zones	
Slab pahoehoe	Autobrecciated flow top; slabs of broken pahoehoe surfaces	A'a and pahoehoe clasts in breccia; thin basal breccia		
Spiny pahoehoe	Continuous top and bottom spinose surface	High degree of crystallinity		Autobrecciation
Rubbly pahoehoe	Autobrecciated flow top; broken and intact pahoehoe lobes; coherent vesicular crust below breccia; lower vesicular crust	Massive interior; distorted by rounded vesicles; smooth pahoehoe base	Well-defined vesicular zones	Basal breccia
A'a	Autobrecciated flow top; slabs of broken pahoehoe surfaces	2- to 5-m flow thickness; clasts entrained within the core; core pushing into the flow-top breccia; 5%–20% vesicularity of clasts and core; minor eolian sediment infill	Round vesicles; inflation features; segregation structures	Smooth pahoehoe surfaces

Note: Modified from Keszthelyi (in press).

Pahoehoe: P-Type; Spongy; Slab; Spiny; Rubbly.

Pillow lava

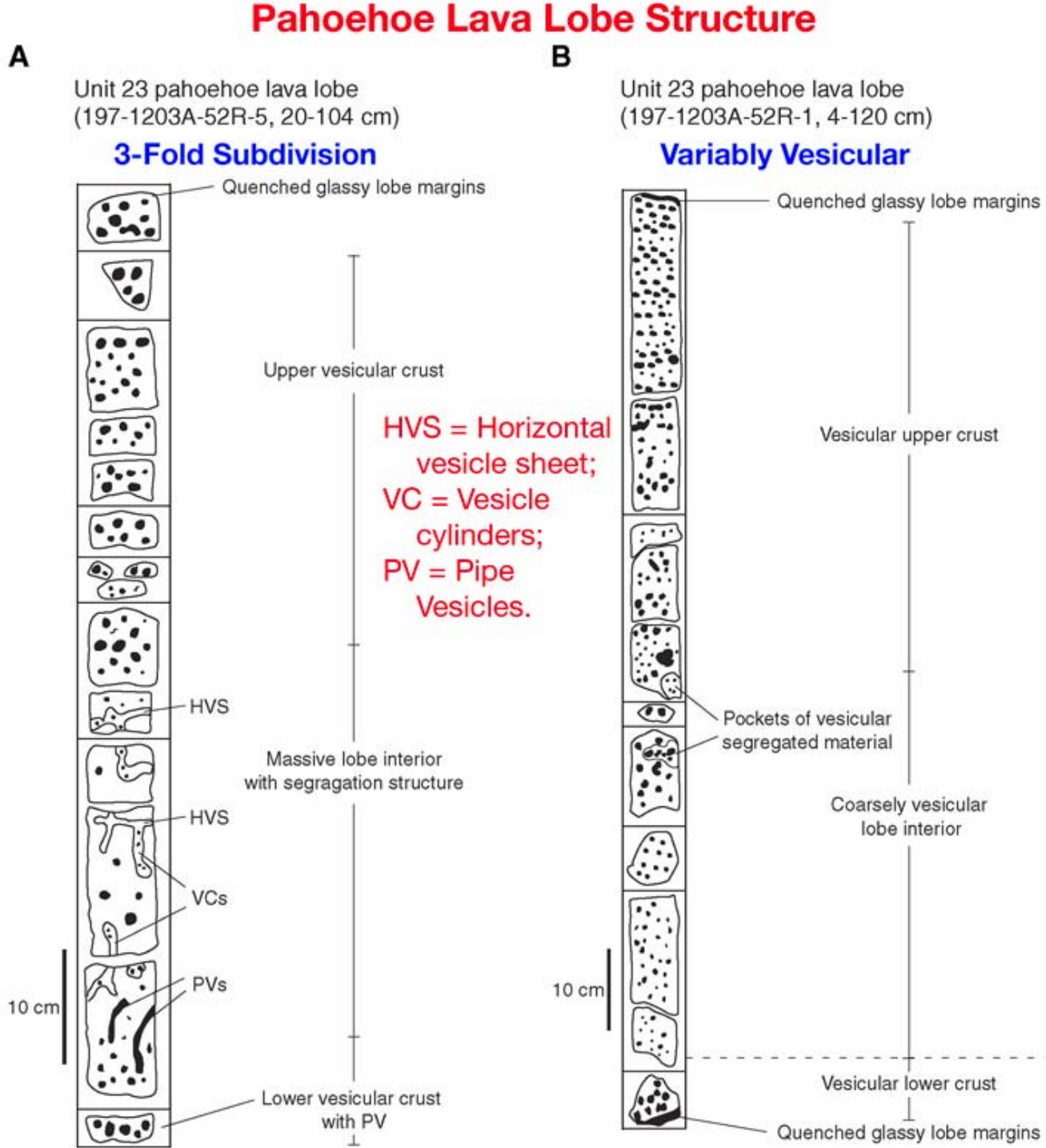
A'a

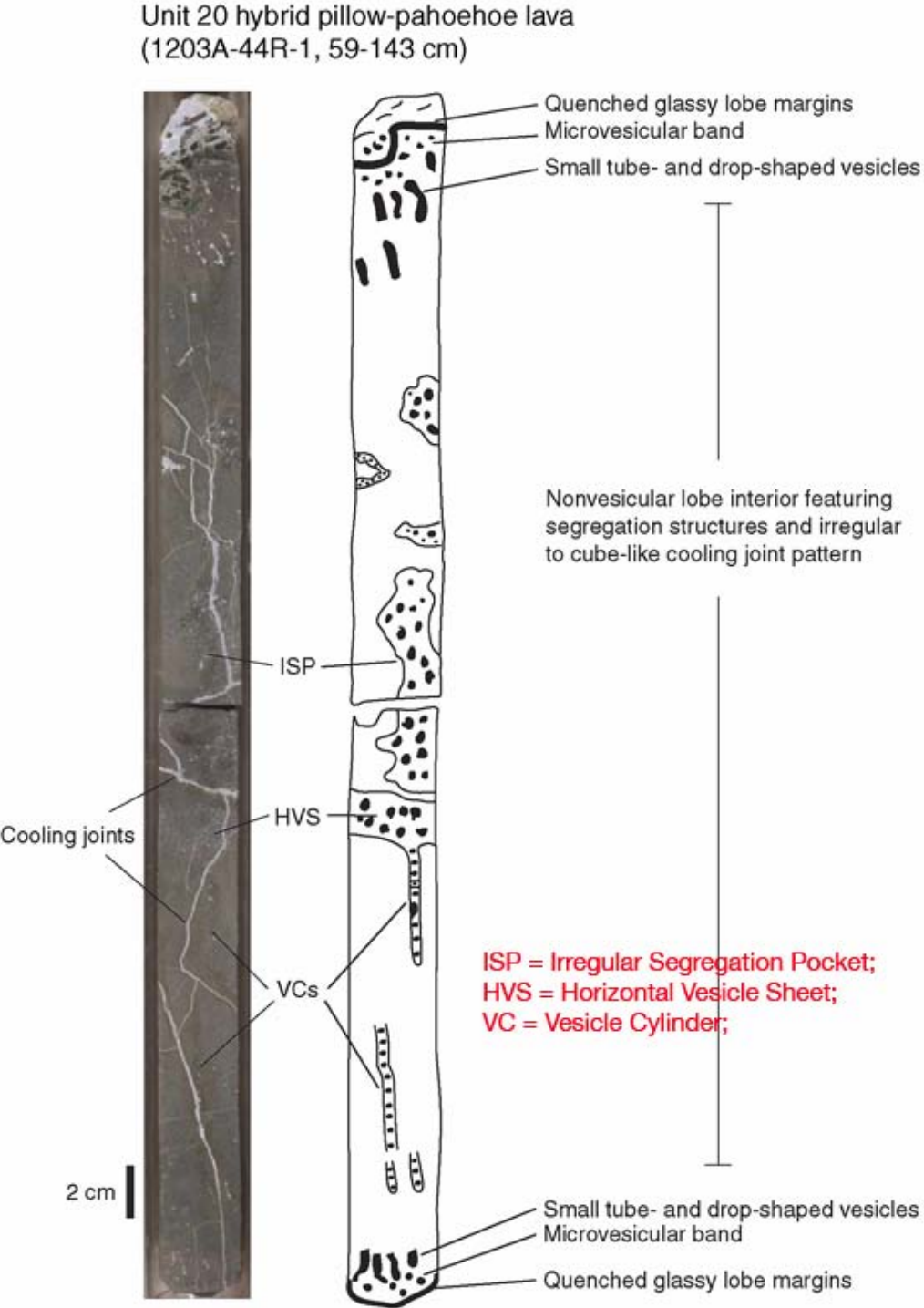
Lava Lobe Structures

Table T4. Lobe structures: terminology, definitions, and abbreviations.

Terminology	Abbreviation	Definition
Contact:		
Distinct	cg	Contact featuring clearly separated glassy pahoehoe surfaces
Annealed, fused	ca	Contact between lobes is marked by a centimeter-thick glassy band formed by fusion of the original lobe surfaces
Discontinuous	cd	Contact between lobes dissipates or disappears when followed in outcrop
Vesiculation structure:		
Vesicles	ve	Molds of gas-filled voids frozen in the lava and are referred to as microscopic (<2 mm diameter) or macroscopic (>2 mm diameter)
Diktytaxitic texture	vd	Microscopic (<2.0 mm), irregular intercrystalline voids and outlined by crystal faces of adjacent groundmass minerals (Fuller, 1931)
Segregation vesicle	sv	Vesicles lined by segregated material
Pipe vesicles and vesicle cylinders	pv vc	Roughly cylindrical pipes of near-vertical orientation that are hollow (pv) or filled with vesicular segregated material (vc)
Horizontal vesicle sheets	hvs	Sheets of vesicular segregated material, centimeters to tens of centimeters thick, that are continuous (>50 m long) and discontinuous (1–10 m long) on an outcrop scale; these sheets were previously identified as segregation veins or vesicle sheets (e.g. Goff, 1996)
Megavesicles	mv	Dome-shaped voids with flat floors and arched to dome-shaped roofs; their dimensions range from several to tens of centimeters; they are floored by moderately vesicular to nonvesicular segregated material and occur in close association with horizontal vesicle sheets
Vesicular zone	hvz	Decimeter- to meters-thick horizons with high concentrations (>10 vol%) of macroscopic vesicles
Petrographic texture:		
Crystallinity	c, hc, hyh, G	Relative abundance of crystals vs. glassy mesostasis is indicated by holocrystalline (c [crystallinity = 90%–100%]), hypocrystalline (hc [50%–90%]), hypohyaline (hyh [10%–50%]), or holohyaline (G [0%–10%])
Granularity		Crystal size of the lava groundmass (See Table T5, p. 81)

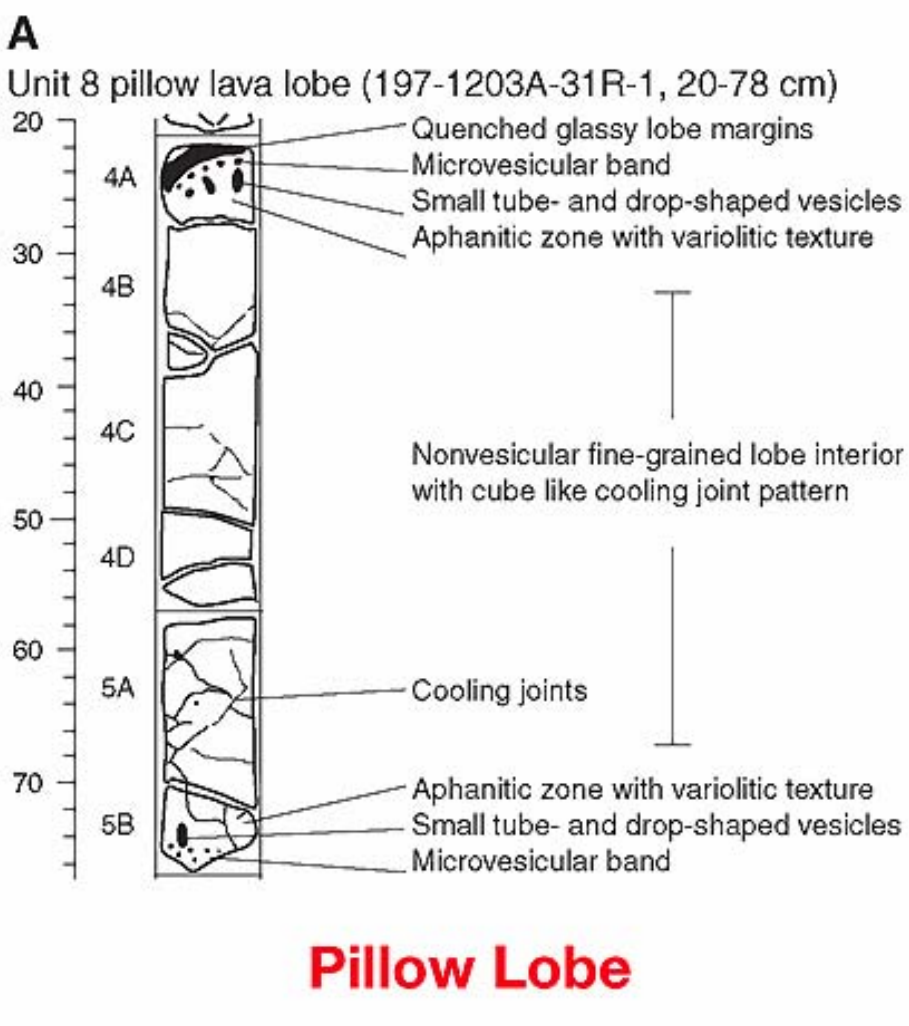
Pahoehoe Lava Lobe Structure

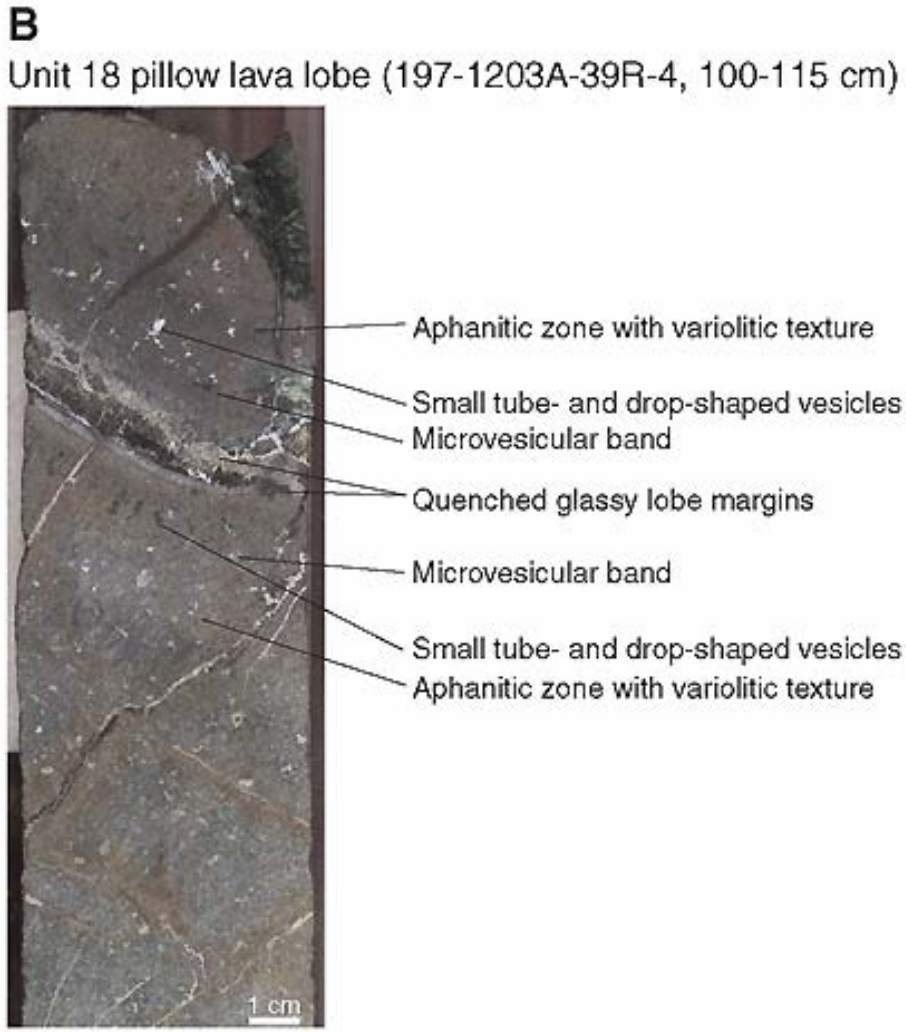




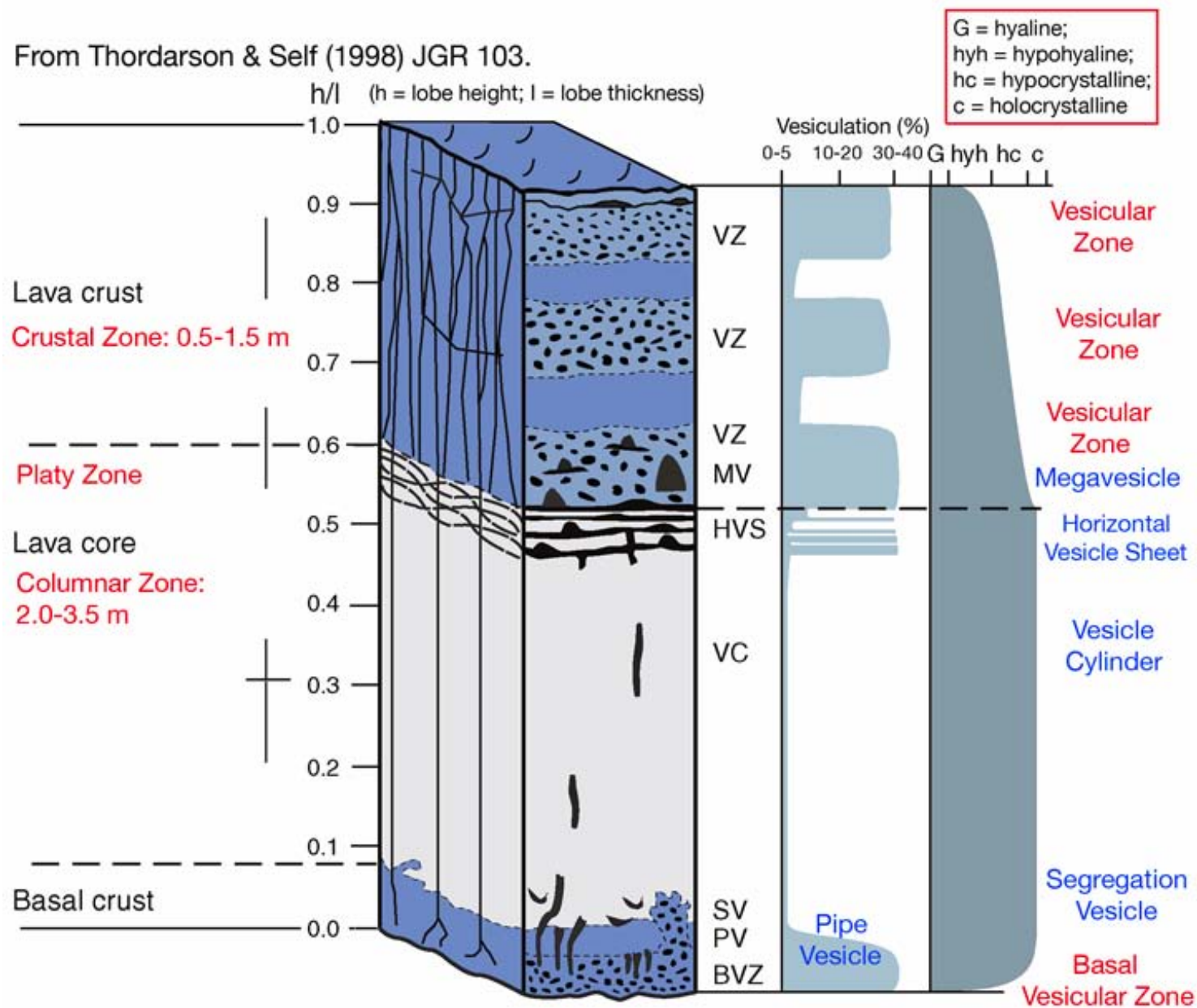
Hybrid Pillow-Pahoehoe Lava

Pillow Lobe Structure





Vesicles


From Thordarson & Self (1998) JGR 103.
h/l (h = lobe height; l = lobe thickness)
G = hyaline;
hyh = hypohyaline;
hc = hypocrystalline;
c = holocrystalline
Vesiculation (%)
0-5 10-20 30-40 G hyh hc c
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Lava crust
Crustal Zone: 0.5-1.5 m
Platy Zone
Lava core
Columnar Zone:
2.0-3.5 m
Basal crust
VZ
VZ
VZ
MV
HVS
VC
SV
PV
BVZ
Pipe
Vesicle
Vesicular Zone
Vesicular Zone
Vesicular Zone
Megavesicle
Horizontal Vesicle Sheet
Vesicle Cylinder
Segregation Vesicle
Basal Vesicular Zone

Vesicles

Vesicles in Hawaiian lava flow

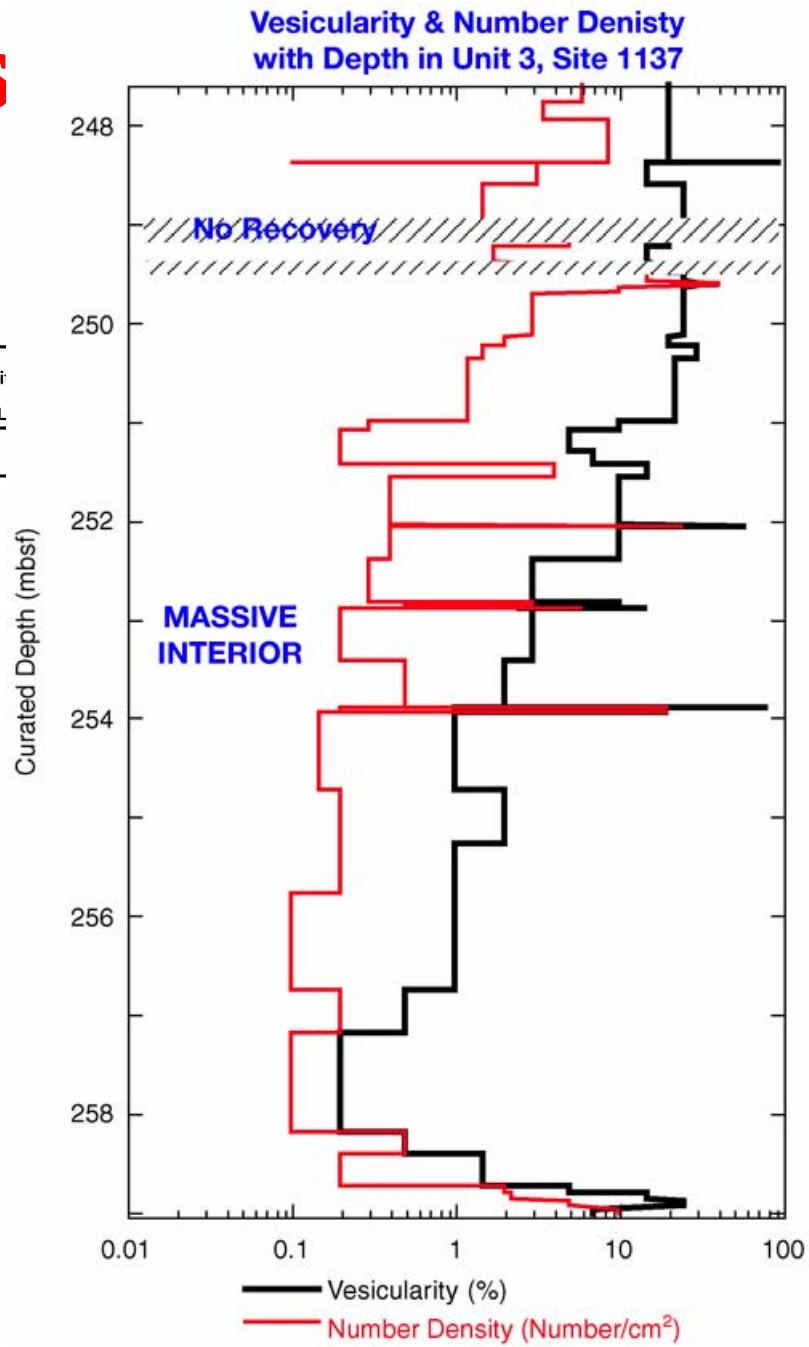
Vesicles

Table T5. Vesicle description sheet.

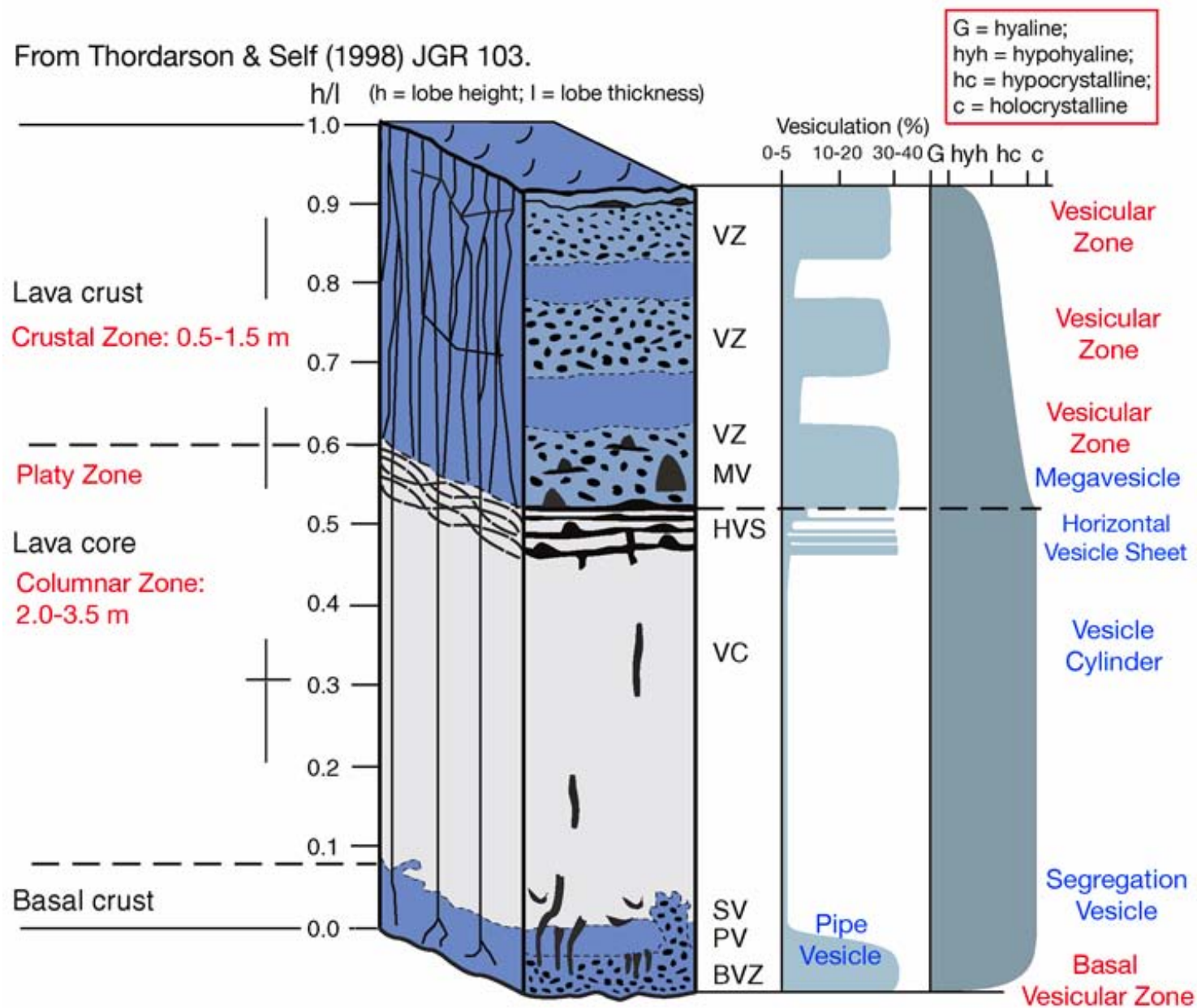
Leg	Sub	Site	Hole	Core	Type	Section
183						

Top (cm)	Bottom (cm)	Vesicularity (%)	Maximum size (mm)	Average size (mm)	Minimum size (mm)	N Density (N/cm2)	Sphericit (H,M,L

- Core section
- Vesicularity
- Max. and Avg. size
- Density
- Sphericity
- Angularity
- Grading
- Vesicle Fill (%)



Vesicles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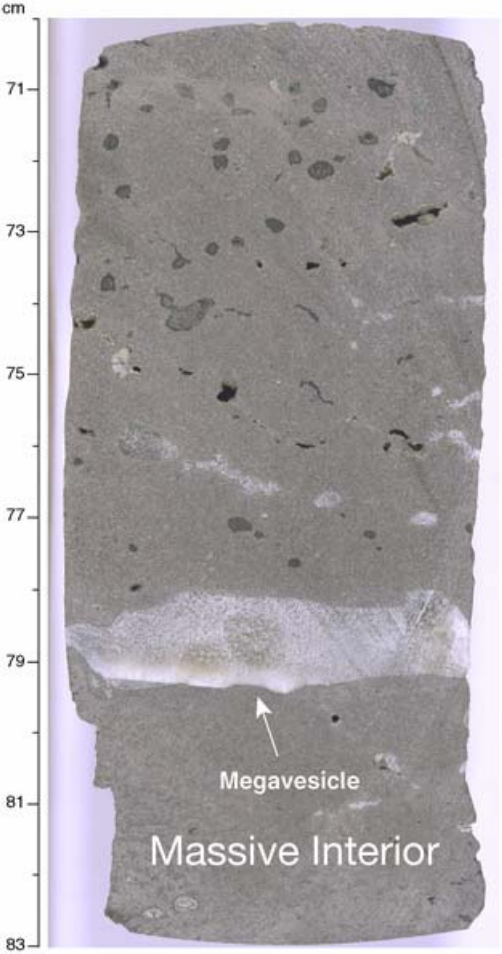
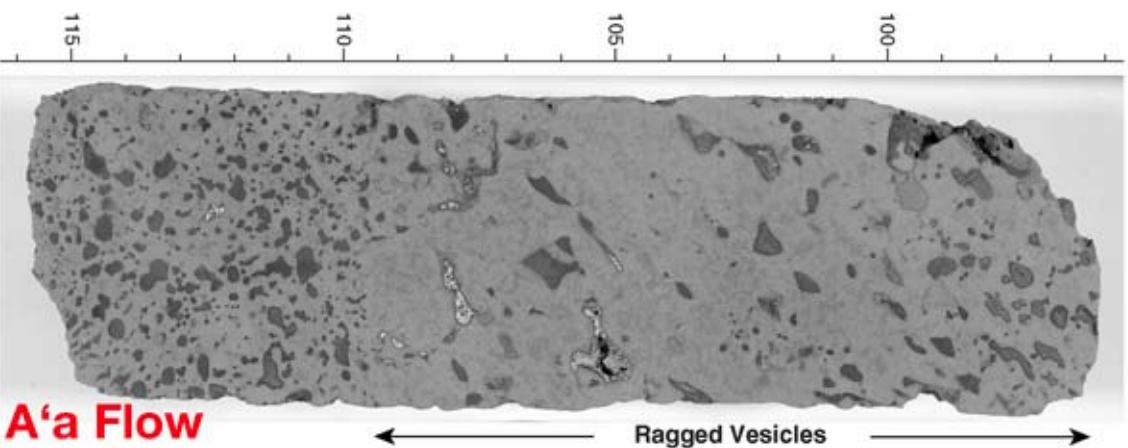
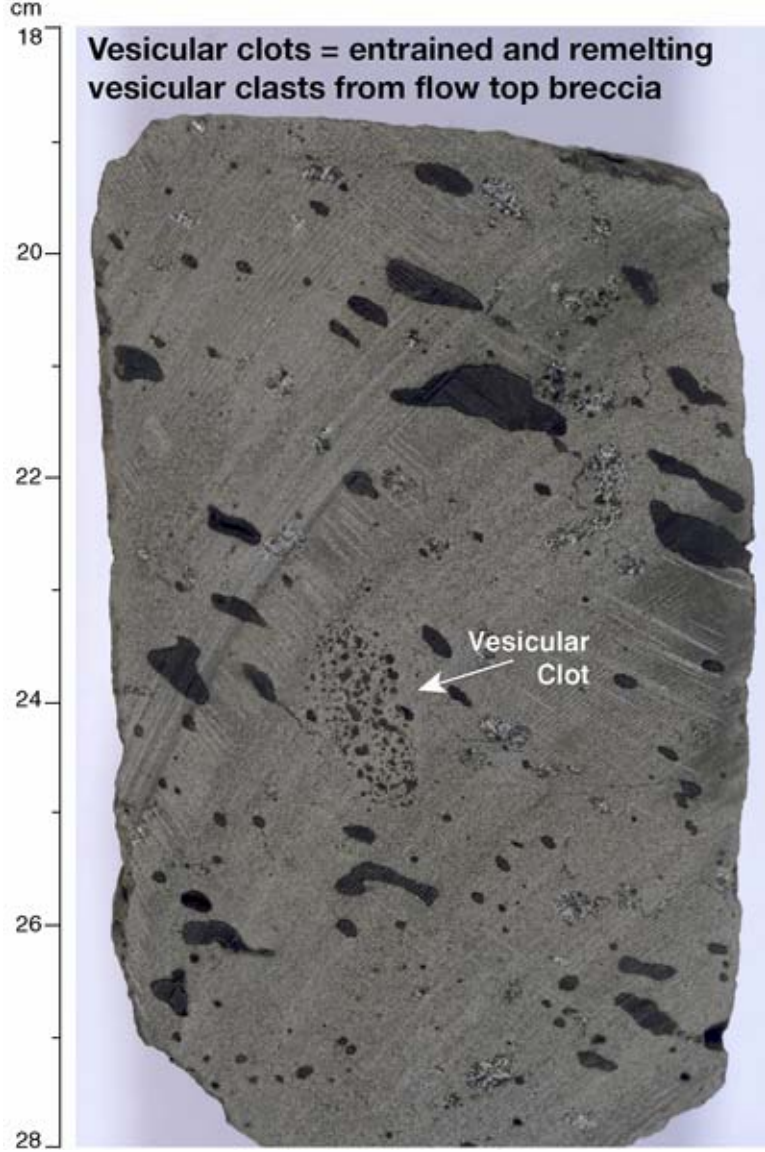
h/l (h = lobe height; l = lobe thickness)
G = hyaline;
hyh = hypohyaline;
hc = hypocrystalline;
c = holocrystalline
Vesiculation (%)
0-5 10-20 30-40 G hyh hc c
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Lava crust
Crustal Zone: 0.5-1.5 m
Platy Zone
Lava core
Columnar Zone:
2.0-3.5 m
Basal crust
VZ
VZ
VZ
MV
HVS
VC
SV
PV
BVZ
Pipe
Vesicle
Vesicular Zone
Vesicular Zone
Vesicular Zone
Megavesicle
Horizontal Vesicle Sheet
Vesicle Cylinder
Segregation Vesicle
Basal Vesicular Zone

Vesicles

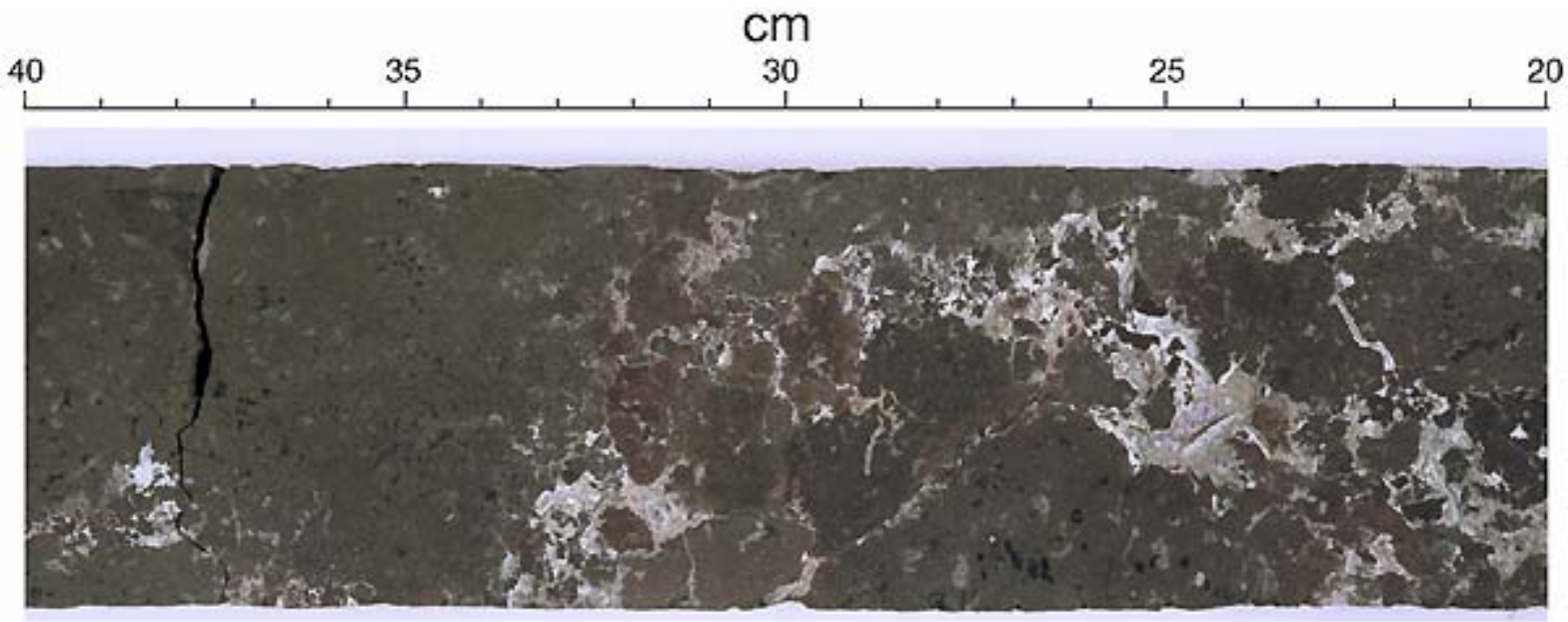

cm
71
73
75
77
79
81
83
Megavesicle
Massive Interior


cm
120
125
130


115
110
105
100
cm
A'a Flow
Ragged Vesicles

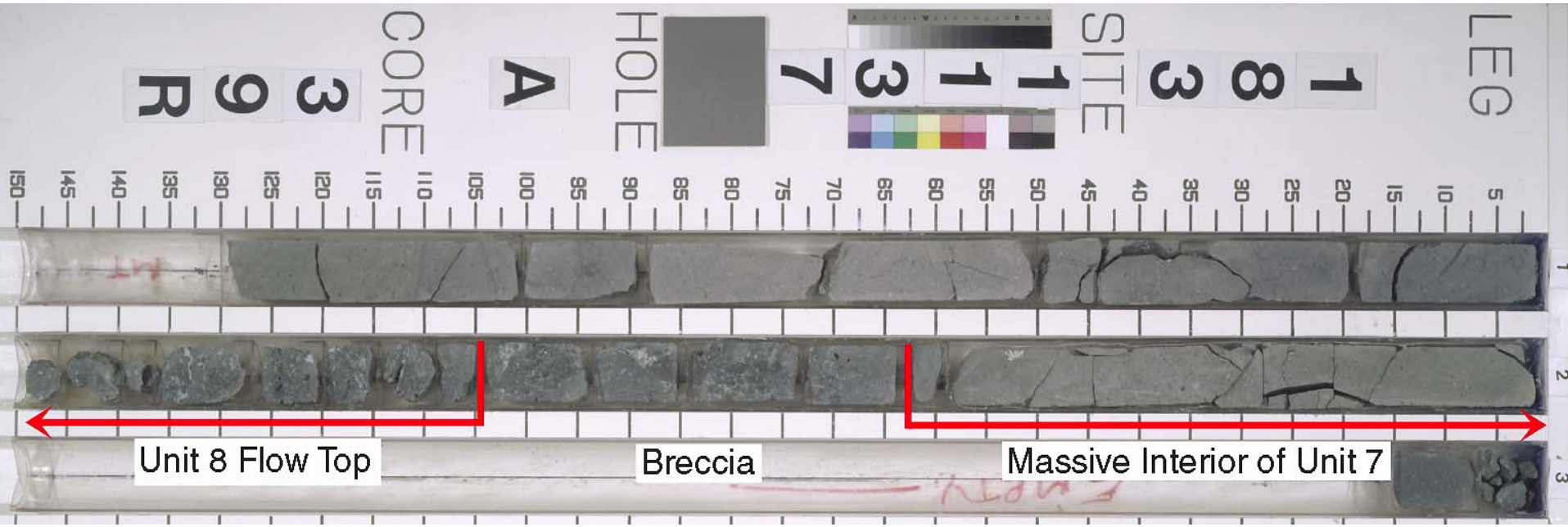

cm
18
20
22
24
26
28
Vesicular clots = entrained and remelting vesicular clasts from flow top breccia
Vesicular Clot

Unit Boundaries



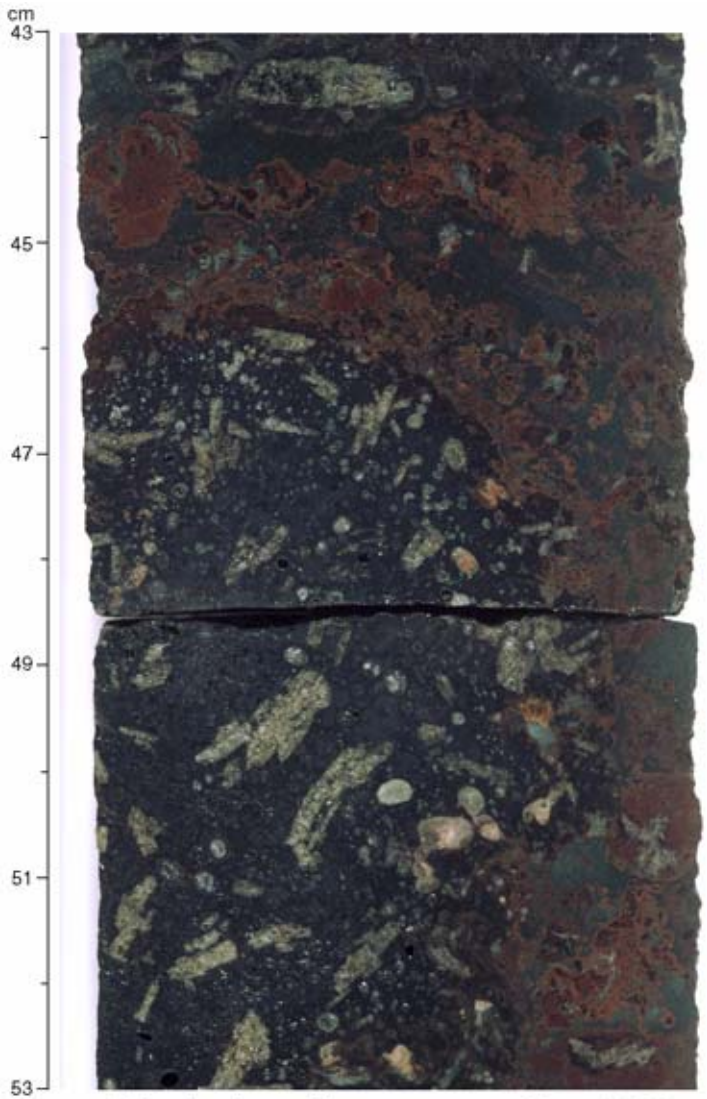
Basal Breccia, Unit 7, Site 1137, Kerguelen Plateau
(ODP Leg 183)

Unit Boundaries



Site 1203, Unit 8-9 Boundary (32R-1, 73-87 cm)

Phenocrysts



Plagioclase Phenocrysts, Site 1137.

Site 1203, Unit 14 (35R-4, 131-149 cm)

Igneous Thin Section Description Sheet

THIN SECTION: **81** 192-1183A-66R-2(4B) 60-66 **Unit:7** **OBSERVER:** MG, CRN. WJC, PRC

ROCK NAME: **Sparsely olivine-phyric basalt**

WHERE SAMPLED: **massive interior**

GRAIN SIZE: **Fine**

TEXTURE: **Subophitic to interstal with subvariolitic patches**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
olivine	0	2	0.05	0.6	0.4		Subhedral to euhedral	Clay pseudomorphs after olivine
Plagioclase	<<1	<<1					Elongated subhedral lath	
GROUNDMASS								
plagioclase	50	50	0.02	0.08	0.03		Acicular to elongated laths	Feathery in subvariolitic areas
clinopyroxene	35	35	0.06	0.2	0.1		Anhedral	
mesostasis	0	10						
OPAQUE MINERALS								
Titanomagnetite	3	3			<0.01		Skeletal to elongated trellis	Interstitial; Unaltered
Sulfides	trace	trace			<<0.01		Bleb	Inclusions in groundmass and in mesostasis

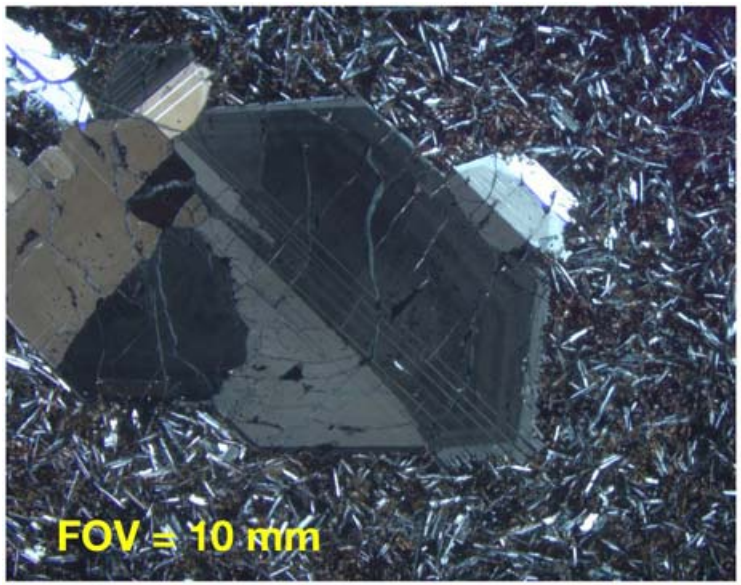
SECONDARY MINERALOGY	PERCENT		SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.		REPLACING / FILLING	COMMENTS
brown/green clay	12						Olivine/Mesostasis	

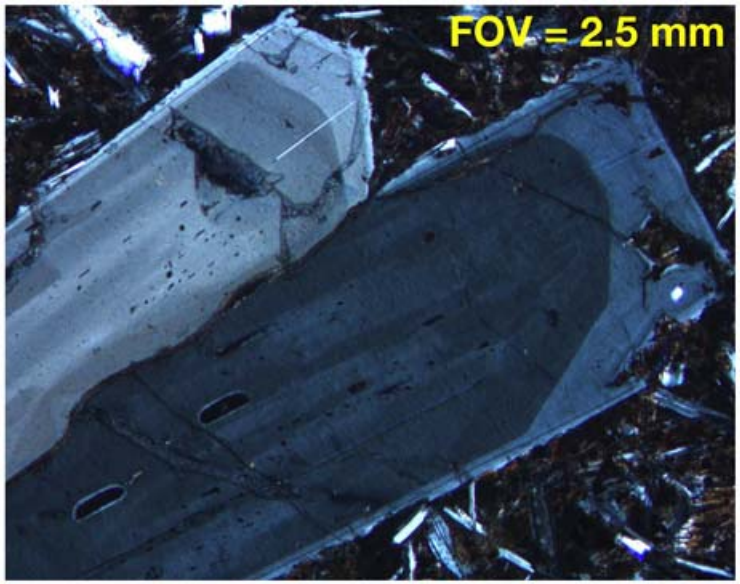
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.		FILLING / MORPHOLOGY	COMMENTS
Miarolitic cavities	5		0.5	1.8	0.5		Equant angular to elongated	Completely filled with green clays

VEINS	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.		FILLING / MORPHOLOGY	COMMENTS
calcite	75						spherulitic	
chalcedony	20						spherulitic	
quartz	5						anhedral equant	

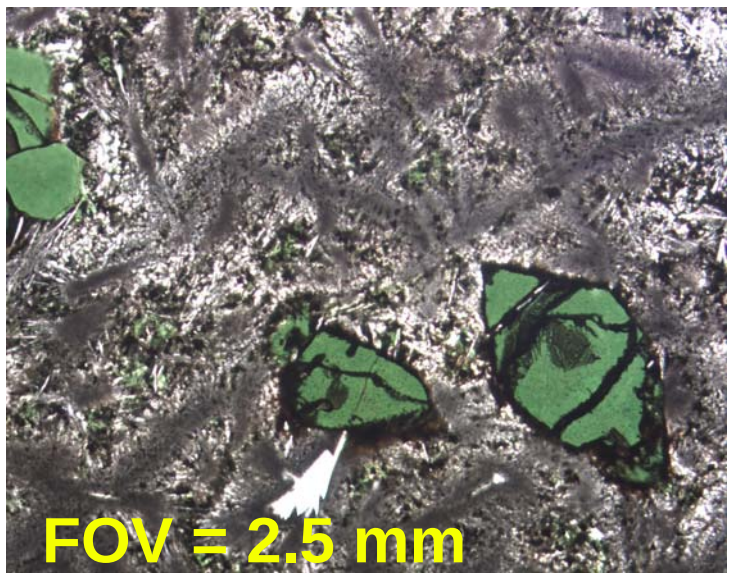
COMMENTS : A vein cross-cuts the thin section. Elongated miarolitic cavities are ~perpendicular to the vein. Only one equant angular cavity is observed, it is close to the vein and filled with a blue mineral in addition to the same green clays that fill the other mi

Phenocrysts





Euhedral, Subhedral, Anhedral



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Alteration (% of total alteration)

Secondary minerals (type & abundance)

Structure (fracture orientation)

Veins: size and fill

Phenocryst type & abundance

Groundmass mineralogy (type & abundance)

Texture (subophitic, variolitic, granoblastic, foliated) Photomicrographs

Foliation (gneissose, schistose)

Vesicles: size, shape, abundance, type

Volcaniclastic deposits: scoria, ash, tuff, lapilli

Unit boundaries

Geochemistry

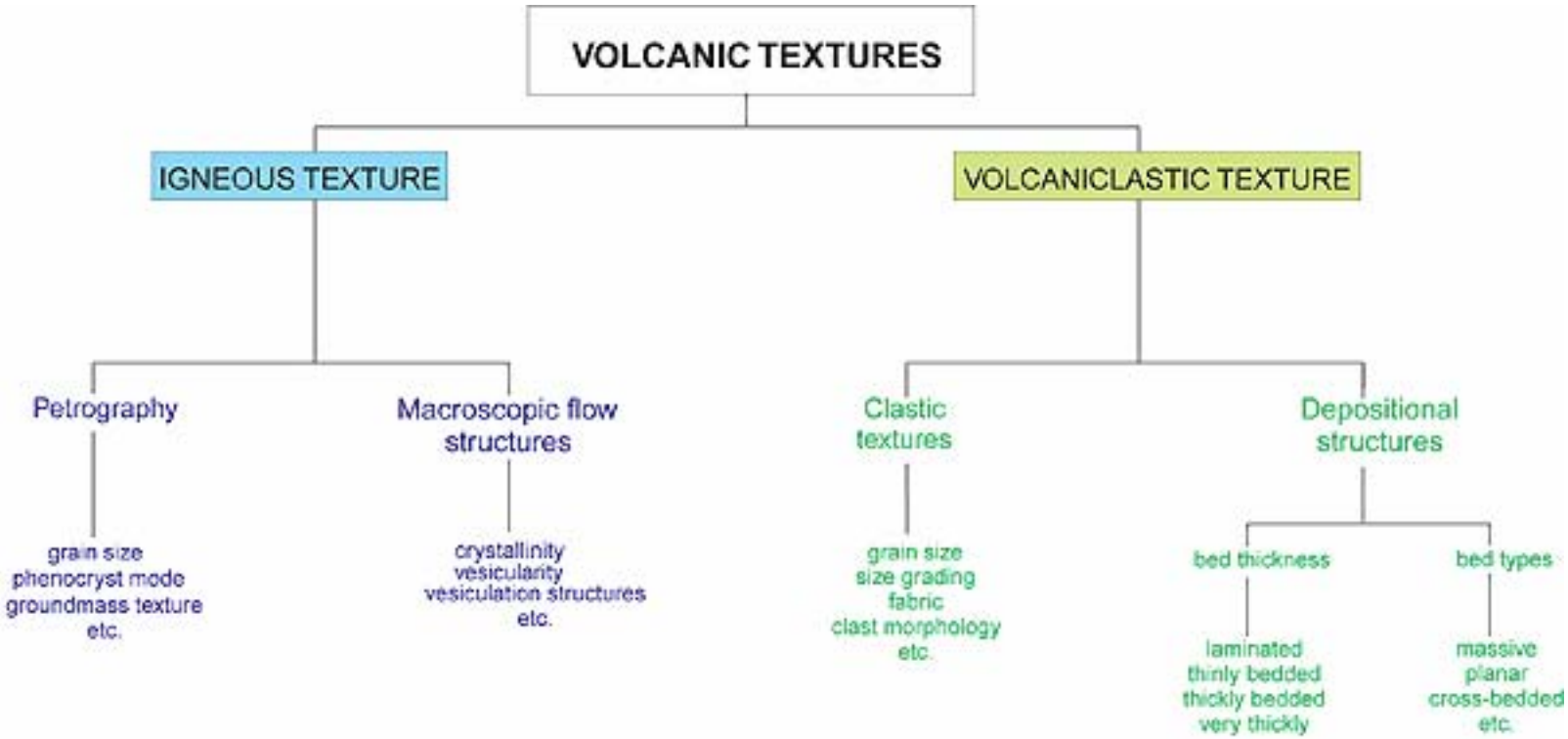

Figure 197-EXP-D-1. Nongeneric classifaction of volcanic deposits. Modified after McPhie et al. (1993).