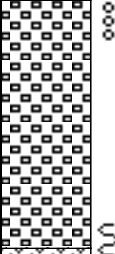


Core Photo

187-1163A-1 W (0.0 - 161.0 mbsf)					
METERS	CORE AND SECTION	GRAPHIC LITH.	DISTURB.	COLOR	DESCRIPTION
1 2	1 2 3			lt gn GY vlt BR lt BR	<p>CLAY</p> <p>The entire core is variably colored clay. The clay contains abundant carbonate as evidenced by its reaction with dilute HCl. From 0 to 10 cm in Section 187-1163A-1W-1 is a soupy, very light brown ooze. From 10 to 99 cm is a light greenish gray, moderately stiff carbonate-rich clay. The upper contact of this interval is severely drilling disturbed and smeared over 15 cm, but the lower contact is sharp and irregular. From 99 to 105 cm is a pale cream calcareous clay, and from 105 to 133 cm is a very light brown calcareous clay with rare 1 to 3 cm thick layers and lenses of light brown clay. The contacts of the layers and lenses are sharp and irregular, and all layers effervesce in HCl. From 133 to 136 cm is a thin interval of medium brown clay, underlain by an interval of layered, very light brown to medium brown calcareous clay. This interval extends through Section 187-1163A-1W-2 to the top 4 cm of the core catcher. The layers range from 1 mm to 3 cm thick, and have predominantly sharp but irregular contacts. A few layer contacts are diffuse, but this may be an artifact of the coring or splitting process.</p> <p>From 4 to 13 cm in Section 187-1163A-1W-CC is a medium brown, drilling disturbed calcareous clay. A single fragment of basalt with fresh glass was embedded in a thin (4 cm) interval of severely drilling disturbed light brown clay at the base of the core catcher.</p>

Core Photo

cm	Piece number	Graphic representation	Orientation	Shipboard studies	Lithologic unit	Alteration	Structure
0		sediment					
1	1	all for ICP		ICP			
50							
100							
150							

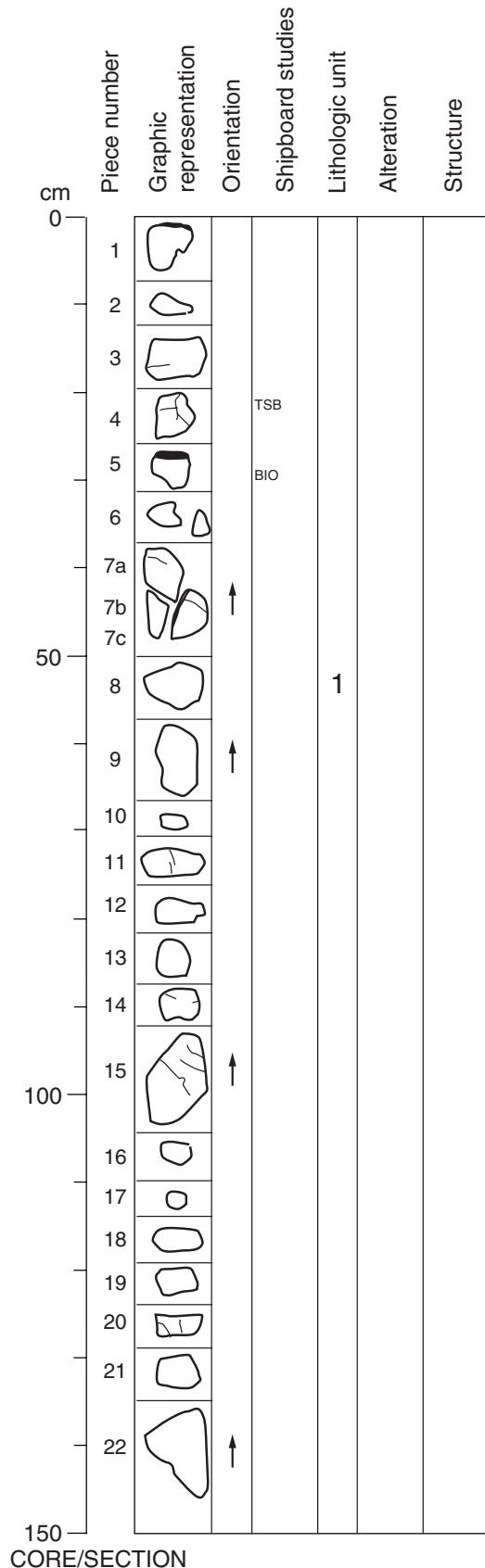
187-1163A-1W-CC

Piece: 1

One piece of rock recovered at the bottom of this section. It was used for ICP analysis.

CORE/SECTION

Core Photo



187-1163A-2R-1

UNIT 1: MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-22

INTERNAL CONTACTS: Pieces 1 and 5 recovered chilled margins. Piece 1 consists of a thin layer of palagonite on ~7 mm of clear glass + phenocrysts. There is no clear glass on Piece 5, but the zone of coalesced spherulites is ~1.5 cm wide with a thin (~2 mm) discontinuous layer of glass + spherulites in the middle, toward one side of the piece.

PHENOCRYSTS:

	Abundance %	Size (mm)			Shape
		avg.	max.	min.	
Plagioclase	2	2	4	0.5	prismatic
Olivine	1-2	1	4	0.5	equant
Total	3-4				

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES: No vesicles were observed, but Piece 22 contains miarolitic cavities (up to 1.5 mm across) lined with blue cryptocrystalline silica/clay.

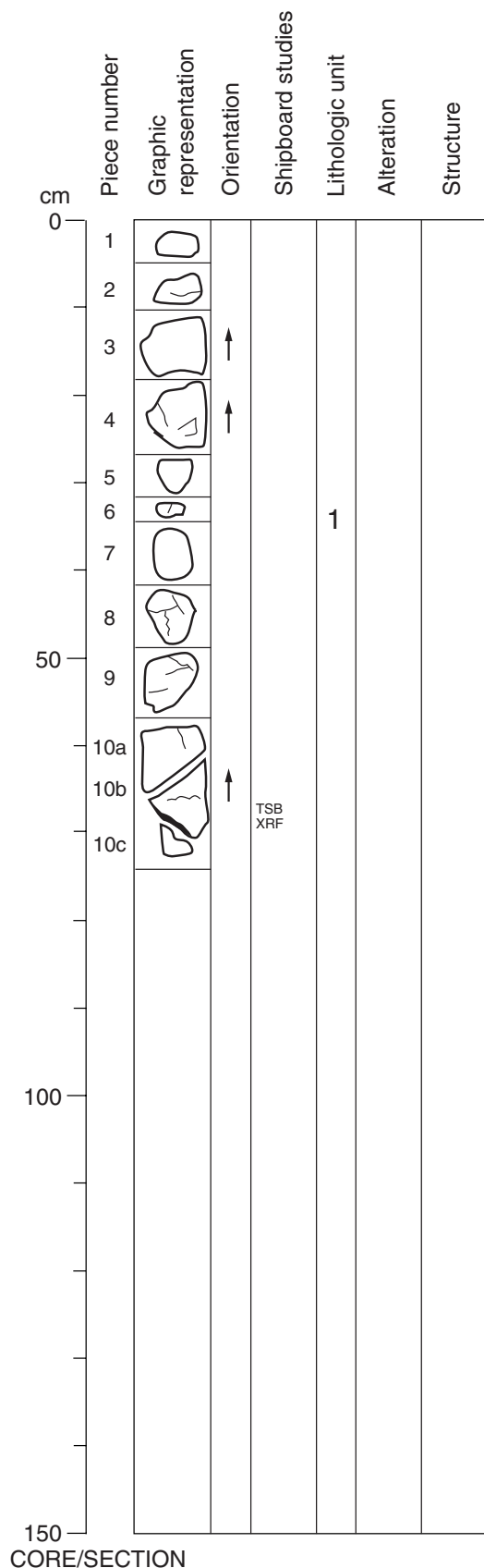
VEINS/FRACTURES: Piece 7 has a thin (~1 mm) composite vein with sparry calcite lining the edges and the center filled with a cream colored micritic calcite. Similar materials, joined by Mn oxide, occur on open fracture/vein surfaces that now form outside edges of pieces on Pieces 6, 7, 8, 14, 15, 16, 20, and 22. Pieces 1, 2, and 5 have a pinkish clay on outer surfaces. Pieces 1, 6, 7, 8, and 11 have a pistachio to dull green clay coating outside surfaces in addition to calcite + Mn oxide. Fractures lined with Fe oxyhydroxides ± clay occur in Pieces 3, 4, 7, 11, 15, and 20. Pieces 18 and 20 have Mn oxide-lined fractures.

ALTERATION: Overall the section is slightly to moderately altered. Alteration varies from patchy replacement of groundmass by dark green smectite to alteration halos that parallel fractures, veins and the edges of pieces. Degree of alteration increases slightly down section as the amount of patchy groundmass replacement by dark green smectite increases. Piece 22 has patches of calcite in the groundmass as well as smectite. Pieces 3, 4, 7, 12, 19, and 21 have alteration halos ranging from 5 to 20 mm wide; in general, the alteration halos are marked by an increase in the amount of groundmass smectite. Piece 18 has an oxidative alteration halo (Fe oxyhydroxides + clay) on one side. Patches of cream to pinkish-white sediment + Mn oxide spots occur on Pieces 1, 3 and 4. In altered areas, olivine is 50%-100% altered to yellowish-white to greenish-white clay, less commonly to Fe oxyhydroxides + clay. Less than 20% of the olivine in the section is fresh (e.g., interior of Piece 4). Plagioclase is unaltered throughout.

STRUCTURE: Pillow sequence

ADDITIONAL COMMENTS: Olivine is euhedral to subhedral; plagioclase is subhedral throughout. ~15% of phenocrysts occur as glomerocrysts. These tend to be made up of small (~1 mm) crystals of prismatic plagioclase and equant olivine. One glomerocryst in Piece 4 includes spinel as well as plagioclase + olivine. Pieces 9 and 15 have ~2% olivine; the rest of the pieces have ~1% olivine.

Core Photo



187-1163A-2R-2

UNIT 1: MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-10

INTERNAL CONTACTS: Pieces 8 and 9 recovered chilled margins. Piece 8 consists of a thin layer of palagonite on one corner, followed by ~4 mm of clear glass + phenocrysts and ~5 mm of small (<0.2 mm) coalesced spherulites; glass near the top of the zone of coalesced spherulites is partially palagonitized. There is no clear glass on Piece 9, only a zone of coalesced spherulites ~4 mm wide.

PHENOCRYSTS:

	Abundance %	Size (mm)		Shape
		avg.	max. min.	
Plagioclase	2	2	5 0.5	prismatic to tabular
Olivine	1	1	2 0.5	equant
Total	3			

GROUNDMASS: Microcrystalline

COLOR: Light gray

VESICLES: Vesicles (<<1%) were observed only in Piece 3, where they are small (<0.3 mm) and lined with a blue cryptocrystalline silica/clay. Pieces 1, 2, and 5 contain miarolitic cavities (up to 1 mm across) lined with blue cryptocrystalline silica/clay.

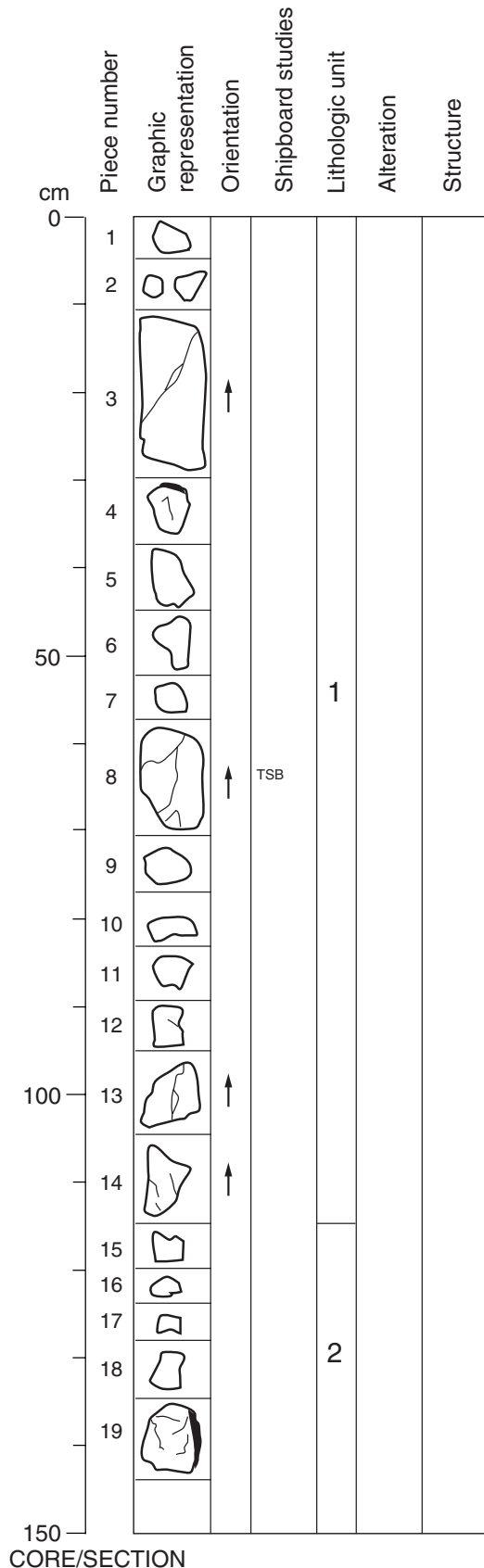
VEINS/FRACTURES: Piece 10 has broken along a thin (~1 mm) calcite + Mn oxide vein. Piece 9 has a thin (<1 mm) cream-colored clay vein that appears to be connected to patches of a similar material that occurs on an outer surface. Similar patches of cream-colored clay occur on outer surfaces of Pieces 3, 5, 6, 7, and 8. Fractures lined with Mn oxide occur in Pieces 2, 3, 4, 6, and 10.

ALTERATION: Overall the section is slightly (Pieces 1 to 9) to moderately (Piece 10) altered. Alteration is largely restricted to alteration halos that parallel fractures, veins and the edges of pieces (e.g., Pieces 3 to 9). The rock is ~15%-30% altered in these areas and the alteration halos make up 10%-15% of the rock. Fresh olivine occurs throughout the section (i.e., ~80%-90% of olivines are unaltered). Plagioclase is unaltered throughout. Piece 10 has wide gray alteration halos (2-4 cm) as well as pervasive groundmass replacement by calcite.

STRUCTURE: Pillow lavas

ADDITIONAL COMMENTS: Olivine is euhedral to subhedral; Plagioclase is subhedral throughout. ~15% of phenocrysts occur as glomerocrysts. These tend to be made up of small (~1 mm) crystals of prismatic plagioclase and equant olivine. In Piece 3 olivine phenocrysts occur predominantly in clusters of 3 to 4 crystals (1 mm in size). Several olivines in Piece 3 contain spinel inclusions; one olivine in Piece 9 contains melt inclusions. Plagioclase is seriate in Pieces 7 to 10.

Core Photo



187-1163A-3R-1

UNIT 1: SPARSELY TO MODERATELY PLAGIOCLASE OLIVINE PHYRIC BASALT

PIECES 1-14

UNIT CONTACT: Depth in section: 115 cm

Description: Change in lithology from plagioclase-olivine phyric to aphyric
INTERNAL CONTACTS: Chilled margins were recovered on Pieces 3, 4, 9, and 10 and one of the pebbles of Piece 2 in the working half. Clear glass was only recovered on Piece 3, where the chilled margin consists of a thin layer of palagonite, followed by 7 mm of glass + phenocrysts, 3 mm of discrete spherulites + glass and 5 mm of coalesced spherulites. Piece 4 consists of 2 mm of glass + spherulites + phenocrysts and >5 mm of coalesced spherulites; Pieces 9 and 10 include only the zone of coalesced spherulites. The spherulites in all pieces are small (<~0.2 mm).

PHENOCRYSTS:

	Abundance %	avg.	max.	min.	Shape
Plagioclase	1-2	1	4	0.5	prismatic to tabular
Olivine	1-2	1	3	0.5	equant
Total		3			

GROUNDMASS: Microcrystalline

COLOR: Light gray

VESICLES: Spherical vesicles (<<1%) were observed in Pieces 2 and 5, where they are small (<0.3 mm) and unfilled. Pieces 6, 12, and 13 contain miarolitic cavities (<1 mm across) lined with blue cryptocrystalline silica/clay.

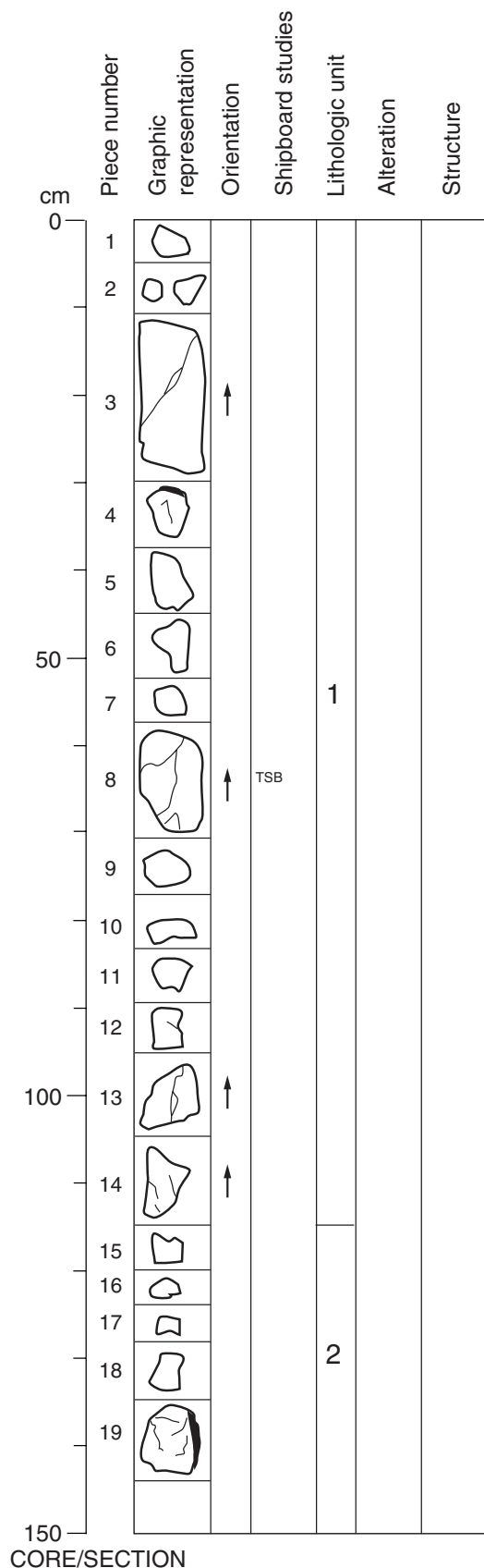
VEINS/FRACTURES: Pieces 3 and 8 are crosscut by composite calcite ± clay veins. In Piece 3 the vein is ~3 mm wide with pinkish brown micritic to very finely crystalline sparry calcite forming the middle of the vein and white sparry calcite along the sides; Mn oxide occurs as spots and layers that partially line the walls of the vein. A fragment of a similar composite vein occurs on the outside of Piece 14. The vein in Piece 8 is also composite, but here consists of thin, cream-colored clay (± calcite?) which is disrupted by anastomosing sparry calcite. Fractures lined with Mn oxide occur in Pieces 4, 12, and 14. Piece 1 has a patch of orange-brown calcareous sediment on one side; one of the pebbles in Piece 2 has a patch of pinkish-brown micritic calcite, and Pieces 4, 5, 6, 10, and 14 have patches of cream to pinkish colored clay + Mn oxide spots on outer surfaces. Piece 1 has patches of a dull green clay + Mn oxide on outer surfaces.

ALTERATION: Overall the section is slightly (Pieces 1 through 3, and 9 through 14) to moderately (Pieces 4 through 8) altered. Alteration is largely restricted to oxidation halos that parallel fractures, veins and the edges of pieces (e.g., Pieces 1 through 5, 7 through 9, and 11 through 14). The rock is ~30%-40% altered in these areas and the alteration halos make up 10%-15% of the rock. Piece 1 has concentric alteration halos that range from brown (oxidative) on the outermost surface to darker gray inward from that, with the interior of the piece being fresh and a slightly lighter gray color. Fresh olivine occurs throughout the section (i. e., ~80% of olivines are unaltered). Plagioclase is unaltered throughout.

STRUCTURE: Pillow lavas

ADDITIONAL COMMENTS: Olivine is euhedral to subhedral; plagioclase is subhedral throughout. ~25% of phenocrysts occur as glomerocrysts. These tend to be made up of small (~1 mm) crystals of prismatic plagioclase and equant olivine. Olivines in Pieces 3, 9, and 12 contain spinel(?) inclusions; some of the inclusions may be melt inclusions, but it isn't always possible to tell because of their small size. Plagioclase is seriate throughout. Anhedral tabular plagioclase phenocrysts 2-3 mm across have sieve-textured cores (Pieces 11 and 13). Piece 3 is the most highly phyric (2% plagioclase, 2% olivine); other pieces are borderline sparsely to moderately phyric, with olivine always ~1% and plagioclase ranging from 1% to 2%.

Core Photo



187-1163A-3R-1 (cont'd)

UNIT 2: APHYRIC BASALT

PIECES 15-19

INTERNAL CONTACTS: Chilled margins were recovered on Pieces 16, 17, and 19. Clear glass was recovered only on Piece 19, which consists of a thin layer of palagonite, 4 mm of glass + phenocrysts, 4 mm of glass + spherulites + phenocrysts and 3 mm of coalesced spherulites. Pieces 16 and 17 recovered only palagonite on glass + spherulites. The spherulites in all pieces are small (<~0.2 mm).

GROUNDMASS: Microcrystalline

COLOR: Dark to medium gray

VESICLES: Small (<0.3 mm) spherical vesicles (~1%) are present in all pieces; they are filled with smectite in Piece 18, but elsewhere are unfilled. Some of the cavities may be miarolitic cavities (<1 mm across) lined with blue cryptocrystalline silica/clay (e.g., Piece 18).

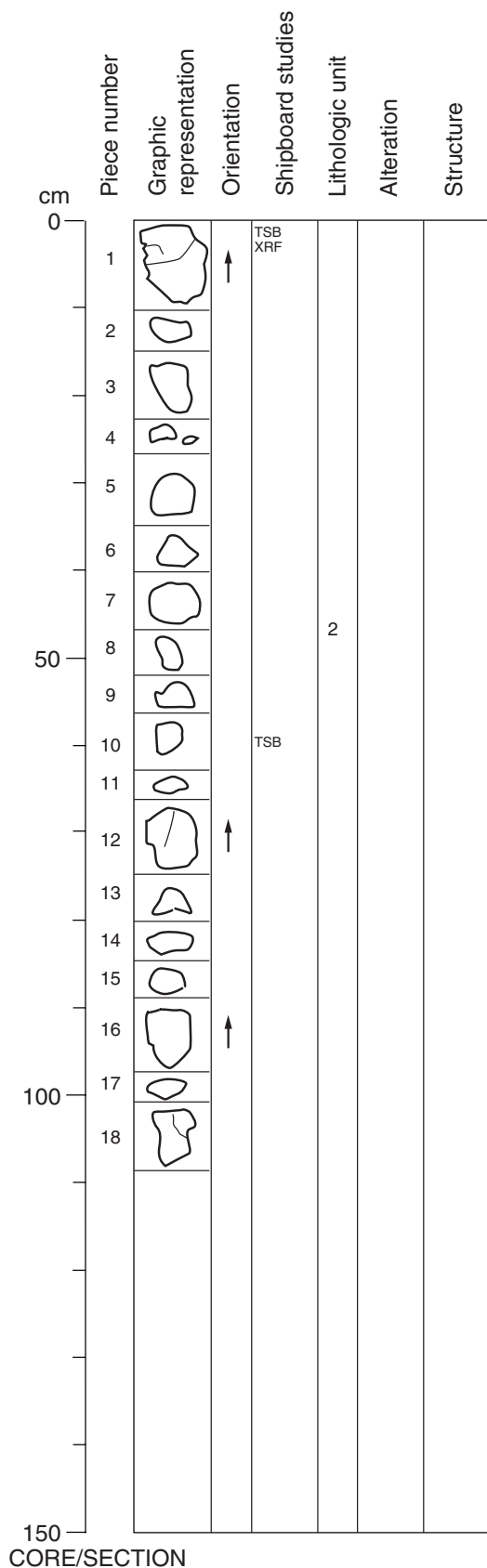
VEINS/FRACTURES: Radial fractures crosscut the chilled margin of Piece 19.

ALTERATION: Overall the section is slightly (Pieces 15 through 17, and 19) to moderately (Piece 18) altered. In Pieces 15, 17, and 19, alteration is largely restricted to oxidation halos that parallel fractures or edges of pieces; alteration halos around the radial fractures are ~5 mm wide. The rock is ~30%-40% altered in these areas and the alteration halos make up ~5% of the rock. Groundmass of Piece 18 is pervasively altered to smectite + Fe oxyhydroxides. Fresh groundmass olivine is present throughout the section (i.e., ~90% of olivines are unaltered), except in Piece 18 where it is ~50% replaced by Fe oxyhydroxides. Plagioclase is unaltered throughout. A portion of the palagonite on Piece 19 has been replaced by a white clay.

STRUCTURE: Pillow lavas, based on the radial fractures and curved shape of Piece 19.

ADDITIONAL COMMENTS: Small (<0.5 mm) microphenocrysts/large groundmass crystals of olivine and plagioclase are present throughout (<1% of the mode). The olivine is equant; plagioclase ranges from acicular to prismatic.

Core Photo



187-1163A-3R-2

UNIT 2: APHYRIC BASALT

PIECES 1-18

INTERNAL CONTACTS: A chilled margin was recovered only on Piece 1. It consists of a thin layer of palagonitized glass + small (<0.2 mm) spherulites.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

%	Abundance		Size (mm)		Shape
	avg.	max.	min.		
1-2	0.5	1	<0.5	variable	

Vesicles: The vesicles range from spherical to irregular in shape; some of them may be miarolitic cavities.

Filling: Vesicles are unfilled (or lined with thin layers of blue-gray clay and/or Fe oxyhydroxides) in Pieces 1, 2, 5, 6, 8, 10 through 18, and parts of Pieces 3 and 7. They are filled with calcite in Pieces 4, 8, 9, 15, and parts of Pieces 3, 7, and 17.

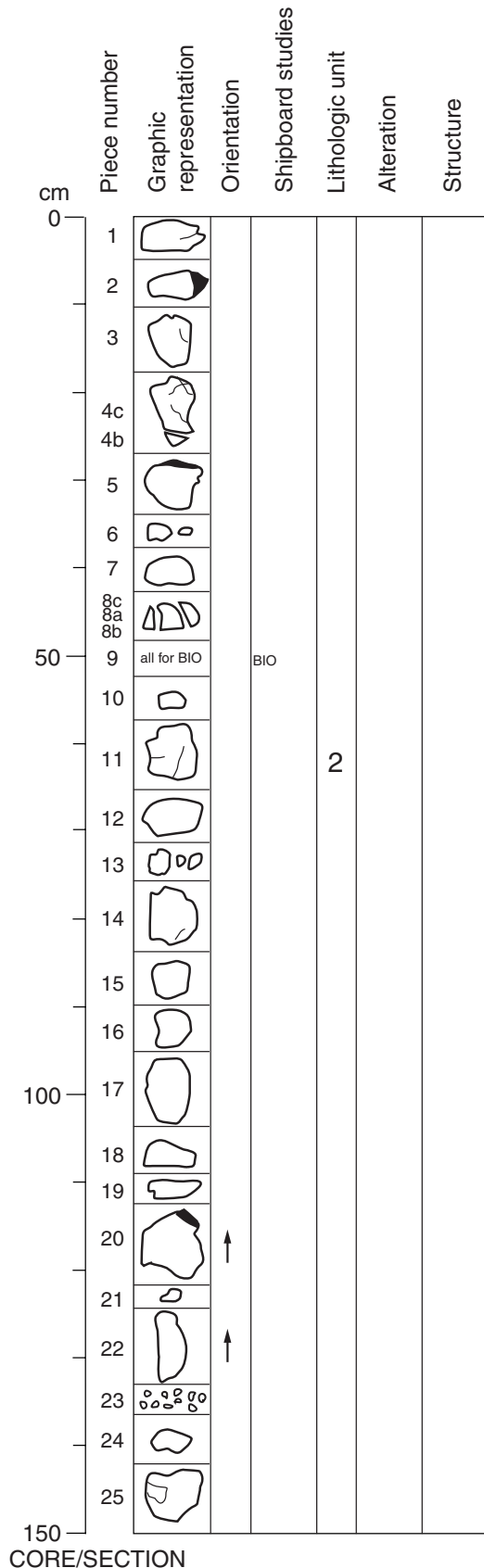
VEINS/FRACTURES: Fractures, probably lined with Fe oxyhydroxides (\pm Mn oxide) in Pieces 1, 9, 12, and 18. Piece 1 has a very thin (<~0.2 mm wide) white clay/silica vein crosscutting the chilled margin.

ALTERATION: Overall the section is slightly (Pieces 1 to 7, 11, 12, and 14 through 18) to moderately (Pieces 8 through 10, and 13) altered. In the slightly altered pieces, alteration is largely restricted to narrow (~3 mm wide) oxidation halos that parallel fractures or edges of pieces. The rock is ~30%-40% altered in these areas and the alteration halos make up ~5% of the rock. Alteration is more pervasive in the moderately altered pieces and involves some replacement of groundmass phases by Fe oxyhydroxides + clay \pm calcite. Fresh groundmass olivine is present in slightly altered pieces (<1% of mode), i.e., ~90% of olivines are unaltered. Olivine is 50%-100% replaced by Fe oxyhydroxides + clay in alteration halos. Plagioclase is unaltered throughout. Pieces 9, 12, 16, and 18 have thin patches of micritic calcite (+clay?) + Mn oxide on outside surfaces of pieces. Piece 11 has clay + Mn oxide and Piece 15 has a fragment of sparry calcite on outside surfaces

STRUCTURE: Pillow lavas

ADDITIONAL COMMENTS: Small (<0.5 mm) microphenocrysts/large groundmass crystals of olivine and plagioclase are present throughout (<1% of the mode). The olivine is equant; plagioclase ranges from acicular to prismatic.

Core Photo



187-1163A-4R-1

UNIT 2: APHYRIC BASALT

PIECES 1-25

INTERNAL CONTACTS: Chilled margins were recovered on Pieces 2, 4, 5, 11, and 20 and one of the pebbles in Piece 13. Clear glass was only recovered on a small portion of Piece 20 (~2-3 mm). For most of Piece 20 and all of the others, the chilled margin consists of ~2-3 mm of glass + discrete spherulites + phenocrysts, followed by 2-3 mm of coalesced spherulites; all have thin layers of palagonite on top and the glass in the zone of discrete spherulites. Piece 4 is replaced by palagonite. Spherulites are small (<0.2 mm) in all samples.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)		Shape
	avg.	max. min.	
1	0.5	1	<0.5 variable

Vesicles: The vesicles range from spherical to irregular in shape.

Filling: Vesicles are unfilled (or lined with thin layers of blue-gray clay and/or Fe oxyhydroxides) in Pieces 2 to 8, 10 to 12, 14, 15, and 19; they are filled with clay in Piece 18. In pieces 12, 14, 16, 17, 22, and 25 some vesicles (~5%-50%) are totally filled with calcite (other vesicles in these samples are unfilled).

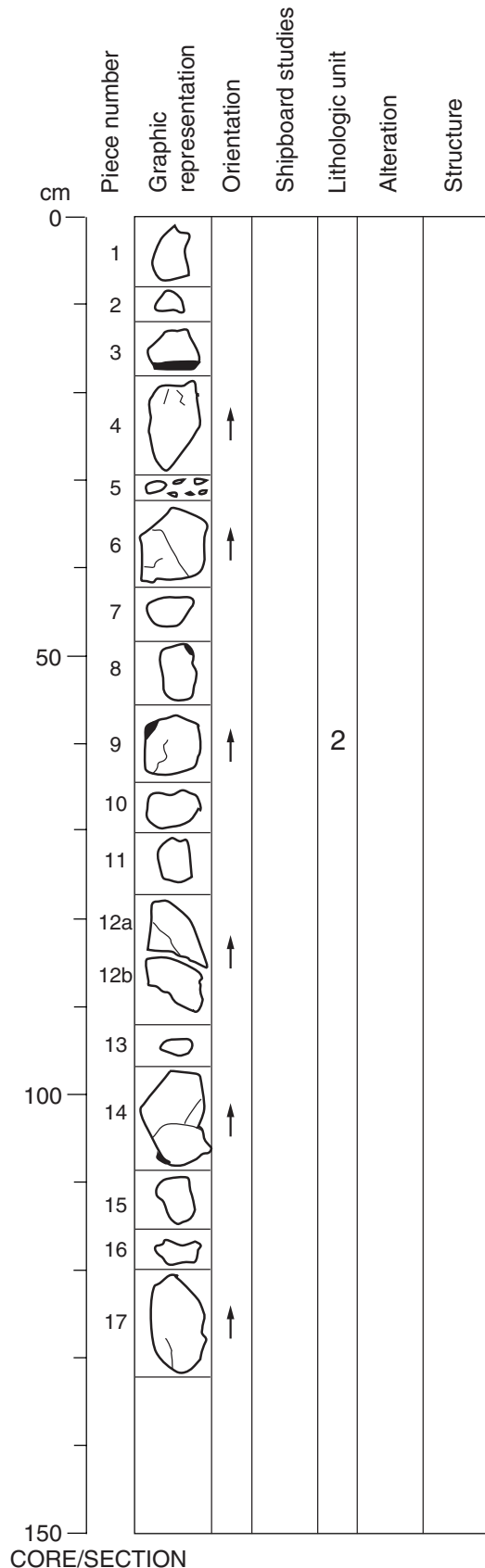
VEINS/FRACTURES: Fractures, probably lined with Fe oxyhydroxides, occur in Pieces 4a, 7, 8, 14, and 22. Radial fractures in Pieces 2, 11, and 20. There is a thin calcite vein in the chilled margin of Piece 4a that connects to a patch of sparry calcite on an outside surface.

ALTERATION: Overall the section is slightly (Pieces 2, 3, 5 to 19) to moderately (Pieces 4, 22, and 25) altered. In the slightly altered pieces, alteration is largely restricted to narrow (~3 mm wide) oxidation halos that parallel fractures or edges of pieces. The rock is ~30%-40% altered in these areas and the alteration halos make up ~5% of the rock. Among the slightly altered pieces, Pieces 14, and 16 through 19 have a slightly more pervasive form of alteration and are borderline moderately altered. Alteration is pervasive in the moderately altered pieces and involves some replacement of groundmass phases by Fe oxyhydroxides + clay ± calcite. Fresh groundmass olivine is present in slightly altered pieces (<1% of mode), i. e., ~90% of olivines are unaltered. Olivine is 50% 100% replaced by Fe oxyhydroxides + clay in alteration halos and moderately altered pieces. Plagioclase is unaltered throughout. Pieces 11, 13, 16, and 18 have fragments of sparry calcite on outside surfaces. Pieces 18, 20, and 22 have patches of cream-colored sediment. Piece 5 has a patch of clay + calcite + Mn oxide on an outer surface. Pieces 2, 6, 8, 10, 11, 12, 13, 18, and 24 have retained portions of weathered outer surfaces.

STRUCTURE: Pillow lavas.

ADDITIONAL COMMENTS: Piece 1 is a moderately altered plagioclase-olivine aphyric basalt from Unit 1 which must have fallen down the hole. Small (<0.5 mm) microphenocrysts/large groundmass crystals of olivine and plagioclase are present throughout (<1% of the mode) the aphyric basalts. The olivine is equant; plagioclase ranges from acicular to prismatic.

Core Photo



187-1163A-5R-1

UNIT 2: APHYRIC BASALT

PIECES 1-25

INTERNAL CONTACTS: A chilled margin was only recovered on Piece 3. It consists of 1 mm of palagonite, followed by 1-2 mm of glass + spherulites and 5 mm of coalesced spherulites.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)		Shape
	avg.	max. min.	
<1	<0.5	0.5	variable

Vesicles: The vesicles range from spherical to irregular in shape.

Filling: Vesicles are unfilled (or lined with thin layers of blue-gray clay and/or Fe oxyhydroxides) in Pieces 1 to 4, 7, 8, 1 to 12, and 14. In Pieces 6, 9, and 14 most of the vesicles (50%-75%) are unfilled, but some are filled with calcite (Pieces 6 and 14) and some with clay (Pieces 9 and 14)

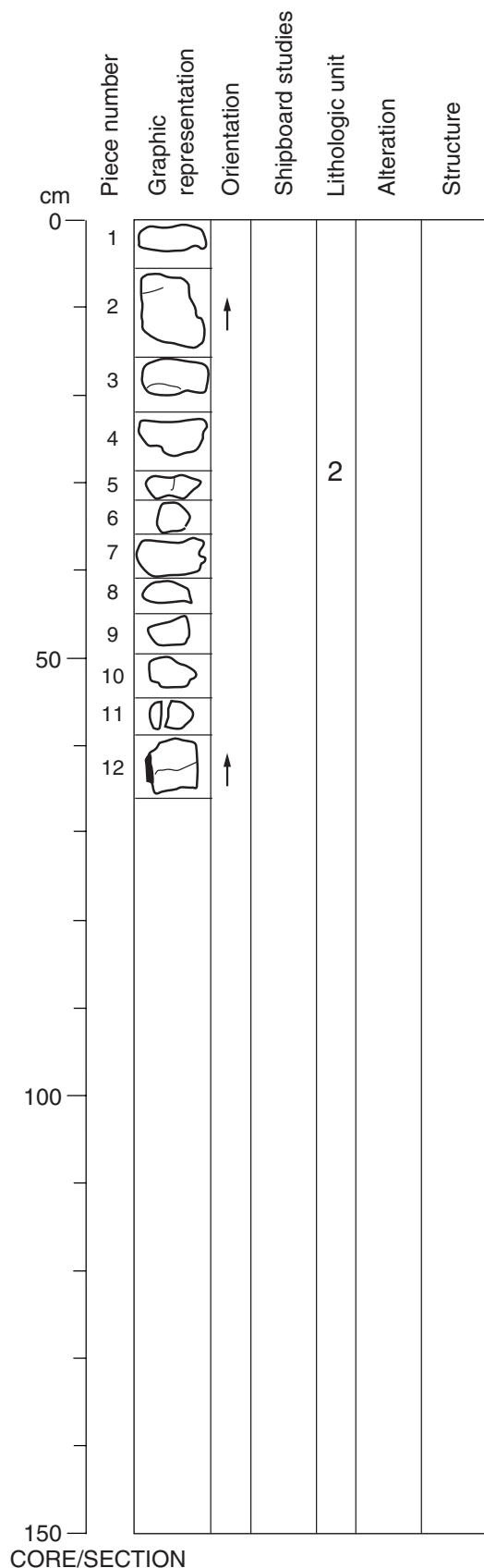
VEINS/FRACTURES: Fractures, probably lined with Mn ± Fe oxyhydroxides, occur in Pieces 4, 12, and 14. Pieces 8 and 9 have fragments of composite pinkish-brown calcite veins (minimum ~3 mm wide) on a corner of each piece; these consist of a mixture of sparry calcite on the walls of the veins and more micritic calcite + Mn oxide in the middle.

ALTERATION: Overall the section is slightly (Pieces 1 to 4, 8 to 10, and 15) to moderately (Pieces 5, 7, 11, 12, 14, and 17) altered. In the slightly altered pieces, alteration is largely restricted to narrow (~3 mm wide) oxidation halos that parallel fractures or edges of pieces. The rock is ~30%-40% altered in these areas and the alteration halos make up ~5% of the rock. Among the slightly altered pieces, Pieces 3 and 4 have a slightly more pervasive form of alteration and are borderline moderately altered. Alteration is pervasive in the moderately altered pieces and involves some replacement of groundmass phases by Fe oxyhydroxides + clay ± calcite. Fresh groundmass olivine is present in slightly altered pieces (<1% of mode), i.e., ~90% of olivines are unaltered. Olivine is 50%-100% replaced by Fe oxyhydroxides + clay in alteration halos and moderately altered pieces. Pieces 2 to 4, 6, 9, 12a, 14, 15, and 17 have patches of cream-colored calcareous sediment + Mn oxide on outer surfaces. Pieces 1 and 3 have patches of clay+ Mn oxide on an outer surfaces. Pieces 1 to 7, 9, 11, 13, 15, 16, and 17 have retained portions of weathered outer surfaces.

STRUCTURE: Pillow lavas

ADDITIONAL COMMENTS: The groundmass contains small, acicular plagioclase crystals (~1 mm long) and equant olivines (<0.5 mm), commonly occurring in clusters of several crystals (clusters 1-2 mm across).

Core Photo



187-1163A-5R-2

UNIT 2: APHYRIC BASALT

PIECES 1-12

INTERNAL CONTACTS: Piece 12 (oriented) has a 7 mm thick coating of calcareous clay with glass/palagonite fragments, up to 8 mm across. The sediment runs along the side of this piece for 5.5 cm. Over this interval, the sediment grades from buff calcareous sediment with ~0.2 mm in diameter Mn-oxide spots to a rusty-orange sediment that contains an increasing amount of glass and palagonite fragments. The stratigraphy here is consistent with some density sorting. The glass in the sediment contains small (<0.5 mm) plagioclase microlites, similar to the aphyric basalt suggesting it was probably derived from this unit. The palagonite around the glass is concentric, suggesting alteration took place within the sediment rather than prior. Piece 6 has a 6 mm wide chilled margin of which the outer 1 mm is a glass rind. Piece 4 has a 5 mm wide chilled margin with a <1 mm thick glass rind. The outer surface adjacent to this margin in this piece is concave shaped.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)			Shape
	avg.	max.	min.	
1-2	0.4	0.75	0.1	spheroidal

Filling: Is variable even within a single piece, most vesicles are unfilled, some are either partially lined or filled with either bluish gray cryptocrystalline quartz or orange Fe oxyhydroxide. Few vesicles are lined with bluish-gray cryptocrystalline quartz with Mn oxide nodules in the core of the vesicle

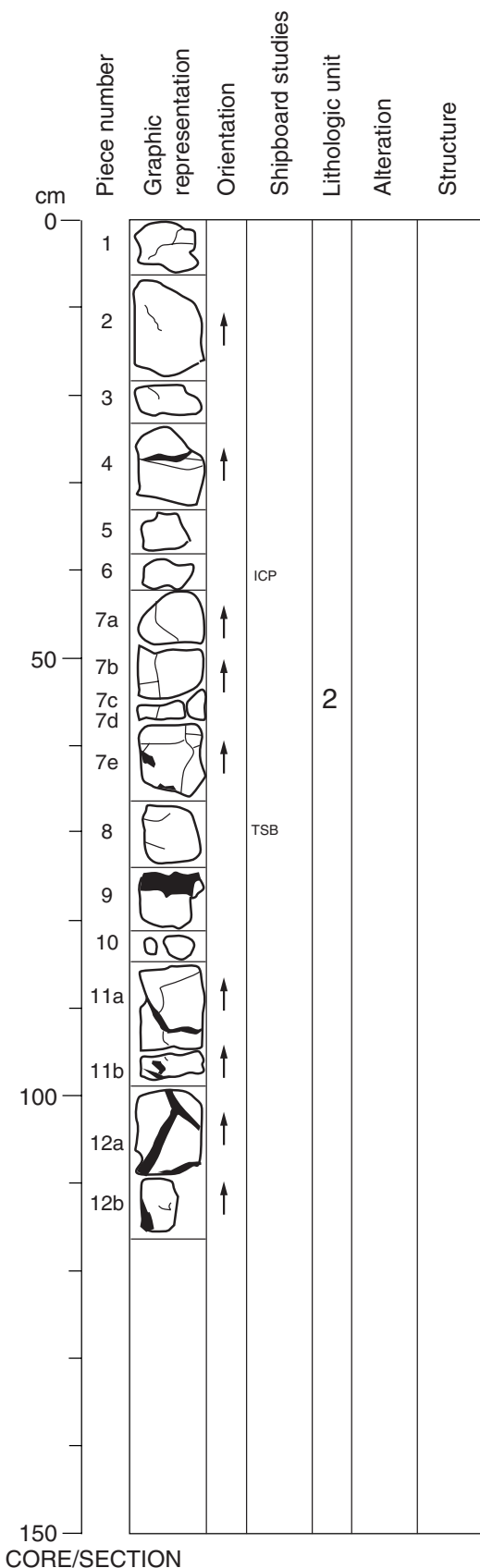
VEINS/FRACTURES: Piece 12 (oriented) has a 0.25 mm wide quartz and Mn oxide vein cutting horizontally across the piece, connecting with the sediment described above.

ALTERATION: Pieces 1, 2, 4, 7, 8, 9, 10, and 12 have orange brown oxidized/weathered margins ranging from 1 mm wide in Piece 4 to 8 mm wide in Piece 7. The margin only appears along one edge in each of the above pieces. Piece 2 has a more pervasively altered groundmass (~10%) to an orange-brown speckled look. Overall the section is slightly altered.

STRUCTURE: Pillow lava

ADDITIONAL COMMENTS: Rare prismatic plagioclase phenocrysts, up to 3 mm long, are found in Pieces 7, 8, 9, and 10. Piece 6 contains flow aligned plagioclase microphenocrysts. Piece 11 consists of two pebble sized basalt pieces.

Core Photo



187-1163A-6R-1

UNIT 2: APHYRIC BASALT

PIECES 1-12

INTERNAL CONTACTS:

(Basalt): Pieces 3, 4, 5, and 6 have <1 mm thick glass rinds in chilled margins that range from 8 mm wide in Piece 5 to 5 mm wide in Pieces 4 and 6. Piece 4 is the only oriented piece and the chilled margin occurs along the side of the piece.

(Sediment): Pieces 8 and 10 are entirely medium-grained pinkish tan calcareous sediment. The sediment is a clayey calcarenite. Typically the clay is more tan in color and the crystalline calcite is more pink. Piece 9 has a 2.2 cm thick coating of this sediment. A few palagonite fragments are present in the sediment, up to 5 mm across, as well as Mn oxide spots (~0.25 mm in diameter) and basalt clasts, probably derived from the wall rock, clast content is ~5%. The sediment is generally pinkish tan except where it is in contact with the basalt, here the sediment occurs as an orange-red band ~5 mm thick. The sediment includes enclaves of even more clay-rich material (up to 3 cm long); lithic clasts (e.g., Palagonite) tend to be most abundant in these areas.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)		Shape
	avg.	max. min.	
1-2	0.5	1.2 0.2	spheroidal

Filling: Is variable, most commonly the vesicles are unfilled however, some are lined, partially or completely filled with bluish gray cryptocrystalline quartz, calcite, Fe oxyhydroxide or light green clay.

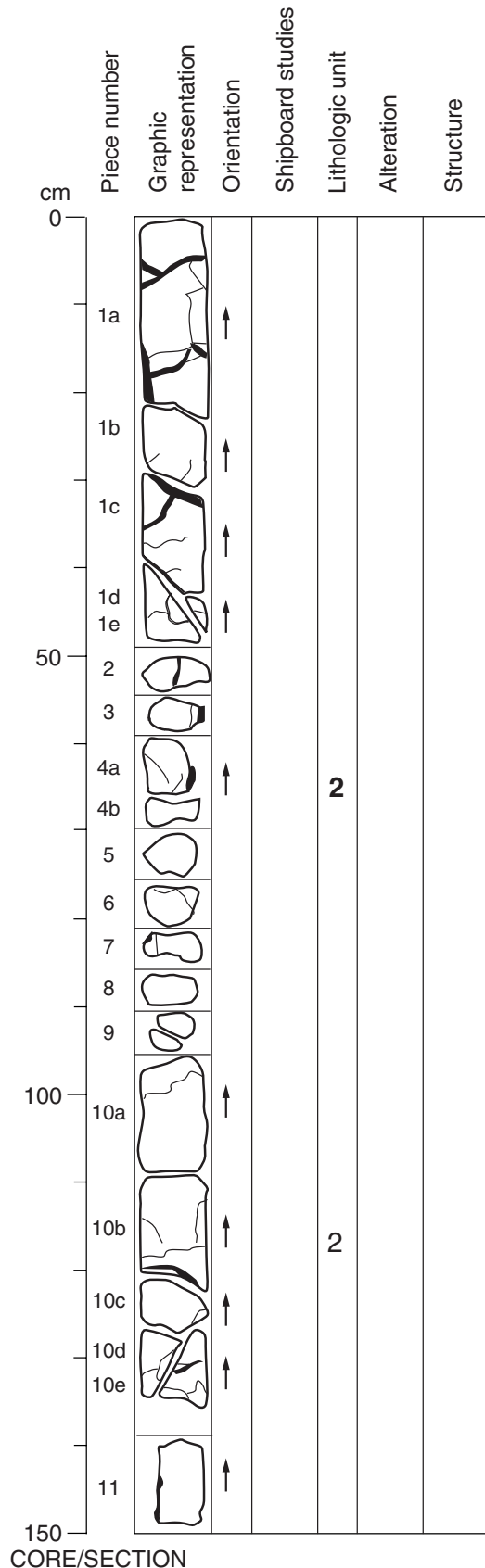
VEINS/FRACTURES: Pieces 4, 7a, 7b, 7c, 7d, 7e, 11a, 11b, 12a, and 12b have calcite/calcareous clay veins ranging in width from 7 mm wide in Piece 12a to 0.2 mm wide in Pieces 7a, 7b, 7c, 7d, and 7e. These veins cut oriented pieces both horizontally and vertically. The wide veins in Pieces 11 and 12 are filled with sediment similar to Pieces 8, 9, and 10.

ALTERATION: Overall the section is moderately altered, this section is more altered than the previous sections from this hole, which is probably largely due to the increased vein density in this section. The veins discussed above have oxidized halos which occur in variable widths even along a single vein within a single piece (e.g., Piece 7e) where a veins goes from having no halo to a 7 mm wide halo over a distance of a few centimeters. The largest halo occurs in Piece 4 and is 1 cm wide. Alteration is characterized by replacement of groundmass by Fe oxyhydroxide + clay.

STRUCTURE: Pillow lava

ADDITIONAL COMMENTS: Vugs which contain sparry calcite occur in Pieces 7e, 11a, and 11b. Rare prismatic plagioclase phenocrysts up to 3 mm long occur in Piece 1.

Core Photo



187-1163A-6R-2

UNIT 2: APHYRIC BASALT

PIECES 1-11

INTERNAL CONTACTS:

(Glass): Piece 7 has a <1 mm thick glass/palagonite rind on its outer surface with now visible spherulitic zone on the cut face.

(Sediment): Pieces 3 and 4a have buff colored micritic calcite (±clay) containing ~10% lithic fragments (palagonite) and Mn oxide concretions. This material is crosscut by sparry calcite veins. Neither piece is oriented and these surfaces probably represent where the pieces fractured along veins. This coating is 4 mm thick on Piece 4a and 6 mm thick on Piece 3.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)		Shape
	avg.	max. min.	
1-2	0.5	1.0 0.2	spheroidal

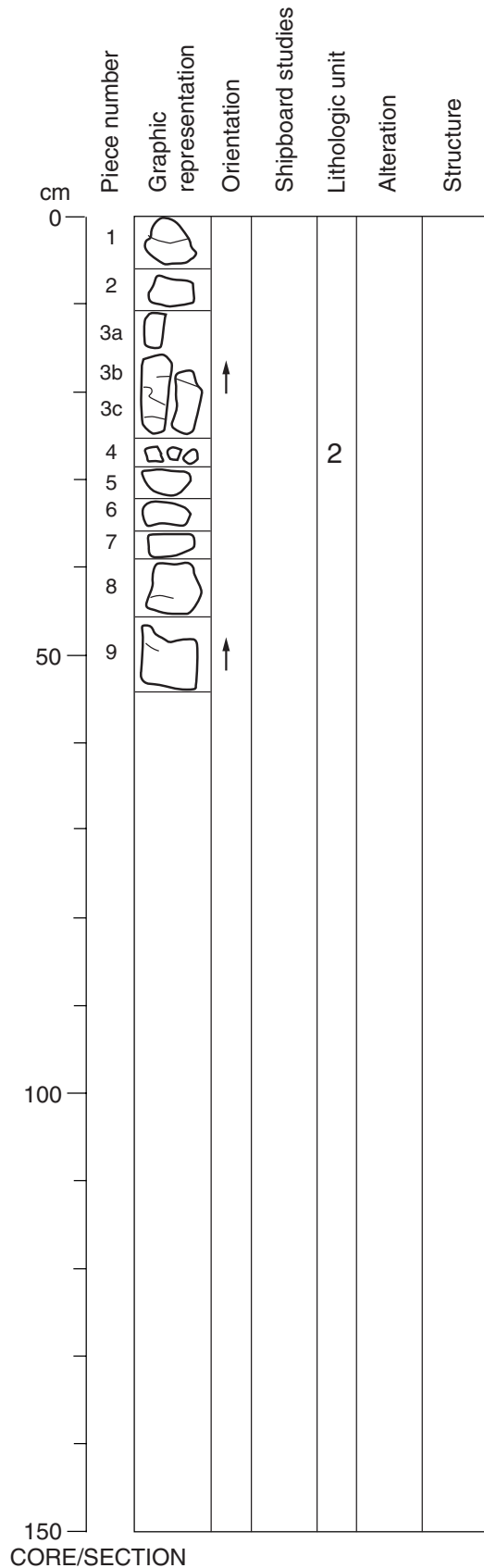
Filling: Is highly variable, in some pieces (e.g., Piece 8) most of the vesicles are unfilled or lined with bluish-gray clay. However in other pieces (e.g., Piece 10a) vesicles are most commonly entirely filled with either light green clay or crystalline calcite. Some vesicles are also lined with Fe oxyhydroxide and filled with light green clay.

VEINS/FRACTURES: Pieces 1a, 1c, 1d, 2, 4a, 5, 6, 10a, 10b, and 10e have calcite/calcareous clay veins up to 6 mm wide in Piece 1a to 0.25 mm wide in Piece 10e. The wider veins are filled predominately with a pinkish finely crystalline sparry calcite. This sparry calcite encloses areas adjacent to the vein wall that is a buff colored clay rich micritic limestone. Lithic fragments (e.g., basalt and palagonite) are concentrated in these areas. Both are crosscut by clear sparry calcite that tends to form only thin veins usually along vein walls (e.g., Piece 10)

ALTERATION: Overall the section is moderately altered. Pieces with filled vesicles also have a speckled Fe oxyhydroxide texture in the groundmass, indicating more pervasive alteration. These pieces also tend to contain more veins. The veins in this section all have oxidized halos that range in width from 3 mm wide in Piece 10e to 8 mm wide in Piece 6. Pieces 2, 3, 4a, 6, 7, 8, and 11 have an orange-brown oxidized margins ranging from 2 mm wide in Piece 8 to 5 mm wide in Piece 6. Mn oxide spots, <1 mm in diameter, are present throughout the calcite/calcareous clay and one the outer surfaces of some basalt.

STRUCTURE: None

Core Photo



187-1163A-6R-3

UNIT 2: APHYRIC BASALT

PIECES 1-9

INTERNAL CONTACTS: Pieces 8 and 9 have chilled margins. No glass is present on Piece 9 where the margin is 1 mm thick. Piece 8 has a 5 mm thick zone of glass and phenocrysts, with 2 mm of glass and spherulites and ~5 mm of coalesced spherulites.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

%	Size (mm)			Shape
	avg.	max.	min.	
2-3	0.5	2	<1	rounded

Filling: Is variable, most commonly the vesicles are unfilled however some are lined, partially or completely filled with bluish gray cryptocrystalline silica, calcite, Fe oxyhydroxide or light green clay.

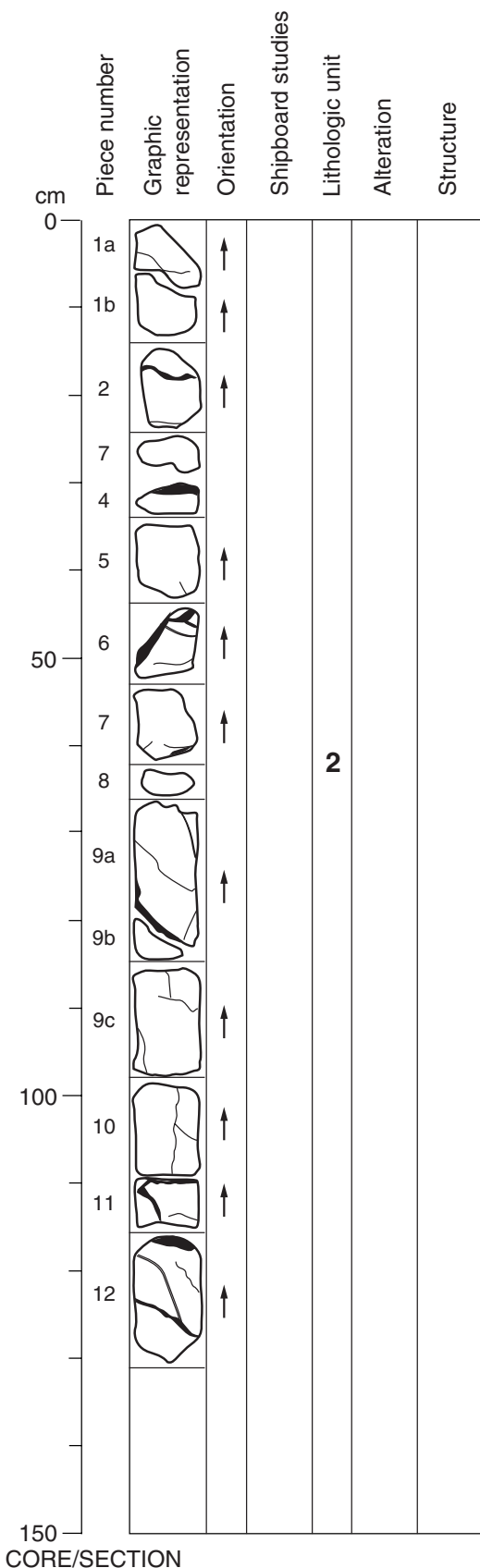
VEINS/FRACTURES: Open unfilled fractures (1 mm width) occur in Piece 8 and 9.

ALTERATION: Overall the section is slightly altered (Pieces 2 and 6 through 9). Oxidized oxidation halos occur on the edges of all the pieces at the edges ranging from 2 to 4 mm, except for Piece 4. One oxidation halo occurs on Pieces 5 and 3b. A coating of white clays with Mn oxide nodules occur on the outer surface of Pieces 1, 2, and 3 up to 1.5 mm thick. Pieces 1, 3, and 5 are moderately altered, here alteration is pervasive with replacement of ~15% of the groundmass by Fe oxyhydroxide ± clays.

STRUCTURE: Pillow lava

ADDITIONAL COMMENTS: Scarce prismatic plagioclase phenocrysts up to 3 mm long occur in Pieces 1 and 8.

Core Photo



187-1163A-7R-1

UNIT 2: APHYRIC BASALT

PIECES 1-12

INTERNAL CONTACTS:

(Glass): Piece 7 (oriented) has a 1.2 cm thick chilled margin with an ~1 mm thick glass/palagonite rind. Piece 8 has a 5 mm wide chilled margin with <0.5 mm thick glass rind.

(Sediment): Piece 3 is entirely clayey calcarenite. The calcite is pink to white in color and the calcareous clay is buff to tan. The sediment contains <5% lithic clasts up to 5 mm long of yellow palagonite and altered basalt (the latter probably derived from the wall rock). It also contains <1% Mn oxide concretions. It is cross cut by thin (<1 mm wide) sparry calcite veins that tend to occur along the vein walls (i.e., Between the basalt and the sediment infill). This sediment also occurs on the outside of Pieces 4, 6, and 12 where it ranges in thickness from 3 mm in Piece 12 to 9 mm thick in Piece 4. Pieces 2 and 7 have buff to light brown clay in patches on outer surfaces that range from 1 mm thick on Piece 7 to 3 mm thick on Piece 2. This sediment on Piece 7 is associated with its glass/palagonite rind.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)			Shape
	avg.	max.	min.	
1	0.4	0.8	0.2	spheroidal

Filling: Highly variable; some pieces (e.g., Piece 2) contain vesicles that are most commonly unfilled or lined with bluish-gray clay or Fe oxyhydroxide.

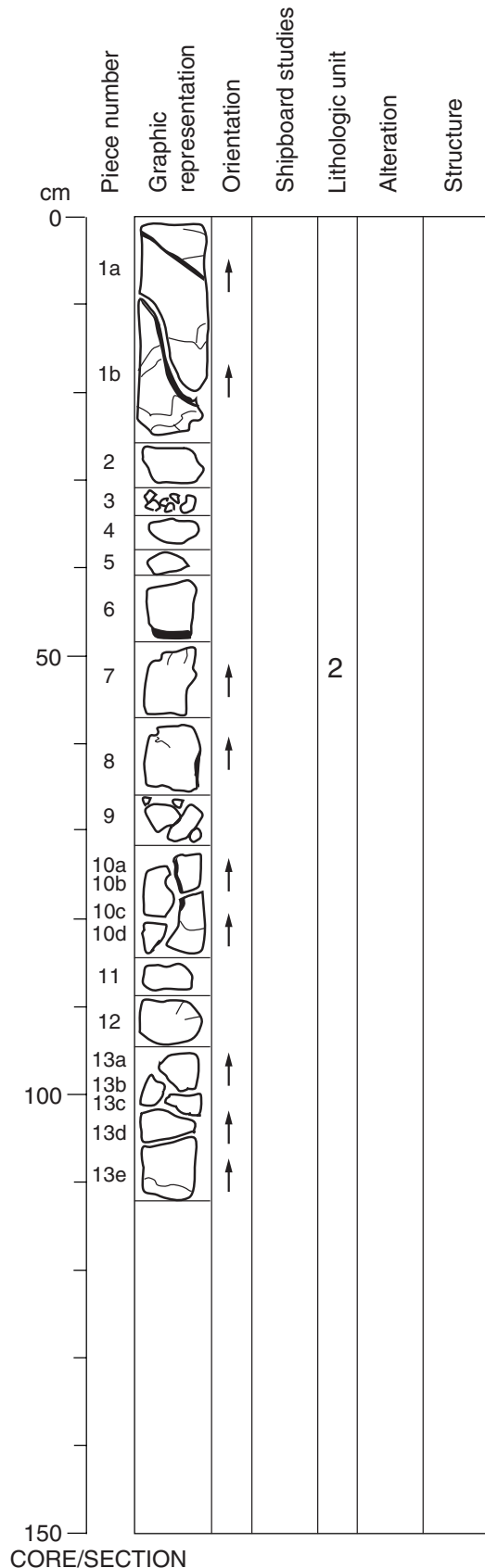
Other pieces (e.g., Piece 11a) contain vesicles that are most commonly filled with light green clay, some vesicles in these pieces are also less commonly filled with calcite and/or Fe oxyhydroxide.

VEINS/FRACTURES: Pieces 1, 2, 6, 9, 10, 11a, 11b, and 12 have sparry calcite (\pm clay) with Mn oxide veins ranging from 4 mm wide in Piece 6 to ~0.25 mm wide in Pieces 10 and 11a. Large veins in Pieces 6 and 9 also have palagonite fragments included in them. In Piece 9 the vein contains ~30% lithic fragments of yellow palagonite and basalt clasts up to 6 mm long. Veins in oriented pieces cut through the piece both horizontally and vertically.

ALTERATION: Overall the section is moderately altered with pieces that have filled vesicles (e.g., Piece 11a) also having Fe oxyhydroxide speckled more pervasively through the piece. Pieces 2, 4, 5, 6, 7, 8, 9, 10, 11a, 11b, and 12 have oxidized margins that range from 1 mm wide in Pieces 10, 11a, and 11b to 4 mm wide in Pieces 2, 4, and 8. With the exception of small veins in Pieces 10 and 11a, all veins have oxidized halos ranging from 9 mm wide in Piece 2 to 4 mm wide in Piece 9.

STRUCTURE: Pillow lava

Core Photo



187-1163A-7R-2

UNIT 2: APHYRIC BASALT

PIECES 1-13

INTERNAL CONTACTS:

(Glass): Piece 1b (oriented) has a 1.4 cm thick chilled margin including an 8 mm thick glass/palagonite rind at the bottom of the piece. Piece 7 (oriented) has a 5 mm thick chilled margin including a <1 mm thick glass/palagonite rind at the top of the piece. Piece 12 has a 9 mm thick chilled margin including ~1 mm thick glass/palagonite rind. Piece 6 has a 1 cm thick chilled margin with no glass/palagonite. Piece 8 (oriented) has a 1.1 cm thick chilled margin with no glass/palagonite at the top of the piece.

(Sediment): Piece 2 is a calcareous clay cemented hyaloclastite breccia. The breccia is matrix supported and poorly sorted with angular to subangular clasts. The matrix is buff to pinkish tan calcareous clay. Clasts consist of basaltic chilled margins and glass/palagonite rinds that range in size from 1 mm to 4 mm across with the largest clasts consisting of basaltic chilled margins. Where palagonitized rims of glass occur the palagonite is concentric, suggesting alteration within the sediment. Pieces 4, 5, 6, and 7 have calcareous clay "patches" on their outer surfaces, this clay is very similar to the matrix in the breccia described above and ranges in thickness from <1 mm in Piece 5 to 5 mm in Piece 6.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)		Shape
	avg.	max. min.	
1-2	0.3	0.75 0.1	spheroidal

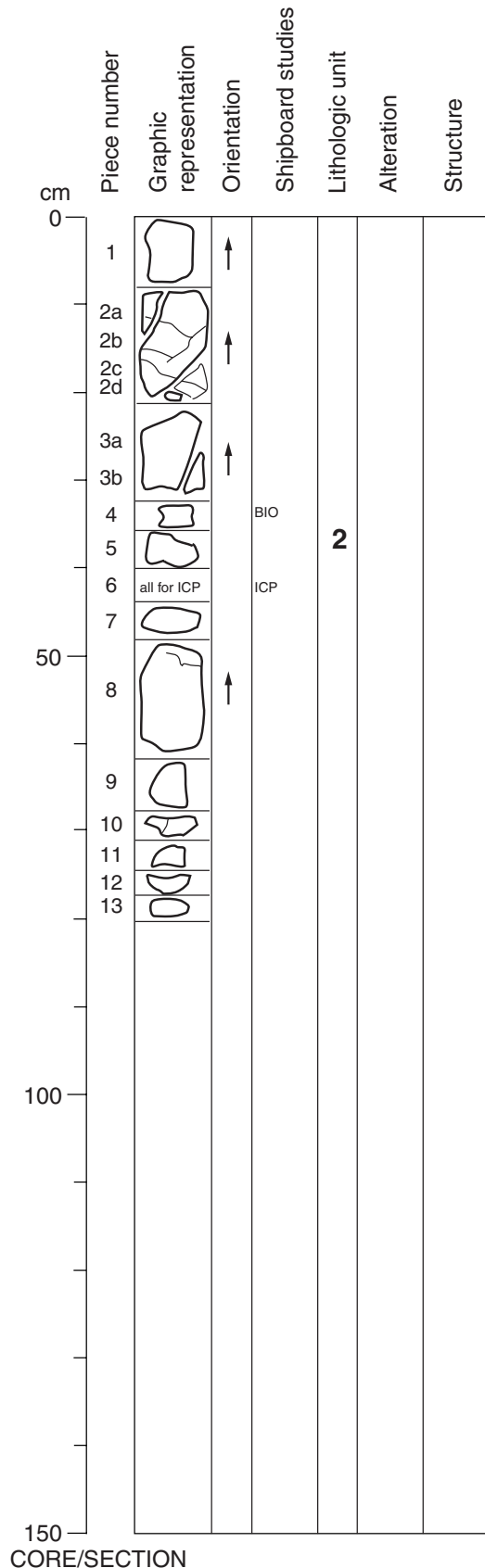
Filling: Is highly variable, some pieces (e.g., Piece 12) have vesicles that are most commonly unfilled with some being lined with bluish gray clay. Other pieces (e.g., Piece 13) are filled most commonly by light green clay, but also may be filled with calcite or Mn oxide. A few vesicles are lined with Fe oxyhydroxide and filled with light green clay.

VEINS/FRACTURES: Piece 2 has small (~0.25 mm wide) white calcite veins in the breccia matrix. Pieces 1a, 1b, 8, 10b, 13d, and 13e have sparry calcite (± clay) veins ranging from <0.5 mm in Piece 13 to 4 mm in Piece 1b. In general the wider veins consist of buff clay-rich(?) micritic to very finely crystalline sparry calcite; this is disrupted (veined or recrystallized) by pinkish brown finely crystalline sparry calcite. Thin white sparry calcite veins crosscut these; often lining the walls of the vein discontinuously. The veins contain lithic fragments of palagonite and altered basalt. Mn oxide concretions occur throughout, but are more commonly associated with the buff micritic calcite. The walls of the veins are sometimes lined with red to orange Fe oxyhydroxides. Pieces 1a and 1b also contain open fractures which range from 0.2 mm to 2 mm wide.

ALTERATION: Mn oxide spots <0.5 mm in diameter are present throughout the matrix of the breccia. All veins, with the exception of those in the breccia matrix and the tiny ~0.2 mm wide calcite veins in Piece 13e, have oxidized halos ranging from 2 mm in Piece 1a to 1.5 cm in Piece 1b. Pieces 1a, 4, 5, 6, 7, 8, 11, and 12 have oxidized margins ranging from 4 mm in Piece 7 to 1 cm in Piece 6.

STRUCTURE: Pillow lava

Core Photo



187-1163A-8R-1

UNIT 2: APHYRIC BASALT

PIECES 1-13

INTERNAL CONTACTS:

(Glass): Piece 8 has a 7 mm thick glassy margin with 1 mm layer of palagonite and small spherulites throughout. Fragments of glass/palagonite occur on Piece 7.

(Sediment): Pieces 4, 5, and 9 are calcareous clay cemented hyaloclastite breccia. The breccia is matrix supported and poorly sorted with angular to subangular clasts. The matrix is buff to pinkish tan calcareous clay. Clasts consist of basaltic glass/palagonite rinds that range in size from 1 mm to 4.5 cm across. Patchy calcareous clay coating on outer surfaces occur with Mn oxide nodules on Pieces 13, 11, 8, and 7.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)			Shape
	avg.	max.	min.	
1-2	0.5	1	0.1	rounded

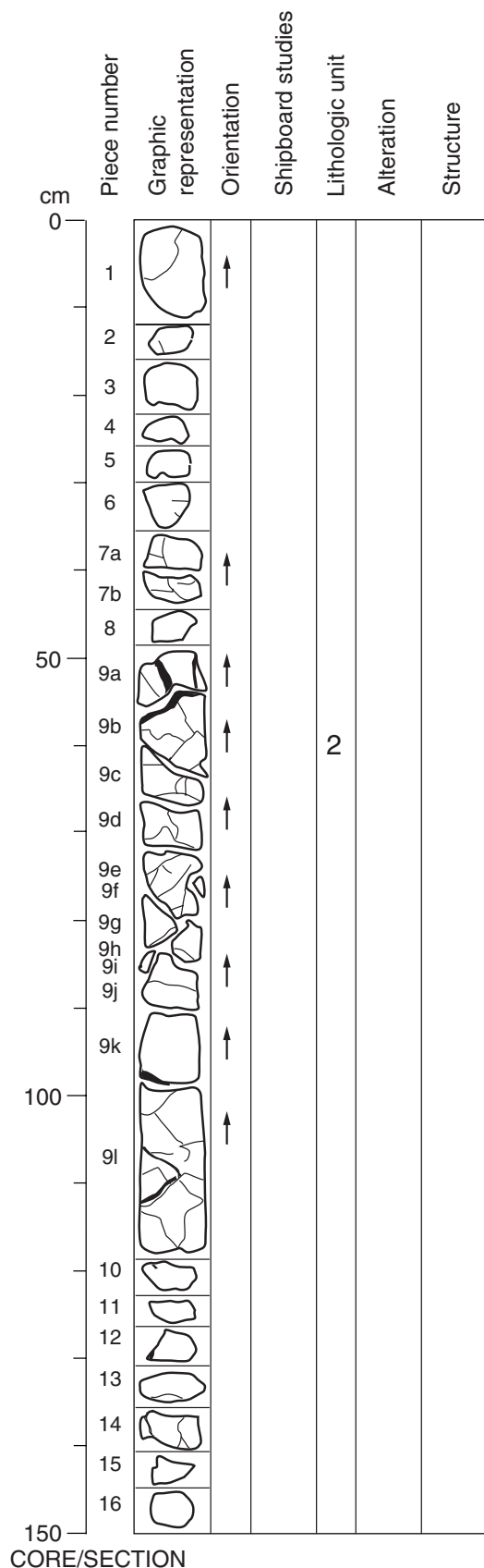
Filling: Is highly variable; mostly pieces have vesicles that are most commonly unfilled, with some being lined with bluish gray clay, by light green clay, by with calcite or Mn oxide. A few vesicles are lined with Fe oxyhydroxide and filled with light green clay.

VEINS/FRACTURES: Piece 2a and 2c have very thin, <0.5 mm wide, of calcite surrounded by alteration halos. Piece 10a contains a Mn oxide lined fracture.

ALTERATION: Overall, pieces are slightly to moderately (Pieces 1, 2, 3, and 13) altered. Mn oxide spots, <0.5 mm in diameter, are present throughout the matrix of the breccia. Pieces 13, 12, 11, 10, 8, 7, and 3 have oxidized margins ranging from 2 mm in Piece 3 to 8 mm in Piece 10. An alteration halo (3 cm width) occurs on Piece 1 with a patchy replacement of the groundmass by calcite ± clay and Fe oxyhydroxide. A coating of calcite (1 mm thick) occurs on Piece 2b. Some of the pieces also have a coating of light green clay (e.g., Piece 2b).

STRUCTURE: Pillow lava

Core Photo



187-1163A-9R-1

UNIT 2: APHYRIC BASALT

PIECES 1-16

INTERNAL CONTACTS:

(Basalt): Pieces 2, 3, 6, 7, 10, 11, 15, and 16 have chilled margins that average ~5 mm wide. Clear glass (<1 mm) was recovered only on a portion of Piece 16; in all other cases the chilled margin consisted of ~4-5 mm of discrete to coalesced small (<0.2 mm) spherulites.

(Sediment): Fragments of a pale pink to cream colored calcareous clay sediment was recovered on the outer surface of Pieces 1, 2, and 8.

GROUNDMASS: Microcrystalline

COLOR: Medium gray where unaltered, light to dark brown in alteration halos

VESICLES:

Abundance %	Size (mm)		Shape
	avg.	max. min.	
<1	<0.5	1 <0.3	variable

Vesicles: The vesicles range from spherical to irregular in shape.

Filling: Vesicles are unfilled (or lined with thin layers of blue-gray clay and/or Fe oxyhydroxides) in Pieces 1 through 7, and 9 through 16. In Piece 8 most of the vesicles (50%-75%) are unfilled, but some are filled with calcite.

Vesicles in alteration halos tend to be lined with Fe oxyhydroxides.

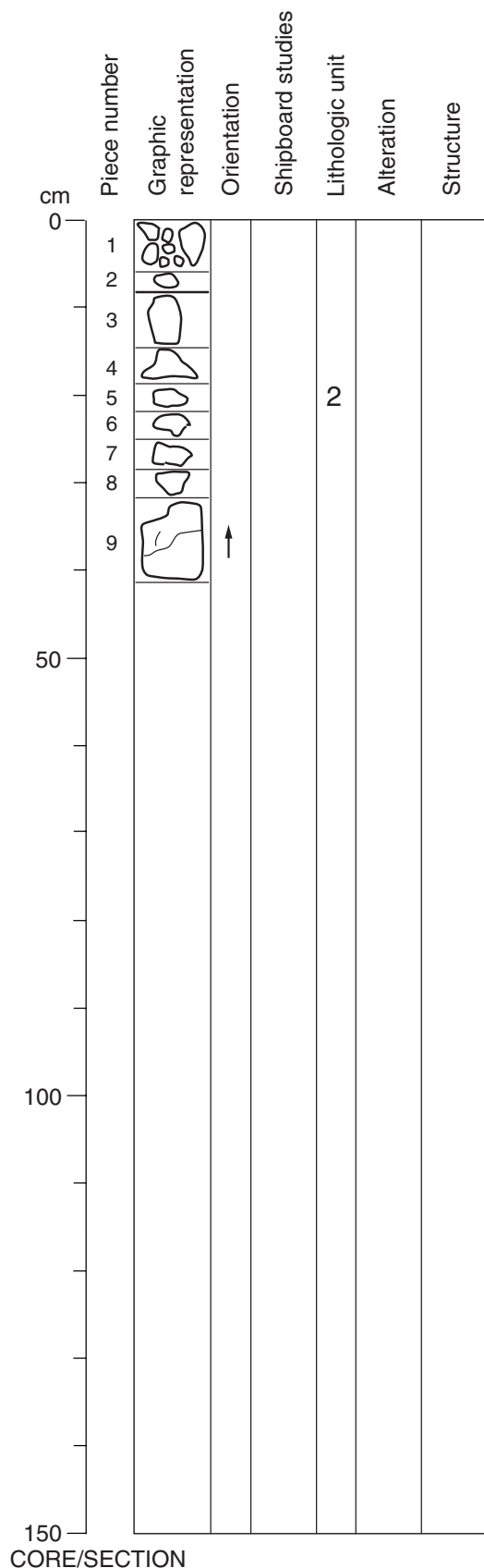
VEINS/FRACTURES: Pieces 7, 13, and 14 contain thin (<0.3 mm) anastomosing white calcite veins. Piece 10 has a 1 cm long vein/fracture filling perpendicular to a chilled margin, filled with cream colored clay + Mn oxide. Piece 9 is intensely veined in a boxwork structure. The veins range from thick (5 mm wide) composite veins filled with a mixture of cream-colored micritic calcite and/or clay, pinkish brown finely crystalline sparry calcite and whitesparry calcite; the pinkish brown calcite predominates in the vein. The cream-colored material tends to be disrupted by the pinkish brown calcite; it also occurs on its own (or with sparry calcite) in thinner veins (~1 mm wide). The white sparry calcite veins crosscut both other materials. Lithic fragments (e.g., palagonite and basalt) occur in the wider veins; the lithic fragments and concretions tend to be associated with the cream colored clay/calcite; Mn oxide occurs in all types of calcite materials, but seems to be most common in the cream colored clay/micritic calcite. Locally the sides of the veins are lined with Mn oxide and/or Fe oxyhydroxides. The veins are generally anastomosing (i.e., not straight or sharp). Sparry to botryoidal (Piece 14) calcite occurs on outer surfaces of Pieces 7, 12, and 14; these are probably fragments of veins. Fractures, probably lined with Mn ± Fe oxyhydroxides, occur in Pieces 1, 6, 9, 14, and 16. Pieces 3 and 6 have short radial fractures through chilled margins.

ALTERATION: Overall the section is slightly (Pieces 1 to 6, 8, 10 to 12, 15, and 16) to moderately (Pieces 7, 9, 13, and 14) altered. In the slightly altered pieces, alteration is largely restricted to narrow (~3 mm wide) oxidation halos that parallel fractures or edges of pieces. The rock is ~50% altered to Fe oxyhydroxides + clay in these areas and the alteration halos make up ~5% of the rock. In the moderately altered pieces, oxidative alteration halos are predominant, but the density of veins is higher and the alteration halos wider (up to 1 cm wide). The alteration also consists of zoned alteration halos. Within the boxwork structure created by the veins in Piece 9, for example, there are halos ~3-6 mm wide on each side of the vein that are dark orange-brown where the rock is highly altered to Fe oxyhydroxides to clay; inward from this is a lighter brown halo (~1 mm) that is moderately to highly altered to Fe oxyhydroxides + clay; this is followed by a wider, often irregular shaped area that is a dark to medium gray and is characterized by patchy to pervasive groundmass replacement by smectite. Fresh basalt may be present within the center. Fresh groundmass olivine is present in slightly altered pieces (<1% of mode), i. e. ~90% of olivines are unaltered. Olivine is 50%-100% replaced by Fe oxyhydroxides + clay in alteration halos and moderately altered pieces.

STRUCTURE: Pillow lavas.

ADDITIONAL COMMENTS: The groundmass contains small, acicular plagioclase crystals (~1 mm long) and equant olivines (<0.5 mm), commonly occurring in clusters of several crystals (clusters 1-2 mm across). A round olivine phenocryst (4 mm in size) occurs in Piece 1 and a round plagioclase phenocryst (2 mm long) with a sieve-textured core occurs in Piece 2.

Core Photo



187-1163A-9R-2

UNIT 2: APHYRIC BASALT

PIECES 1-9

INTERNAL CONTACTS:

(Glass): Pieces 3, 4, and 6 have a glassy margins with thicknesses ranging from 1 mm (Piece 3) to 3 mm (Piece 6). Piece 1 consist of more than 20 fragment of basalt (ranging from 4 cm to 0.5 mm in size), some of which include fragments of glassy margins.

(Sediment): Piece 2 is a buff to pinkish tan calcareous sediment or vein fragment containing sparse clasts of basalt and palagonite. The outer surfaces are coated in large Mn spots (2 mm). Pieces 1, and 7 through 9 have patchy coatings of calcareous clay + Mn oxide on outer surfaces.

GROUNDMASS: Microcrystalline

COLOR: Medium gray

VESICLES:

Abundance %	Size (mm)		Shape
	avg.	max. min.	
1-2	0.5	1 0.1	rounded

Filling: Overall the section, vesicle filling is variable. Most pieces have vesicles that are unfilled or lined with bluish gray clay. In Piece 9, most of the vesicles are filled with light green clay, calcite or Mn oxide; a few vesicles in this piece are lined with Fe oxyhydroxide and filled with light green clay.

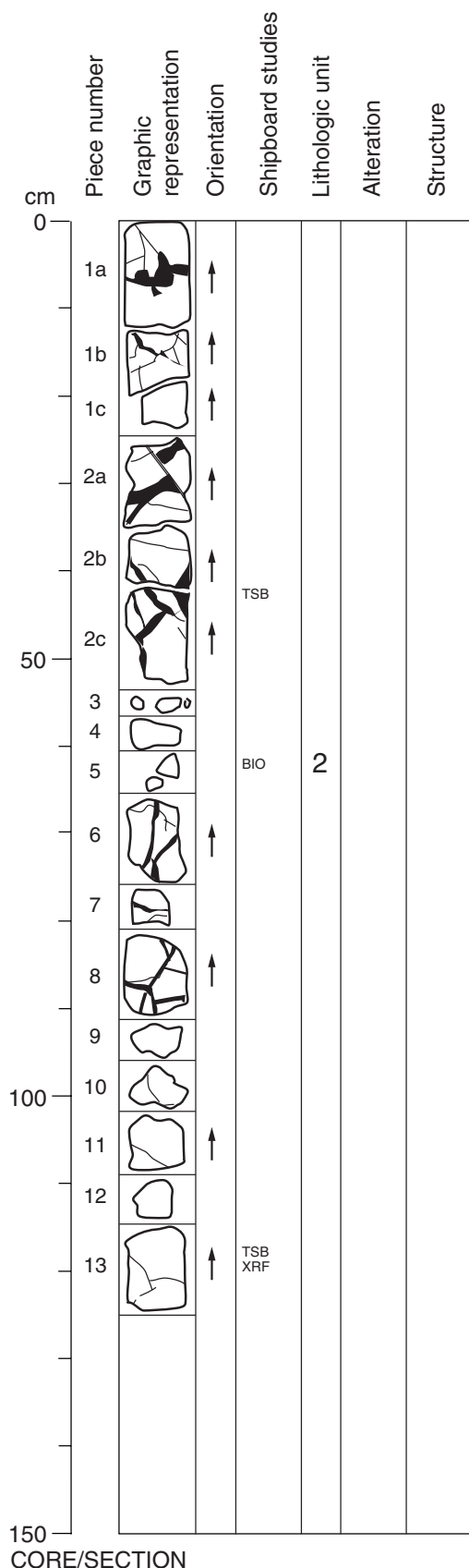
VEINS/FRACTURES: Piece 9 has a very thin vein (<0.2 mm) of calcite and clay. Pieces 7 and 8 have fragments of calcite veins on outer surfaces.

ALTERATION: Alteration in this section is highly variable, ranging from slightly (Pieces 1, and 3 through 8) to moderately (Piece 9) altered. In Piece 9, there is patchy replacement of groundmass by brown clay and Fe oxyhydroxides. Pieces 3, 5, 6, and 9 have oxidized margins ranging in size from 5 mm in Pieces 3 and 4 to 7 mm in Piece 7. A coating of sparry calcite (1 mm thick) occur on Piece 7.

STRUCTURE: Pillow lava

ADDITIONAL COMMENTS: The groundmass contains small, acicular plagioclase crystals (~1 mm long) and equant olivines (<0.5 mm).

Core Photo



187-1163A-10R-1

UNIT 2: APHYRIC BASALT

PIECES 1-13

INTERNAL CONTACTS:

(Basalt): Chilled margins were recovered on Pieces 4, 12, and 13. Glass was recovered only on Piece 13 (<1 mm); in general, the margins consist of 4-5 mm of spherulites + glass.

(Sediment): Thick layers of sediment (up to 3 cm) are attached to basalt on Pieces 10 and 11. The sediment is lithic rich in Piece 10 (~75% lithic clasts) consisting of angular basalt and subangular yellow palagonite ranging from sand- to pebble-size (i.e., up to 2 cm) with a matrix of cream colored micritic calcite + clay crosscut by white sparry calcite veins. The matrix is stained red adjacent to some basalt clasts. Piece 11 contains fewer (~20%) and smaller (up to 1.5 cm, but most <5 mm) lithic fragments, and the matrix appears to be a pinkish brown very finely crystalline sparry calcite. Piece 3 is a hyaloclastite breccia consisting of ~50% clasts of palagonite + glass in a cream- to pinkish beige colored clay matrix; botryoidal quartz fills some void space. Palagonite has a concentric alteration pattern around the glass, suggesting that the alteration occurred in the sediment. Piece 4 has a layer of pinkish brown clay + palagonite fragments that is similar in appearance to the matrix of Piece 3.

GROUNDMASS: Microcrystalline

COLOR: Medium gray where unaltered, light to dark brown in alteration halos

VESICLES:

Abundance %	Size (mm) avg.	max.	min.	Shape
<1	<0.5	1	<0.3	variable

Vesicles: The vesicles range from spherical to irregular in shape. Larger pits (up to 3 mm in size; e.g., Pieces 1 and 2) are probably miarolitic cavities.

Filling: Vesicles are unfilled (or lined with thin layers of blue-gray clay and/or Fe oxyhydroxides) in Pieces 2, 6, 7, and 11. In Pieces 2, 4, and 9 most of the vesicles (50%-75%) are unfilled, but some are filled with calcite; most vesicles in Piece 1 are filled with clay + Fe oxyhydroxides. Vesicles in alteration halos tend to be lined with Fe oxyhydroxides.

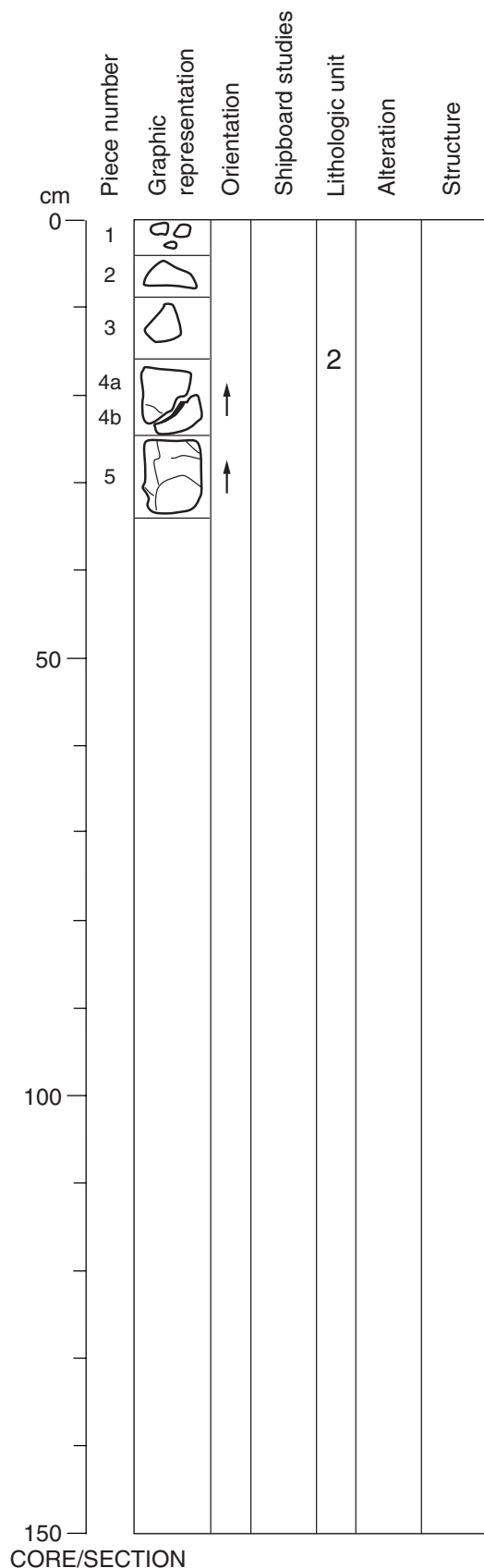
VEINS/FRACTURES: Calcite veins occur in Pieces 1, 2, 7, and 8. These range from <1 mm wide sparry calcite veins (e.g., Pieces 2, 7, and 8) to larger composite veins (Pieces 1 and 2). As in the previous section, the composite veins are filled with a mixture of cream-colored micritic calcite and/or clay, pinkish brown finely crystalline sparry calcite and white sparry calcite; the pinkish brown calcite predominates in the vein. The cream colored material tends to be disrupted by the pinkish brown calcite; it also occurs on its own (or with sparry calcite) in thinner veins (~1 mm wide). The white sparry calcite veins crosscut both other materials. Lithic fragments (e.g., palagonite and basalt) occur predominantly in association with the cream colored clay/calcite; Mn oxide occurs in all types of calcite materials, but seems to be most common in the cream colored clay/micritic calcite. Locally the sides of the veins are lined with Mn oxide and/or Fe oxyhydroxides. The veins are generally anastomosing (i.e., not straight or sharp). In Pieces 7 and 8 the veins consist of thinner (1-2 mm) cream-colored micritic calcite + clay crosscut by sparry calcite; disruption of the micritic material by the sparry calcite is clearly shown in Piece 8. Piece 6 contains 2 diverging (but connected) veins that crosscut a chilled margin; they are filled with a pinkish beige clay that contains lithic fragments; nearer the chilled margin the lithic fragments are palagonite, further from the chilled margin, the lithics are predominantly angular fragments of basalt. A Mn oxide-lined fracture occurs in Piece 13.

ALTERATION: Overall the section is slightly (Pieces 4, and 11 to 13) to moderately (Pieces 1, 2, and 6 through 10) altered. In the slightly altered pieces, alteration is largely restricted to narrow (~3 mm wide) oxidation halos that parallel edges of pieces. The rock is ~50% altered to Fe oxyhydroxides + clay in these areas and the alteration halos make up ~5% of the rock. In the moderately altered pieces, oxidative alteration halos are predominant, and these samples tend to be crosscut by numerous or thick veins, and the alteration halos wider (up to 1 cm wide). In these halos, which are ~3-6 mm wide on each side of the vein, the rock is a dark orange-brown where highly altered to Fe oxyhydroxides to clay. In ward of this the rock is typically altered by patchy groundmass replacement by Fe oxyhydroxides + clay. Fresh groundmass olivine is present in slightly altered pieces (<1% of mode), i.e., ~90% of olivines are unaltered. Olivine is 50%-100% replaced by Fe oxyhydroxides + clay in alteration halos and moderately altered pieces.

STRUCTURE: Pillow lavas.

ADDITIONAL COMMENTS: The groundmass contains small, acicular plagioclase crystals (~1 mm long) and equant olivines (<0.5 mm), commonly occurring in clusters of several crystals (clusters 1-2 mm across).

Core Photo



187-1163A-10R-2

UNIT 2: APHYRIC BASALT

PIECES 1-5

INTERNAL CONTACTS:

(Basalt): A chilled was recovered only on the top of Piece 5. It is a maximum of 1 cm wide and consists of palagonitized glass + spherulites.

(Sediment): Patches of cream to pink colored sediment (1-2 mm thick) occur on outer surfaces of Pieces 2, 4a, and 5.

GROUNDMASS: Microcrystalline

COLOR: Medium gray where unaltered, light to dark brown in alteration halos

VESICLES:

%	Abundance		Size (mm)		Shape
	avg.	max.	max.	min.	
<1	<0.3	0.5	<0.1	variable	

Vesicles: The vesicles range from spherical to irregular in shape.

Filling: Vesicles are unfilled (or lined with thin layers of blue-gray clay and/or Fe oxyhydroxides) in all pieces.

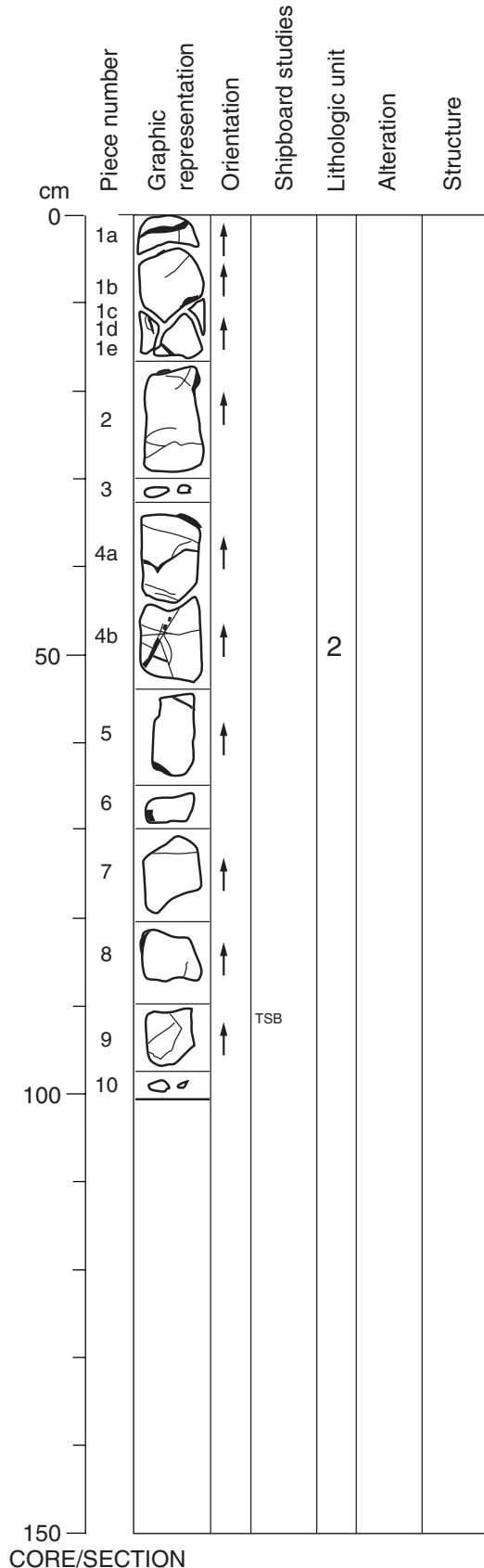
VEINS/FRACTURES: Piece 4 has broken along a 1-2 mm wide composite vein consisting of cream-colored clay at one end and pinkish brown very finely crystalline sparry calcite at the other, both of which are crosscut by white sparry calcite veins, that generally follow the wall of the vein. Piece 5 is crosscut by a thin (<0.3 mm) sparry calcite vein (horizontal relative to core) and a thin (<0.3 mm) micritic calcite vein (vertical) that crosscuts the chilled margin on the top of this piece. Piece 5 also has a red silica/clay vein that crosscuts the spherulitic zone parallel to the chilled margin. Mn oxide is common in all veins.

ALTERATION: Overall the section is slightly altered. Alteration is largely restricted to narrow (~3 mm wide) oxidation halos that parallel edges of pieces (Piece 2) or veins (Pieces 4 and 5). The rock is ~50% altered to Fe oxyhydroxides + clay in these areas and the alteration halos make up <5% of the rock. Fresh groundmass olivine is present outside of alteration halos, but is 50%-100% replaced by Fe oxyhydroxides + clay in alteration halos.

STRUCTURE: Pillow lavas.

ADDITIONAL COMMENTS: The groundmass contains small, acicular plagioclase crystals (~1 mm long) and equant olivines (<0.5 mm).

Core Photo



187-1163A-11R-1

UNIT 2: APHYRIC BASALT

PIECES 1-10

INTERNAL CONTACTS:

(Sediment): Patches of cream to pink colored sediment (1-5 mm thick) occur on outer surfaces of 2, 3, and 6 through 10. On Pieces 2, 5, 6, 7, and 10 the sediment is a buff colored micrite + Mn oxide; on Pieces 6 and 10 it contains a few lithic fragments (mostly palagonite, 1-10 mm in size); associated with the sediment of Piece 6 is a layer of botryoidal calcite. Piece 9 includes a thick layer (~2 cm) of lithic-rich (~75%) sediment in a cream-colored micritic calcite matrix (~25%). The clasts are angular basalt (ranging from 1 to 20 mm) and angular to subangular palagonite ± glass (1 to 15 mm). Palagonite ranges from yellow to orange-brown in color; it forms concentric layers around glass, indicating alteration within the sediment. One corner of the sediment is crosscut by a thick network of sparry calcite. A 5 mm wide fragment of sediment on the side of Piece 8 is a clay-rich calcarenite crosscut by sparry calcite.

GROUNDMASS: Microcrystalline

COLOR: Medium gray where unaltered, light to dark brown in alteration halos

VESICLES:

Abundance %	Size (mm) avg.	Size (mm) max.	Size (mm) min.	Shape
<1	<0.3	0.5	<0.1	variable

Vesicles: The vesicles range from spherical to irregular in shape; some of the irregular ones may be miarolitic cavities.

Filling: Vesicles are unfilled (or lined with a white to blue-gray clay) in Pieces 1a, 1b, 4a, and 5 through 8. Some of the vesicles (<10%-20%) are filled by calcite and/or clay in Pieces 1e, 2, 4b, 4c, and 9; other vesicles in these same samples are unfilled. Vesicles in alteration halos range from unfilled to lined with Fe oxyhydroxides.

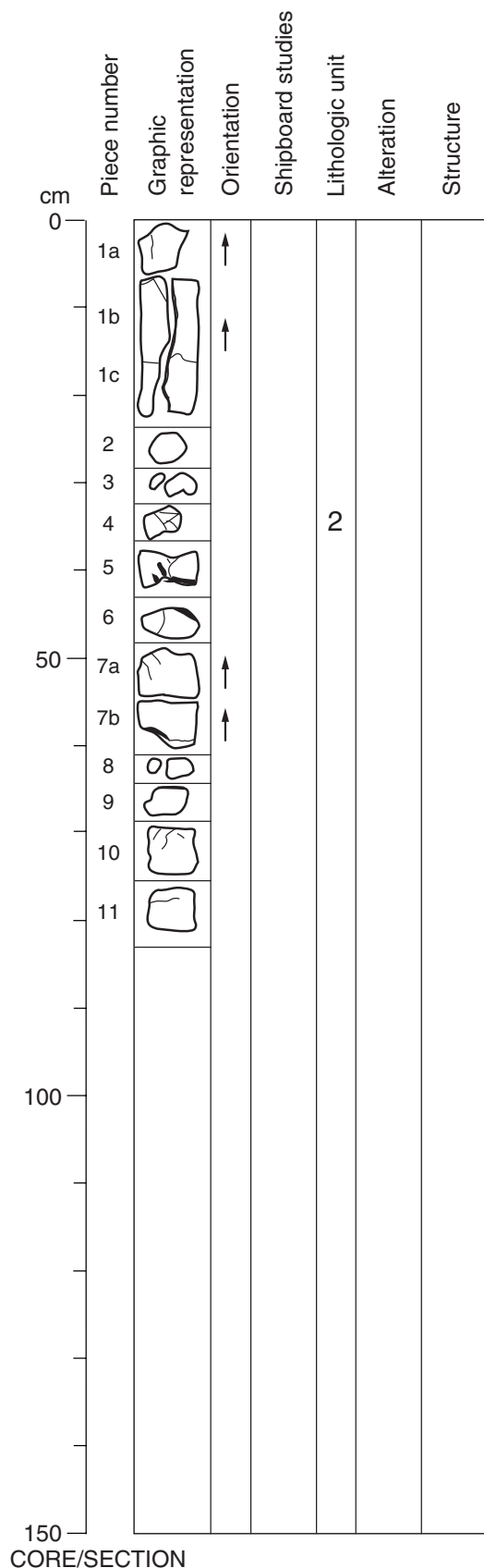
VEINS/FRACTURES: Assorted calcite veins occur in Pieces 1, 2, 4, 5, and 9. A composite vein occurs in Piece 4, consisting of ~6 mm of pinkish brown finely crystalline sparry calcite, with small fragments of buff micritic calcite and crosscut by white sparry calcite; Piece 5 has a fragment of a similar composite vein on the bottom. Piece 1 has broken along several buff colored micritic calcite (+Mn oxide) veins; this piece also has a micritic calcite vein crosscut by sparry calcite and a micritic vein (4 mm wide) rich in palagonite and basalt clasts over a 2 cm long interval. Mn oxide is common in all veins. Mn oxide-lined fractures occur in Pieces 2 and 7.

ALTERATION: Overall the section is slightly (Pieces 5 to 8) to moderately (Pieces 1 to 4, and 9) altered. In slightly altered pieces, alteration is largely restricted to narrow (~5-6 mm wide) oxidation halos that parallel edges of pieces; however, these may have been vein margins along which the sample has broken. In these halos the rock is ~50% altered to Fe oxyhydroxides + clay and the alteration halos make up <5% of the rock. Fresh groundmass olivine is present outside of alteration halos, but is 50%-100% replaced by Fe oxyhydroxides + clay in alteration halos. Moderately altered pieces tend to be crosscut by more veins and the alteration halos are wider (up to 2 cm between two veins in Piece 4). Alteration is more pervasive away from the veins as well, consisting of patchy replacement of groundmass by Fe oxyhydroxides + clay ± calcite. Piece 2 shows this type of alteration, but has retained only fragments of veins on its top and bottom surfaces.

STRUCTURE: Pillow lavas.

ADDITIONAL COMMENTS: The groundmass contains small, acicular plagioclase crystals (~1 mm long) and equant olivines (<0.5 mm). A tabular plagioclase crystal 2 mm long in size occurs in Piece 8.

Core Photo



187-1163A-11R-2

UNIT 2: APHYRIC BASALT

PIECES 1-11

INTERNAL CONTACTS:

(Basalt): Chilled margins were recovered on Pieces 4, 7a, and 10. They consist of 2-5 mm of glass + phenocrysts, 3-4 mm of discrete spherulites in glass and 3-4 mm of coalesced spherulites. In Piece 4, the glass between the spherulites is palagonitized. The chilled margin occurs on the top of oriented Piece 7a.

(Sediment): Piece 8 consists of two pebble-size fragments of pinkish brown calcareous sediment (clayey calcarenite), containing <1% Mn oxide concretions, and ~5% angular lithic fragments of palagonite and altered basalt up to 1 cm in size. Piece 9 has a 5 mm thick layer of a similar sediment attached to outer surfaces.

GROUNDMASS: Microcrystalline

COLOR: Medium gray where unaltered, light to dark brown in alteration halos

VESICLES:

Abundance %	Size (mm)			Shape
	avg.	max.	min.	
<1	<0.3	0.5	<0.1	variable

Vesicles: The vesicles range from spherical to slightly irregular in shape.

Filling: Vesicles are unfilled (or lined with a white to blue-gray clay) in all pieces.

VEINS/FRACTURES: Pieces 1, 4, 5, and 6 are crosscut by buff-colored micritic calcite veins (1-10 mm in width) containing 5%-20% lithic fragments and Mn oxide concretions, and disrupted or crosscut by white sparry calcite veins. On Piece 5, one of the sparry calcite veins turns into a fragment of a vug filling on one side of the piece. Lithic fragments include angular basalt and subangular palagonite. An anastomosing vein in the chilled margin of Piece 4 is pinkish brown clay + Mn oxide. Very thin (<0.5 mm) sparry calcite veins occur in Pieces 1 and 4 and Pieces 6, 7b, and one of the pebbles in Piece 3 have fragments of sparry calcite veins on an outer surface. An Mn oxide-lined fracture occurs in Piece 2. Radial fractures through chilled margins occur in Pieces 7 and 10.

ALTERATION: Overall the section is slightly (Pieces 2, 3, and 7 through 11) to moderately (Pieces 1, and 4 to 6) altered. In slightly altered pieces, alteration is largely restricted to narrow (~5-6 mm wide) oxidation halos that parallel edges of pieces. Pieces 7 and 11 are free of alteration halos. In the halos the rock is ~50% altered to Fe oxyhydroxides + clay and the alteration halos make up <5% of the rock. Fresh groundmass olivine is present outside of alteration halos, but is 50%-100% replaced by Fe oxyhydroxides + clay in alteration halos. Moderately altered pieces tend to be crosscut by veins which have alteration halos ranging from 3 to 5 mm wide on each side of the vein as well as alteration halos along edges of the pieces. Alteration is more pervasive away from the veins as well, consisting of patchy replacement of groundmass by Fe oxyhydroxides + clay. Away from the glassy margin of Piece 4 the groundmass is pervasively altered in this way.

STRUCTURE: Pillow lavas.

ADDITIONAL COMMENTS: The groundmass contains small, acicular plagioclase crystals (~1 mm long) and equant olivines (<0.5 mm). There is a 4 mm long tabular plagioclase phenocryst in the chilled margin of Piece 7a.

187-1163A-2R-1, 20-23 cm (TS#78)			Unit: 1			OBSERVER:	Gee	
ROCK NAME:	Moderately plagioclase-olivine phyric basalt							
WHERE SAMPLED:	piece 4							
GRAIN SIZE:	microcrystalline							
TEXTURE:	intersertal							
PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS
			min.	max.	av.			
PHENOCRYSTS								
Plagioclase	3	3	1.5	2.3	2		euohedral to subhedral, prismatic	Plagioclase is seriate as is olivine to microphenocryst scale, disequilibrium twins common. Sieve textured cores in some larger crystals.
Olivine	0.5	2	0.4	1.8	1.5		euohedral to subhedral, some skeletal	Mainly replaced, often broken. Some crystals partially replaced by clay + calcite.
Clinopyroxene								
Cr spinel	tr	tr		0.2			euohedral, equant	Crystal is dark reddish brown and has a darker brown altered rim.
GROUNDMASS								
Olivine	4	5	<0.02	0.4	0.3		skeletal	Microphenocrysts usually associated with plagioclase.
Plagioclase	43	44	<0.02	1.5	1		prismatic	Microphenocrysts: Swallow-tail morphology common, plagioclase (?) whiskers on olivine (Image 193), stellate and bow-tie, radial etc.
Clinopyroxene								
Opaque Minerals	<1	<1	<0.1				blebs	
Glass	41	45						
SECONDARY MINERALOGY	PERCENT	LOCATION	SIZE (mm)			REPLACING / FILLING	COMMENTS	
			min.	max.	av.			
Clays	8					olivine and groundmass	Second observer comment: I think the degree of alteration may be higher than this.	
Calcite						replacing olivine		
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS	
			min.	max.	av.			
Vesicles	1			0.1		filled with yellow clay / round		
COMMENTS : Glomerocrysts of plagioclase and olivine microphenocrysts are common, ~20% of all microphenocrysts in glomerocrysts < 1.5 mm. Quench textures dominate plagioclase, clinopyroxene and olivine morphology. A fracture crosscuts a plagioclase phenocryst, no alteration, late stage. The thin section contains a vesicle ~0.3 mm in size that was refilled with melt (now a darker brown quench mesostasis).								

187-1163A-2R-2, 67-70 cm (TS#79) Unit: OBSERVER: Kempton
ROCK NAME: Moderately plagioclase-olivine phyric basalt
WHERE SAMPLED: piece with fracture/very thin vein
GRAIN SIZE: microcrystalline
TEXTURE: intersertal with

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS
			min.	max.	av.			
PHENOCRYSTS								
Plagioclase	3	3	0.5	2	2		prismatic to tabular, subhedral to anhedral	Plagioclase is seriate. Sieve textured cores in some larger crystals; sieve textures in other plagioclase probably a growth feature, not due to resorption. All have albite twins. Most unzoned, but some larger crystals in glomerocrysts have discontinuous zoning. Some stained along subparallel microcracks.
Olivine	2	2	0.2	2	1.5		euohedral to subhedral, some skeletal	
Clinopyroxene								
Cr spinel	tr	tr		0.3			anhedral, equant	Occurs as dark reddish brown crystals included in plagioclase and as discrete crystals.
GROUNDMASS								
Olivine	2	2		0.2	0.1		equant to skeletal	Microphenocrysts usually associated with plagioclase.
Plagioclase	40	40		1.5	1		prismatic	
Clinopyroxene	2	2		0.25			anhedral, elongate	Reaches 0.15 mm in miarolitic cavities; elsewhere is dominated by quench crystal growth in mesostasis.
Opaque Minerals	2	2		< 30 microns			equant, anhedral	Generally <2 microns, but up to in miarolitic cavities.
Glass								
Mesostasis	43	49						Includes glass + quench crystals plagioclase, olivine, and clinopyroxene.

SECONDARY MINERALOGY	PERCENT	LOCATION	SIZE (mm)			REPLACING / FILLING	COMMENTS
			min.	max.	av.		
Clays	3					replacing groundmass, filling miarolitic cavities, filling vein	
Calcite	3					replacing olivine / filling vesicles and miarolitic cavities	

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS
			min.	max.	av.		
Vesicles	<<1	distributed		0.1		filled with calcite / round	Some vesicles lined with clay, then filled with calcite; some unfilled.
Miarolitic cavities		distributed				filled with calcite / irregular	Mode not estimated since this is reflected in the amount of calcite.

COMMENTS : Plagioclase and clinopyroxene are seriate, so maximum groundmass crystal size and minimum phenocryst size is arbitrary. Glomerocrysts of plagioclase and olivine microphenocrysts are common, ~20% of all microphenocrysts in glomerocrysts; some of these are equant clusters ~2 mm across, others form as long chains of crystals; plagioclase dominates the clusters. Groundmass is dominated by quench crystal morphologies. There is a thin (25-50 micron wide) vein/fracture of clay + Fe oxyhydroxides ± Mn oxides; there is no clear alteration halo associated with this vein/fracture.

187-1163A-3R-1, 63-66 cm (TS#80) Unit: 1 OBSERVER: Gee
ROCK NAME: Moderately plagioclase-olivine phyric bsalt
WHERE SAMPLED: piece 8 crosscut by vein
GRAIN SIZE: microcrystalline
TEXTURE: intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS
			min.	max.	av.			
PHENOCRYSTS								
Plagioclase	4	4		3	2		subhedral	Concentric oscillatory zoning and other disequilibrium textures common, including sieve texture. Broken fragments.
Olivine Clinopyroxene	2.5	3		2	1		subhedral	
GROUNDMASS								
Olivine	6	6	<0.01	0.8			skeletal euhedral	These are microphenocrysts from 0.6 mm down, distinguished from small phenocrysts by their skeletal morphology.
Plagioclase	40	40						Forms elongate, anhedral crystals in miarolitic cavities.
Clinopyroxene								May be up to 20 microns in miarolitic cavities, but generally less than 2 microns.
Opaque Minerals	<1	<1		<2 microns			equant	Second observer comment: Very little glass; quench crystals of plagioclase + olivine + clinopyroxene; the quench olivine + glass is replaced by Fe oxyhydroxides + clay (so there may be more than 3.5% clay in the rock; ~ 20-30% Fe oxyhydroxides + clay).
Glass	44	47						
Mesostasis								

SECONDARY MINERALOGY	PERCENT	SIZE (mm)			REPLACING / FILLING	COMMENTS
		min.	max.	av.		
Clays	3.5				olivine	Perfect polygonal granoblastic texture, with alteration halo
Calcite					vein between 0.6 and 2 mm	

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS
			min.	max.	av.		
Vesicles	<1			0.1		generally unfilled	Small miarolitic cavities are common (~0.1-0.3 mm across); coarser grained clinopyroxene in these areas

COMMENTS : Glomerocrysts up to 6 mm long include circa 40% of phenocrysts over 1.5 mm, all the crystals involved are subhedral, olivine is broken and plagioclase shows disequilibrium textures. Microphenocrysts of olivine and plagioclase nucleated on 'ragged' phenocrysts.
(basalt)

COMMENTS : The vein consists predominantly of sparry calcite crystals; approximately half of the vein is clear calcite with radial extinction; the rest has a dusty appearance where the sparry calcite is full of inclusions (clay?) plus areas that are micritic calcite + clay. In these dusty areas are irregular shaped patches of FeMn oxyhydroxides and round Mn oxide concretions up to 0.3 mm in size. Also present are rare small (<50 microns) angular crystals of plagioclase and other materials probably derived from the adjacent basalt groundmass. At one point the vein truncates at smaller (~0.6 mm wide) vein of micritic calcite + clay. The adjacent wall rock is ~40% altered to Fe oxyhydroxides + clay after groundmass glass and quench olivine.
(vein)

187-1163A-3R-2, 0-4 cm (TS#81)			Unit: 2			OBSERVER:		Kempton	
ROCK NAME:	Aphyric bsalt								
WHERE SAMPLED:	piece typical of unit								
GRAIN SIZE:	microcrystalline								
TEXTURE:	plumose and sheaf quench textures								
PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS	
			min.	max.	av.				
PHENOCRYSTS									
Plagioclase									
Olivine									
Clinopyroxene									
GROUNDMASS									
Olivine	6	6	0.1	1.2		equant to skeletal in microphenocrysts	Includes larger skeletal crystals (>1 mm) probably qualify as microphenocrysts to small equant (euhedral) crystals ~0.1 mm in size.		
Plagioclase	25	25		1.5		prismatic, to acicular to skeletal	Acicular crystals with aspect ratios of ~25:1. Occurs only as plumose quench crystals in the mesostasis.		
Clinopyroxene									
Opaque Minerals									
Glass									
Mesostasis	66	68					Modal estimate includes quench crystals of plagioclase, olivine and clinopyroxene as well as glass.		
SECONDARY MINERALOGY	PERCENT	SIZE (mm)			REPLACING / FILLING	COMMENTS			
		min.	max.	av.					
Clays + Fe oxyhydroxides	2					olivine and/or glass in mesostasis			
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS		
			min.	max.	av.				
Vesicles	1	distributed	<0.1	0.2		unfilled			
COMMENTS :									
Microphenocrysts of olivine and larger groundmass plagioclase crystals tend to occur in clusters of several crystals (i.e. ~30% of the crystals do this). Skeletal olivine microphenocrysts typically have acicular to skeletal plagioclase radiating from it, suggesting that the plagioclase nucleated on the olivine.									

187-1163A-3R-2, 57-60 cm (TS#82)			Unit: 2			OBSERVER:		Russo	
ROCK NAME:		Aphyric basalt							
WHERE SAMPLED:		pillow interior (piece 10)							
GRAIN SIZE:		microcrystalline							
TEXTURE:		intersertal							
PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS	
			min.	max.	av.				
PHENOCRYSTS									
Plagioclase									
Olivine									
Clinopyroxene									
GROUNDMASS									
Olivine	~2	3	0.1	1	0.4		equant to skeletal	~30% olivine has been replaced mainly by iddingsite with some calcite.	
Plagioclase	40	43		1	0.5		sheaf, lath-like, prismatic	Plagioclase is seriate and commonly twinned.	
Clinopyroxene	25	29					plumose quench	Only present in groundmass as plumose quench textures; but forms anhedral elongate to subhedral crystals up to 0.1 mm in miarolitic cavities.	
Opaque Minerals	<1	<1		<2 microns			equant	May be up to 0.1 mm in size in miarolitic cavities, but elsewhere is less than a few microns (hard to tell because polish on thin section is not good).	
Mesostasis	20	25							
Cr spinel	tr	tr		0.1			equant		
SECONDARY MINERALOGY	PERCENT	LOCATION	SIZE (mm)			REPLACING / FILLING	COMMENTS		
			min.	max.	av.				
Clays	10						groundmass mesostasis, clinopyroxene and plagioclase		
Calcite	~3						replacing groundmass and olivine		
VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS		
			min.	max.	av.				
Vesicles	<1	<1		0.3			calcite, light green to brown clay, Fe oxyhydroxide and opaques.	Vesicles vary from unfilled to entirely filled with calcite. Some vesicles have Fe oxyhydroxide lining with light green clay filling and one vesicles is lined with Fe oxyhydroxide with light green clay and an opaque in its core.	
COMMENTS :		Miarolitic cavities, now filled with calcite and/or lined or filled with clay, are very common and range up to 0.8 mm across;							

187-1163A-6R-1, 70-73 cm (TS#83) Unit:2 OBSERVER: Russo
ROCK NAME: Fine grained carbonate
WHERE SAMPLED: inter-pillow sediment of unit 2
GRAIN SIZE: fine grained
TEXTURE: granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS
			min.	max.	av.			

PHENOCRYSTS

Plagioclase
Olivine
Clinopyroxene

GROUNDMASS

Olivine
Plagioclase
Clinopyroxene
Opaque Minerals
Glass

SECONDARY MINERALOGY	PERCENT	LOCATION	SIZE (mm)			REPLACING / FILLING	COMMENTS
			min.	max.	av.		

Clays

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS
			min.	max.	av.		

COMMENTS : Slide consists of 85% granular calcite, up to 0.8 mm across. The remainder of the slide consists of ~5% each tanish-brown clay, sparry calcite and lithic clasts. These three constituents are concentrated together in a ~6 mm wide band in the center of the thin section. The lithic fragments are angular pieces of glass/palagonite, up to 6 mm long, with prismatic plagioclase and equant olivine microphenocrysts, up to 0.6 mm and 0.4 mm, respectively. These phase commonly occur together as glomerocrysts.

187-1163A-10R-1, 41-43 cm (TS #84) **Unit: 2** **OBSERVER:** **Kempton**
ROCK NAME: **Aphyric basalt**
WHERE SAMPLED: **piece crosscut by a calcite vein**
GRAIN SIZE: **microcrystalline**
TEXTURE: **intersertal to sheaf quench morphologies**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS
			min.	max.	av.			
PHENOCRYSTS								
Plagioclase Olivine Clinopyroxene								
GROUNDMASS								
Olivine	10	10		1.5	0.5		equant to skeletal in microphenocrysts	Includes larger skeletal crystals (>1 mm) probably qualify as microphenocrysts to small equant (euhedral) crystals ~0.1 mm in size.
Plagioclase	35	35		1.5	0.7		prismatic, acicular to skeletal, rarely tabular	Prismatic crystals tend to have acicular growth extensions on them; they also tend to have sieved cores, but the melt inclusions tend to parallel cleavages or twin planes, suggesting that these form as a growth phenomenon and not as partial resorption. Acicular crystals have aspect ratios of ~25:1.
Clinopyroxene				0.15				Occurs predominantly as plumose quench crystals in the mesostasis; forms anhedral crystals up to 150 microns in size in miarolitic cavities.
Opaque Minerals	1	1		<25 microns				Typically less than 10 microns, but may reach 25 in miarolitic cavities.
Glass								
Mesostasis	29	54						Modal estimate includes quench crystals of plagioclase, olivine and clinopyroxene as well as glass.

SECONDARY MINERALOGY	PERCENT	SIZE (mm)			REPLACING / FILLING	COMMENTS
		min.	max.	av.		
Clays + Fe oxyhydroxides	25					replacing glass and/or olivine in mesostasis

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS
			min.	max.	av.		
Vesicles	<1	distributed		0.4			most unfilled; a few filled with calcite
Miarolitic cavities	<<1	distributed		0.2			

COMMENTS : Microphenocrysts of olivine and larger groundmass plagioclase crystals tend to occur in glomerocrysts (i.e. ~30% of the crystals); they tend to form radiating clusters of plagioclase with olivine at the center of the cluster. Skeletal olivine microphenocrysts typically have acicular to skeletal plagioclase radiating from it, suggesting that the plagioclase nucleated on the olivine.
(basalt):

COMMENTS : Calcite + clay vein approximately 1 cm wide containing ~20% angular lithic clasts of basalt, palagonite and feldspar. Palagonite clasts range up to 4 mm in size; these contain unaltered plagioclase microphenocrysts and calcite pseudomorphs after olivine, and the clasts in general are 25-75% replaced by sparry calcite. MnO concretions up to 0.2 mm in diameter common in the dusty portion of the vein. The vein is made of clay at one end of the thin section; lithic clasts are more abundant here (~50% of the mode). Along its length away from the clay segment, the vein turns into a mixture of clay + micritic calcite over an length of ~2-3 mm and then turns into a dusty micritic calcite. Clear sparry calcite occurs along the vein in association with the lithic clasts, particularly the palagonite, partially replacing them. At the end of the thin section opposite the clay portion of the vein are several branching sparry calcite veins (up to 0.2 mm wide) that crosscut the main vein. A thinner calcite vein (<0.1 mm) crosscuts the basalt.
(vein):

187-1163A-10R-1, 116-120 cm (TS#85)			Unit: 2			OBSERVER:	Russo	
ROCK NAME:	Aphyric basalt							
WHERE SAMPLED:	pillow interior (piece 13)							
GRAIN SIZE:	microcrystalline							
TEXTURE:	intersertal							
PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS
			min.	max.	av.			
PHENOCRYSTS								
Plagioclase								
Olivine								
Clinopyroxene								
GROUNDMASS								
Olivine	5	5	0.1	0.8	0.4	euhedral, skeletal to equant sheaf to lath-like plumose quench texture	Olivine and plagioclase occur as clusters (about 30% of olivine). Plagioclase is seriate.	
Plagioclase	36	36		1	0.6			
Clinopyroxene	15	15						
Opaque Minerals Mesostasis	40	41						
SECONDARY MINERALOGY	PERCENT		SIZE (mm)			REPLACING / FILLING	COMMENTS	
			min.	max.	av.			
Clays	~1					groundmass mesostasis	Yellow to reddish brown in color.	
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS	
			min.	max.	av.			
Vesicles	~3		0.2	0.4	0.3	unfilled		
COMMENTS :	thin section is very fresh, with little to no alteration.							

187-1163A-11R-1, 90-94 cm (TS#87) Unit: 2 OBSERVER: Gee
ROCK NAME: Basalt breccia
WHERE SAMPLED: piece 9
GRAIN SIZE: fine grained to microcrystalline
TEXTURE: hypocrytalline

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm)			APPROX. COMP.	MORPHOLOGY	COMMENTS
			min.	max.	av.			
PHENOCRYSTS								
Plagioclase								
Olivine								
Clinopyroxene								
GROUNDMASS								
Olivine	1	2	0.2	0.6	0.4			
Plagioclase	30	35	<0.1	1.8	0.7			Seriate, therefore no phenocrysts; larger crystals show strain extinction.
Clinopyroxene	0	30		0.6	0.4			
Opaque Minerals								
Glass	<10	33						

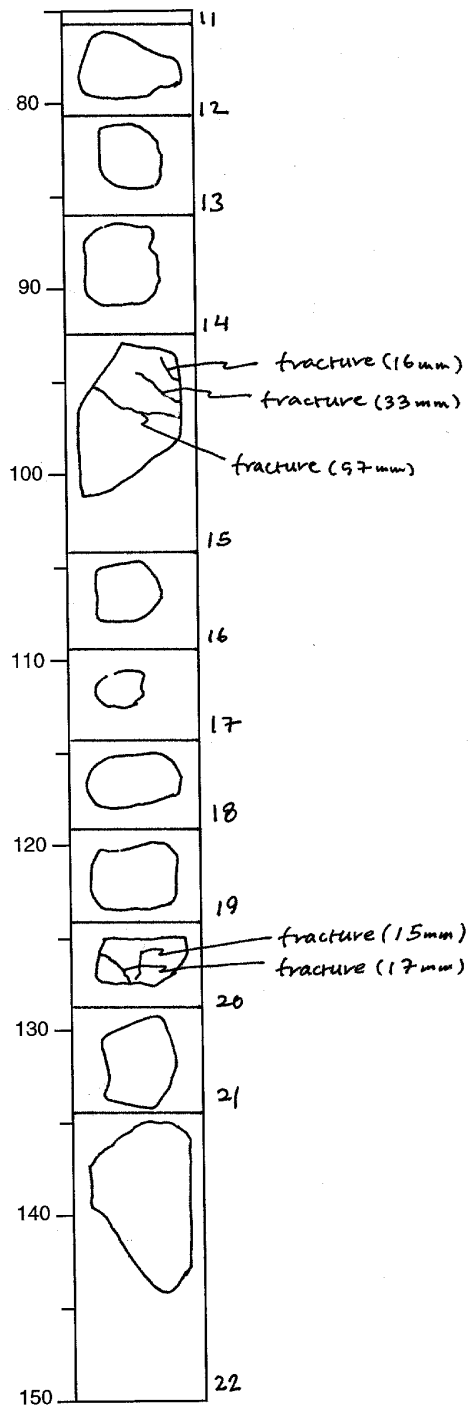
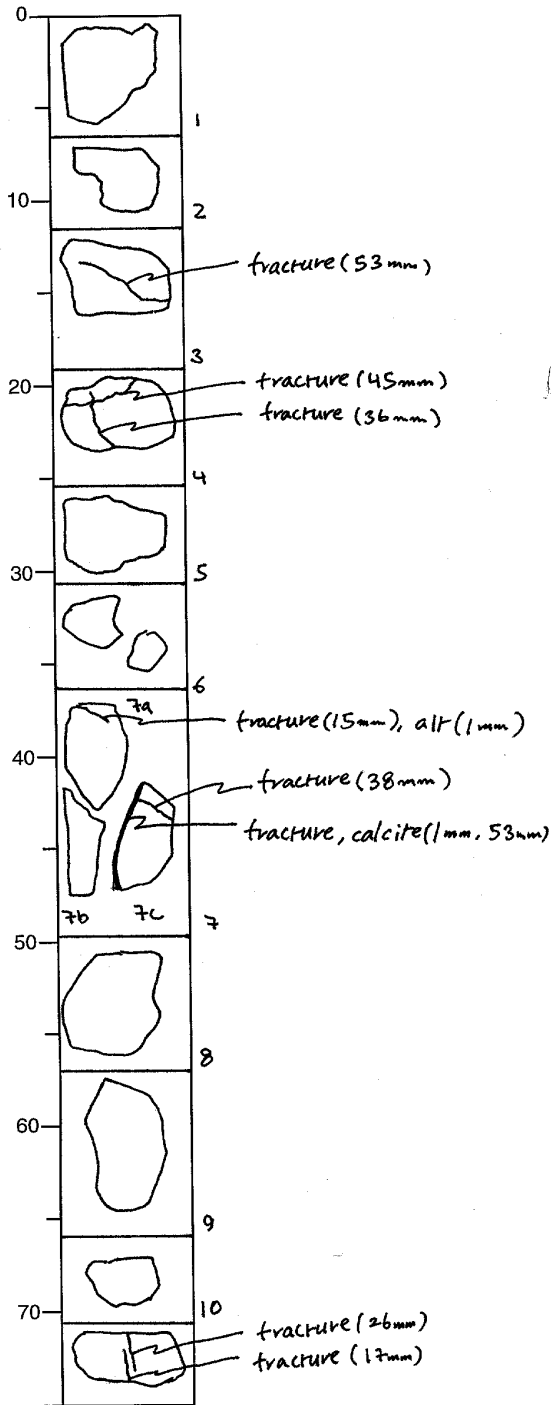
SECONDARY MINERALOGY	PERCENT	LOCATION	SIZE (mm)			REPLACING / FILLING	COMMENTS
			min.	max.	av.		
Clays	60					glass and clinopyroxene,	
Carbonates including aragonite,							

VESICLES/CAVITIES	PERCENT	LOCATION	SIZE (mm)			FILLING / MORPHOLOGY	COMMENTS
			min.	max.	av.		

COMMENTS : A 'Y'-shaped vein up to 16 mm across and predominantly filled with carbonate and micritic mud with Mn-oxide splits the basalt into 3 main pieces. Thes 3 pieces are further cut by 0.4 to 0.8 mm veins filled with crystalline carbonate with a sweeping fan extinction. There are no cross-cutting relationships between the veins. Small (up to 0.05 mm) prismatic colorless (in PPL) crystals line the sides of the veins; they have high birefringence (~3rd order reds) with uneven inclined extinction, and may be aragonite. The host basalt forms angular clasts in the veins. There are also highly altered palagonite clasts, now a mixture of calcite and some concentrically zoned clays which tend to be oblong (up to 2.2 mm long). Plagioclase and olivine are still present in some palagonite clasts (max 0.2 mm). Glomerocrysts (only plagioclase remaining) up to 1.6 mm long consisting of a central plagioclase (~1.4 mm) long with clusters of much smaller plagioclase (~0.2 mm) group together to form complex glomerocrystic clusters up to 3 mm x 2.5 mm. There is some relict olivine in these clusters. All igneous percentages are of the basalt not including the vein filling.

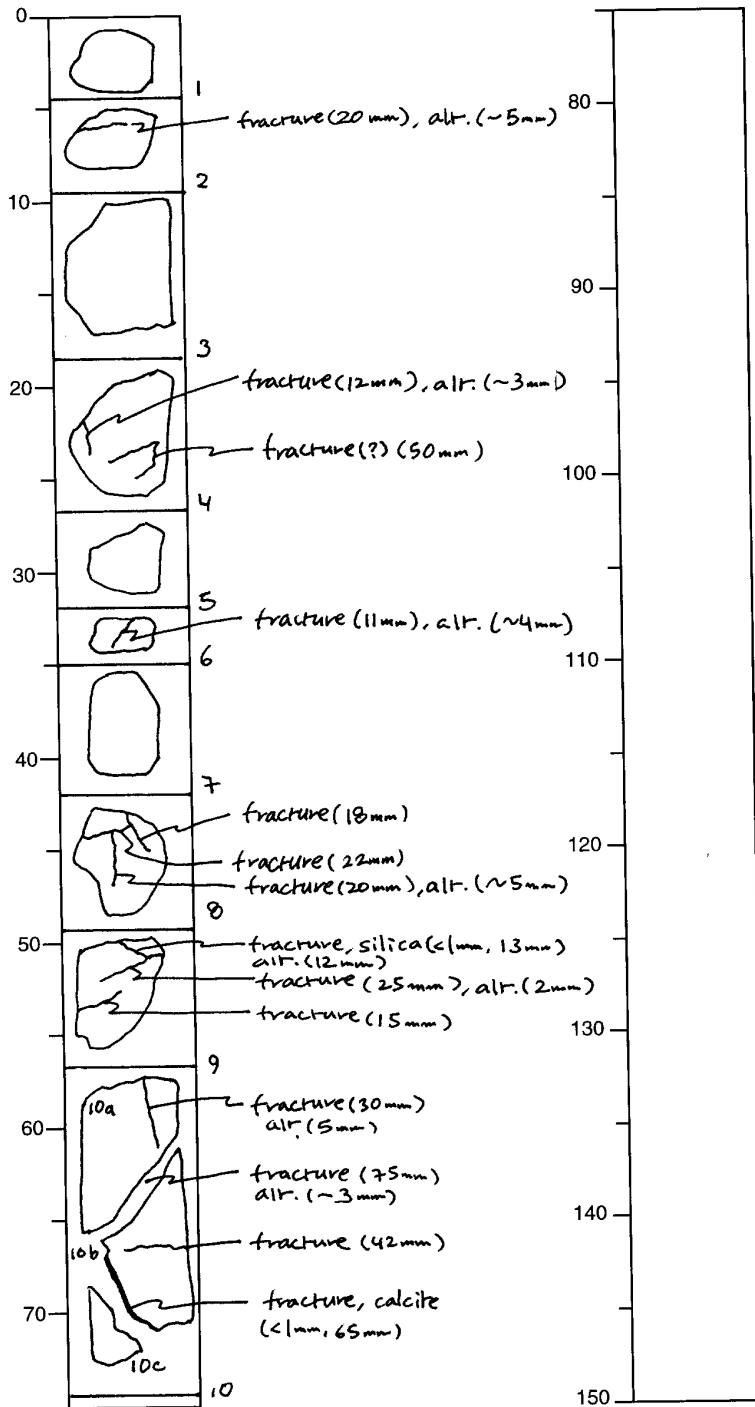
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observ
187	1163A	2R	1	



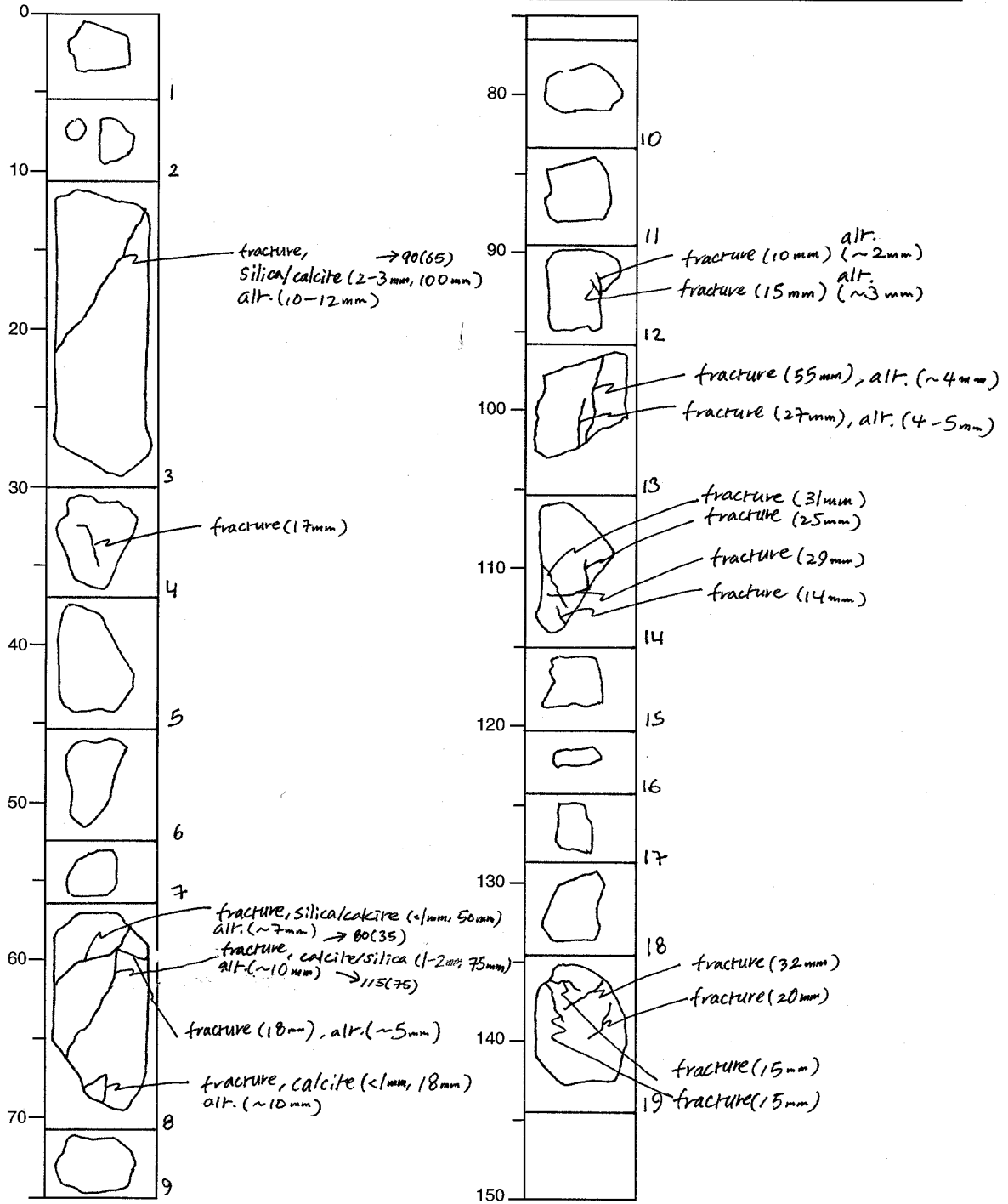
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1163A	2R	2



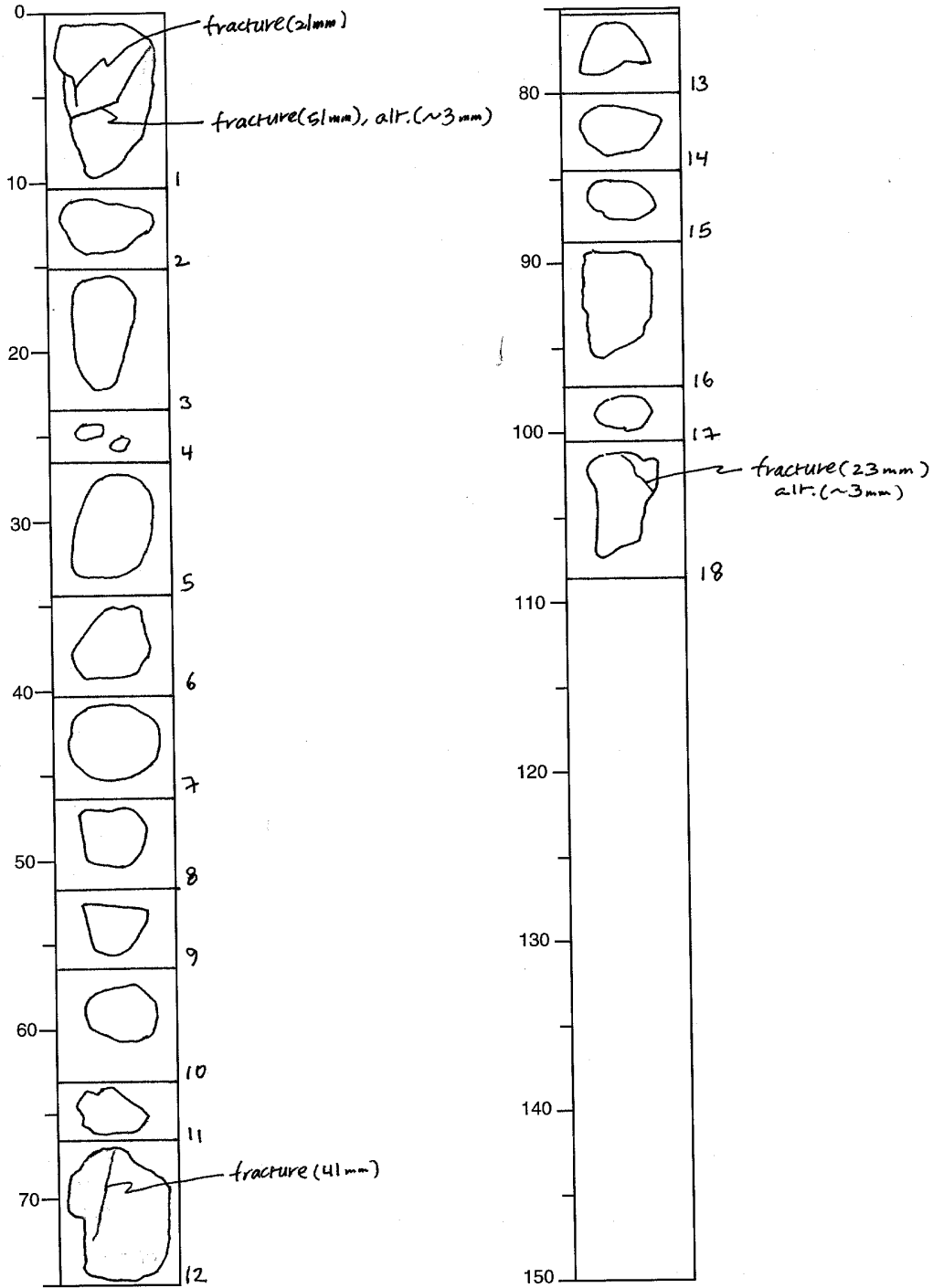
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1163A	3R	1	



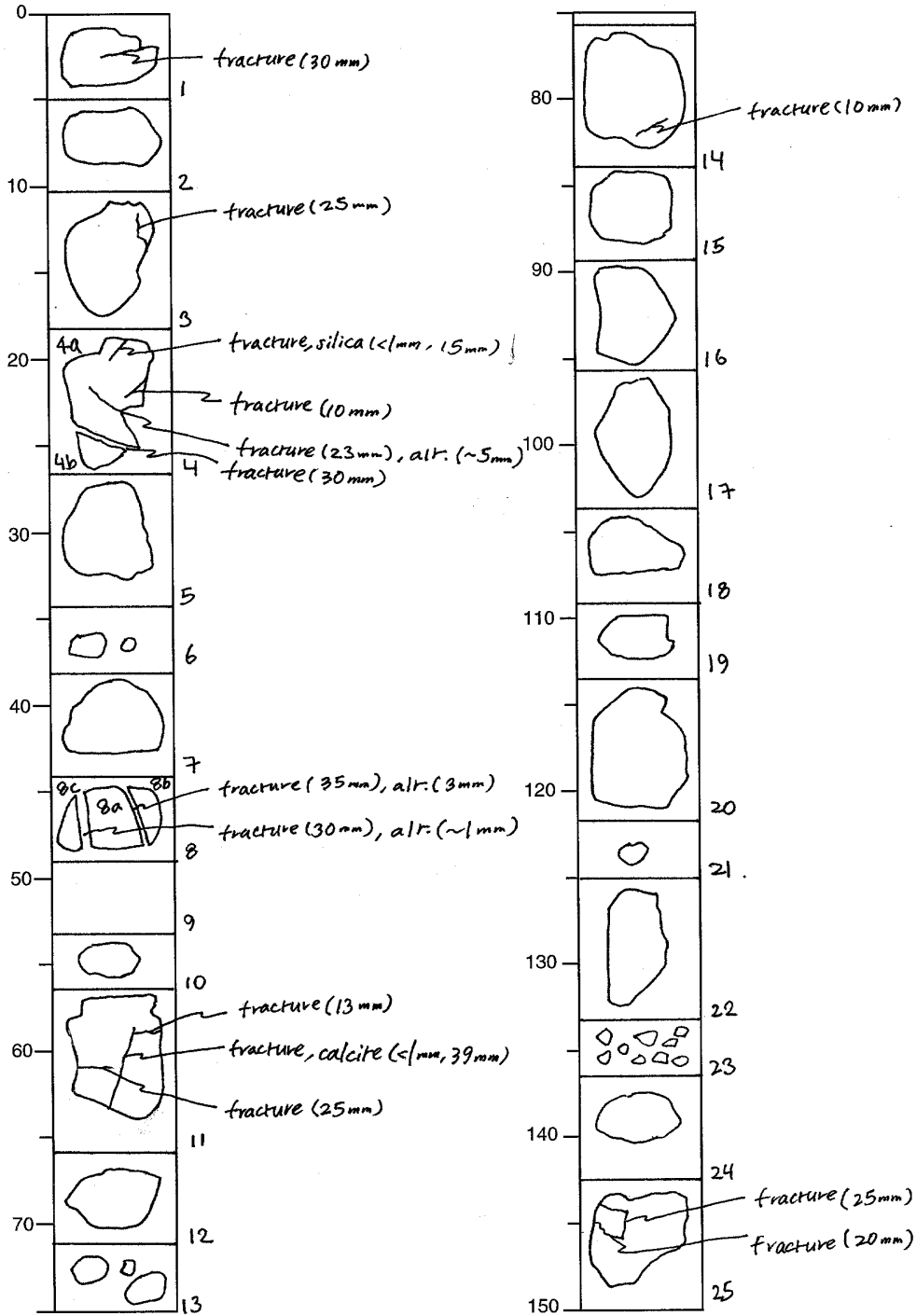
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	O
187	1163A	3R	2	



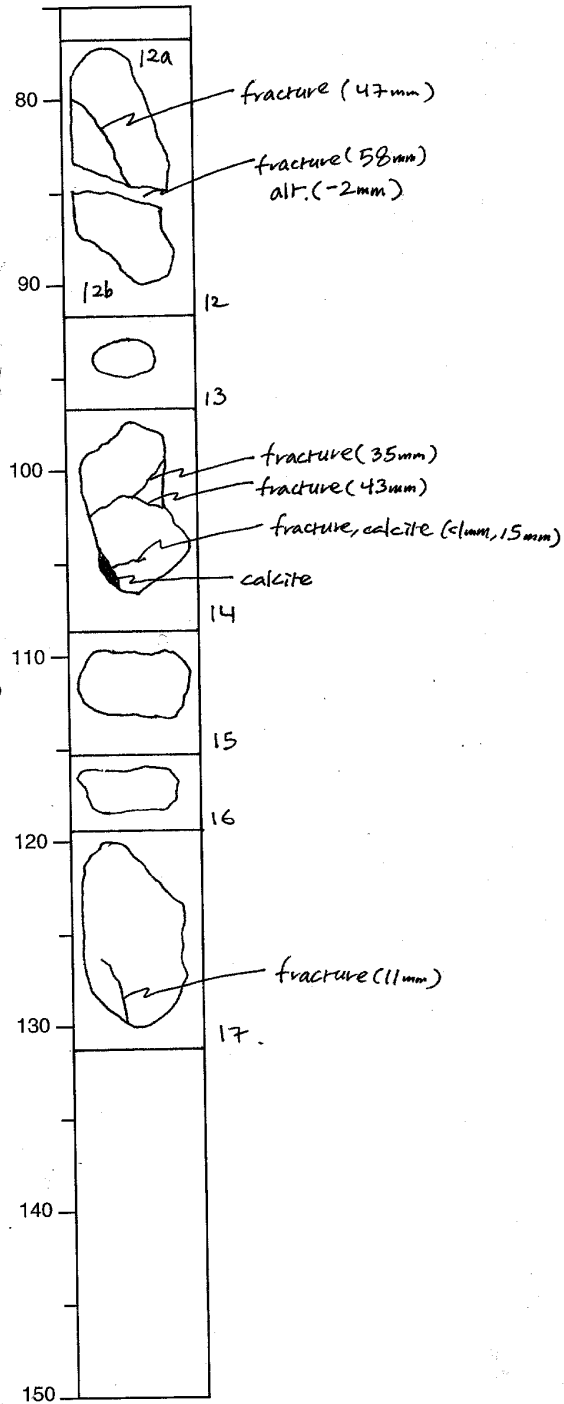
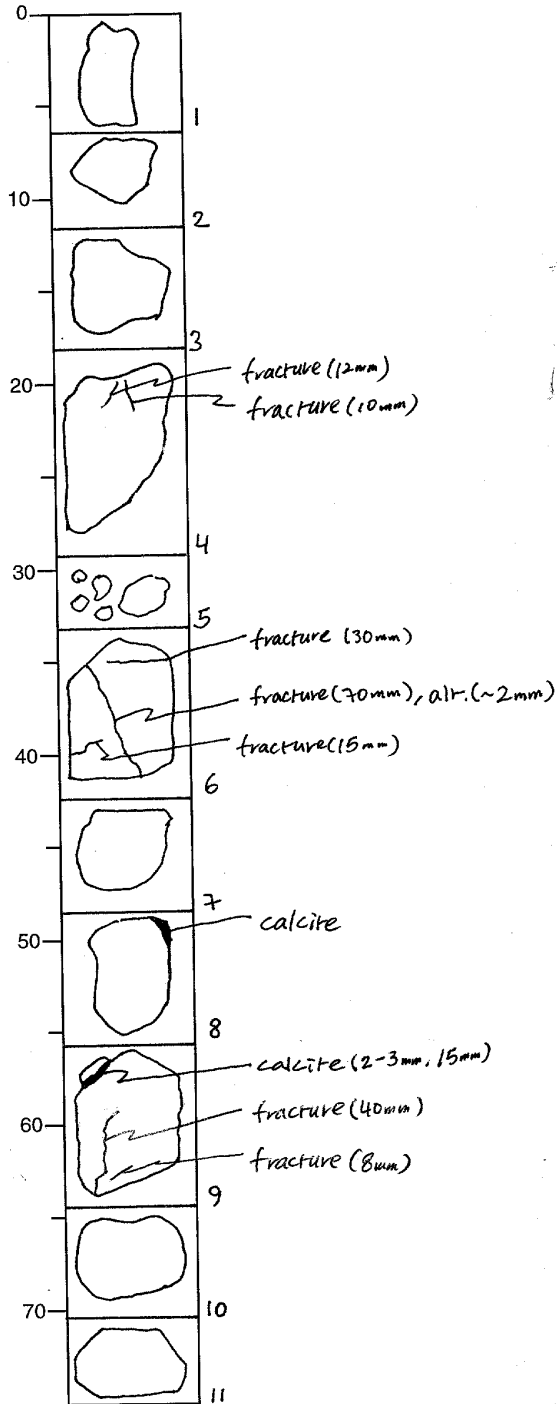
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1163A	4R	1.	



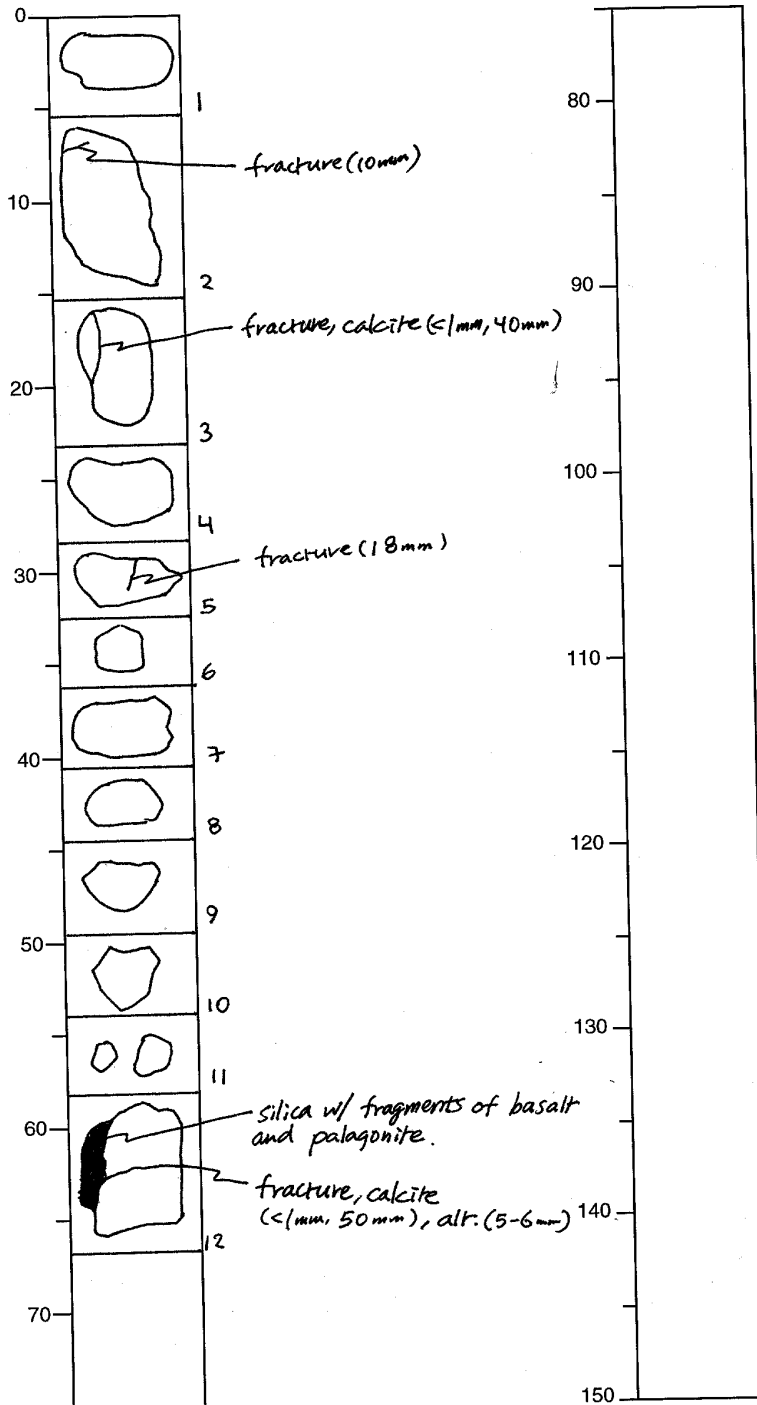
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
197	1163A	5R	1	



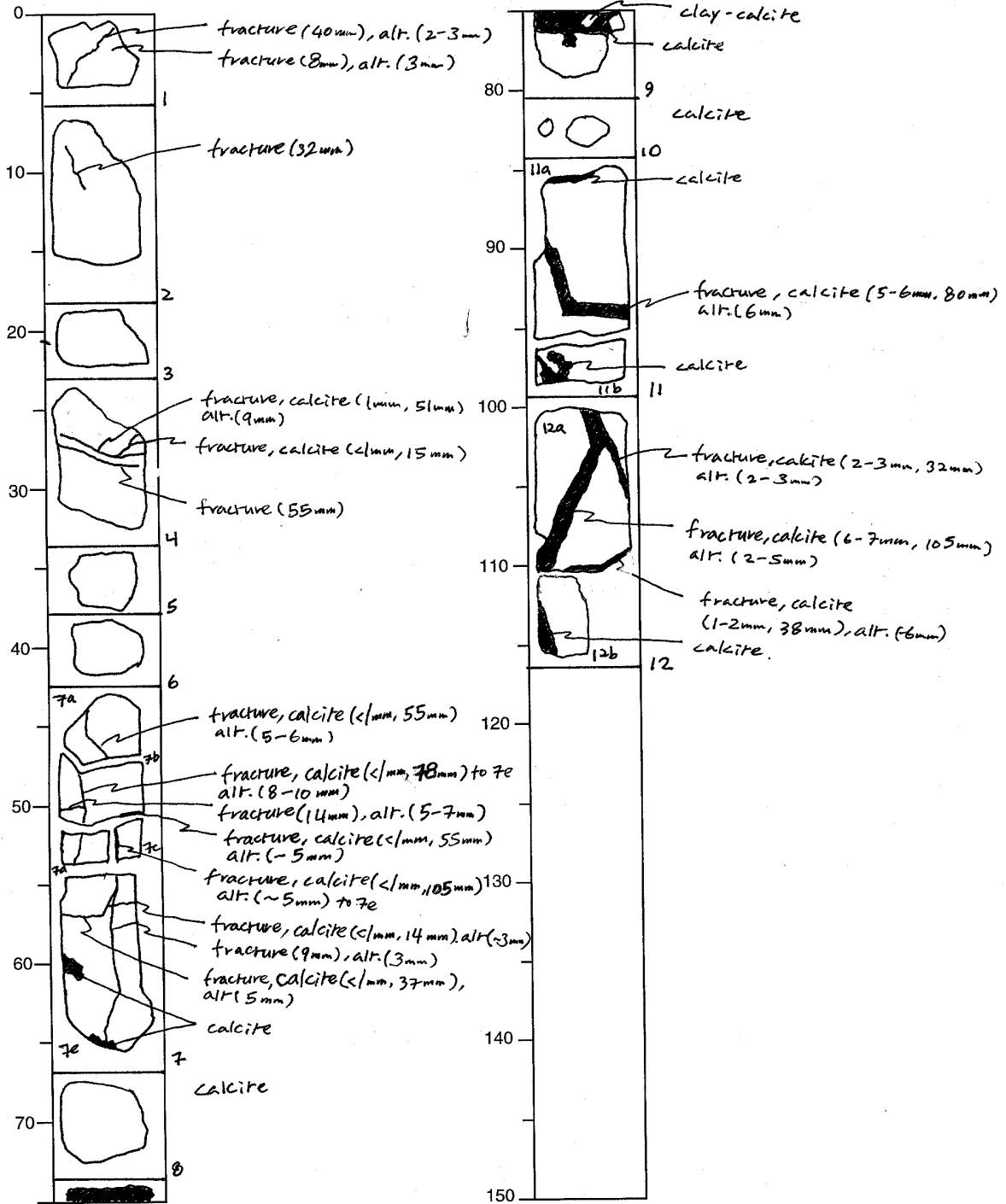
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
107	1163A	5R	2



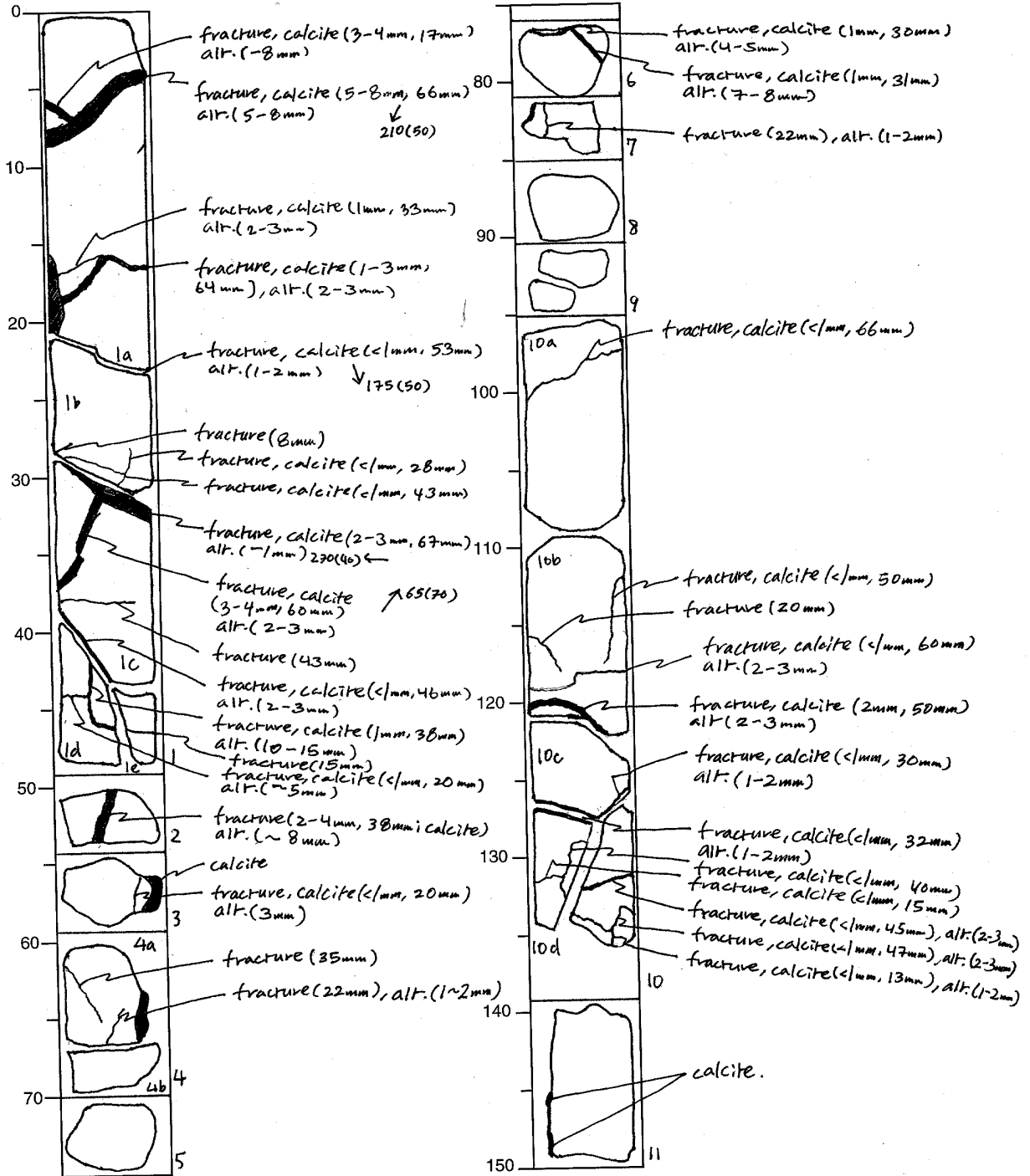
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1163A	6R	1	



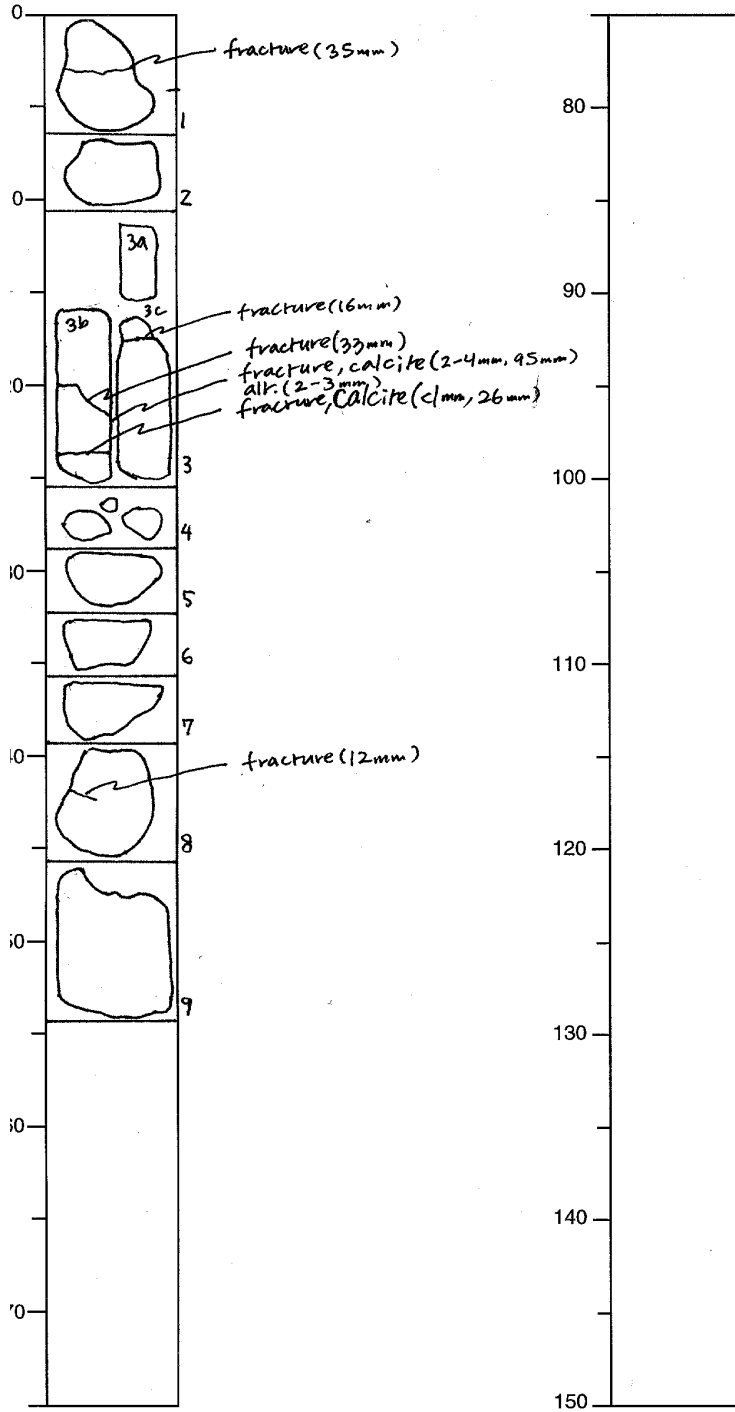
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1163A	6R	2	



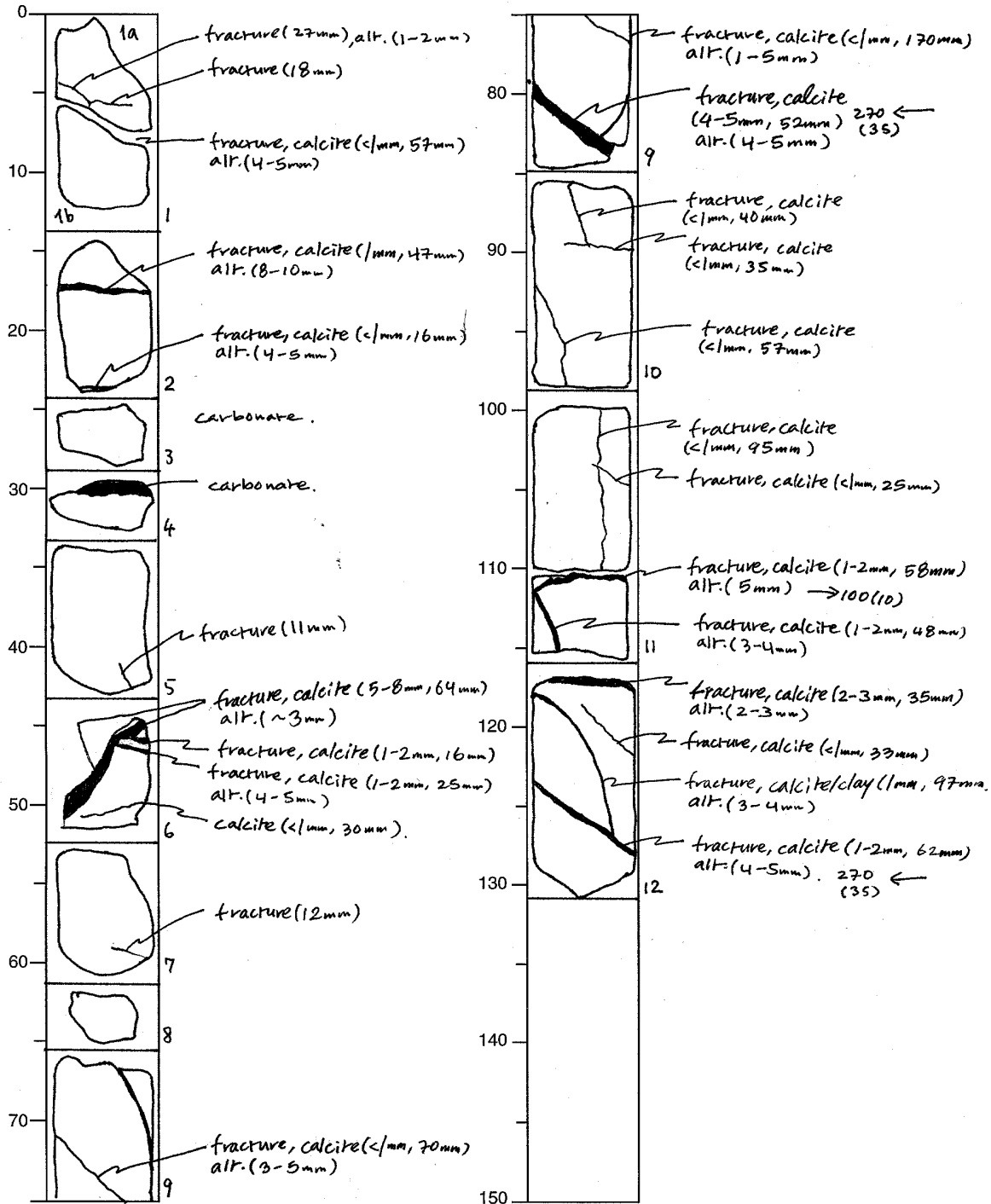
TRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1163	GR	3



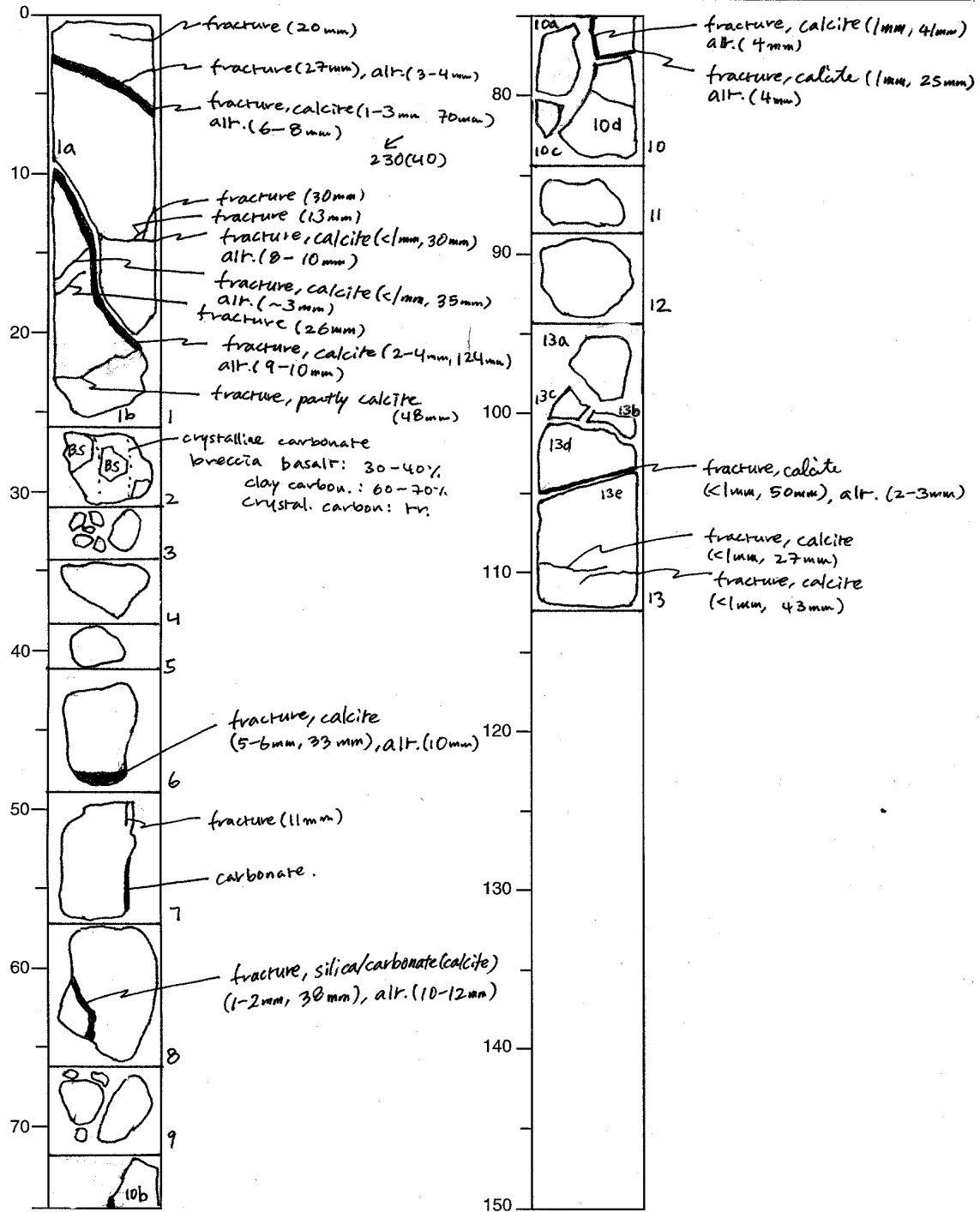
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1163A	7R	1	



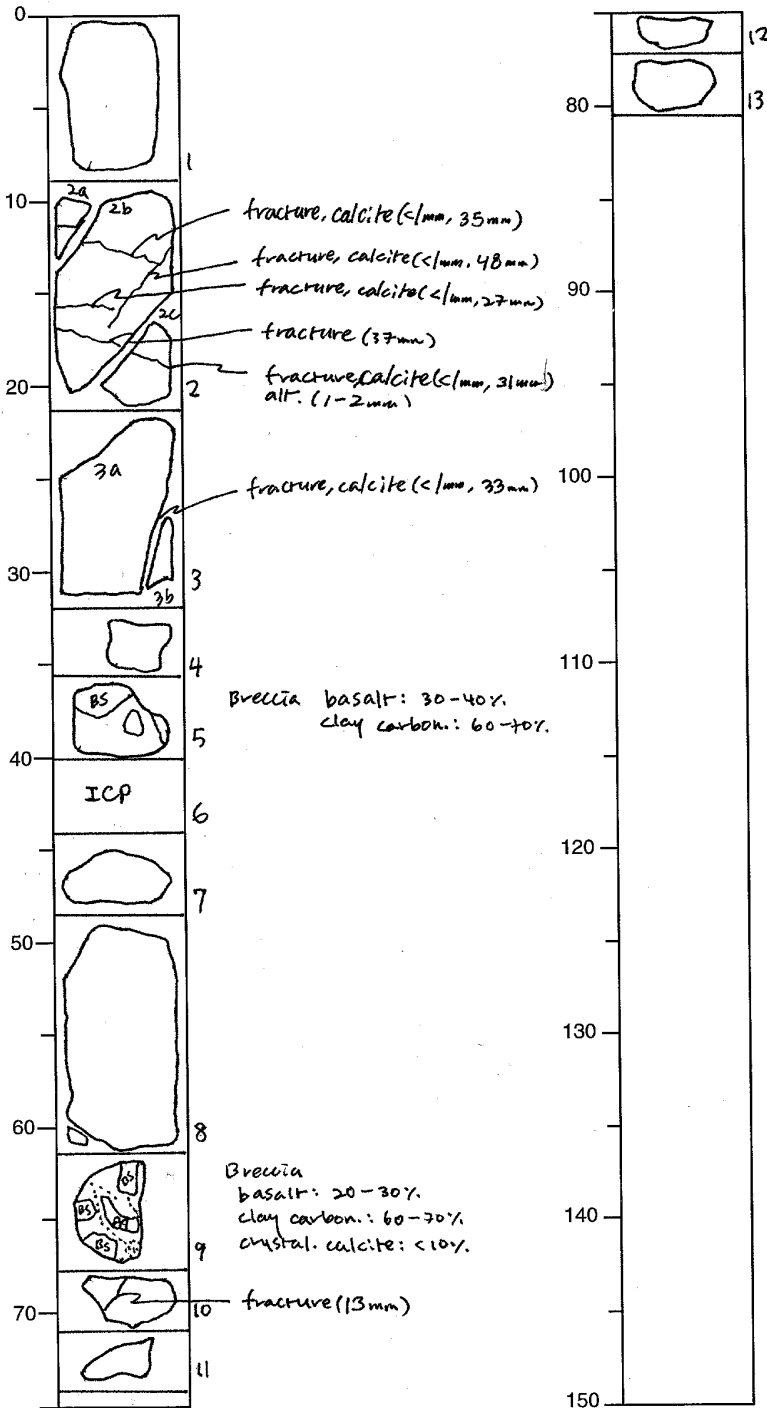
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1163A	7R	2	



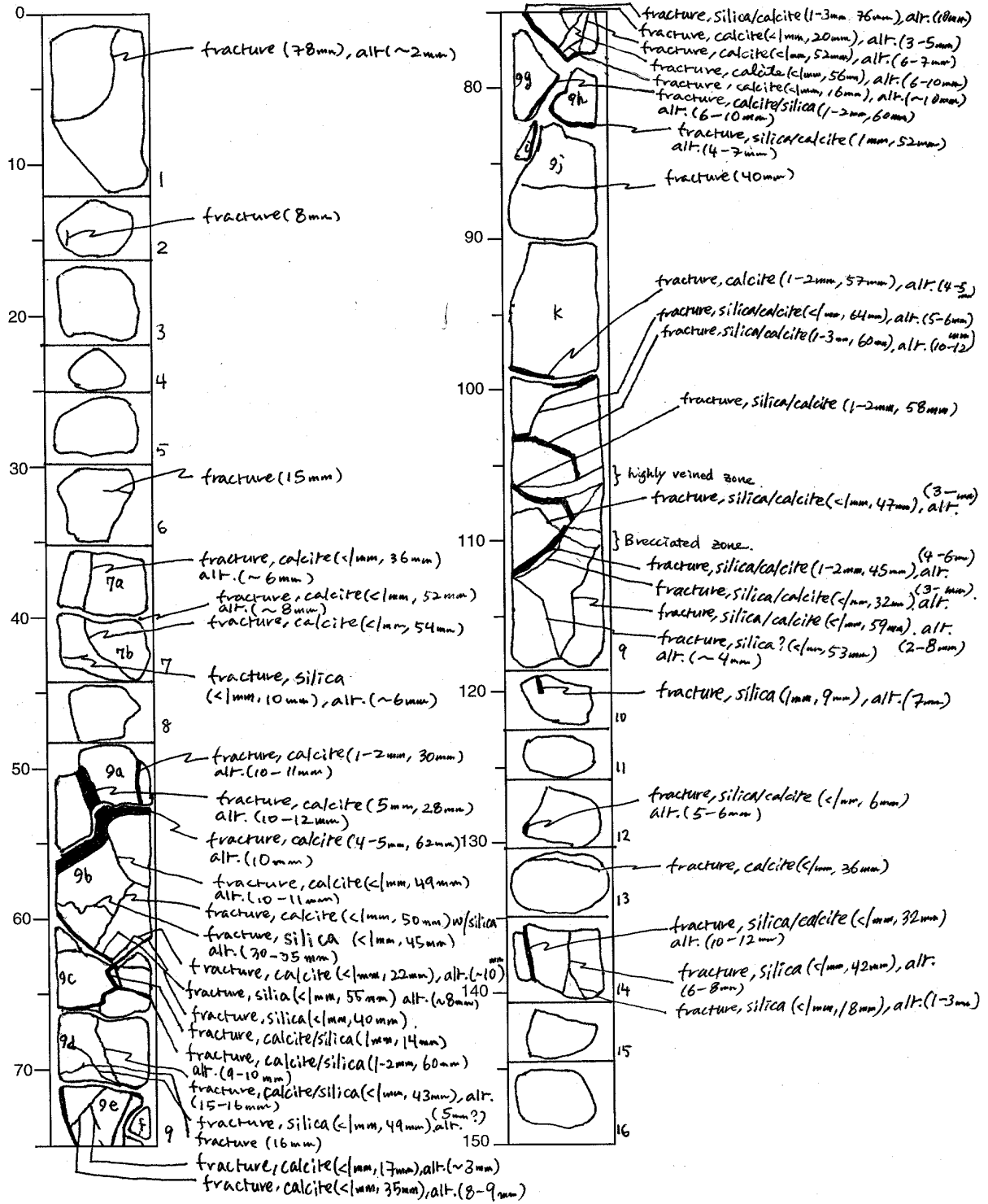
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1163A	8R	1



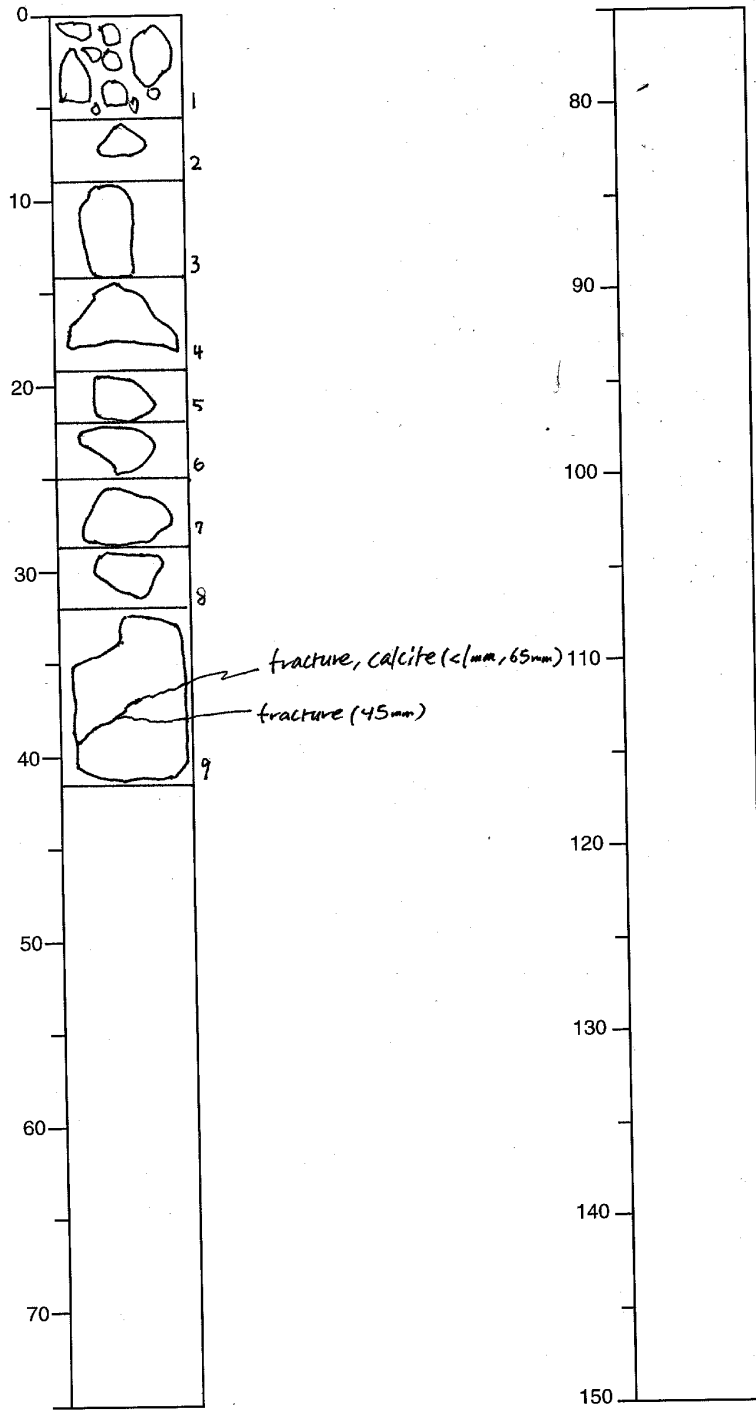
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	463A	9R	1	



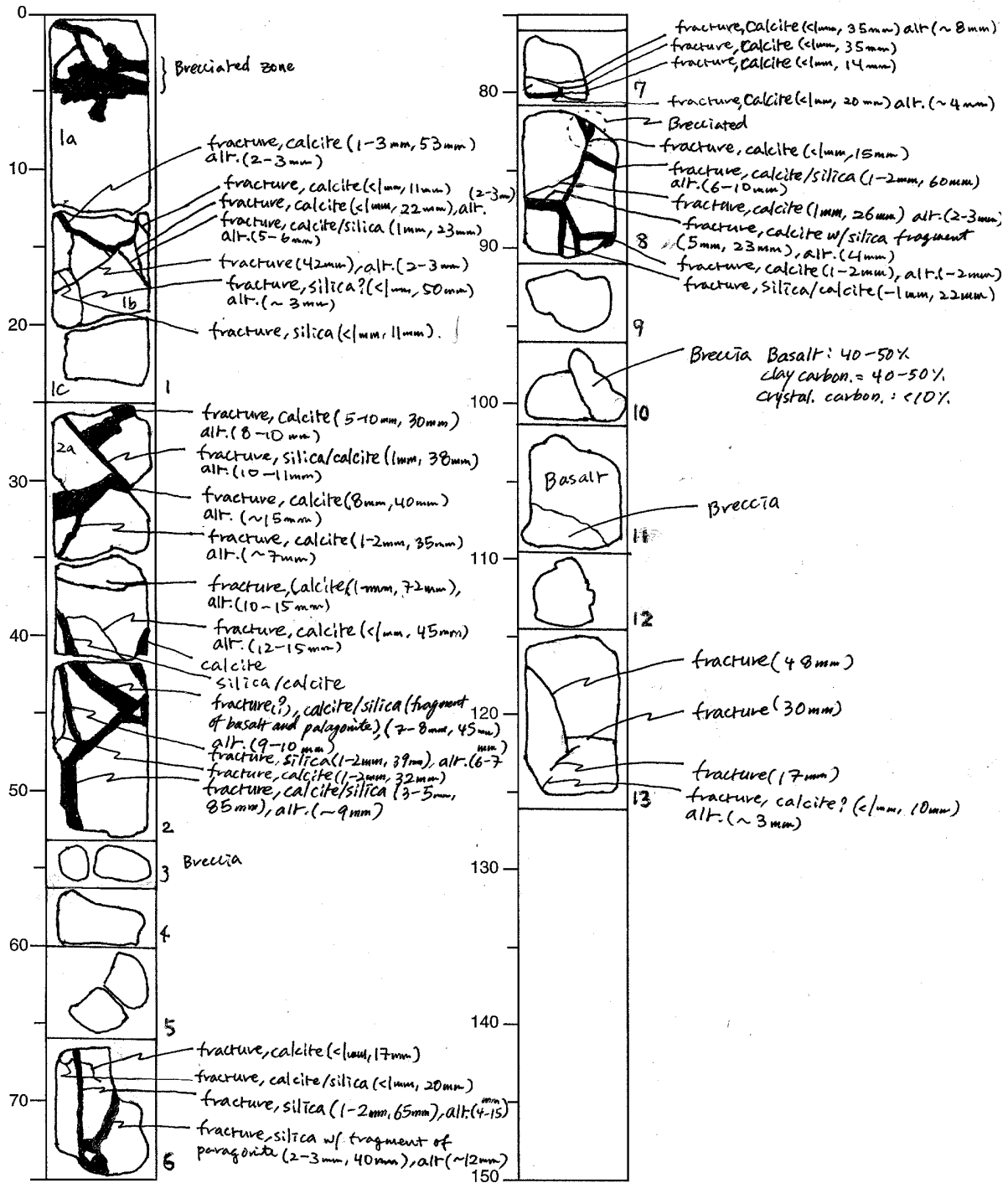
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1163A	9R	2



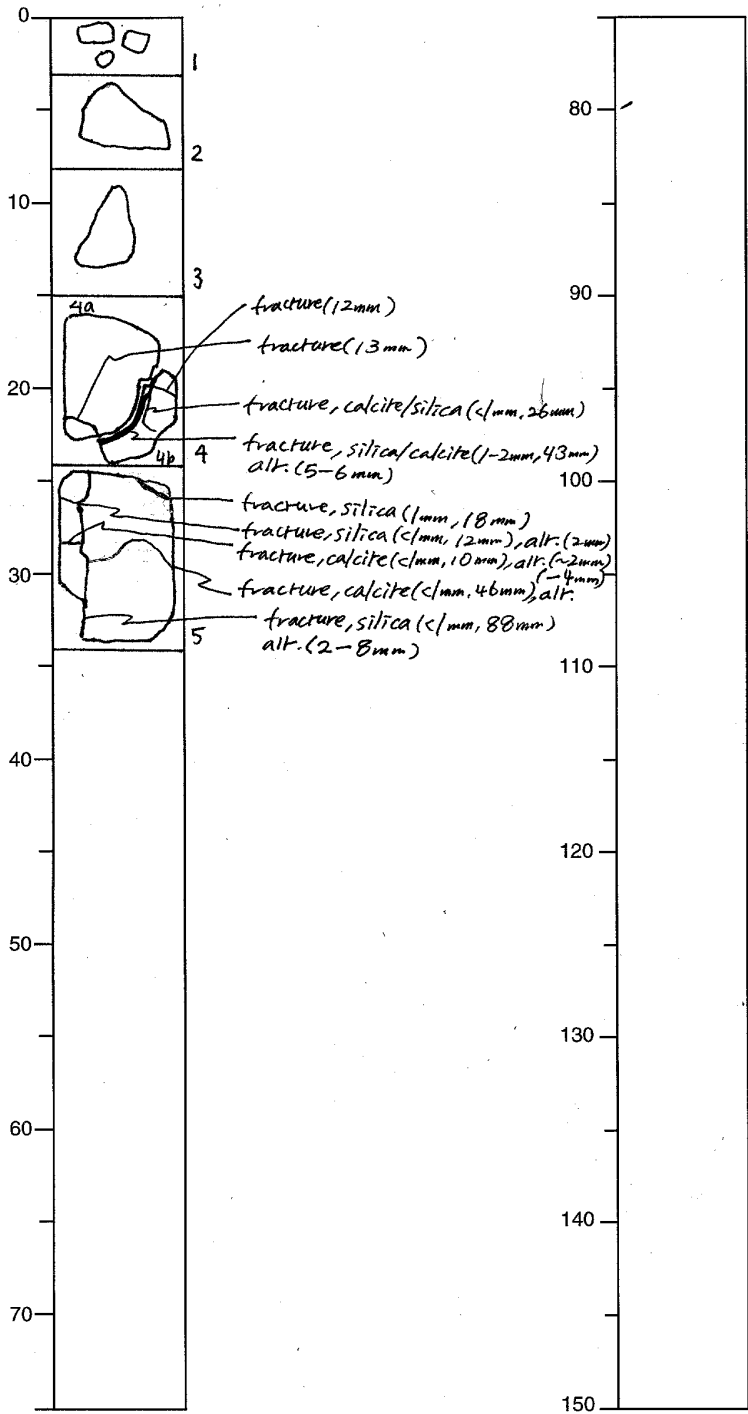
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1163A	10R	1	



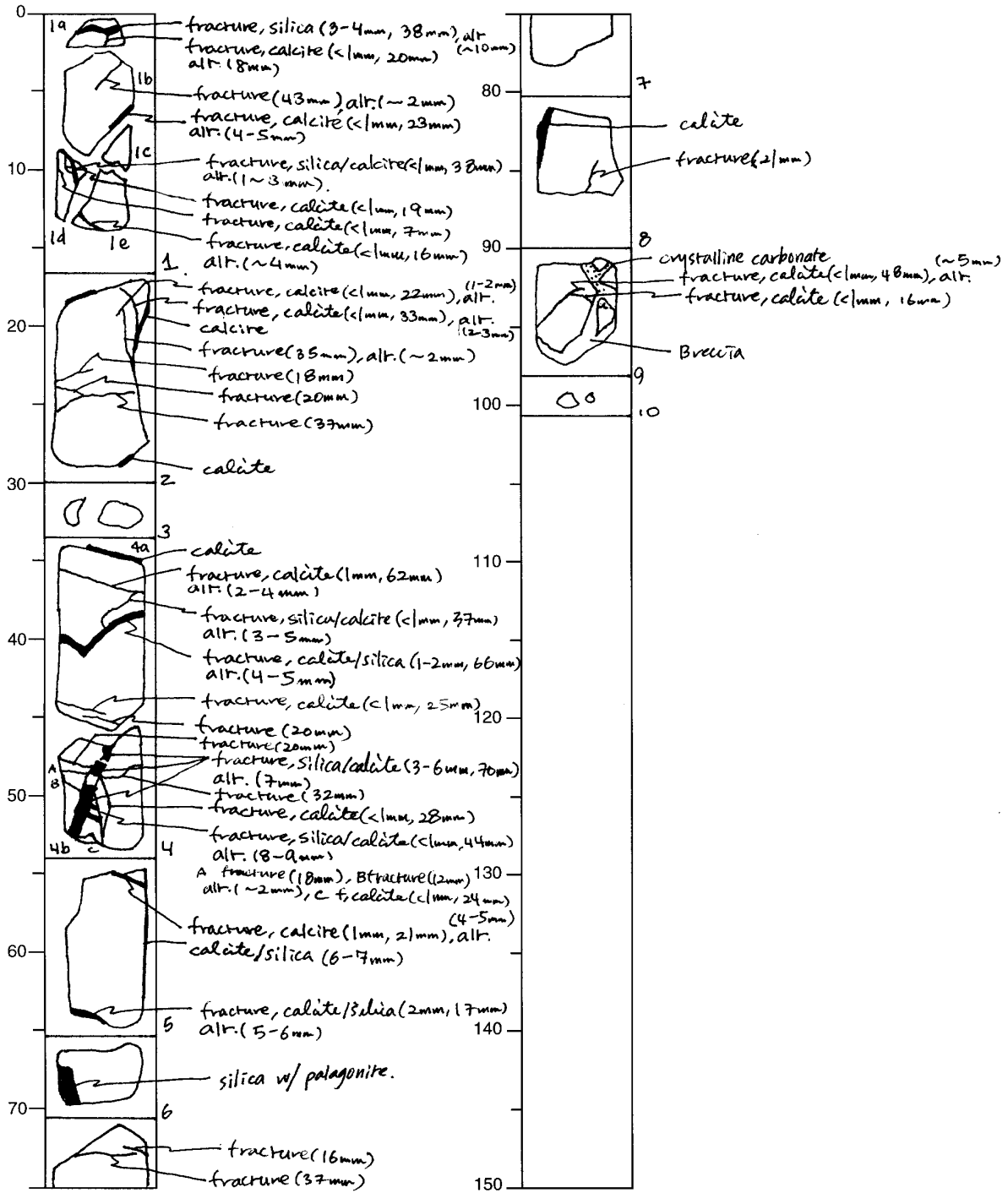
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1163A	10R	2



STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
107	1163A	11R	1	



STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Obse
107	1163A	11R	2	

