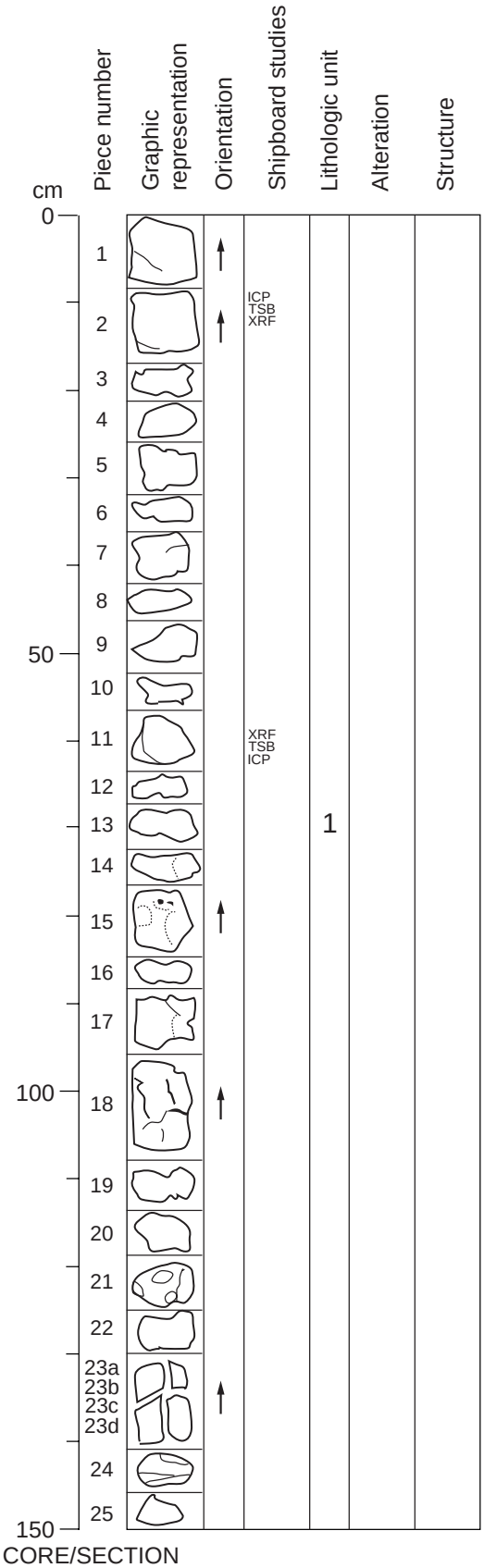
Core Photo



187-1156A-2R-1

UNIT 1: BASALT-CARBONATE BRECCIA

PIECES 1-25

This is a breccia made up of basalt, glass and micrite clasts in a micritic carbonate matrix. Some of the basalt clasts have adhering patches or fracture infills of calcareous sediments. These appear to have been broken along with the basalt at the time of brecciation. All void space in the coarse breccia has been filled by sediment. This sediment is dominantly calcareous, now micritic.

In places, it is itself a fine, matrix supported polymict breccia with components derived from the basalt, basaltic glass/ palagonite, the pre-existing sediment and probably new sediment. Finally, sediment has been partially replaced by patchy, sparry calcite which also form linings along cavities. There is no obvious sorting either by clast size or density.

CLAST MATERIAL

a) Basalt:

Basalt clasts are angular and vary in size from less than 1 mm to 12 cm. All clasts are moderately plagioclase-olivine phyric. The overall percentage of olivine and plagioclase phenocrysts varies (non systematic) from fragment to fragment, as do their relative abundance, but in general there is more plagioclase than olivine. Olivine and plagioclase and olivine glomerocrysts are seen in most pieces (e.g., Piece 18, 23, and 24).

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	3	2	5	<1	tabular
Olivine	1.5	1.5	3	<1	euhedral
Total	4.5				

GROUNDMASS: Fine-grained
COLOR: Buff to medium gray
VESICLES: There are <1% of <1 mm diameter vesicles in the basalt, with rare vesicles in the glass, lined with cryptocrystalline blue silica (e.g., Piece 12).

b) **Glass/Palagonite**:

Glass fragments occur throughout the section. Glass is variably palagonitized and clasts of palagonite are present in the calcareous matrix of pieces with micritic sediment attached (e.g., Pieces 3 and 8). The mode of the chilled margins is ~10 mm (e.g., Pieces 6 and 8).

c) **Micritic limestone**

A pink micrite occurs both as a coating on basalt and glass clasts and as clasts within the carbonate matrix (e.g., Pieces 19 to 21). These clasts are angular to rounded and vary in size from less than 1 mm to 2.5 cm. Mn oxide coating with dendritic growth down into the clast occur. Where the micrite adheres to the side of basalt clast the Mn oxide coating is present on both the sediment and the basalt, but is thickest where the sediment tapers out (e.g., Piece 8).

d) **Mn concretions**

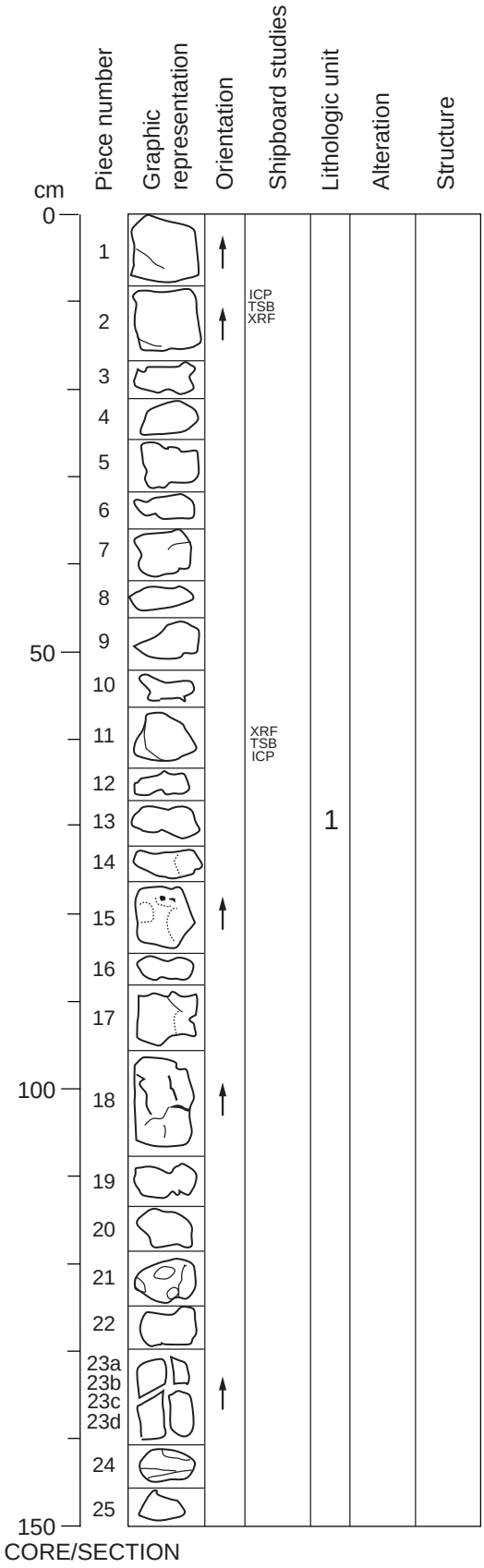
Small (<1 mm) rounded concretions of Mn oxide are present in the micritic clasts and in the carbonate matrix. The centers of these nodules are in some cases occupied by small olivine or plagioclase crystals. These Mn nodules are concentrated in discontinuous wispy horizons in Piece 24.

MATRIX

Carbonate matrix is present in all pieces except for Piece 1. The matrix is micritic and has a grayish color. The amount varies from ~2% in Piece 18 to ~90% in Piece 24, the mode is ~30% carbonate (e.g., Pieces 7, 8, 11, 15, 16, 17, and 20). Vugs of calcite up to 3 mm in size are present in Pieces 10, 19, 20, 21, 22 and 23.

VEINS/FRACTURES: Fractures are rare in the basalt in this section, possibly due to the fragmental nature of the core, all existing fractures have already been exploited. Where fractures do exist they are small (e.g., <1 mm wide fracture with a 10 mm diameter) oxidation halo in Piece 1 and similar sized Mn coated fractures in Piece18.

Core Photo



187-1156A-2R-1 (cont'd)

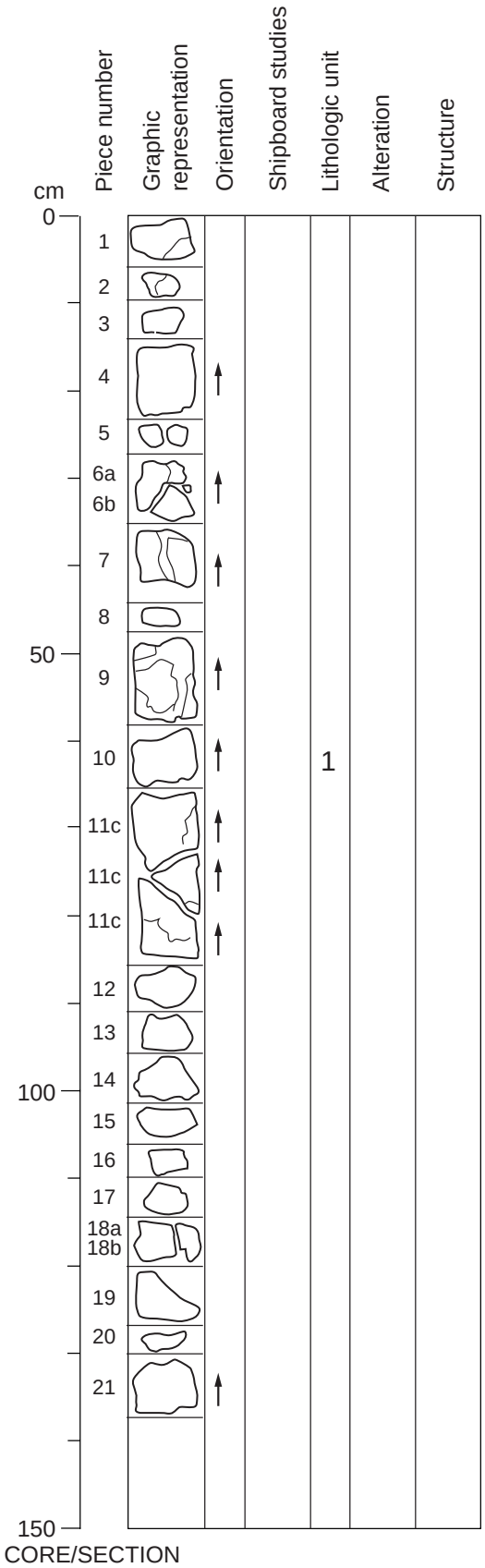
UNIT 1: BASALT-CARBONATE BRECCIA

PIECES 1-25

ALTERATION: Overall the basalt in this section is slightly altered. Olivine has been replaced by Fe oxyhydroxide in oxidized margins at the edges of pieces (e.g., the bottom of Piece 1), and in halos around open fractures (e.g., Piece 18). In Piece 2 olivine is replaced by a waxy green-yellow hydrated silicate(?). Approximately 50% of all olivine in this section has been replaced. Glass is variably palagonitized and clasts of palagonite are present in the micrite and calcareous matrix of pieces with sediment attached, e.g., Pieces 3 and 8. Cross-sections of round palagonite clasts (in cut faces) frequently display concentric zones of variably colored alteration products ranging from yellow-cream to pink-brown, e.g., Piece 8. Where these round clasts dominate the sediment there is an oolitic appearance (e.g., Piece 8) (Drawing attached). Buff colored basalt has brown alteration (clays?) replacing the groundmass (e.g Piece 4). Pieces 13, 15 and 18 have bleached altered glass in their chilled margins, this is crossed by a series of interconnecting veins which have a green surface. There are small (<10 mm) vugs lined with dog tooth calcite in Pieces 8, 9, 10, 11, 19, and 20, they are mainly in the sparry calcite.

STRUCTURE: Pillow lava debris with calcareous sediment, later cross-cut by sparry calcite: an immature breccia.

Core Photo



187-1156A-2R-2

UNIT 1: BASALT-CARBONATE BRECCIA

PIECES 1-21

CLAST MATERIAL:

a) **Basalt**: (see description on 187-1156A-2R-1)
Basalt clasts are angular and vary in size from less than 1 cm to 20 cm. The overall percentage of olivine and plagioclase phenocrysts varies (non-systematic) throughout the section, as do their relative abundance, but in general there is more plagioclase than olivine. Olivine and plagioclase and olivine glomerocrysts are seen in most pieces (e.g., Piece 9, 6, 18, and 21). In Piece 11, there is a gradational increase in the modal percentage of plagioclase and olivine from the top to the bottom of the piece caused by flow banding. Pieces 12,16, and 17 are sparsely phyric basalt. These may be fragments of a flow banded pillow (e.g., Piece 11). An olivine on the outer surface of Piece 15 has numerous glassy melt inclusions up to 20 micrometer across.

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	4	1.5	5	<1	tabular
Olivine	1	1	3	<1	euhedral
Total	5				

GROUNDMASS: Fine-grained

COLOR: Buff to medium gray

VESICLES:There are <1% of <1 mm diameter vesicles in the basalt, with rare vesicles in the glass.

b) **Glass/Palagonite**: (see description on 187-1156A-2R-1)
Most of the pieces have glass fragments, except for Pieces 16, 17, 18, and 19. The width of the chilled margin is generally ~5 mm (e.g., Piece 4, 7, 11, and 13).
The size range of the variably palagonitized clasts varies from less than 1 cm to 5 cm.

c) **Micritic limestone** (see description on 187-1156A-2R-1).
The amount of micritic limestone is less abundant from Pieces 11 to 21. The clasts of micritic limestone are angular to rounded. Their size varies between less than 1 mm to 3 cm.

d) **Mn concretions** (see description on 187-1156A-2R-1).
Mn nodules are concentrated in discontinuous wispy horizons in Pieces 4, 9 and 10.

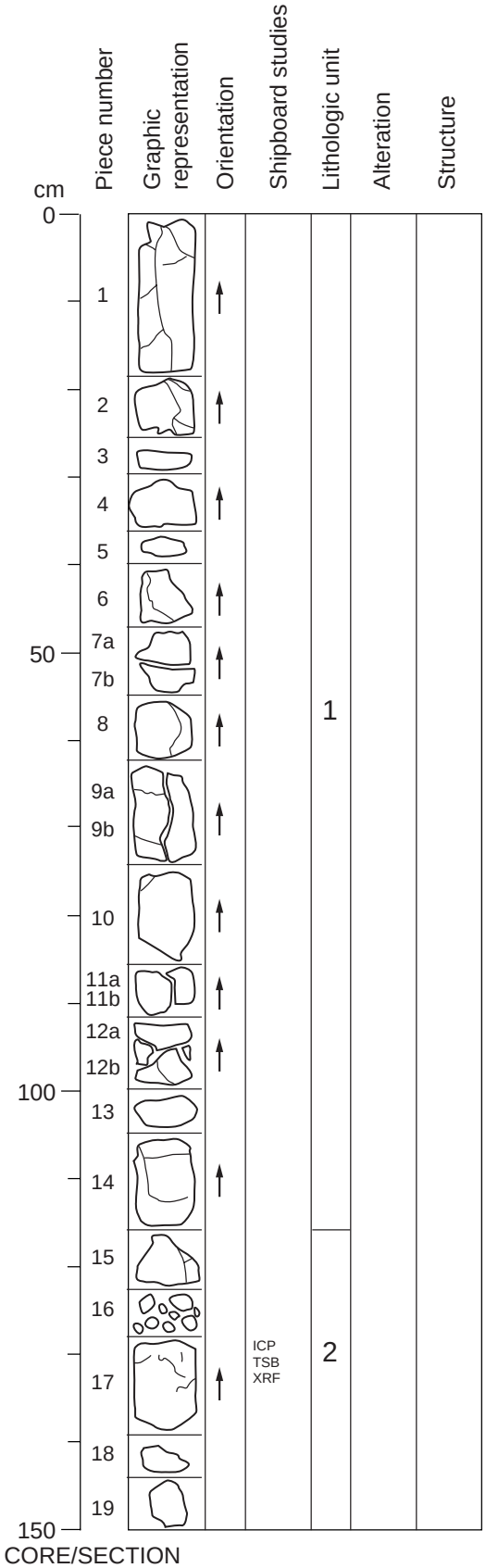
MATRIX: (see description on 187-1156A-2R-1).
Carbonate sediment is present in all pieces except for Pieces 8, 12, 15, 17, and 19. The amount varies from ~1% in Piece 20 to ~60% in Piece 4, the mode is ~30% carbonate (e.g., Pieces 1, 4, 6, 7, 9, 10, and 21).
Calcite vugs up to 3 cm in size occur on Pieces 6 and 7.

VEINS/FRACTURES: Fractures are rare in the basalt in this section, possibly due to the fragmental nature of the core, all existing fractures have already been exploited. In Piece 10, there are two veins 4 mm wide filled by pink micrite.

ALTERATION: Overall the basalt in this section is slightly altered. Olivine has been replaced by Fe oxyhydroxide in oxidized margins at the edges of pieces (e.g., Piece 15), and in halos around open fractures (e.g., Piece 7). Approximately 50% of all olivine in this section has been replaced. Glass is variably palagonitized and clasts of palagonite are present in the micrite and calcareous matrix of pieces with sediment attached (e.g., Pieces 4 and 7). Cross-sections of round palagonite clasts (in cut faces) frequently display concentric zones of variably colored alteration products ranging from yellow-cream to pink-brown (e.g., Piece 4). Buff colored basalt has brown alteration (clays?) replacing the groundmass (e.g., Piece 6). Chilled margins in Pieces 8 and 10 are partially replaced by cryptocrystalline white (hydrous) silica.

STRUCTURE: Pillow lava debris with calcareous sediment, later cross-cut by sparry calcite: an immature breccia.

Core Photo



187-1156A-2R-3

UNIT 1: BASALT-CARBONATE BRECCIA

PIECES : 1-14

CLAST MATERIAL:
a) **Basalt**: (see description on 187-1156A-2R-1).
The size of basalt clasts vary from less than 1 cm to 18 cm.
The overall percentage of olivine and plagioclase phenocrysts varies (non-systematic) throughout the section, as do their relative abundance but in general there is more plagioclase than olivine.

PHENOCRYSTS:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	3	1.5	4	<1	tabular
Olivine	1	1	2	<1	euhedral
Total	4				

GROUNDMASS: Fine-grained
COLOR: Buff to medium gray
VESICLES: There are <1% of <1 mm diameter vesicles.
b) **Glass/Palagonite**: (see description on 187-1156A-2R-1).
Glassy clasts occur throughout the section in the pinkish micritic sediment. They do not have a preferred orientation. The clast size varies from less than 1 mm to 1 cm. The mode of the chilled margins is ~10 mm (e.g., Pieces 2, 3, 4, and 7).
c) **Micritic limestone**: (see description on 187-1156A-2R-1).
Micritic limestone clasts vary from less than 1 mm to 6 cm.
d) **Mn concretions**: (see description on 187-1156A-2R-1).
Mn nodules form wispy horizons, e.g., Pieces 7, 9, 12 and 14.
MATRIX:(see description on 187-1156A-2R-1).
Carbonate sediment is present in all pieces except for Piece 11. The amount varies from ~0.5% in Pieces 3 and 5 to ~90% in Piece 7. Calcite vugs up to 0.2 cm are present in this section (e.g., Piece 2).
VEINS/FRACTURES: Fractures are rare in this section, possibly due to the fragmental nature of the core.
ALTERATION: Overall the basalt in this section is slightly altered. Olivine has been replaced by Fe oxyhydroxide in oxidized margins at the edges of pieces (e.g., Pieces 2 and 8). Approximately 30% of all olivine in this section has been replaced. Glass is variably palagonitized and clasts of palagonite are present in the micrite and calcareous matrix of pieces with sediment attached (e.g., Pieces 1 to 3).
STRUCTURE: Pillow lava debris with calcareous sediment, later cross-cut by sparry calcite. An immature sediment, a breccia.

UNIT 2: MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

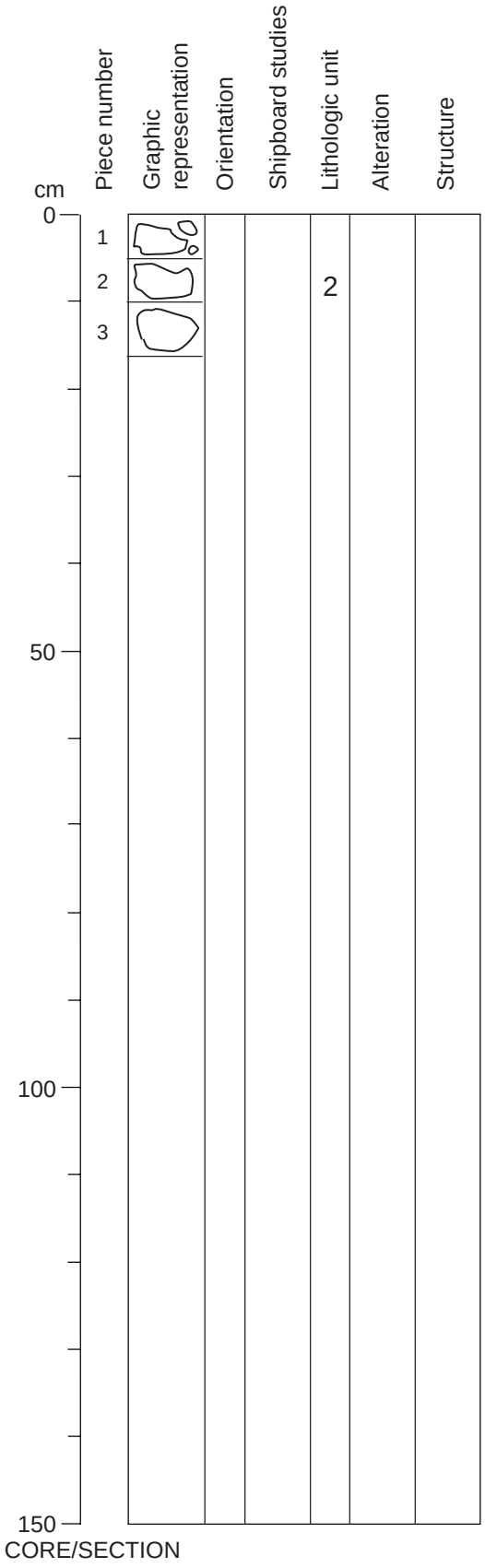
PIECES:15-19

INTERNAL CONTACTS: Glassy rinds and/or chilled margins on Pieces 15 to 17. The glassy rinds range from 0.3 mm thick in Piece 16 to 1.5 cm in Piece 17.

PHENOCRYSTS:**S**:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	1.5	1.5	3	<1	euhedral
Olivine	1	1	2	<1	equant
Total	2.5				

GROUNDMASS: Fine-grained
COLOR: Medium gray
ALTERATION: Overall the unit 2 is slightly altered. Glass is variably palagonitized in Pieces 15, 16, and 17. Olivine is replaced by Fe oxyhydroxide in oxidation haloes around veins (e.g., piece 19).
STRUCTURE: Pillow
ADDITIONAL COMMENTS: Piece 18 is made up of clasts of pink micrite surrounded by a crystalline matrix.

Core Photo



187-1156A-2R-4

UNIT 2: MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

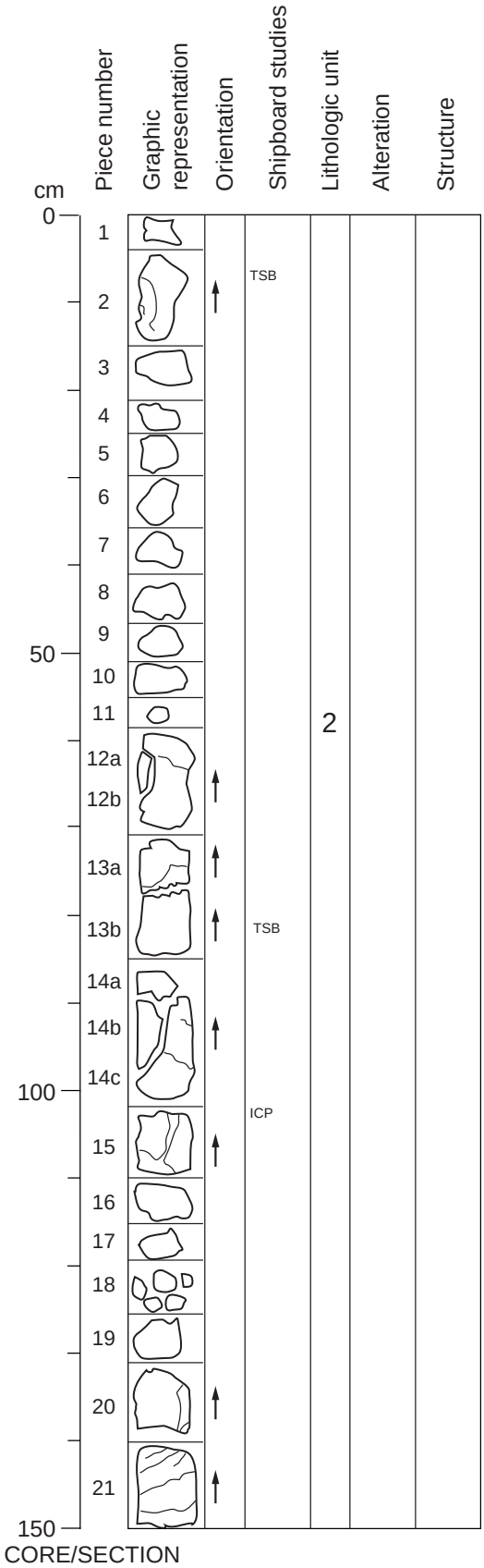
PIECES 1-3

INTERNAL CONTACTS: Chilled margin on Piece 2 4 mm thick.

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	2	1.5-2	2.5	<1	euhedral
Olivine	1	1	1.5	<1 e	quant
Total	3				

GROUNDMASS: Fine-grained
COLOR: Medium gray
ALTERATION: Overall the section is slightly altered. Oxidized rim at edge of Piece 2 where olivine is replaced by Fe oxyhydroxide, elsewhere a green-yellow waxy silicate is replacing olivine.
ADDITIONAL COMMENTS: Olivine and plagioclase glomerocrysts in Piece 2 up to 2 mm comprised of ~ 15 crystals. Some carbonate coating the outside and Mn spots (<1 mm). Piece 2 is a rounded cobble.

Core Photo



187-1156A-3R-1

UNIT 2: MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

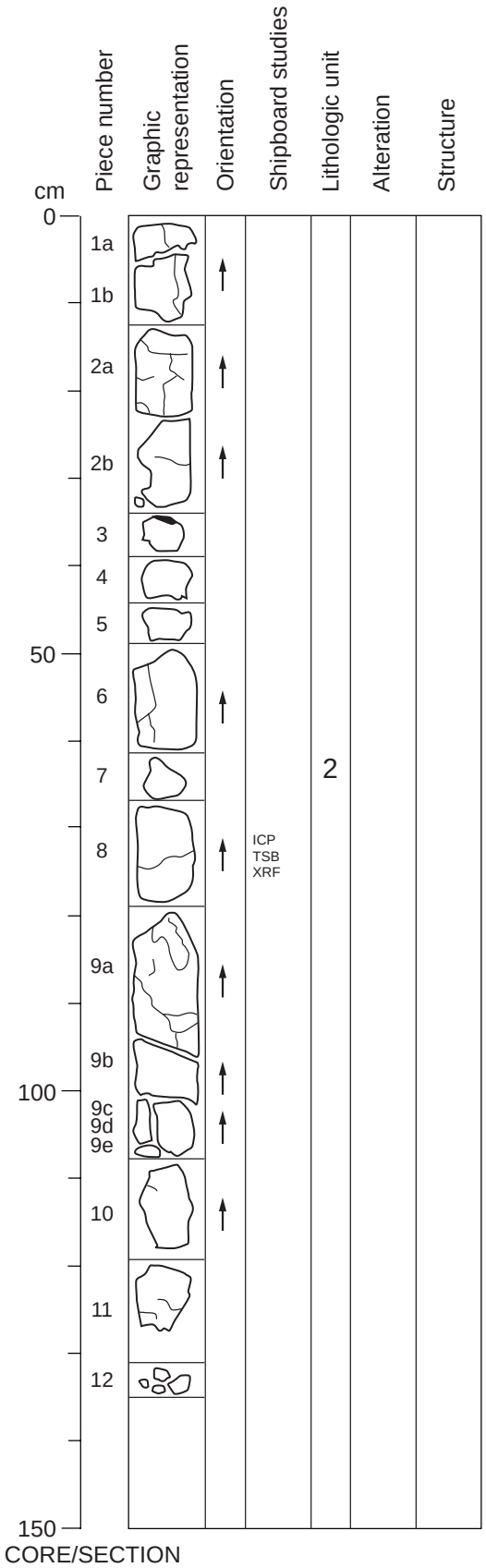
PIECES 1-21

INTERNAL CONTACTS: Glassy rinds and/or chilled margins on Pieces 2, 3, 4, 11, 14, 15, 17, 19, 20, and 21.

PHENOCRYSTS:	**Abundance**	**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**
Plagioclase	2-3	2	5	<1	tabular
Olivine	2	1.5	4	<1	equant
Total	4-5			

GROUNDMASS: Fine-grained
COLOR: Buff to medium gray
VESICLES: Rare (~0.5%) small (<0.5 mm) vesicles lined with cryptocyrstalline blue silica (e.g., Piece 2).
VEINS/FRACTURES: Fractures predominantly orthogonal to glassy rind, generally filled with calcite (e.g., Piece 14b). Piece 14b has a 4 mm thick calcite filled vein orthogonal to the glassy bottom, which is cross-cut by a later thin sub-horizontal (<1 mm) calcite vein. Pieces 12, 15, and 19 also have fractures which are variously filled with calcite, cryptocyrstalline silica and Mn oxide.
ALTERATION: Overall slight, although the buff pieces have altered groundmass, possibly to brown clays (e.g., Pieces 1 and 2). Olivine within the oxidized zones at the edges are replaced by Fe oxyhydroxide, away from this area a waxy green-yellow alteration product is more common (e.g Piece 5). Mn spots (<1 mm) commonly coat the outside of the pieces.
STRUCTURE: Pillow lava
ADDITIONAL COMMENTS: Piece 1 is highly phyric (~ 20% phenocrysts), as are parts of Piece 2. In Piece 2 there is flow banding where the top 30 mm below the glassy rind has flow aligned plagioclase and is highly phyric (~20%), the bottom 30 mm also has an accumulation of phenocrysts and flow alignment of plagioclase. The center of Piece 2 is less phyric than the top and bottom, ~5%. Pieces 10, 12, 15, and 17 also have flow banded and/or flow alignment of plagioclase phenocryst. Piece 16 is crystalline calcite with <10% palagonite and glass.

Core Photo



187-1156A-3R-2

UNIT 2: MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-12

INTERNAL CONTACTS: Glassy rinds and/or chilled margins on Pieces 2a, 3, 4, 8, and 11. Palagonite ranges from a thin layer on the outermost surface (Pieces 3, 4, 8, and 11) to a thick rind (8 mm, Piece 2). Clear glass is typically about 3 mm thick. The glass in the coalesced spherulite zones in this core tend to be palagonitized, which contrasts with that in most cores from earlier sites.

INTERNAL CONTACTS- Sediment: Calcareous sediment occurs attached to basalt on Pieces 1 and 2, in Piece 1 this is a breccia similar to that described in 1156A-2R-1. It consists of angular clasts of palagonite and highly altered porphyritic basalt similar to that seen in the rest of this section. The surrounding sediment is a light grayish brown clayey calcareous mud which is not well lithified, and is cemented by a grayish brown micrite and veins of sparry calcite. The micrite contains small nodules (<0.5 mm) of Mn oxide. The sediment attached to Piece 2 is grayish brown micrite, some of which is intimately mixed with the palagonite of the glassy margin.

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	3-5	3	6	<1	prismatic lath
Olivine	2-3	1	3	<1	equant
Total	5-8				

GROUNDMASS: Fine-grained to microcrystalline

COLOR: Grayish brown (in altered areas) to medium gray (unaltered areas)

VESICLES: Rare vesicles (<<1%), some lined with amorphous blue silica (Piece 2); elsewhere vesicles are unfilled.

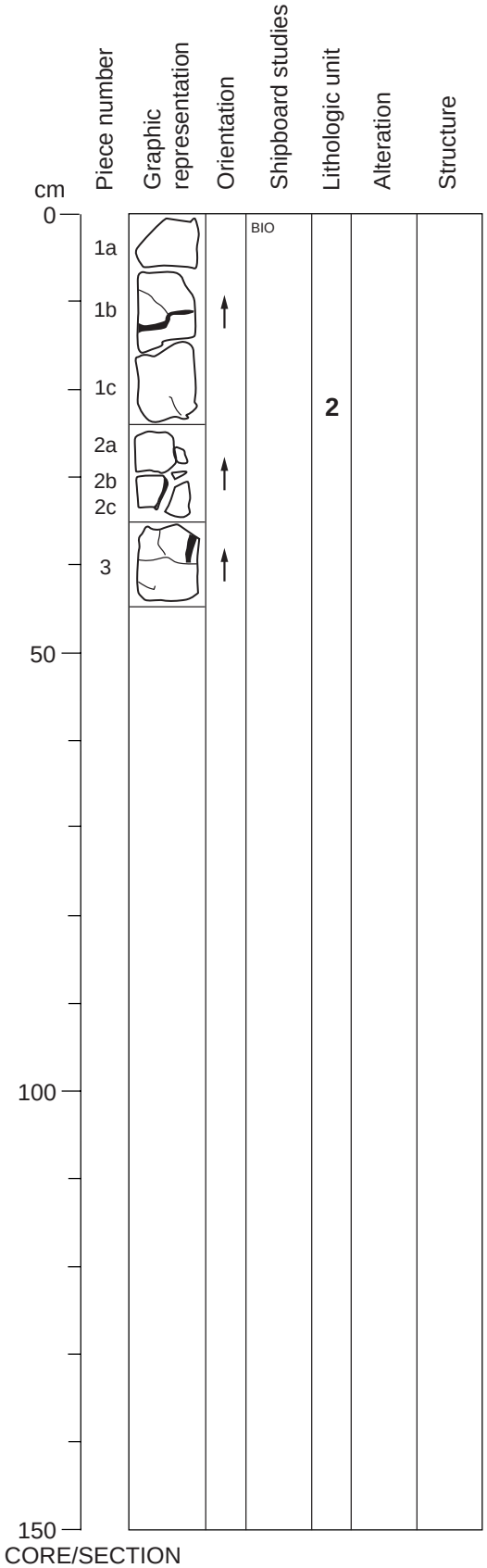
VEINS/FRACTURES: Thin calcite and Mn oxide veins occur in Pieces 2, 3, 8, 9 and 11. Grayish brown micritic veins occur in Pieces 1, 2, 3, 7, and 12. Mn oxide coated fractures occur in Pieces 2a and 9a.

ALTERATION: Most pieces in this section are moderately altered (~30%). Pieces 1, 5, 6, and 8 are only slightly altered (<10%). In general, the alteration consists of replacement of olivine (50%-100%) by Fe oxyhydroxides and replacement of groundmass by a mixture of Fe oxyhydroxides and clay. These zones of alteration are most intense along veins (alteration halos up to 1 cm wide) and at the edges of pieces. In Pieces 1 and 3 there is also patchy replacement of groundmass by olive green smectite in areas outside the more oxidized regions. Pieces 4 and 5 show a concentric arrangement of alteration zones in which the oxidized zone forms the outer rind of the piece (<1 cm wide). Inward of this is a zone ~0.5 cm wide where the groundmass is replaced by smectite. The interior of the piece is relatively unaltered (<5%). In general, olivine in the oxidized zone is 100% altered. In the smectite zone it ranges from 0% to ~30%. In Piece 3, olivine is partially replaced by a waxy yellow clay.

STRUCTURE: Unknown

ADDITIONAL COMMENTS: Clusters of plagioclase and plagioclase and olivine are common. Larger plagioclase phenocrysts show evidence for partial resorption. Piece 6 contains an olivine with a spinel inclusion.

Core Photo



187-1156A-3R-3

UNIT 2: MODERATELY TO SPARSELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-3

INTERNAL CONTACTS- Glass: Glassy rinds and/or chilled margins on Pieces 1 and 2. Piece 1c consists mostly of a coalesced spherulite zone (no clear glass); the thickness of clear glass on Piece 2 is obscured by sediment, but is probably about 5 mm.

INTERNAL CONTACTS- Sediment: Piece 2 has calcareous sediment with angular clasts of bleached palagonite attached to basalt. The sediment is continuous with a 1 mm wide vein filled by micrite changing to a mix of micrite and sparry calcite further away from the glassy margin into the piece interior.

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	1-4	2	3	<1	prismatic
Olivine	1-2	1	3	<1	equant
Total	2-6				

GROUNDMASS: Fine-grained to microcrystalline

COLOR: Grayish brown (in altered areas) to medium gray (unaltered areas)

VESICLES: Rare vesicles (<<1%) are small ((<0.5 mm) and unfilled.

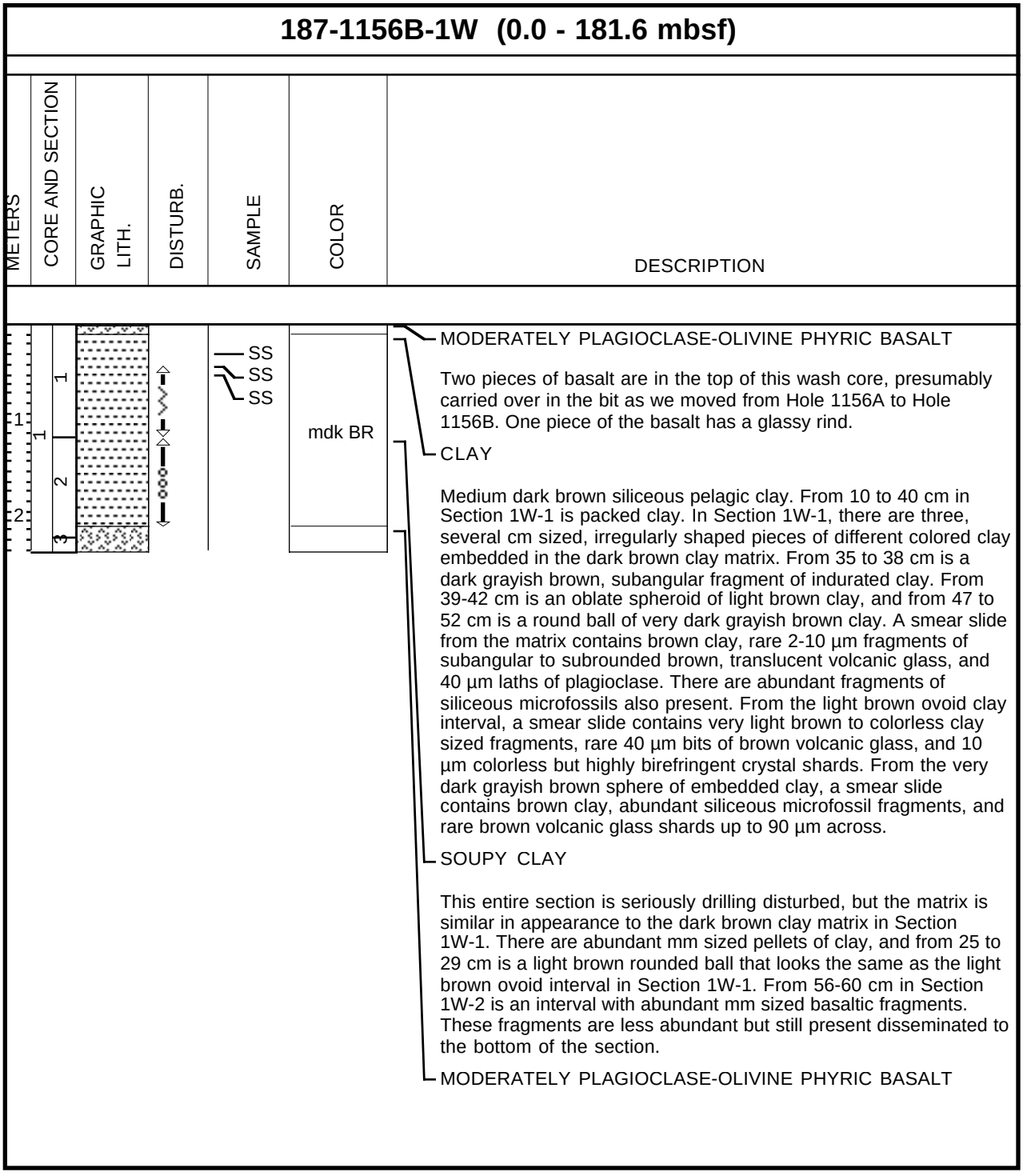
VEINS/FRACTURES: Millimeter wide veins of micritic calcite occur in Pieces 1, 2 and 3. The boundaries of the vein with the basalt are neither straight nor sharp. Locally these veins contain patches of more sparry calcite. In Piece 1 a portion of the vein becomes an open fracture and the calcite here has euhedral terminations on the crystals. In Piece 3, a 3-mm wide vein of micritic calcite splays into three smaller veins, which all terminate at an unfilled fracture.

ALTERATION: All pieces in this section are moderately altered (~30%). In general, the alteration consists of replacement of olivine (50%-100%) by Fe oxyhydroxides and replacement of groundmass by a mixture of Fe oxyhydroxides and clay. These zones of alteration are most intense along veins (alteration halos up to 1 cm wide) and at the edges of pieces. There is also patchy replacement of groundmass by olive green smectite in areas outside the more oxidized regions. In Piece 1, olivine is partially replaced by a waxy yellow clay.

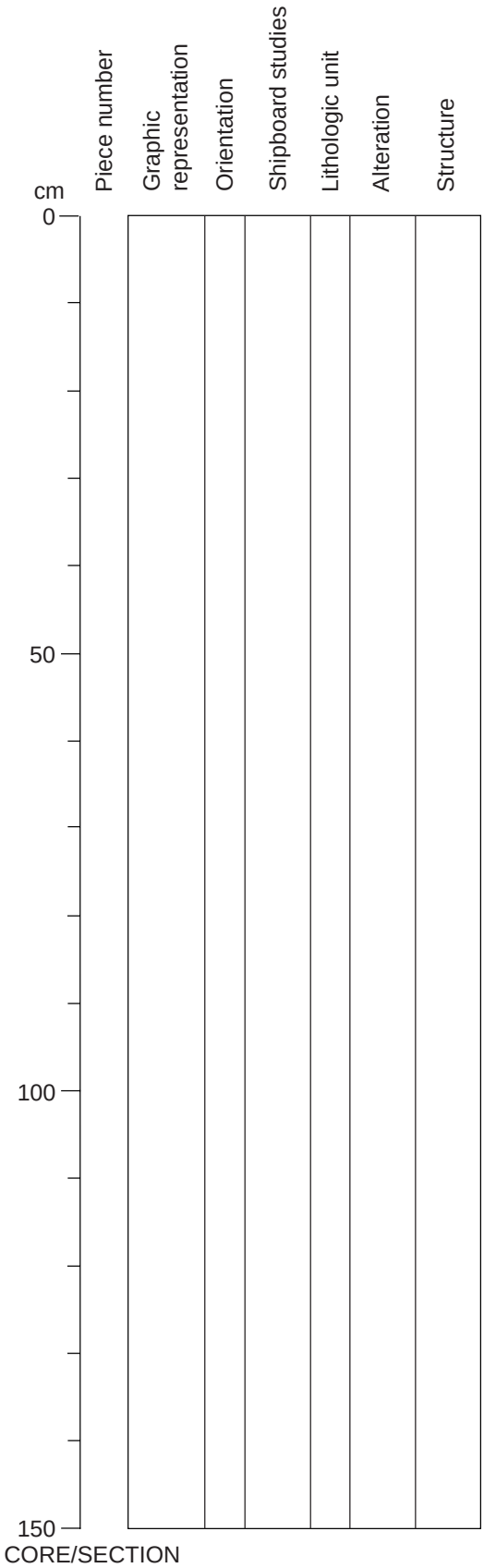
STRUCTURE: Unknown

ADDITIONAL COMMENTS: Plagioclase varies in size and morphology from small acicular crystals in portions of Piece 1 to larger prismatic crystals elsewhere. Phenocryst content also varies, being highest in Piece 1 and lowest in Piece 3.

Core Photo


187-1156B-1W (0.0 - 181.6 mbsf)
METERS
CORE AND SECTION
GRAPHIC LITH.
DISTURB.
SAMPLE
COLOR
DESCRIPTION
1
2
1
2
3
SS
SS
SS
mdk BR
MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT
Two pieces of basalt are in the top of this wash core, presumably carried over in the bit as we moved from Hole 1156A to Hole 1156B. One piece of the basalt has a glassy rind.
CLAY
Medium dark brown siliceous pelagic clay. From 10 to 40 cm in Section 1W-1 is packed clay. In Section 1W-1, there are three, several cm sized, irregularly shaped pieces of different colored clay embedded in the dark brown clay matrix. From 35 to 38 cm is a dark grayish brown, subangular fragment of indurated clay. From 39-42 cm is an oblate spheroid of light brown clay, and from 47 to 52 cm is a round ball of very dark grayish brown clay. A smear slide from the matrix contains brown clay, rare 2-10 µm fragments of subangular to subrounded brown, translucent volcanic glass, and 40 µm laths of plagioclase. There are abundant fragments of siliceous microfossils also present. From the light brown ovoid clay interval, a smear slide contains very light brown to colorless clay sized fragments, rare 40 µm bits of brown volcanic glass, and 10 µm colorless but highly birefringent crystal shards. From the very dark grayish brown sphere of embedded clay, a smear slide contains brown clay, abundant siliceous microfossil fragments, and rare brown volcanic glass shards up to 90 µm across.
SOUPY CLAY
This entire section is seriously drilling disturbed, but the matrix is similar in appearance to the dark brown clay matrix in Section 1W-1. There are abundant mm sized pellets of clay, and from 25 to 29 cm is a light brown rounded ball that looks the same as the light brown ovoid interval in Section 1W-1. From 56-60 cm in Section 1W-2 is an interval with abundant mm sized basaltic fragments. These fragments are less abundant but still present disseminated to the bottom of the section.
MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

Core Photo



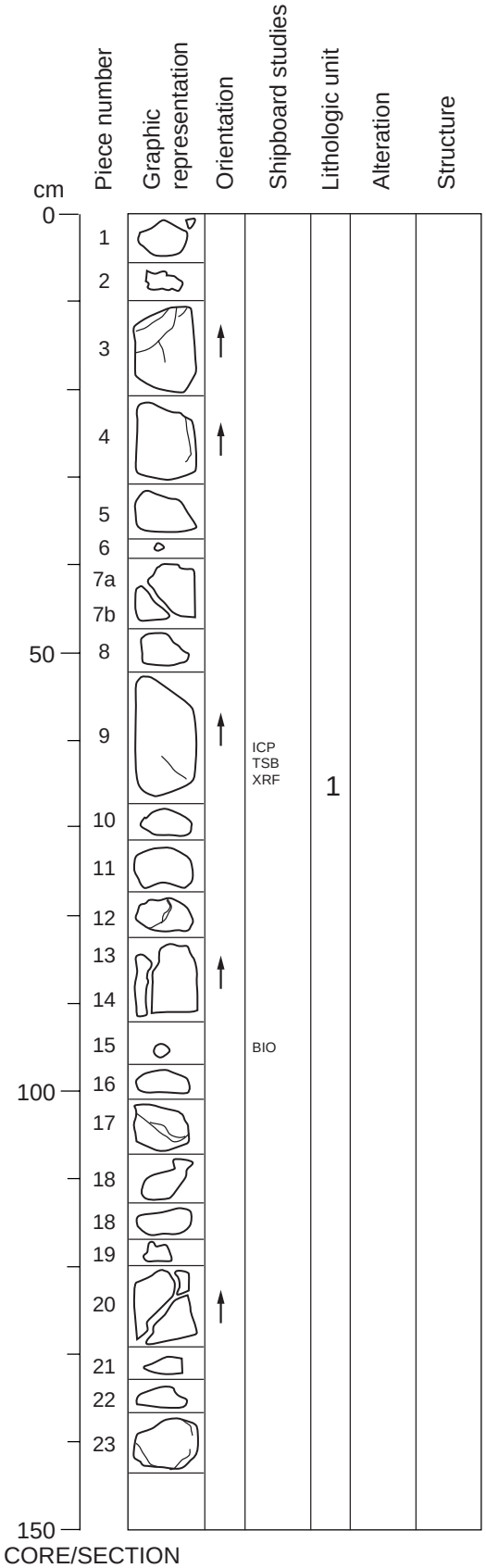
187-1156B-1W (igneous rocks recovered in Wash Core)

MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-3 (Note these are currently not labelled as Pieces 1-3, but 1W-2, Piece 1 and 1W-3, Pieces 1 and 2.)

Pieces 1-3 are moderately plagioclase-olivine phyric basalt. The pieces consist of ~4% plagioclase phenocrysts and 2% olivine phenocrysts. Plagioclase ranges from 1-3 mm in size and olivine is typically less than 1 mm in size. All pieces are moderately altered. Olivine is 50%-100% replaced by Fe oxyhydroxides; plagioclase is unaltered throughout. In areas of most intense alteration, groundmass is replaced by a mixture of Fe oxyhydroxides and clay. These zones of alteration are most intense along edges of pieces (alteration halos up to 1 cm wide). Rare vesicles (<<1%) are small (<0.3 mm) and unfilled. Piece 1 (i.e., 1W-2, Piece 1) retains a small fragment of a chilled margin, which is cross-cut by an Fe-stained clay vein ~1 cm long. Piece 3 (i.e., 1W-3, Piece 2) includes a contact between porphyritic basalt and a calcareous breccia similar to that observed in Hole 1156A. The breccia consists of angular clasts of highly altered porphyritic basalt, bleached palagonite, and pink micrite. The breccia is cemented by a light grayish brown micrite. Although the basalt pieces are similar to those in the underlying core from this hole, we believe that their inclusion in Unit 1 of the underlying core is unjustified at this time because of (1) the circumstances under which this wash core was taken, (2) the absence of breccia rinds on any of the basalt pieces from Core 1156A-2R, and (3) the greater abundance of phenocryst phases in the basalts from Core 1156A-2R.

Core Photo



187-1156B-2R-1

UNIT 1: HIGHLY TO MODERATELY PHYRIC PLAGIOCLASE-OLIVINE BASALT

PIECES 1-23

INTERNAL CONTACTS: Pieces. Piece 12 and 16 have thin (<1 mm) glassy margins with abundant plagioclase and olivine phenocrysts.

PHENOCRYSTS:

	Abundance	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	6-15	2	6	1	prismatic rounded
Olivine	2-3	1	3	<0.5	equant
Total	8-18				

GROUNDMASS: Fine-grained

COLOR: Light to medium grey in unaltered zones, grayish brown in altered areas

VESICLES: Overall <1% spherical to round vesicles (0.2-0.5 mm), variably filled with smectite and/or calcite. Unfilled vesicles in Pieces 5, 10, 11, 13, 15, 16, and 23. In Piece 13 and 23 vesicle density is higher along piece margins.

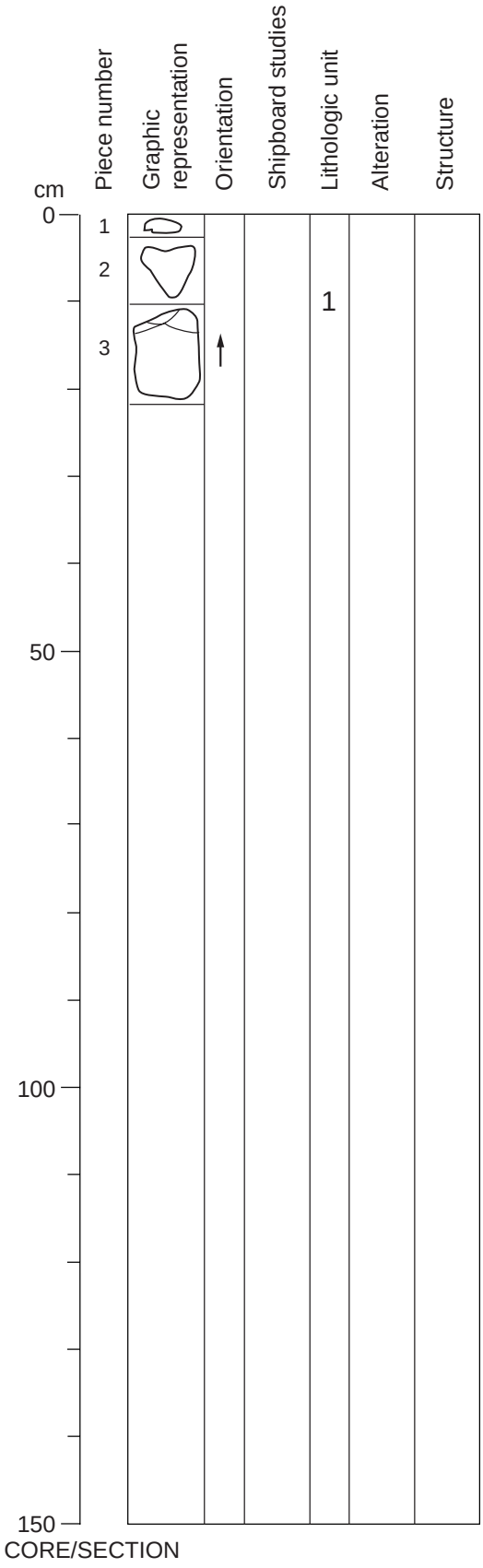
VEINS/FRACTURES: small (<0.5 mm) calcite filled veins in Pieces 3, 4, 5, and 20. A 1 mm calcite vein is attached to Piece 5.

ALTERATION: Overall the section is slightly altered, except for Piece 15 which is moderately altered. Alteration comprises of partial to full replacement of olivine by Fe oxyhydroxides and replacement of groundmass by a mixture of Fe oxyhydroxides and clay (Pieces 1 and 2). The groundmass alteration is patchy, has a distinct brown to greenish color and forms a network.

STRUCTURE: Unknown

ADDITIONAL COMMENTS: Plagioclase and plagioclase and olivine clusters are common. The large plagioclase crystals (4-6 mm) are mostly rounded. The amount of olivine and plagioclase phenocrysts varies unsystematically throughout the core, making an assessment of the general rock texture difficult. Pieces 1, 3, 10, 11, 15, 18,19, 22, and 23 are moderately phyric, whereas Pieces 4, 5, 7, 8, 9, 12, 13 16, and 20 are highly phyric.

Core Photo



187-1156B-2R-2

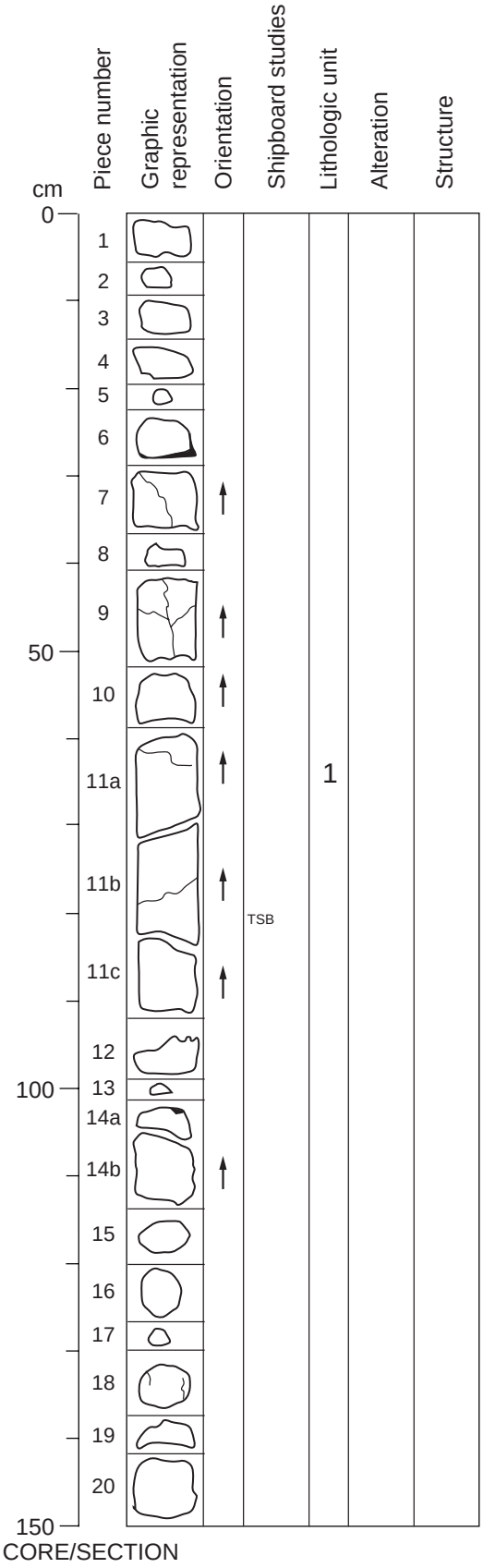
UNIT 1: MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-3

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	4-6	2	7	1	prismatic rounded
Olivine	2-3	1	3	<0.5	equant
Total	6-9				

GROUNDMASS: Fine-grained
COLOR: Grayish brown (in altered areas) to medium gray (unaltered areas)
VESICLES: Rare vesicles (<<1%) are small (<0.5 mm) and unfilled in Pieces 1 and 2, filled with smectite in Piece 3.
VEINS/FRACTURES: There is a thin (<1 mm) calcite vein in Piece 3.
ALTERATION: Pieces 1 and 2 are moderately altered (~30%); Piece 3 is slightly altered. In general, the alteration consists of replacement of olivine (50%-100%) by Fe oxyhydroxides and replacement of groundmass by a mixture of Fe oxyhydroxides and clay (Pieces 1 and 2). In Piece 3 there is predominantly patchy replacement of groundmass by olive green smectite.
STRUCTURE: Unknown
ADDITIONAL COMMENTS: Plagioclase and plagioclase and olivine clusters are common.

Core Photo



187-1156B-3R-1

UNIT 1: MODERATELY TO HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-20

INTERNAL CONTACTS - GLASS: Glassy margins and palagonite occur on Pieces 3, 6, 11c, and 12. In most cases, the amount of fresh glass is minimal. Pieces 11c and 12 have no fresh glass and start at the coalesced spherulite zone. Pieces 3 and 6 have 2 to 4 mm of glass and phenocrysts, mixed with palagonite.

PHENOCRYSTS:

	Abundance	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	2-9	4	7	1	prismatic rounded
Olivine	1-4	1	2	0.5	equant
Total	3-13				

GROUNDMASS: Fine-grained

COLOR: Grayish brown (in altered areas) to medium gray (unaltered areas)

VESICLES:

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

Filling: Vesicles are unfilled in most pieces, but in Pieces 1, 4, and 18 they are filled with calcite and in Pieces 1, 11a, 11b, and 14b they are filled with smectite.

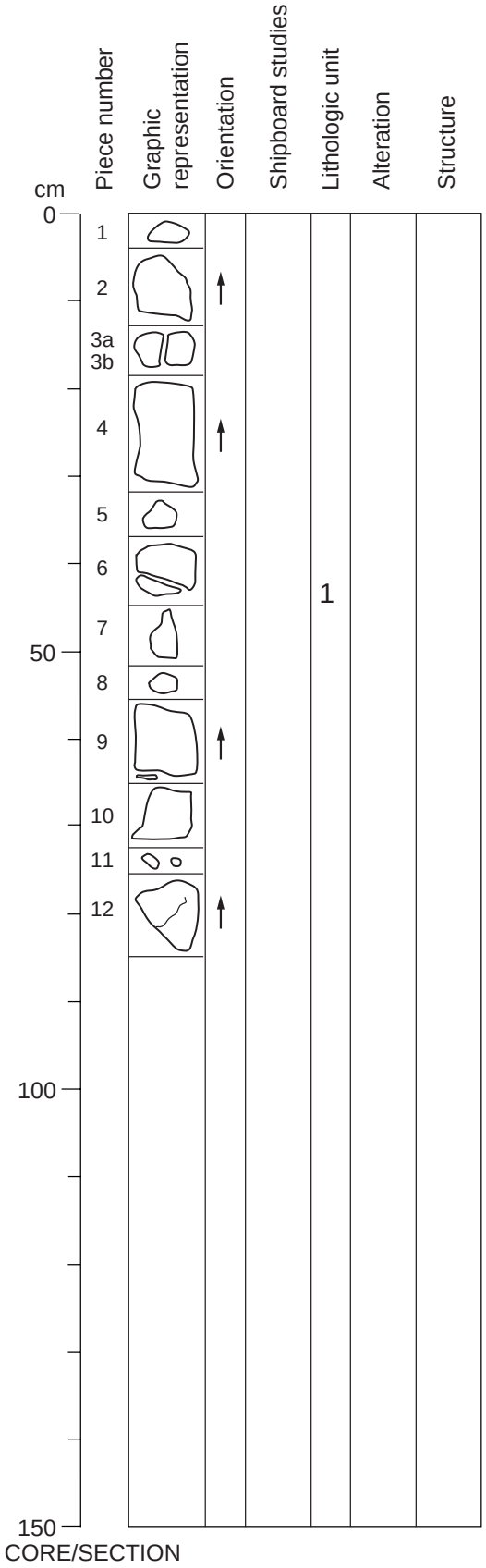
VEINS/FRACTURES: There are thin (<1 mm) calcite ± Mn oxide veins in Pieces 7, 9, 11a, 11b, 12, and 14b. There are veins filled with Fe-stained clay and calcite in Pieces 6, 9, and 11c.

ALTERATION: Most pieces are only slightly altered (<10%), but Pieces 5, 7, 8, 9, 11c, 12, and 14b are moderately altered (~30%-50%). In general, the alteration consists of replacement of olivine (50%-100%) by Fe oxyhydroxides and replacement of groundmass by a mixture of Fe oxyhydroxides and clay (Pieces 1 and 2). These tend to be in alteration halos around veins or at the margins of pieces, but can also be pervasive as in Pieces 11c and 12. In Pieces 1, 11, 14, and 18 there is patchy replacement of groundmass by olive green smectite.

STRUCTURE: Unknown

ADDITIONAL COMMENTS: Plagioclase and plagioclase + olivine clusters are common. Plagioclase occurs as relatively large (~5 mm) crystals with a sieve texture, interpreted as evidence of resorption.

Core Photo



187-1156B-3R-2

UNIT 1: HIGHLY TO MODERATELY PHYRIC PLAGIOCLASE-OLIVINE BASALT

PIECES 1-12

PHENOCRYSTS:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	4-12	3	7	0.5	prismatic rounded
Olivine	2-3	1	2	0.5	equant
Total	6-15				

GROUNDMASS: Fine-grained

COLOR: Light to medium gray in unaltered zones, grayish brown in altered areas.

VESICLES:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
	1-2	0.5	1	<0.5	round

Filling: In most pieces filled with smectite and/or calcite. Unfilled vesicles in Piece 1. Vugs filled with drusy calcite and Mn oxide in Piece 4.

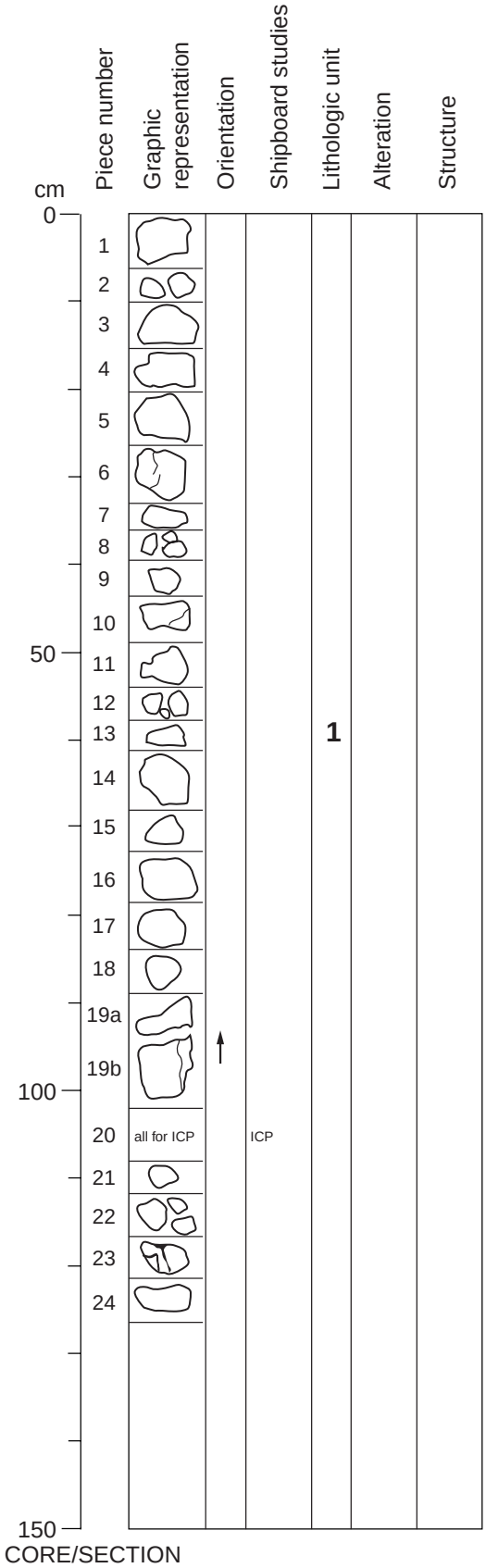
VEINS/FRACTURES: Open fractures in Pieces 6 and 12, partly covered with Mn oxide. A 0.5 to 1 cm wide micritic calcite vein is attached to Piece 3b and has an irregular contact with the basalt. Highly altered basalt pieces are enclosed in the vein material. Mn oxide forms the boundary layer between calcite and basalt. Unconsolidated mud is attached to Piece 4.

ALTERATION: Slightly altered parts in Pieces 1, 2, 3, and 5. Pieces 4, 7,8, 9, 10, and 12 are moderately altered, due to more pervasive groundmass alteration. Groundmass alteration is characterized by replacement of groundmass olivine by Fe oxyhydroxide and patchy groundmass replacements with brownish green smectite. Alteration halos (0.5-1 cm) visible in Piece 1, 2, and 3. Olivine phenocrysts are altered (50%-100%) to Fe oxyhydroxides throughout, except for slightly altered parts.

STRUCTURE: unknown

ADDITIONAL COMMENTS: No glass rinds occur in this section. The large plagioclase crystals (4-6 mm) are mostly rounded. The amount of olivine and plagioclase phenocrysts varies unsystematically throughout the core, making an assessment of the general rock texture difficult.

Core Photo



187-1156B-4R-1

UNIT 1: MODERATELY TO HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-24

INTERNAL CONTACTS: Glassy palagonite rinds are present on Pieces 1 and 19. The rinds vary from 8 mm thick in Piece 1 to 1.5 cm thick in Piece 19.

PHENOCRYSTS:

	Abundance	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	7	2	6	1<	prismatic subhedral
Olivine	2	1	2.5	1<	subhedral
Total	9				

GROUNDMASS: Fine-grained

COLOR: Medium gray

VESICLES:

Abundance	**Size** (mm)			**Shape**
%	**avg.**	**max.**	**min.**	
<1	0.5	2.5	<0.5	round

Filling: Blue to white cryptocrystalline silica lines the inner walls of most vesicles (e.g., Piece 6). Greenish clay fills the vesicles, eg Pieces 4 and 11.

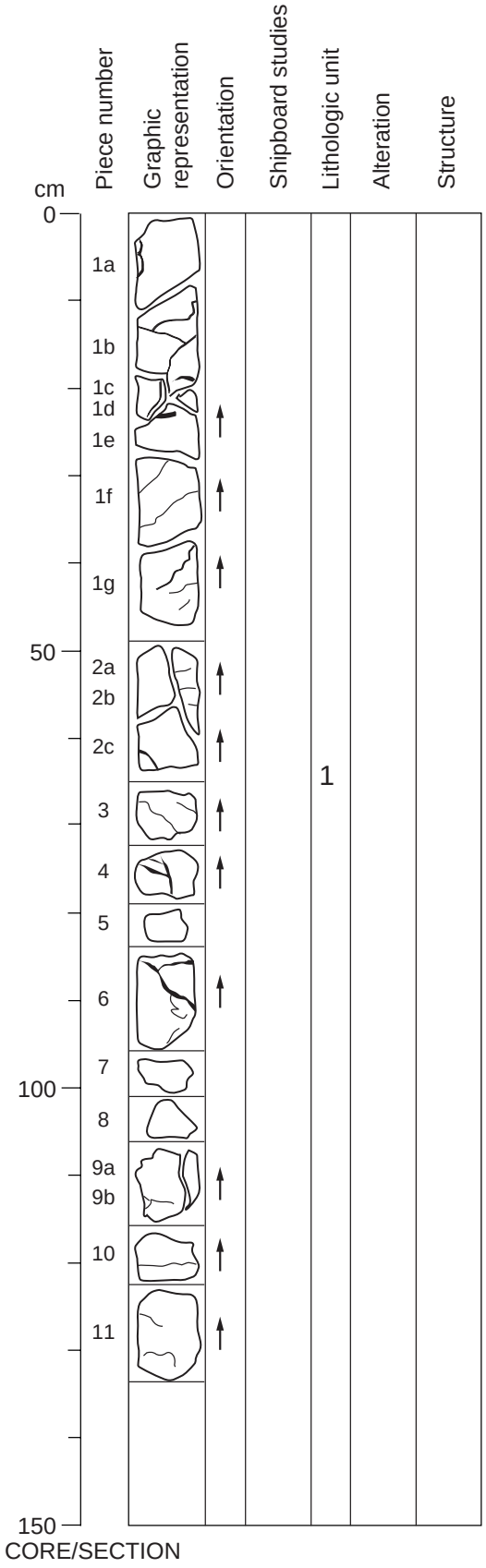
VEINS/FRACTURES: Calcite veins are present in Piece 23.

ALTERATION: Slightly to moderately altered, though variable from piece to piece. Glass is commonly altered to palagonite, and 0.3 to 1.5 cm thick alteration halos are common on edges of pieces. Many pieces have mm thick weathered rinds on multiple faces, and a few pieces are pervasively altered. Phenocrysts are most commonly fresh except in alteration halos where Fe oxyhydroxides and yellow brown clay replace olivine and plagioclase. Vesicles are lined with a thin coating of silica, spotted with Mn oxide. Rare vesicles are lined with light green translucent smectite and filled with calcite. A few pieces have sub-cm sized patches of semi-adhered sediment that falls away with handling. The siliceous sediment contains palagonite fragments. Alteration halos are also present around veins. Thin (<1 mm thick) Mn oxide veins have halos up to 1 cm thick. Phenocrysts in halos (particularly plagioclase) are only slightly altered, but groundmass is altered to yellow brown clay.

STRUCTURE: Pillow lava.

ADDITIONAL COMMENTS: Approximately 30% of the phenocrysts are glomerocrysts of plagioclase and olivine, up to 6 mm. The percentage of phenocrysts given is an average, phenocryst content ranges from aphyric in Piece 15 to 15% in Piece 18.

Core Photo



187-1156B-4R-2

UNIT 1: MODERATELY TO HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-11

INTERNAL CONTACTS: Glassy/palagonite rinds are present on Pieces 1g, 4, and 11. The rinds vary from 4 mm thick in Piece 4 to 1.4 cm thick in Piece 1g.

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	10	2.5-3	8	<0.5	prismatic subhedral
Olivine	4	1.5	3	<0.5	subhedral
Total	14				

GROUNDMASS: Fine-grained

COLOR: Medium gray

VESICLES:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
	<1	0.5	<1	<0.5	round

Filling: Blue to white cryptocyrstalline silica lines the inner walls of most vesicles

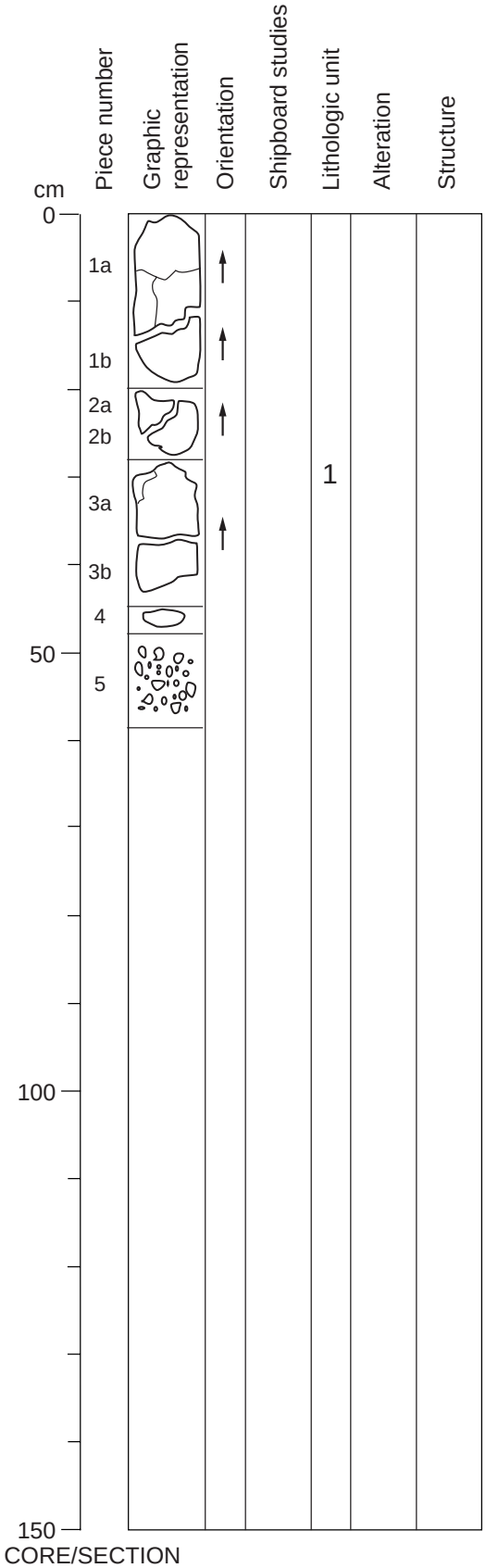
VEINS/FRACTURES: Calcite veins are present in Pieces 1b, 1c, 1e, 1f, 1g, and 2c. Pieces 4 and 6 have white calcite with buff clay veins which range in width from 0.5 mm in Piece 6 to 1.2 mm in Piece 4. Open fractures occur in Pieces 3, 4f and 9a and are generally 0.5 mm wide.

ALTERATION: Slight. Generally olivine is fresh to slightly altered to Fe oxyhydroxide. Mn spots (<1 mm) are present on the outside of Pieces 1 (all), 2, 3, and 8. Rare open fracture surfaces are Fe-stained and have a thin coating of gray silica with spotty manganese.

STRUCTURE: Pillow lava

ADDITIONAL COMMENTS: Some pieces (e.g., Piece 1g) are up to 25% phyric.

Core Photo



187-1156B-4R-3

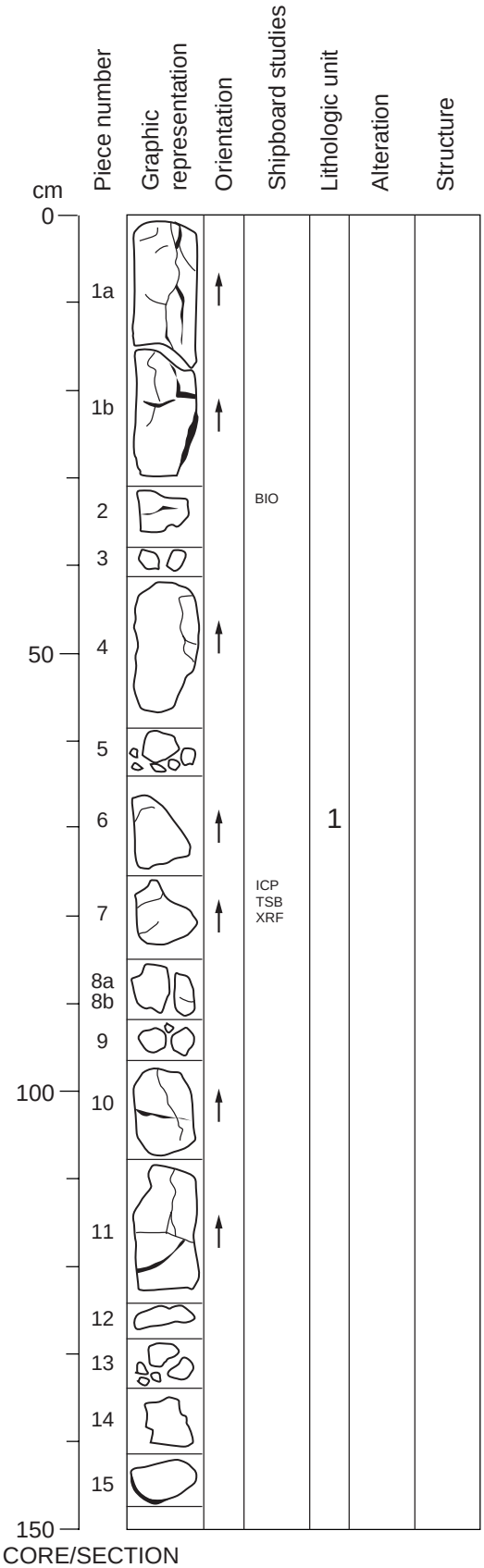
UNIT 1: HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-5

PHENOCRYSTS:	**Abundance**	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	12	2	4	<1	prismatic
Olivine	3	2	3	<1	euhedral
Total	15				

Groundmass: Fine-Grained
Color: Medium gray
VEINS/FRACTURES: Piece 1a has a bifurcating vein with a 2 mm light colored halo and some patches of oxidization. Calcite coats the surfaces of the fractured vein on Pieces 2a and 2b.
ALTERATION: Slight. Generally olivine is fresh to slightly altered to Fe oxyhydroxide. Mn spots (<1 mm) are present on the outside of Piece 1a.
STRUCTURE: Not distinguishable
ADDITIONAL COMMENTS: Approximately 30% of the phenocrysts are glomerocrysts of plagioclase and olivine, up to 6 mm . Plagioclase is seriate and ranges from acicular to tabular. Vesicles are rare overall (<1%) and in Piece 1a are concentrated at the top of the piece. Piece 5 is a bag of assorted basalt debris all <10 mm.

Core Photo



187-1156B-5R-1

UNIT 1: HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-15

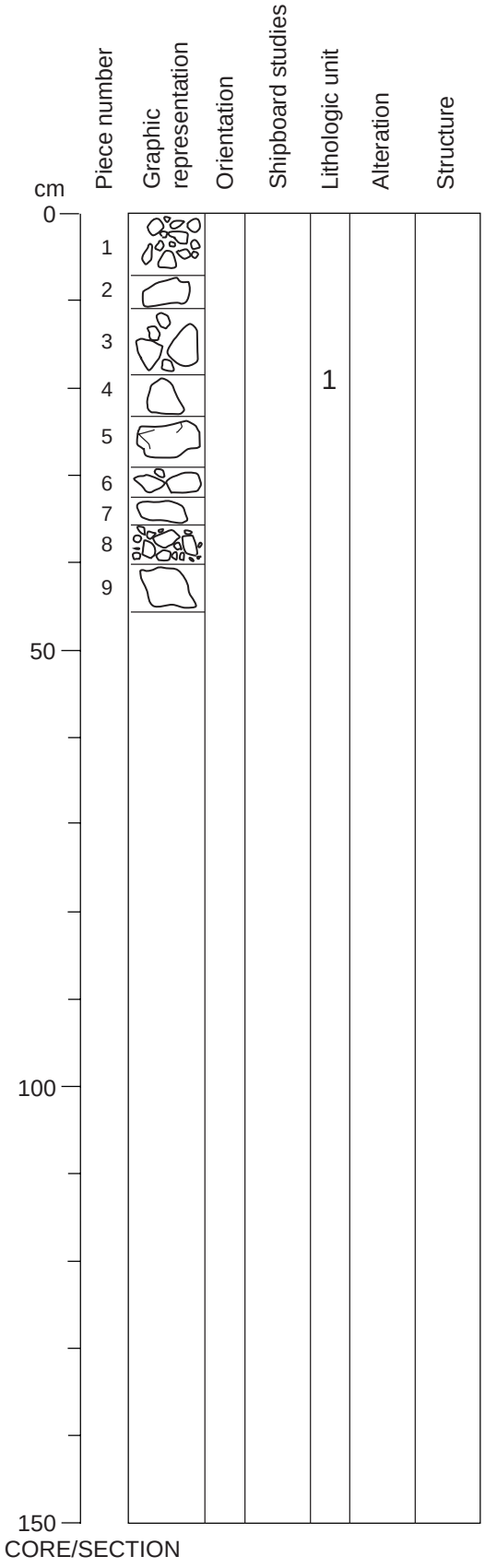
INTERNAL CONTACTS: Chilled margins with or without a glassy rind are common (e.g., Piece 4).

PHENOCRYSTS:

	Abundance	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	13	2	4	<1	prismatic
Olivine	2	1.5	2.5	<1	euhedral
Total	15				

GROUNDMASS: Fine-grained
COLOR: Medium gray
VEINS/FRACTURES: Anastomosing and bifurcating veins in Piece 1 are infilled with calcite, crystal size increases downwards from microcrystalline to 2.5 mm and correlates with an increase in vein width and oxidation halo from 2 to 7 mm and 5 to 30 mm, respectively. Pieces 4, 10, and 11 also have calcite filled veins.
ALTERATION: Slight to moderately altered. Approximately 80% of all olivine is replaced by Fe oxyhydroxide (in oxidized margins to veins and edges) and green-yellow clays. Green-yellow clay is also present in the groundmass as is brown clay and calcite (e.g., Piece 1). Mn spots are in veins and on outside edges associated with calcite and pink carbonate coatings or fillings. External fracture faces are also coated with Fe-stained silica and a blue silica. Rare (<<1%) small vesicles (<1 mm) are lined with blue cryptocrystalline silica.
STRUCTURE: Pillow lava
ADDITIONAL COMMENTS: Plagioclase glomerocrysts up to 8 mm in Piece 10. Fresh olivine is present in Piece 14.

Core Photo



1**87-1156B-5R-2**

UNIT 1: MODERATELY TO HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-9

PHENOCRYSTS:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	7	2	5	<0.5	prismatic
Olivine	3	1	2	<0.5	subhedral
Total	10				

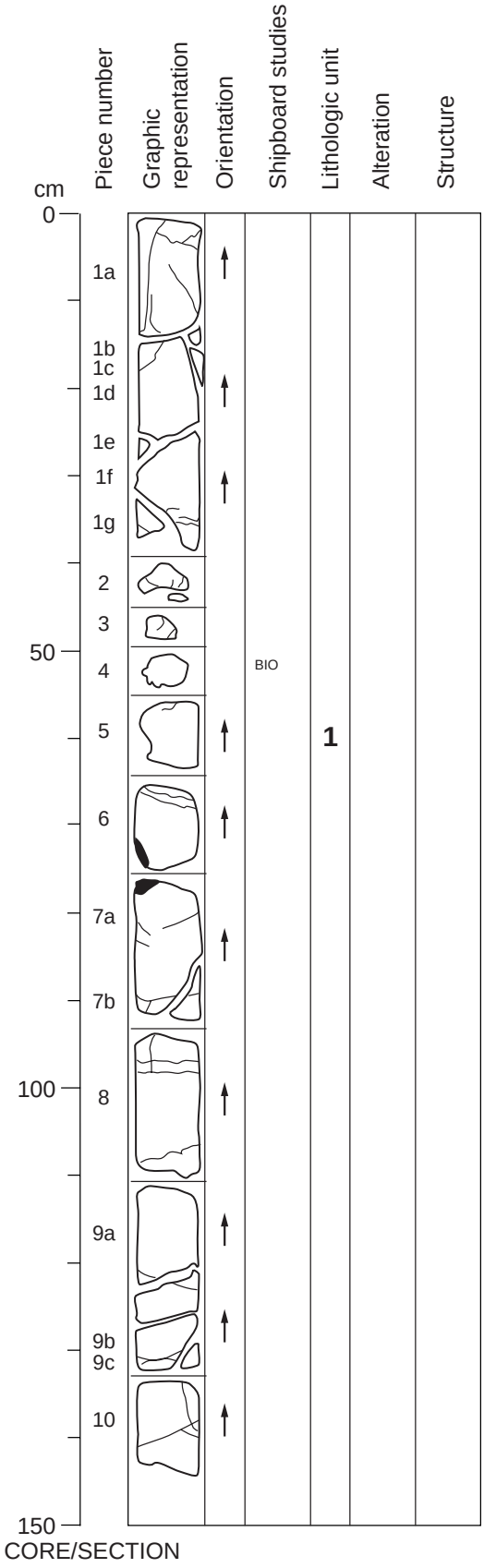
GROUNDMASS: Fine-grained
COLOR: Medium gray

VESICLES:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
	<1	0.5	<1	<0.5	round

Filling: Vesicle walls are lined with blue to white cryptocrystalline silica or infilled with buff colored clay.

ADDITIONAL COMMENTS: Pieces 1, 3, 5, 7, 8, and 9 are pebble to cobble sized fragments on which all outer surfaces are weathered fracture surfaces. On these surfaces most (~80%) olivines are altered to iddingsite.

Core Photo



187-1156B-6R-1

UNIT 1: MODERATELY TO HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-10

INTERNAL CONTACTS - GLASS: Glass/chilled margins occur on the bottoms of Pieces 6 and 8 and on the top of Piece 7. Piece 6 includes a thin palagonite rim and ~4 mm of clear glass and phenocrysts. Piece 7 is largely palagonitized glass (1.5 cm thick), with only small lozenges of unaltered clear glass included in the palagonite. The palagonite is capped by a 2 mm layer consisting of micritic calcite and Mn oxide, Fe-stained clay and sparry calcite. Piece 8 has ~3 mm of palagonite and the glass in between the spherulites in the coalesced spherulite zone is altered to white clay and palagonite, but there is ~1-2 mm of clear unaltered glass in between.

PHENOCRYSTS:	**Abundance**	**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**
Plagioclase	5-8	3	7	1	prismatic rounded
Olivine	2-3	1	3	1	equant
Total	3-13				

GROUNDMASS: Fine-grained

COLOR: Brown (in altered areas) to medium gray (unaltered areas)

VESICLES:	**Abundance**	**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**
	1	0.5	1	<0.5	round

Filling: Vesicles in most pieces are unfilled, but in Piece 9 they are filled with smectite.

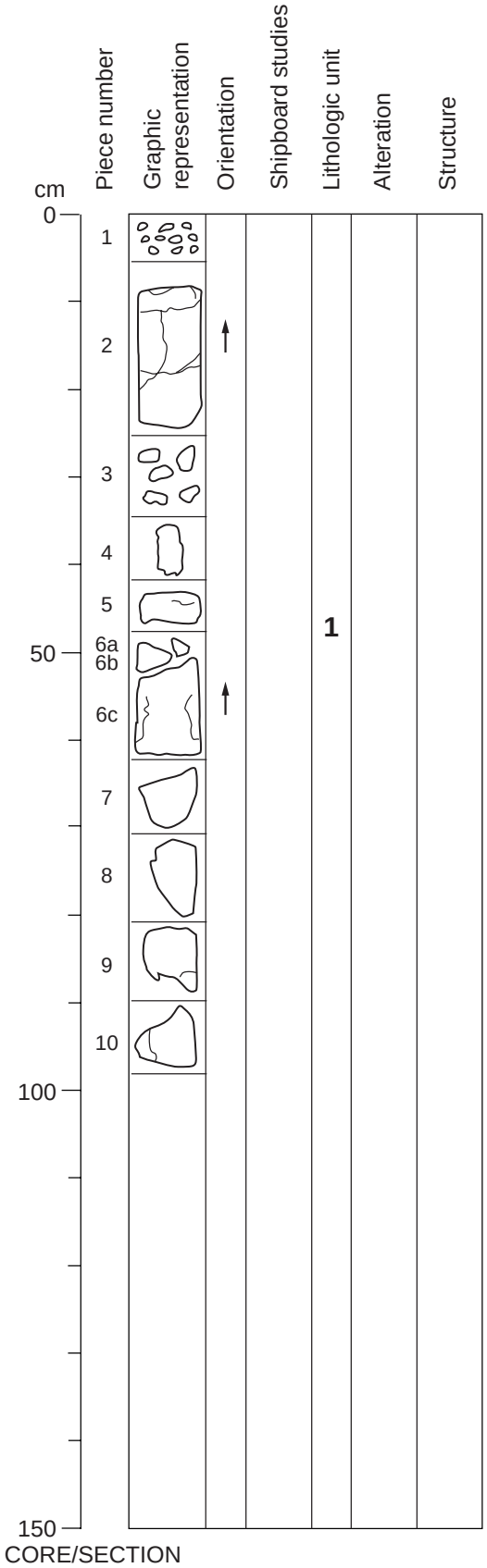
VEINS/FRACTURES: There are thin (<1 mm) calcite ± Mn oxide veins in Pieces 1, 2 and 4-9; the veins are anastomosing and have neither sharp boundaries nor straight sides against the host basalt. There are veins filled with Fe-stained clay + calcite in Pieces 1 and 8 . Piece 1 has a near vertical vein running the length of the piece (15 cm) consisting of Fe-stained clay + Mn oxide and sparry calcite; the amount of clay relative to calcite varies along the length, but in general the clay occurs at the center and the sparry calcite at the sides of the vein. This veins branches and/or connects with several smaller veins along the length of the piece. Fractures line with Mn oxide occur in Pieces 1 to 4, 7, and 8.

ALTERATION: Most pieces are moderately altered (~40%), but Pieces 3 and 4 are only slightly altered (~10%). In general, the alteration consists of replacement of olivine (50%-100%) by Fe oxyhydroxides and replacement of groundmass by a mixture of Fe oxyhydroxides and clay. These tend to be concentrated in alteration halos around veins or at the margins of pieces. In Pieces 9 and 10 there is patchy replacement of groundmass by olive green smectite, and in Piece 5 there is patchy replacement of groundmass by brown clay. Some samples also show a concentric arrangement of alteration zones in which the oxidized zone forms the outer edge of the piece (<1 cm wide). Inward of this is a zone ~0.5 cm wide where the groundmass is replaced by smectite. The interior of the piece is less altered, but still contains groundmass smectite. In general, olivine in the oxidized zone is 100% altered. In the smectite zone it ranges from ~30% to 50% altered. Plagioclase tends to be unaltered throughout.There are thin coatings of calcite and Mn oxide on the outer surfaces of Pieces 2 and 8.

STRUCTURE: probably pillow lavas

ADDITIONAL COMMENTS: Plagioclase and plagioclase and olivine clusters are common. Plagioclase occurs as relatively large crystals with clear evidence for partial resorption. Plagioclase ranges from anhedral to subhedral and olivine is generally subhedral to euhedral.

Core Photo



187-1156B-6R-2

UNIT 1: MODERATELY TO HIGHLY PLAGIOCLASE-OLIVINE PHYRIC BASALT

PIECES 1-6

INTERNAL CONTACTS - GLASS: An altered glassy margin occurs on one of the rubble clasts grouped together in Piece 1. Piece 5 has a relatively unaltered chilled margin with ~1 mm of clear glass.

PHENOCRYSTS:

	Abundance	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	8-12	1.5	5	0.5	prismatic rounded
Olivine	2-3	1	3	0.5	equant
Total	3-13				

GROUNDMASS: Fine-grained

COLOR: Brown (in altered areas) to medium gray (unaltered areas)

VESICLES:

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

Filling: Vesicles in most pieces are unfilled, but in Piece 1 they are filled with smectite.

VEINS/FRACTURES: There are thin (<1 mm) calcite and Mn oxide veins in Pieces 2 and 6; the veins are anastomosing and have neither sharp boundaries nor straight sides against the host basalt. Piece 2 has a near vertical (relative to the core) vein consisting of Fe-stained clay and Mn oxide and calcite.

ALTERATION: The section is moderately altered (~40%) throughout. In general, the alteration consists of replacement of olivine (80%-100%) by Fe oxyhydroxides and replacement of groundmass by a mixture of Fe oxyhydroxides and clay. These tend to be concentrated in alteration halos around veins or at the margins of pieces. In Pieces 2 and 6 there is patchy replacement of groundmass by olive green smectite, and in Piece 6 there is patchy replacement of groundmass by calcite as well as brown clay. Some samples also show a concentric arrangement of alteration zones (e.g., Piece 6) in which the oxidized zone forms the outer edge of the piece (<1 cm wide). Inward of this is a zone ~0.5 cm wide where the groundmass is replaced by smectite. The interior of the piece is less altered, but still contains groundmass smectite. The boundary between the different smectite-bearing zones is relatively sharp. Plagioclase tends to be unaltered throughout. There is a yellowish brown surface coating on each piece.

STRUCTURE: Not determined

ADDITIONAL COMMENTS: Plagioclase and plagioclase and olivine clusters are common. Plagioclase occurs as relatively large crystals with clear evidence for partial resorption. Plagioclase ranges from anhedral to subhedral and olivine is generally subhedral to euhedral.

187-1156A-2R-1, 8-12 cm (TS#2) **Unit: 1** **OBSERVER:** **Kempton**

ROCK NAME: **Moderately plagioclase-olvine phyric basalt**
WHERE SAMPLED: **near top of unit**
GRAIN SIZE: **microcrystalline**
TEXTURE: **intersertal**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	3	3	0.5	3			tabular to blocky; anhedral to subhedral	Twinning ubiquitous; many crystals show evidence for partial resorption in the presence of irregular cavities filled with devitrified glass; in some cases these occur concentrated at the rims of crystals, in others the interiors of the crystals are strongly resorbed; most crystals show normal zoning, but discontinuous zoning seen in some crystals. Plagioclase iron stained along fractures.
Olivine	<1	2	0.5	1.5			equant; euhedral to subhedral	Most crystals are 100% replaced by a pale brown smectite; a few are partially replaced (<20%) by iddingsite.
Clinopyroxene								
Spinel	<<1	<<1		0.4			subhedral	1 crystal observed attached to a feldspar phenocryst.
GROUNDMASS								
Olivine	<1	2						
Plagioclase	35	35		0.5			skeletal (swallowtail) to tabular	
Clinopyroxene	20	20					elongate bundles to plumose quench textures (the former predominates)	
Opaque Minerals	2	2		<5 microns			equant	
Glass								
Mesostasis	20	35						

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays ± Fe oxyhydroxides	19				replacing mesostasis and olivine; filling vesicles	Vesicle fillings are quite variable in this thin section. In one place, a vesicle is observed to be filled by a golden brown smectite, with a paler brown smectite in the middle of the vesicle; attached to the side of the vesicle are two small half-moon shaped nodules of calcite. Elsewhere smectite alone fills most vesicles but it varies between the golden brown and pale brown clays. Most olivine is 100% replaced by pale brown smectite. This contrasts with previous sites where olivine was replaced predominantly by Fe oxyhydroxides.
Calcite	<1				replacing mesostasis and filling vesicles	Rare vesicles are filled with calcite only.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	1	distributed	<0.1	0.8	0.3		

COMMENTS : Glomerocrysts of plagioclase and plagioclase + olivine are present.

187-1156A-2R-1, 62-65 cm (TS#28) **Unit:1** **OBSERVER:** **Russo**

ROCK NAME: **Moderately plagioclase-olvine basalt**
WHERE SAMPLED: **pillow Interior**
GRAIN SIZE: **microcrystalline**
TEXTURE: **intersertal**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	4		1	4	2		subhedral to anhedral	Plagioclase is platy, twinned, and oscillatory zoned. Some (~33%) of the plagioclase have sieve textured cores, occasionally aligned along cleavage or twin planes. One Cr-spinel was observed near the edge of a single plagioclase phenocryst.
Olivine	2		0.5	1.5	1		subhedral	Iddingsite is present along some fractures.
Clinopyroxene								
GROUNDMASS								
Olivine	4						equant	
Plagioclase	28						lath-like	
Clinopyroxene								
Opaque Minerals								
Mesostasis	60						some plumose quench texture	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays (smectite)	1 to 2				groundmass	

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

COMMENTS : Some calcite is also seen in the groundmass (<3%) and can not be traced to the edge of the slide along a fracture or in a vein. Plagioclase is also seriate making the distinction of the smallest plagioclase phenocryst arbitrary.

187-1156A-2R-3, 129-133cm (TS#29) **Unit:2** **OBSERVER:** **Gee**

ROCK NAME: **Moderately plagioclase-olvine phyric basalt**
WHERE SAMPLED: **Unit 2**
GRAIN SIZE: **Fine grained**
TEXTURE: **Porphyritic, intersertal**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	4	4	0.4	2	1.5		Laths, euhedral to broken	Larger phenocrysts are broken and may show sieve texture. Concentric and discontinuous zoning present.
Olivine	1	1.5	0.4	1.6	1		Equant and skeletal euhedral to broken	Skeletal olivine is ~400 microns, whereas equant crystal tend to be larger, 1.5-2 mm but broken or ragged. Melt inclusions (up to ~80 microns) in equant crystals (Photomicrograph taken).
Clinopyroxene	1	1	0.4	2	1		broken crystals to subhedral	Ragged crystal faces(resorption) and good twin planes
GROUNDMASS								
Olivine								
Plagioclase							acicular	Plagioclase is the only phase seen in the g/m, usually in radiating clusters.
Clinopyroxene								
Opaque Minerals								
Glass								

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays	3				groundmass and vesicles	
Calcite	tr				veins and in rare vesicles	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	<<1						Filled with brown clay

COMMENTS : Some replacement of groundmass (5%) by clays and replacement of olivine along fractures by iddingsite (10%), also a vein cross the thin section. The majority of the large phenocrysts show some disequilibrium textures, e.g. sieve and broken/fractured plagioclase, broken/fractured olvine and clinopyroxene. Plagioclase is often (~20%) grouped in clusters. Second observer comment (PDK): There are no clinopyroxene phenocrysts in this thin section. The slide is too thick and some plagioclase has higher birefringence, which has been misidentified as cpx. The term broken in the description of phenocrysts refers to the presence of microcracks, now lined with a birefringent clay or epidote mineral, which crosscut the crystals.

187-1156A-3R-1, 5-9 cm (TS#2) **Unit:2** **OBSERVER:** **Hauff**

ROCK NAME: **Plagioclase-olvine phyric basalt**
WHERE SAMPLED: **unit 2**
GRAIN SIZE: **microcrystalline**
TEXTURE: **intersertal**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	5						Tabular, blocky	Partially resorbed along cleavage planes; spinel inclusions in some phenocrysts; Fe oxyhydroxide staining along microcracks and cleavage planes.
Olivine	1		0.2	1.2	0.5			0% altered to 100% altered and replaced by a mixture of Fe oxyhydroxide and smectite along crystal faces and cracks.
GROUNDMASS								
Olivine							anhedral	
Plagioclase							sheaf-laths	Sheaf quench texture and hollow-box textures
Clinopyroxene								
Opaque Minerals								
Glass								
Mesostasis	34							Includes quench clinopyroxene and plaglioclase + glass

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays	60%				Plagioclase, clinopyroxene	Light brown to greenish affecting small sheafs of plagioclases.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	<1						Vesicles plugged during precipitation. Vesicles filled with light green clays.

COMMENTS :

187-1156A-3R-2, 73-77 cm (TS#8) **Unit:2** **OBSERVER:** **Kempton**

ROCK NAME: **Moderately plagioclase-olvine phyric basalt**
WHERE SAMPLED: **near chilled margin**
GRAIN SIZE: **microcrystalline to cryptocrystalline**
TEXTURE: **sheaf quench textures**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	4	4	0.3	1.5	1		tabular to rounded; subhedral to anhedral	Complex plagioclase evolution indicated by a partially resorbed core overgrown by large euhedral/subhedral rim, which included several small anhedral plagioclase crystals during growth. Plagioclase shows some Fe staining along cracks.
Olivine			0.2	0.8	0.5		equant, rarely skeletal	
Clinopyroxene								
GROUNDMASS								
Olivine								
Plagioclase	20	20					acicular to skeletal + sheaf quench textures	
Clinopyroxene	see comments below						intergrown with plagioclse sheafs	
Opaque Minerals	<1%	<1%		<5 microns				
Glass								

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays						
Fe oxyhydroxides	?				glass?	The groundmass is clearly stained by Fe oxyhydroxides, but how much is actual replacement cannot be accurately assessed. As much as 40% of the groundmass appears to be stained.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	<1		<0.1	0.3		unfilled	Vesicles vary in size throughout the thin section. They are largest in the more coarsely crystallized areas.

COMMENTS : Slide is badly plucked making estimation of vesicle abundance difficult. The proportions of groundmass phases cannot be accurately assessed due to the predominance of plagioclase sheaf quench textures. The quench textures vary from one side of the slide to the other, being smaller, poorly developed sheafs (i.e. immature sheaf) at one end and more fully developed sheaf textures at the other. Where the sheafs are better developed there is some concentration of glass (now devitrified) in areas of mesostasis. Clinopyroxene is intimately intergrown with plagioclase in the quench textures.

187-1156B-3R-1, 80-84 cm (TS#32) **Unit:1** **OBSERVER:** **Miller**

ROCK NAME: **Highly plagioclase-olvine phyric basalt**
WHERE SAMPLED: **unit 1**
GRAIN SIZE: **Aphanitic**
TEXTURE: **Hypocrystalline, intersertal**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	12		0.2	3.5	1.5		Tabular to blocky and laths, subhedral	Twinning and concentric zoning are common, as are embayments. Fluid and glass inclusions are present, glass inclusions appear more common. Fe staining is present along fractures, sieve textures present but not common.
Olivine	3		0.2	1.2	0.75		Subheral to anhedral	Most are fractured, some appear rounded but euhedral points are present on many crystals, rarely in clusters with plagioclase, predominantly fresh, only minor alteration along fractures and crystal margins.
Clinopyroxene								
GROUNDMASS								
Olivine	1				0.1			
Plagioclase	20				0.2			Box, hopper, swallowtail and quench textures common.
Clinopyroxene	10							Plumose quench texture.
Opaque Minerals	1				2-5 microns			Disseminated in glass, ~100 micron Cr-spinels occur as inclusions in olivine and plagioclase.
Mesostasis	33							

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays	18					Replacing groundmass glass and after quench textured groundmass phases, pale yellow brown.
Fe-oxyhydroxide	tr					

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	2						Most are not filled, but smectite filling is present in a few vesicles.

COMMENTS : Point counted, 1400 points, 0.5 mm counting interval. Abundant phenocrysts are fresh, although groundmass is about 20% altered to yellow brown clay.One side of the thin section is significantly more altered than the other.

187-1156B-5R-1, 75-79 cm (TS# 33) **Unit:1** **OBSERVER:** **Russo**

ROCK NAME: **Moderately plagioclase phyric basalt**
WHERE SAMPLED: **pillow interior**
GRAIN SIZE: **microcrystalline**
TEXTURE: **plumose quench texture with acicular plagioclase**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	3		0.5	2.8	1		lath-like to prismatic	Plagioclase is often twinned and rarely oscillatory zoned. ~15-20% of plagioclase phenocrysts are embayed and/or skeletal.
Olivine								
Clinopyroxene								
GROUNDMASS								
Olivine	1						equant, subhedral	
Plagioclase	20						acicular	
Clinopyroxene								
Opaque Minerals	5		< 20 microns				oval (blebs)	Occurs in 'pockets' between plumose texture and acicular plagioclase as small ovals.
Mesostasis	65						plumose textures	Likely dominated by clinopyroxene, but difficult to be sure.

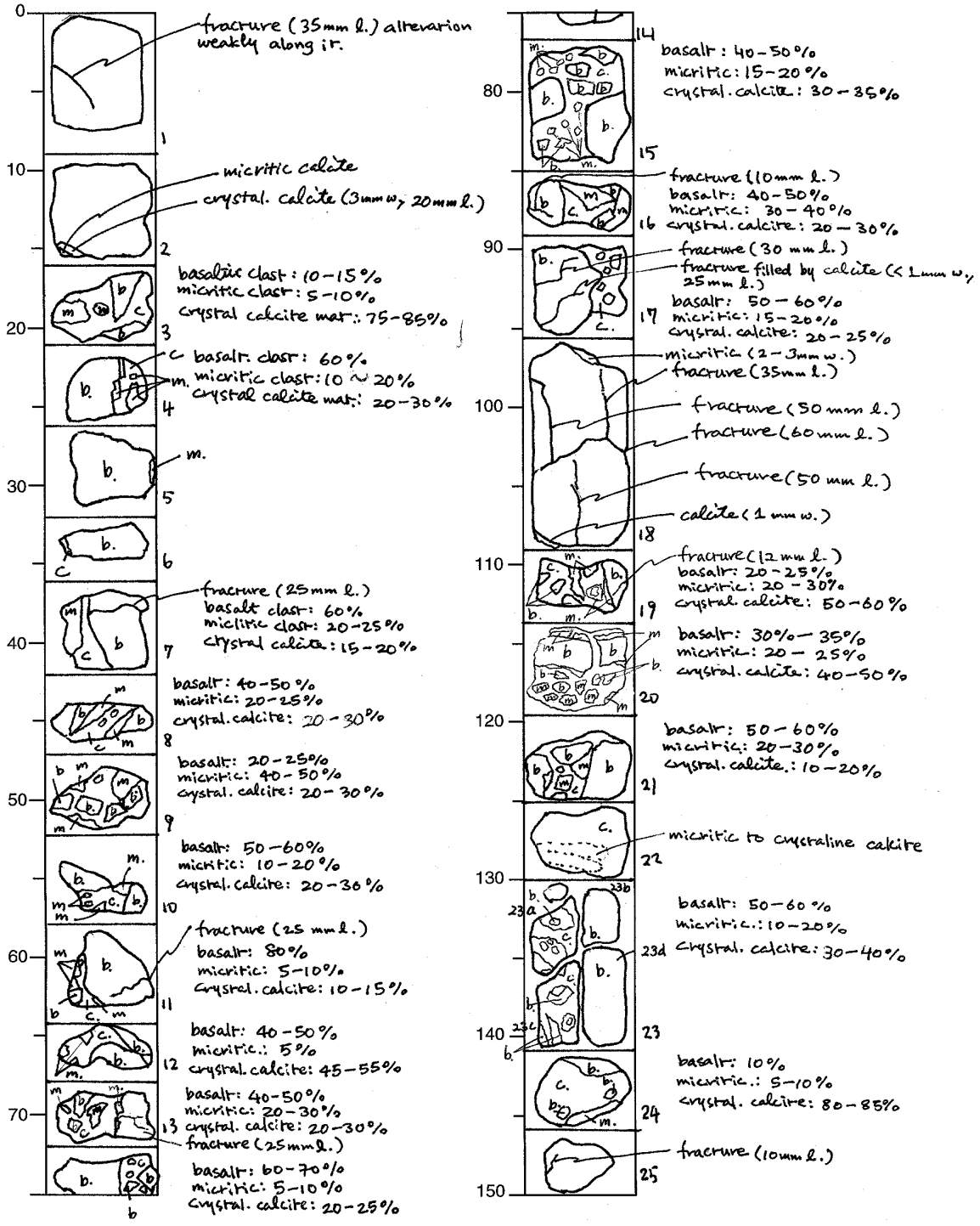
SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays	6				groundmass	Yellow to light brown in color (smectite?).

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

COMMENTS : Images (82 and 83) embayed and skeletal plagioclase. Image 81 shows typical groundmass texture with plumose quench texture.

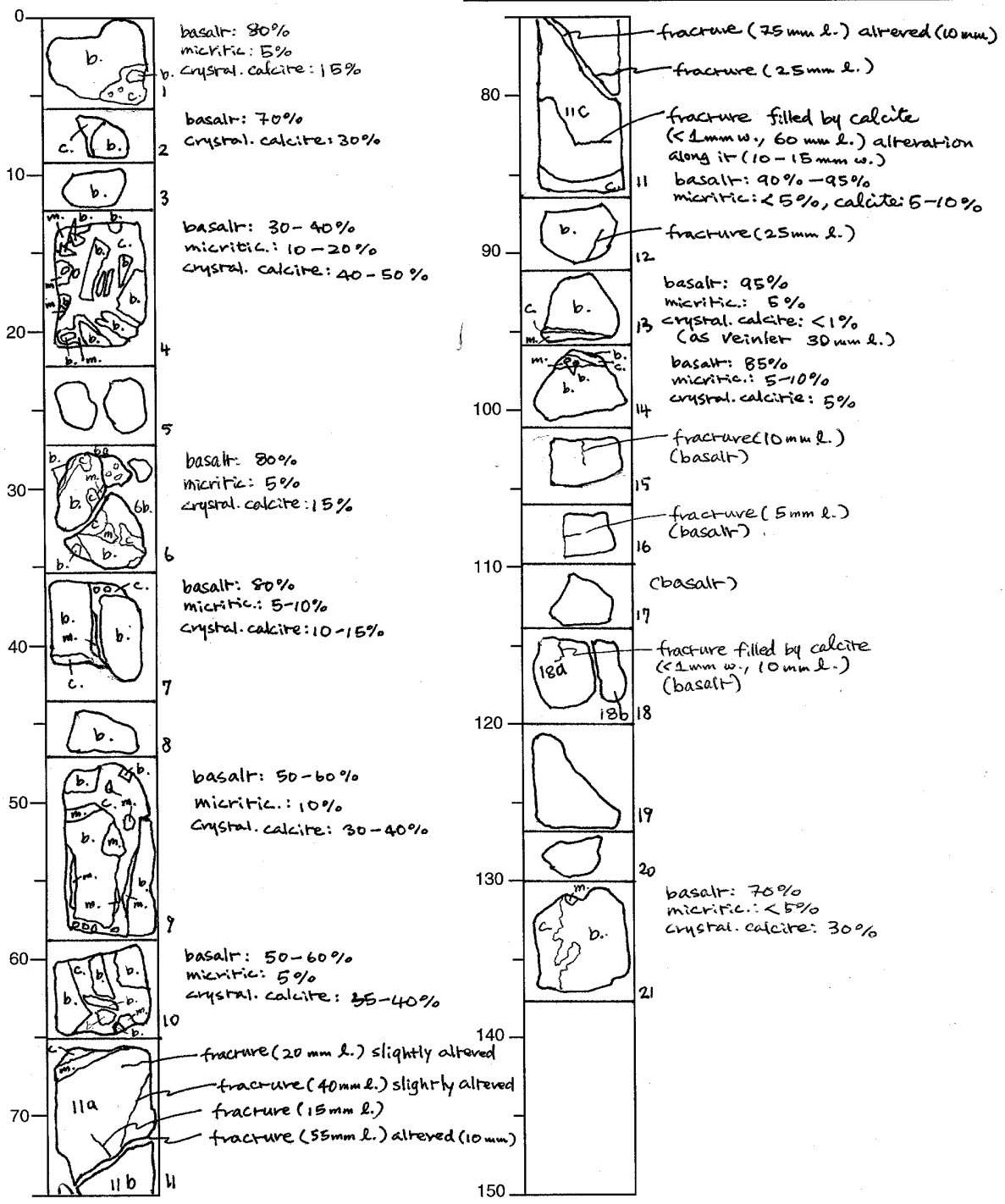
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156A	2	1	H.S.



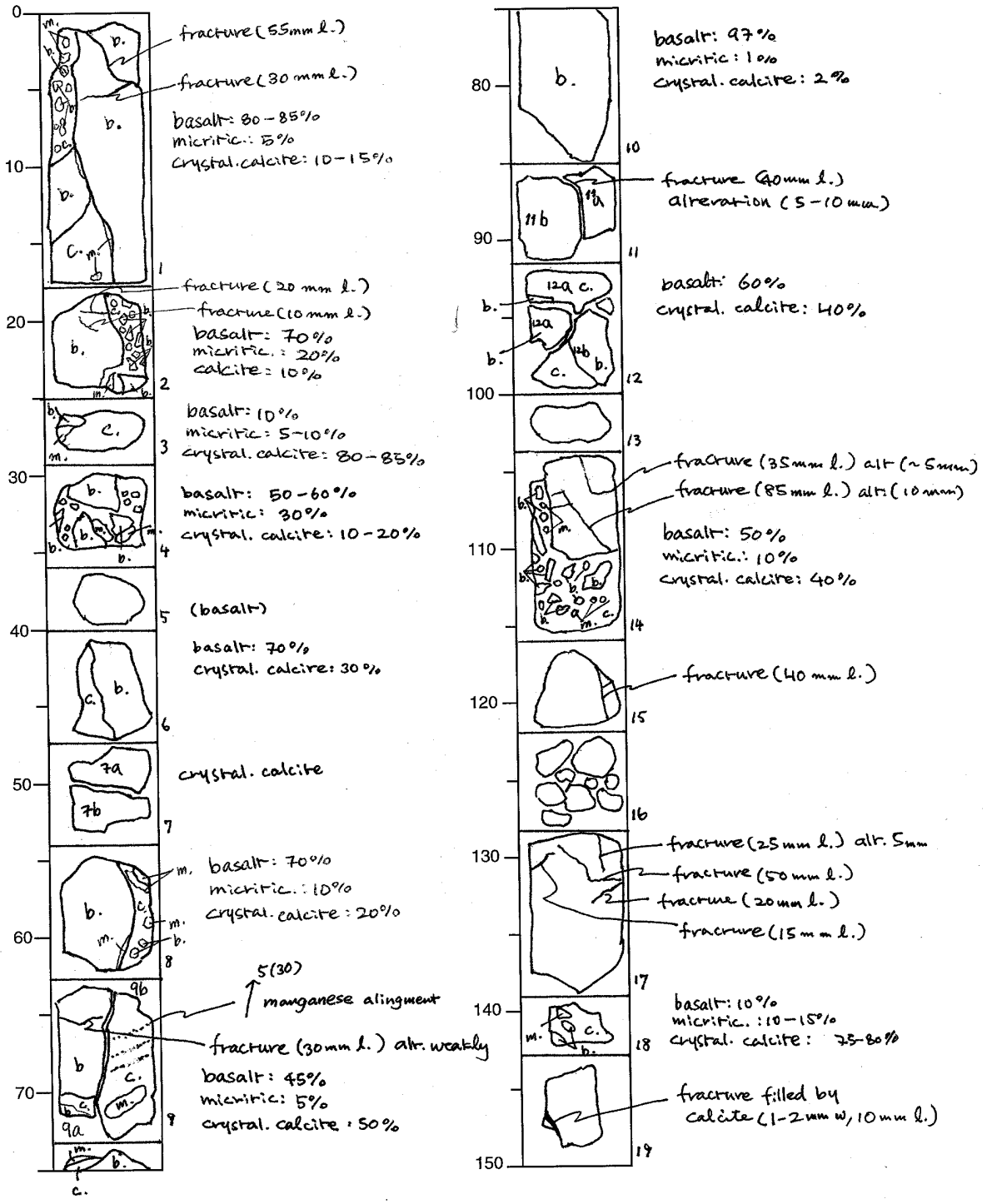
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156A	2R	2	H.S.



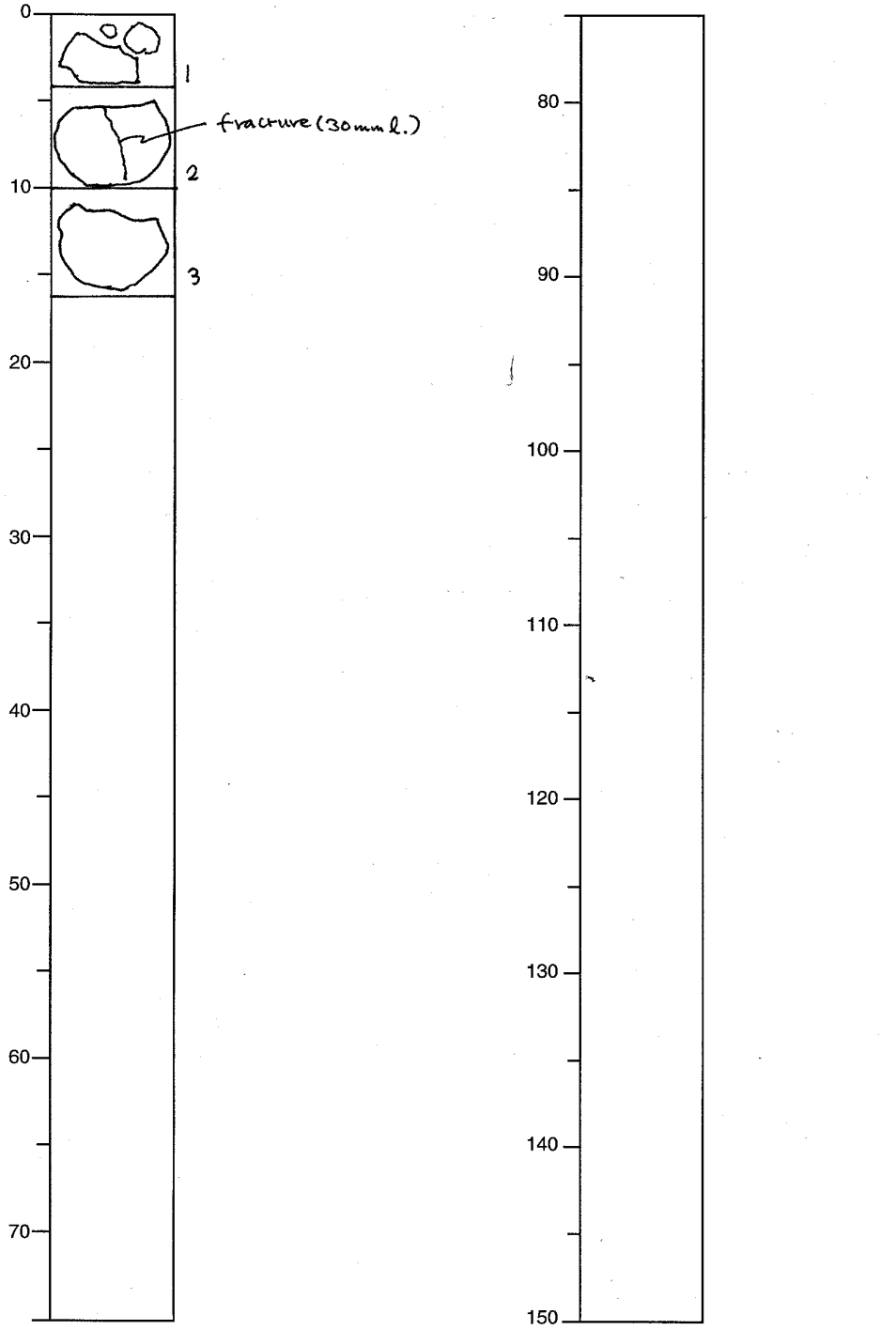
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156A	2R	3	H.S.



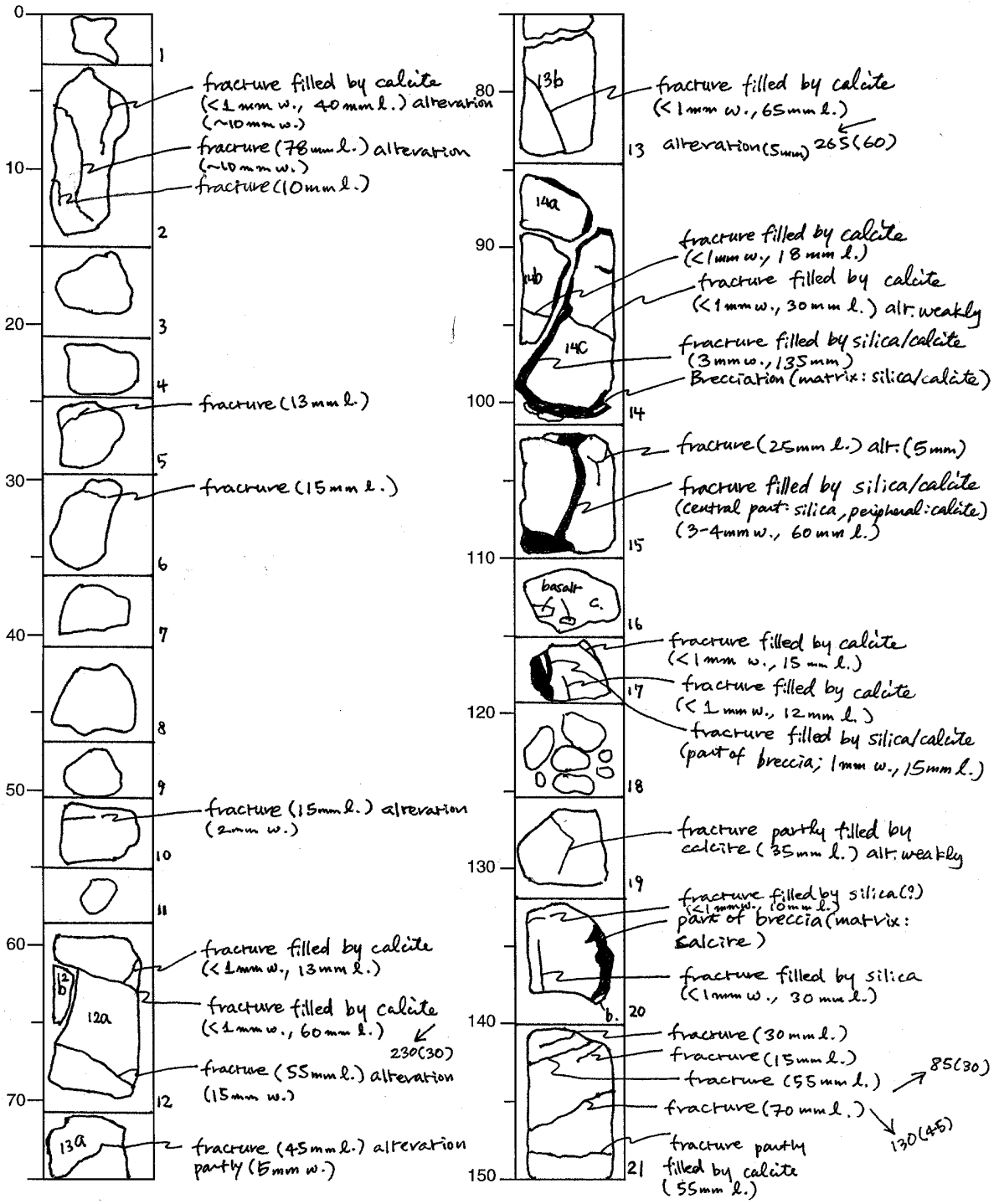
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1156A	2R	4



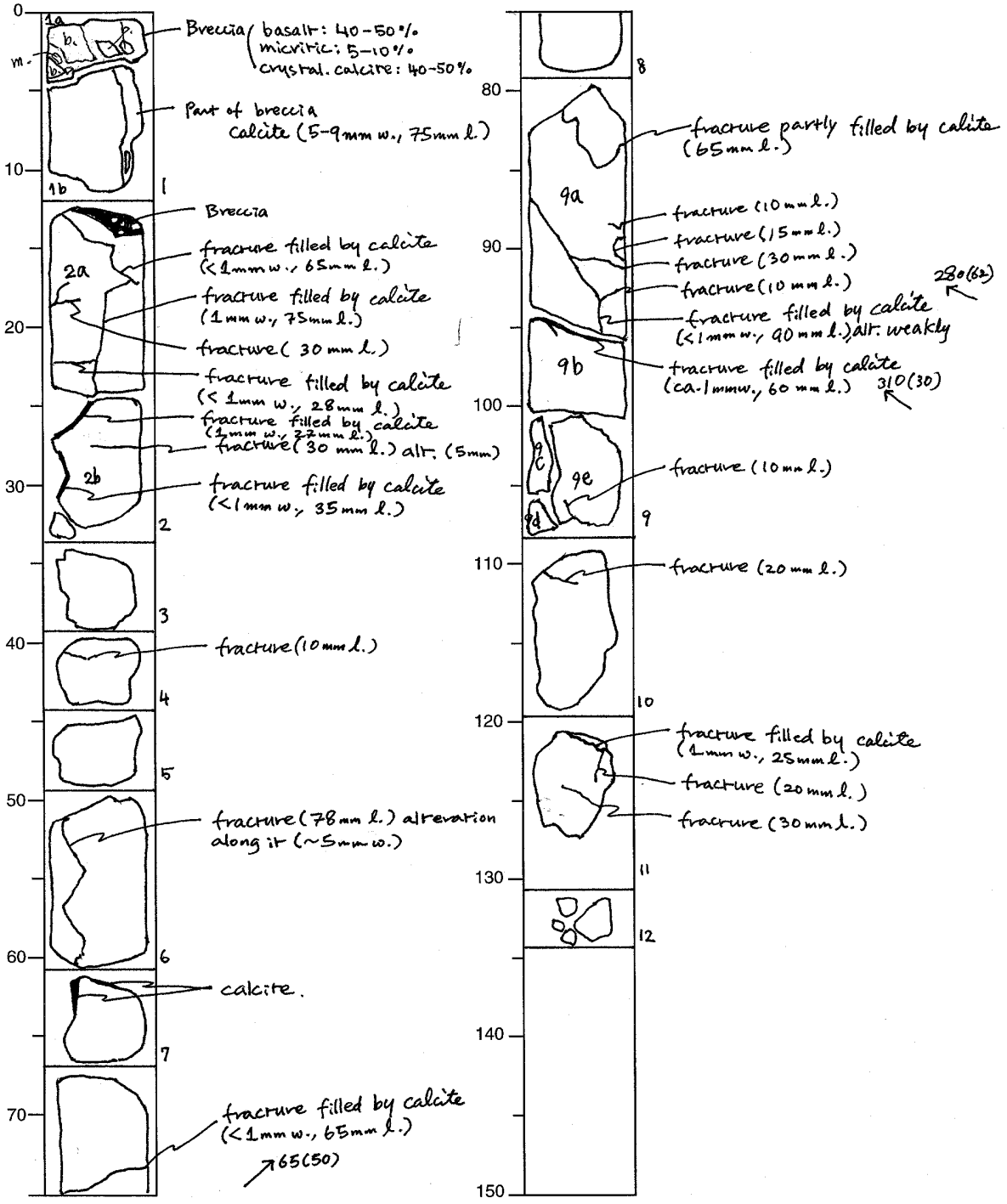
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156A	3R	1	H.S.



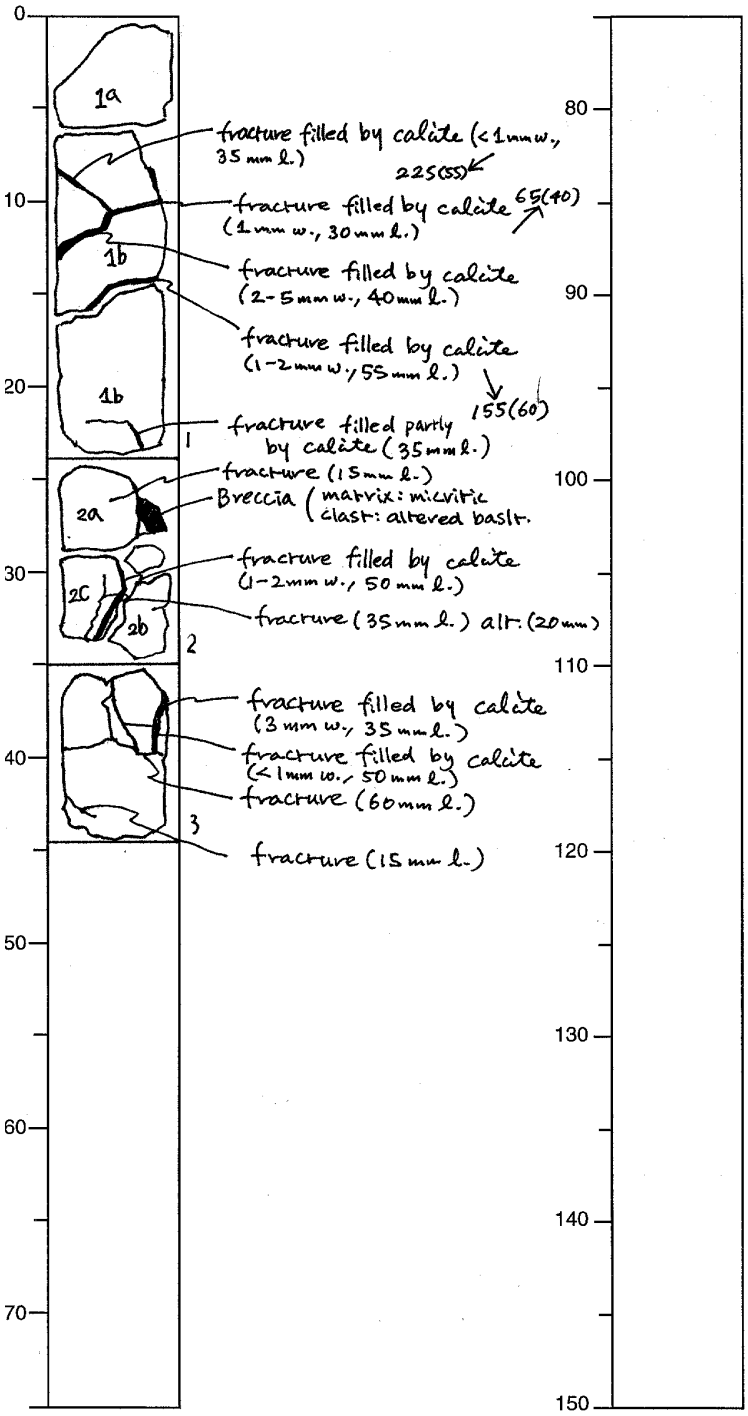
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156A	3R	2	H.S.



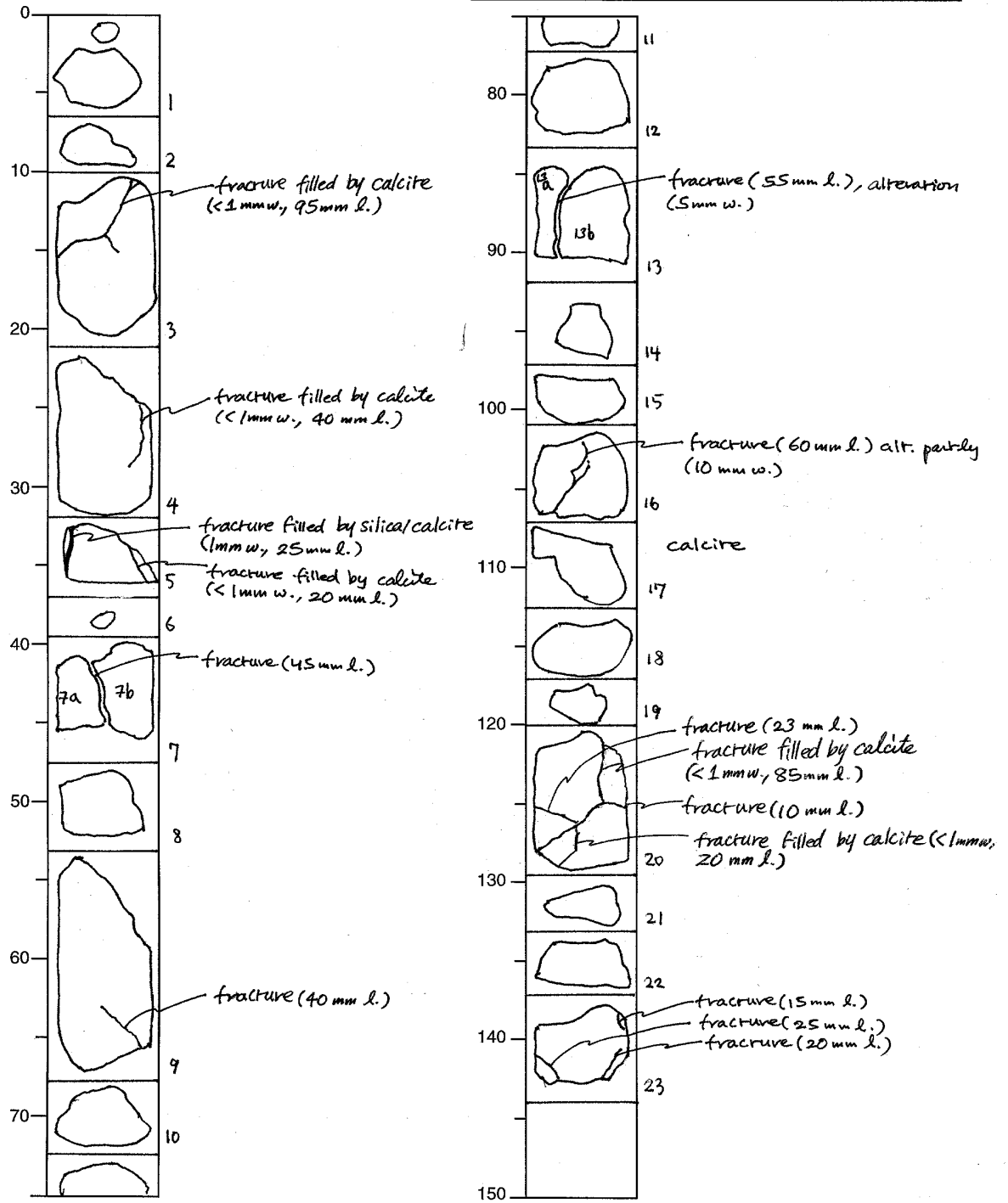
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1156A	3R	3



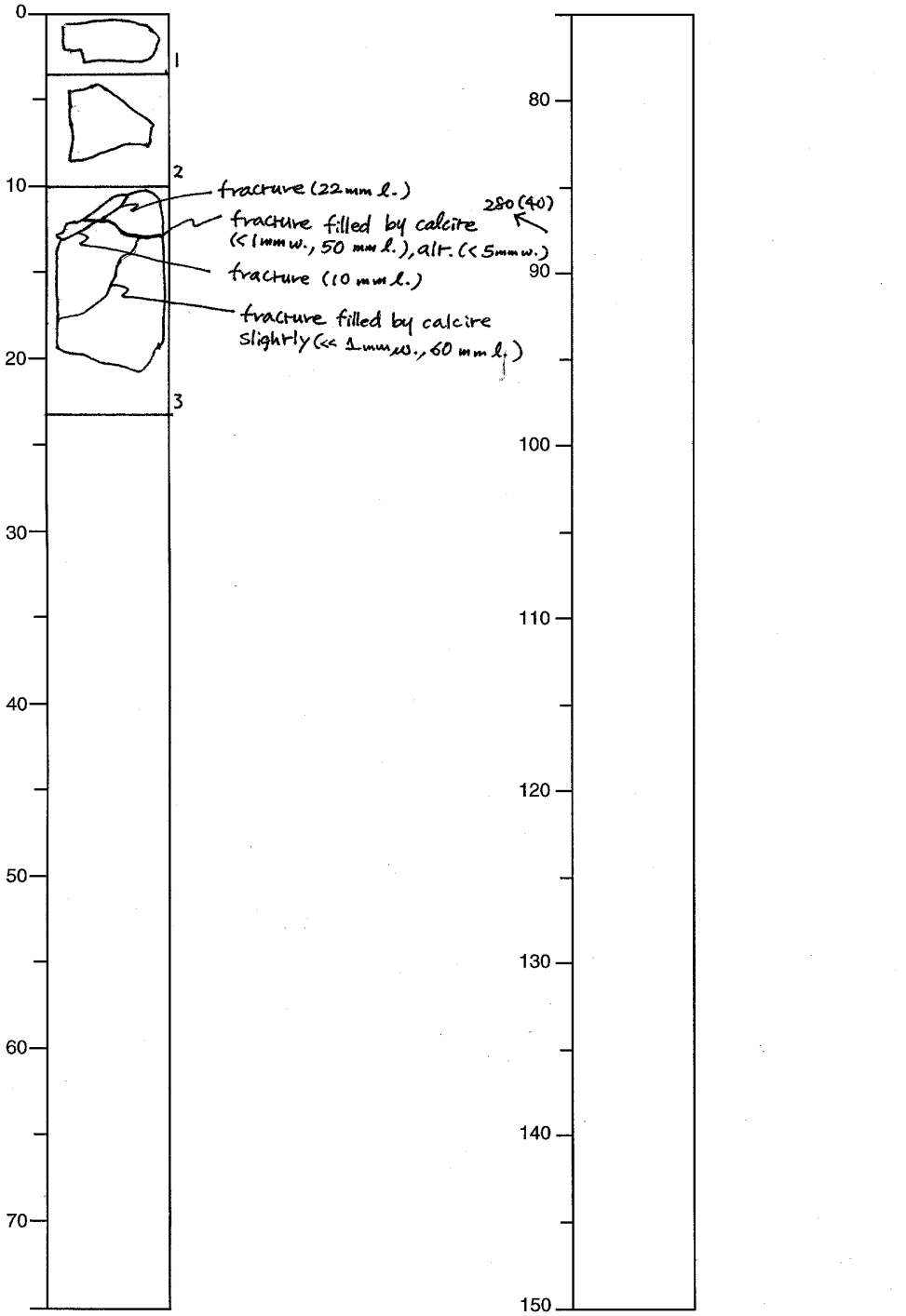
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156B	2	1	HS



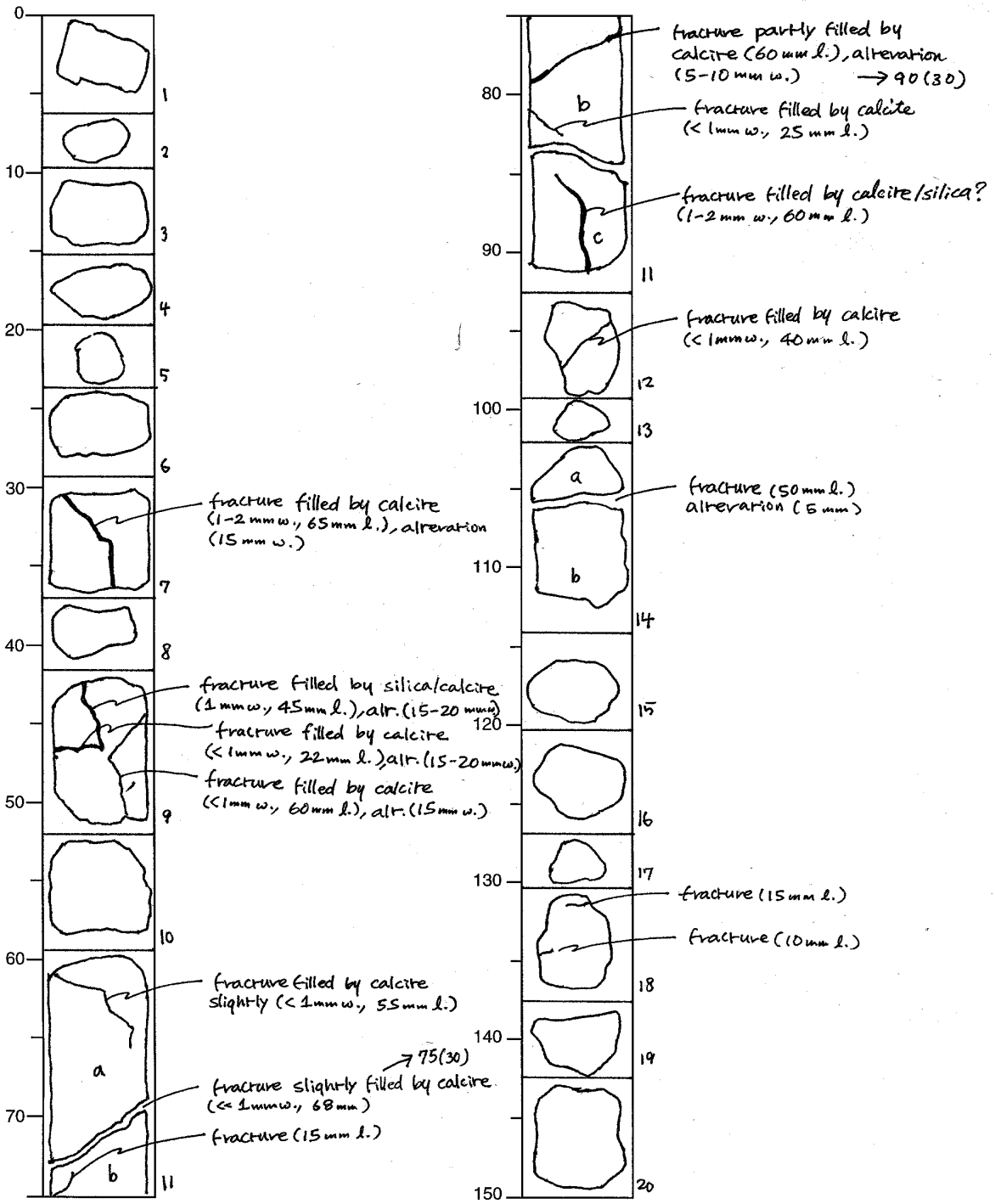
STRUCTURAL GEOLOGY DESCRIPTION

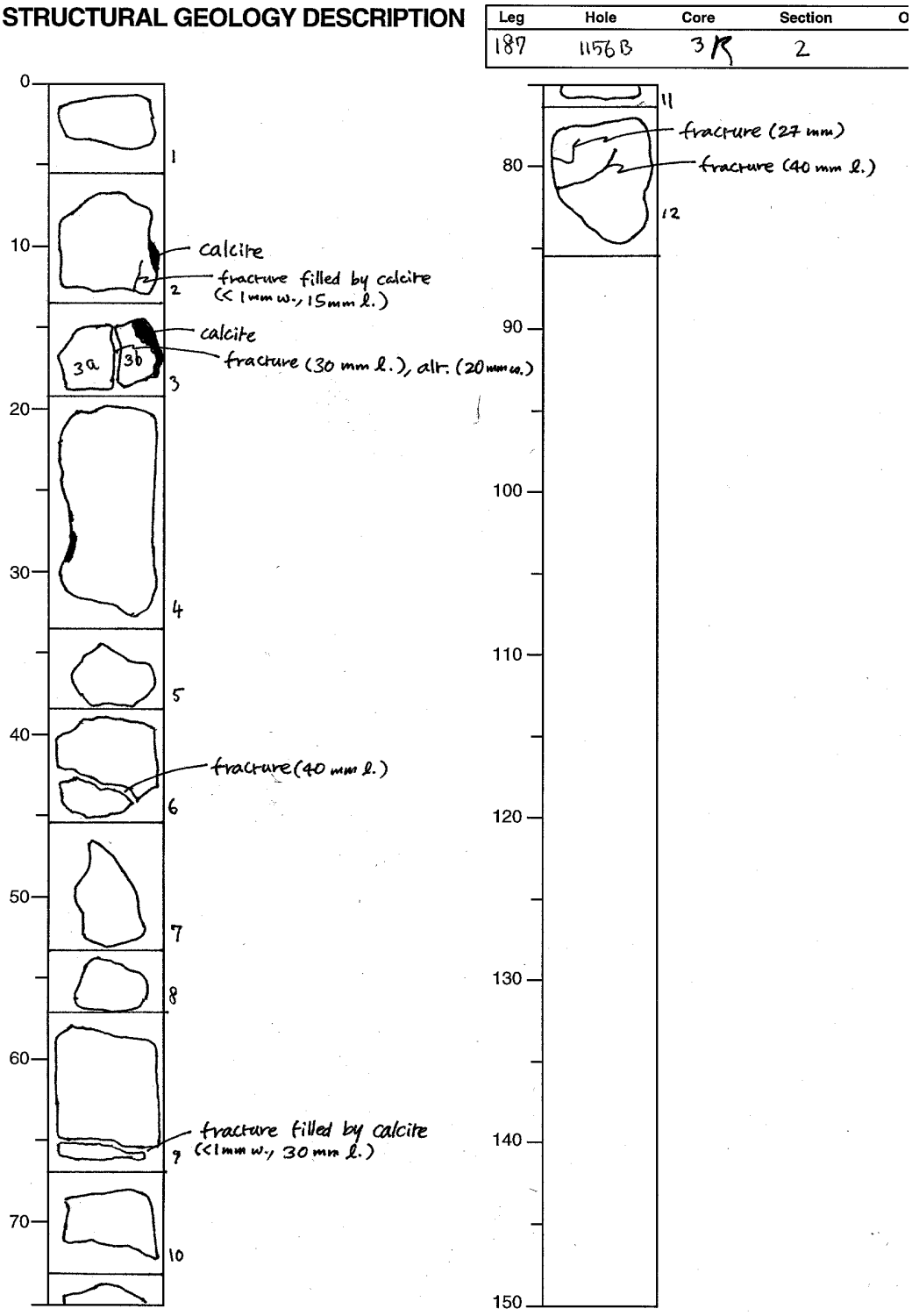
Leg	Hole	Core	Section
187	1156	2R	2



STRUCTURAL GEOLOGY DESCRIPTION

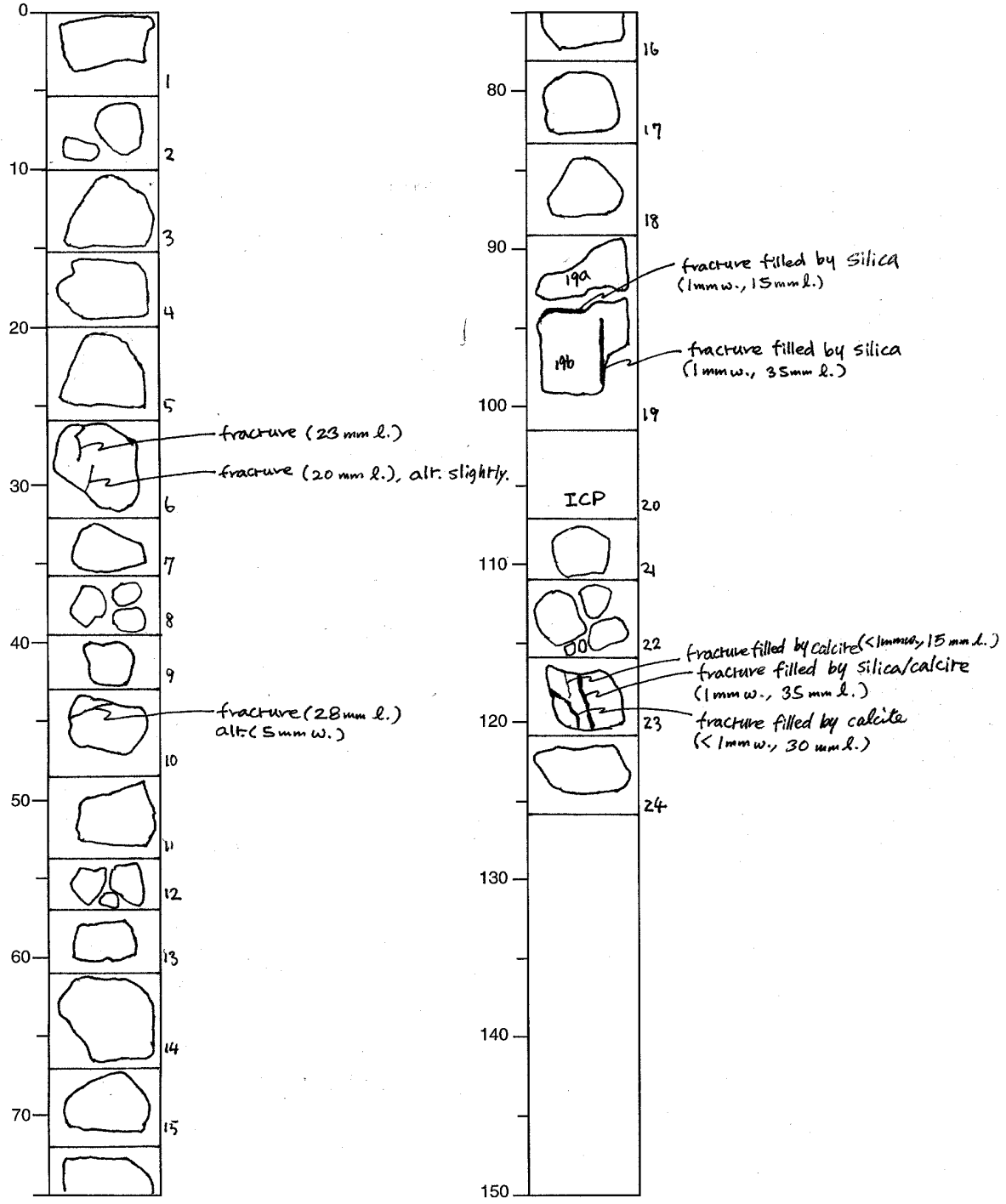
Leg	Hole	Core	Section	Observer
187	1156B	31	1	




STRUCTURAL GEOLOGY DESCRIPTION
Leg 187
Hole 1156B
Core 3R
Section 2
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
1
2
3a
3b
3
4
5
6
7
8
9
10
11
12
calcite
fracture filled by calcite (<1mm w., 15mm l.)
calcite
fracture (30 mm l.), alt. (20 mm a.)
fracture (40 mm l.)
fracture filled by calcite (<1mm w., 30 mm l.)
fracture (27 mm)
fracture (40 mm l.)

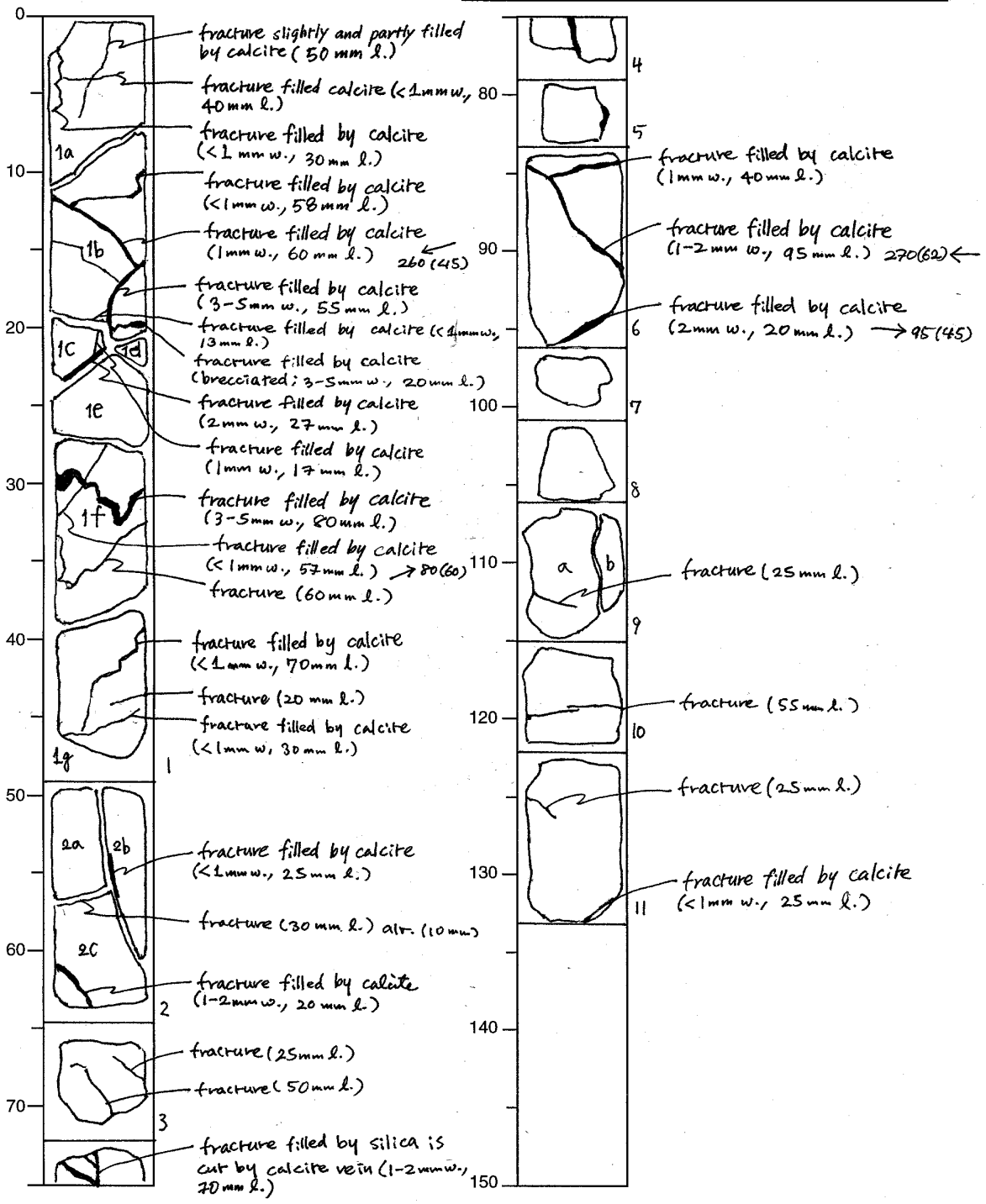
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156B	4R	1	HS



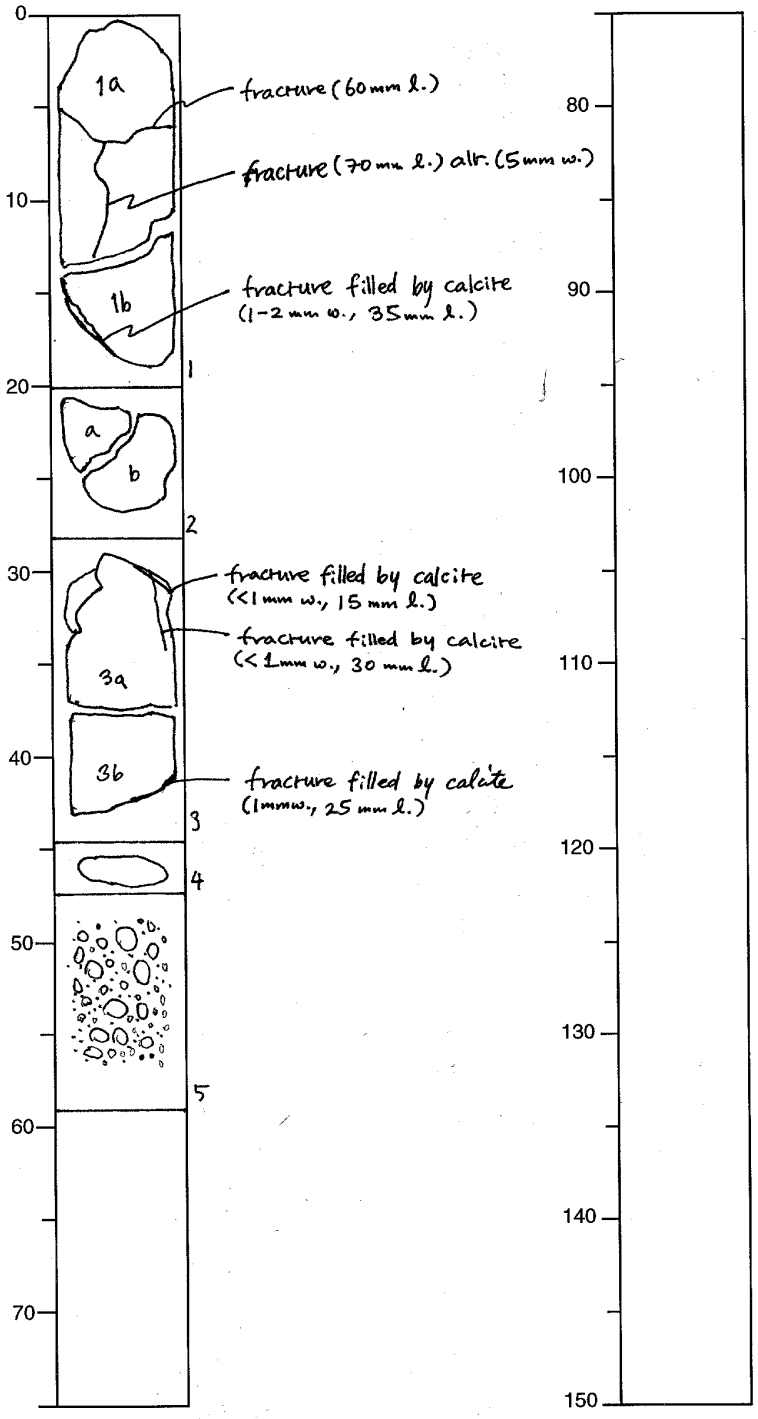
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156B	4R	2	HS



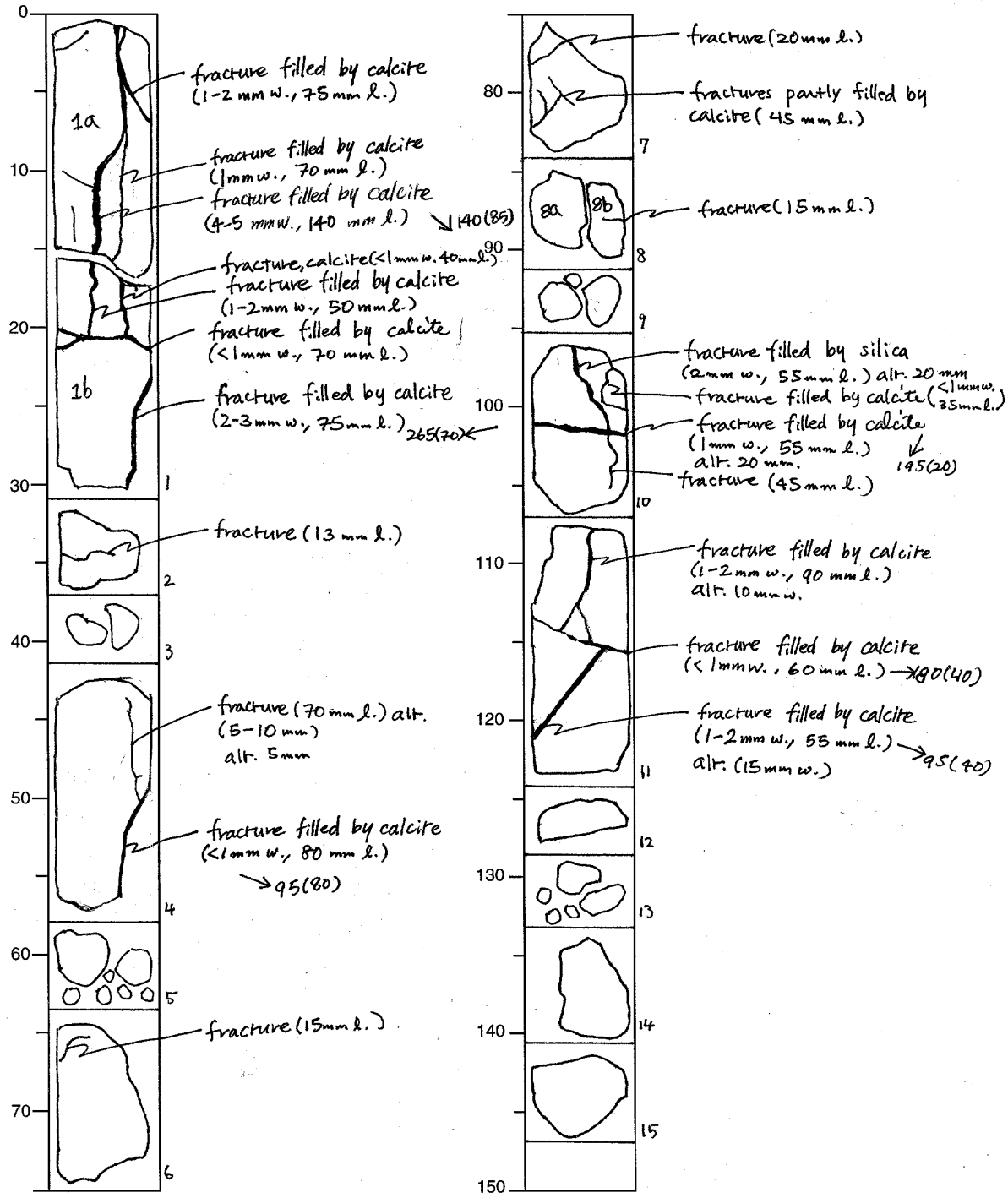
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1156B	4R	3



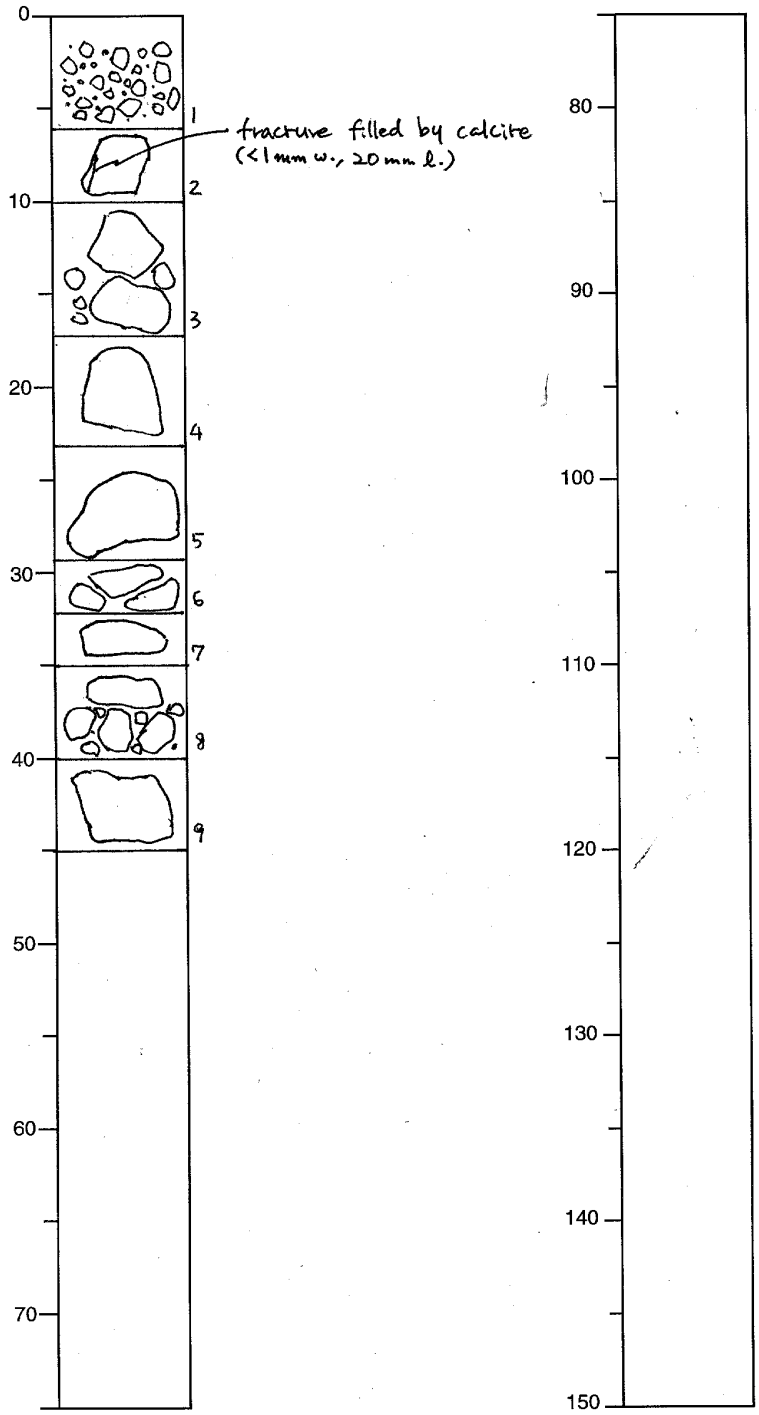
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156B	5 R	1	HS



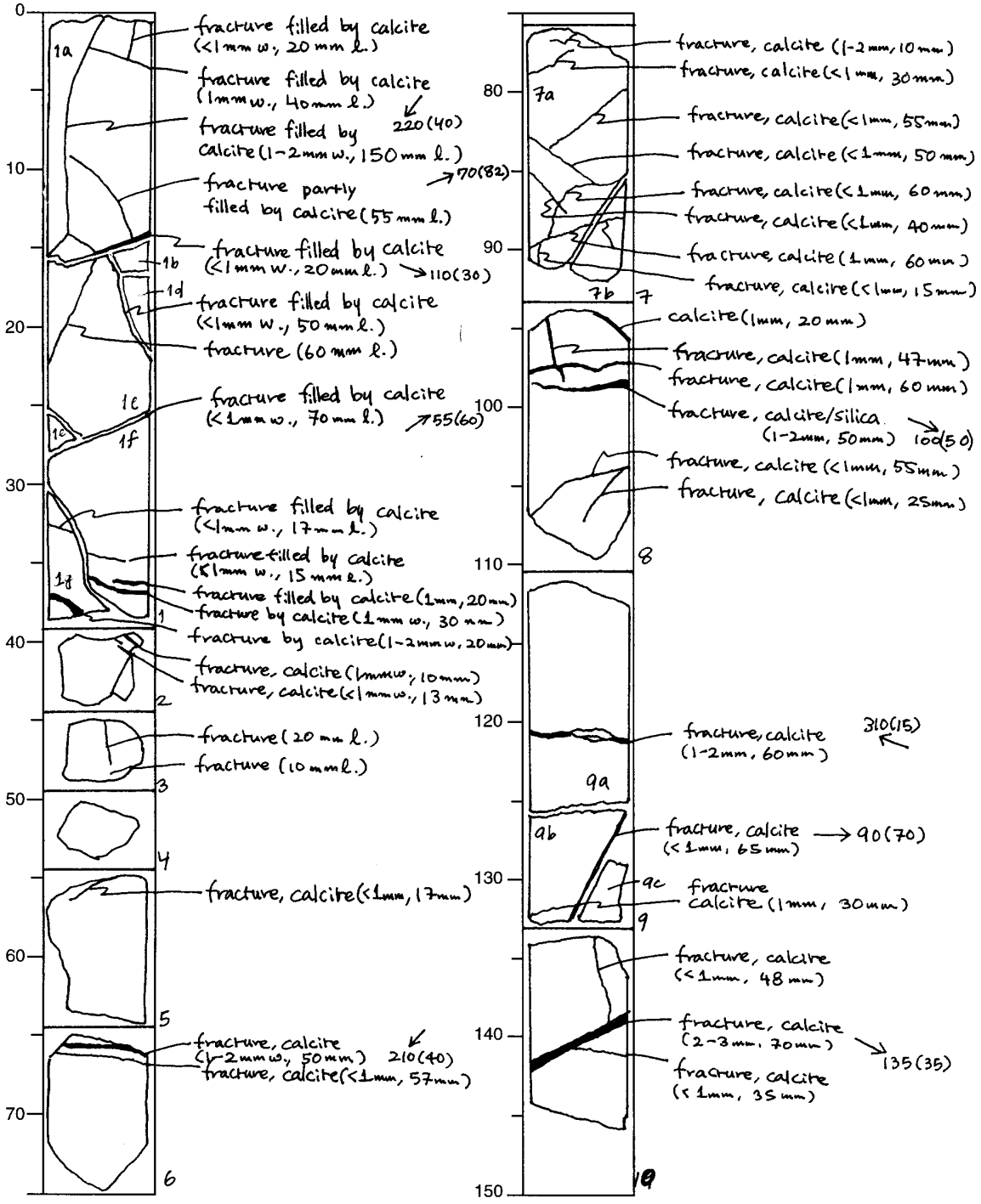
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1156B	5R	2



STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1156B	6R	1.	HS



STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1156B	6R	2