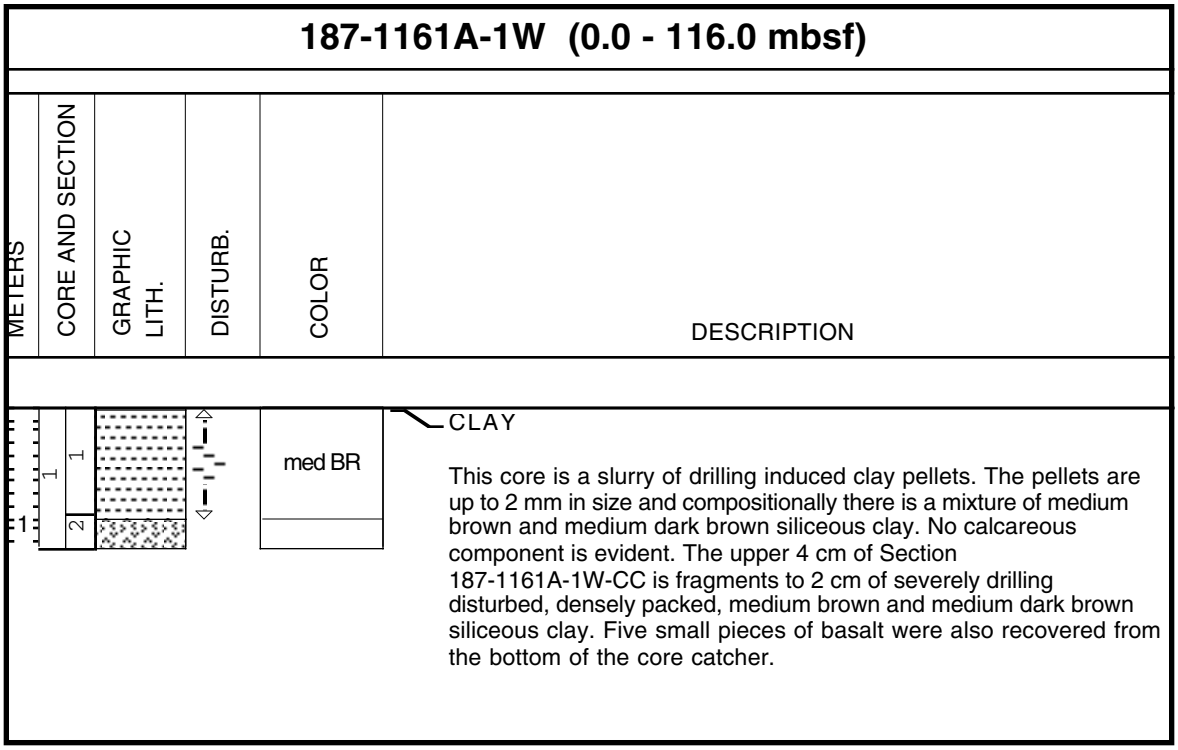
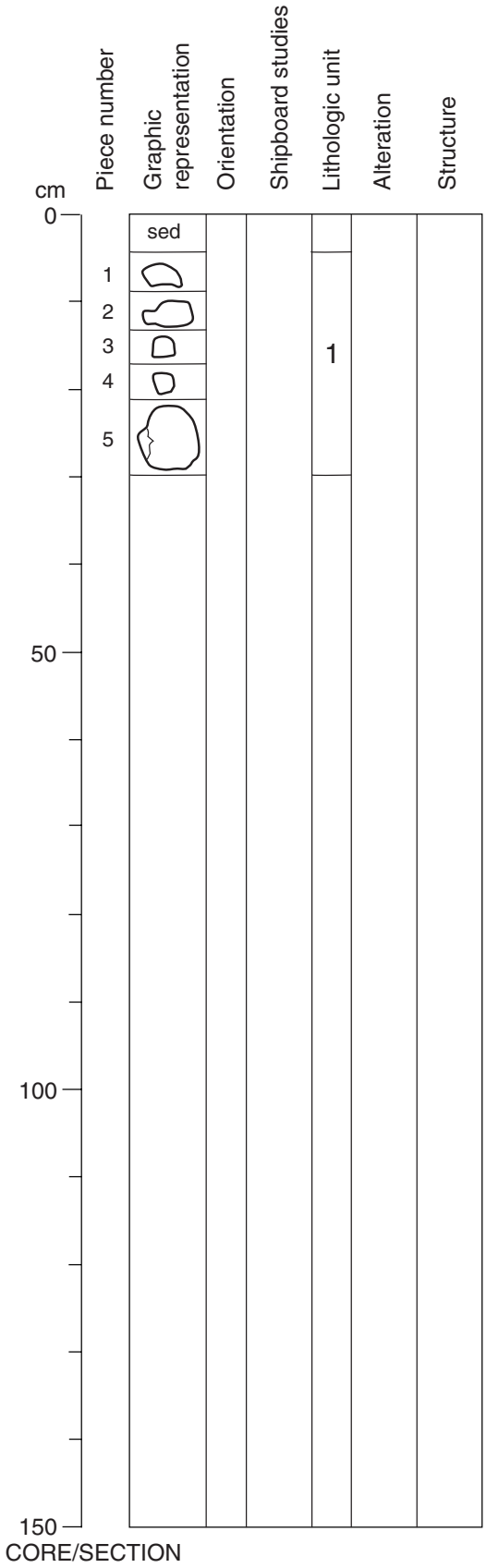
Core Photo


187-1161A-1W (0.0 - 116.0 mbsf)
METERS
CORE AND SECTION
GRAPHIC LITH.
DISTURB.
COLOR
DESCRIPTION
1
1
2
med BR
CLAY
This core is a slurry of drilling induced clay pellets. The pellets are up to 2 mm in size and compositionally there is a mixture of medium brown and medium dark brown siliceous clay. No calcareous component is evident. The upper 4 cm of Section 187-1161A-1W-CC is fragments to 2 cm of severely drilling disturbed, densely packed, medium brown and medium dark brown siliceous clay. Five small pieces of basalt were also recovered from the bottom of the core catcher.

Core Photo



187-1161A-1W-CC

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

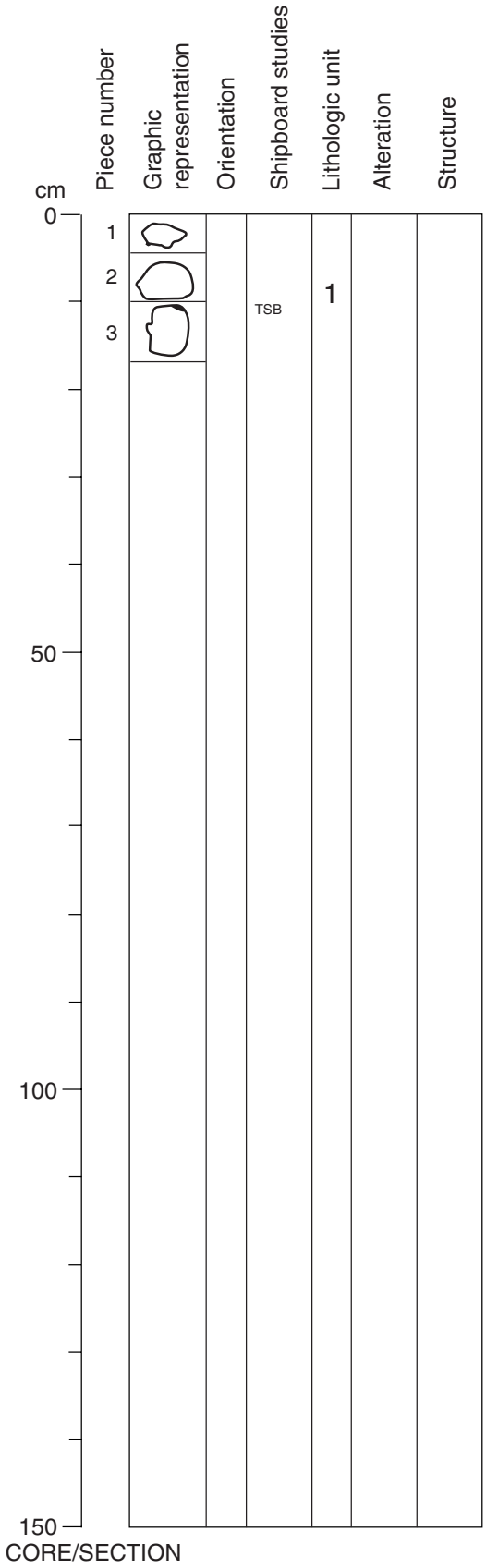
Pieces: 1-5

INTERNAL CONTACTS: A fragment of a chilled margin, <1 mm thick and heavily palagonitized, was recovered on Piece 1.

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

GROUNDMASS: Microcrystalline
COLOR: Grayish brown to light gray
VEINS/FRACTURES: Mn oxide-lined radial fractures occur in Piece 1
ALTERATION: Pieces 1 and 5 are highly altered; Pieces 2 to 4 are moderately altered. In the moderately altered pieces, alteration is concentrated in halos up to 1 cm wide, and characterized by replacement of groundmass olivine and clinopyroxene by Fe oxyhydroxides + brown clay. In the highly altered pieces, this style of alteration is pervasive. Olivine is totally altered throughout. Plagioclase phenocrysts are unaltered. Pieces 1, 2, and 5 have thin coatings of clay + Mn oxide spots ± calcite, similar in appearance to some of the overlying sediment.
STRUCTURE: not distinguishable
ADDITIONAL COMMENTS: ~30% of phenocrysts commonly occur in glomerocrysts.

Core Photo



187-1161A-2R-1

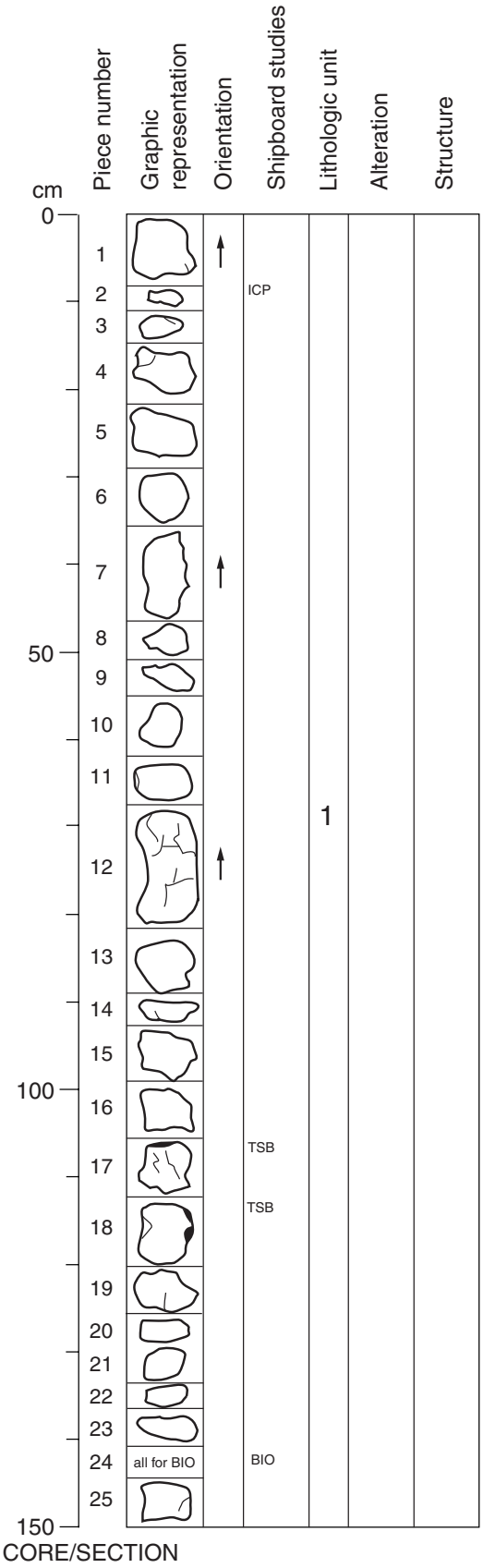
UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC

Pieces: 1-3

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

GROUNDMASS: Microcrystalline
COLOR: Light gray in unaltered areas, grayish brown in altered areas
VEINS/FRACTURES: A Mn oxide-lined fracture occurs in Piece 2
ALTERATION: All pieces in this section are highly altered. Alteration is characterized by replacement of groundmass olivine and clinopyroxene by Fe oxyhydroxides + brown clay. Olivine is totally altered throughout, except in the core of Piece 3, where a few crystals of fresh olivine are observed. Plagioclase phenocrysts are unaltered throughout. Piece 1 has small patches of a cream-colored silty sediment + Mn oxide spots on its outer surface; this piece also has some dendritic growth of Mn oxide for ~3 mm from the outer surface into the interior of the piece.
STRUCTURE: Not distinguishable
ADDITIONAL COMMENTS: Larger crystals of plagioclase have rounded shapes with dark cores; these may be melt inclusions or alternatively the presence of Mn oxide along microcracks.

Core Photo



87-1161A-3R-1

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

Pieces: 1-25

This section includes two different basalt types. Most pieces are sparsely to moderately plagioclase-olivine phyric basalt, but two small pieces (Pieces 9 and 11) are aphyric basalt. Given the limited recovery and small size of the aphyric basalt pieces, combined with the high degree of alteration of many pieces in the section, it cannot be established unequivocally whether the mixture recovered reflects a primary stratigraphic sequence of basalt pillow lavas or is a talus pile; however, the latter is more likely.

Pieces 1-8, 10, 12-25: Sparsely to Moderately Plagioclase-Olivine Phyric Basalt

INTERNAL CONTACTS: Chilled margins were recovered on Pieces 1, 2, 4, 12, 13, 17, 18, and 25. The chilled margins of most samples are highly altered to palagonite ± clay. In Piece 18 the glass is partially replaced by a blue cryptocrystalline silica. Clear glass was recovered only on Piece 12. This sample consists of < 1 mm of palagonite, 4-5 mm of clear glass, 2 mm of small (~0.1 mm) discrete spherulites and 5-6 mm of coalesced spherulites.

PHENOCRYSTS:

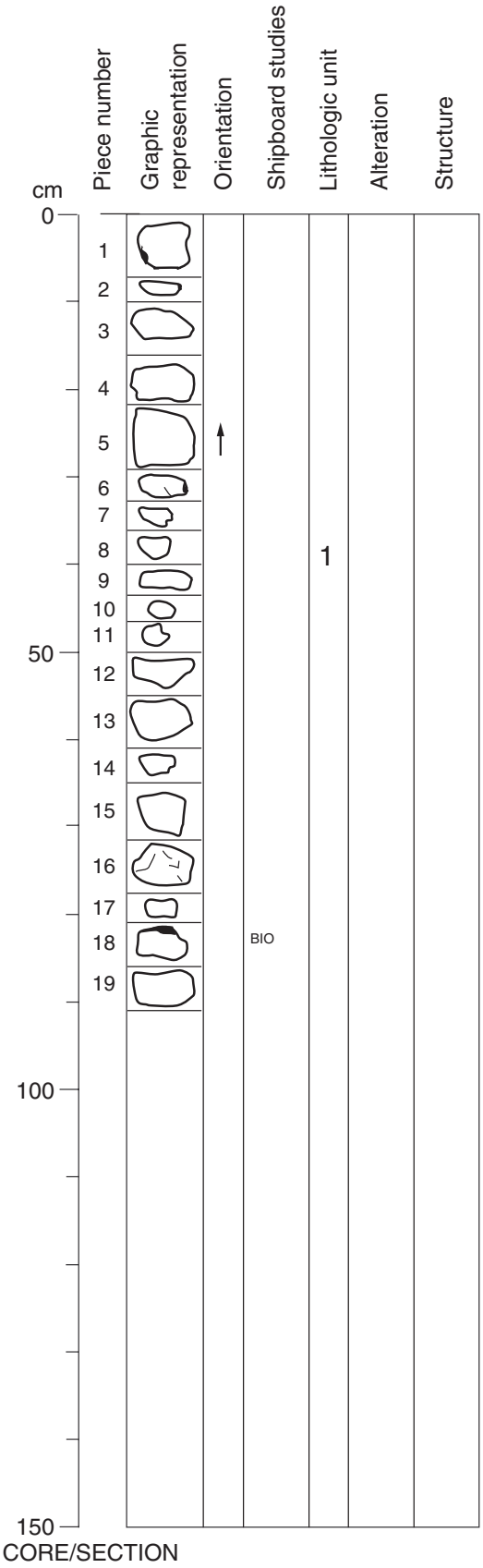
	Abundance	**Size** (mm)			**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	1-2	1	5	0.5	prismatic to tabular
Olivine	1-2	<1	1	0.5	equant
Total	2-3				

GROUNDMASS: Microcrystalline
COLOR: Gray in unaltered areas and brown in altered areas
VEINS/FRACTURES: Mn oxide-lined fractures occur in Pieces 1, 3, 12, 14, 21, and 25. Pieces 12 and 17 have radial fractures through the chilled margins
ALTERATION: The rocks are moderately (Pieces 2, 4, 5, 6,7, 10, 12, 14, 15, 16, 17, 19, and 20) to highly (Pieces 1, 3, 8, 13, 18, 21, 22, 23, and 25) altered. Alteration is characterized by replacement of groundmass olivine and clinopyroxene by Fe oxyhydroxides + brown clay. For Pieces 1, 21, 22, 23, and 25, alteration is pervasive. In Pieces 4, 8, 10, 13, 14, and 20, alteration tends to occur in alteration halos that parallel the edges of the pieces. Olivine is totally altered in alteration halos and 100% of the olivine is altered in the highly altered samples. In Pieces 6, 15 and 20 olivine is partially replaced by a yellow clay. In Pieces 12 and 14 ~30% of the olivine is unaltered. Plagioclase phenocrysts are unaltered throughout. Pieces 1, 3, 6, 9, 10, 13, 14, 15, and 17 have small patches of a cream-colored silty sediment adhering to outer surfaces. This sediment contains yellow fragments of palagonite(?) and Mn oxide concretions. On Piece 23 the sediment is accompanied by a drusy quartz coating. Piece 3 has dendritic growth of Mn oxide extending for ~ 3 mm from the outer surface into the interior of the piece.
STRUCTURE: Talus pile?
ADDITIONAL COMMENTS: Some larger crystals show sieve textures; 20%-30% of phenocrysts occur in glomerocrysts.

Pieces 9 and 11: Aphyric Basalt

GROUNDMASS: Fine-grained
COLOR: Gray in unaltered areas and grayish brown in altered areas
ALTERATION: Piece 9 is highly altered and Piece 11 is moderately altered. In Piece 9 alteration is due to pervasive replacement of groundmass by Fe oxyhydroxides and clay; in Piece 11 alteration occurs in concentric alteration halos that constitute ~80% of the sample
STRUCTURE: Talus pile?

Core Photo



187-1161A-3R-2

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

PIECES 1-19

This section includes a range of basalt lithologies and several pebble-size pieces of basaltic breccia; the different lithologies are distributed unsystematically throughout the section, consistent with recovery from a talus or rubble pile.

Pieces 13, 17 and 18: Aphyric Basalt

INTERNAL CONTACTS: A chilled margin on Piece 18 consist of a thin layer of palagonite followed by ~3 mm of glass (mostly altered to palagonite) + small spherulites; no clear glass was recovered.
GROUNDMASS: Fine grained (Pieces 13 and 17), microcrystalline (Piece 18)
COLOR: Buff to gray-brown (Piece 13); brown (Piece 17); grayish brown (Piece 18)
ALTERATION: Piece 13 is moderately altered; clinopyroxene is partially altered in the groundmass to Fe oxyhydroxides + clay and ~20% of plagioclase is Fe-stained. Piece 17 is highly altered with pervasive groundmass replacement by Fe oxyhydroxides + clay; Mn oxide occurs as spots on the outside edges of the piece and coating fractures. Piece 18 is moderately altered, with alteration concentrated in a zone just below the chilled margin and as a patch along one side; alteration consists of Fe oxyhydroxides + clay after glass and/or groundmass quench phases.
ADDITIONAL COMMENTS: Piece 13 has groundmass plagioclase up to ~0.9 mm and may have subophitic texture; there are ~6 prismatic plagioclase phenocrysts 2-3 mm. Piece 17 contains microphenocrysts of olivine <<1 mm in size.

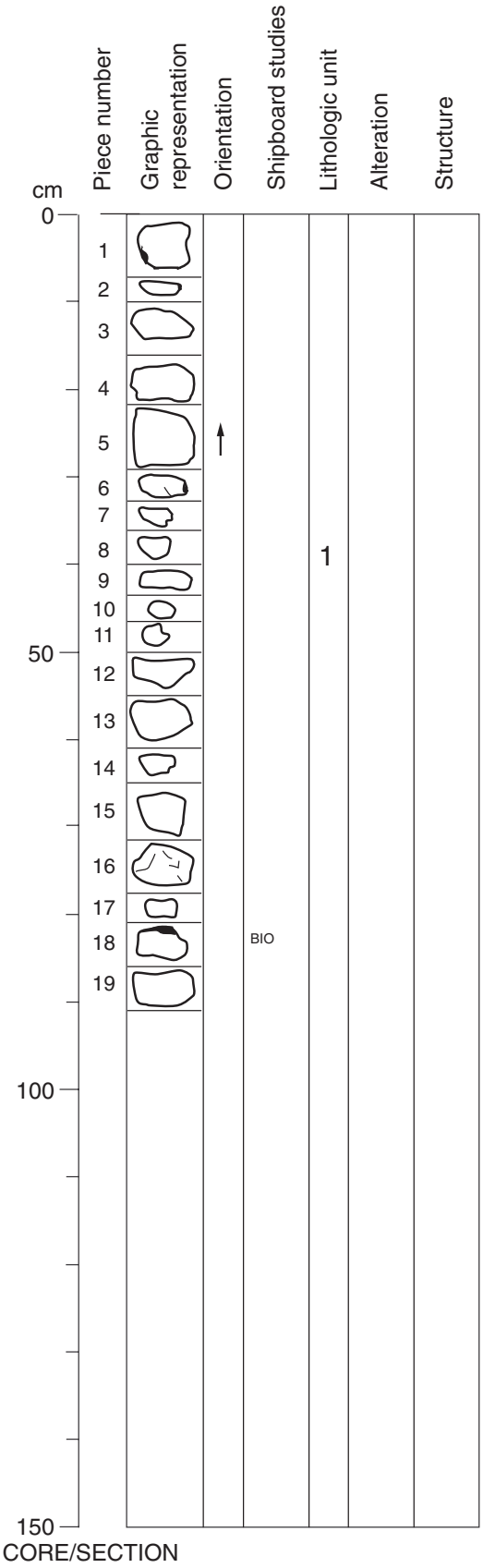
Pieces 1-6, 9-12, 14-16 and 19: Sparsely to Moderately Plagioclase - Olivine Phyric Basalt

INTERNAL CONTACTS: Chilled margins were recovered on Pieces 1, 2, and 6. Piece 1 consists of ~1 mm glass + palagonite; Piece 2 has ~2 mm of glass + palagonite; and ~4 mm of spherulites. Piece 6 has ~5 mm of glass + plagonite.

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

GROUNDMASS: Microcrystalline
COLOR: Brown to gray (altered to fresh)
VESICLES: In Piece 5, miarolitic (?) cavities (<3 mm wide) are partially filled with clays and metallic Mn oxide (?) that project into the cavity.
VEINS/FRACTURES: Fractures in Piece 1 are <<0.2 mm and lined with Mn-oxide and blue cryptocrystalline silica. Piece 4 has incipient fractures ~5 mm long that are discontinuous and lined with silica and Mn oxide. On one outer edge of this piece is a fracture plane Mn oxide and cryptocrystalline silica. Piece 16 has Mn oxide coated fractures <0.2 mm wide. There is a thin <0.2 mm vein filled with crystalline silica and Mn oxide nodules in Piece 6.
ALTERATION: Overall the rocks are moderately to highly altered. Alteration is characterized by pervasive replacement of olivine phenocrysts and groundmass (~15-40%) by Fe oxyhydroxides + clay. In Pieces 4, 5, 15 and 19 this sort of alteration is concentrated in alteration halos up to 2 cm wide. Olivine is partially (~75-90%) replaced by Fe oxyhydroxide in all pieces. The majority of pieces have Mn oxide spots or coatings on the outside. There is a dull pink to red coating on the outside of Pieces 10 and 12. Piece 14 has Mn oxide dendrites 3 mm into the basalt from the outer surface.

Core Photo



187-1161A-3R-2 (cont'd)

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

ADDITIONAL COMMENTS: Pieces 5, 6 and 14 are sparsely phyric, having <2% of phenocrysts. Piece 5 has a fine grained groundmass (coarser than Pieces 1-4) with interlocking plagioclase ~0.8 mm, and more plagioclase than olivine phenocrysts (1% vs. ~0.5%, respectively). Piece 6 consists of 1:1 (?) olivine and plagioclase phenocrysts. Piece 14 has ~1% olivine phenocrysts. The remaining pieces are moderately plagioclase - olivine phyric. Approximately 15% of the plagioclase phenocrysts 2 mm or larger in Piece 1 are rounded. Piece 3 has plagioclase and olivine glomerocrysts up to 7 mm in size. Piece 12 has glomerocrysts up to 6 mm long which are ~60% olivine. Piece 15 has ~2 mm glomerocrysts (crystal clots) which are made up of ~20 small olivine and plagioclase crystals (<<0.5 mm). Piece 16 is the most phyric.

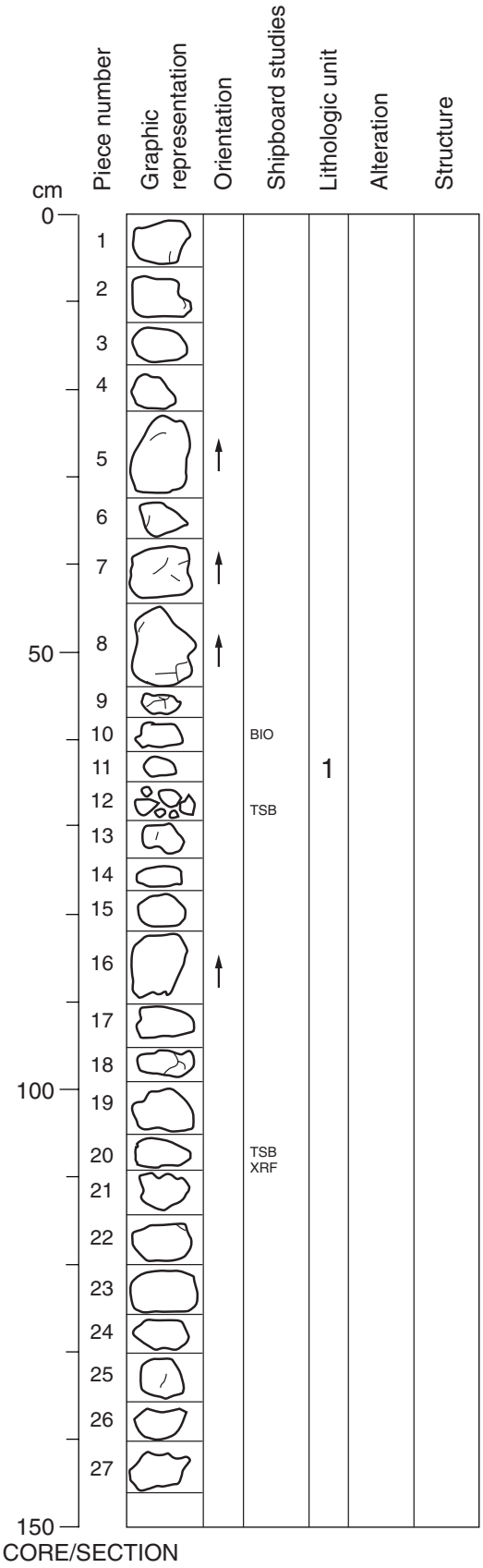
Pieces 7, 8 and part of 11: Basaltic Breccia

This is a poorly sorted, basaltic breccia; the interstitial material between the basaltic clasts is a white silty sediment + quatrz (?). Pieces 7 and 8 are entirely breccia; Piece 11 has a fragment of basaltic breccia adhering to one side of a basalt clast.

CLASTS MATERIAL: Only clasts of basaltic derivation are visible in the breccia; included are highly altered basalt, palagonite, mixtures of glass ± spherulites and palagonite, silicified (blue) basaltic glass and unaltered plagioclase crystals. It is difficult to tell whether the basaltic glass clasts are derived from aphyric or phyric basalt because of their small size, but the larger clasts in Pieces 7 and 11 contain plagioclase and olivine phenocrysts/microphenocrysts. Basalt clasts are typically angular; palagonite and palagonite + glass clasts are angular to subrounded and commonly show concentric layers of different color that parallel the shape of the piece. Clasts sizes range from small pebbles (~2 cm) to coarse sand (<1 mm). A single basaltic pebble makes up more than 50% of the piece for Pieces 7 and 11, with the remainder being similar sediment to Piece 8. Pieces 2, 6 and 9 have <4 mm of sediment adhering to basalt. There is no apparent sorting by size or density. Basalt dominates among the pebble-size clasts, whereas palagonite and basalt are in roughly equal abundance in the very coarse sand to granule size range.

MATRIX: The matrix between basaltic clasts is a cream to white clayey silt ± quartz (?); Mn-oxide concentrations are common throughout the matrix.

Core Photo



187-1161A-4R-1

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

PIECES 1-27

This section includes a range of basalt lithologies and several pebble-to cobble-size pieces of basaltic breccia similar to that in the previous section; the different lithologies are distributed unsystematically throughout the section, consistent with recovery from a talus or rubble pile.

Pieces 16 and 19-27: Aphyric Basalt

GROUNDMASS: Fine-grained
COLOR: Mottled buff to orange-brown
ALTERATION: All pieces are slightly to moderately altered; alteration is characterized by pervasive replacement of groundmass phases (including clinopyroxene) by Fe oxyhydroxides + clay. In all pieces olivine has been ~80%-90% replaced by Fe oxyhydroxide; ~20% of plagioclase is Fe-stained.
ADDITIONAL COMMENTS: Groundmass plagioclase ranges up to 0.9 mm in size, and the texture is probably subophitic. Piece 20 has the coarsest grained groundmass, but is still fine grained. Rare (<<0.5%) rounded plagioclase phenocrysts (~2 mm) and microphenocrysts of both plagioclase and olivine (up to 1.5 mm) are present. No veins or fractures observed.

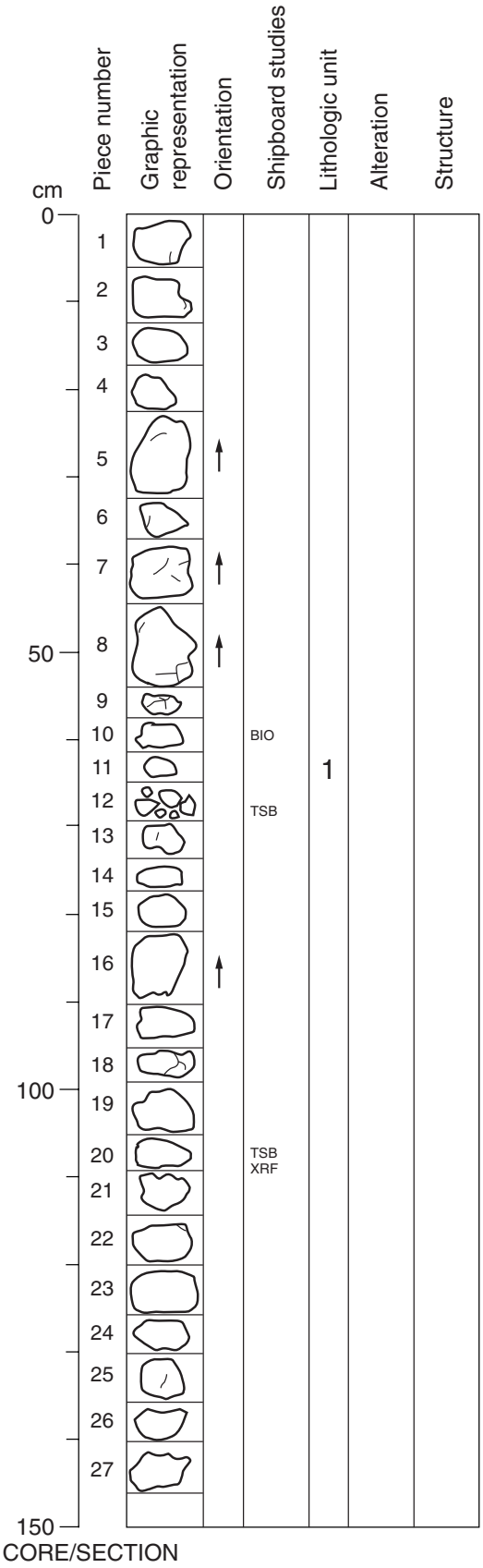
Pieces 1-8, 13-15, 17 and 18: Sparsely to Moderately Plagioclase-Olivine Phyric Basalt

INTERNAL CONTACTS: Piece 1 has a 3 mm thick palagonite rind; no clear glass was recovered, although small spherulites are still visible.

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

GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered
VESICLES: Piece 3 has a linear array (~25 mm long) of vesicles/ miarolitic(?) cavities (each < 2 mm wide) close to one edge; these cavities are lined with blue cryptocrystalline silica, quartz, a mineral with silver-gray metallic luster (Mn oxide?), and platy crystals colored gray and cream to orange.
VEINS/FRACTURES: Fractures in Piece 6 are open, discontinuous, <<0.1 mm wide, and lined with Mn oxide. Discontinuous silica veins occur in Piece 8. Piece 13 has a ~6 mm long, discontinuous, Mn oxide-lined fracture that is <0.1 mm wide. Piece 18 has Mn oxide coated fractures <0.2 mm wide.
ALTERATION: Overall alteration is moderate to high. Where alteration is high, it is characterized by pervasive replacement of olivine phenocrysts and groundmass phases by Fe oxyhydroxides + clay; where moderate, alteration is more restricted to alteration halos (up to 2 cm wide) that tend to parallel sides of pieces and form 20%-50% of the rock. Olivine is partially (up to 95%) replaced by Fe oxyhydroxide in all pieces. The majority of pieces have Mn oxide spots or coatings on the outside. There is a dull pinkish red coating on the outside of Pieces 6, 13, 15, 17, and 18. Piece 13 has Mn oxide along cleavage planes in plagioclase phenocrysts. Piece 15 has a ~15 mm oxidized brown outer margin. Piece 1 has Mn oxide coated crenelations in the fine-grained groundmass. Pieces 1 and 13 have small patches of white silty sediment (+ Mn oxide) on outer surfaces. Piece 8 retains a small fragment of breccia on the bottom.
ADDITIONAL COMMENTS: Pieces 1 to 5 and 14 are sparsely plagioclase-olivine phyric; the rest are moderately phyric. Among the sparsely phyric pieces, plagioclase phenocrysts reach 7 mm in length, but average <2 mm and total ~2%; olivine phenocrysts/microphenocrysts are rare (<<1%). Piece 2 contains rare (<<1%) plagioclase phenocrysts/microphenocrysts that are <2 mm long. Piece 4 contains clusters of plagioclase and/or olivine. Plagioclase is seriate in Piece 14. Piece 8 has plagioclase and olivine glomerocrysts up to 8 mm in size. Piece 15 has small glomerocrysts (up to 3 mm) made of numerous small (<0.8 mm) olivine and plagioclase crystals. Glomerocrysts (<4 mm) in Piece 17 contain ~70% of the phenocrysts.

Core Photo



187-1161A-4R-1 (cont'd)

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

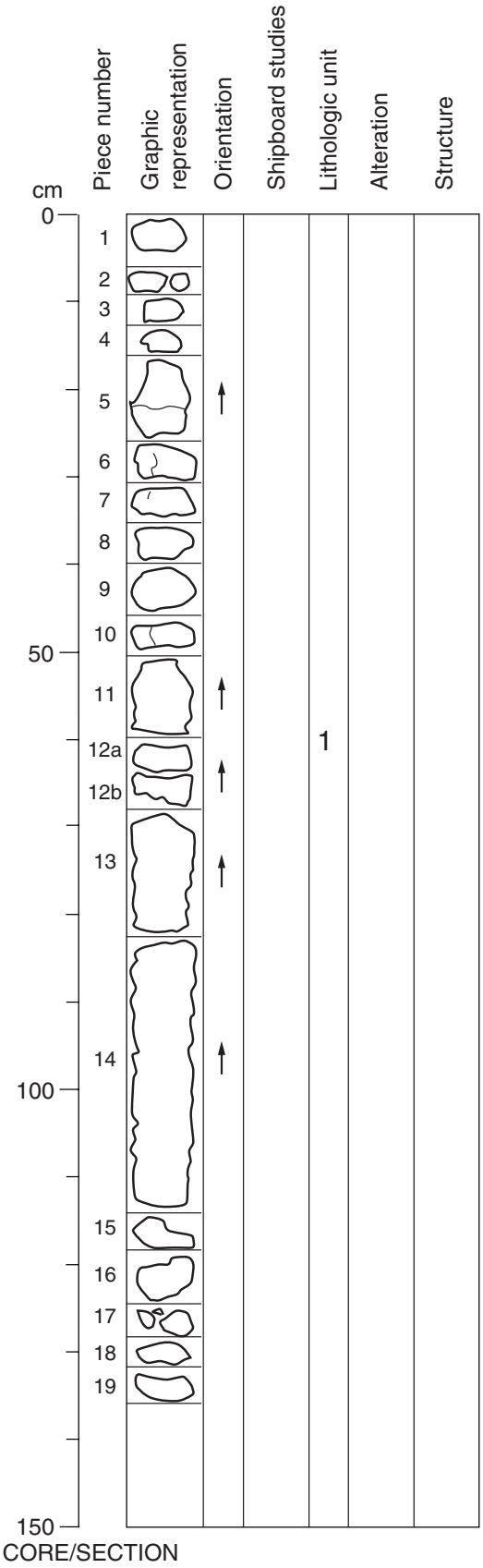
Pieces 9-12: Basaltic Breccia

This is a poorly sorted, basaltic breccia; the interstitial material between the basaltic clasts is a white clayey silt + quartz(?). In Pieces 10, 11, and three pebbles in Piece 12 the breccia is matrix supported; Pieces 9 and three other pebbles in Piece 12 are basaltic clasts (up to 3.5 cm) retaining fragments of breccia matrix adhering to outer surfaces.

CLASTS: Only clasts of basaltic derivation are visible in the breccia; included are highly altered basalt, palagonite, mixtures of glass ± spherulites and palagonite, altered olivine(?), and unaltered plagioclase crystals. Larger clasts can be seen to contain plagioclase and olivine phenocrysts/microphenocrysts. Clast sizes range from coarse sand (<0.1 mm) up to pebble-size (3.5 cm). Basalt dominates among the pebble-size clasts; whereas palagonite and basalt occur in roughly equal proportion in the very coarse sand to granule size range (1-4 mm). There is no apparent sorting by size or density. There is a coating of sediment on the bottom of Piece 8. Piece 9 is fragment of a glass + palagonite margin cross-cut by ~ 1.5-mm-wide silica-filled veins, crystalline quartz, botryoidal silica and Mn oxide spots.

MATRIX: The matrix is cream to white clayey silt; Mn oxide concretions are common throughout the matrix. There is also a clear quartz cement in some areas of the matrix, but this is not uniformly distributed.

Core Photo



187-1161A-5R-1

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

PIECES 1-19

Approximately 50% of this section is basaltic breccia; the remaining pieces are basalt rubble clasts similar to those described in previous sections.

Pieces 1-9: Aphyric to Sparsely Plagioclase-Olivine Phyric Basalt

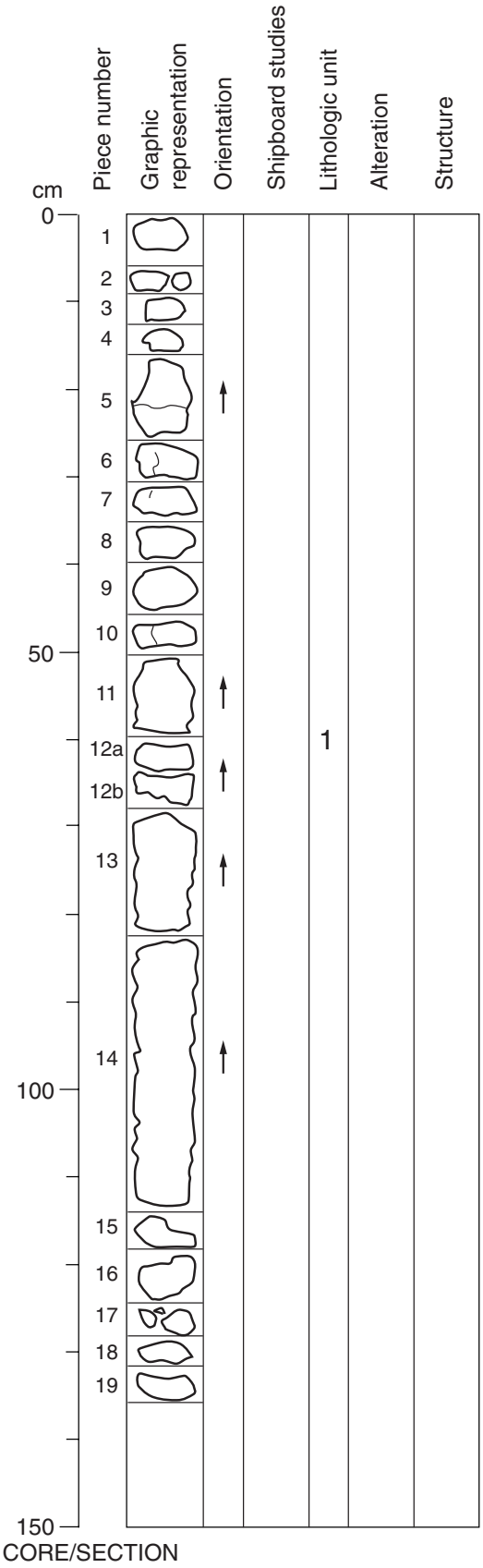
GROUNDMASS: Fine-grained with a felty interlocking texture and plagioclase up to ~0.9 mm long.
COLOR: Mottled buff to gray
VEINS/FRACTURES: Pieces 4, 5 and 6 have either open fractures or are bounded by fracture planes coated with Mn oxide.
ALTERATION: These pieces are moderately altered, with alteration characterized by pervasive replacement of groundmass phases by Fe oxyhydroxides + clay; ~20% of plagioclase is Fe-stained. Olivine microphenocrysts are largely replaced by Fe oxyhydroxide (up to 90%)
ADDITIONAL COMMENTS: There are sparse (<0.5%) prismatic plagioclase phenocrysts ~1.5 mm and even rarer olivine microphenocrysts (<1 mm); maximum ~1% total phenocrysts in Pieces 1, 5, and 8.

Pieces 10, 15, 16, 18 and 19: Sparsely to Moderately Plagioclase-Olivine Phyric Basalt

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

GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered.
VEINS/FRACTURES: In Piece 10 there is an open fracture ~0.4 mm wide lined with Mn oxide. This piece is coated with sediment and Mn oxide dendrites and blue cryptocrystalline silica.
ALTERATION: Overall these pieces are moderately to highly altered, with alteration consisting of pervasive replacement of groundmass phases by Fe oxyhydroxides + clay in most areas. Pieces 10 and 18 having strong alteration halos (up to 1 cm wide) that constitute 30% and 50% of the pieces, respectively.
ADDITIONAL COMMENTS: Glomerocrysts of plagioclase + olivine occur in Piece 16, which is the most phenocryst rich (~3% total). The rest of the pieces are only sparsely phyric.

Core Photo



187-1161A-5R-1 (cont'd)

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

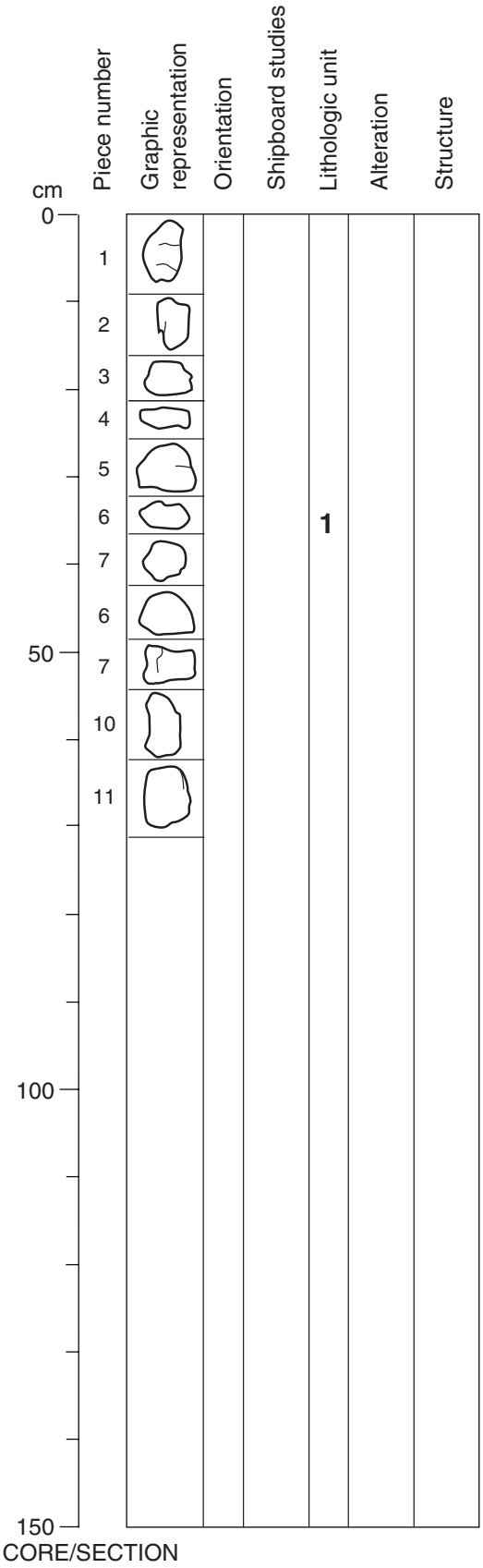
Pieces 11-14 and 17: Basaltic Breccia

This is a poorly sorted, basaltic breccia; the interstitial material between the basaltic clasts is a white clayey silt + quartz(?)

CLASTS: Only clasts of basaltic derivation are visible in the breccia; included are aphyric basalt, sparsely plagioclase-olivine phyric basalt, palagonite, mixtures of glass ± spherulites and palagonite, altered olivine(?) and unaltered plagioclase crystals. Larger basaltic clasts can be seen to contain plagioclase and olivine phenocrysts / microphenocrysts and a clast in Piece 12a has a 1 cm wide chilled margin with clear, unaltered glass. Clast sizes range from <0.1 mm (coarse sand) up to 4 cm (pebble). Basalt dominates among the pebble-size clasts; palagonite constitutes 15%-30% of the very coarse sand to granule size clasts and the proportion of palagonite decreases down the section. Basaltic clasts are typically angular; palagonite and palagonite + glass clasts are angular to subrounded and commonly show concentric layers of different color that parallel the shape of the piece. The range of clasts sizes in Piece 11 is discontinuous, i.e. there are 3 large clasts (~4 cm) with the rest of the clasts ranging from ~1 cm down to sand size. Most of the larger pebble-size clasts have ~5-mm-wide weathered brown margins; smaller basalt clasts in the matrix are altered throughout in this way. The majority (~90%) of the clasts in Piece 11 are aphyric basalt, with the remainder being palagonite and glass. Pieces 12, 13, and 14 have both sparsely phyric and aphyric basalt clasts, the largest of which are between 3-4 cm in size. Alteration halos reach up to 1 cm in width and most clasts are pervasively altered throughout. Some clasts in Piece 13 have a decoration of Mn oxide encircling the fragment. There is no evidence of sorting by density or size.

MATRIX: The matrix is cream to white clayey silt; Mn oxide concretions are common throughout the matrix. There is also local occurrence of carbonate material. Because of the fine grained nature of the matrix, it is unclear whether this is due to the presence of a calcareous sediment in the matrix or due to precipitation of calcite cement.

Core Photo



187-1161B-1W-1

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

PIECES 1-11

This section includes a range of basalt lithologies and several pebble- to cobble-size pieces of basaltic breccia similar to Unit 1 of Hole 187-1161A; the different lithologies are distributed unsystematically throughout the section, consistent with recovery from a talus or rubble pile.

Pieces 1 and 9: Sparsely Plagioclase-Olivine Phyric Basalt

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

GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered.
VESICLES: Unfilled vesicles <0.2 mm in size occur in Piece 1.
VEINS/FRACTURES: Both pieces have Mn oxide-lined fractures.
ALTERATION: Both pieces are moderately altered. Alteration in Piece 1 is concentrated in 1-cm-wide alteration halos where olivine microphenocrysts and groundmass have been replaced by Fe oxyhydroxides + clay; in Piece 9 this alteration is more pervasive. Piece 1 has a small patch of white silty sediment, plus patches of Mn oxide and cryptocrystalline silica on its outer surface.There is dendritic growth of Mn oxide for ~3 mm from the outer surface into the interior of Piece 9; this piece also has a coating of dendritic Mn oxide + drusy quartz.
ADDITIONAL COMMENTS: Olivine microphenocrysts occur in glomerocrysts in Piece 1.

Pieces 2 and 11: Aphyric Basalt

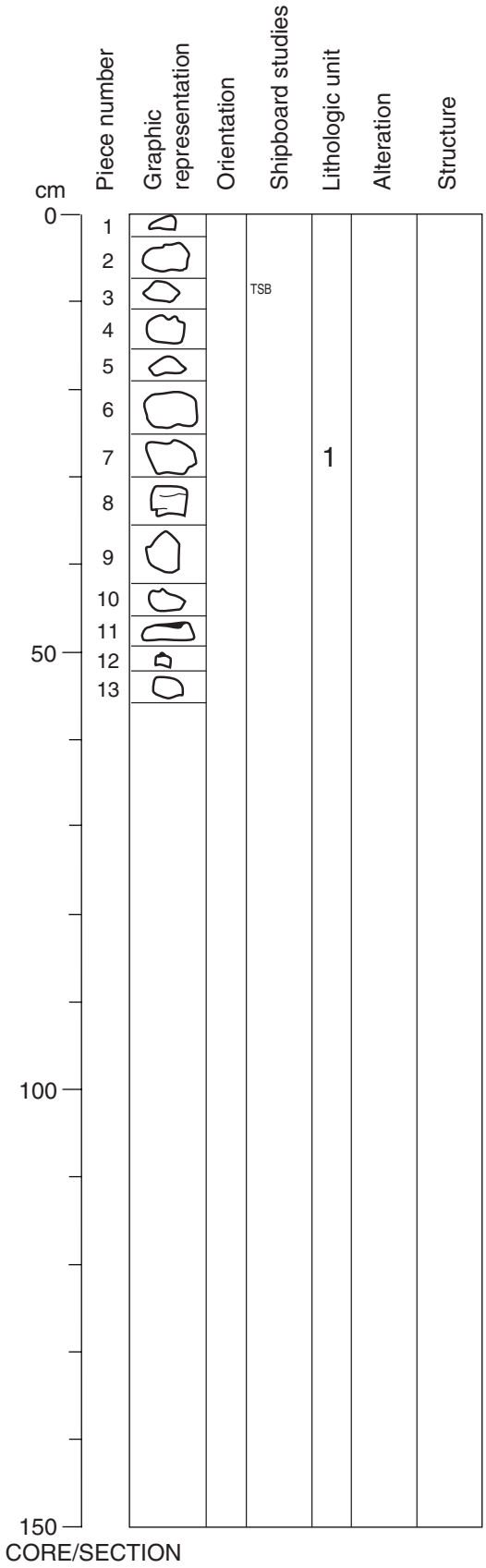
GROUNDMASS: Fine-grained
COLOR: Mottled buff to orange-brown
VESICLES: Piece 11 has vesicles up to 1 mm in size; most are unfilled, but some are filled with a yellow to green smectite near one side of the piece.
ALTERATION: Overall these two pieces are moderately altered; alteration is characterized by replacement of groundmass olivine and/or mesostasis by Fe oxyhydroxides + clay.
ADDITIONAL COMMENTS: Groundmass plagioclase ranges up to 1 mm in size, and the texture is probably subophitic. Rare (<<0.5%) prismatic to tabular plagioclase phenocrysts (~2 mm) and microphenocrysts of olivine (up to 1.5 mm) occur. No veins or fractures observed.

Pieces 7, 8 and 10: Moderately Plagioclase-Olivine Phyric Basalt

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

GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered.
VESICLES: Rare unfilled vesicles range up to ~0.3 mm in size.
VEINS/FRACTURES: Mn oxide-lined fracture occurs in Piece 8.
ALTERATION: Pieces 7 and 8 are highly altered, with alteration characterized by pervasive replacement of olivine phenocrysts and groundmass phases by Fe oxyhydroxides + clay. Piece 10 is moderately altered, and this alteration is concentrated in a discontinuous alteration halo (up to 1 cm wide) that parallels the sides of the piece; the alteration halo forms ~20% of the rock.
ADDITIONAL COMMENTS: Plagioclase is seriate throughout. Small olivine phenocrysts tend to occur in clusters.

Core Photo



187-1161B-2R-1

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

PIECES 1-13

This section includes a range of basalt lithologies and several pebble- to cobble-size pieces of basaltic breccia similar to Unit 1 of Hole 187-1161A; the different lithologies are distributed unsystematically throughout the section, consistent with recovery from a talus or rubble pile.

Pieces 1, 5-8, 11, and 12: Aphyric Basalt

INTERNAL CONTACTS: Chilled margins were recovered on Pieces 11 and 12. Piece 11 has no clear glass and consists only of palagonite + spherulites; the palagonite on one corner of the piece has been bleached white. Piece 12 consists of 1 mm of palagonite, 4 mm of glass + discrete spherulites, and 4 mm of coalesced spherulites. The spherulites in both pieces are small (<~0.2 mm).
GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered.
VEINS/FRACTURES: Piece 8 has a Mn oxide-lined fracture.
ALTERATION: These pieces are slightly to moderately altered. In general, alteration is concentrated in alteration halos that parallel the edges of pieces or fractures. Alteration consists of replacement of groundmass phases by Fe oxyhydroxides + clay. Alteration halos are narrow (~ 5 mm) in Pieces 7 and 8, but constitute most of the piece in Pieces 1 and 6. In Piece 11, alteration occurs in linear bands parallel to a chilled margin. Piece 5 is pervasively altered. Piece 11 has a layer of breccia (like that occurring in Pieces 2 to 4) attached to the outer surface. Pieces 1 and 5 have patchy coatings of white silty sediment + Mn oxide.

Pieces 10 and 13: Sparsely Plagioclase-Olivine Phyric Basalt

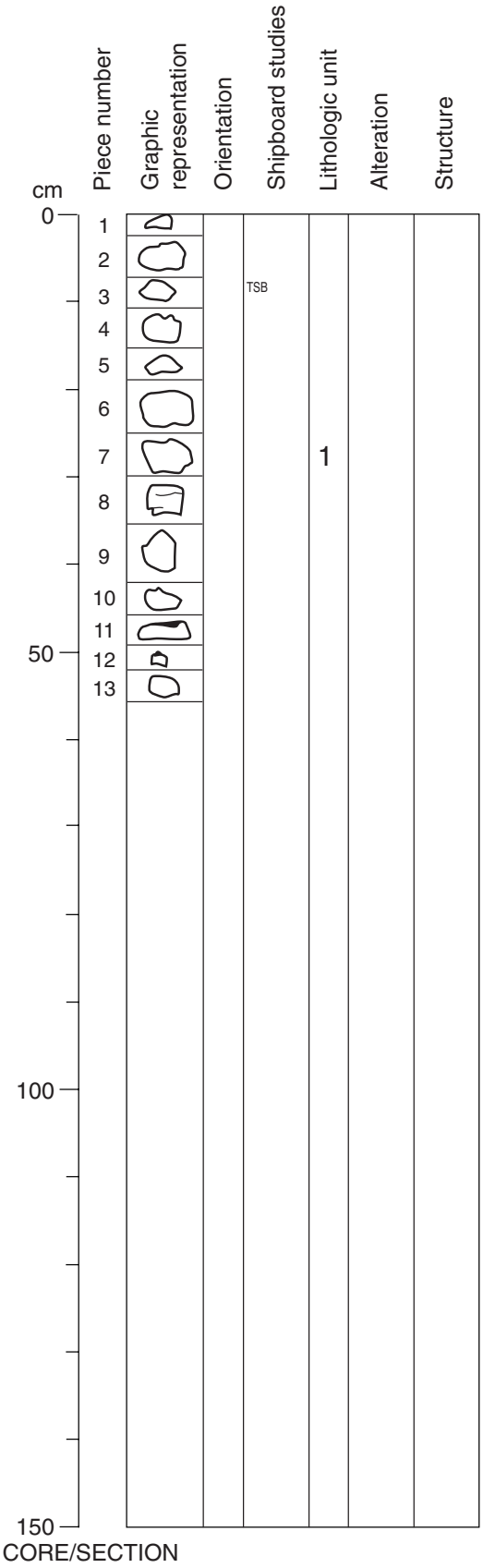
PHENOCRYSTS:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	1	1	2	<0.5	prismatic to rounded
Olivine	1	1.5	3	0.5	equant
Total	2				

GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered.

VESICLES:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
	1		0.2		round

Filling: Vesicles are unfilled. Unfilled miarolitic(?) cavities up to 1.5 mm occur in Piece 10.
ALTERATION: Both pieces are moderately altered, with alteration characterized by patchy replacement of olivine phenocrysts and groundmass phases by Fe oxyhydroxides + clay. Olivine is 100% replaced by Fe oxyhydroxides + clay in altered areas, but elsewhere is totally unaltered. Piece 10 has a fragment of breccia (like that seen in Pieces 2-4) attached to one surface.
ADDITIONAL COMMENTS: Small olivine phenocrysts tend to occur in clusters.

Core Photo



187-1161B-2R-1 (cont'd)

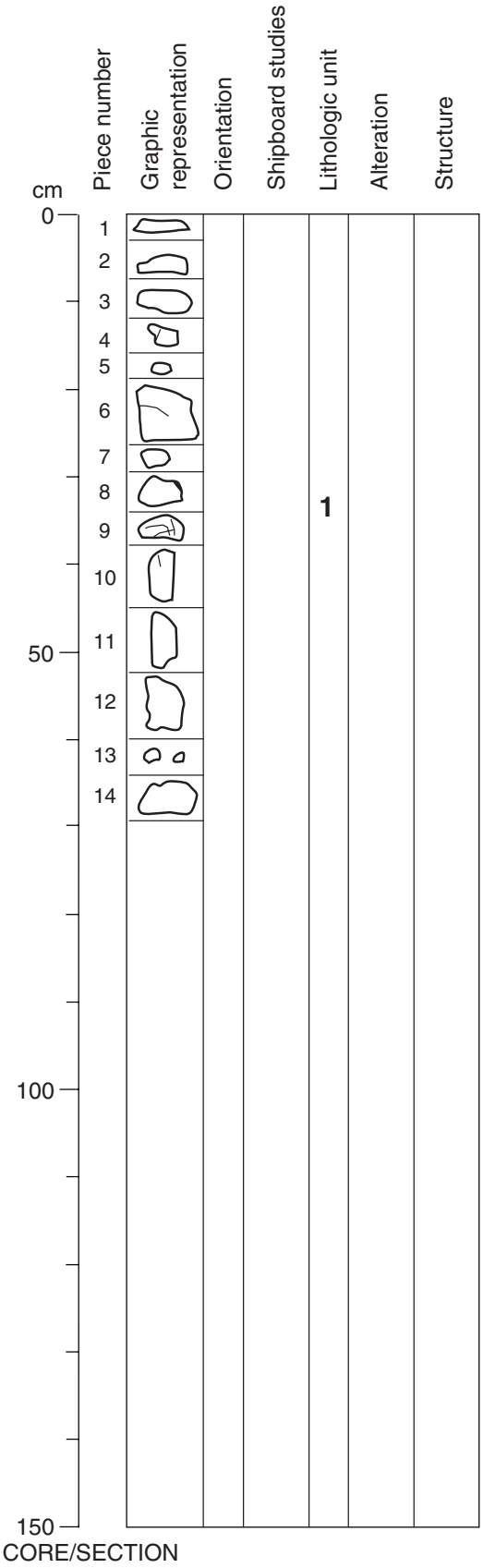
UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA
Pieces 2-4 and 9: Basaltic Breccia

This is a poorly sorted basaltic breccia, cemented by a white to yellowish clayey silt + euhedral quartz.

CLASTS: Only clasts of basaltic derivation are visible in the breccia; included are aphyric basalt, plagioclase-olivine phyric basalt, palagonite, mixtures of palagonite and/or white clay ± spherulites and unaltered plagioclase crystals. Phyric basalt occurs only in Piece 9; elsewhere the basalt is aphyric. Clast sizes range from <0.1 mm (coarse sand) up to 2.5 cm (pebble). Basaltic clasts are typically angular to subangular; palagonite and palagonite + glass clasts are angular to subrounded and commonly show concentric layers of different color that parallel the shape of the piece. The basaltic clasts show a range of alteration characteristics. Larger clasts have alteration halos that range from 1 to 5 mm wide. Wider halos consist of white to light gray clay. The boundary between the unaltered interior is irregular in outline but sharp in its transition from one zone to the other. In some clasts the alteration halo is thinner and composed of reddish palagonite. Both types of rinds can be found on the same clast. The breccia also includes some angular clasts up to 1.5 cm in size that are composed entirely of light gray to buff colored clay. Based on their similarity with the alteration halos, these are not thought to be of sedimentary origin; instead, they appear to be totally altered clasts of basalt and/or basaltic glass. These clasts typically have dendritic Mn oxide growth from their outside edges into the interiors.

MATRIX: The matrix is cream to white clayey silt. Much of this material is probably clay after olivine, glass, palagonite and/or plagioclase. The breccia is cemented by a clear euhedral quartz. Piece 4 has botryoidal quartz filling one cavity.

Core Photo



187-1161B-3R-1

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA

PIECES 1-14

This section includes three different basalt types: aphyric basalt, sparsely plagioclase-olivine phyric basalt and moderately to highly plagioclase-olivine phyric basalt. Given the limited recovery, small size of many pieces, and high degree of alteration, it cannot be established unequivocally whether the mixture recovered reflects a primary stratigraphic sequence of basalt pillow lavas or is a talus pile. However, Pieces 1, 3, 5, 6, and 14 display fragments of white silty sediment similar to breccia matrix occurring in previous sections, making the latter alternative more likely.

Pieces 1, 2 and 8: Sparsely Plagioclase-Olivine Phyric Basalt

INTERNAL CONTACTS: A chilled margin was recovered on Piece 8. It consists of 3 mm of palagonite, followed by < 1 mm of clear glass + phenocrysts and ~3 mm of spherulites.

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

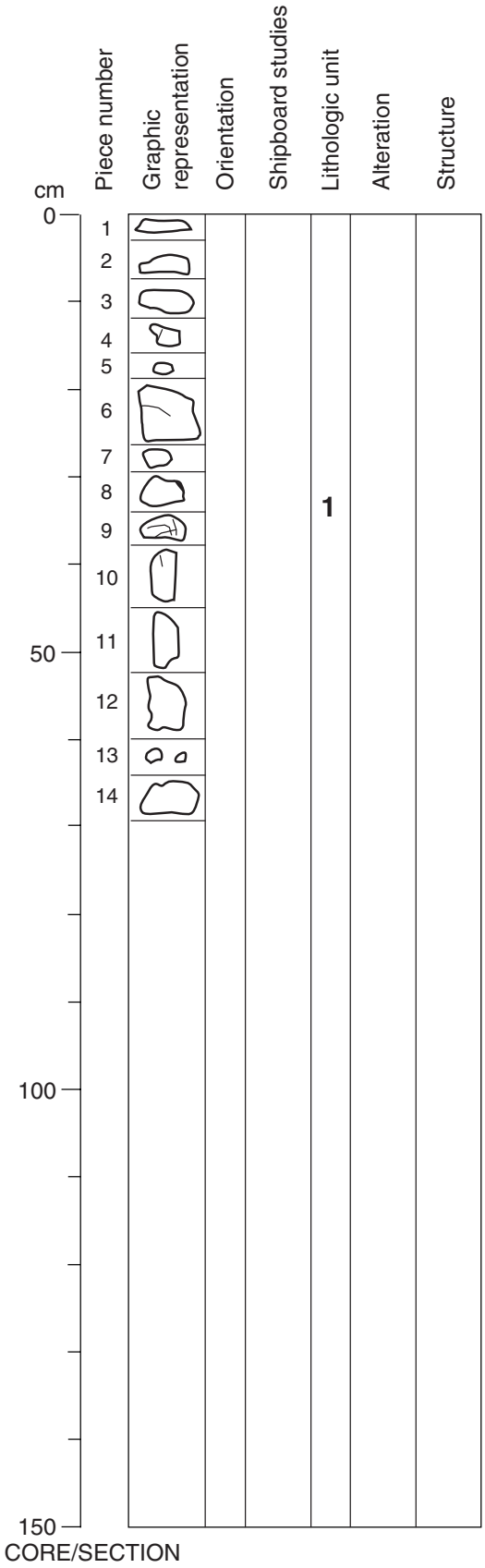
GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered.
VESICLES: Rare, round vesicles make up <1% of Piece 2 and are filled with yellowish-green clay ± Mn oxide.
ALTERATION: These pieces are variably altered from moderately (e.g., Piece 2) to highly (e.g., Pieces 1 and 8). Alteration is pervasive in Piece 1 and concentrated in alteration halos in Pieces 2 (5 mm wide) and 8 (2 cm wide). Alteration is characterized by replacement of groundmass phases by Fe oxyhydroxides and clay; olivines are replaced by Fe oxyhydroxide.
ADDITIONAL COMMENTS: Fresh olivine occurs in the middle of Piece 8.

Pieces 3 and 5-7: Moderately to Highly Plagioclase Olivine Phyric Basalt
Pieces 4 and 9-14: Aphyric Basalt

PHENOCRYSTS:	**Abundance**		**Size** (mm)		**Shape**
	%	**avg.**	**max.**	**min.**	
Plagioclase	3-8	3	8	1	prismatic elongate
Olivine	2-4	1	4	<1	equant
Total	5-12				

GROUNDMASS: Microcrystalline
COLOR: Grayish brown where altered, medium gray where less altered.
VESICLES: Vesicles are present in Piece 6 and are filled with calcite or yellowish clay.
ALTERATION: Overall these pieces are moderately (Pieces 6 and 7) to highly altered (Piece 3). Alteration consists of pervasive replacement of groundmass phases by Fe oxyhydroxides + clay in most areas. Olivine phenocrysts are totally replaced by Fe oxyhydroxides. Some plagioclase crystals are Fe-stained, although otherwise unaltered. Patches of Mn oxide are common on Piece 3.
ADDITIONAL COMMENTS: Phenocryst size and abundance varies from piece to piece. Phenocrysts are largest (up to 8 mm) and most abundant (12%) in Piece 3.

Core Photo



187-1161B-3R-1 (con't)

UNIT 1: BASALTIC RUBBLE WITH INTERVALS OF BASALTIC BRECCIA
Pieces 4 and 9-14: Aphyric Basalt

GROUNDMASS: Microcrystalline
COLOR: Medium gray in unaltered areas and brown in altered ares..
VESICLES: Pieces 11and 14 have round vesicles (<1 mm and 1 mm, respectively) line with blue crypotcyrstalline silica, calcite and green to white clays.
VEINS/FRACTURES: Piece 9 has fracture (< 1 mm wide) coated with quartz and Mn oxide. A fragment of a pinkish vein containing clay and crystalline quartz occurs on the outside of Piece 4: botryoidal Mn oxide is associated with this vein.
ALTERATIONS: All pieces are slightly to moderately altered. Alteration is characterized by replacement of olivine and groundmass phases by Fe oxyhydroxides + clay in alteration halos that parallel fractures or the edges of pieces. Halos range from ~5 mm wide (e.g. Pieces 12 and 14) up to 2.5 cm wide (Piece 9).
ADDITIONAL COMMENTS: Sparse unaltered olivine microphenocrysts can be found in all pieces.

187-1161A-2R-1, 10-13 cm (TS#65) **Unit: 1** **OBSERVER:** **Kempton**

ROCK NAME: **Moderately plagioclase -olivine 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	2	1		prismatic, subhedral to anhedral	~30% of crystals show sieve textures, even the smaller prismatic crystals occuring in glomerocrysts; discontinuous zoning in somecrystals, others unzoned; one large plagioclase has a smaller anhedral plagioclase inclusion in one corner.
Olivine	1	1	0.5	1	0.5		equant, subhedral to anhedral	~10% replaced by Fe oxyhydroxides + clay.
Clinopyroxene								
Spinel	tr	tr		0.4			anhedral	Rectangular shape; occurs with sulfides and contains melt inclusion up to 40 microns across.
GROUNDMASS								
Olivine	1	3		<100 microns			equant	Partially replaced by Fe oxyhydroxides.
Plagioclase	37	37		0.8			prismatic to acicular to skeletal (box structure)	
Clinopyroxene	1	1		200 microns			most clinopyroxene occurs as immature plumose quench growth	Enhanced crystal growth adjacent to miarolitic cavities; in these areas clinopyroxene ranges from granular to elongate; maximum size and modal values recorded refer to these; elsewhere clinopyroxene occurs only as quench crystals in mesostasis and between acicular groundmass plagioclase.
Opaque Minerals	2	2		<5 microns				Most are < 5microns in size, but may be up to 50 microns near miarolitic cavities.
Glass								
Mesostasis	25	53						Includes a combination of quench olivine, clinopyroxene and glass that cannot be reliably distinguished.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays + Fe oxyhydroxides	30				groundmass glass, olivine, clinopyroxene and mesostasis	
Sulfides	tr		<125 microns			Pyrite, chalcopyrite, magnetite and hematite occur in a single grain; smaller sulfide globules occur throughout the thin section (~1-2% of the opaque phases present).

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

COMMENTS : Proportions of groundmass phases difficult to assess because of predominance of quench crystal morphologies and high degree of alteration. Patches of enhanced clinopyroxene and FeTi oxide growth occur throughout the thin section; some appear to be associated with miarolitic cavities, but in other cases, there is no obvious void. Loose clusters of plagioclase and plagioclase + olivine occur (equilibrium growth).

187-1161A-3R-1, 107-108 cm (TS#66) **Unit: 1** **OBSERVER:** **Kempton**

ROCK NAME: **Sparsely plagioclase phyric basalt**
WHERE SAMPLED: **piece with alteration halo around a fracture**
GRAIN SIZE: **microcrystalline**
TEXTURE: **immature plumose quench textures**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	2	2	0.2	1			tabular to prismatic	Most phenocrysts unzoned; some tabular crystals with discontinuous zoning; sieve texture in one prismatic crystal; some prismatic crystals with elongate quench extensions.
Olivine	<1	<1	0.1	1.2			equant, euhedral to anhedral	100% replaced by clay ± Fe oxyhydroxides in alteration halo; elsewhere is largely unaltered.
Clinopyroxene								
GROUNDMASS								
Olivine								
Plagioclase	20	20		0.3			acicular to skeletal	Modal estimate refers only to acicular plagioclase crystals, not to quench morphologies.
Clinopyroxene	see comments						plumose quench intergrowth with plagioclase	
Opaque Minerals	1	1		<10 microns			equant to skeletal	
Glass								
Mesostasis	66	76						Includes glass + quench crystals of clinopyroxene, olivine, and/ or plagioclase that are not readily distinguishable.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays ± Fe oxyhydroxides	10				**filling vesicles, replacing mesostasis**	**Yellow clay, occurs with Fe oxyhydroxides near to the fracture; replaces 15-20% of groundmass in alteration halo, but is negligible outside of the halos.**

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	1			0.2		clay / round	Filled with yellow clay in alteration halo around fracture; near fracture the centers of the vesicles are filled with Fe oxyhydroxides; elsewhere vesicles are unfilled.

COMMENTS : The rock is dominated by plumose quench textures; proportions of groundmass phases cannot be accurately assessed. The fracture is in fact a very thin (<10 microns wide) vein of Fe oxyhydroxides. Approximately 25% of phenocrysts occur in glomerocrysts; glomerocrysts are dominated by plagioclase.

187-1161A-3R-1, 112-113 cm (TS#67) **Unit: 1** **OBSERVER:** **Kempton**

ROCK NAME: **Moderately plagioclase phyric basalt**
WHERE SAMPLED: **across silicified(?) chilled margin**
GRAIN SIZE: **cryptocrystalline to microcrystalline**
TEXTURE: **spherulitic to immature plagioclase sheaf quench textures**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	3	3	0.2	3	1.5		prismatic, subhedral to anhedral	Discontinuous zoning and sieve textures are common; some crystals with elongate quench extensions.
Olivine	<1	<1	0.2	0.7	0.5		equant, euhedral	90 - 100% replaced by Fe oxyhydroxides + clay.
Clinopyroxene								
GROUNDMASS								
Olivine								
Plagioclase	20	20		0.3			acicular to skeletal	Modal estimate refers only to acicular plagioclase crystals, not to quench morphologies.
Clinopyroxene	see comments						plumose quench intergrowth with plagioclase	
Opaque Minerals	<1	<1		<2 microns			equant	
Glass								
Mesostasis	10	77						Includes glass + quench crystals of clinopyroxene, olivine, and/ or plagioclase that are not readily distinguishable.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays ± Fe oxyhydroxides	67				filling vesicles, replacing olivine, mesostasis and quench crystal phases	
MnO					partially filling vesicles	Dark brown/black patches in the groundmass may be Mn oxide.

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	1			0.25		clay / round	Partially filled with yellow clay.

COMMENTS : The rock is dominated by quench textures ranging from spherulitic to immature plagioclase sheaf texture. Alteration appears to be extensive. Therefore, proportions of groundmass phases cannot be accurately assessed. Near the glassy margin, spherulites range from 0.2 to 0.4 mm in diameter and have small acicular plagioclase crystals in their centers. Most of the spherulites are typical plagioclase spherulites, but there may be some olivine dendrite spherulites present as well. Approximately 50% of plagioclase phenocrysts occur in glomerocrysts; ~75% of olivine phenocrysts occur in glomerocrysts. There may be hematite in the groundmass. Unfortunately, the silicified(?) chilled margin was not preserved in the thin section available for inspection. A duplicate thin section of just the glass margin also lost most of the glass in preparation. However, based on the material remaining, there does not appear to be any silicification of the glassy margin. In thin section, these areas are simply darker portions of the palagonite and may therefore, simply be a clay of a slightly different composition.

187-1161A-4R-1, 65-68 cm (TS#69) **Unit: 1** **OBSERVER:** **Kempton**

ROCK NAME: **Basaltic breccia with a moderately plagioclase-olvine phyric basalt clast**
WHERE SAMPLED: **fragment of breccia**
GRAIN SIZE: **clay matrix to pebble-size clasts of basalt**
TEXTURE: **poorly sorted, matrix supported breccia**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	3	3	0.2	4	2		tabular to prismatic	Contains large tabular crystals with sieve textured cores or rims and discontinuous zoning; some smaller prismatic crystals have sieve textures, but much less severe; these also tend to have no zoning or only vague discontinuous zoning; ~65% of crystals occur in glomerocrysts; these tend to be made up of prismatic crystals or blocky crystals < 1 mm across. Large tabular phenocrysts tend to be solitary.
Olivine	1	1	0.1	0.4	0.3		equant, subhedral to euhedral	
Clinopyroxene								
GROUNDMASS								
Olivine	1	2		<0.1			equant, euhedral to subhedral	Partially replaced by iddingsite.
Plagioclase	20	20		0.6			acicular to prismatic (skeletal)	Some with quench growth extensions; aspect ratio (30:1); modal and size estimates refer only to identifiable microlites; quench growth is included in the estimate for mesostasis.
Clinopyroxene								
Opaque Minerals								
Glass								
Mesostasis	25	74						Includes glass + quench crystals of plagioclase, clinopyroxene and olivine not readily distinguishable; ~80% of the mesostasis has a strong orange color, suggesting significant replacement by Fe oxyhydroxides + clay, but the exact proportion of groundmass altered is difficult to assess due to the predominance of quench crystal morphologies.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays ± Fe oxyhydroxides	50				replacing olivine and groundmass, lining vesicles	

VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles	<1			0.3		lined with clay / round	Lined with clay and in some cases filled with a dark cryptocrystalline material that may include Mn oxide.

COMMENTS - basalt clast : This rock is a basaltic breccia. The basalt description above applies to the dominant pebble-size clast (~1.5 cm) included in the breccia, which is a chilled margin across a moderately plagioclase-olivine phyric basalt. The spherulites in the chilled margin are small (<200 microns).

COMMENTS - breccia matrix : Matrix consists of colorless clay. ~15% of the sand-size clasts are angular plagioclase crystals; most unaltered, but some altered to a birefringent material along micro-cracks. Unaltered or partially altered basalt clasts as small as 100 microns are readily identifiable; these all have quench crystal morphologies. Most of the matrix is made up of highly altered material derived from basaltic chilled margins, i.e. glass or glass + spherulites. These clasts are heavily altered to clay (no longer palagonite?) with a pale yellow or buff color. Spherulites and plagioclase microlites that were present in the chilled margins are replaced by clay as well. Some of these retain original-looking clast outlines, but others appear to be partially disaggregated, forming the interstitial clay material. The matrix is loosely cemented by thin (~10 micron) selvages of cryptocrystalline silica and/or clay that surrounds some of the clasts. Patches of FeMn oxyhydroxides occur randomly throughout, sometimes lining the edges of the void spaces in between clasts.

187-1161A-4R-1, 105-109 cm (TS#68) **Unit: 1** **OBSERVER:** **Kempton**

ROCK NAME: **Aphyric basalt**
WHERE SAMPLED: **from typical piece for this lithology**
GRAIN SIZE: **fine grained**
TEXTURE: **intergranular to subophitic**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase	<<1	<<1		3			tabular	Discontinuous zoning.
Olivine	<<1	<<1		1			equant?	Totally altered.
Clinopyroxene								
GROUNDMASS								
Olivine	0	15		0.3			equant?	Size estimate and modal proportion complicated by degree of alteration.
Plagioclase	45	45		1.5			prismatic, anhedral	1-2% altered to clay along microcracks? Most crystals show normal zoning; some larger crystals show discontinuous zoning.
Clinopyroxene	34	37		0.6			anhedral	~10% altered to clays adjacent to altered olivine.
Opaque Minerals	3	3		0.3			equant to elongate when space-filling	Sulfide globules rare but present.
Glass								

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays + Fe oxyhydroxides	18				replacing olivine (mesostasis?) and some clinopyroxene	Locally olivine and/or mesostasis is replaced by a fibrous mineral that is pleochroic in buff to green (fibrous amphibole or chlorite?); there may also be some replacement of olivine by carbonate in association with iddingsite.
Hematite	tr				replacing FeTi oxides	<2% of FeTi oxides replaced by hematite and some areas of mesostasis contain hematite (after Fe oxyhdyroxides).

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

COMMENTS :

187-1161B-2R-1, 5-10 cm (TS#70) **Unit: 1** **OBSERVER:** **Kempton**

ROCK NAME: **Basaltic breccia with assorted basalt clasts**
WHERE SAMPLED: **fragment of breccia**
GRAIN SIZE: **clay matrix to pebble-size clasts of basalt**
TEXTURE: **poorly sorted, matrix supported breccia**

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	APPROX. COMP.	MORPHOLOGY	COMMENTS
PHENOCRYSTS								
Plagioclase								
Olivine								
Clinopyroxene								
GROUNDMASS								
Olivine								
Plagioclase								
Clinopyroxene								
Opaque Minerals								
Glass								
Mesostasis								

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Clays ± Fe oxyhydroxides						

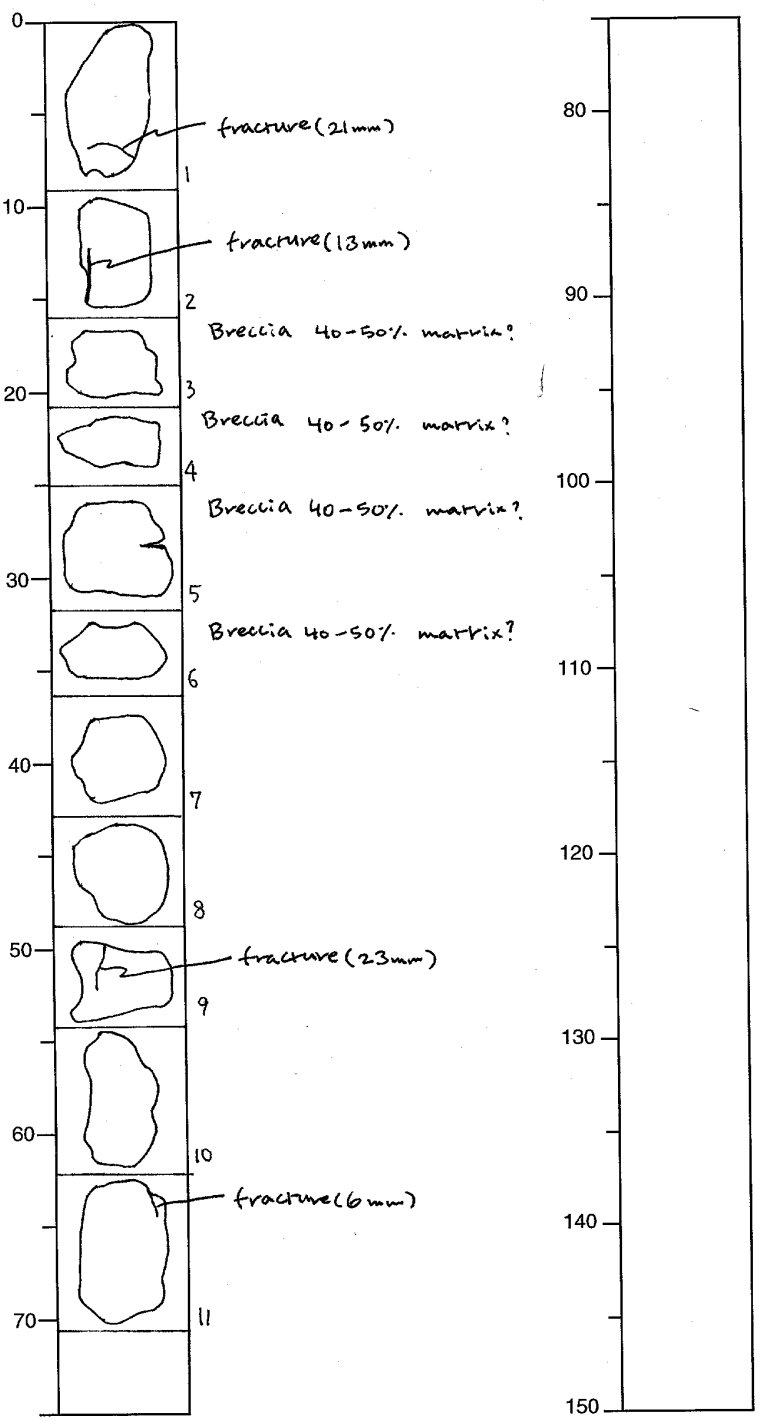
VESICLES/ CAVITIES	PERCENT	LOCATION	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	FILLING / MORPHOLOGY	COMMENTS
Vesicles							

COMMENTS - basalt clast : This rock is a basaltic breccia. It contains clasts of plagioclase phyric basalt from 0.1 to 9 mm across, yellow palagonite ~25 microns up to 1.5 mm and clay pseudomorphs after aphyric basalt up to 1 cm across. Spherulitic and microcrystalline groundmass textures are still observable in the clay pseudomorph clasts. The palagonite clasts show a range of textures, usually with concentric layering involving various shades of yellow to less distinct layering in pale brown where replaced by clay. In general it appears to be the spherulitic growth that gets replaced by clay, with the yellow palagonite being after glass.

COMMENTS - breccia matrix : The matrix consists of colorless to pale brown clay. ~10% of the sand-size clasts are angular plagioclase crystals. Unaltered or partially altered basalt clasts as small as 100 microns are readily identifiable; these all have quench groundmass crystal morphologies. Most of the matrix is made up of highly altered material derived from basaltic chilled margins, i.e. glass or glass + spherulites. The matrix is loosely cemented by thin (~10 micron) selvages of cryptocrystalline silica and/or clay that surrounds some of the clasts. Patches of FeMn oxyhydroxides (up to 0.3 mm across) occur randomly throughout.

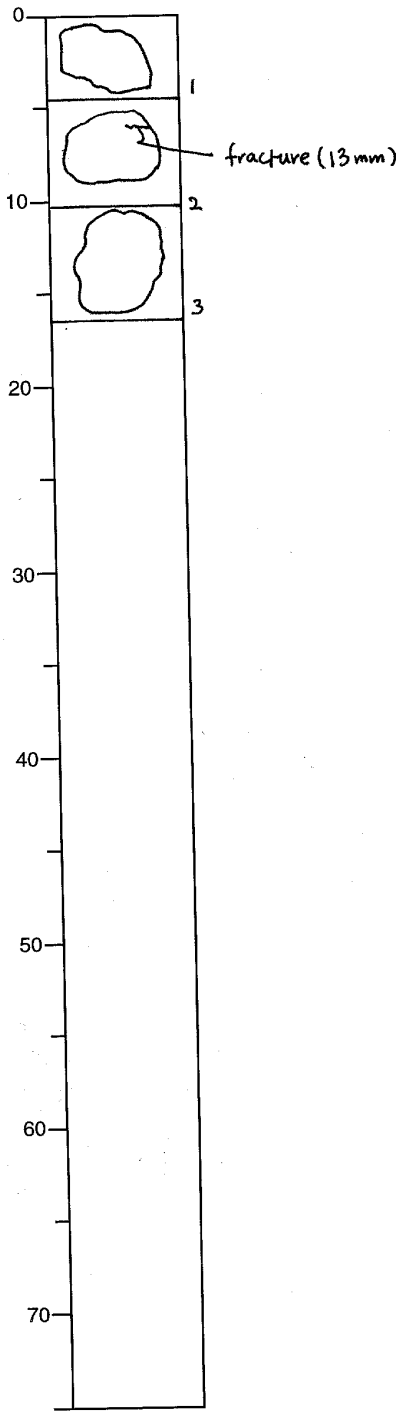
STRUCTURAL GEOLOGY DESCRIPTION

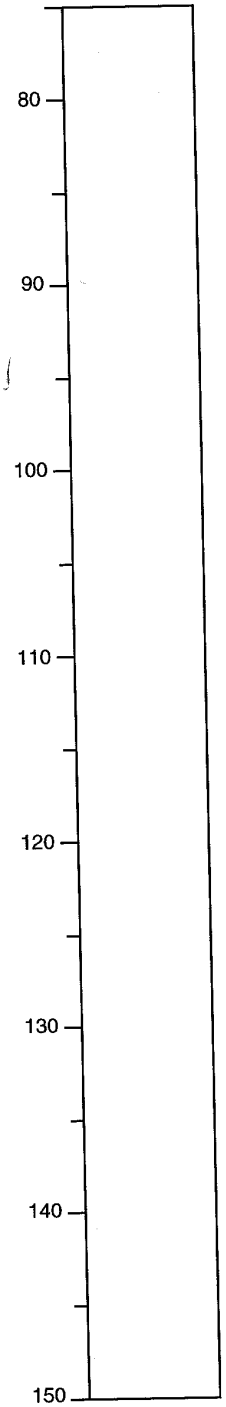
Leg	Hole	Core	Section
187	1161B	1W	1



STRUCTURAL GEOLOGY DESCRIPTION

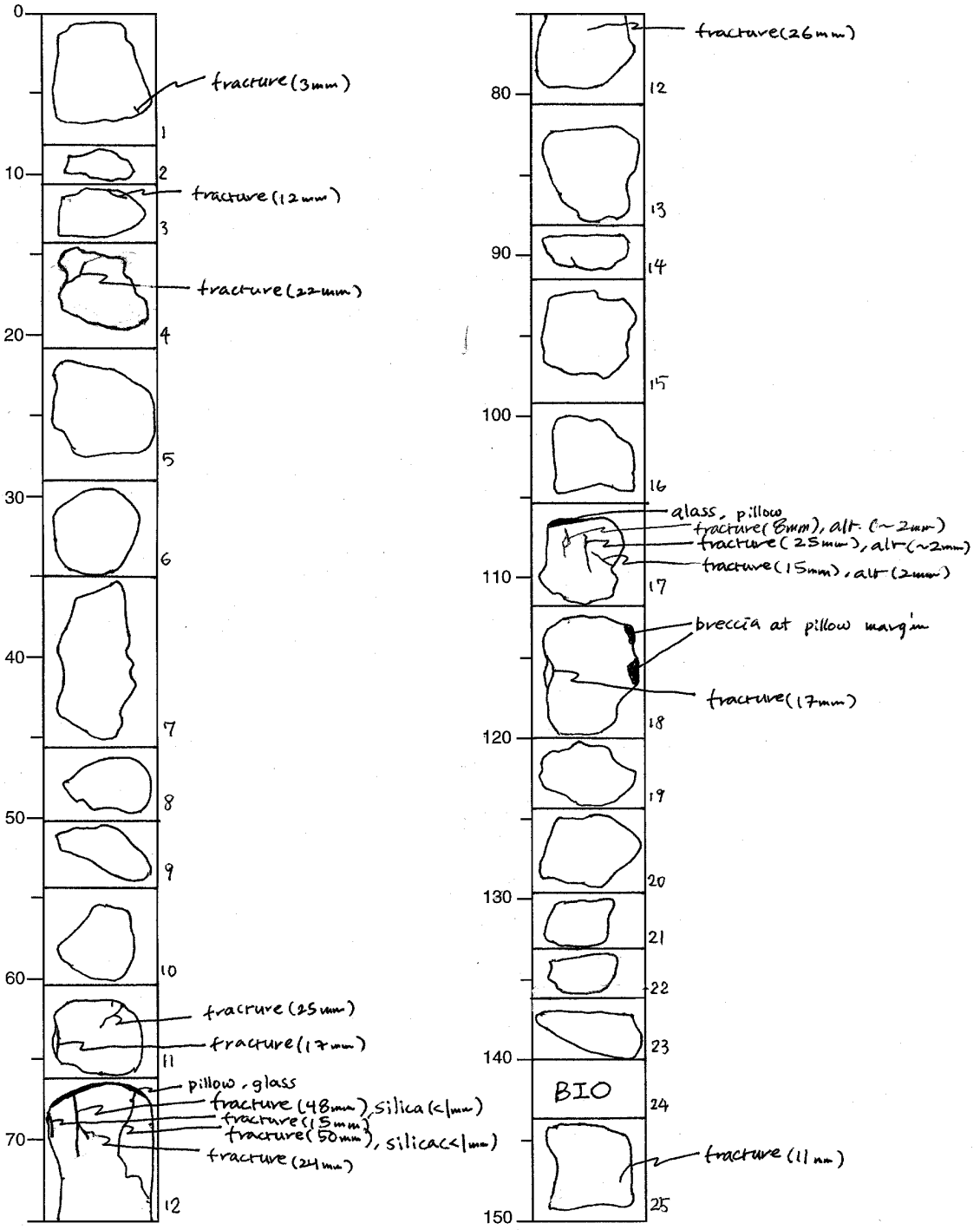
Leg	Hole	Core	Section
187	1161A	2R	1





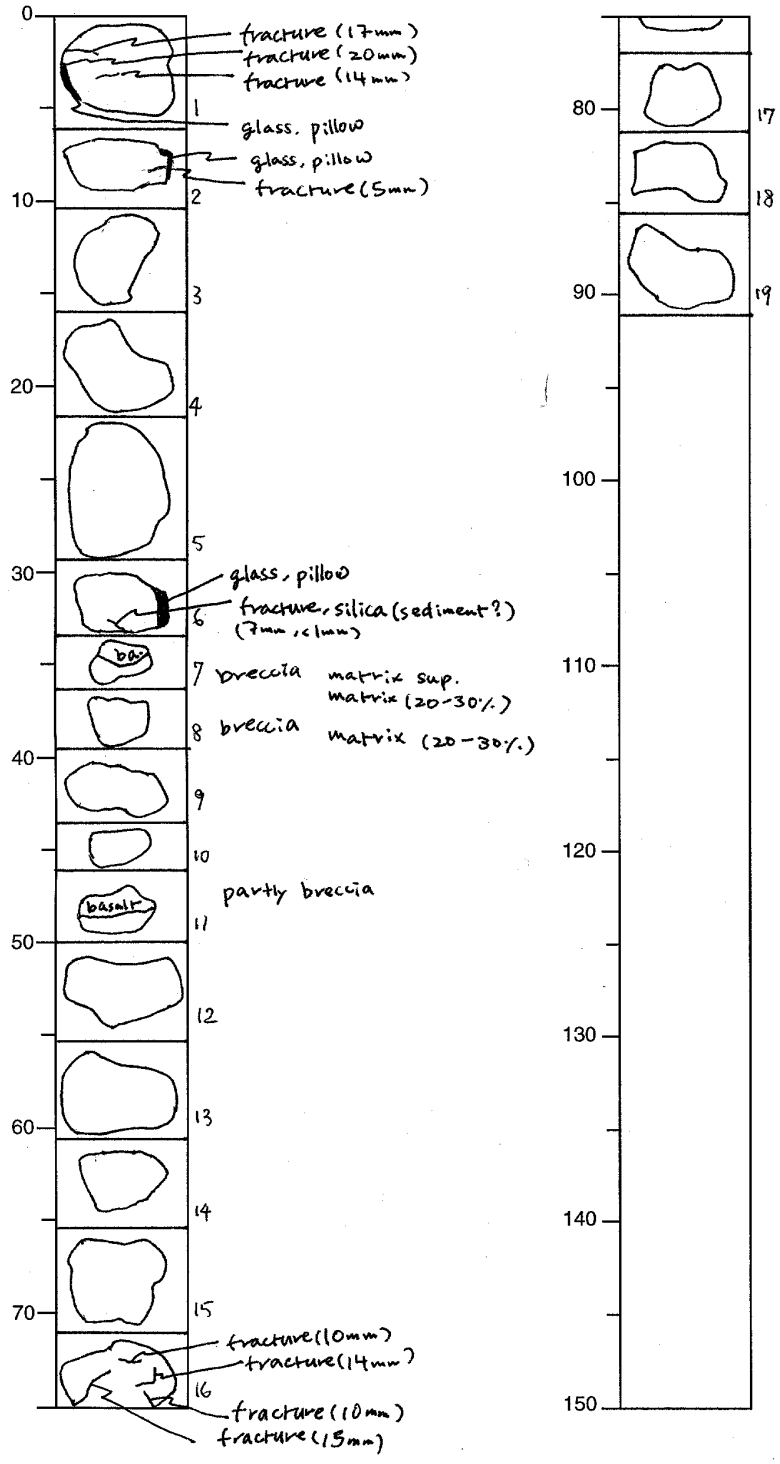
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
187	1161A	3R	1.	



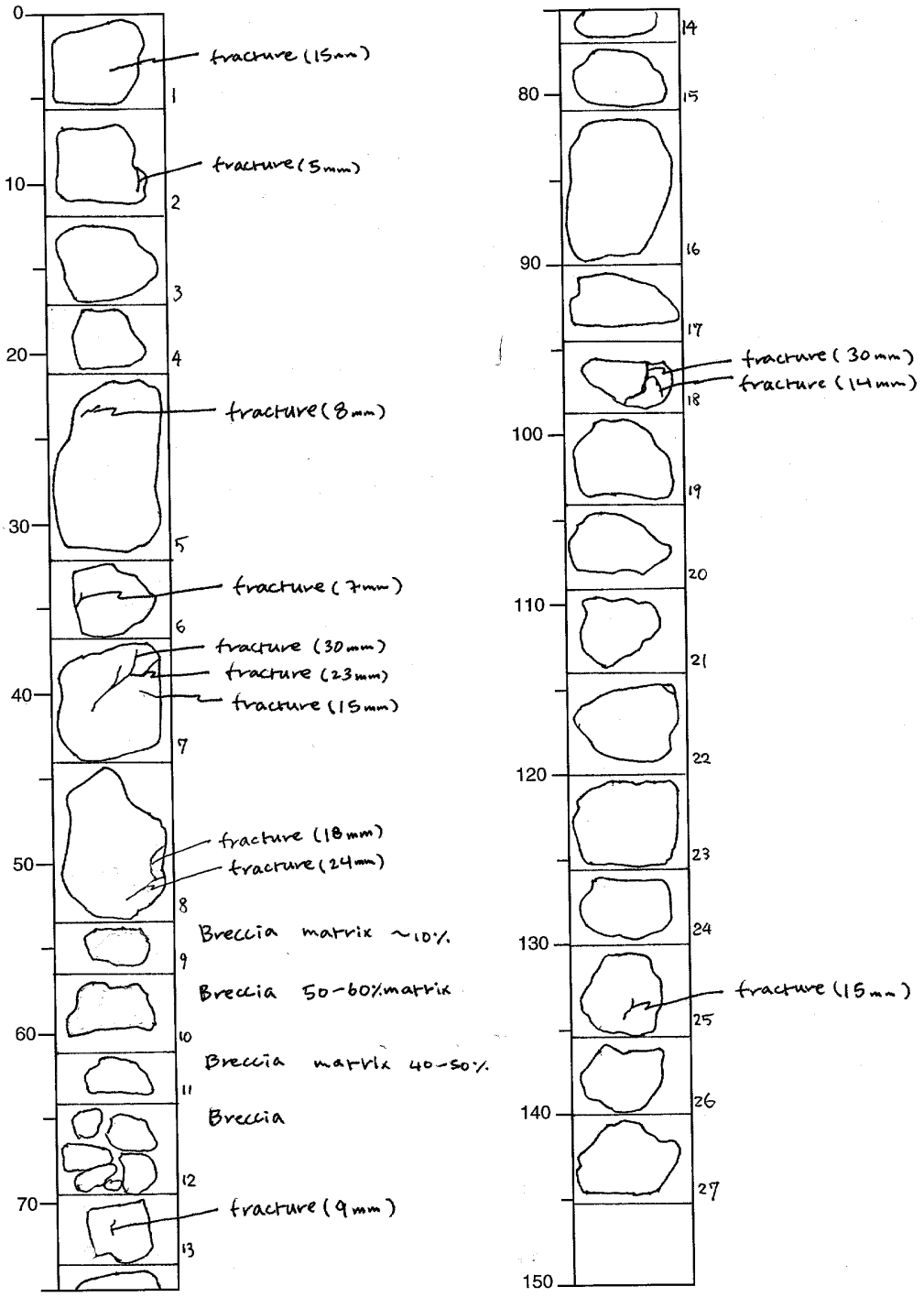
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1161A	3R	2



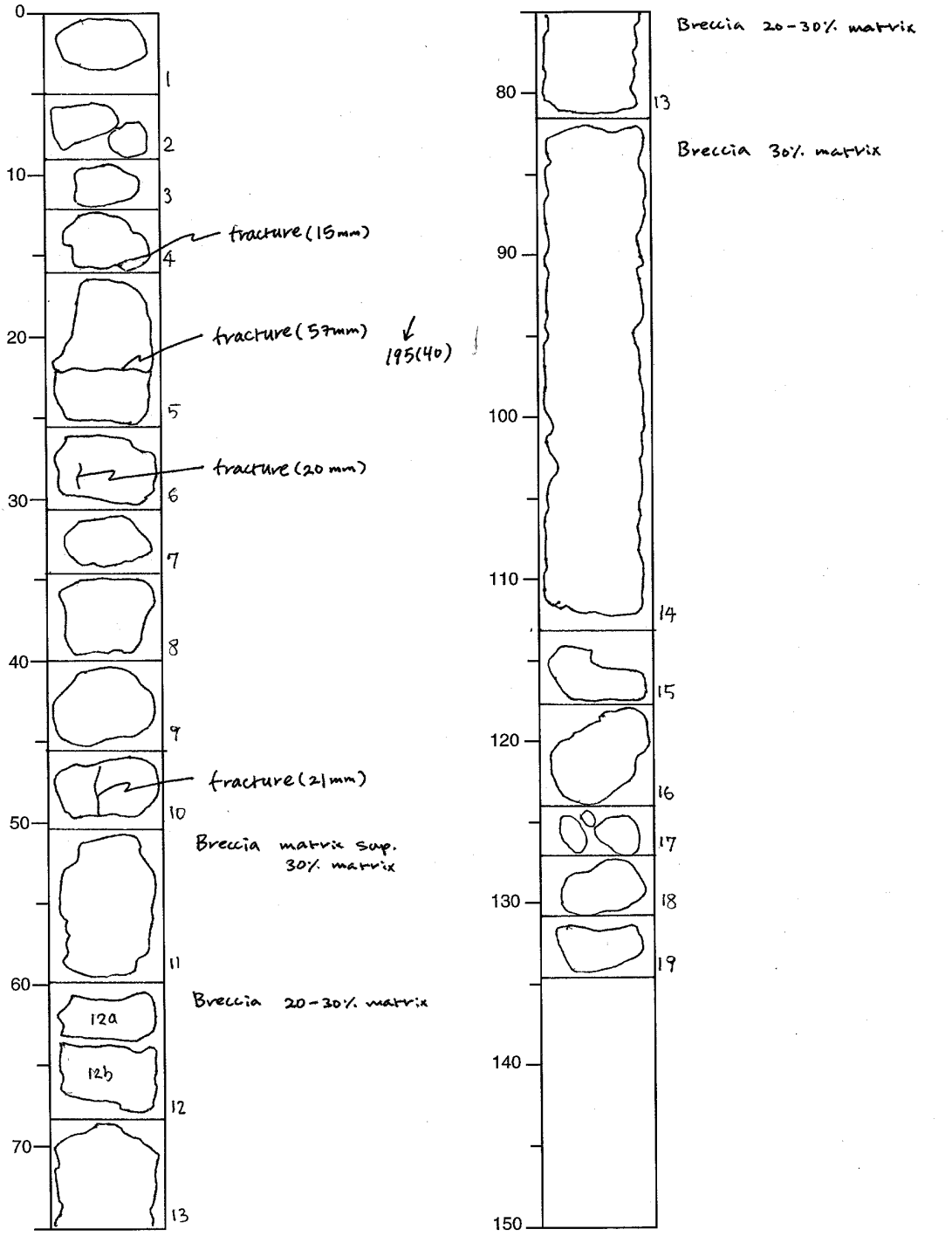
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Ob
187	1161A	4R	1	



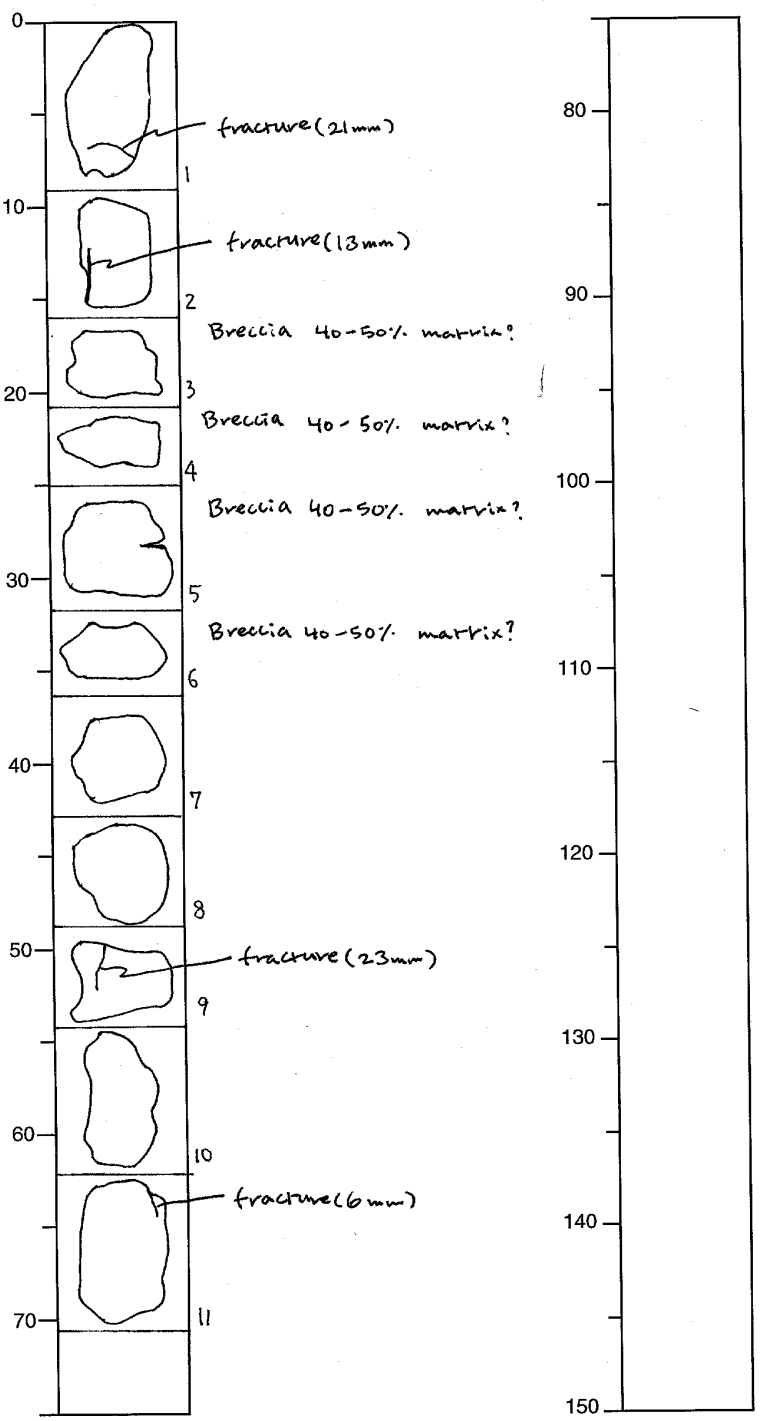
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observe
187	1161A	5R	1	



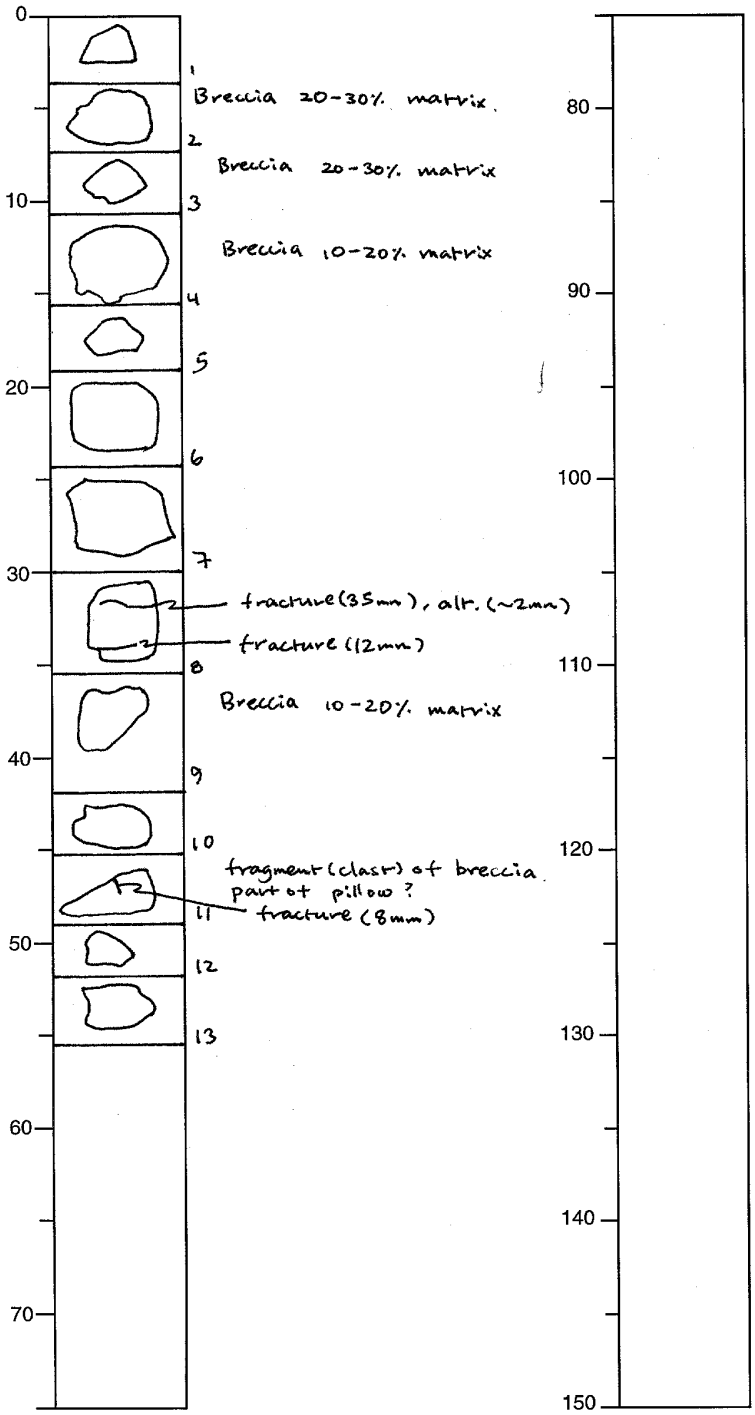
STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1161B	1W	1



STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1161B	2R	1



STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section
187	1161B	3R	1