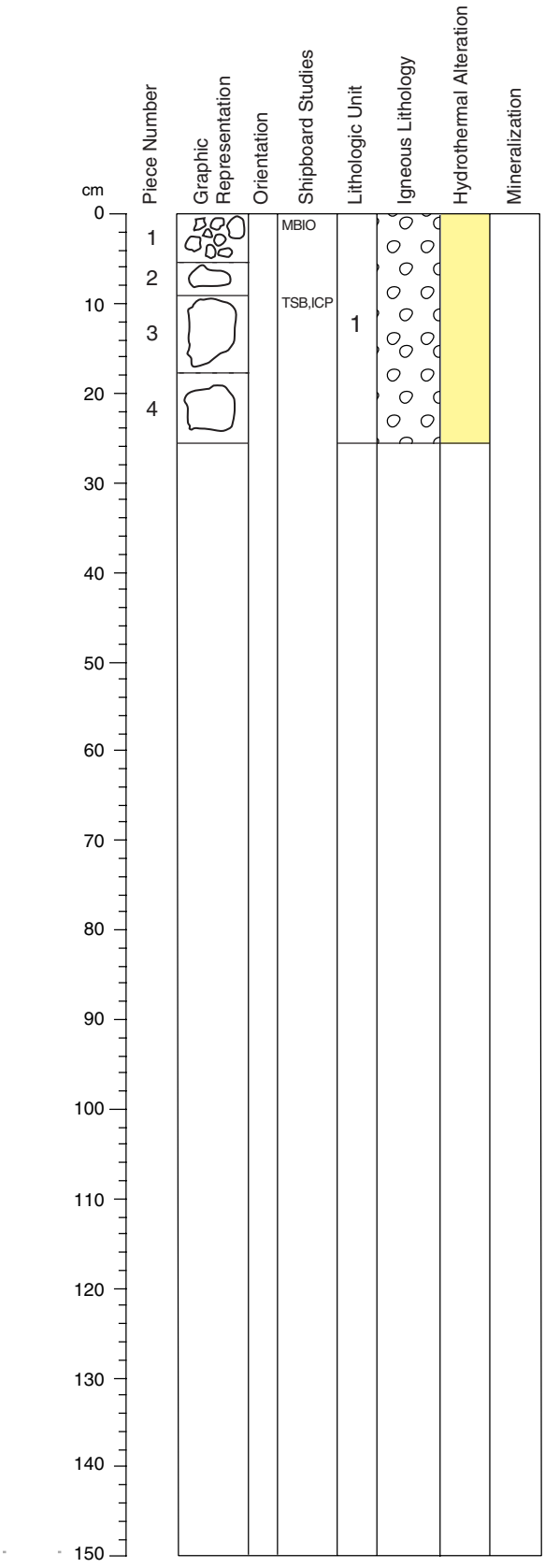
Core Photo

1188A-1R NO RECOVERY



193-1188A-2R-1 (Section top: 9.6 mbsf)

ROCK NAME: Moderately plagioclase-phyric, moderately vesicular rhyodacite.

UNIT: 1
Pieces: 1-4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	1	0	9.60
Lower contact:	5R	1	6	35	33.95

Thickness (m): 24.35

CONTACTS: None.

PHENOCRYSTS: % Grain Size (mm)

Mineral	Mode	Max	Min	Avg.	Shape/Habit
Plagioclase	4	10	0.1	1	Elongate laths

GROUNDMASS: Microlitic glass.

VESICLES: Commonly flattened, length 0.5-15 mm, height 0.2-1.5 mm.

COLOR: Black.

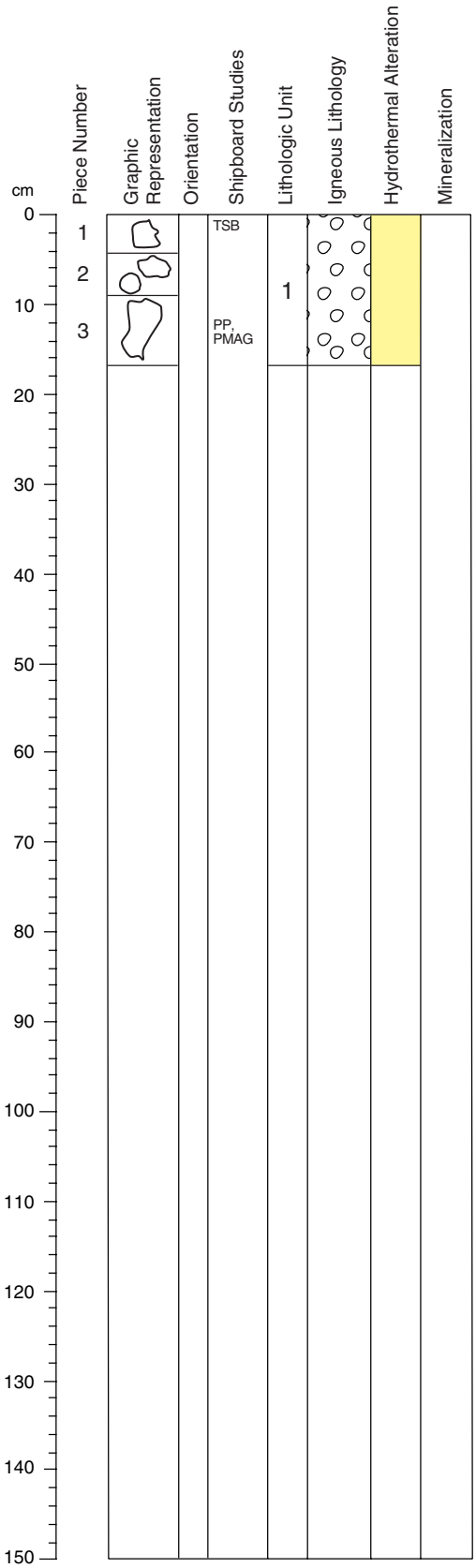
STRUCTURE: Vesicles aligned - flow structure.

ALTERATION: Fresh rock, with incipient alteration. Blue clay mineral coats the inside of many vesicles. Partial coating of green clay-like material on some pieces.

VEINS/FRACTURES: Some discontinuous hairline cracks.

COMMENTS: Refractive Index (RI) measured = 1.501, corresponding to 72 wt% SiO_2.

Core Photo



193-1188A-3R-1 (Section top: 19.2 mbsf)

ROCK NAME: Moderately plagioclase-phyric, moderately vesicular rhyodacite.

UNIT: 1
Pieces: 1-3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	1	0	9.60
Lower contact:	5R	1	6	35	33.95

Thickness (m): 24.35

CONTACTS: None.

PHENOCRYSTS: % Grain Size (mm):

Mineral	Mode	Max	Min	Avg.	Shape/Habit
Plagioclase	3	2.0	0.1	1	Elongate laths
Magnetite	1	0.1	< 0	1	Euhedral, altered to FeOx
Olivine	<1	4	1	2	Glomerocryptic aggregates with FeOx inclusions (magnetite)

GROUNDMASS: Microlitic glass, magnetite microcrysts inferred (pieces are magnetic).

VESICLES: Round to lenticular, diameter 1 x 1 mm to 1-2 x 10 mm.

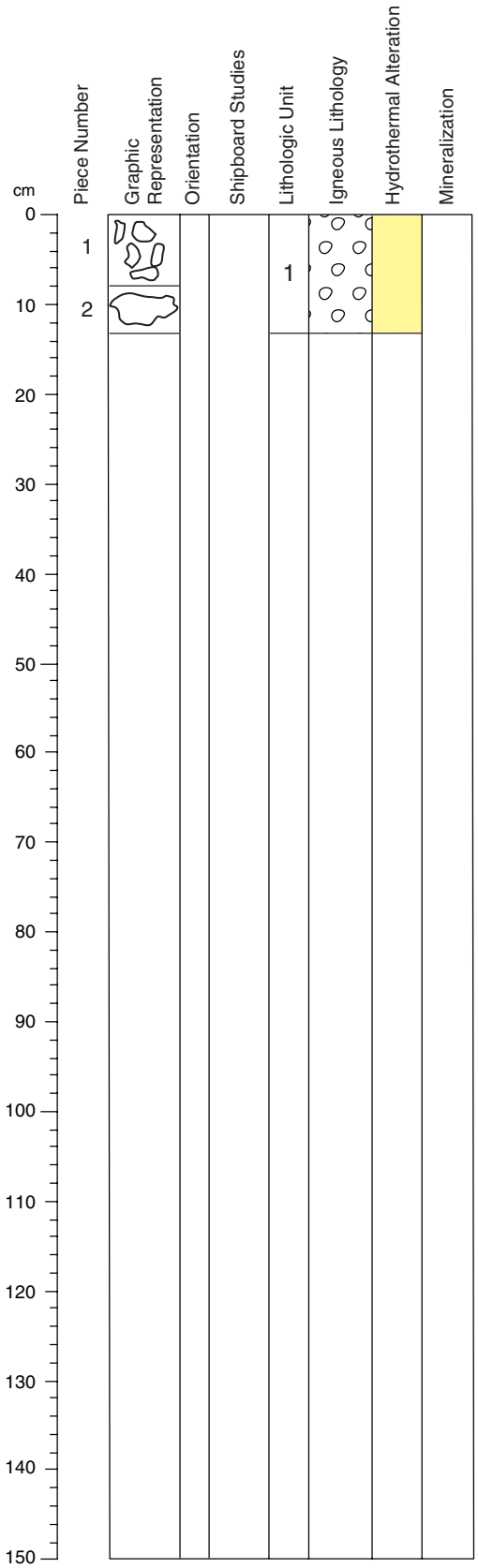
COLOR: Black.

STRUCTURE: Vesicles aligned - flow structure.

ALTERATION: Sulfate films on some pieces; one occurrence of green aggregate (clay?, 10 x 5 mm) on a surface, traces of sulfide probably pyrite.

COMMENTS: R.I = 1.496 measured, corresponds to 73 wt% SiO_2. Refractive indices were measured on an olivine grain (peridot color), picked from loose part of a tiny xenolith. High birefringence, conchoidal fracture, no cleavage. Gamma = 1.670 (± 0.001), alpha = 1.654 (± 0.002). Corresponds to a very magnesian olivine, forsterite 92% (± 2 to 3).

Core Photo



193-1188A-4R-1 (Section top: 28.9 mbsf)

ROCK NAME: Moderately plagioclase-phyric, moderately vesicular rhyodacite.

UNIT: 1
Pieces: 1-2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	1	0	9.60
Lower contact:	5R	1	6	35	33.95

Thickness (m): 24.35

CONTACTS: None.

PHENOCRYSTS: % Grain Size (mm):

Mineral	Mode	Max	Min	Avg.	Shape/Habit
Plagioclase	2	1.0	0.1	<1	Elongate, euhedral laths

GROUNDMASS: Microlitic glass, magnetite microcrysts inferred (pieces are magnetic).

VESICLES: Round to lenticular, diameter 1 x 10 mm; locally <1 x 5 mm or fibrous.

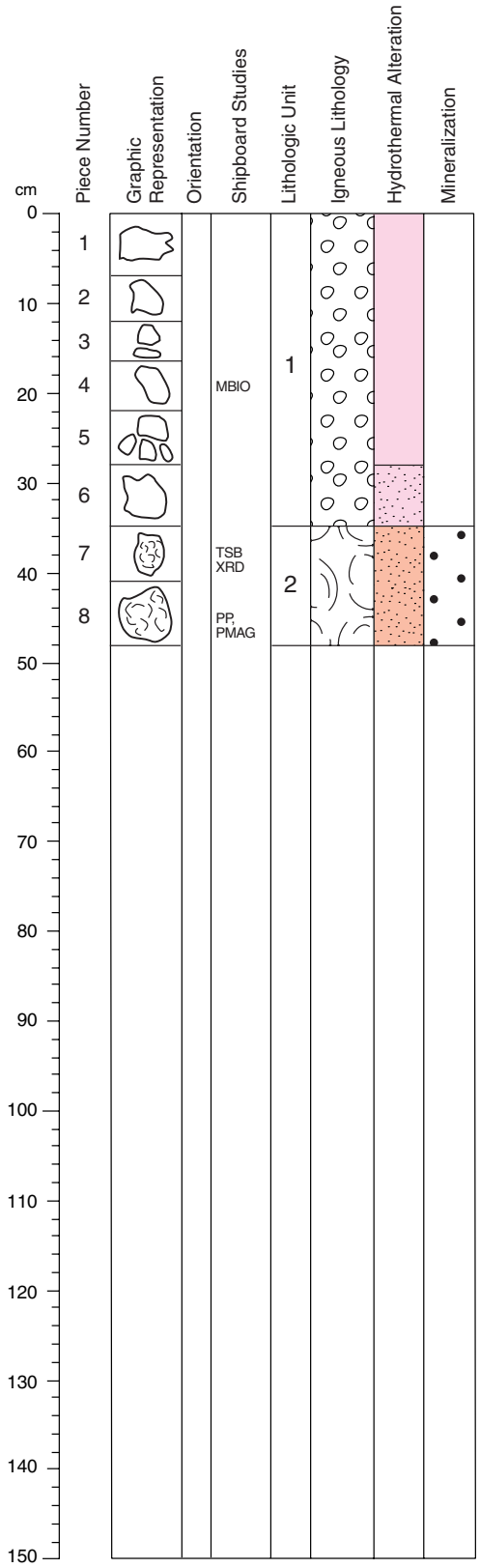
COLOR: Black.

STRUCTURE: Vesicles aligned - flow structure.

ALTERATION: Slightly altered, FeOx and clay films, sulfate in veins.

COMMENTS: R.I. = 1.496 measured, corresponds to 73 wt% SiO_2

Core Photo



193-1188A-5R-1 (Section top: 33.6 mbsf)

ROCK NAME: Sparsely plagioclase-phyric, moderately vesicular rhyodacite.

UNIT: 1
Pieces: 1-6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	1	0	9.60
Lower contact:	5R	1	6	35	33.95

Thickness (m): 24.35

CONTACTS: None.

PHENOCRYSTS: % Grain Size (mm)

Mineral	Mode	Max	Min	Avg.	Shape/Habit
Plagioclase	1	1	0.1	0.5	Euhedral

GROUNDMASS: Microlitic glass.

VESICLES: Round to elongate.

COLOR: Black to gray.

STRUCTURE: Flow structure (elongate vesicles) on the surface of Piece 1

ALTERATION: Clay, FeOx, sulfate in films, grading to slightly to moderately altered (pervasive).

COMMENTS: Refractive Index measured = 1.496 corresponding to 72 wt% SiO_2 (one piece).

ROCK NAME: Altered, aphanitic, perlitic dacite(?).

UNIT: 2
Pieces: 7-8

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	5	1	7	35	33.95
Lower contact:	5	1	8	48	34.08

Thickness (m): 0.13

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray (bleached).

STRUCTURE: Silica veinlets.

ALTERATION: High intensity pervasive alteration (bleaching followed by silicification).

VEINS/FRACTURES: Silica veinlet.

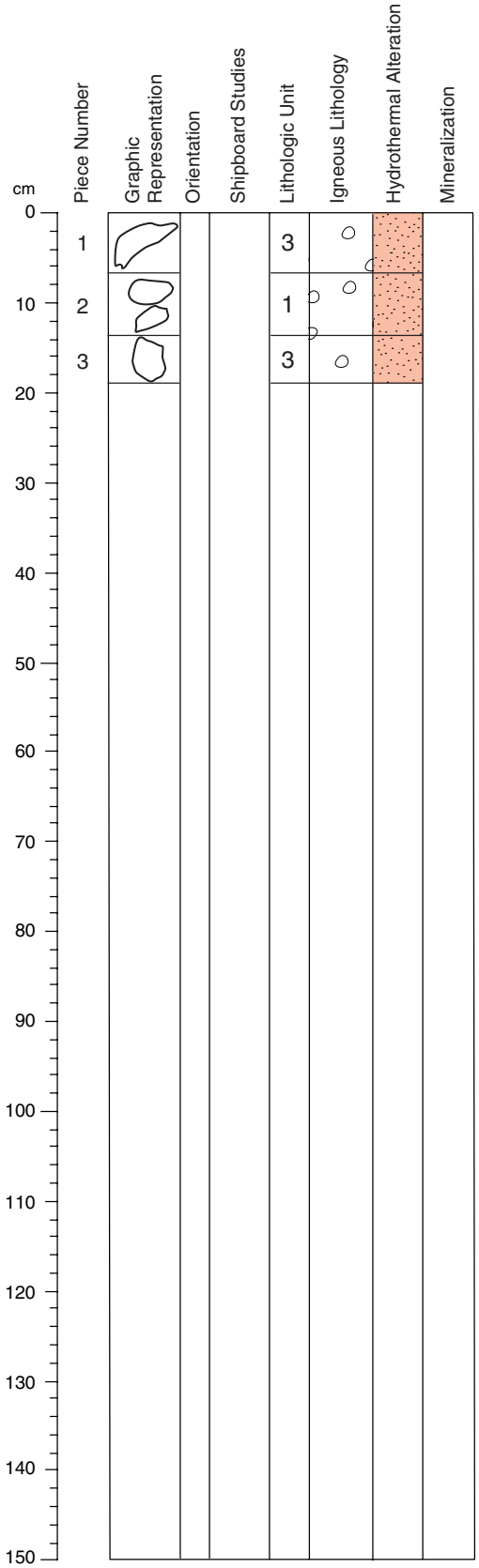
COMMENTS: Trace disseminated pyrite.

MINERALIZATION:
Major minerals:

Name	Abundance (%)	Size	Morphology	Characteristics
Silica	70 - 75	Very fine	Granular	
Clay	10 - 20	Very fine	Massive	
Pyrite	10	Very fine		Extremely fine-grained

Minor minerals: None.
Trace minerals (<2%): None.

Core Photo



193-1188A-6R-1 (Section top: 38.6 mbsf)

ROCK NAME: Highly altered, moderately vesicular, aphyric rhyodacite.

UNIT: 3
Pieces: 1 and 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6 R	1	1	0	38.60
Lower contact:	6 R	1	3	20	38.80

Thickness (m): 0.20

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Microlitic.

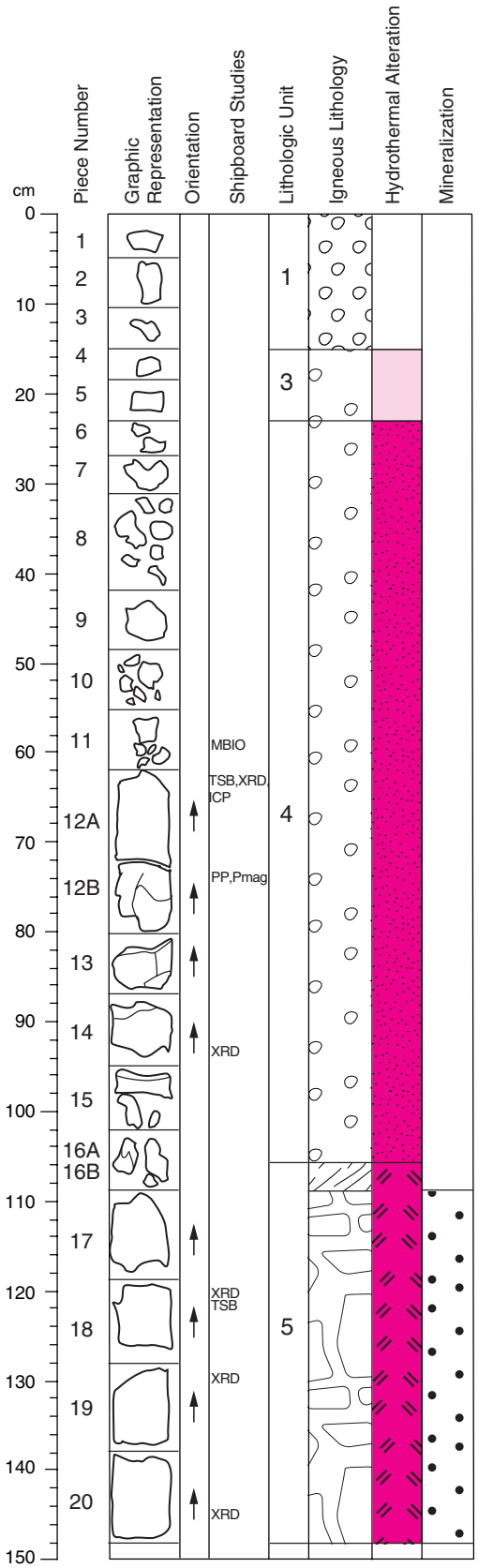
VESICLES: Round to lenticular (5%-7%), 1-3 mm x 1-10 mm.

COLOR: Gray.

ALTERATION: Weak bleaching, pervasive moderate intensity alteration. Anhydrite (+pyrite) lines vesicles.

COMMENTS: Piece 2 consists of two pebbles which resemble Unit 1 in Cores 1188A-2R to 5R, and may have fallen down the pipe. RI (measured) of the microlitic glass from this piece is 1.501 ± 0.003, corresponding to rhyodacite.

Core Photo



193-1188A-7R-1 (Section top: 48.2 mbsf)

ROCK NAME: Moderately plagioclase phyric, moderately vesicular rhyodacite.

UNIT: 1
Pieces: 1-3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	1	0	9.60
Lower contact:	5R	1	6	35	33.95

Thickness (m): 24.35

CONTACTS: None.

PHENOCRYSTS: % Grain Size (mm):

Mineral	Mode	Max	Min	Avg.	Shape/Habit
Plagioclase	3	1	0.1	0.5	Euhedral
Olivine	Trace	1			

GROUNDMASS: Microlitic glass.

VESICLES: Round to lenticular.

COLOR: Black.

ALTERATION: Fresh.

COMMENTS: Small pieces, considered to be equivalent to Unit 1 above (pieces fallen down the pipe?). RI (measured) = 1.499 ± 0.004, corresponding to rhyodacite.

ROCK NAME: Moderately vesicular aphyric ?dacite.

UNIT: 3
Pieces: 4 and 5

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6R	1	1	0	38.60
Lower contact:	6R	1	3	20	38.80

Thickness (m): 0.20
CONTACTS: None.

PHENOCRYSTS: Aphyric.

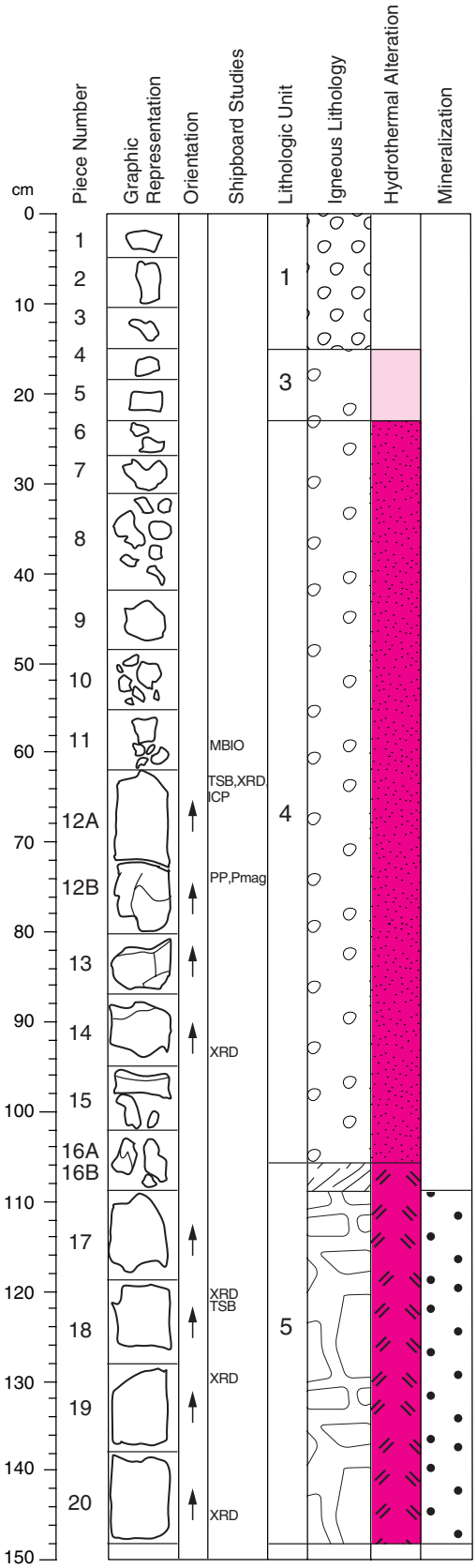
GROUNDMASS: Microlitic glass.

VESICLES: Dominantly round up to 2 mm.

COLOR: Black.

ALTERATION: Fresh.

Core Photo



193-1188A-7R-1 (Section top: 48.2 mbsf)

ROCK NAME: Completely altered, moderately vesicular aphyric ?dacite.

UNIT: 4
Pieces: 6-16A

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	6	23	48.43
Lower contact:	7R	1	16A	105	49.25

Thickness (m): 0.82

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Round to lensoidal, diameter: 1 to 2 mm x 2 to 15 mm.

COLOR: Light gray-green to gray.

STRUCTURE: Intervals of flowbanding (Pieces 6 and 14) and an interval of breccia (Piece 8).

ALTERATION: Intense bleaching (sulfate-clay alteration) with weakly developed patchy silicification.

VEINS/FRACTURES: Medium- to coarse-grained irregular anhydrite-pyrite veins, which form the "matrix" in the breccia. Piece 12, anhydrite veins +/- pyrite.

COMMENTS: Unit 4 is probably the altered equivalent of unit 3. Anhydrite-pyrite vesicle fill, trace honey yellow sphalerite noted in Pieces 11 and 15.

ROCK NAME: Completely altered fractured aphyric volcanic rock.

UNIT: 5
Pieces: 16B - 20

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	16B	105	49.25
Lower contact:	7R	1	20	148	49.68

Thickness (m): 0.43

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

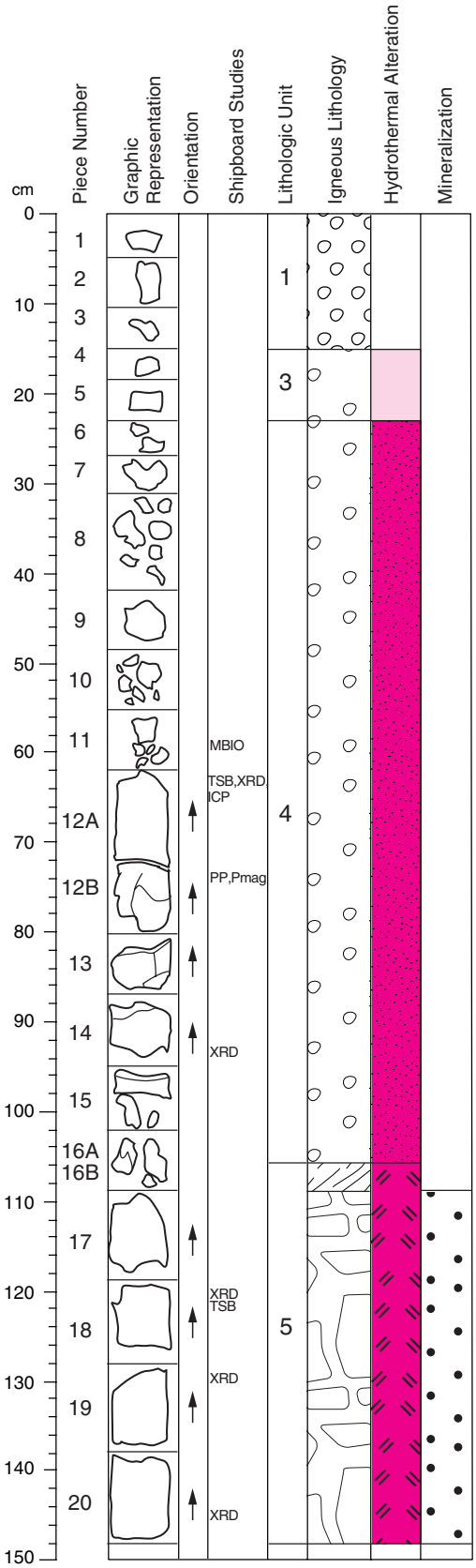
VESICLES: Irregular vugs (probably secondary) make up <5% of Pieces 18 to 20.

COLOR: Green, blue-gray, white.

STRUCTURE: Remnant perlitic(?) to pseudoclastic.

ALTERATION: Greenish-gray alteration (silica-sulfate-chloritic clay), grading to gray-blue silica-sulfate-clay bleaching at base of unit (Sections 1188A-7R-1, Pieces 19 and 20, and 7R-2, Piece 1). Remnant volcanic texture (perlitic?) replaced by silica and rimmed by chloritic clay. Fragments hosted in a stockwork "matrix" of anhydrite (silica-pyrite) with white sulfate alteration halos bleaching the clay rims of many fragments. In the gray-blue portion of the unit, fragments are dominantly sulfate-clay and are again hosted in an anhydrite-pyrite stockwork. Silica occurs as late drusy vug fills, with trace pyrite.

Core Photo



193-1188A-7R-1 (Section top: 48.2 mbsf)

UNIT: 5
Pieces: 16B - 20 (cont'd)

VEINS/FRACTURES: Intense alteration of rock along fracture network resulting in pseudoclastic texture. Late stage anhydrite-sulfide veins.

COMMENTS: Color of dominant alteration mineral assemblage changes from green in Pieces 17 and 18 to blue-gray in Pieces 19 and 20.

MINERALIZATION: Pieces: 17, 18, 19 and 20.

Major minerals:

Name	Abundance (%)	Size	Included in, Characteristics
Anhydrite	60-70	Very fine-grained	Replacing other minerals; associated with silica.
Clay	10-25	Very fine-grained	Replacing other minerals.
Pyrite	10-20	Very fine-grained	Extremely fine-grained.

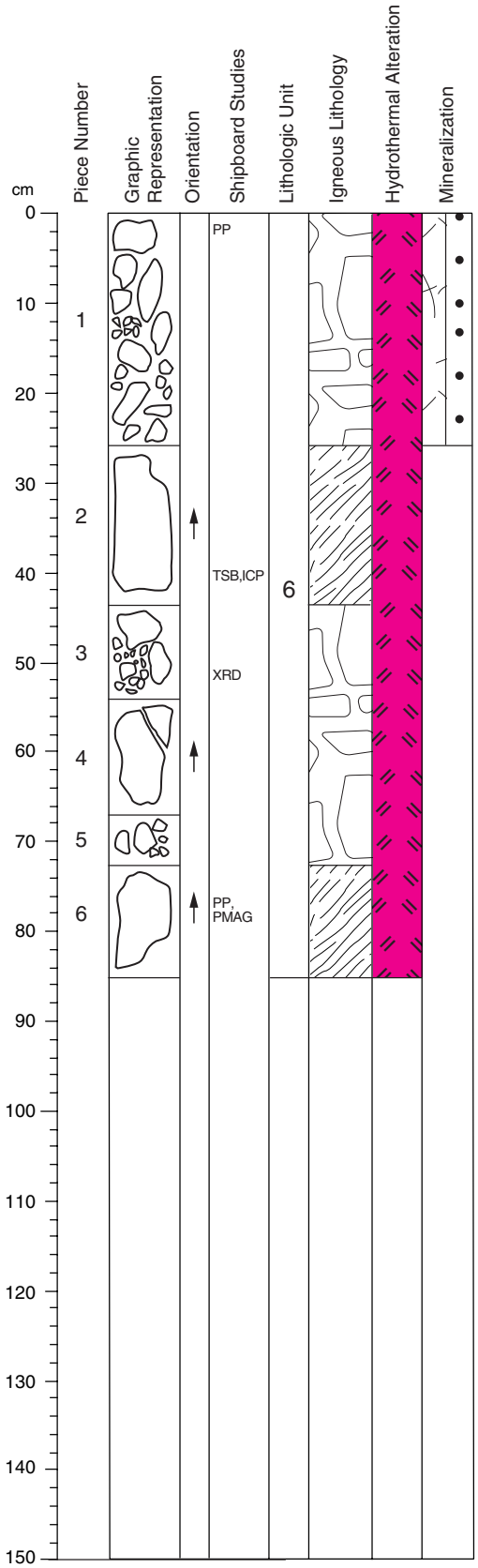
Minor minerals:

Name	Abundance (%)	Size	Included in, Characteristics
Silica	5-10	Very fine-grained	Associated with anhydrite.

Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Replacement of original ?dacite by anhydrite and later by clay minerals.

Core Photo



193-1188A-7R-2 (Section top: 49.7 mbsf)

ROCK NAME: Completely altered, fractured, flow banded volcanic rock.

UNIT: 6
Pieces: 1-6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	2	1	0	49.68
Lower contact:	8R	1	11	140	59.30

Thickness (m): 9.60

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Gray, green, and white.

STRUCTURE: Pseudoclastic or autobrecciated textures and flow banding of original volcanic rock preserved in Pieces 2-6. Piece 1 is similar to interval 1188A-7R-1, Pieces 16B-20.

ALTERATION: Greenish gray (silica-sulfate-chloritic clay) to gray-blue (silica-sulfate-clay) altered fragments hosted in a stockwork "matrix" of anhydrite +/- silica-pyrite veins with white sulfate alteration halos bleaching the clayey rims of many fragments. Void space partly filled with anhydrite and minor silica and sulfide.

VEINS/FRACTURES: Late stage anhydrite-sulfide veins.

COMMENTS: Fragments show locally preserved flow banding which is pseudomorphed by the alteration assemblage.

MINERALIZATION: (Pieces: 1 and 2)

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	70	Very fine-grained	Associated with silica.
Clay	15	Very fine-grained	Replacing other minerals.

Minor minerals:

Name	Abundance (%)	Size	Included in, Characteristics
Pyrite	10	Very fine-grained	Aggregates of crystals with sugary texture filling veins.
Silica	5	Very fine-grained	Associated with anhydrite.

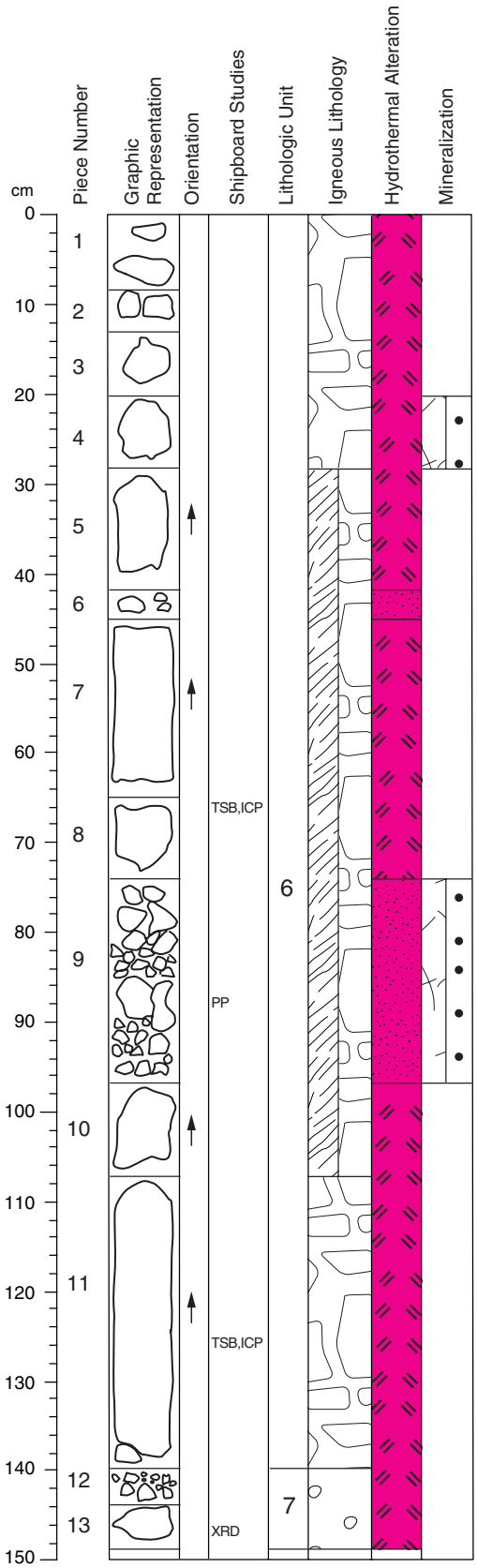
Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Replacement of original ?dacite by anhydrite and later clay minerals; network veins of pyrite.

STRUCTURES/VEINS/FRACTURES:

Size	Veins <0.5 mm.
Orientation	Veins - anastomosing.
Minerals	Pyrite - aggregates of crystals with a sugary texture.

Core Photo



193-1188A-8R-1 (Section top: 57.9 mbsf)

ROCK NAME: Completely altered, fractured flow banded volcanic rock.

UNIT: 6
Pieces: 1-11

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact: :	7R	2	1	0	49.68
Lower contact:	8R	1	11	140	59.30

Thickness (m): 9.60

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None, except for 30% in Piece 1, which is thought to have fallen from overlying rhyodacite unit.

COLOR: Gray, green, and white.

STRUCTURE: Pseudoclastic or autobrecciated textures in Pieces 3, 4, 7, 8, 10, and 11. Flow banding of original volcanic rock preserved in Pieces 5, 7, 8, 10, and 11.

ALTERATION: Greenish gray (silica-sulfate-choritic clay) to gray-blue (silica-sulfate-clay) altered fragments hosted in a stockwork "matrix" of anhydrite-(silica-pyrite) veins with white sulfate alteration halos bleaching the clayey rims of many fragments. Void space partly filled with anhydrite and minor sulfide.

VEINS/FRACTURES: Intense alteration of rock along fracture network resulting in pseudoclastic texture. Late stage anhydrite-silica-sulfide veins.

COMMENTS: Fine-grained pyrite appears to be disseminated in many of the fragments, but on close examination seem more likely to be associated with fine silica veinlets as well as siliceous replaced flow bands.

MINERALIZATION: Pieces: 4 and 9.

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Clay	35-70	Very fine-grained	Massive.
Anhydrite	20-35	Very fine-grained	Spherical aggregates.

Minor minerals:

Name	Abundance (%)	Size	Included in, Characteristics
Pyrite	5	Very fine-grained	In clay and barite, veins and disseminations.
Silica	5-25	Very fine-grained	In anhydrite, aggregates with sugary texture.

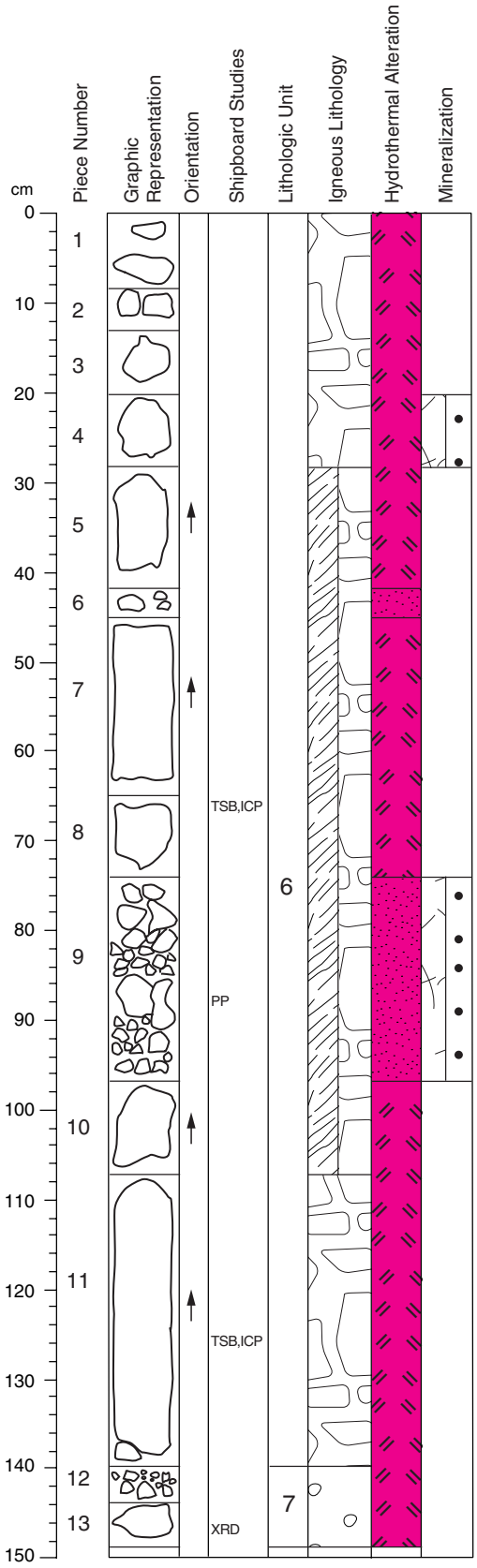
Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Replacement of original ?dacite by anhydrite and later clay minerals; network veins of pyrite.

STRUCTURES/VEINS/FRACTURES:

Size	Veins <1 mm.
Orientation	Intersecting vein network.
Minerals	Pyrite.

Core Photo



193-1188A-8R-1 (Section top: 57.9 mbsf)

ROCK NAME: Completely altered, hydrofractured flow banded volcanic rock.

UNIT: 7
Pieces: 12-13

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	8R	1	12	140	59.30
Lower contact:	9R	1	6	53	68.13

Thickness (m): 8.83

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: 5% in Piece 13.

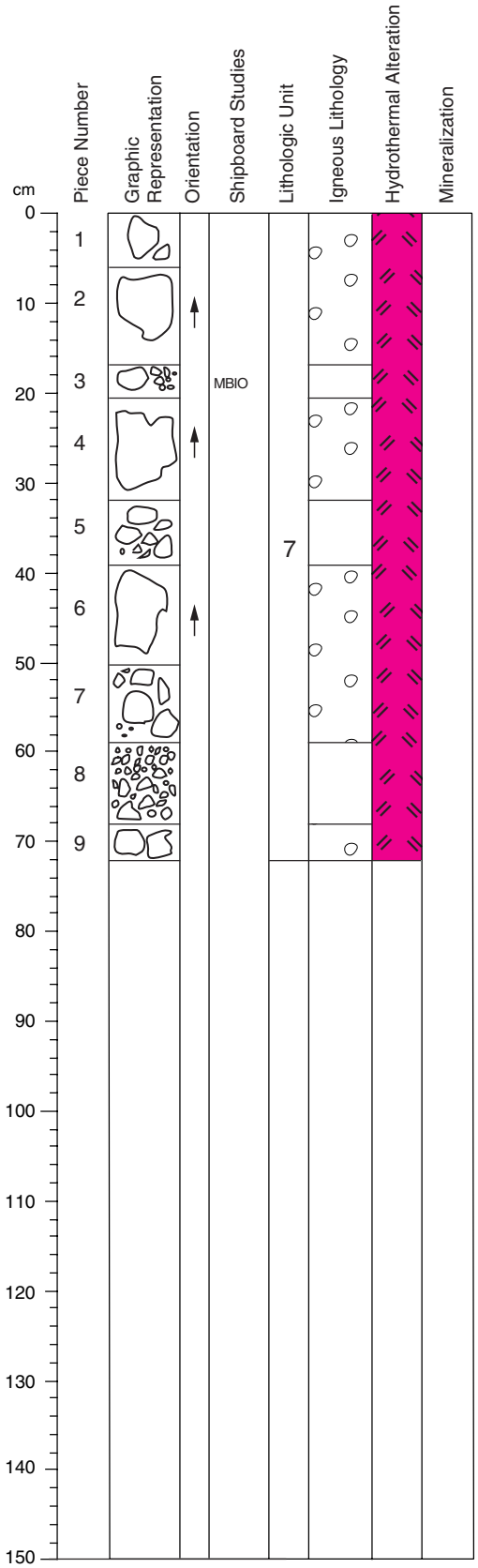
COLOR: Gray, green, and white.

STRUCTURE: Flow banding in Piece 13.

ALTERATION: Bleached (silica-sulfate altered) unit. Variation in color from white to medium gray seems to reflect silica abundance (darker intervals contain more silica) and appear to be related to the fractures with zoned alteration halos. Vesicles are lined by anhydrite, with minor pyrite and silica.

VEINS/FRACTURES: Intense alteration of rock along fracture network resulting in pseudoclastic texture. Late stage anhydrite-silica-sulfide veins.

Core Photo



193-1188A-8R-2 (Section top: 59.4 mbsf)

ROCK NAME: Pervasively bleached, vesicular volcanic rock.

UNIT: 7
Pieces: 1-9

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	8R	1	12	140	59.30
Lower contact:	9R	1	6	53	68.13

Thickness (m): 8.83

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine grained.

VESICLES: 5% in Pieces 1 and 2.

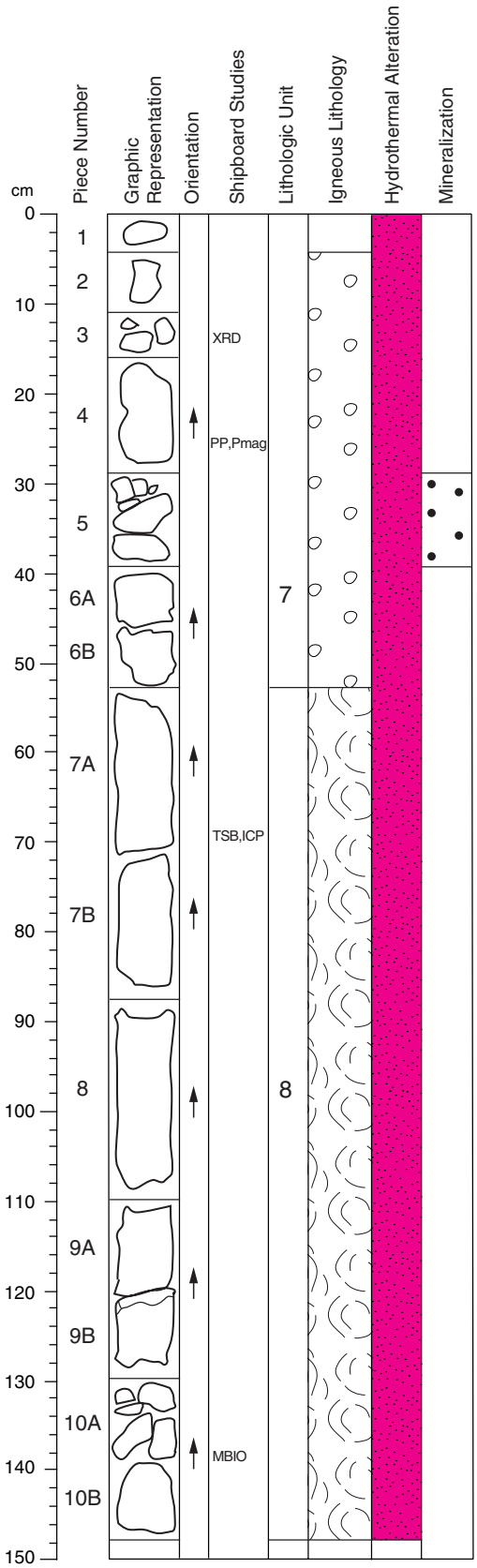
COLOR: Gray, green, and white.

STRUCTURE: Elongate vesicles in Pieces 2 and 4.

ALTERATION: Pervasive bleached alteration.

VEINS/FRACTURES: Intense alteration of rock along fracture network resulting in pseudoclastic texture. Late stage anhydrite-sulfide veins.

Core Photo



193-1188A-9R-1 (Section top: 67.6 mbsf)

ROCK NAME: Pervasively bleached, vesicular volcanic rock.

UNIT: 7
Pieces: 1-6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	8R	1	12	140	59.30
Lower contact:	9R	1	6	53	68.13

Thickness (m): 8.83

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: 5% vesicles in Pieces 2 through 6, typically tube-shaped and measuring from 1 to 3 mm across and up to 1 cm long.

COLOR: White and gray.

STRUCTURE: Elongated vesicles in Pieces 2 and 7.

ALTERATION: Bleached (silica-sulfate altered) unit. Variation in color from white to medium gray seems to reflect silica abundance. Vesicles contain silica, anhydrite, and minor pyrite.

VEINS/FRACTURES: Intense bleaching-type alteration of rock associated with late stage anhydrite-sulfide veins.

MINERALIZATION: Piece 5

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Clay	65	Very fine-grained	
Anhydrite	20	Medium-grained	
Quartz	10	Very fine-grained	

Minor minerals:

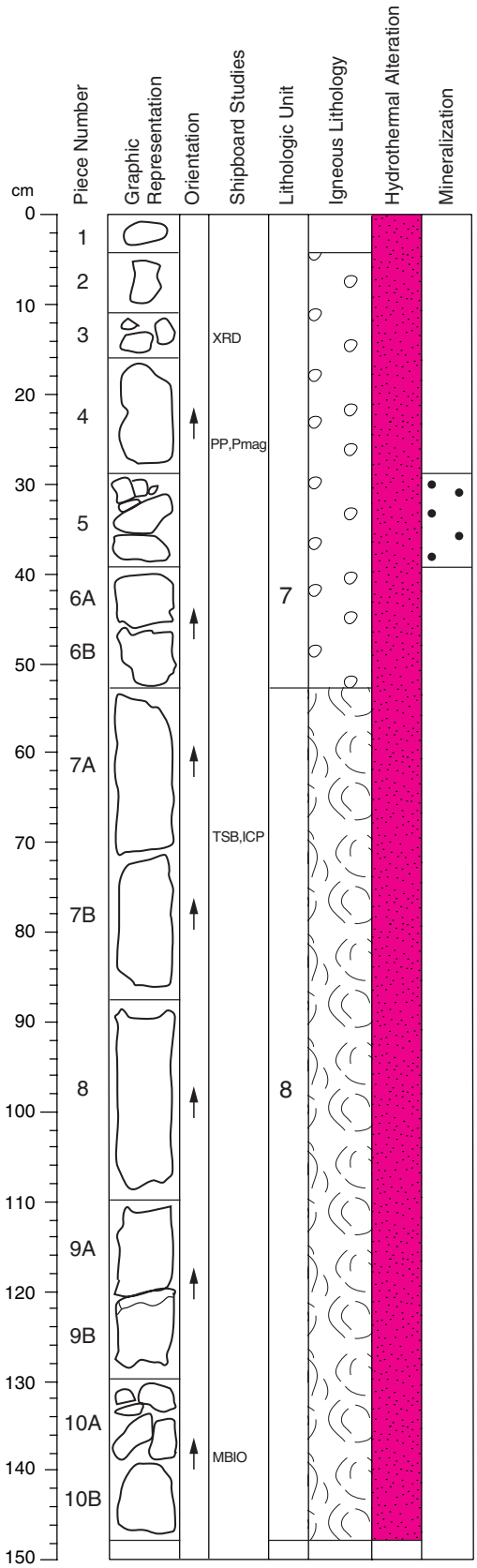
Name	Abundance (%)	Size	Included in, Characteristics
Pyrite	3	Fine-grained	In anhydrite, druse.

Trace minerals (<2%):

Name	Abundance (%)	Size	Included in, Characteristics
Sphalerite	2	Fine-grained	In anhydrite, druse.

TEXTURAL DESCRIPTION: Euhedral pyrite and sphalerite crystals within anhydrite; sphalerite on and around pyrite crystals.

Core Photo



193-1188A-9R-1 (Section top: 67.6 mbsf)

ROCK NAME: Completely altered, fractured volcanic rock.

UNIT: 8
Pieces: 7-10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9R	1	7	53	68.13
Lower contact:	10R	1	8	83	78.13

Thickness (m): 10.00

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Vugs only, up to 5 mm across, up to 5%.

COLOR: White and gray.

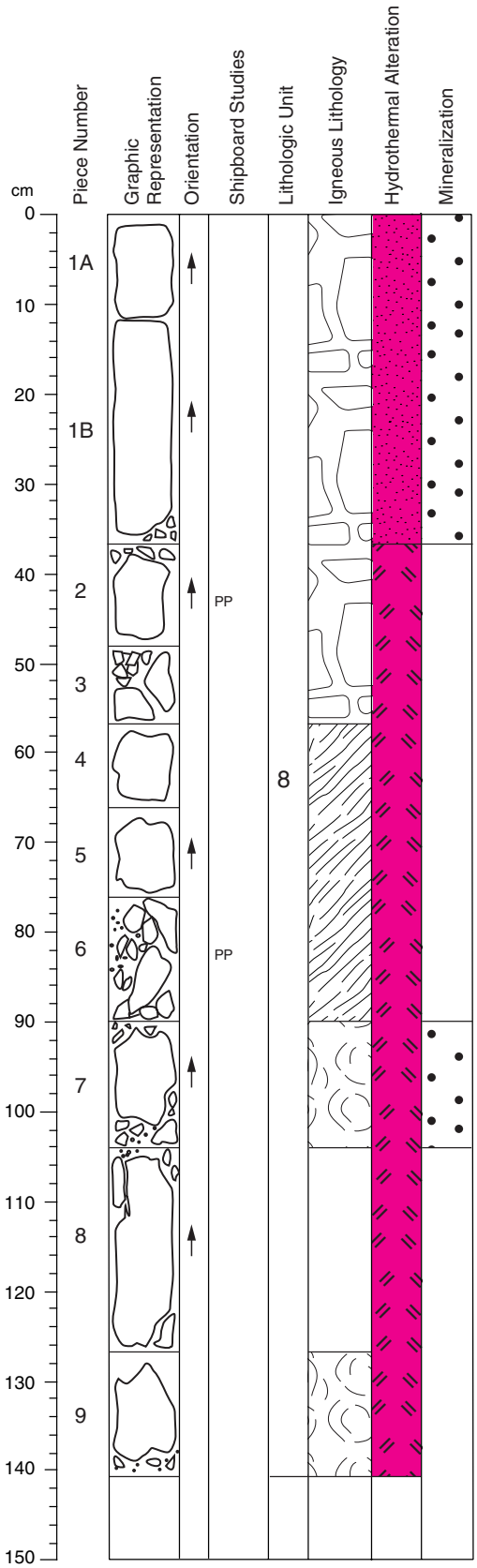
STRUCTURE: Relict perlitic structure, which gives rise to the pseudoclastic texture. Flowbanding present.

ALTERATION: Strongly bleached, silica-anhydrite dominate alteration. Void space partly filled with anhydrite and minor sulfide.

VEINS/FRACTURES: Anastomosing network of anhydrite and silica-pyrite veinlets.

COMMENTS: Distinguished from previous unit by intense pseudoclastic texture development. Appears to be a more pervasively bleached equivalent to Unit 5.

Core Photo



193-1188A-9R-2 (Section top: 69.1 mbsf)

ROCK NAME: Completely altered fractured volcanic rock.

UNIT: 8
Pieces: 1-9

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9R	1	7	53	68.13
Lower contact:	10R	1	8	83	78.13

Thickness (m): 10.00

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Typically a trace to 2% vesicles, reaching 2 mm in diameter.

COLOR: White and gray.

STRUCTURE: Relict perlitic structure, which gives rise to the pseudoclastic texture. Flow banding in Pieces 4 and 9.

ALTERATION: Strongly bleached silica-anhydrite dominate alteration. Void space partly filled with anhydrite and minor sulfide. Intense alteration of rock along fracture network of silica veins.

VEINS/FRACTURES: Silica and late stage anhydrite-sulfide veins.

MINERALIZATION: Pieces 1 and 7.

Major minerals

Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	40-50	Very fine-grained	Granular
Quartz	25-40	Very fine-grained	Granular
Clay	10-20	Very fine-grained	Massive

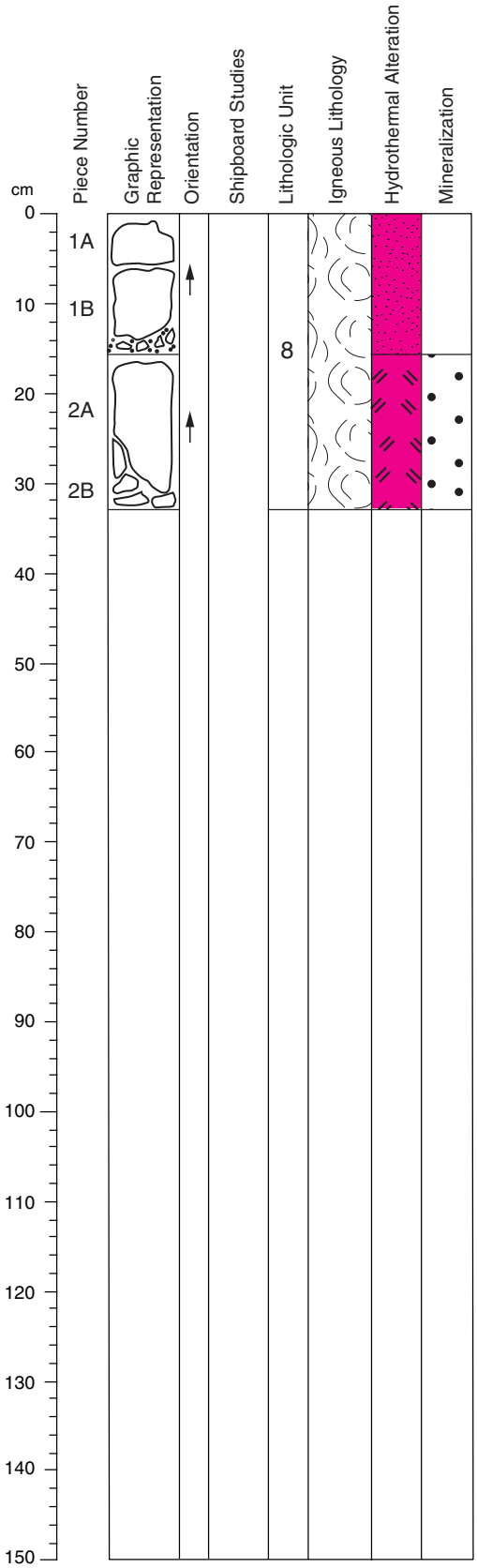
Minor minerals

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	5-10	Very fine-grained	

Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Very fine-grained pyrite disseminations and druses in a matrix of granular quartz and anhydrite.

Core Photo



193-1188A-9R-3 (Section top: 70.6 mbsf)

ROCK NAME: Completely altered fractured volcanic rock.

UNIT: 8
Pieces: 1-2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9R	1	7	53	68.13
Lower contact:	10R	1	8	83	78.13

Thickness (m): 10.00

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: White and gray.

STRUCTURE: Relict perlitic structure, which gives rise to the pseudoclastic texture.

ALTERATION: Strongly bleached silica-anhydrite dominate alteration. Void space partly filled with anhydrite and minor sulfide. Intense alteration of rock along fracture network of silica veins.

VEINS/FRACTURES: Intense alteration of rock along fracture network resulting in pseudoclastic texture. Late stage anhydrite-sulfide veins.

MINERALIZATION: Piece 2

Major minerals

Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	45	Fine-grained	Granular
Quartz	25	Fine-grained	Granular
Clay	20	Very fine-grained	Massive

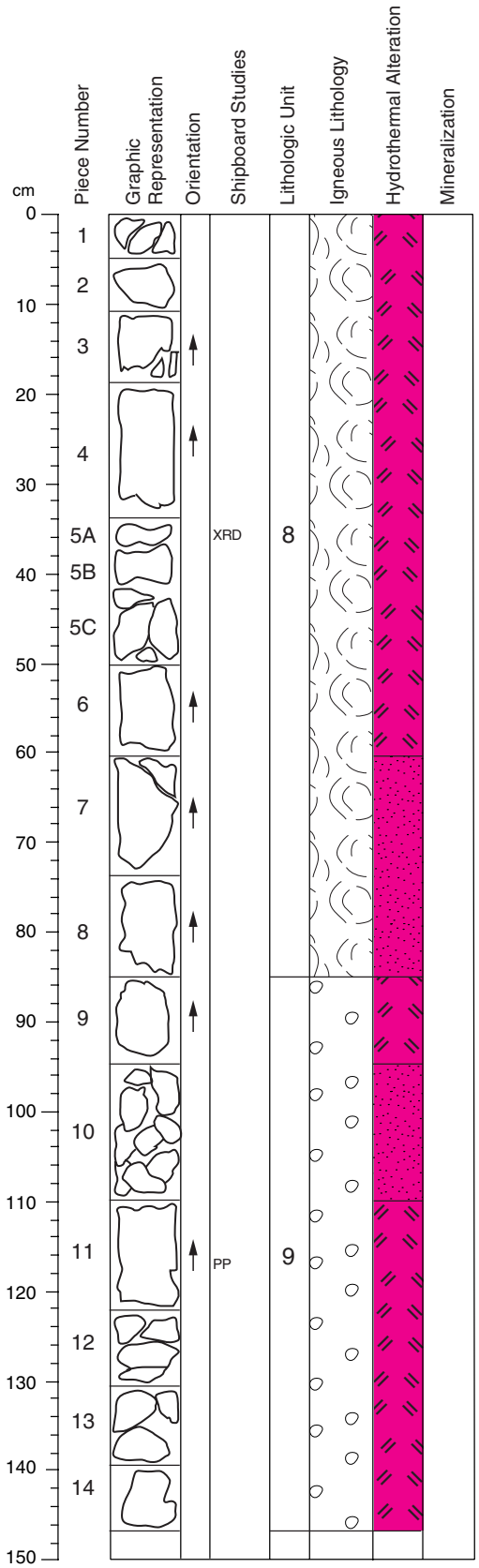
Minor minerals

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	10	Very fine-grained	

Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Extremely fine-grained pyrite in a matrix of granular quartz, anhydrite, and clay.

Core Photo



193-1188A-10R-1 (Section top: 77.3 mbsf)

ROCK NAME: Completely altered fractured volcanic rock.

UNIT: 8
Pieces: 1-8

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9R	1	7	53	68.13
Lower contact:	10R	1	8	83	78.13

Thickness (m): 10.00

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Typically 2% to 5% vesicles reaching 1 mm diameter.

COLOR: White and gray.

STRUCTURE: Relict perlitic structure, which gives rise to the pseudoclastic texture. Elongate vesicles in Pieces 4 and 8.

ALTERATION: Strongly bleached, silica-anhydrite dominate alteration. Void space partly filled with anhydrite and minor sulfide. Intense alteration of rock along fracture network of silica veins.

VEINS/FRACTURES: Silica and late stage anhydrite-sulfide veins.

ROCK NAME: Completely altered, bleached sparsely vesicular volcanic rock.

UNIT: 9
Pieces: 9-14

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact::	10	1	9	83	78.13
Lower contact:	12	1	3	38	96.98

Thickness (m): 18.85

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Typically 2% to 5% vesicles, with elongated tube shapes about 1 mm across and 1 cm long.

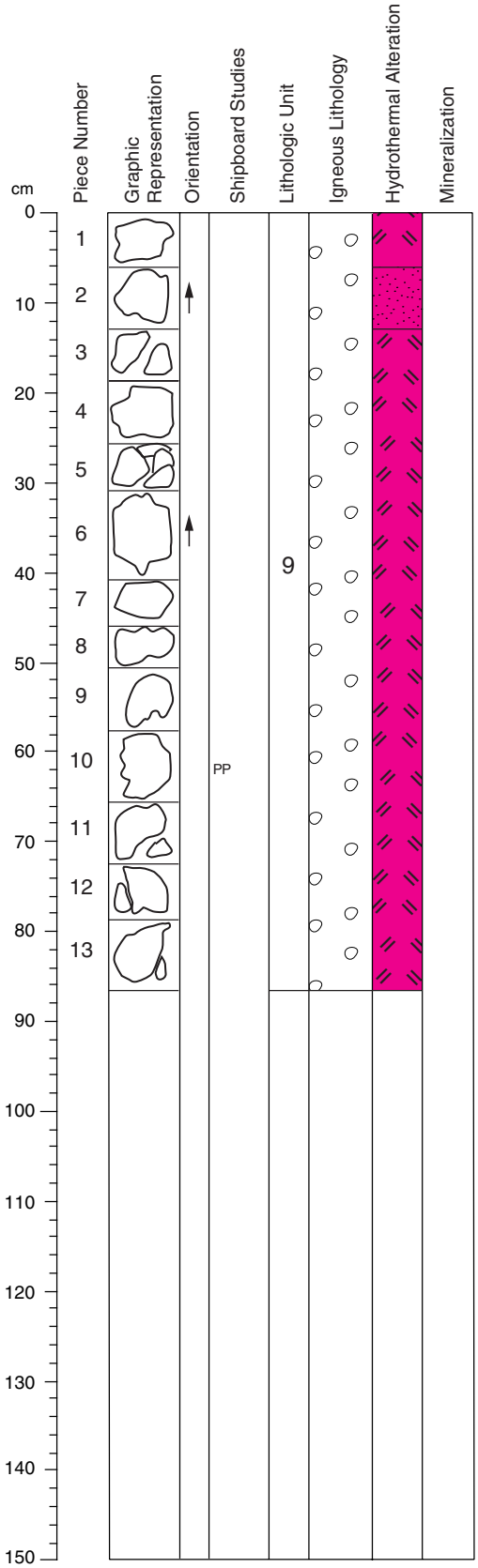
COLOR: White and gray.

STRUCTURE: Elongate vesicles in Piece 11.

ALTERATION: Bleached (silica-sulfate altered) unit. Variation in color from pure white to medium gray seems to reflect silica abundance (darker intervals contain more silica) and is probably related to fluid-bearing fractures with zoned alteration halos. Vesicles are filled with silica and pyrite (dominantly) and less commonly by anhydrite. Pyrite is also associated with the zoned halos and finely disseminated throughout the rock.

VEINS/FRACTURES: Late stage anhydrite-sulfide veins.

Core Photo



193-1188A-10R-2 (Section top: 78.8 mbsf)

ROCK NAME: Completely altered, bleached sparsely vesicular volcanic rock.

UNIT: 9
Pieces: 1-13

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	9	83	78.13
Lower contact:	12R	1	3	38	96.98

Thickness (m): 18.85

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Trace to 3% spherical and ovoid vesicles ~1 mm across (up to 4 mm in Piece 2).

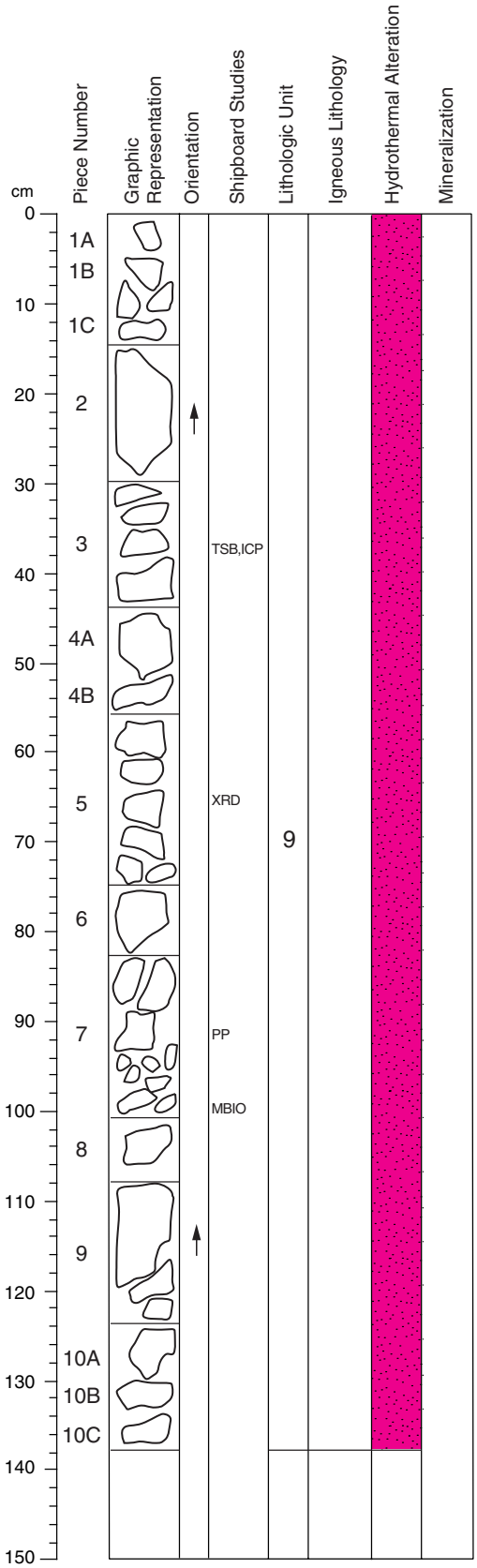
COLOR: White and gray.

STRUCTURE: Elongated vesicles in Piece 1. Flow banding in Piece 13.

ALTERATION: Bleached (silica-sulfate altered) unit. Variation in color from pure white to medium gray seems to reflect silica abundance (darker intervals contain more silica) and is probably related to fluid-bearing fractures with zoned alteration halos. Vesicles are filled with silica and pyrite (dominantly) and less commonly by anhydrite. Pyrite is also associated with the zoned halos and finely disseminated throughout the rock.

VEINS/FRACTURES: Late stage anhydrite-sulfide veins

Core Photo



193-1188A-11R-1 (Section top: 86.9 mbsf)

ROCK NAME: Completely altered, bleached, sparsely vesicular volcanic rock.

UNIT: 9

Pieces: 1-10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	9	83	78.13
Lower contact:	12R	1	3	38	96.98

Thickness (m): 18.85

CONTACTS: None.

PHENOCRYST: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Rarely observed, maximum 1%.

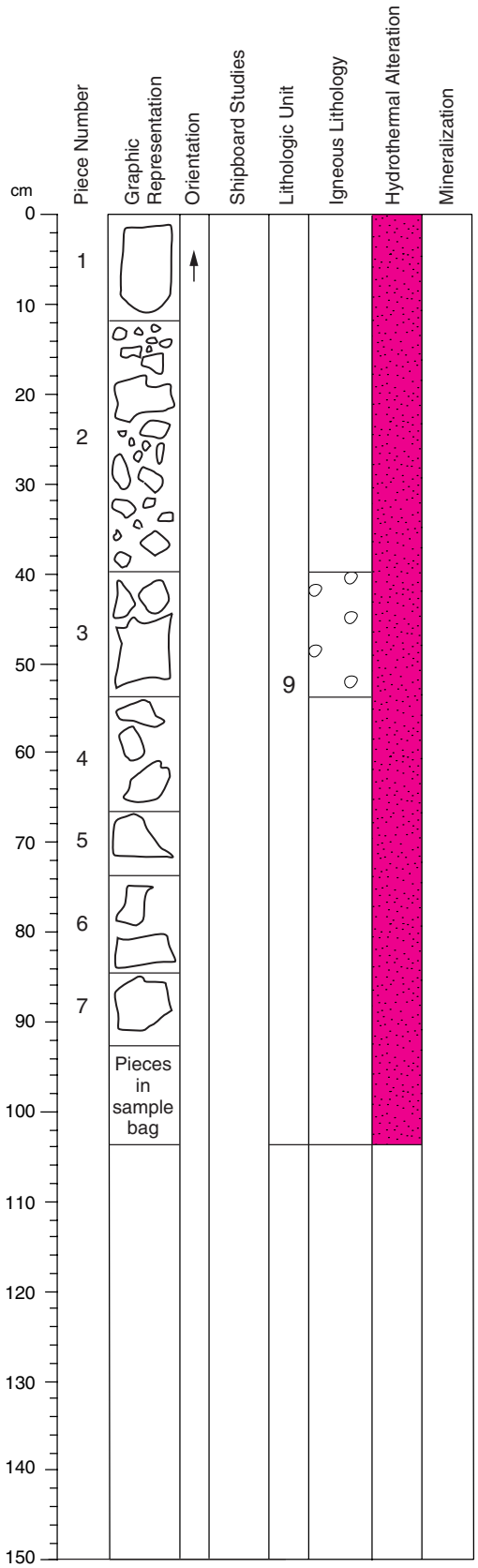
COLOR: White and gray.

STRUCTURE: None.

ALTERATION: Bleached (silica-sulfate altered) unit. Variation in color from pure white to medium gray seems to reflect silica abundance (darker intervals contain more silica) and is probably related to fluid-bearing fractures with zoned alteration halos. Vesicles are filled with silica and pyrite (dominantly), and less commonly by anhydrite. Pyrite is finely disseminated, and is found associated with the zoned halos.

VEINS/FRACTURES: Late stage anhydrite-sulfide veins.

Core Photo



193-1188A-11R-2 (Section top: 88.28 mbsf)

ROCK NAME: Completely altered, bleached, sparsely vesicular volcanic rock.

UNIT: 9

Pieces: 1-7

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	9	83	78.13
Lower contact:	12R	1	3	38	96.98

Thickness (m): 18.85

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None, except 5% in Piece 3.

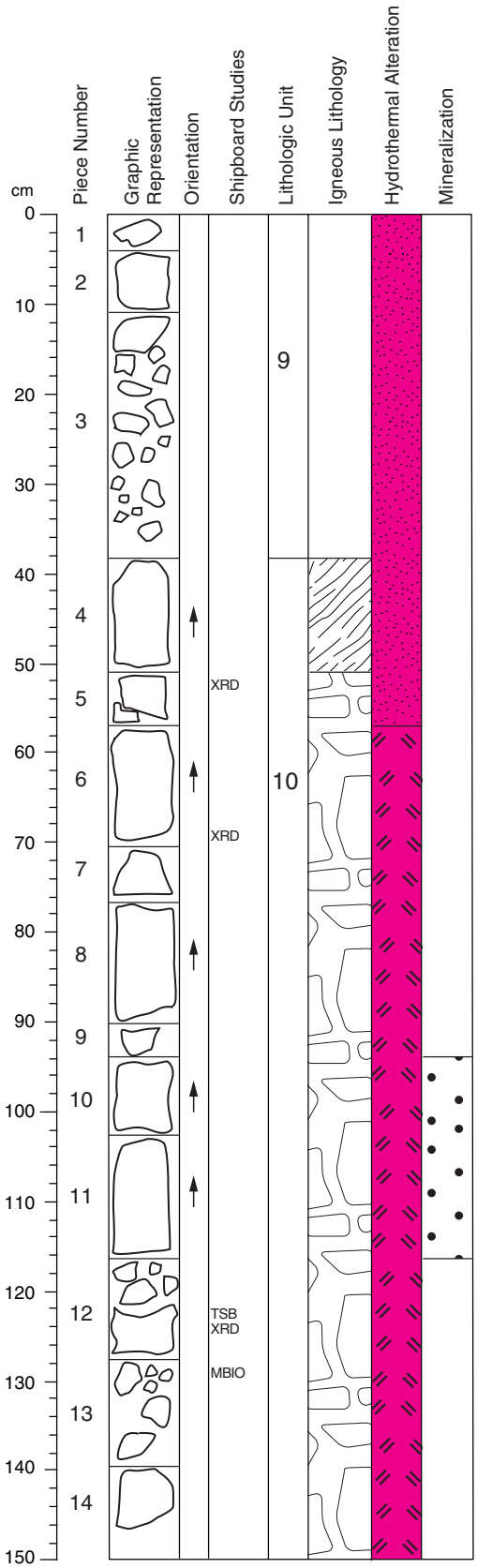
COLOR: White and gray.

STRUCTURE: Relic flow banding in Pieces 5, 6, and 7.

ALTERATION: Bleached (silica-sulfate altered) unit. Variation in color from pure white to medium gray seems to reflect silica abundance (darker intervals contain more) and is probably related to fluid-bearing fractures with zoned alteration halos. Vesicles are filled with silica and pyrite (dominantly) and less commonly by anhydrite. Pyrite is finely disseminated throughout the rock, and is also associated with the zoned halos.

VEINS/FRACTURES: Late stage anhydrite-sulfide veins.

Core Photo



193-1188A-12R-1 (Section top: 96.6 mbsf)

ROCK NAME: Completely altered, bleached, sparsely vesicular volcanic rock.

UNIT: 9
Pieces: 1-3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	9	83	78.13
Lower contact:	12R	1	3	38	96.98

Thickness (m): 18.85

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None apparent.

COLOR: White and gray.

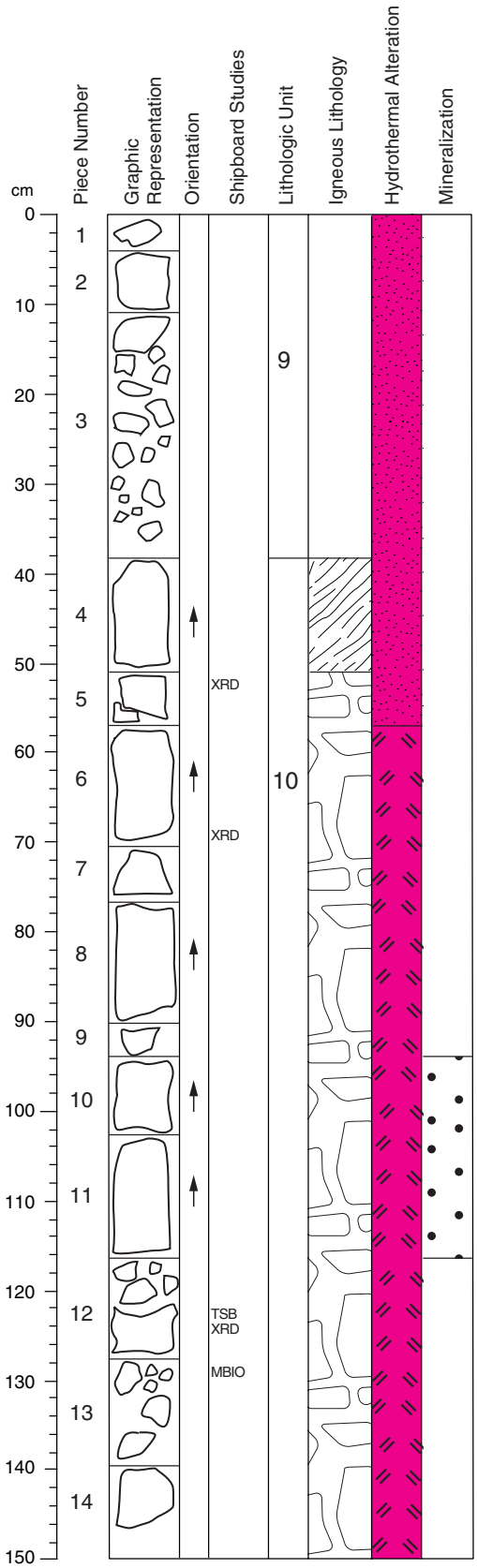
STRUCTURE: None.

ALTERATION: Bleached (silica-sulfate altered) unit. Variation in color from pure white to medium gray seems to reflect silica abundance (darker intervals contain more) and is probably related to fluid-bearing fractures with zoned alteration halos. Vesicles are filled with silica and pyrite (dominantly) and less commonly by anhydrite. Pyrite is disseminated throughout the rock, and is also associated with the zoned halos.

VEINS/FRACTURES: Late stage anhydrite-sulfide veins.

COMMENTS: These three pieces of rock were included in Unit 9 (which continues from Section 1188A-10R-1) based on lithologic similarity, despite the lack of vesicularity. They are strikingly different from the breccia in Unit 10, and are considered to have fallen down the hole between cored intervals.

Core Photo



193-1188A-12R-1 (Section top: 96.6 mbsf)

ROCK NAME: Completely altered, fractured, flow banded volcanic rock.

UNIT: 10
Pieces: 4-14

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	12R	1	4	38	96.98
Lower contact:	12R	2	4B	53	98.61
Thickness (m): 1.63					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None apparent.

COLOR: Dark green - light gray.

STRUCTURE: Brecciated, intermittently perlitic and flow-banded. Relic flowbanding in Pieces 4 and 11.

ALTERATION: Early pervasive gray-green silica-sulfate-chlorite alteration of the volcanic fabric, with later fracturing and pervasive flooding by silica, with associated sulfide (pyrite and a trace of chalcopyrite). Late scattered simple to anastomosing anhydrite veins exhibit bleached and siliceous alteration halos. Clasts appear chlorite rich, matrix appears to be comprised of clay-silica. Chlorite and chalcopyrite evident. Bleached and siliceous alteration halos along anhydrite veins.

VEINS/FRACTURES: Late scattered simple to anastomosing anhydrite veins.

MINERALIZATION: Pieces 10 and 11.

Major minerals

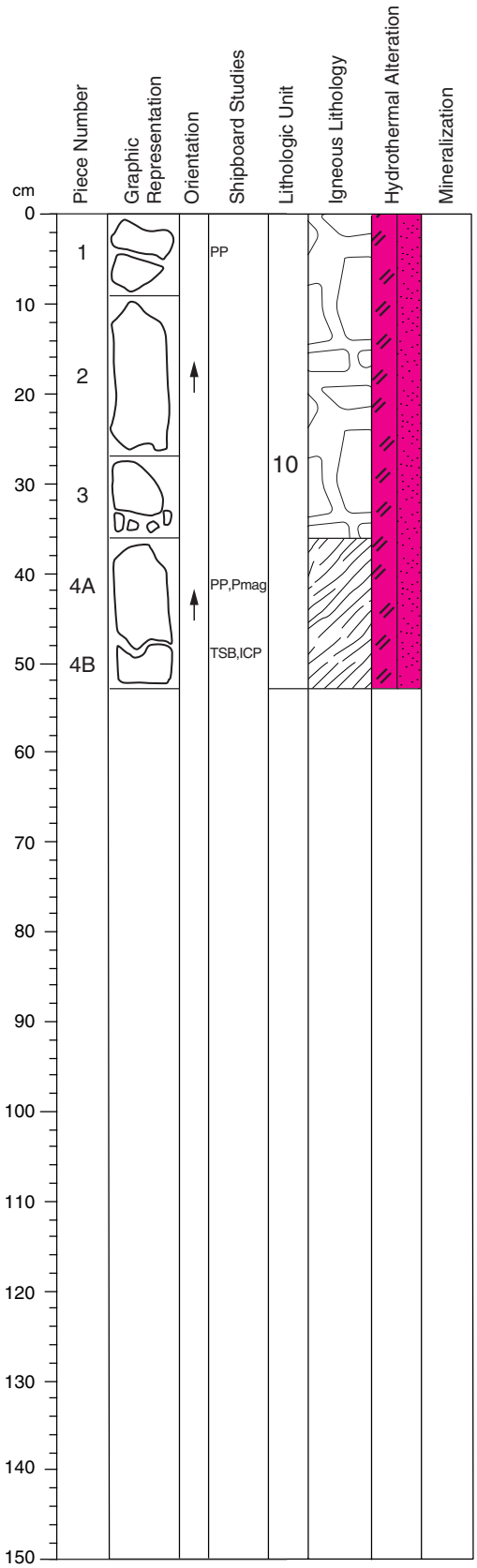
Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	45	Fine-grained	Granular.
Quartz	20	Fine-grained	Granular.
Clay	20	Very fine-grained	Massive.
Pyrite	15	Very fine-grained	Disseminated.

Minor minerals: None.

Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Extremely fine-grained pyrite in a matrix of granular quartz, anhydrite, and clay.

Core Photo



193-1188A-12R-2 (Section top: 98.08 mbsf)

ROCK NAME: Completely altered, fractured, flow banded volcanic rock.

UNIT: 10

Pieces: 1-4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	12R	1	4	38	96.98
Lower contact:	12R	2	4B	53	98.61
Thickness (m): 1.63					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None apparent.

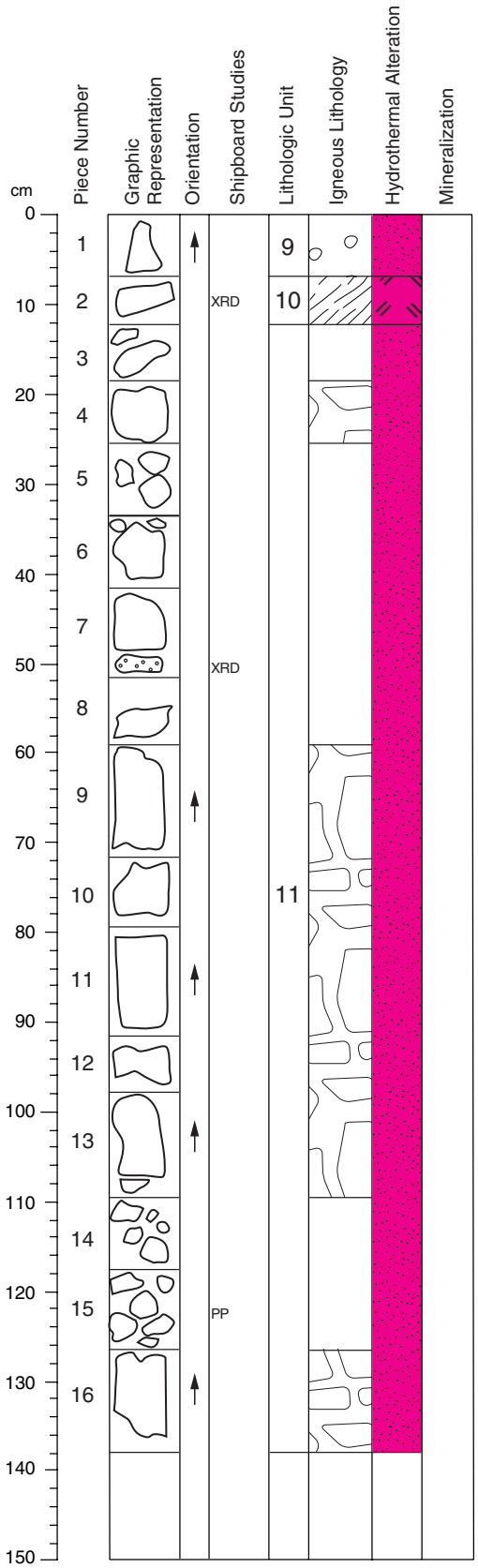
COLOR: Dark green - light gray.

STRUCTURE: Brecciated, intermittently perlitic and flow-banded (in Pieces 2 and 4). In Piece 4, the banding is folded into tight recumbent folds during flow.

ALTERATION: Early pervasive gray-green silica-sulfate-chlorite alteration of the volcanic fabric, with later fracturing and pervasive flooding by silica, with associated sulfide (pyrite and a trace of chalcopyrite). Late scattered simple to anastomosing anhydrite veins exhibit bleached and siliceous alteration halos. Clasts appear chlorite rich, matrix appears to comprise clay-silica. Chlorite and chalcopyrite evident. Bleached and siliceous alteration halos along anhydrite veins.

VEINS/FRACTURES: Late scattered simple to anastomosing anhydrite veins.

Core Photo



193-1188A-13R-1 (Section top: 106.3 mbsf)

ROCK NAME: Completely altered, bleached sparsely vesicular volcanic rock (one piece fallen from above).

UNIT: 9(?).
Piece: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	1	0.0	106.3
Lower contact:	13R	1	2	7.0	106.37

Thickness (m): 0.07

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Remnant filled vesicles.

COLOR: White and gray.

STRUCTURE: None.

ALTERATION: Bleached.

COMMENTS: Probably belongs to Unit 9 (Fallback).

ROCK NAME: Completely altered, fractured, flow banded volcanic rock.

UNIT: 10
Piece: 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	2	7.0	106.37
Lower contact:	13R	1	3	12.0	106.42

Thickness (m): 0.05

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

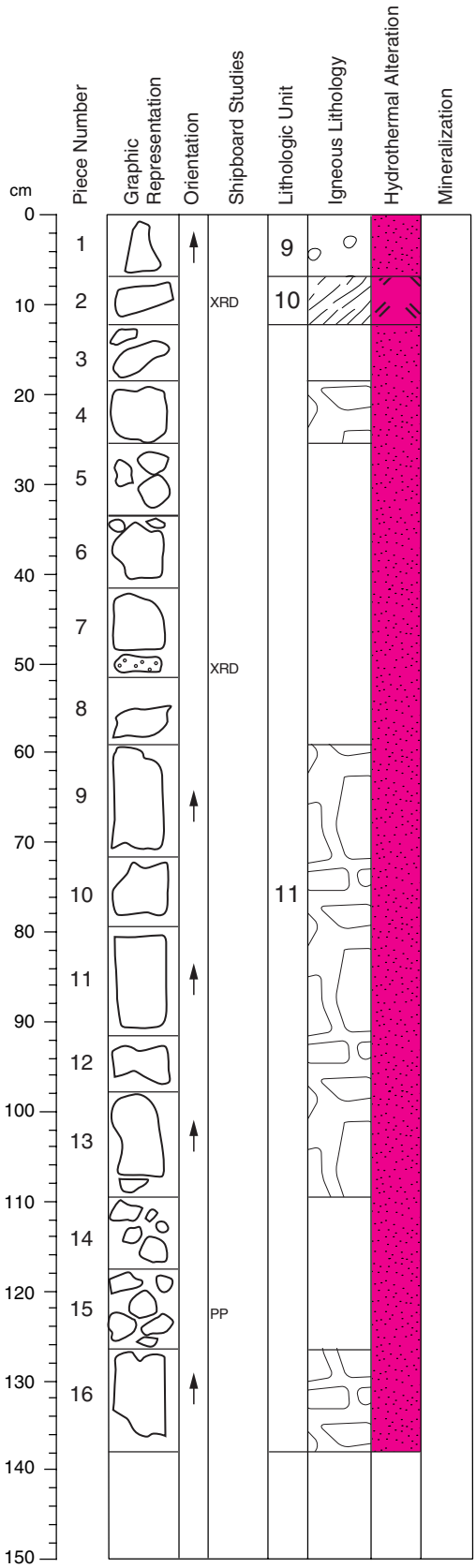
VESICLES: Filled or lined vesicles (anhydrite, barite, chalcopyrite) in dark green, chloritic bands.

COLOR: Dark green - light gray; banded.

STRUCTURE: Brecciated, intermittently perlitic and flow banded.

ALTERATION: Early pervasive gray-green silica-sulfate-chlorite alteration of the volcanic fabric, with later fracturing and pervasive addition of silica, with associated sulfide (pyrite and trace chalcopyrite). Late, scattered, simple to anastomosing anhydrite veins exhibit bleached and siliceous alteration halos. Clasts appear chlorite rich, matrix appears to comprise clay-silica. Chlorite and chalcopyrite evident.

Core Photo



193-1188A-13R-1 (Section top: 106.3 mbsf)

ROCK NAME: Bleached and fractured volcanic rock.

UNIT: 11
Piece: 3-16

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	3	12	106.42
Lower contact:	14R	1	1	2	116.02
Thickness (m): 9.60					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Filled or lined vesicles (anhydrite, barite, chalcopyrite) in dark green, chloritic bands.

COLOR: Gray.

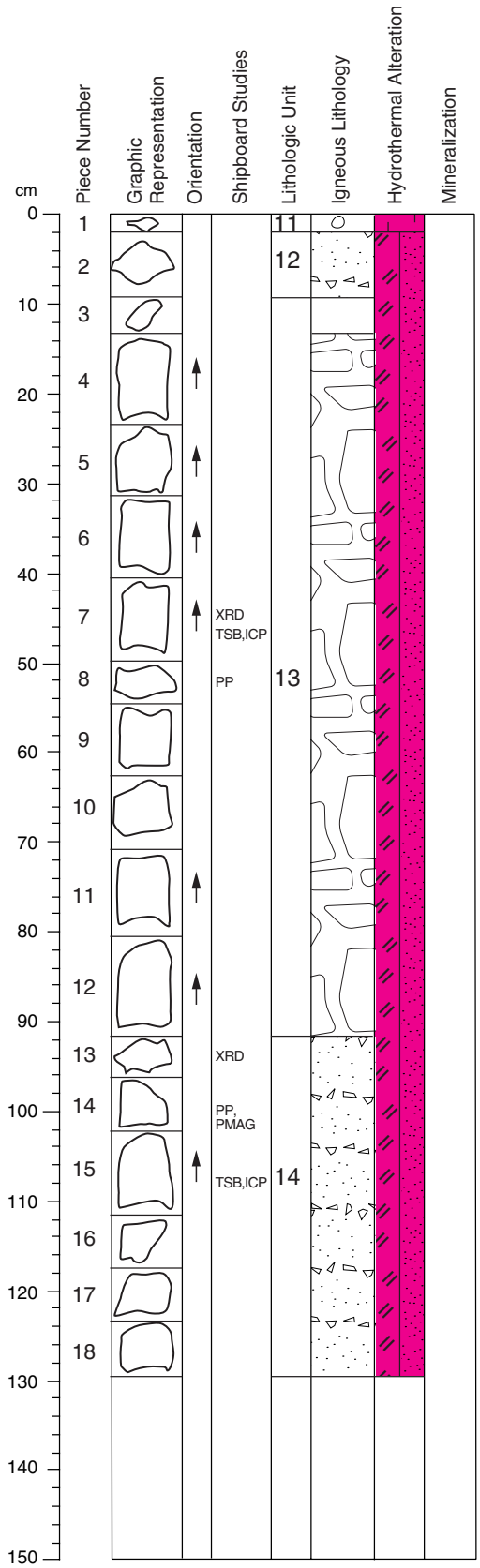
STRUCTURE: Massive and jigsaw breccia.

ALTERATION: Pervasively bleached (silica-sulfate altered) fractured unit. Two different styles of veining are present, both appear to postdate the pervasive bleaching alteration. Irregular, anastomosing vuggy sulfate veins contain up to 5% pyrite. This pyrite appears primarily as open space fill in vugs, and postdates earlier narrow, sharply defined silica-trace pyrite in stockwork veins. Some veins have halos of white clays.

VEINS/FRACTURES: Poorly to strongly developed silica-sulfate stockwork vein system. Late sulfate (anhydrite) veins with scattered pyrite cross-cuts earlier alteration.

COMMENTS: Pyrite also occurs, finely disseminated, in the altered parent rock.

Core Photo



193-1188A-14R-1 (Section top: 116.0 mbsf)

ROCK NAME: Bleached and fractured volcanic rock.

UNIT: 11
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	3	12	106.42
Lower contact:	14R	1	1	2	116.02

Thickness (m): 9.60

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Rarely preserved (3%, 1-2 mm spherical).

COLOR: Gray.

STRUCTURE: Massive and jigsaw breccia.

ALTERATION: Pervasively bleached (silica-sulfate altered) fractured unit. Two different styles of veining are present, both appear to postdate the pervasive bleaching alteration. Irregular, anastomosing vuggy sulfate veins contain up to 5% pyrite. This pyrite appears primarily as open space fill in vugs, and postdates earlier narrow, sharply defined silica-trace pyrite in stockwork veins. Some veins have halos of white clays.

VEINS/FRACTURES: Poorly to strongly developed silica-sulfate stockwork vein system. Late sulfate (anhydrite) veins with scattered pyrite cross-cuts earlier alteration.

COMMENTS: Pyrite also occurs, finely disseminated, in the altered parent rock.

ROCK NAME: Completely altered volcaniclastic, granule to pebble breccia.

UNIT: 12
Pieces: 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	1	2	2	116.02
Lower contact:	14R	1	2	9	116.09

Thickness (m): 0.07

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: White and yellow clasts; sulfate-clay (very soft).

VESICLES: None.

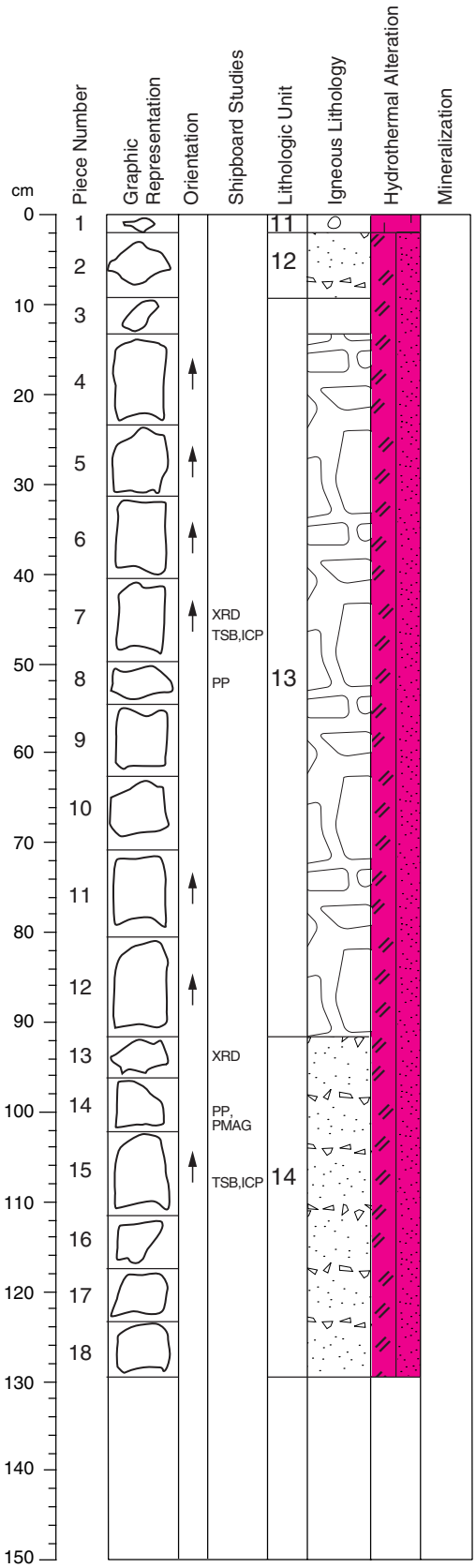
COLOR: Gray, yellow, and white.

STRUCTURE: Volcaniclastic, granule to pebble breccia. Clasts: 2 mm to 10 mm (white and yellow), matrix: gray brown (clay-silica).

ALTERATION: Strongly bleached, sulfate-rich altered volcanic clasts are cemented in silica. Some clasts contain silica. Trace disseminated pyrite occur in the silica.

VEINS/FRACTURES: None.

Core Photo



193-1188A-14R-1 (Section top: 116.0 mbsf)

ROCK NAME: Bleached and fractured volcanic rock

UNIT: 13
Pieces: 3-12

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	1	3	9	116.09
Lower contact:	14R	1	12	92	116.92

Thickness (m): 0.83

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Gray/white to white/gray.

STRUCTURE: Fractured volcanic rock. Possible remnant flow banding (in Piece 10), vesicles, and perlite (in Piece 4). Clasts: 5 mm to 20 mm maximum width, white clasts: 2 mm to 20 mm. Matrix: gray-brown ?clay silica.

ALTERATION: Pervasively bleached (sulfate-clay altered) fractured rocks. Very distinct narrow silica halos along anhydrite veins. Pyrite occurs disseminated in the altered body of the rock and in veins.

VEINS/FRACTURES: Well developed hydrofracturing hosts a stockwork of sharply defined silica-trace pyrite veins, some of which appear to predate anhydrite veins, while others seem to be synchronous.

COMMENTS: Rocks are similar to Unit 11.

ROCK NAME: Completely altered, volcaniclastic pebble breccia.

UNIT: 14
Pieces:13-18

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	1	13	92	116.92
Lower contact:	14R	1	18	130	117.30

Thickness (m): 0.38

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Gray clasts; silica-clay, white clasts sphalerite-clay?

VESICLES: 5%, <1 mm , spherical in gray clasts.

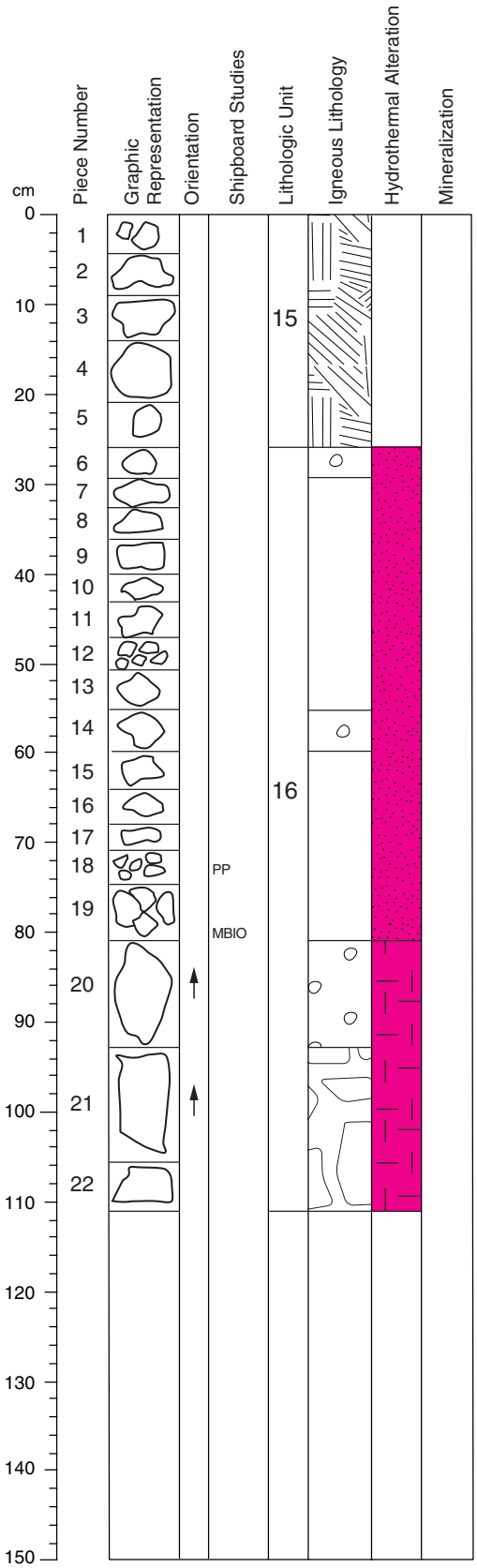
COLOR: Gray, yellow, and white.

STRUCTURE: Volcaniclastic, granule to pebble breccia. Clasts: 2 mm to 10 mm (white and yellow), matrix: gray brown (clay-silica).

ALTERATION: Strongly bleached, sulfate-rich altered volcanic clasts are cemented in silica. Trace pyrite occurs disseminated in the silica.

VEINS/FRACTURES: None.

Core Photo



193-1188A-15R-1 (Section top: 125.7 mbsf)

ROCK NAME: Crustiform anhydrite-pyrite vein.

UNIT: 15

Pieces: 1-5

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15R	1	1	0	125.70
Lower contact:	15R	1	5	26	125.94

Thickness (m): 0.24

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: None

VESICLES: None.

COLOR: White.

STRUCTURE: None.

ALTERATION: Bleached volcanic fragments attached to vein margin.

COMMENTS: Up to 3% sulfide (mostly pyrite).

MINERALIZATION: Pieces 1 and 5.

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	>97		Granular

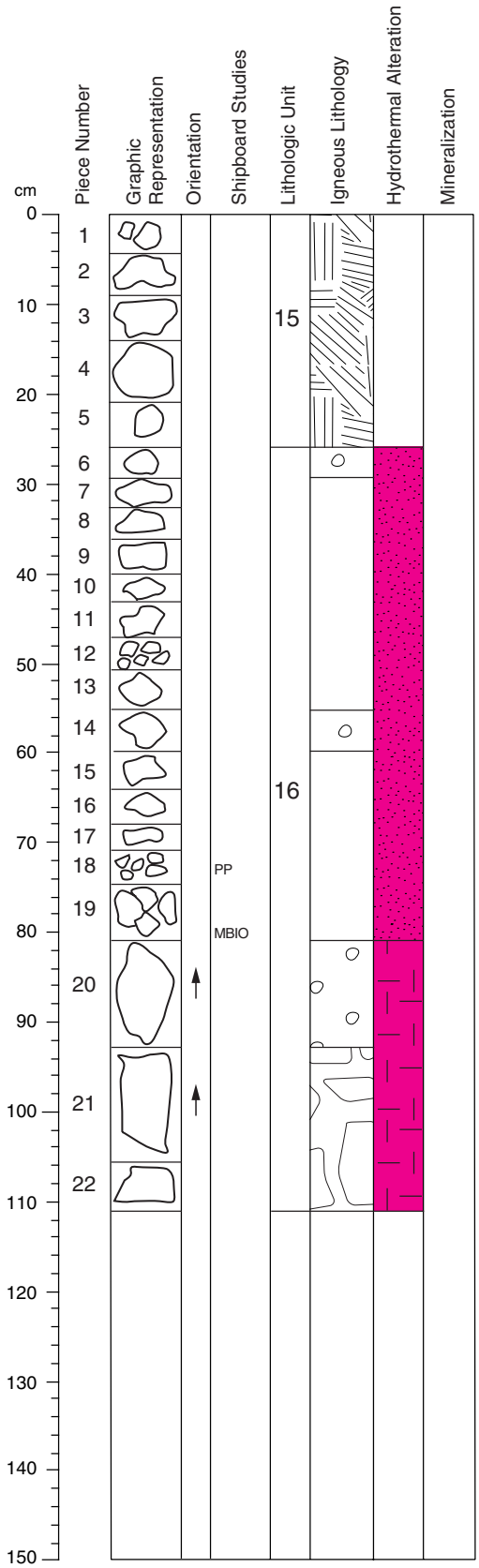
Minor minerals

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	<3		Druse and aggregates with sugary texture.

Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Massive, coarse-grained, interlocking anhydrite.

Core Photo



193-1188A-15R-1 (Section top: 125.7 mbsf)

ROCK NAME: Bleached and silicified sparsely vesicular volcanic rock.

UNIT: 16

Pieces: 6-22

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15R	1	6	26	125.94
Lower contact:	15R	1	22	111	126.81

Thickness (m): 0.87

CONTACTS: None.

PHENOCRYSTS: Aphyric

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely vesicular.

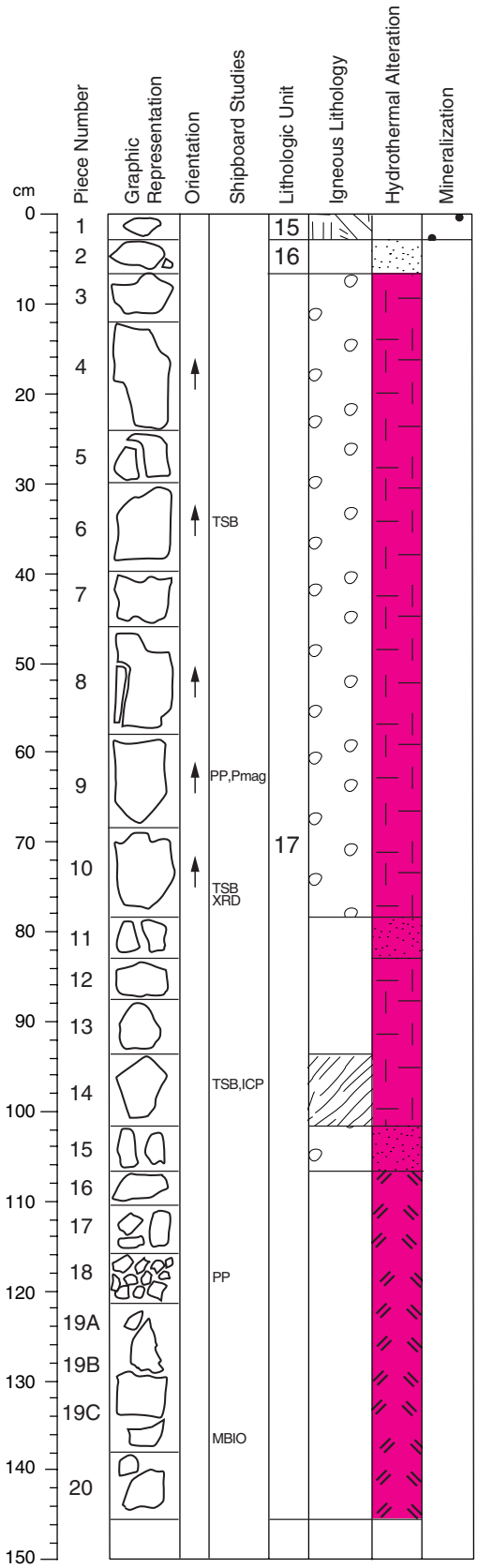
COLOR: White-gray to gray-white.

STRUCTURE: None.

ALTERATION: Overall, strongly silicified unit. Dominant alteration minerals/types are: Pieces 6- through 10 - sulfate, chlorite, pyrite; Piece 11-- sulfate; Pieces 12 through 20 - siliceous/chlorite alteration; and Pieces 21-22- silicic rocks and sulfate. Pyrite occurs throughout the rock as fine-grained vesicle fill, intergrown with anhydrite and/or quartz. Apparent extremely fine-grained disseminated pyrite is probably material filling microscopic vesicles.

VEINS/FRACTURES: Scattered sulfate veining and fine sulfide veinlets. Pieces 21 and 22 are cut by <<1 mm wide pyrite veinlets with 1 mm anhydrite selvages, surrounded by well defined 2-5 mm silica alteration halos.

Core Photo



193-1188A-16R-1 (Section top: 135.4 mbsf)

ROCK NAME: Two pieces out of place.

UNIT: 15
Pieces: 1-Fallback

UNIT: 16
Pieces: 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15R	1	6	26	125.94
Lower contact:	15R	1	22	111	126.81

Thickness (m): 9.50

CONTACTS: None.

PHENOCRYSTS: None.

STRUCTURE: None.

ALTERATION:

VEINS/FRACTURES:

COMMENTS: Piece 1 is anhydrite-pyrite vein material dislodged from Unit 15. Piece 2 is a bleached, altered rock dislodged from Unit 16.

MINERALIZATION:

COLOR: White and yellow

Major minerals

Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	85	Coarse-grained	Open spaces fill.
Pyrite	15	Very fine-grained	Open spaces fill.

Minor minerals: None.

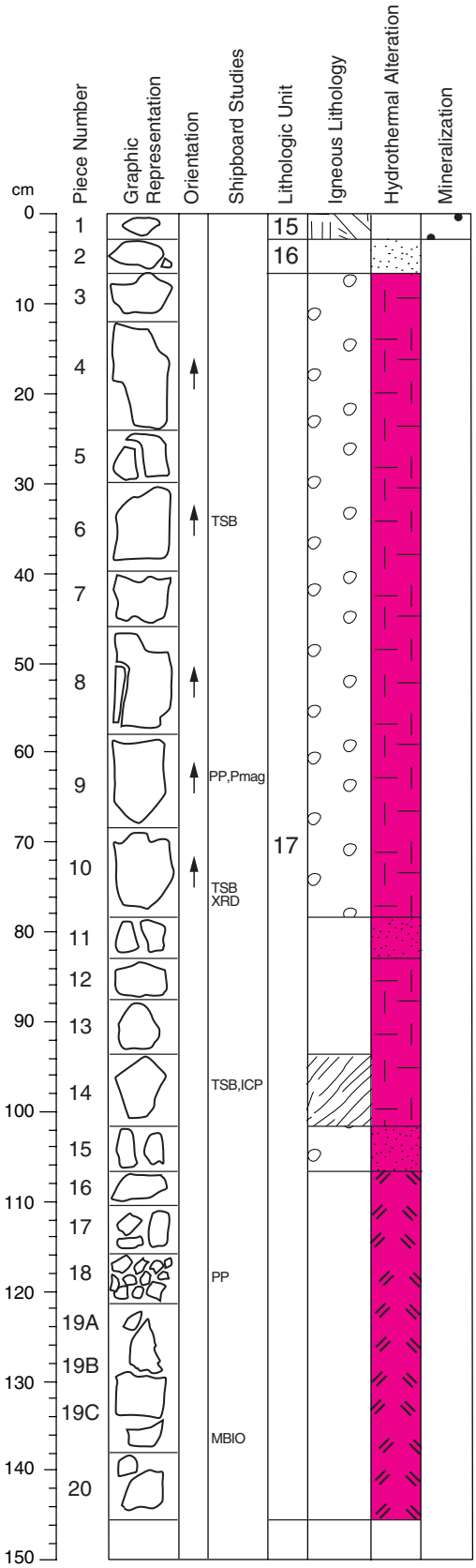
Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Unit 16 Replacement of original volcanic rock by anhydrite and clay minerals; network veins of pyrite.

STRUCTURES/VEINS/FRACTURES:

Size	Anhydrite > 2 mm, pyrite < 0.5 mm
Orientation	None
Minerals	Anhydrite and pyrite

Core Photo



193-1188A-16R-1 (Section top: 135.4 mbsf)

ROCK NAME: Completely silicified, sparsely vesicular volcanic rock

UNIT: 17
Pieces: 3-20

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	1	3	6	135.46
Lower contact:	16R	2	1	5	136.91

Thickness (m): 1.45

CONTACTS: None

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely vesicular, 3% round to elongate, length 1 mm, height 1-7 mm.

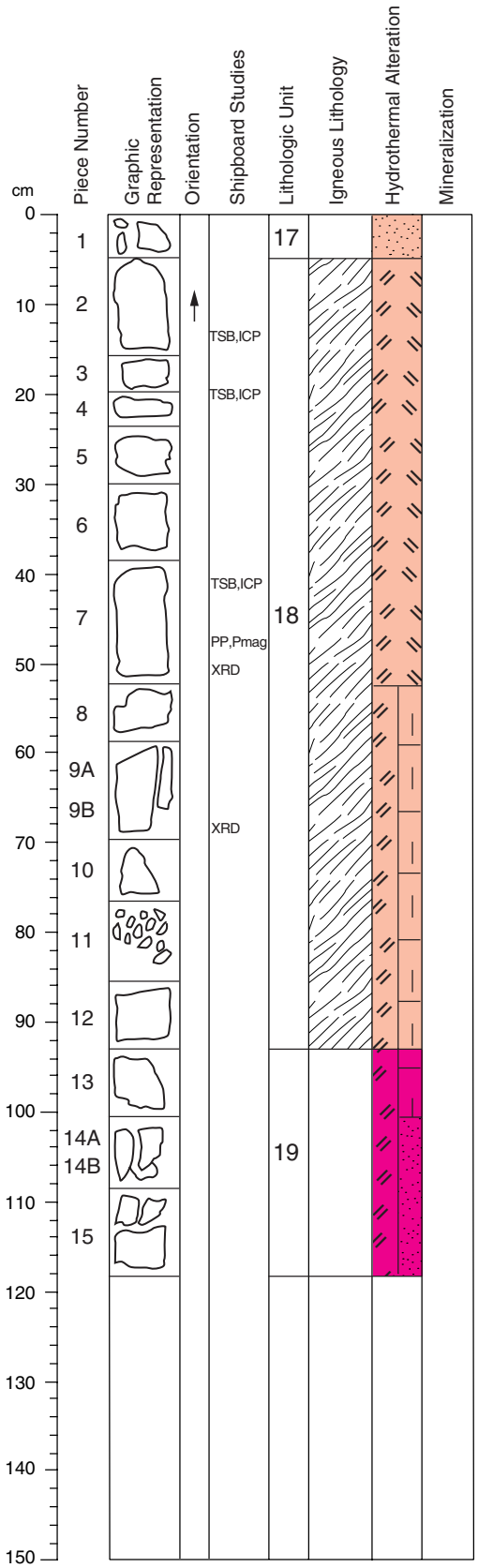
COLOR: Light gray, light green-gray.

STRUCTURE: Flow banding in Pieces 7, 10 and 14. Folded and disrupted in Piece 10 and Piece 14.

ALTERATION: Very strongly silicified rock. The unit comprises hard, pervasively silicified vesicular volcanic rock which is cut by <<1 mm wide pyrite veinlets with 1 mm anhydrite selvages, surrounded by well defined 2-5 mm silica alteration halos. Pyrite occurs throughout the rock as fine-grained vesicle fill, intergrown with anhydrite and/or quartz. Extremely fine-grained disseminated pyrite is probably material filling microscopic vesicles.

VEINS/FRACTURES: Rare medium-grained anhydrite veins are developed locally. Abundant pyrite veinlets. Sub mm to mm veins of quartz and very fine-grained pyrite. Sometimes with diffuse gray alteration halos. (Clay(?) minerals).

Core Photo



193-1188A-16R-2 (Section top:136.86 mbsf)

ROCK NAME: Highly silicified, sparsely vesicular dacite(?), with greenish alteration and irregular silica-anhydrite veining.

UNIT: 17
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	1	3	6	135.46
Lower contact:	16R	2	1	5	136.91

Thickness (m): 1.45

CONTACTS: None.

PHENOCRYSTS: None

GROUNDMASS: Completely altered.

VESICLES: None.

COLOR: Light gray, light green-gray.

STRUCTURE: Massive.

ALTERATION: Highly silicified rock with greenish alteration and irregular silica-anhydrite veining.

Comments: ?Filled vesicles.

ROCK NAME: Highly silicified, sparsely vesicular dacite(?), with greenish alteration and irregular silica-anhydrite veining.

UNIT: 18
Pieces: 2-12

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	2	2	5	136.91
Lower contact:	16R	2	12	94	137.80

Thickness (m): 0.89

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Dark gray-green.

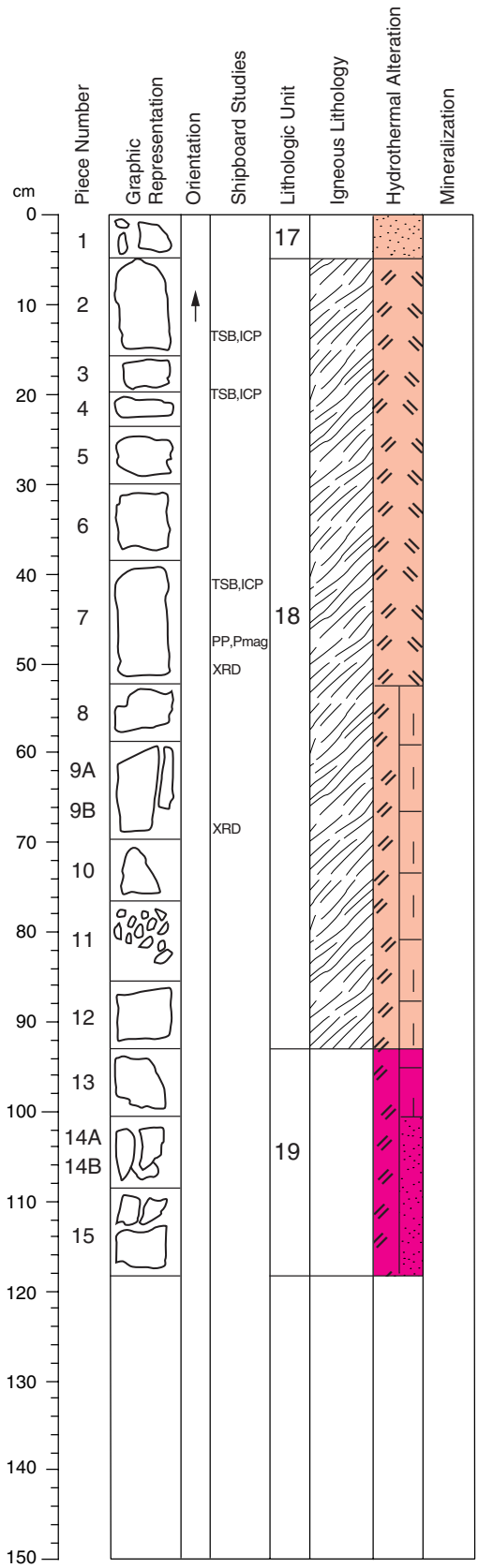
STRUCTURE: Planar and convolute laminations.

ALTERATION: Gray-green alteration, dominantly silicification, with minor chlorite. Trace very fine grained disseminated pyrite throughout rock.

VEINS/FRACTURES: Minor vuggy silica. Silica and sulfate veins.

COMMENTS: Occasional occurrences of volcanic clasts (Piece 8). Folded lamination (flow banding) in Piece 12.

Core Photo



193-1188A-16R-2 (Section top:136.86 mbsf)

ROCK NAME: Highly silicified, sparsely vesicular dacite(?), with greenish alteration and irregular silica-anhydrite veining.

UNIT: 19
Pieces: 13-15

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	2	13	94	137.80
Lower contact:	18R	1	17	71	155.41

Thickness (m): 17.61

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Rare

COLOR: Light gray, light green, white.

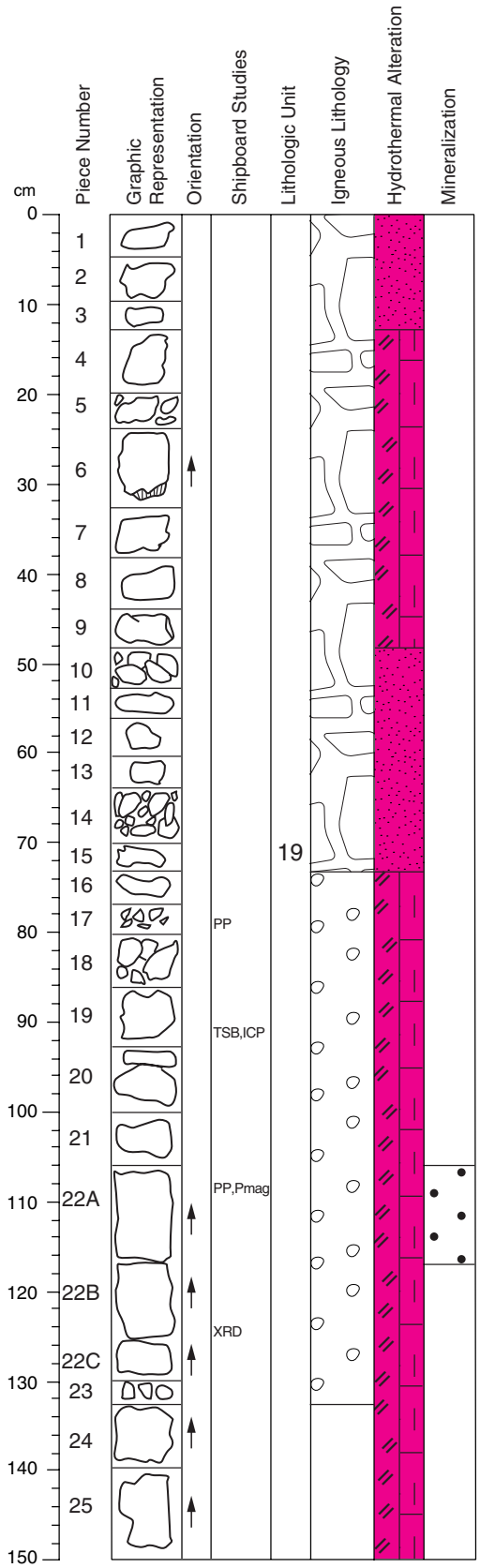
STRUCTURE: Silicified, bleached volcanic rock. Bleached, siliceous alteration halos along veins.

ALTERATION: Gray-green alteration, dominantly silicification, with minor chlorite. Trace very fine-grained disseminated pyrite throughout rock.

VEINS/FRACTURES: Fine silica-trace pyrite veinlets and more abundant irregular, anastomosing to simple anhydrite with minor magnetite ± trace pyrite veins which have distinct bleached, siliceous alteration halos. There is evidence to suggest the silica veinlets and the anhydrite-magnetite veins are coeval.

COMMENTS: No primary volcanic texture preserved except for rare ?perlite (Piece 7).

Core Photo



193-1188A-17R-1 (Section top: 145.1 mbsf)

ROCK NAME: Silicified, bleached, sparsely vesicular volcanic rock.

UNIT: 19
Pieces: 1 to 25

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	2	13	94	137.80
Lower contact:	18R	1	17	71	155.41

Thickness (m): 17.61

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Rare.

COLOR: Light gray, light green, white.

ALTERATION: Silicified, bleached volcanic rock. Bleached, siliceous alteration halos along veins.

VEINS/FRACTURES: Fine silica-trace pyrite veinlets and more abundant irregular, anastomosing to simple anhydrite-minor magnetite-trace pyrite veins which have distinct bleached to siliceous alteration halos.

COMMENTS: No primary volcanic texture preserved except for rare ?perlite (Piece 7). There is evidence to suggest the silica veinlets and the anhydrite-magnetite veins are coeval.

MINERALIZATION: Piece 22A

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Clay	60	Very fine-grained	
Magnetite	15	Very fine-grained	Magnetite spheres < 1 mm
Anhydrite	10	Very fine-grained	Anhydrite/pyrite veins
Silica	10	Very fine-grained	

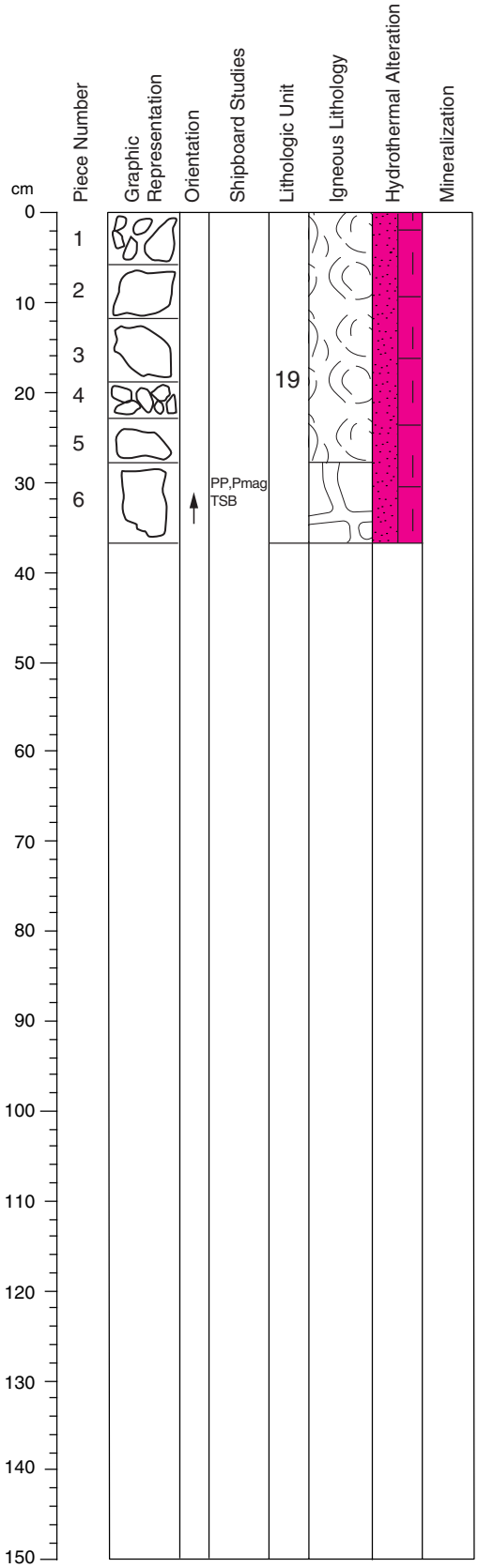
Minor minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	5	Very fine-grained	

Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Disseminated magnetite and pyrite veinlets with distinct alteration halos cutting a matrix of clay, silica, and anhydrite; some aggregates of magnetite have a spherical shape.

Core Photo



193-1188A-17R-2 (Section top: 146.6 mbsf)

ROCK NAME: Silicified, bleached, sparsely vesicular volcanic rock.

UNIT: 19
Pieces: 1 to 6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	2	13	94	137.80
Lower contact:	18R	1	17	71	155.41

Thickness (m): 17.61

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Trace to 2%-3% up to 2 mm across.

COLOR: White.

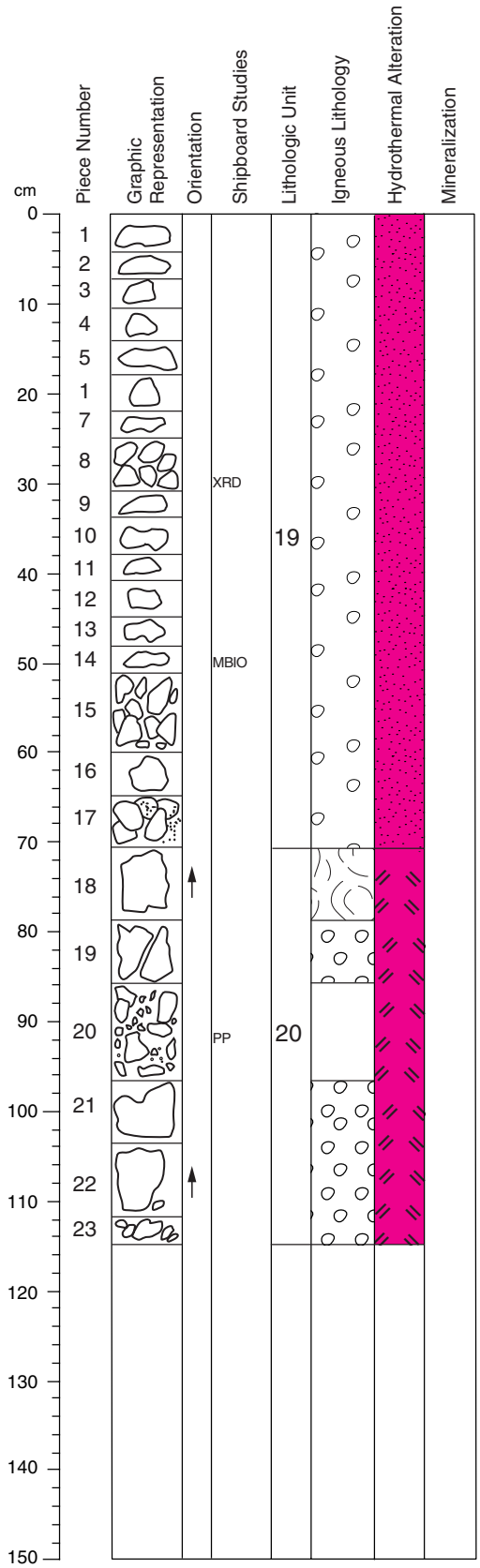
STRUCTURE: Generally massive texture with traces of remnant perlitic and vesicular texture.

ALTERATION: Silicified, bleached volcanic rock and as halos along veins.

VEINS/FRACTURES Fine silica-trace pyrite veinlets and more abundant irregular, anastomosing to simple anhydrite minor magnetite-trace pyrite veins which have distinct bleached to siliceous alteration halos.

COMMENTS:

Core Photo



193-1188A-18R-1 (Section top: 154.7 mbsf)

ROCK NAME: Silicified, bleached, sparsely vesicular, volcanic rock.

UNIT: 19
Pieces: 1 to 17

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	2	13	94	137.80
Lower contact:	18R	1	17	71	155.41

Thickness (m): 17.61

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Relic vesicles to 2%-3% up to 2 mm across.

COLOR: White.

STRUCTURE: Massive texture.

ALTERATION: Silicified, bleached volcanic rock with alteration halos along veins.

VEINS/FRACTURES: Fine silica-trace pyrite veinlets and more abundant irregular, anastomosing to simple anhydrite-minor magnetite-trace pyrite veins which have distinct bleached to siliceous alteration halos.

COMMENTS:

ROCK NAME: Completely silicified, bleached, moderately vesicular volcanic rock.

UNIT: 20
Pieces: 18 to 23

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	18R	1	18	71	155.41
Lower contact:	19R	1	4	22	164.52

Thickness (m): 9.11

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Ovoid vesicles 5% to 10%, up to 2 mm across.

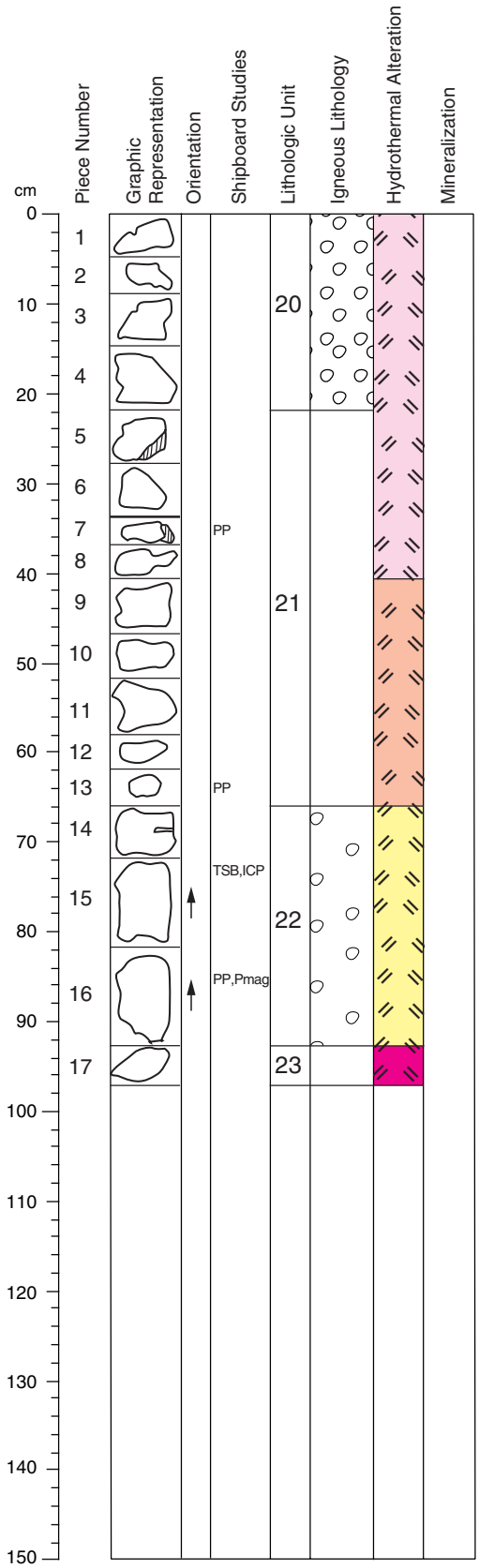
COLOR: Dark gray, dark green.

STRUCTURE: Massive with some remnant perlitic texture.

ALTERATION: Silicified unit, with similar alteration to overlying material. Fine- to very coarse-grained anhydrite vesicle and vug fill (± trace pyrite).

VEINS/FRACTURES: None.

Core Photo



193-1188A-19R-1 (Section top: 164.3)

ROCK NAME: Silicified, bleached, moderately vesicular, volcanic rock.

UNIT: 20

Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	18R	1	18	71	155.41
Lower contact:	19R	1	4	22	164.52

Thickness (m): 9.11

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Ovoid vesicles 5% to 10%, up to 2 mm across, generally unfilled.

COLOR: Dark gray, dark green.

STRUCTURE: Massive with some remnant perlitic texture.

ALTERATION: Silicified unit, with similar alteration to overlying material. Fine to very coarse-grained anhydrite vesicle and vug fill (± trace pyrite).

VEINS/FRACTURES: A hairline fracture in Section 1188A-19R-1, Piece 4 contains very fine-grained pyrite and displays a 1 cm wide siliceous alteration halo.

COMMENTS: Patchy chlorite alteration to pseudoclastic texture (Piece 4).

ROCK NAME: Silicified volcanic rock.

UNIT: 21

Pieces: 5 to 13

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	19R	1	5	22	164.52
Lower contact:	19R	1	13	66	164.96

Thickness (m): 0.44

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None.

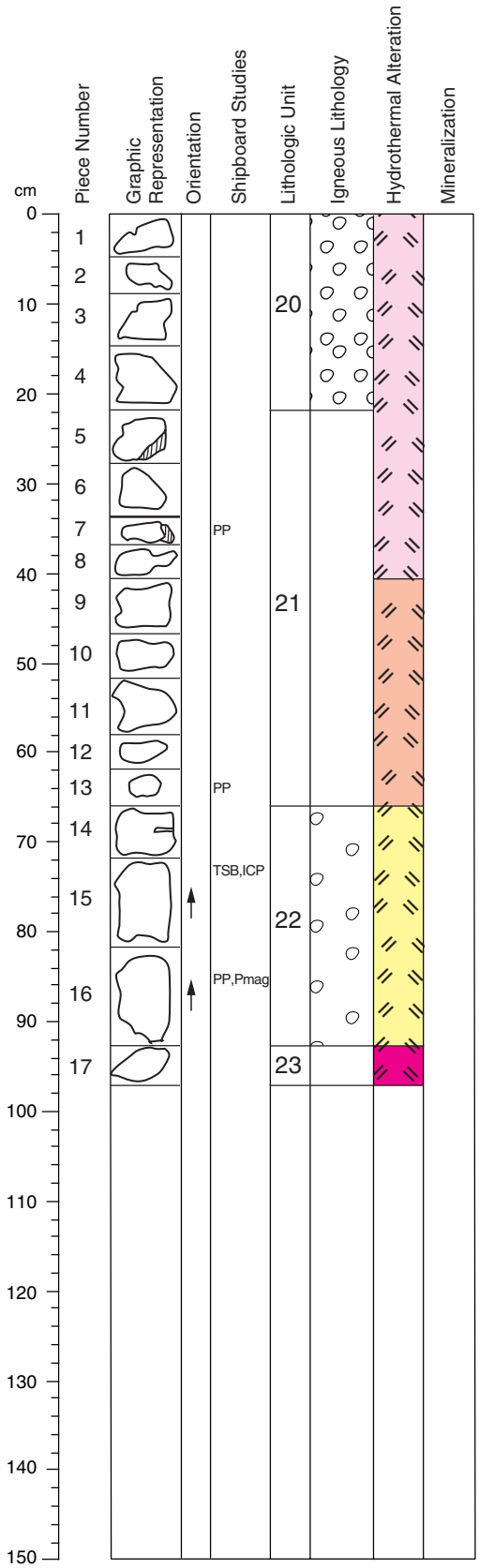
COLOR: Light gray.

STRUCTURE: Massive. Some pieces exhibiting remnant microperlitic texture.

ALTERATION: Silicified, bleached volcanic rock with rare vesicles, which are silica filled. Piece 9 exhibits green clay (chlorite) alteration. Very little pyrite throughout.

VEINS/FRACTURES: Various pyrite-magnetite-silica ± anhydrite filled veinlets.

Core Photo



193-1188A-19R-1 (Section top: 164.3 mbsf)

ROCK NAME: Moderately altered, moderately vesicular dacite(?).

UNIT: 22
Pieces: 14 to 16

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	19R	1	14	66	164.96
Lower contact:	19R	1	16	93	165.23

Thickness (m): 0.27

CONTACTS: None.

PHENOCRYSTS: % Grain Size (mm):

Mineral	Mode	Max	Min	Avg.	Shape/Habit
Plagioclase	Rare	<1 mm			

GROUNDMASS: Microlitic.

VESICLES: 5%; generally round to lensoidal, mostly <1 mm, some up to 10 mm long.

COLOR: Dark gray.

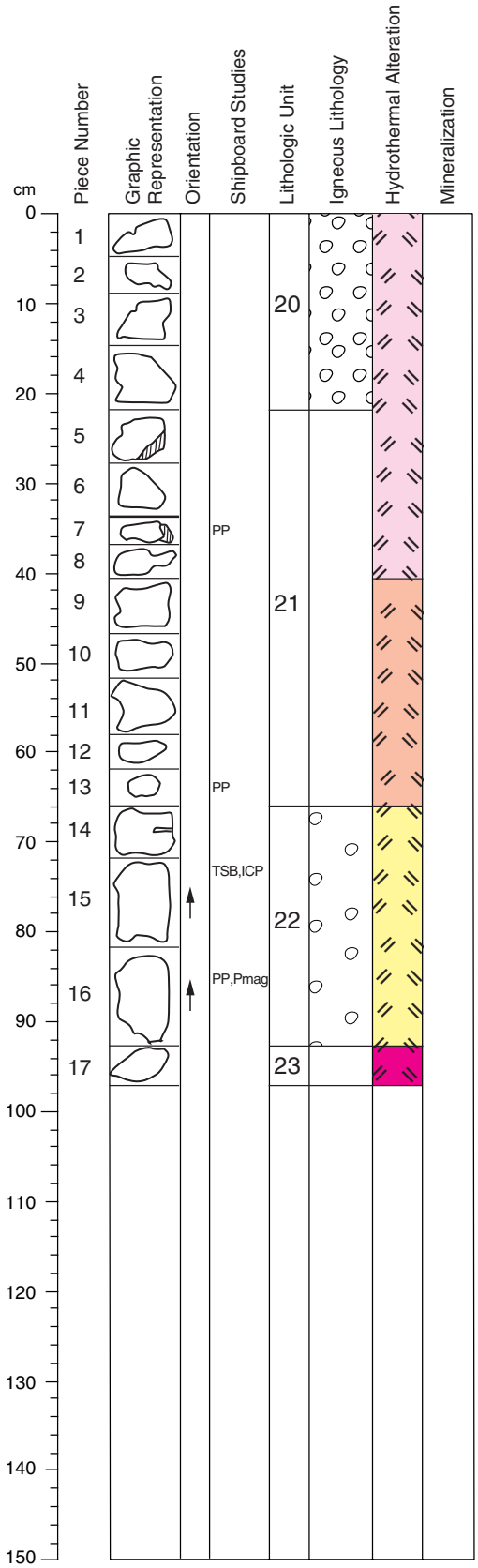
STRUCTURE: Massive. Some elongation and alignment of vesicles at top of unit may represent a flow structure.

ALTERATION: Slightly bleached selvages along silica-anhydrite veins. Microvesicles are silica and anhydrite filled. Traces of very fine grained disseminated pyrite, also in vesicles.

VEINS/FRACTURES: Rare silica-anhydrite veins.

COMMENTS: Thin section observation: The groundmass contains about 30 modal% euhedral plagioclase microlites and rare clinopyroxene microcrysts. By comparison with fresh aphyric rhyodacite in the upper part of the core (unit 3) we can infer that this unit is also of felsic composition (dacite?).

Core Photo



193-1188A-19R-1 (Section top: 164.3 mbsf)

ROCK NAME: Completely altered, silicified, weakly to moderately chloritic, magnetite-bearing volcanic rock.

UNIT: 23
Pieces: 17

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	19R	1	17	93	165.23
Lower contact:	20R	1	11	91	173.81

Thickness (m): 9.58

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Fine-grained.

VESICLES: None.

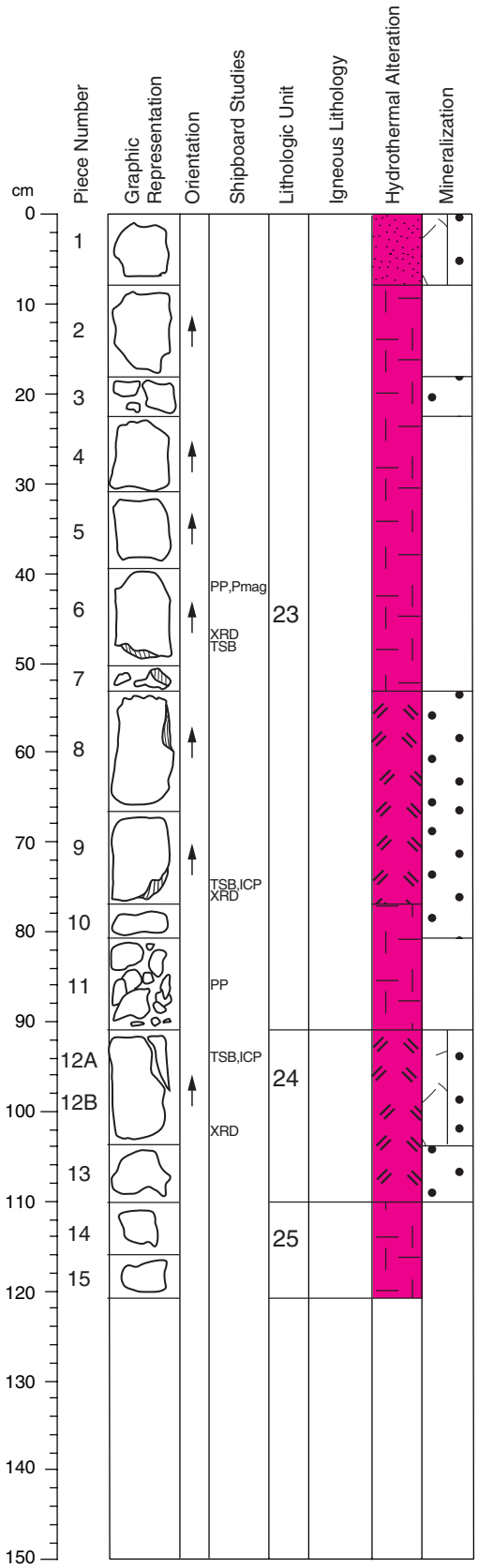
COLOR: Gray, green.

STRUCTURE: Massive.

ALTERATION: Pervasively silicified unit with green chloritic clay-rich patches. Pyrite and magnetite are disseminated throughout, but pyrite tends to be more abundant in chloritic sections of the unit.

VEINS/FRACTURES: Very fine, slightly vuggy anastomosing silica-anhydrite+/-pyrite veining is faintly visible and appears to have been overprinted by the pervasive silicification event. This event also appears to be related to the ~5% very fine-grained magnetite which is disseminated throughout the unit. Rare, poorly defined silica-anhydrite-pyrite veins are also overprinted by the pervasive silicification. veinlets.

Core Photo



193-1188A-20R-1 (Section top: 173.9 mbsf)

ROCK NAME: Completely altered, silicified, weakly to moderately chloritic, magnetite-bearing ?volcanic rock.

UNIT: 23
Pieces: 1 to 11

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	19R	1	17	93	165.23
Lower contact:	20R	1	11	91	173.81

Thickness (m): 9.58

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Fine-grained.

VESICLES: None.

COLOR: Dark gray, dark green.

STRUCTURE: Massive, pseudoclastic to stockwork.

ALTERATION: Pervasively silicified unit with green chloritic clay-rich patches. Pyrite and magnetite are disseminated throughout, but pyrite tends to be more abundant in chloritic sections of the unit.

VEINS/FRACTURES: Very fine, slightly vuggy anastomosing silica-anhydrite ± pyrite veining is faintly visible and appears to have been overprinted by the pervasive silicification event. This event appears to be related to the ~5% very fine-grained magnetite which is disseminated throughout the unit. Rare poorly defined silica-anhydrite-pyrite veins are also overprinted by the pervasive silicification.

COMMENTS: No primary volcanic texture. Faint pseudoclastic texture: chlorite-rich apparent clasts; magnetite bearing apparent matrix. Piece 1 is similar to Unit 19 and possibly fell into the hole.

MINERALIZATION: Pieces 1, 3, 8, 9, and 10

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Clay	65-75	Very fine-grained	Includes chlorite (?)
Anhydrite	10-45	Very fine-grained	

Minor minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	5-10	Very fine-grained	Disseminated subhedral to euhedral, some with face striations, veinlet network.
Silica	5	Very fine-grained	Piece 19 contains 10%.

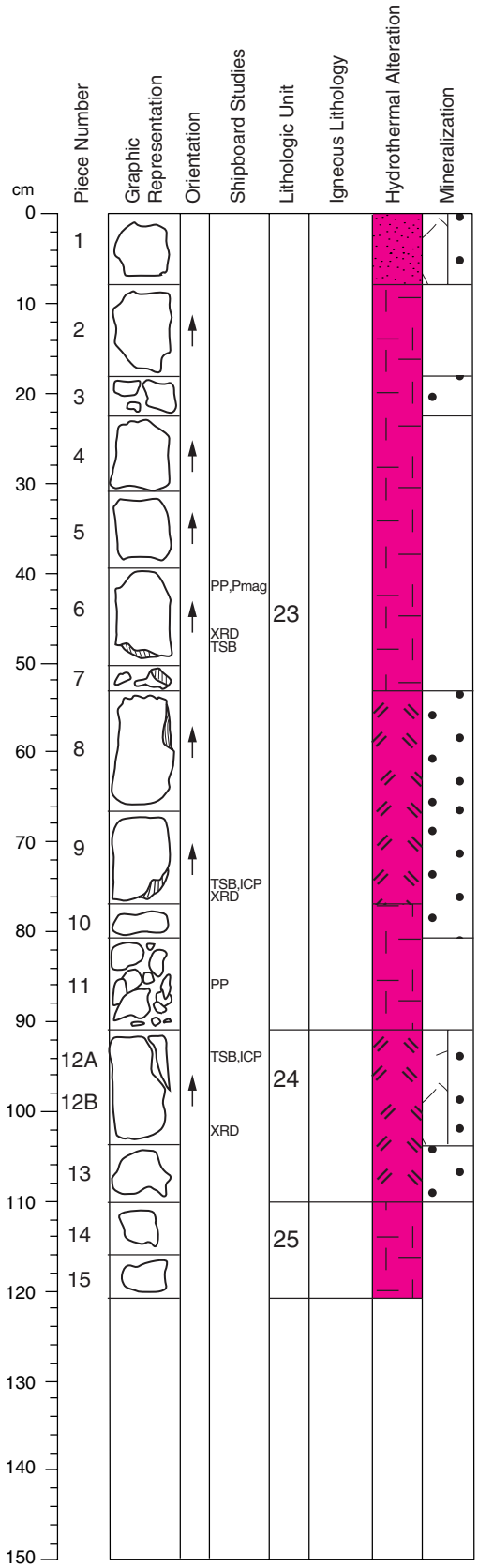
Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Very fine-grained, minor, disseminated pyrite in veinlets cutting a matrix of anhydrite, silica, and clay.

STRUCTURES/VEINS/FRACTURES:

Size	Veins < 0.5 mm.
Orientation	Veins - network

Core Photo



193-1188A-20R-1 (Section top: 173.9 mbsf)

ROCK NAME: Dark green, silicified rock with ovoid sulfate patches.

UNIT: 24
Pieces: 12 to 13

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	20R	1	12A	91	173.81
Lower contact:	20R	1	13	110	175.00

Thickness (m): 0.19

CONTACTS: None.

PHENOCRYSTS: None

GROUNDMASS: Fine- to coarse-grained.

VESICLES: None.

COLOR: Dark green, white.

STRUCTURE: Massive, spotty.

ALTERATION: Dark green, pervasively silicified rocks with hairline silica filled fractures, rimmed by sulfate alteration halos. Very fine-grained pyrite is disseminated throughout the rock, but more concentrated in vuggy, silica lined cavities.

VEINS/FRACTURES: Hairline silica-pyrite-magnetite filled fractures and ovoid sulfate patches (perhaps after vesicles?).

COMMENTS: No primary volcanic texture. Distinctive rock unit due to spotty and partially coarse-grained texture. Extremely fine-grained dark spots may be magnetite.

MINERALIZATION: Pieces 12A, 12B, and 13

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Clay	60	Very fine-grained	Includes chlorite (?)
Anhydrite	30-40	Very fine-grained	

Minor minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	10	Very fine-grained	Disseminated subhedral to euhedral, some face striations. veinlet network.

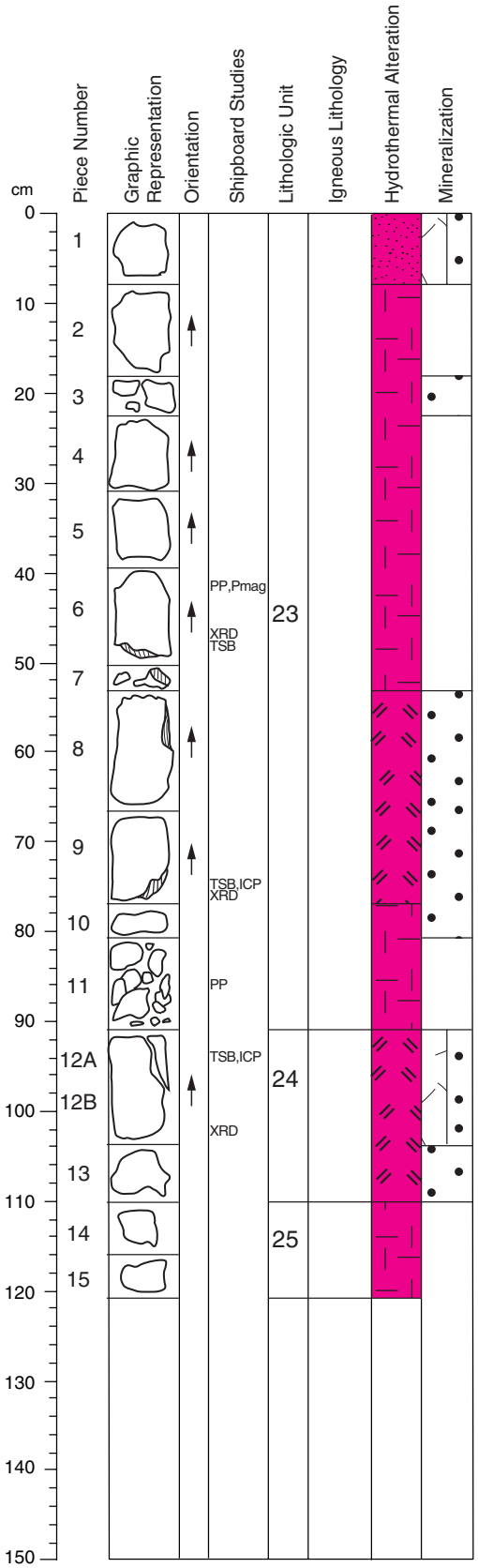
Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Very fine-grained, minor, disseminated pyrite in veinlets cutting a matrix of anhydrite, silica, and clay

STRUCTURES/VEINS/FRACTURES:

Size	Veins < 0.5 mm.
Orientation	Veins - network

Core Photo



193-1188A-20R-1 (Section top: 173.9 mbsf)

ROCK NAME: Dark green, silicified rock with ovoid sulfate patches.

UNIT: 25
Pieces: 14 to 15

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	20R	1	14	110	175.00
Lower contact:	21R	1	18	149	184.59

Thickness (m): 9.59

CONTACTS: None.

PHENOCRYSTS: None

GROUNDMASS: Fine-grained.

VESICLES: None.

COLOR: Dark gray, green.

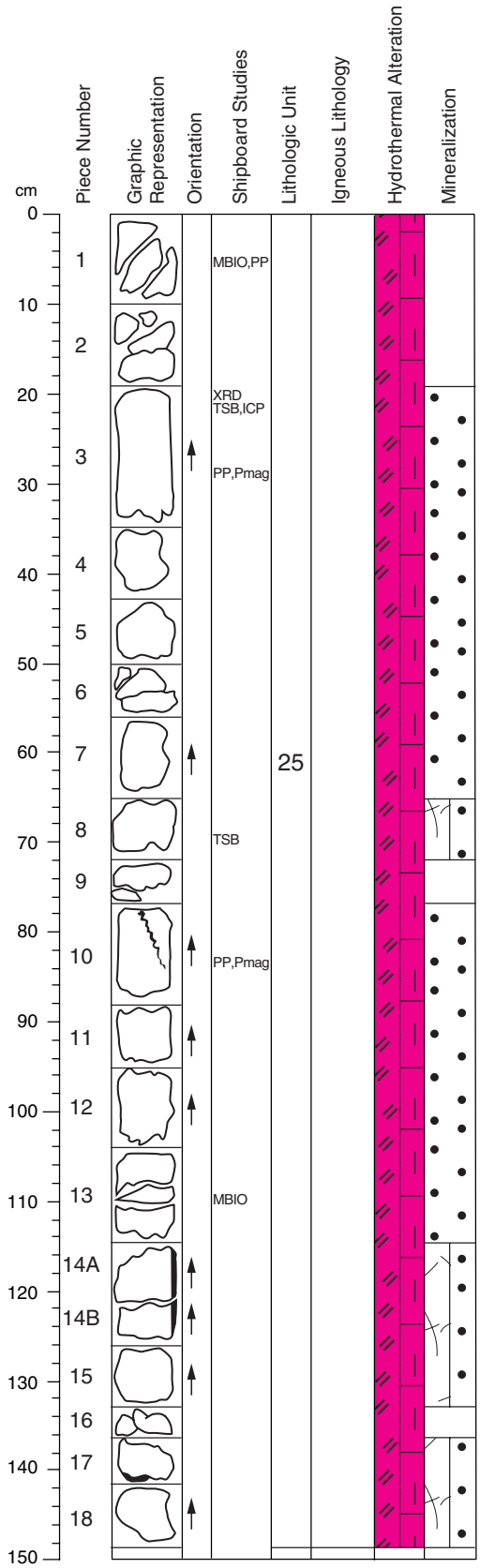
STRUCTURE: Massive.

ALTERATION: Remnant soft green clay-rich patches, containing disseminated magnetite, are surrounded by pervasive to patchy, fine-grained silica ± pyrite which is associated with vuggy cavities lined by fine crystalline quartz. Very fine-grained euhedral pyrite is noticeably more abundant in silicified zones, particularly in the vuggy cavities.

VEINS/FRACTURES: Network of anastomosing hairline fractures filled with silica-pyrite-magnetite.

COMMENTS: No primary volcanic texture. Magnetite appears to be approximately evenly distributed through the rock, suggesting it predates the silica-pyrite introduction.

Core Photo



193-1188A-21R-1 (Section top: 183.1 mbsf)

ROCK NAME: Patchy quartz, magnetite, chlorite-clay bearing rock.

UNIT: 25
Pieces: 1 to 18

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	20R	1	14	110	175.00
Lower contact:	21R	1	18	149	184.59

Thickness (m): 9.59

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Dark green, dark gray.

STRUCTURE: Massive.

ALTERATION: Remnant soft green clay-rich patches, containing disseminated magnetite, are surrounded by pervasive fine-grained silica, with minor pyrite. Very fine-grained euhedral pyrite is noticeably more abundant in silicified zones, particularly in the vuggy cavities.

VEINS/FRACTURES: Fine network of silica-pyrite ± anhydrite veinlets with bleached, silicified halos.

COMMENTS: No primary volcanic texture.

MINERALIZATION: Pieces 3-8, 10-15, and 17-18.

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	30-45	Very fine-grained	
Magnetite	5-25	Very fine-grained	
Silica	10-30	Very fine-grained	
Clays	10-25	Very fine-grained	

Minor minerals:

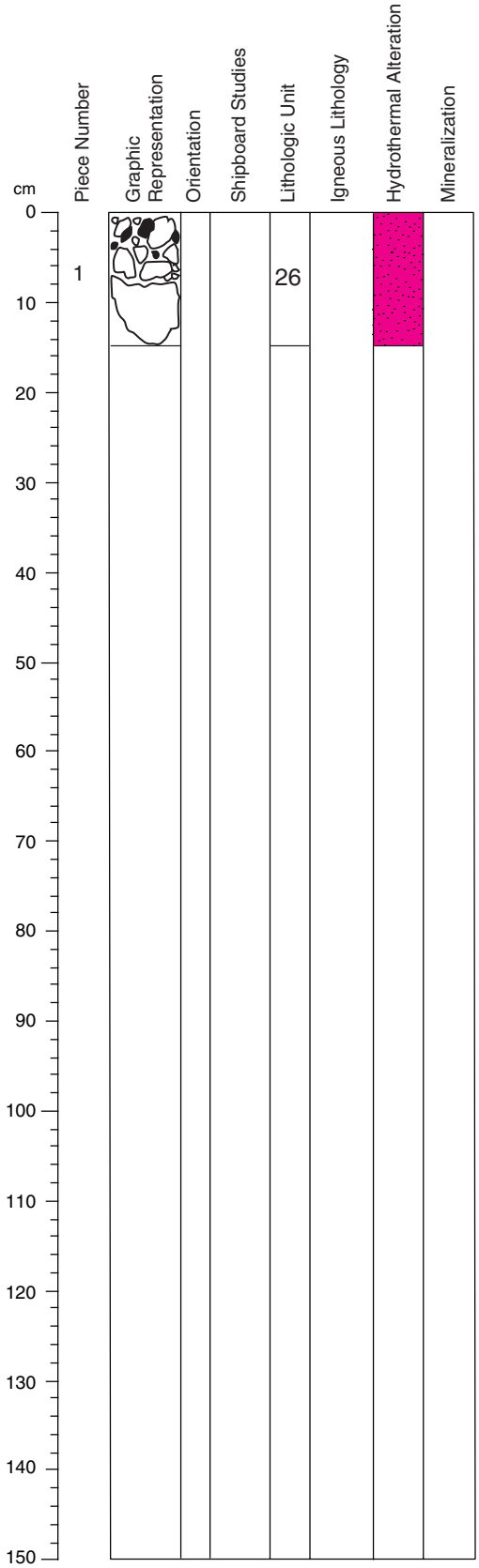
Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	5-15	Very fine-grained	Disseminated subhedral to euhedral, association with trace yellow sphalerite and chalcopyrite.

Trace minerals (<2%):

Name	Abundance (%)	Size	Morphology, Characteristics
Sphalerite	<1	Very fine-grained	

TEXTURAL DESCRIPTION: Very fine-grained aggregates of disseminated magnetite with minor granular pyrite and trace granular sphalerite in a matrix of very fine-grained granular anhydrite, silica, and clay.

Core Photo



193-1188A-22R-1 (Section top: 192.7 mbsf)

ROCK NAME: Vuggy, massive, sulfate-silica rock with traces of disseminated pyrite and iron oxide.

UNIT: 26
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	22R	1	15	0	192.70
Lower contact:	23R	1	1	19	202.20

Thickness (m): 9.5

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: White.

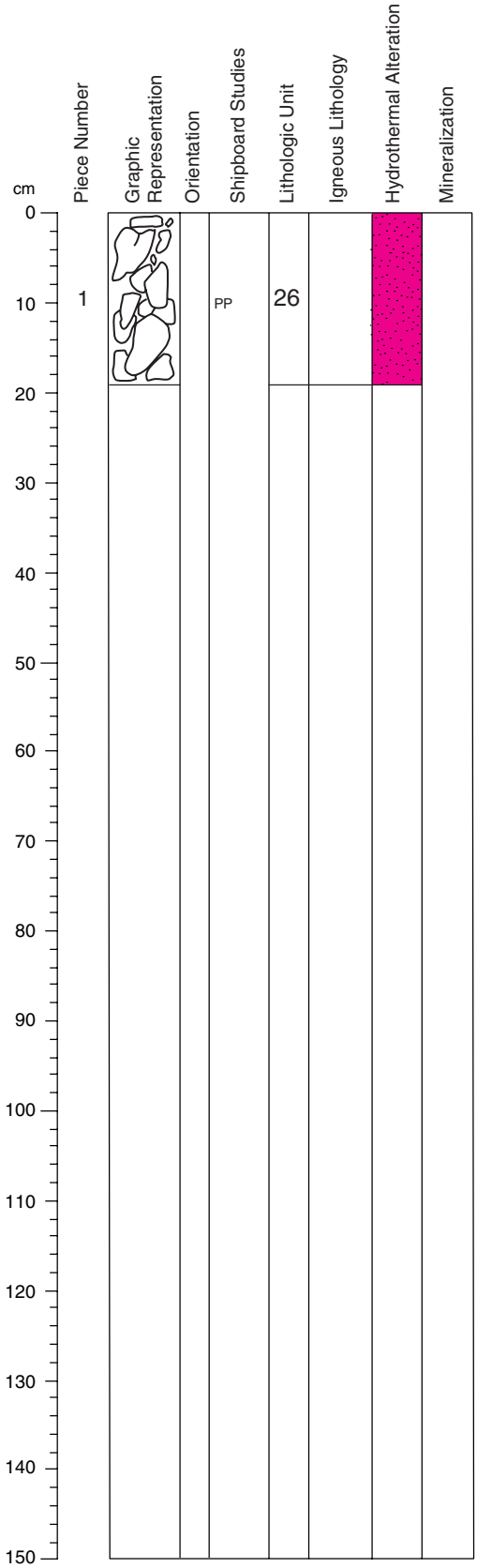
STRUCTURE: Massive.

ALTERATION: Complete, pervasive bleaching (sulfate, clay, silica).

VEINS/FRACTURES: None.

COMMENTS: There are fresh, aphyric dacite pebbles in this interval => fallen from above?

Core Photo



193-1188A-23R-1 (Section top: 202.1 mbsf)

ROCK NAME: Vuggy, massive, sulfate-silica rock with traces of disseminated pyrite and iron oxide.

UNIT: 26

Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact::	22R	1	1	0	192.70
Lower contact:	23R	1	1	19	202.20

Thickness (m): 17.66

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

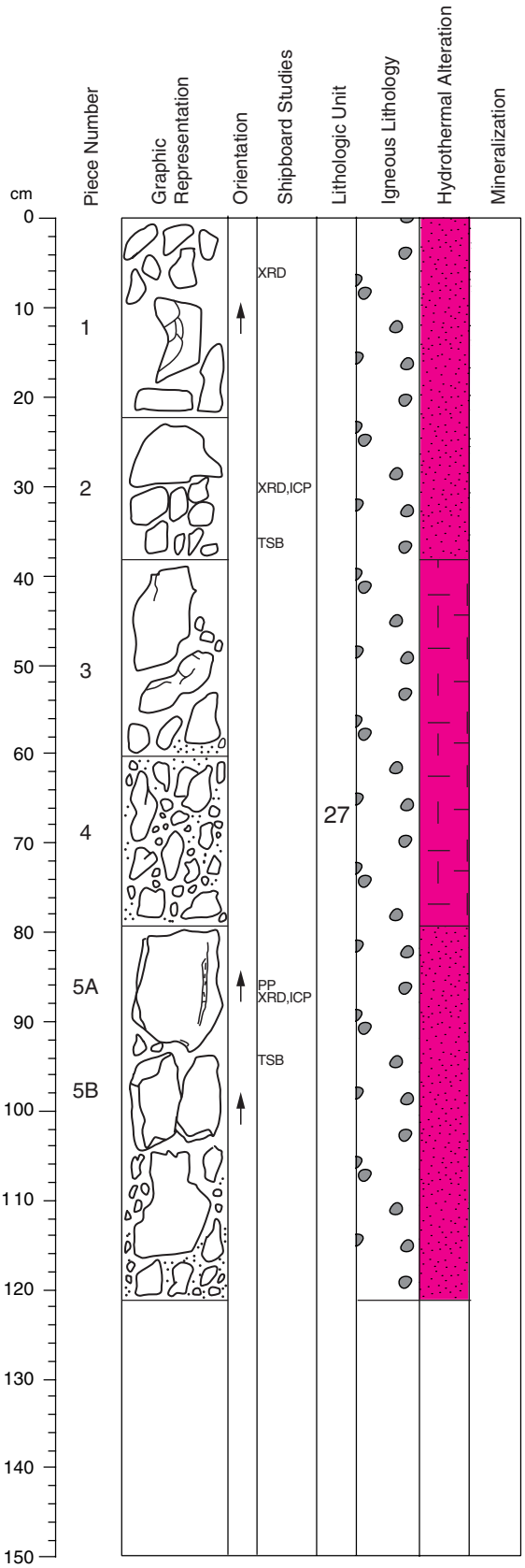
COLOR: White.

STRUCTURE: Massive.

ALTERATION: Complete, pervasive bleaching (sulfate, clay, silica).

VEINS/FRACTURES: None.

Core Photo



ADCB Core Description

193-1188F-1Z-1 (Section top: 218.0 mbsf)

ROCK NAME: Completely altered, silicified, aphyric volcanic rock.

UNIT: 27
Pieces: 1 to 5

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	1	1	0	218.00
Lower contact:	1Z	3	2	3	221.03

Thickness (m): 3.03

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray, minor green.

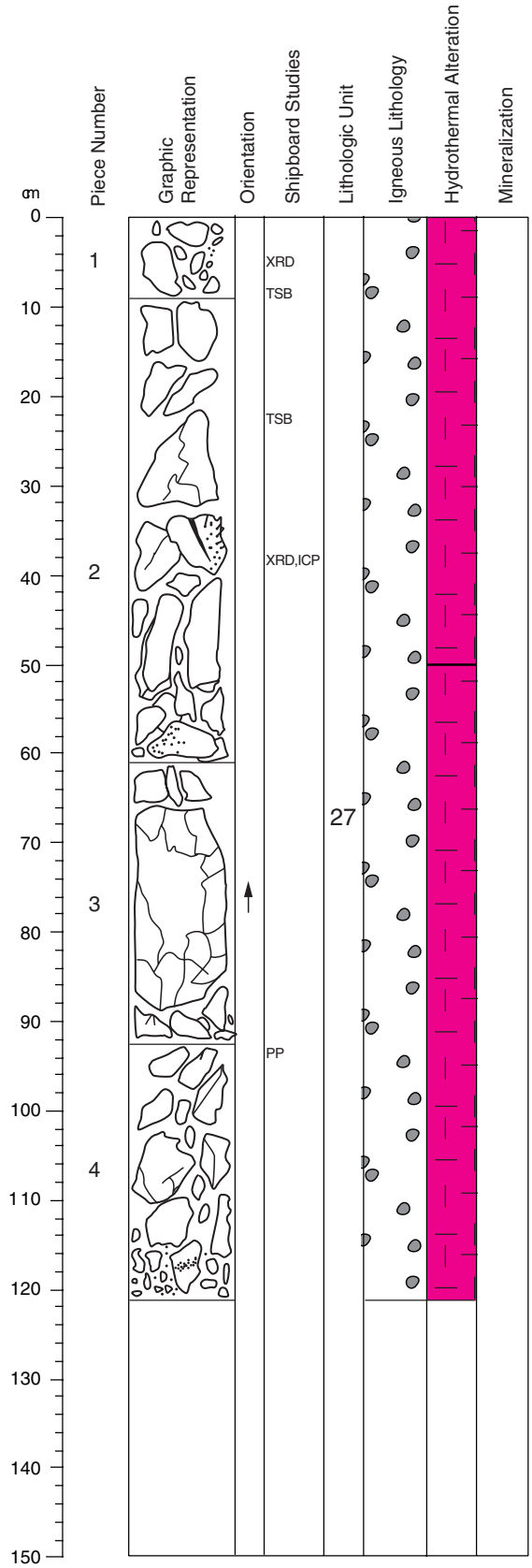
STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicification with minor greenish, intervals (remnant silica-sulfate clay (GSC) domains) and softer, more clayey pieces. Cut by irregular anhydrite-pyrite±silica veins with cyclically zoned, 1 to 2 cm wide siliceous alteration halos.

VEINS/FRACTURES: Few mm-scale anhydrite-pyrite veins, some with minor silica.

COMMENTS: Intensely fractured core.

Core Photo



ADCB Core Description

193-1188F-1Z-2 (Section top: 219.2 mbsf)

ROCK NAME: Completely altered, silicified, aphyric volcanic rock.

UNIT: 27
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	1	1	0	218.00
Lower contact:	1Z	3	2	63	221.03

Thickness (m): 3.03

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray, minor green.

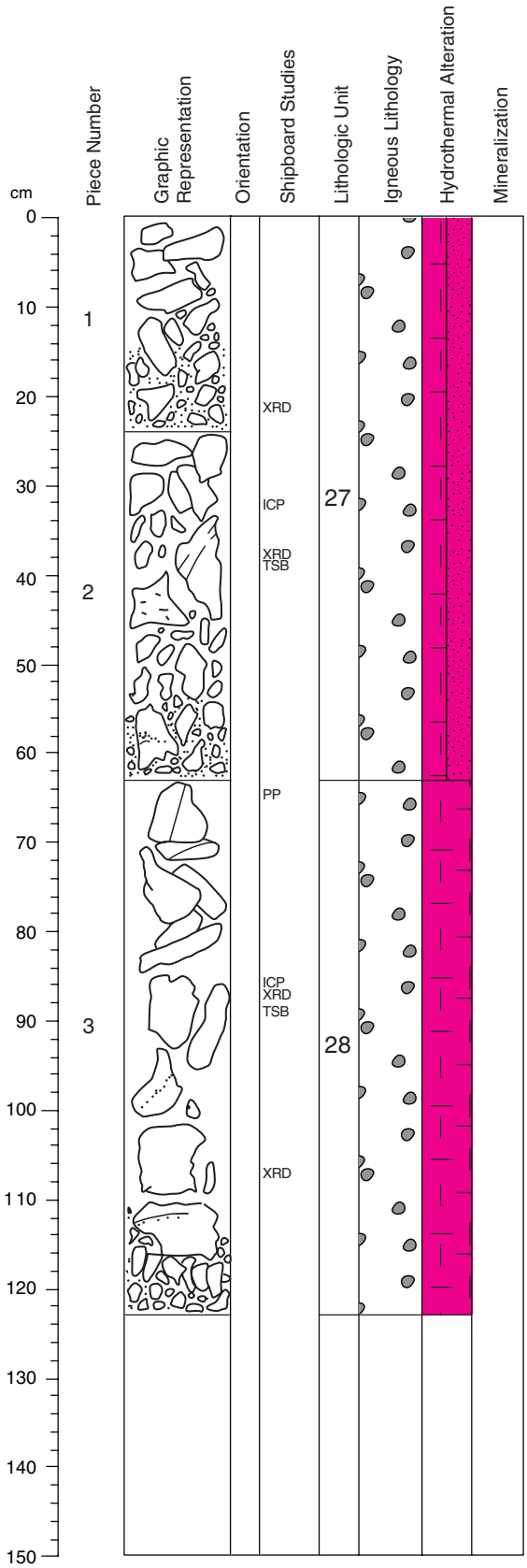
STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicification with minor greenish, chloritic intervals (remnant GSC domains) and softer, more clayey pieces. Cut by irregular anhydrite-pyrite ±silica veins with cyclically zoned, 1 to 2 cm wide siliceous alteration halos.

VEINS/FRACTURES: Few mm-scale anhydrite-pyrite veins, some with minor silica.

COMMENTS: Intensely fractured, rubbly core. One fragment in Piece 2 contains relict spherulitic texture (radiating crystal aggregates recognizable under the binocular microscope).

Core Photo



ADCB Core Description

193-1188F-1Z-3 (Section top: 220.4 mbsf)

ROCK NAME: Completely altered, silicified, aphyric volcanic rock.

UNIT: 27
Pieces: 1 to 2.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	1	1	0	218.00
Lower contact:	1Z	3	2	63	221.03

Thickness (m): 3.03

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray, minor green.

STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicification with minor greenish, chloritic intervals (remnant GSC domains) and softer, more clayey pieces. Cut by irregular anhydrite-pyrite ±silica veins with cyclically zoned, 1 to 2 cm wide siliceous alteration halos.

VEINS/FRACTURES: Few mm-scale anhydrite-pyrite veins, some with minor silica.

COMMENTS: Intensely fractured, rubbly core.

ROCK NAME: Completely altered, silicified and locally green clay bearing, aphyric volcanic rock.

UNIT: 28
Pieces: 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	3	3	63	221.03
Lower contact:	1Z	4	1	60	222.80

Thickness (m): 1.77

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray, green.

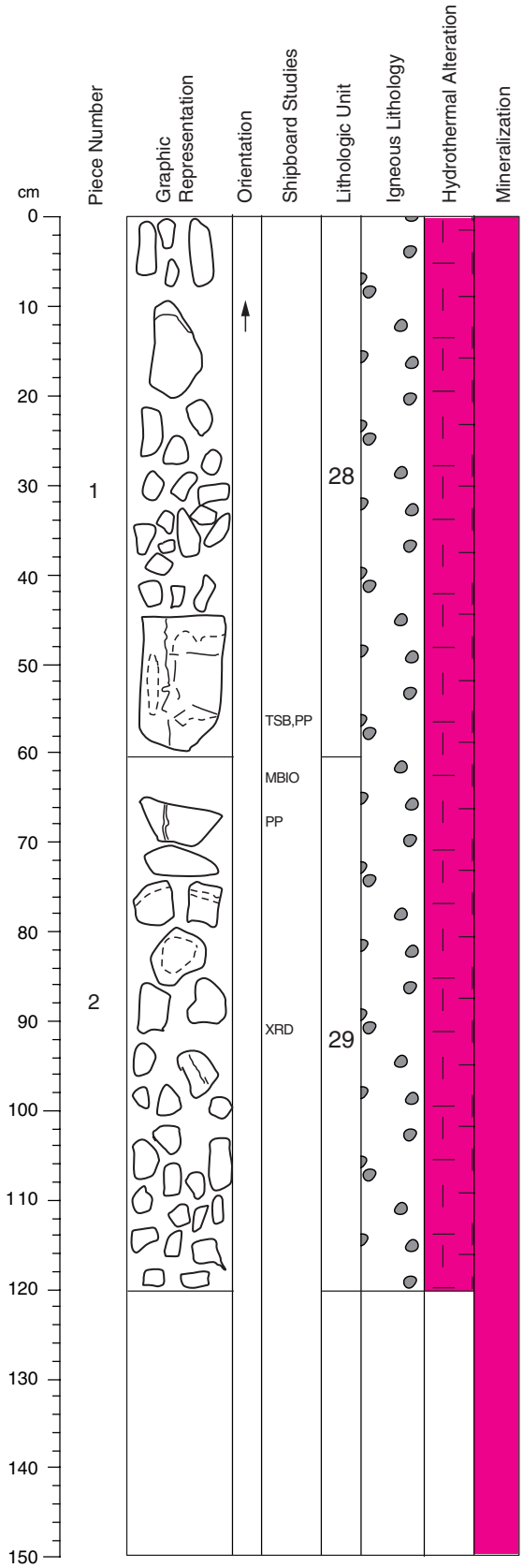
STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicification and abundant green clayey/chloritic material (remnant GSC domains?). Similar to Unit 27 but with a dominance of chloritic material. Anhydrite-pyrite coated fractures show distinct, cyclically banded silicified alteration halos overprinting the GSC alteration. Remnant kernels of groundmass domains encircled by such veins are green (green clay/chlorite).

VEINS/FRACTURES: Narrow (<1 mm) anhydrite-silica-pyrite veins. Some with pronounced oscillating siliceous alteration halos. Few second generation silica+anhydrite±pyrite veins.

COMMENTS: Intensely fractured, rubbly core. No primary igneous textures preserved. Distinctive from Units 27 and 29 due to green chloritic domains.

Core Photo



ADCB Core Description

193-1188F-1Z-4 (Section top: 221.6 mbsf)

ROCK NAME: Completely altered, silicified and locally green clay bearing, aphyric volcanic rock.

UNIT: 28
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	3	3	63	221.00
Lower contact:	1Z	4	1	60	222.80

Thickness (m): 1.77

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray, green.

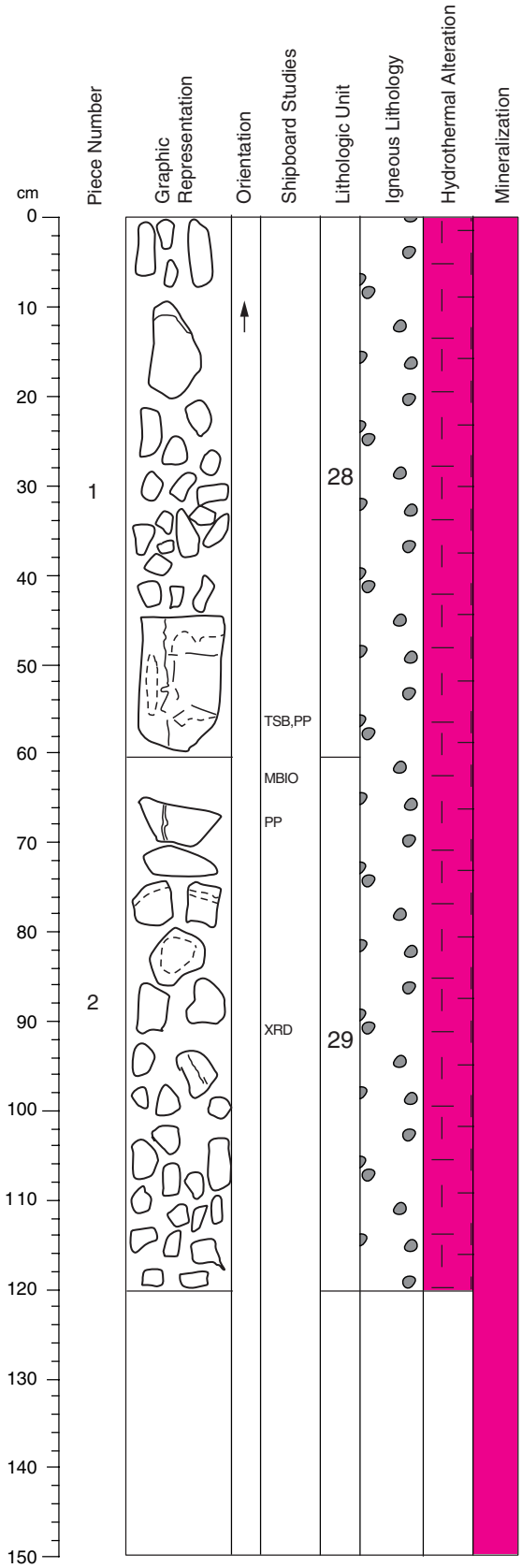
STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicification and abundant, green material (remnant GSC domains?). Similar to Unit 27 but with a dominance of material. Anhydrite-pyrite coated fractures show distinct, cyclically banded silicified alteration halos overprinting the GSC alteration. Remnant kernels of groundmass domains encircled by such veins are green.

VEINS/FRACTURES: Narrow (<1 mm) anhydrite-silica-pyrite veins. Some with pronounced oscillating siliceous alteration halos. Few second generation silica+anhydrite±pyrite veins.

COMMENTS: Intensely fractured, rubbly core. No primary igneous textures preserved. Distinctive from Units 27 and 29 due to green, “chloritic” domains.

Core Photo



93-1188F-1Z-4 (Section top: 221.6 mbsf)

ROCK NAME: Completely altered, silicified, aphyric volcanic rock.

UNIT: 29
Pieces: 2.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	4	2	60	222.80
Lower contact:	3Z	1	3	142	223.78

Thickness (m): 3.38

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray.

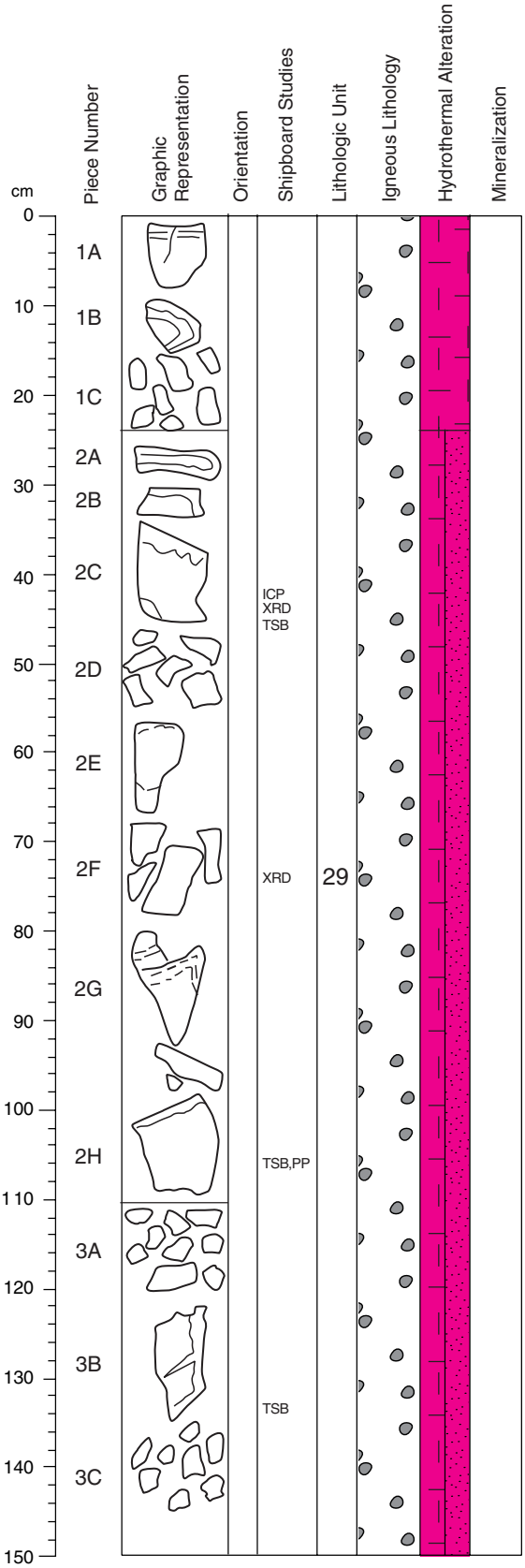
STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicified intervals intercalated with cream colored, softer, more clay-rich material.

VEINS/FRACTURES: Narrow (<1 mm) anhydrite-pyrite-silica veins with well-developed, 10 to 15 mm wide, gray siliceous alteration halos.

COMMENTS: Intensely fractured, rubbly core. No primary igneous textures preserved. Note that thickness is based on the total of curated length of core.

Core Photo



ADCB Core Description

193-1188F-2Z-1 (Section top: 221.6 mbsf)

ROCK NAME: Completely altered, silicified, aphyric volcanic rock.

UNIT: 29
Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	4	2	60	222.80
Lower contact:	3Z	1	3	142	223.78

Thickness (m): 3.38

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray.

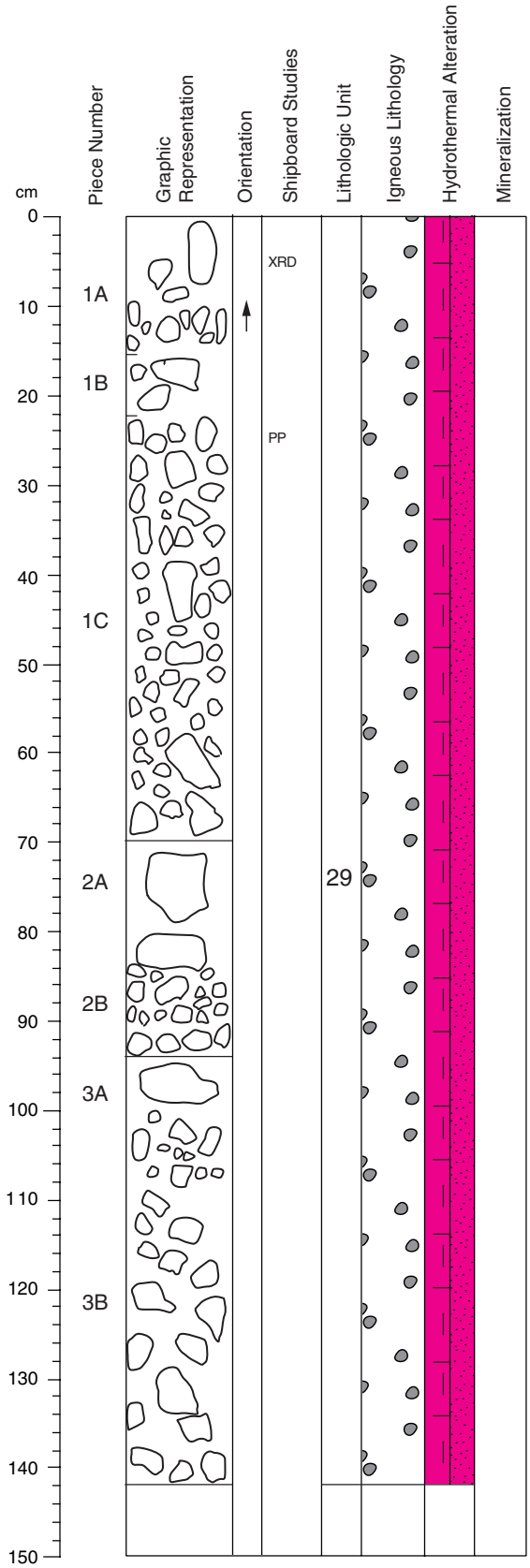
STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicified intervals intercalated with cream colored, softer, more clay-rich material.

VEINS/FRACTURES: Narrow (<1 mm) anhydrite-pyrite-silica veins with well-developed, 10 to 15 mm wide, gray siliceous alteration halos.

COMMENTS: Intensely fractured, rubbly core. No primary igneous textures preserved. Note that thickness is based on the total of curated length of core.

Core Photo



ADCB Core Description

193-1188F-3Z-1 (Section top: 222.4 mbsf)

ROCK NAME: Completely altered, silicified, aphyric volcanic rock.

UNIT: 29
Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1Z	4	2	60	222.80
Lower contact:	3Z	1	3	142	223.78

Thickness (m): 3.38

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray.

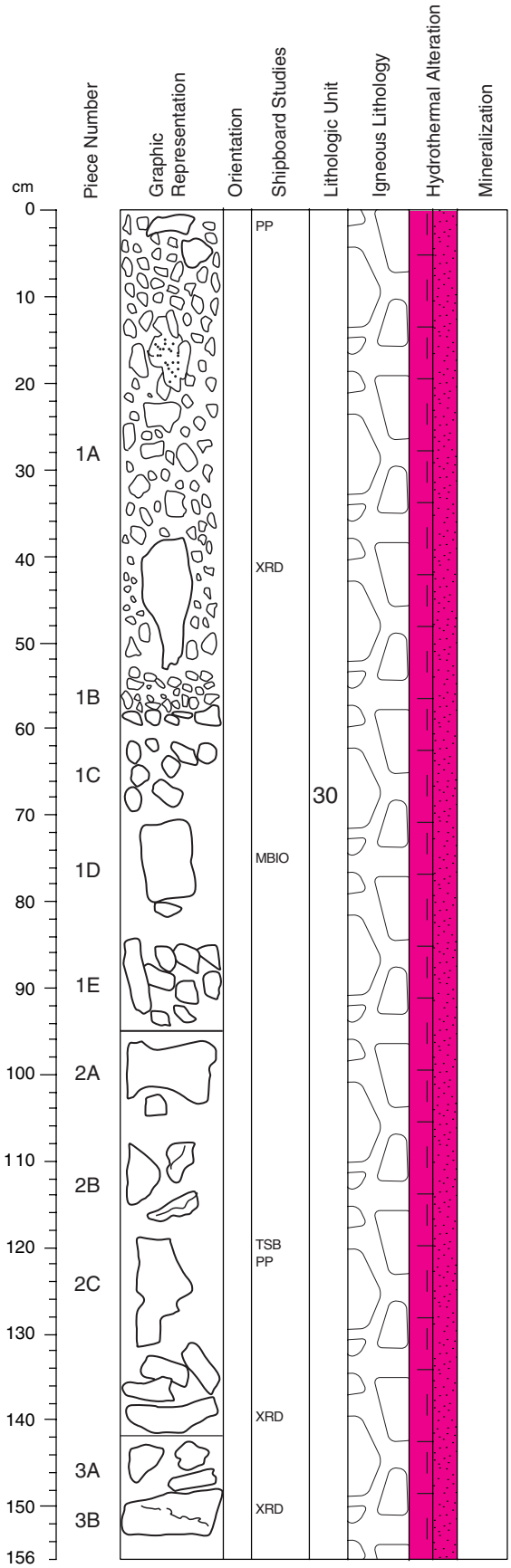
STRUCTURE: Massive.

ALTERATION: Pervasive pale gray silicified intervals intercalated with cream colored, softer, more clay-rich material. This section contains more broken puggy intervals with silicified fragments cemented in clay.

VEINS/FRACTURES: Narrow (<1 mm) anhydrite-pyrite-silica veins with well-developed, 10 to 20 mm wide, gray, cyclic siliceous alteration halos.

COMMENTS: Intensely fractured, rubbly core. No primary igneous textures preserved. Note that thickness is based on the total of curated length of core.

Core Photo



1188F-4Z NO RECOVERY
1188F-5Z NO RECOVERY

ADCB Core Description

193-1188F-3Z-2 (Section top: 223.78 mbsf)

ROCK NAME: Completely altered, brecciated, volcanic rock.

UNIT: 30
Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	3Z	2	1	0	223.78
Lower contact:	6Z	1	1	44	233.54

Thickness (m): 9.76.

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray, minor white.

STRUCTURE: Massive, locally fractured.

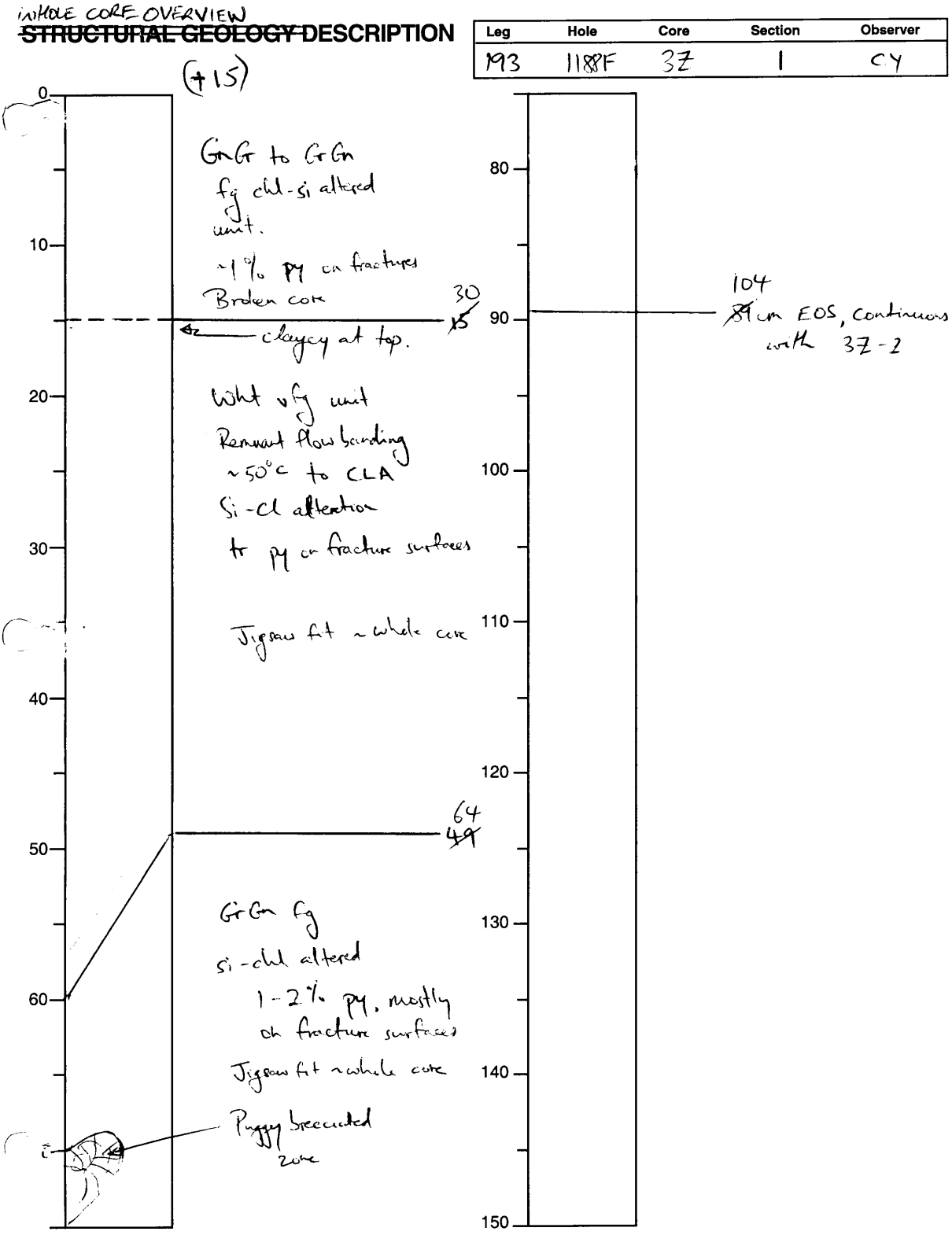
ALTERATION: Hard, indurated, pervasively silicified and less abundant cream-colored (more clay-rich) fragments embedded in a light gray, clay-anhydrite matrix. Late pyrite+silica±anhydrite veinlets cut larger pieces and have well developed, banded (cyclic) siliceous alteration halos (up to 2 cm wide).

VEINS/FRACTURES: Narrow (<1 mm) anhydrite-pyrite-silica veins with well-developed, 10 to 20 mm wide, gray, cyclic siliceous alteration halos.

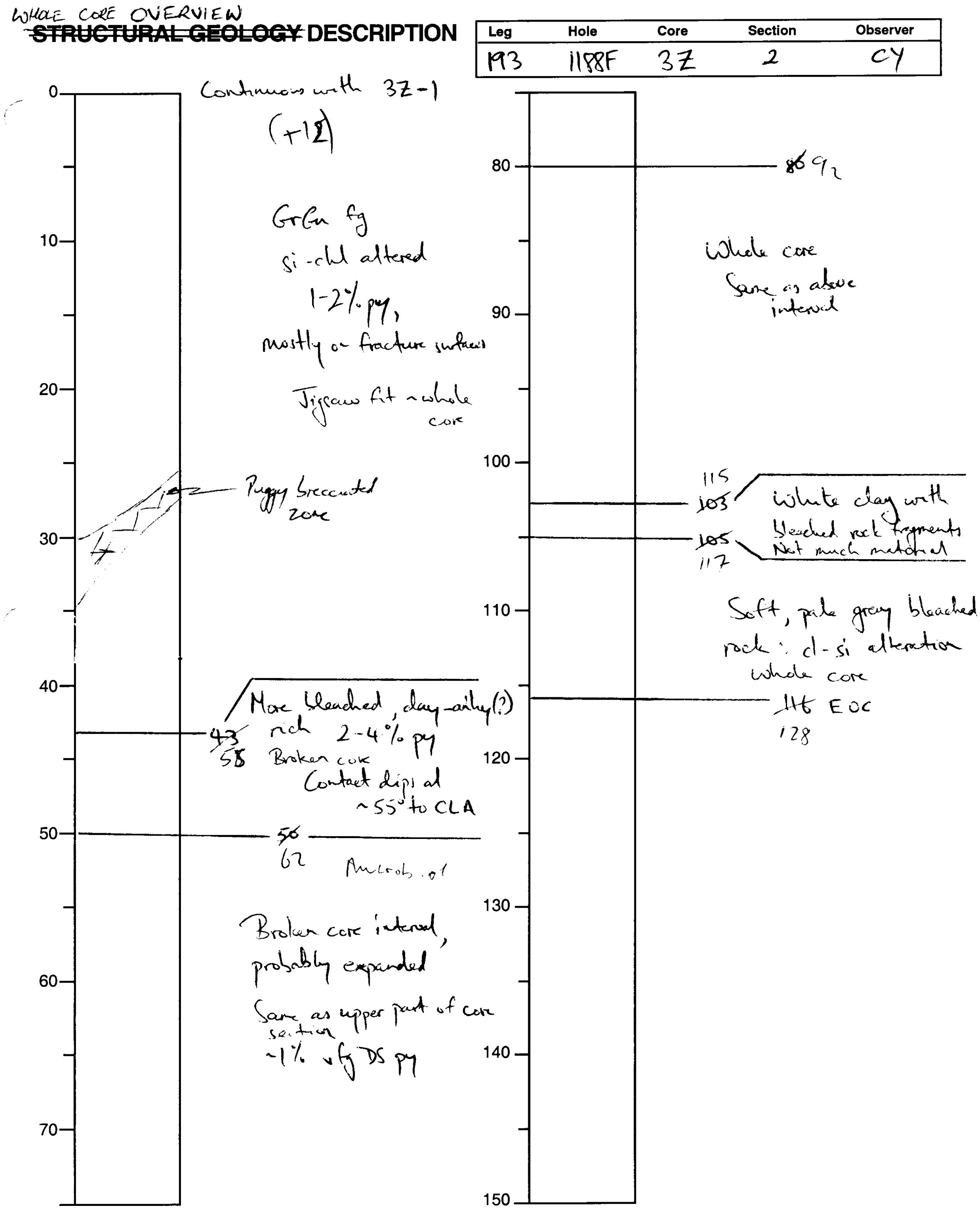
COMMENTS: Intensely fractured, rubbly core. No primary igneous textures preserved.

Note: Cores 4Z and 5Z were empty, therefore thickness is probably exaggerated.

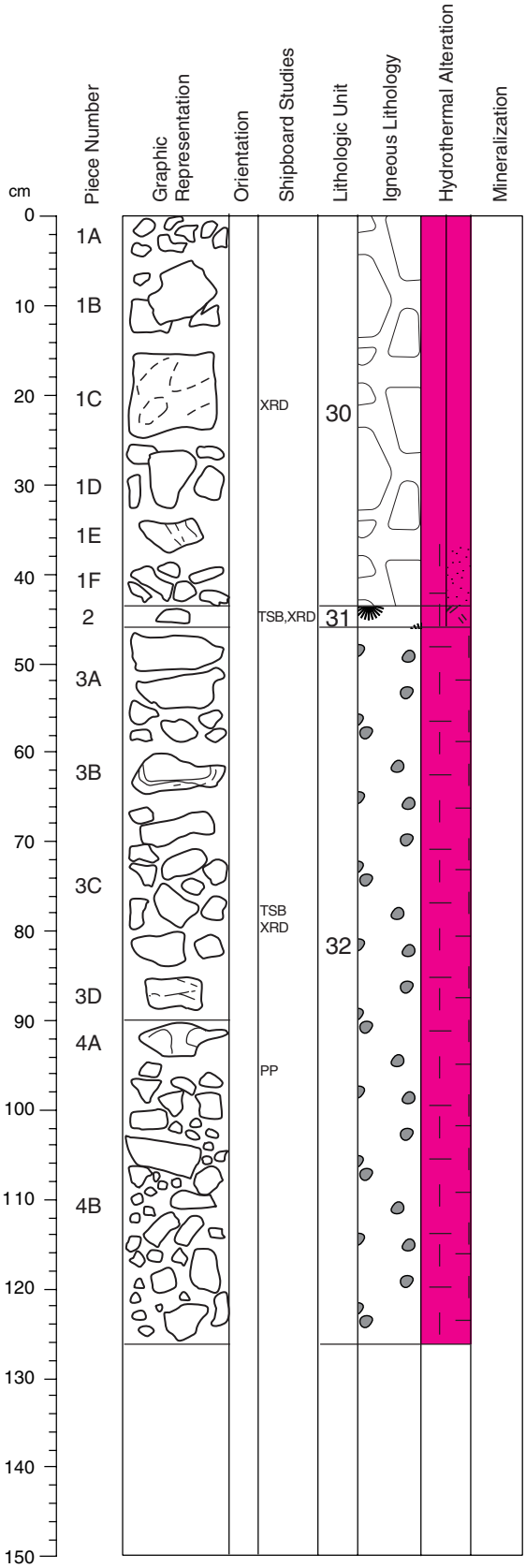
Core Photo


WHOLE CORE OVERVIEW
~~STRUCTURAL GEOLOGY~~ DESCRIPTION
Leg 193
Hole 1188F
Core 3Z
Section 1
Observer CY
(+15)
GnGr to GrGn
fg chl-Si altered
unit.
~1% Py on fractures
Broken core
30
15
clayey at top.
Wht vfg unit
Remnant flow banding
~50° c to CLA
Si-Cl alteration
tr Py on fracture surfaces
Jigsaw fit ~whole core
64
49
GrGn fg
Si-chl altered
1-2% Py, mostly
on fracture surfaces
Jigsaw fit ~whole core
Piggy brecciated
zone
104
~~89~~ cm EOS, continues
with 3Z-2
0
10
20
30
40
50
60
80
90
100
110
120
130
140
150

Core Photo


WHOLE CORE OVERVIEW
~~STRUCTURAL GEOLOGY~~ DESCRIPTION
Leg | Hole | Core | Section | Observer
193 | 1188F | 3Z | 2 | CY
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Continuous with 3Z-1 (+12)
GrGn fg
Si-chl altered
1-2% py,
mostly on fracture surfaces
Jigsaw fit ~whole core
Puggy brecciated zone
More bleached, clay-anhy(?) rich 2-4% py
Broken core
Contact dips at ~55° to CLA
43 58
56 62
Broken core interval, probably expanded
Same as upper part of core section
~1% vfg DS py
80 92
Whole core
Same as above interval
115 103
105 117
white clay with bleached rock fragments
Not much matched
Soft, pale grey bleached rock: cl-si alteration
whole core
116 EOC
128

Core Photo



ADCB Core Description

193-1188F-6Z-1 (Section top: 233.1 mbsf)

ROCK NAME: Completely altered, brecciated, volcanic rock.

UNIT: 30
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	3Z	2	1	0	223.78
Lower contact:	6Z	1	1	44	233.54

Thickness (m): 9.76.

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray, minor white.

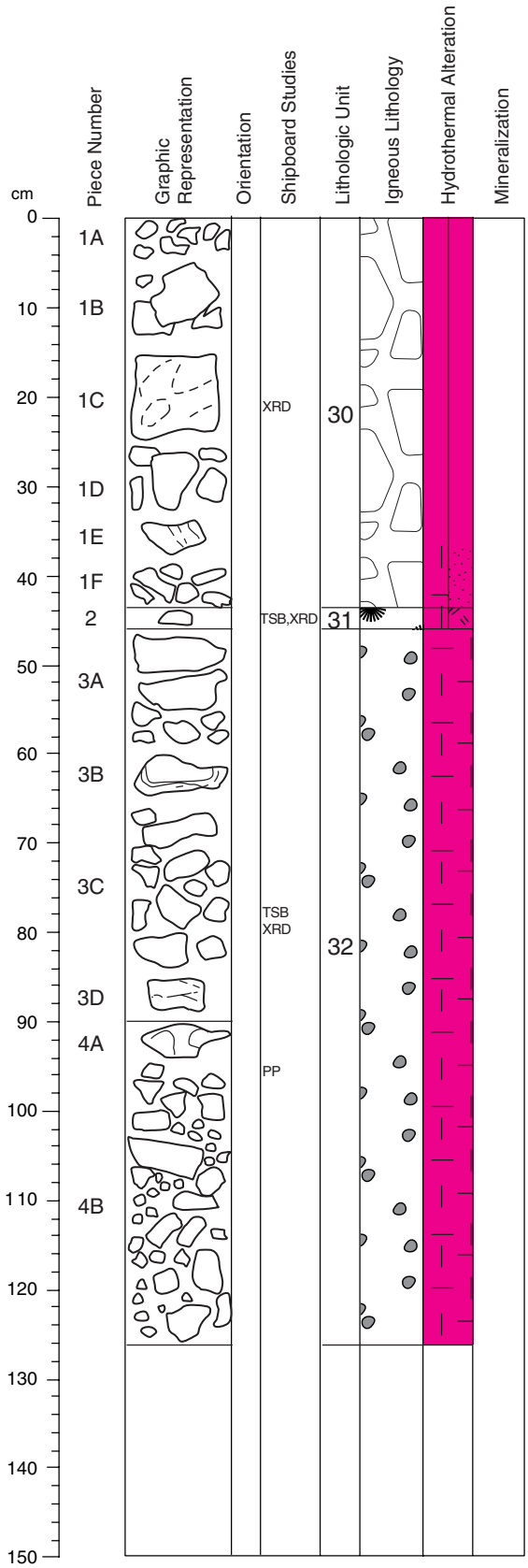
STRUCTURE: Massive.

ALTERATION: Hard, indurated, pervasively silicified and less abundant cream-colored (more clay-rich) fragments embedded in a light gray, clay-anhydrite matrix. Late pyrite+silica±anhydrite veinlets cut larger pieces and have well developed, banded (cyclic) siliceous alteration halos (up to 2 cm wide).

VEINS/FRACTURES: Narrow (<1 mm) anhydrite-pyrite-silica veins with well-developed, 10 to 15 mm wide, gray siliceous alteration halos.

COMMENTS: Intensely fractured, rubbly core. No primary igneous textures preserved. Note: Cores 4Z and 5Z were empty, therefore, thickness is probably exaggerated.

Core Photo



193-1188F-6Z-1 (Section top: 233.1 mbsf)

ROCK NAME: Completely altered, spherulitic volcanic rock.

UNIT: 31
Pieces: 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6Z	1	2	44	233.54
Lower contact:	6Z	1	2	47	233.57

Thickness (m): 0.03.

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: White spherulites in gray-green groundmass.

STRUCTURE: Spherulitic, spotty.

ALTERATION: White siliceous (minor clay) spherulites occur in a dark green silica-chlorite groundmass. Pyrite crystals occur locally as vug fill in spherulites. Minor Fe-oxide spotting.

VEINS/FRACTURES: None.

COMMENTS: Single piece of spherulitic volcanic rock. Contains 50% isolated, white, round, altered spherulites (up to 1 mm in diameter, radiating crystal aggregates). Central vugs are common and often filled by pyrite crystals.

ROCK NAME: Completely altered, silicified, massive, aphyric volcanic rock.

UNIT: 32
Pieces: 3 to 4.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6Z	1	3	47	233.57
Lower contact:	6Z	2	1B	23	234.57

Thickness (m): 1.00

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray, gray.

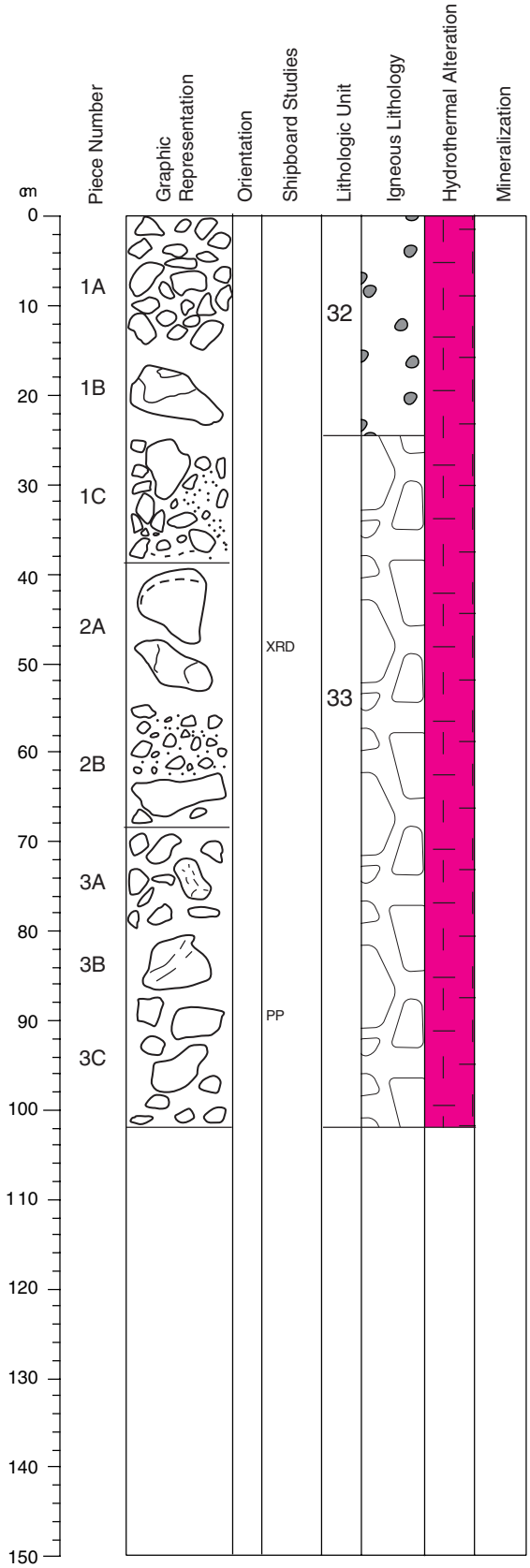
STRUCTURE: Massive.

ALTERATION: Light gray indurated, silicified and less abundant creamy colored more clay-rich pieces. Fracture surfaces with silica and sulfate. Trace disseminated pyrite tends to be more abundant in less strongly silicified pieces. Scattered Fe-oxide spotting after sulfide.

VEINS/FRACTURES: Anhydrite±silica±pyrite veins with cyclic, siliceous alteration halos. Some are crosscut by hairline pyrite±silica veinlets.

COMMENTS: Fractured, rubbly core. No igneous textures.

Core Photo



ADCB Core Description

193-1188F-6Z-2 (Section top: 234.6 mbsf)

ROCK NAME: Completely altered, silicified, aphyric, massive volcanic rock.

UNIT: 32
Pieces: 1A to 1B

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6Z	1	3	47	233.57
Lower contact:	6Z	2	1B	23	234.57

Thickness (m): 1.00

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray, gray.

STRUCTURE: Massive.

ALTERATION: Light gray indurated, silicified and less abundant cream colored clay-rich pieces. Fracture surfaces with silica and sulfate. Trace disseminated pyrite tends to be more abundant in less strongly silicified pieces. Scattered Fe-oxide after sulfide.

VEINS/FRACTURES: Anhydrite-silica-pyrite veins with cyclic, siliceous alteration halos. Some are crosscut by hairline pyrite-silica veinlets.

COMMENTS: Fractured, rubbly core. No igneous textures

ROCK NAME: Silicified volcanic fragments in soft gray clay.

UNIT: 33
Pieces: 1C to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6Z	2	1C	23	234.57
Lower contact:	6Z	2	3	101	235.35

Thickness (m): 0.78

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray, gray.

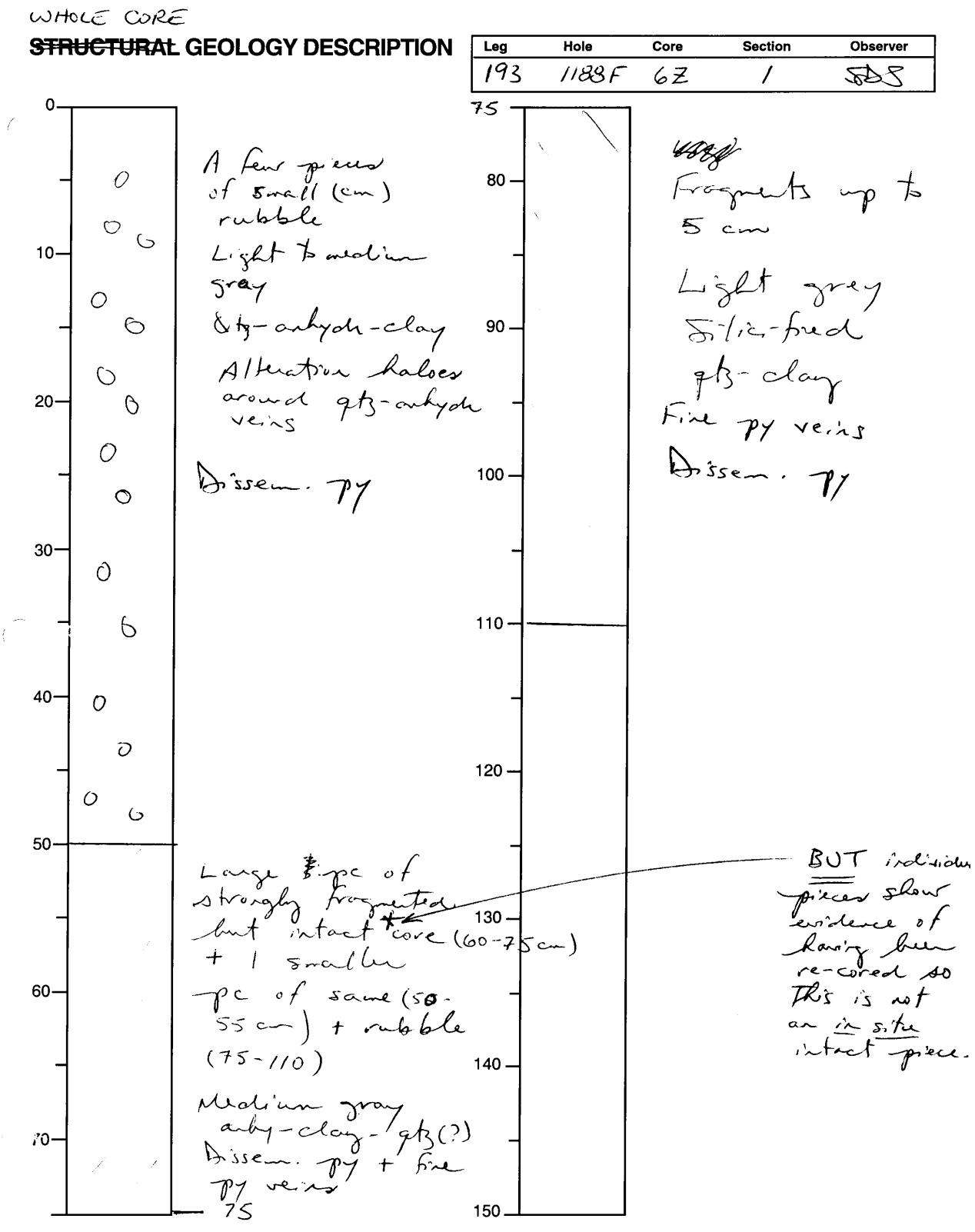
STRUCTURE: Brecciated.

ALTERATION: Pervasively silicified fragments in soft gray clay. Fracture surfaces are mostly coated with white silica-anhydrite with zoned cyclic alteration halos (up to 1 cm half-width). Trace pyrite is found disseminated, and as vug fill.

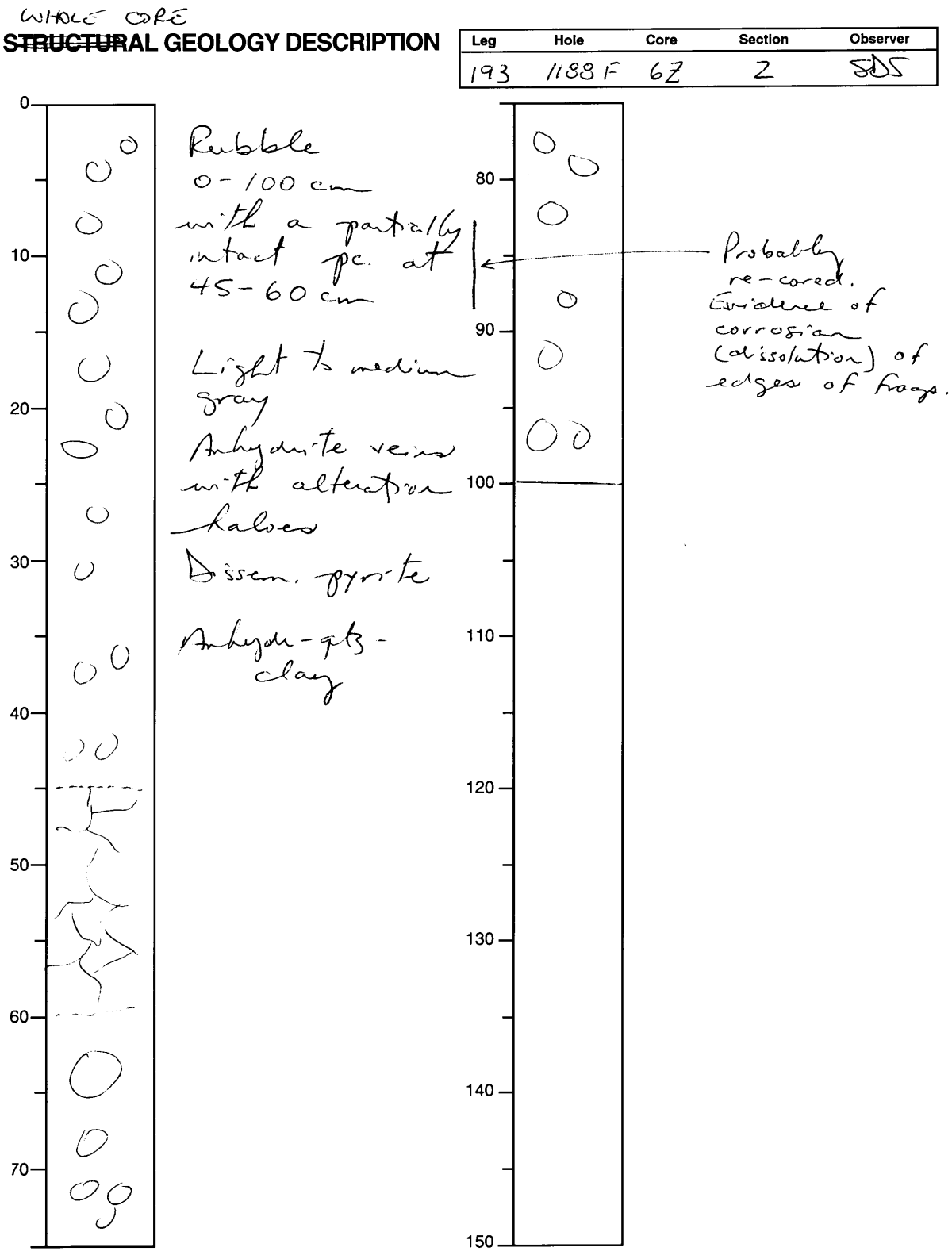
VEINS/FRACTURES: None.

COMMENTS: Fractured, rubbly core with cm-sized fragments. Quartz-pyrite spots may be remnant plagioclase phenocrysts. Piece 3A contains rare plagioclase phenocrysts.

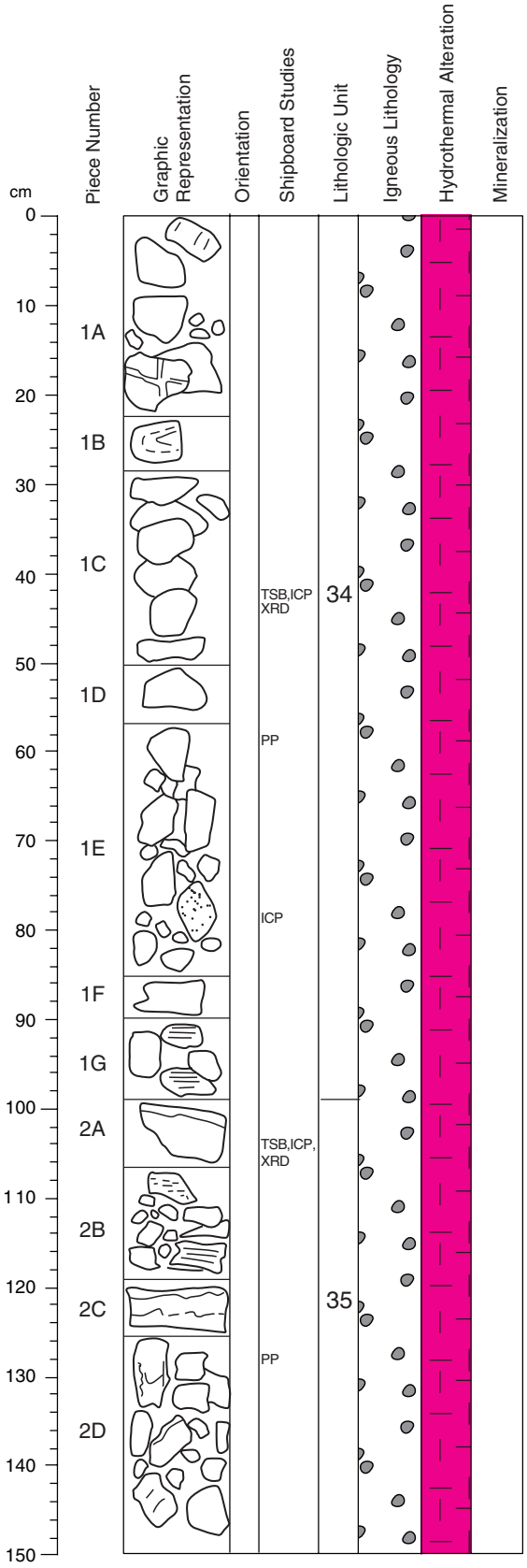
Core Photo


WHOLE CORE
~~STRUCTURAL~~ GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 6Z
Section 1
Observer SDS
A few pieces of small (cm) rubble
Light to medium gray
&tg-anhydr-clay
Alteration haloes around qtz-anhydr veins
Dissem. py
Fragments up to 5 cm
Light gray
Si/ic-fred qtz-clay
Fine py veins
Dissem. py
Large pc of strongly fragmented but intact core (60-75 cm)
+ 1 smaller pc of same (50-55 cm) + rubble (75-110)
Medium gray anhy-clay-qtz(?)
Dissem. py + fine py veins
75
BUT individual pieces show evidence of having been re-cored so this is not an in situ intact piece.

Core Photo


WHOLE CORE
STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 6Z
Section 2
Observer SDS
Rubble 0-100 cm with a partially intact pc. at 45-60 cm
Light to medium gray
Anhydrite veins with alteration halos
Dissem. pyrite
Anhydr-qtz-clay
Probably re-cored. Evidence of corrosion (dissolution) of edges of frags.
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-7Z-1 (Section top: 235.0 mbsf)

ROCK NAME: Silicified, massive, aphyric volcanic rock.

UNIT: 34
Pieces: 1 (1A-1G)

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7Z	1	1A	0	235.00
Lower contact:	7Z	1	1G	102	236.02

Thickness (m): 1.02

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Possible remnant microvesicles (<1 mm in diameter) filled with silica. Fine pyrite bands in Piece 1F may be pseudomorphing a flow structure.

COLOR: Light gray, white.

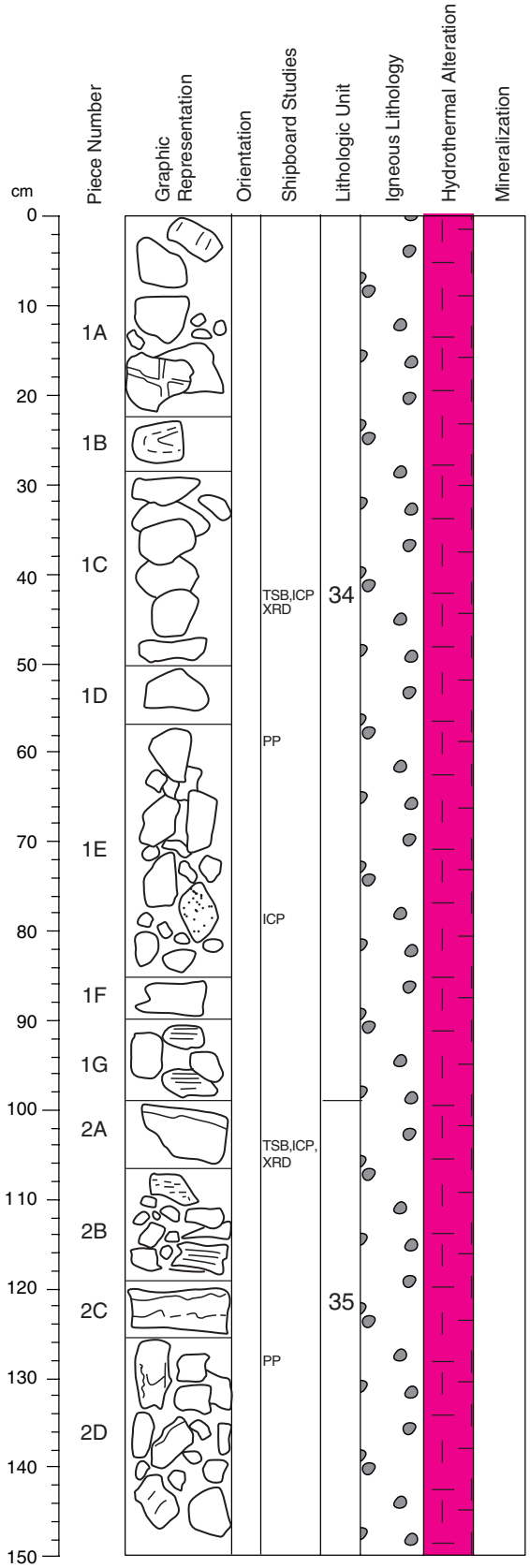
STRUCTURE: Massive.

ALTERATION: Rounded pebbles of silicified, sparsely microvesicular volcanic rock. Intensity of silicification decreases away from edges of pebbles, leaving less silicified kernels. Pyrite is finely disseminated in the less silicified kernels, but absent from the intensely silicified piece margins. FeOx spots on white coated surfaces is after pyrite. Distinct blue amorphous surface coating (silica-clay?) on some fragments of Piece 1E.

VEINS/FRACTURES: Anhydrite±pyrite veins, some with cyclic siliceous alteration halos, locally crosscut by anhydrite veins. Some pieces with less than 1 mm wide silica-pyrite veins.

COMMENTS: Fractured, rubbly core.

Core Photo



193-1188F-7Z-1 (Section top: 235.0 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, volcanic rock.

UNIT: 35

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7Z	1	2A	102	236.02
Lower contact:	7Z	2	3	65	237.11

Thickness (m): 1.09

CONTACTS: None.

PHENOCRYSTS: Plagioclase, trace to 2%, replaced by white clay. Size ranges from 0.1 to 2 mm. Lath-shaped and commonly aligned.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray, light gray.

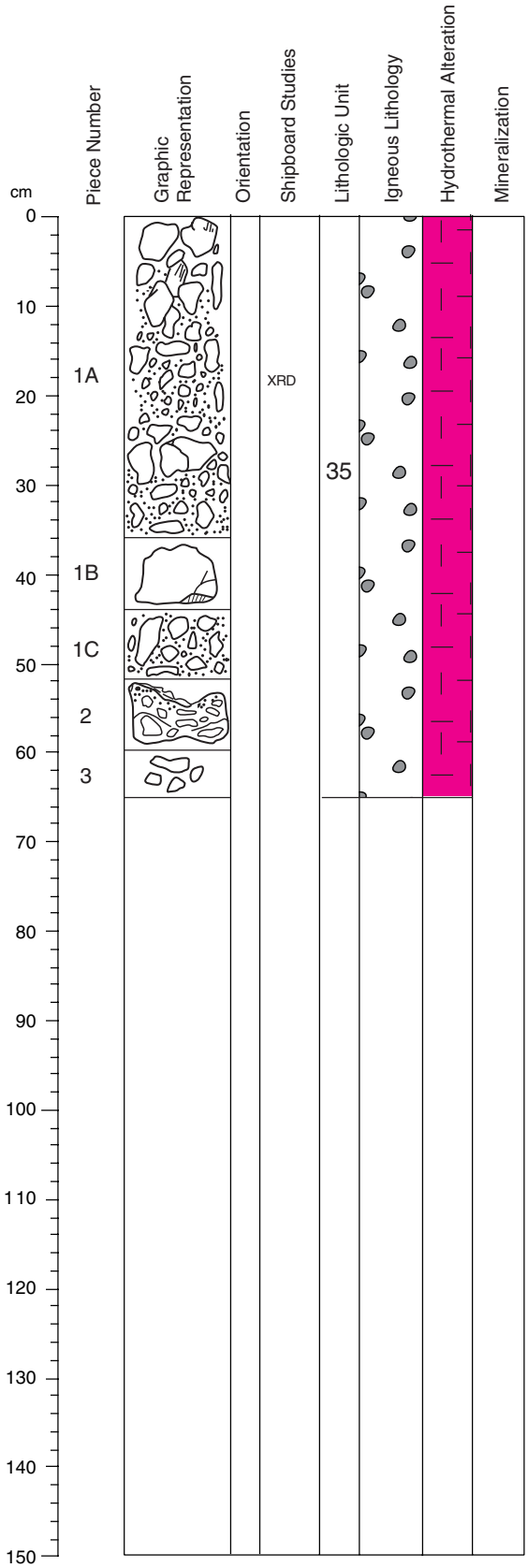
STRUCTURE: Massive.

ALTERATION: Intensely silicified rock. White silica-sulfate coated fracture surfaces have distinct banded silicified alteration halos. Planar to convoluted lamination is defined by silica and gray-greenish clay. It is unclear whether they are vein halos or possible pseudomorphed flow banding. Remnant plagioclase phenocrysts are generally corroded to skeletal. Pyrite occurs as very fine-grained disseminations and as slightly coarser microvesicle fill (± quartz).

VEINS/FRACTURES: None.

COMMENTS: Remnant flow banding in Piece 2C.

Core Photo



ADCB Core Description

193-1188F-7Z-2 (Section top: 236.51 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 35
Pieces: 1-3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7Z	1	2A	102	236.02
Lower contact:	7Z	2	3	65	237.11

Thickness (m): 1.09

CONTACTS: None.

PHENOCRYSTS: Plagioclase, trace to 2%, replaced by white clay. Size ranges from 0.1 to 2 mm. Lath-shaped and commonly aligned.

GROUNDMASS: Very fine grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, generally quartz filled).

COLOR: Gray, light gray.

STRUCTURE: Massive.

ALTERATION: Intensely silicified rock. White silica-sulfate coated fracture surfaces have distinct banded silicified alteration halos. Pyrite occurs as very fine grained disseminations and as slightly coarser microvesicle fill (± quartz).

VEINS/FRACTURES: Anhydrite-pyrite veins.

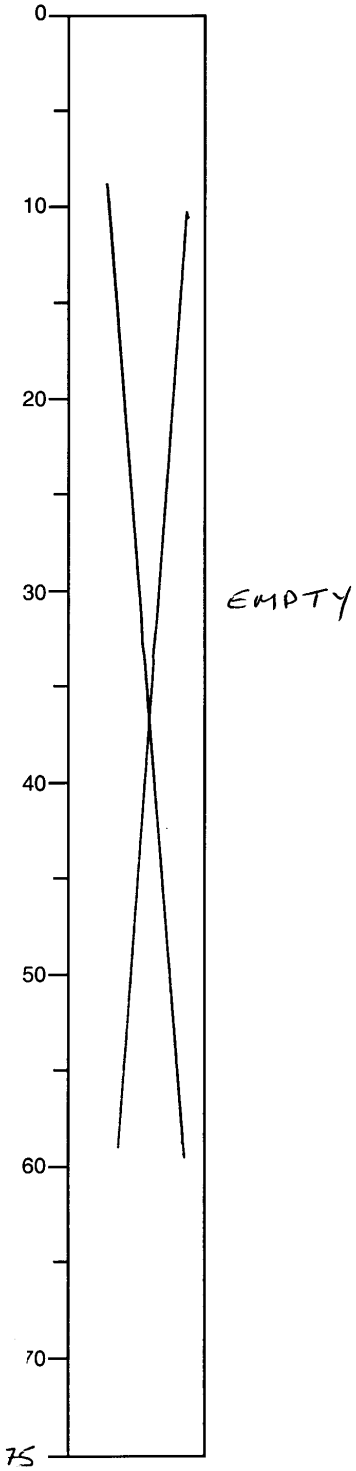
COMMENTS: Pieces 1C and 3 are rubble. Piece 2 has silicified fragments embedded in a matrix of light-gray clay.

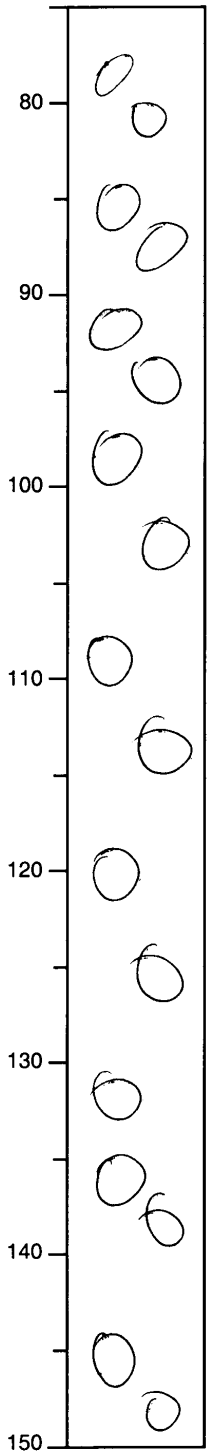
Core Photo

WHOLE CORE

~~STRUCTURAL~~ GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
193	1188F	7Z	1	~~SD~~ S





Rubble 2-8 cm

Light gray *

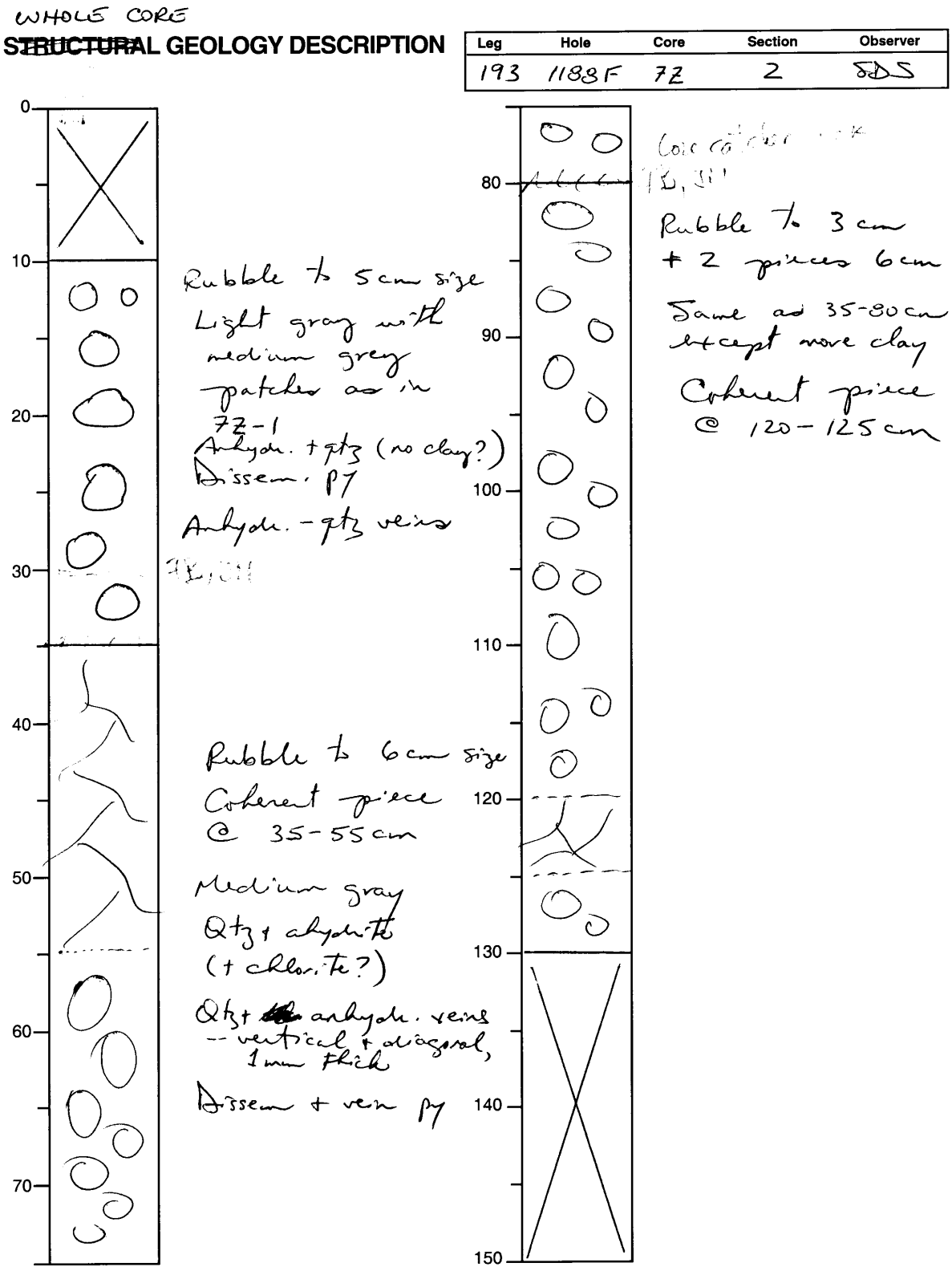
~~S~~ Fairly hard so probably silica-fied

Qtz - anhydrite Seems to have very little clay

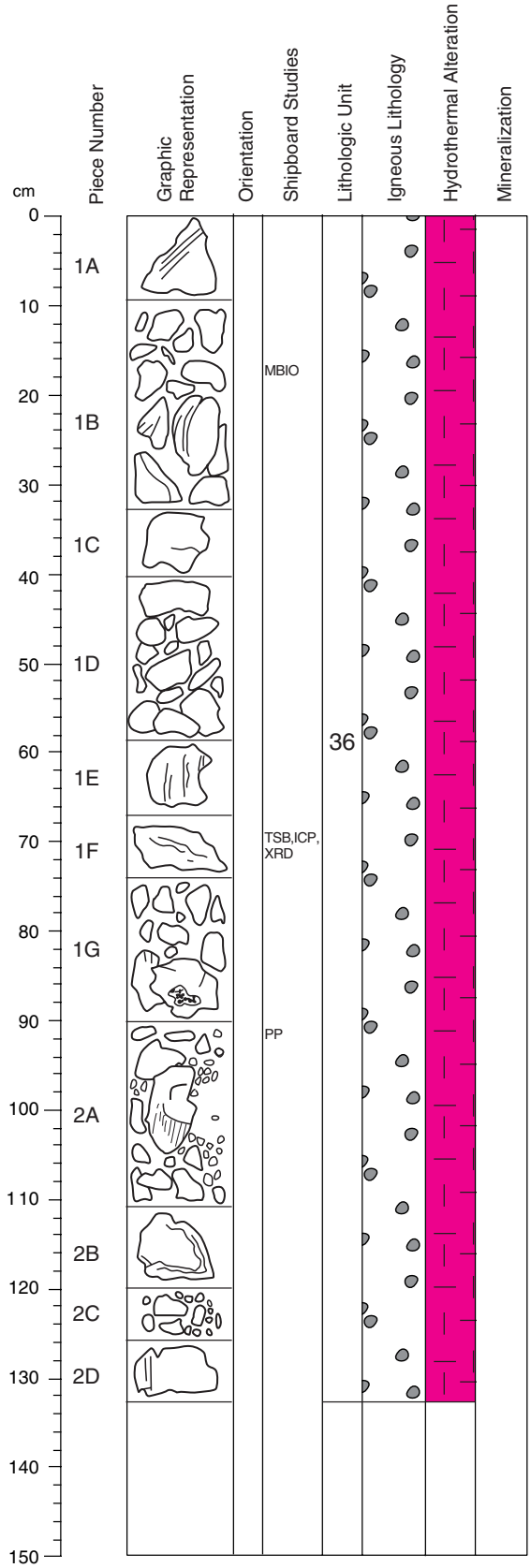
Qtz - anhydr - py veins and fine cracks with only py

* a few bands of darker (medium) gray in the predominantly light gray

Core Photo


WHOLE CORE
STRUCTURAL GEOLOGY DESCRIPTION
Leg 193 Hole 1188F Core 72 Section 2 Observer SDS
Rubble to 5 cm size
Light gray with medium grey patches as in 72-1
Anhydr. + qtz (no clay?)
Dissem. py
Anhydr. - qtz veins
Rubble to 6 cm size
Coherent piece @ 35-55 cm
Medium gray
Qtz + anhydrite (+ chlorite?)
Qtz + anhydr. veins -- vertical + diagonal, 1 mm thick
Dissem + vein py
Rubble to 3 cm + 2 pieces 6 cm
Same as 35-80 cm except more clay
Coherent piece @ 120-125 cm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-8Z-1 (Section top: 236.2 mbsf)

ROCK NAME: Completely altered, silicified, massive, aphyric volcanic rock.

UNIT: 36
Pieces: 1-2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	8Z	1	1	0	236.20
Lower contact:	9Z	1	1A	10	237.80

Thickness (m): 1.60

CONTACTS: None.

PHENOCRYSTS: Rare plagioclase. Trace phenocrysts (up to 2 mm) in Pieces 1G-2D, replaced by white clay.

GROUNDMASS: Very fine-grained. Two cut pieces in Piece 1D exhibit zoned interiors with spherulitic (or variolitic) cores.

VESICLES: None. Thin, elongated and oriented pyrite aggregates (up to 3 mm long) may represent filled flattened vesicles.

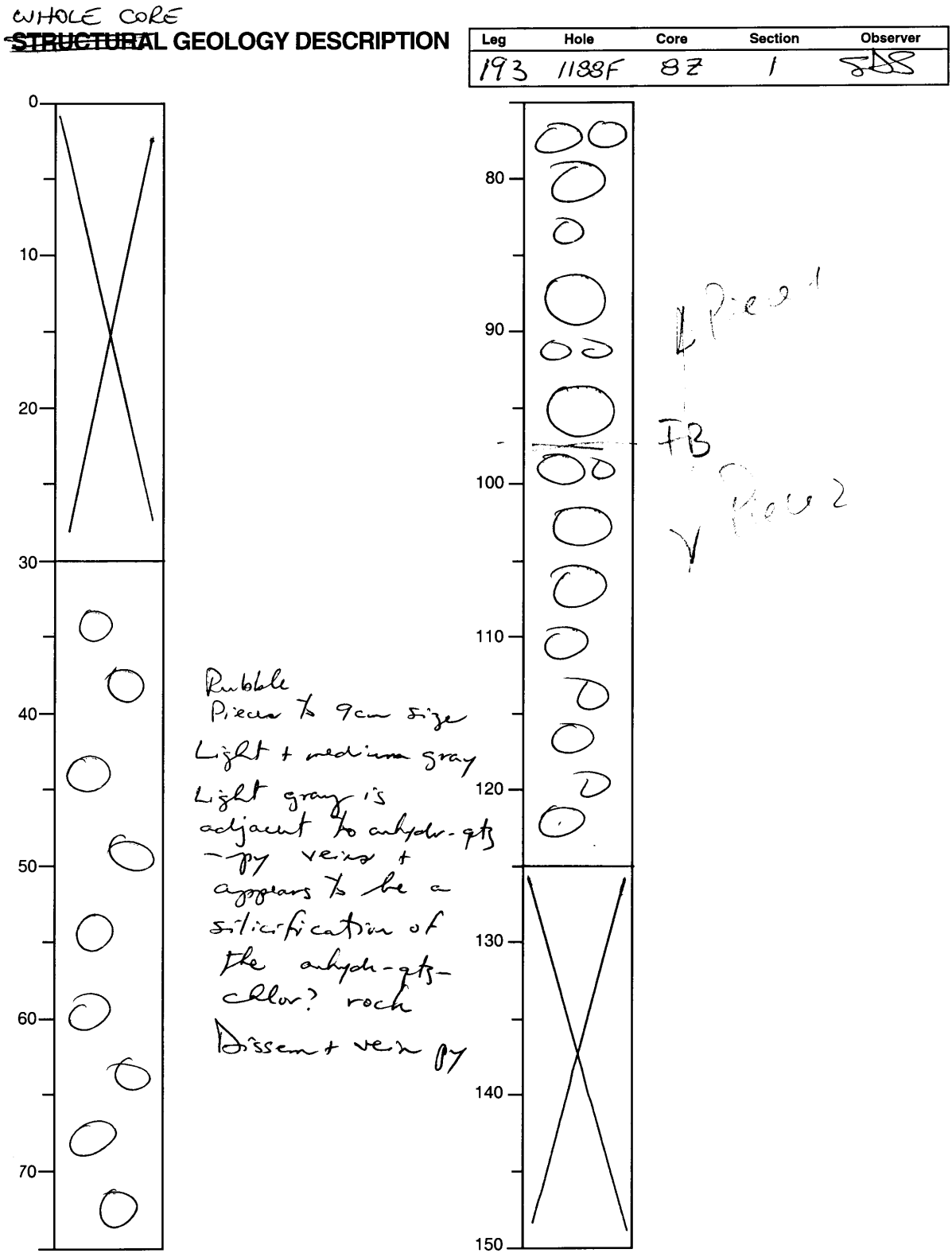
COLOR: Light gray.

STRUCTURE: Massive.

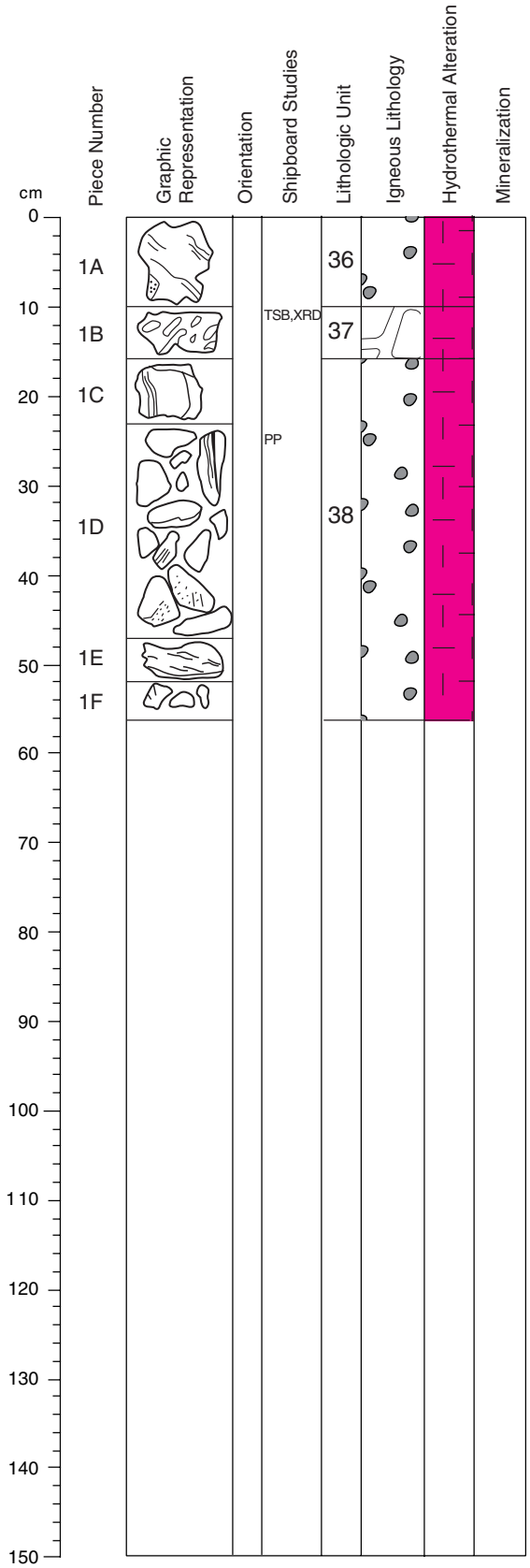
ALTERATION: Intensely silicified rock. Highly silicified, almost cherty or felsic looking irregular halos along anhydrite-pyrite veins. Rock away from halos is soft with patchy anhydrite and pyrite. Colors in halos range from whitish gray to dark gray.

VEINS/FRACTURES: Anhydrite-pyrite veins.

Core Photo


WHOLE CORE
~~STRUCTURAL~~ GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 8Z
Section 1
Observer SDS
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Rubble
Pieces to 9cm size
Light + medium gray
Light gray is adjacent to anhydr-gtz -py veins + appears to be a silicification of the anhydr-gtz-chlor? rock
Dissem + vein py
1 Piece
FB
Piece 2

Core Photo



ADCB Core Description

193-1188F-9Z-1 (Section top: 237.7 mbsf)

ROCK NAME: Completely altered, silicified, massive, aphyric volcanic rock.

UNIT: 36
Pieces: 1A

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	8Z	1	1	0	236.20
Lower contact:	9Z	1	1A	10	237.80

Thickness (m): 1.60

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray to white.

STRUCTURE: Massive.

ALTERATION: Intensely silicified rock. Flame-like zoned to patchy halo, sometimes cut by narrow pyrite veins. Whitish to light gray elongate patches in halos are soft and consist of silica-clay with some anhydrite and pyrite.

VEINS/FRACTURES: Pyrite veinlets.

ROCK NAME: Completely altered, silicified breccia rock.

UNIT: 37
Pieces: 1B.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9Z	1	1B	10	237.80
Lower contact:	9Z	1	1B	16	237.86

Thickness (m): 0.06

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

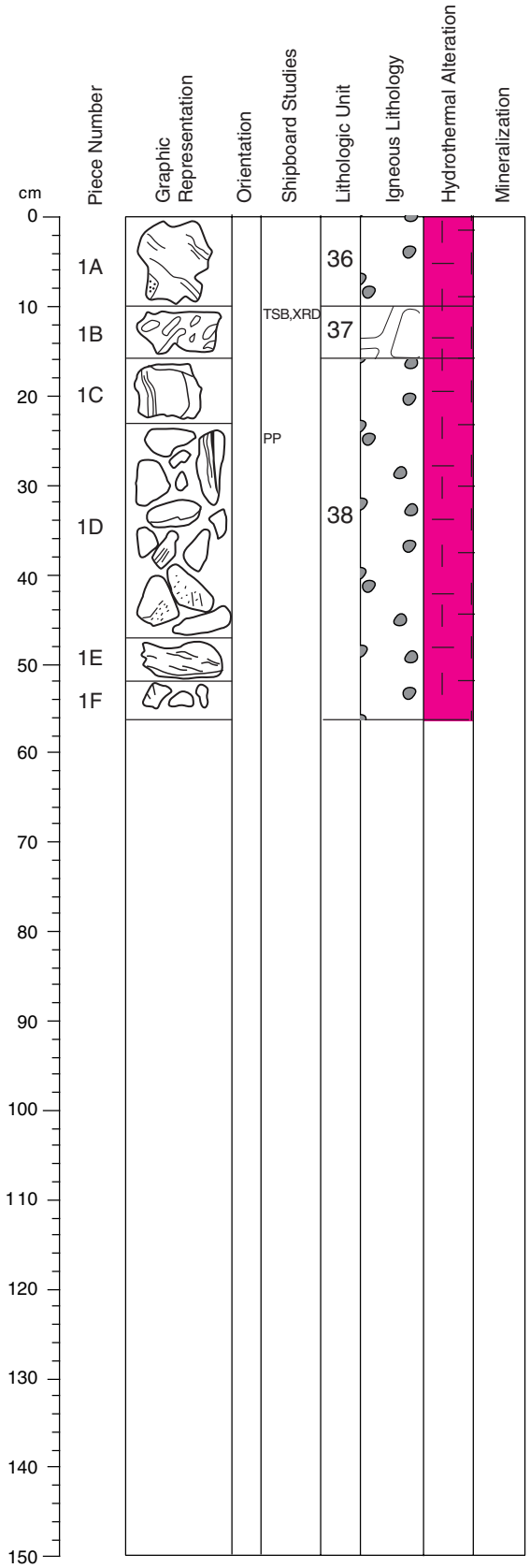
COLOR: Tanish-gray to white.

STRUCTURE: Clastic(?). Irregular to flattened cm-scale “clasts” float in a tan fine-grained matrix.

ALTERATION: Irregular white clasts(?) are soft, anhydrite-clay-quartz-pyrite bearing material. The groundmass is light green and fine-grained with disseminated gray silica-clay. There are dark-gray completely silicified oval patches developed in the piece.

VEINS/FRACTURES: None.

Core Photo



193-1188F-9Z1 (section top: 237.7 mbsf)

ROCK NAME: Completely altered, silicified, massive aphyric volcanic rock.

UNIT: 38.
Pieces: 1C-1F

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9Z	1	1C	16	237.86
Lower contact:	11G	1	6	66	240.40
Thickness (m): 2.54					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray.

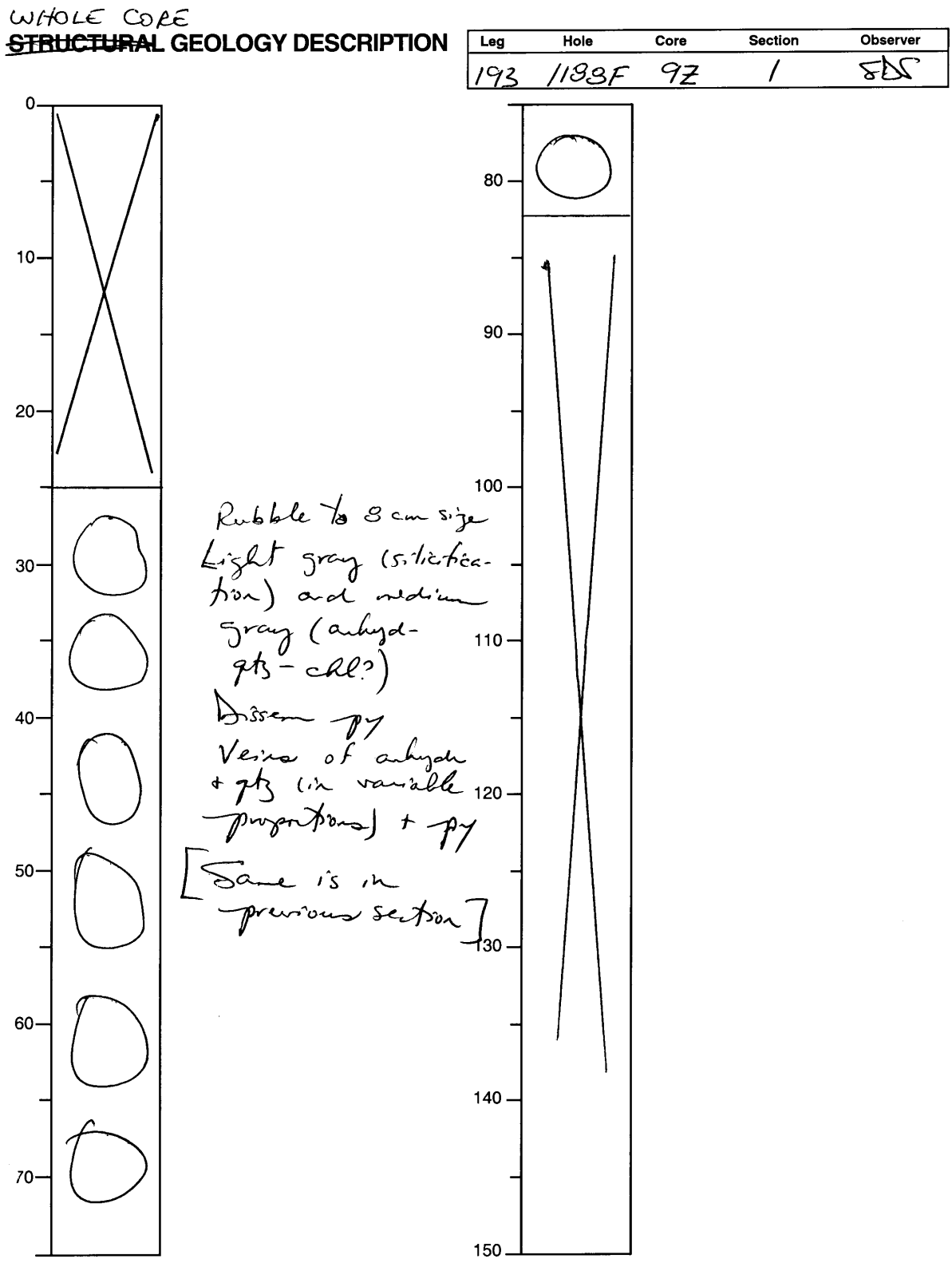
STRUCTURE: Massive.

ALTERATION: Highly silicified rocks. Zoned halos consist of dark gray silicified bands alternating with softer bands that have a bleached appearance. Away from the halos, alteration is pervasive, but anhydrite-pyrite rich as well as quartz-rich patches are developed.

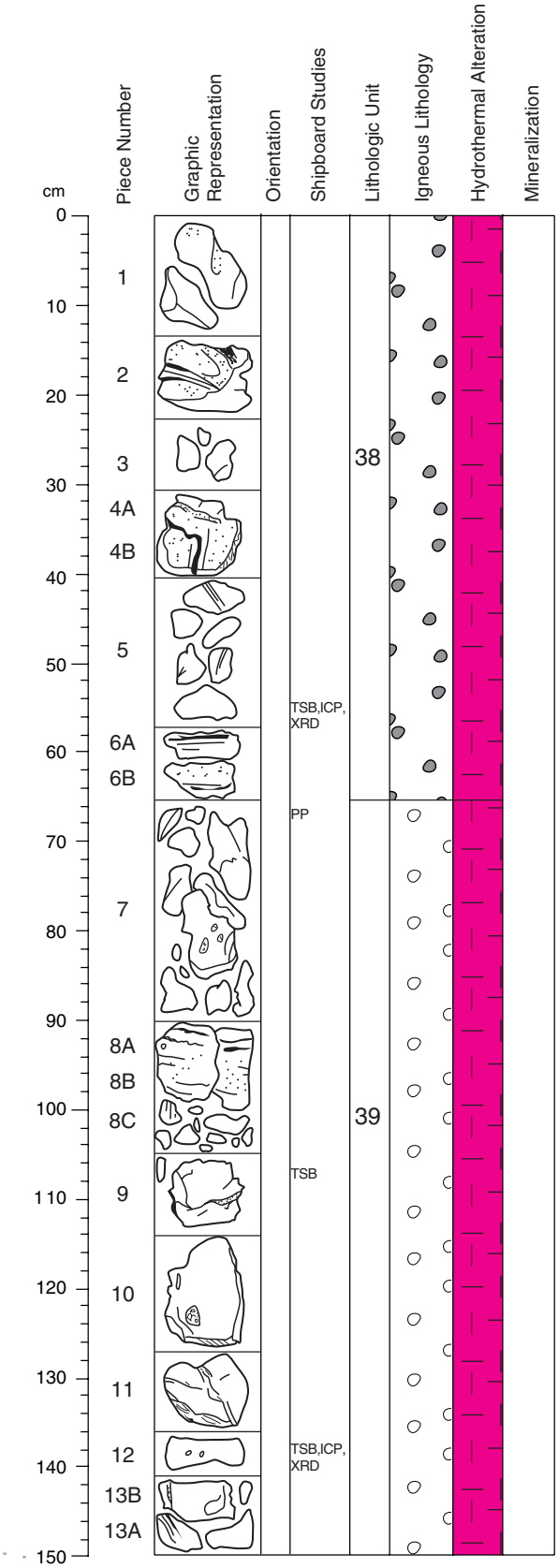
VEINS/FRACTURES: Piece 1E has silica veinlet with a cm-wide halo of patchy silicification. The silica vein and associated halo are cut by a narrow pyrite vein.

COMMENTS: Mostly rubble.

Core Photo


WHOLE CORE
~~STRUCTURAL~~ GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 9Z
Section 1
Observer SDS
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Rubble to 8 cm size
Light gray (silicification) and medium gray (anhydrite - chl?)
Dissem py
Veins of anhydr + gtz (in variable proportions) + py
[Same is in previous section]

Core Photo



1188F-12Z NO RECOVERY

ADCB Core Description

193-1188F-11G-1 (Section top: 238.9 mbsf)

ROCK NAME: Completely altered, silicified, massive, aphyric volcanic rock.
UNIT: 38
Pieces: 1-6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact: :	9Z	1	1C	10	237.86
Lower contact:	11G	1	6	66	240.40

Thickness (m): 2.54

CONTACTS: None.

PHENOCRYSTS: Trace plagioclase (1 mm long) in Pieces 5 and 6.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray.

STRUCTURE: Massive. Piece 2 contains oriented elongate pyrite aggregates, similar to stretched flattened vesicles.

ALTERATION: Highly silicified rocks. Zoned halos along anhydrite-quartz-pyrite veins. There are trace ovoid quartz patches, with pyrite, up to about 5 mm across.

VEINS/FRACTURES: Anhydrite-quartz-pyrite veins. In Piece 4 two anhydrite-quartz-pyrite veinlets cut a cm wide zoned halo associated with an anhydrite-pyrite vein.

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, sparsely vesicular volcanic rock.
UNIT: 39
Pieces: 7-13

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11G	1	7	66	240.40
Lower contact:	13Z	1	3C	80	242.20

Thickness (m): 2.64

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Trace to 1% lath-shaped phenocrysts from 0.5 to 4 mm, commonly aligned, replaced by white clay. In Piece 12 there may be an additional phenocryst type, which is somewhat more blocky and is replaced by soft milky-blue clay.

GROUNDMASS: Very fine-grained.

VESICLES: Up to 3% round-ovoid vesicles, commonly lined by pyrite-anhydrite, most less than 1 mm across, some are several mm across.

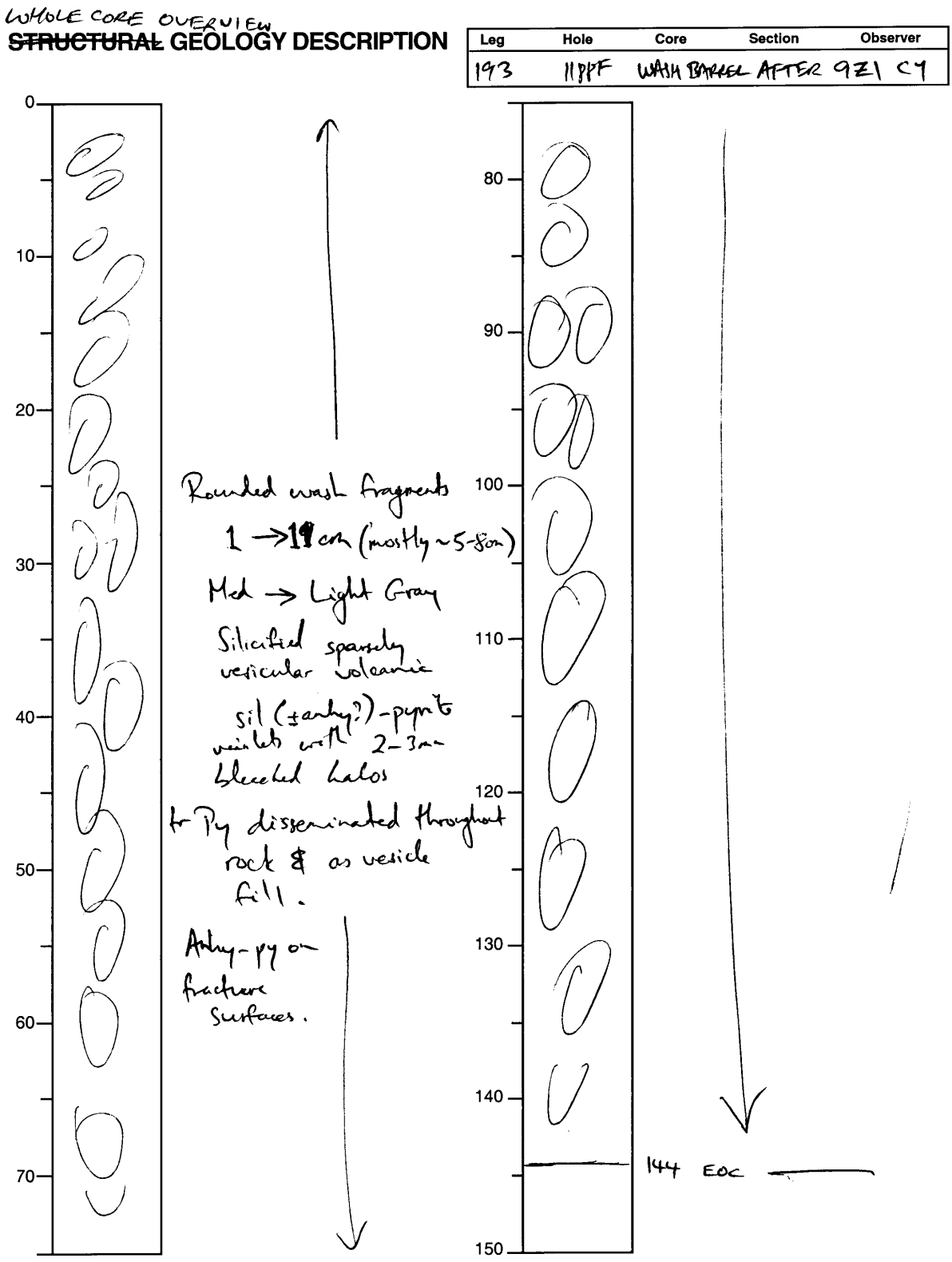
COLOR: Light gray.

STRUCTURE: Massive. Aligned plagioclase phenocryst.

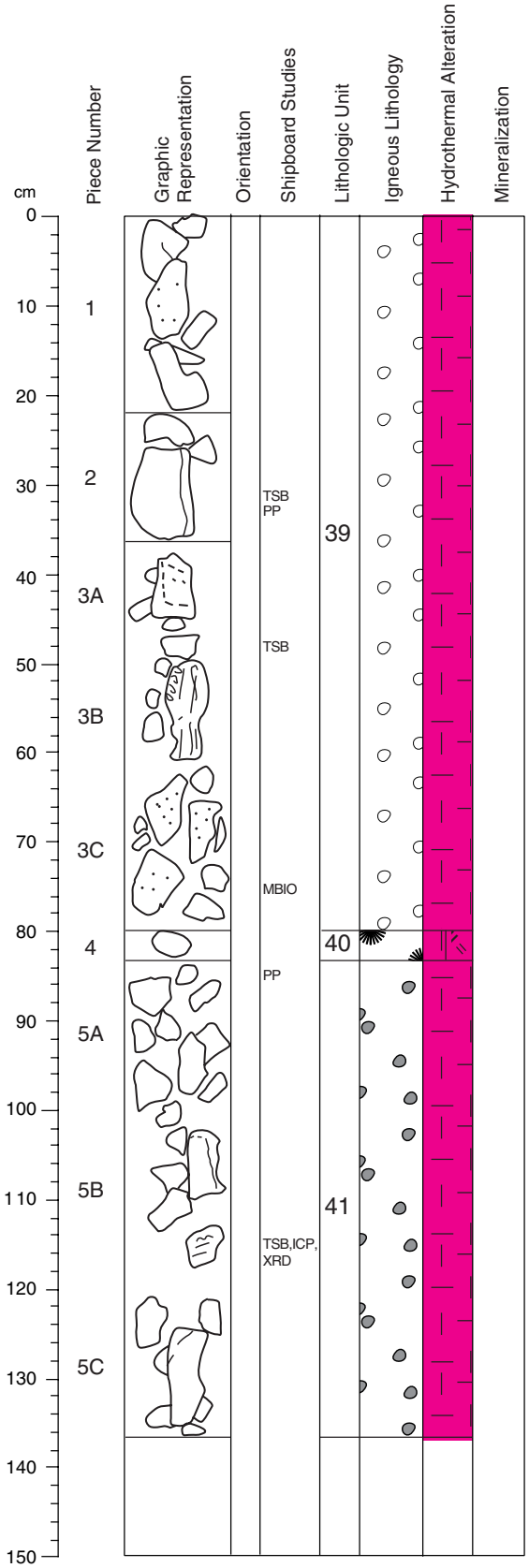
ALTERATION: Highly silicified rocks. Plagioclase phenocrysts are replaced by soft, white, clayey material. Pyrite is abundant in groundmass and filling vesicles together with anhydrite. Zoned halos are associated with anhydrite veins, some of which are preserved on the surfaces of some pieces. Vesicles are lined with clay-silica and pyrite and often filled with blocky anhydrite. Piece 8 has acicular, clear crystals overgrowing anhydrite and pyrite in vugs.

VEINS/FRACTURES: Quartz-rich veins in Pieces 10, 11, and 13. Pyrite-anhydrite veinlets are common and cut quartz-rich veins.

Core Photo


WHOLE CORE OVERVIEW
~~STRUCTURAL~~ GEOLOGY DESCRIPTION
Leg
Hole
Core
Section
Observer
193
11PPF
WASH BARREL AFTER 9Z1 C4
Rounded wash fragments
1 →19 cm (mostly ~5-6cm)
Med → Light Gray
Silicified sparsely vesicular volcanic
sil (±anhy?)-pyr veinlets with 2-3mm bleached halos
to Py disseminated throughout rock & as vesicle fill.
Anhy-py on fracture surfaces.
144 EOC
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-13Z-1 (Section top: 241.4 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, sparsely vesicular volcanic rock.

UNIT: 39
Pieces: 1-3C

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11G	1	7	66	240.40
Lower contact:	13Z	1	3C	80	242.20

Thickness (m): 2.64

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Trace to 1% lath-shaped phenocrysts from 0.1 to 3 mm, commonly aligned, replaced by white clay.

GROUNDMASS: Very fine-grained.

VESICLES: Up to 4% round to ovoid vesicles, commonly lined by pyrite-anhydrite, most less than 1 mm across, some are several mm across.

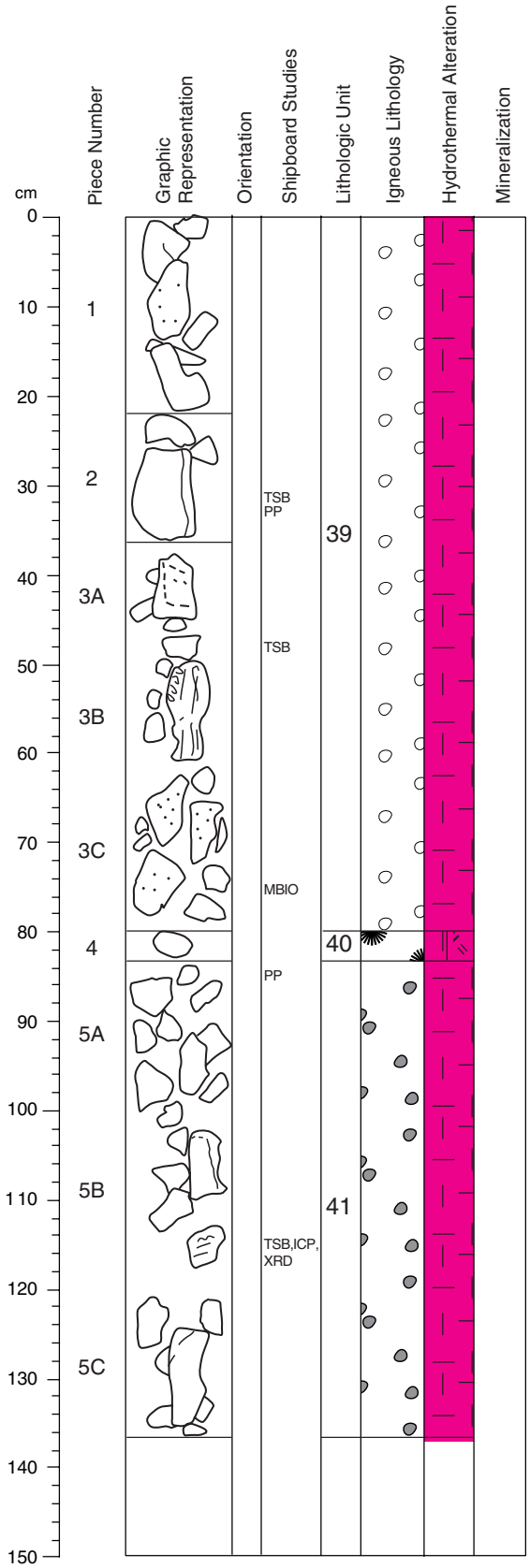
COLOR: Light gray.

STRUCTURE: Cut rock in Piece 3B exhibits flow banding with layers of autoclastic breccia, oriented parallel to the alignment of oriented plagioclase phenocrysts in the adjacent vesicular part of the rock. The vesicles are ovoid, oriented obliquely to the trend defined by the phenocrysts and the flow banding.

ALTERATION: Highly silicified rocks. Plagioclase phenocrysts are replaced by soft, white, clayey material. Pyrite is abundant in groundmass and filling vesicles together with anhydrite. Zoned halos are associated with anhydrite veins, some of which are preserved on the surfaces of some pieces. Open vesicles are lined with clay-silica and pyrite and often filled with blocky anhydrite.

VEINS/FRACTURES: Locally silica veins with silicification halos are developed.

Core Photo



193-1188F-13Z-1 (Section top: 241.4 mbsf)

ROCK NAME: Completely altered, spherulitic volcanic rock.

UNIT: 40
Piece: 4.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13Z	1	4	80	242.20
Lower contact:	13Z	1	4	83	242.23

Thickness (m): 0.03

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: White spots (spherulites) in gray-green groundmass.

STRUCTURE: Spherulitic, spotty.

ALTERATION: White siliceous (minor clay) spherulites occur in a dark green silica-chlorite groundmass.

VEINS/FRACTURES: None.

COMMENTS: Single piece of spherulitic volcanic rock. Contains 50% isolated, white, highly altered spherulites.

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 41
Pieces: 5A-5C.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13Z	1	5	83	242.23
Lower contact:	15Z	1	6	44	250.84

Thickness (m): 8.61

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1%, lath shaped, size range: 0.1 to 2 mm. Commonly replaced by white clay (±silica).

GROUNDMASS: Very fine-grained.

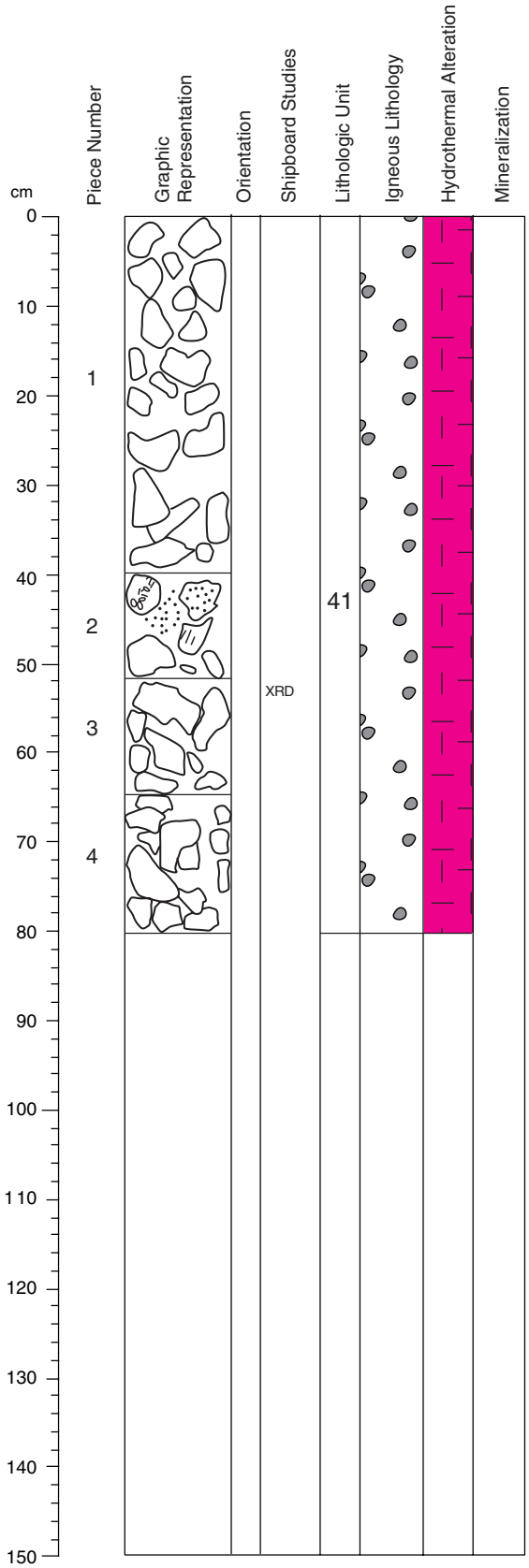
VESICLES: Less than 2% to absent, generally <1 mm, occasionally flat, elongate (up to 3 mm). Some pieces show a spotty texture with anhydrite-pyrite aggregates possibly representing amygdales after microvesicles (<1 mm diameter).

COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Highly silicified. Remnant plagioclase phenocrysts replaced by bluish white clay. Microvesicles(?) filled by anhydrite and pyrite.

Core Photo



ADCB Core Description

193-1188F-13Z-2 (Section top: 242.5 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 41
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13Z	1	5	83	242.23
Lower contact:	15Z	1	6	44	250.84

Thickness (m): 8.61

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1%, lath shaped, size range: 0.1 to 2 mm. Commonly replaced by white clay (±silica).

GROUNDMASS: Very fine-grained.

VESICLES: Less than 2% to absent, generally <1 mm, occasionally flat, elongate (up to 3 mm). Some pieces show a spotty texture with anhydrite-pyrite aggregates possibly representing amygdales after microvesicles (<1 mm diameter).

COLOR: Light gray.

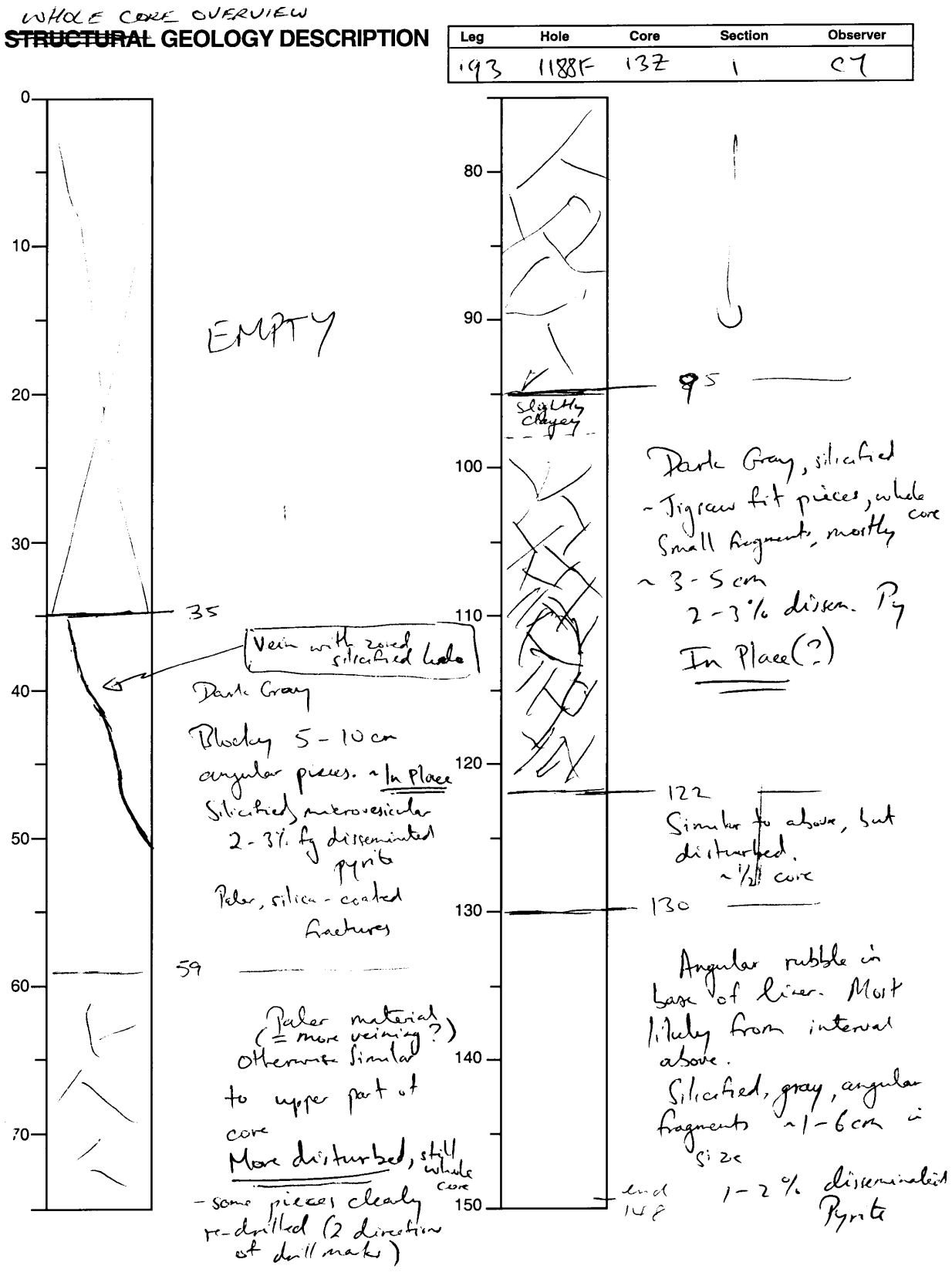
STRUCTURE: Massive.

ALTERATION: Highly silicified. Remnant plagioclase phenocrysts replaced by bluish white clay. Microvesicles(?) filled by anhydrite and pyrite.

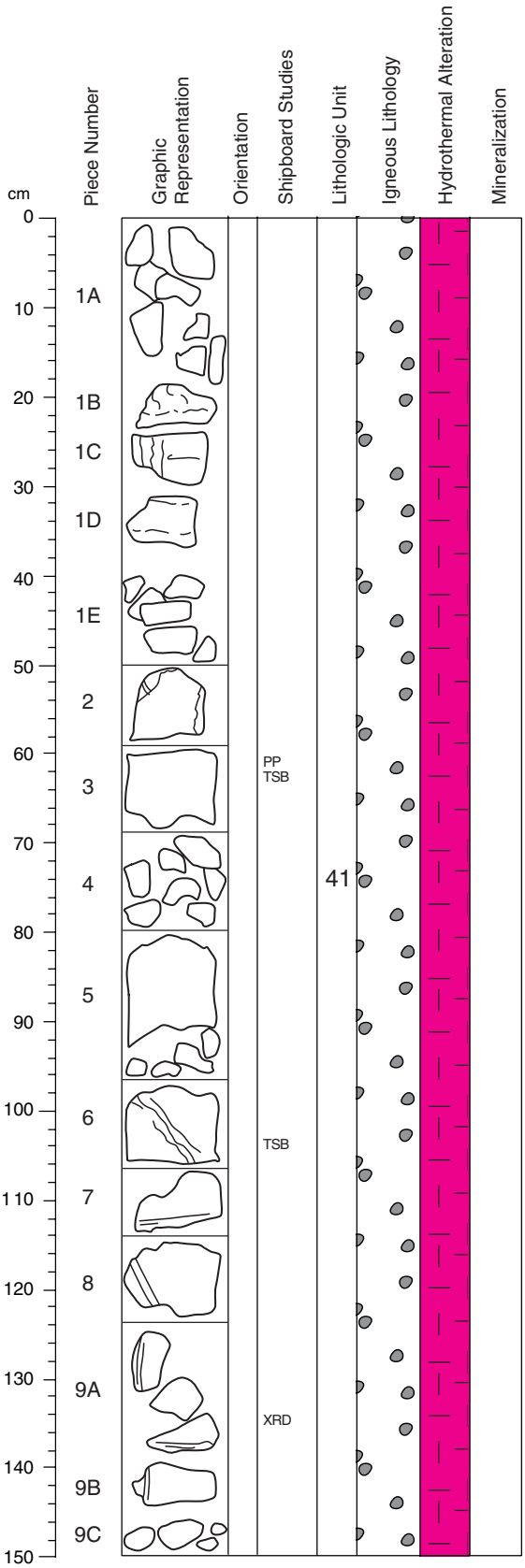
VEINS/FRACTURES: Hairline to several mm thick anhydrite-pyrite veins and veinlets, predominantly with mm to cm wide siliceous alteration halo.

COMMENTS: Occasional round to bulbous, irregular dark gray siliceous patches within the groundmass. This section consists mainly of rubble.

Core Photo


WHOLE CORE OVERVIEW
STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 137
Section 1
Observer CT
EMPTY
35
Vein with zoned silicified halo
Dark Gray
Blocky 5-10 cm angular pieces. ~In Place
Silicified, microvesicular
2-3% fg disseminated pyrite
Paler, silica-coated fractures
59
(Paler material (= more veining?) Otherwise similar to upper part of core
More disturbed, still whole core
- some pieces clearly re-drilled (2 direction of drill marks)
95
slightly clayey
Dark Gray, silicified
- Jigsaw fit pieces, whole core
Small fragments, mostly ~3-5 cm
2-3% disem. Py
In Place(?)
122
Similar to above, but disturbed.
~1/2 core
130
Angular rubble in base of liner. Most likely from interval above.
Silicified, gray, angular fragments ~1-6 cm in size
1-2% disseminated Pyrite
end 147

Core Photo



ADCB Core Description

193-1188F-14Z-1 (Section top: 245.9 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 41
Pieces: 1 to 9

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13Z	1	5	83	242.23
Lower contact:	15Z	1	6	44	250.84

Thickness (m): 8.61

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1%, lath shaped, size range: 0.1 to 2 mm. Commonly replaced by white clay (±silica).

GROUNDMASS: Very fine-grained.

VESICLES: Less than 2% to absent, generally <1 mm, occasionally flat, elongate (up to 3 mm). Some pieces show a spotty texture with anhydrite-pyrite aggregates or silica possibly representing amygdales after microvesicles (<1 mm diameter).

COLOR: Light gray.

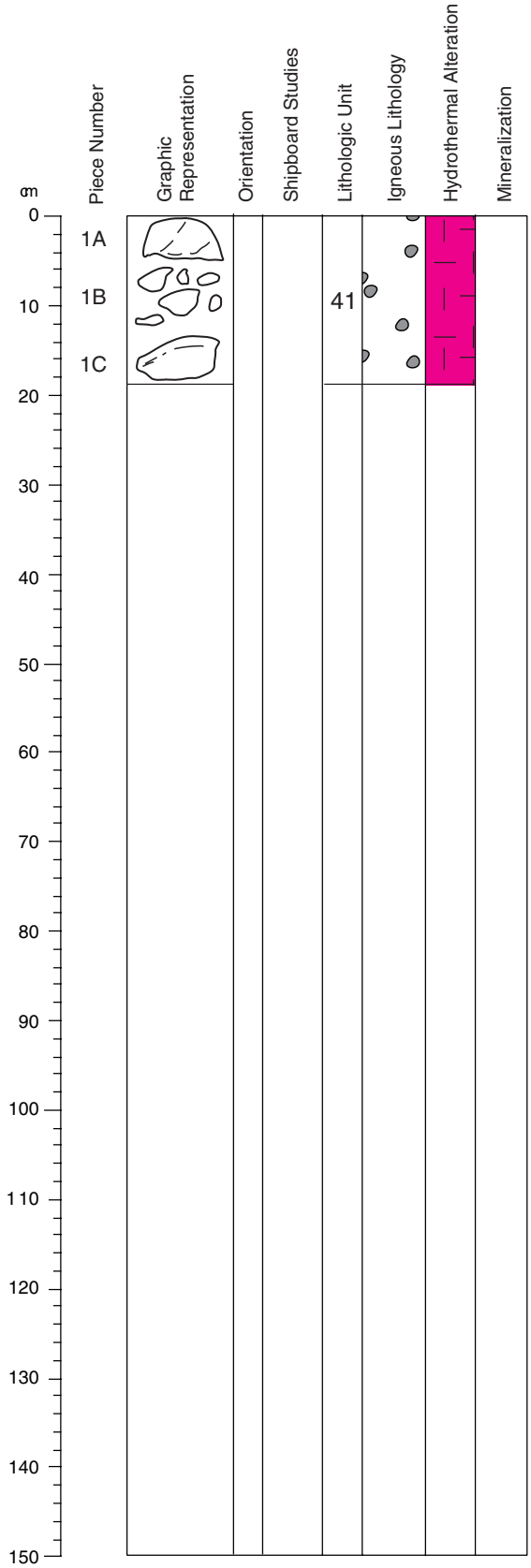
STRUCTURE: Massive.

ALTERATION: Highly silicified. Remnant plagioclase phenocrysts replaced by bluish white clay. Microvesicles (?) filled by anhydrite and pyrite. Pieces 2, 3, 5, and 6 have a slight greenish tinge indicating that they may be more chloritic.

VEINS/FRACTURES: Hairline to several mm thick anhydrite-pyrite veins and veinlets, predominantly with mm to cm wide siliceous alteration halo.

COMMENTS: Occasional spherical, irregular dark gray siliceous patches within the groundmass. Pieces 1B, 1C, and 1D contain 1 to 2 cm wide clastic zones. These pieces probably represent an autoclastic zone.

Core Photo



ADCB Core Description

193-1188F-14Z-2 (Section top: 247.41 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 41
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13Z	1	5	83	242.23
Lower contact:	15Z	1	6	44	250.84

Thickness (m): 8.61

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1%, lath shaped, size range: 0.1 to 2 mm. Commonly replaced by white clay (± silica).

GROUNDMASS: Very fine-grained.

VESICLES: Less than 2% to absent, generally <1 mm, occasionally flat, elongate (up to 3 mm). Some pieces show a spotty texture with anhydrite-pyrite aggregates possibly representing amygdales after microvesicles (<1 mm diameter). Locally, vesicles (1 to 2 mm diameter) lined with or filled by silica, pyrite and/or anhydrite.

COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Highly silicified. Remnant plagioclase phenocrysts replaced by bluish white clay. Microvesicles (?) filled by anhydrite and pyrite.

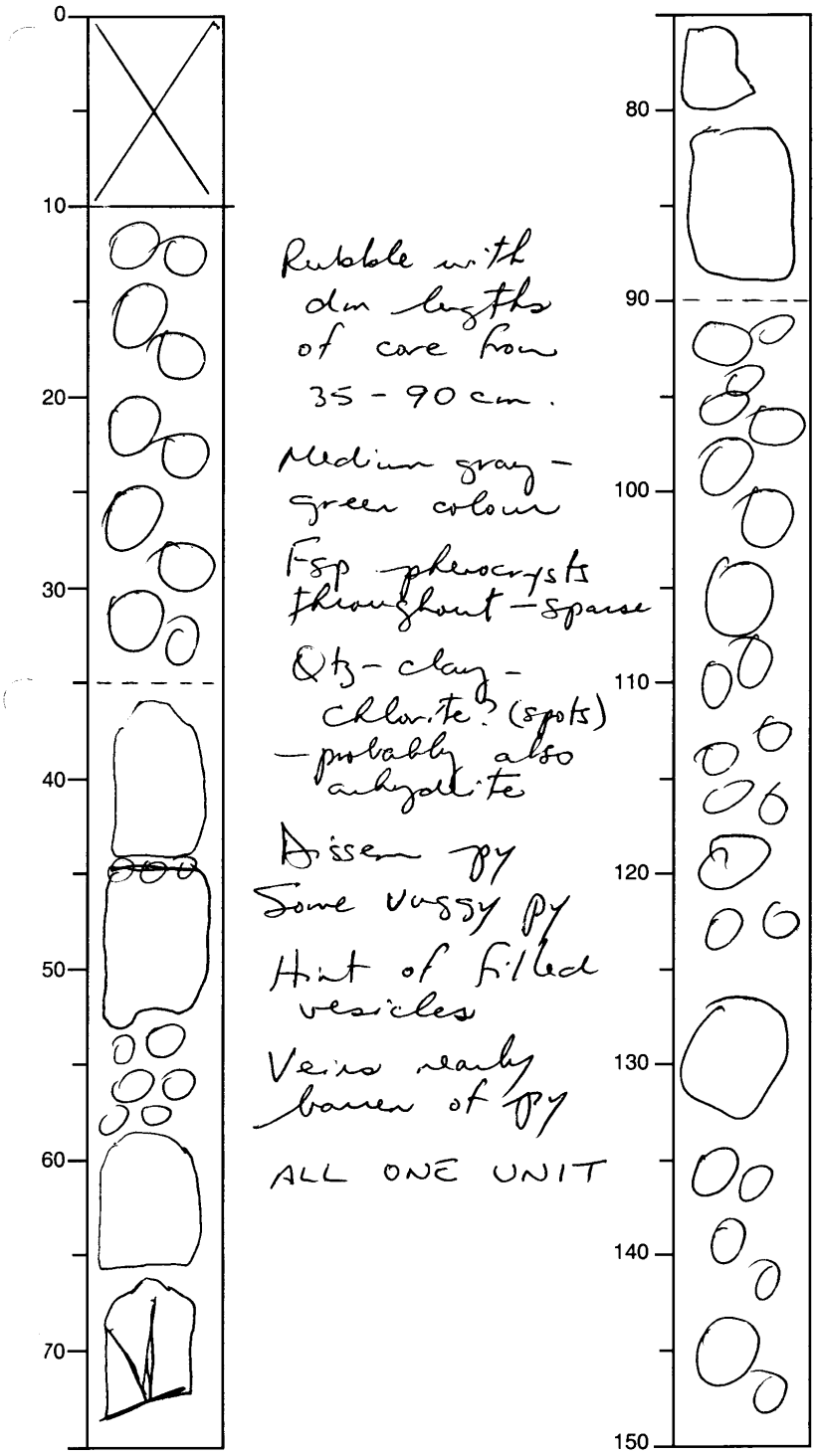
VEINS/FRACTURES: Hairline to several mm thick anhydrite-pyrite veins and veinlets, predominantly with mm to cm wide siliceous alteration halo.

COMMENTS: Occasional spherical, irregular dark gray siliceous patches within the groundmass.

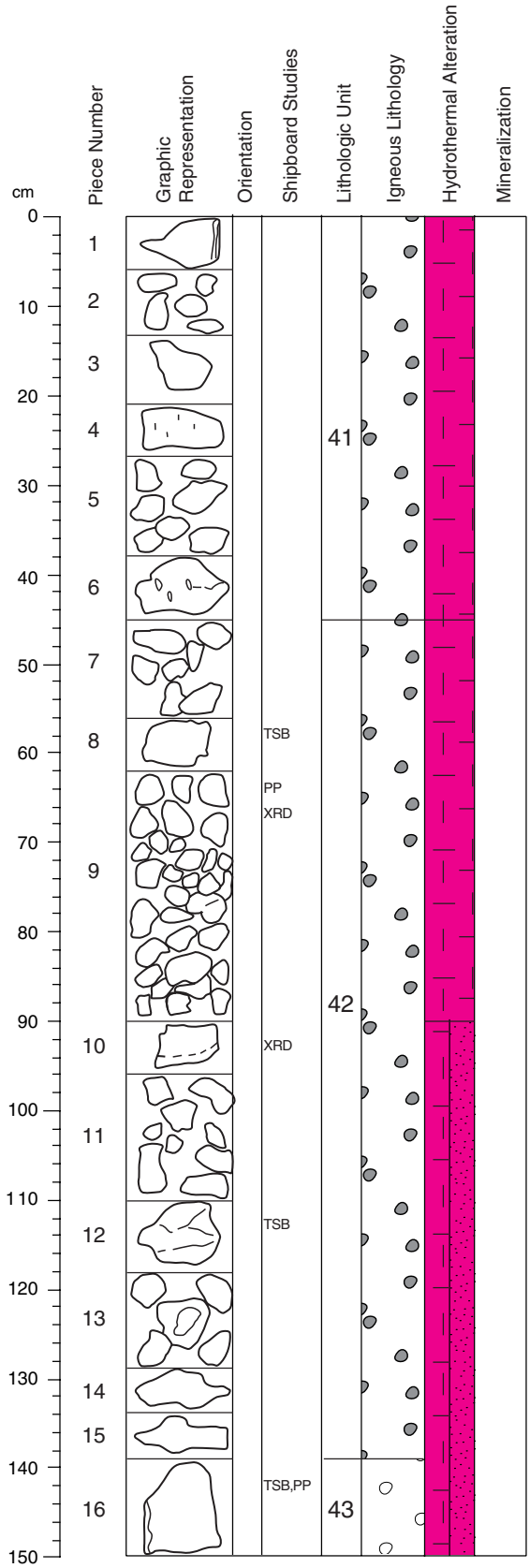
Core Photo

STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
193	1188F	14	Z	SDS



Core Photo



ADCB Core Description

193-1188F-15Z-1 (Section top: 250.4 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 41
Pieces: 1 to 6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13Z	1	5	83	242.23
Lower contact:	15Z	1	6	44	250.84

Thickness (m): 8.61

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1%, lath shaped, size range: 0.1 to 2 mm. Commonly replaced by white clay (± silica).

GROUNDMASS: Very fine-grained.

VESICLES: Less than 2% to absent, generally <1 mm, occasionally flat, elongate (up to 3 mm). Some pieces show a spotty texture with anhydrite-pyrite aggregates possibly representing amygdales after microvesicles (<1 mm diameter).

COLOR: Light gray.

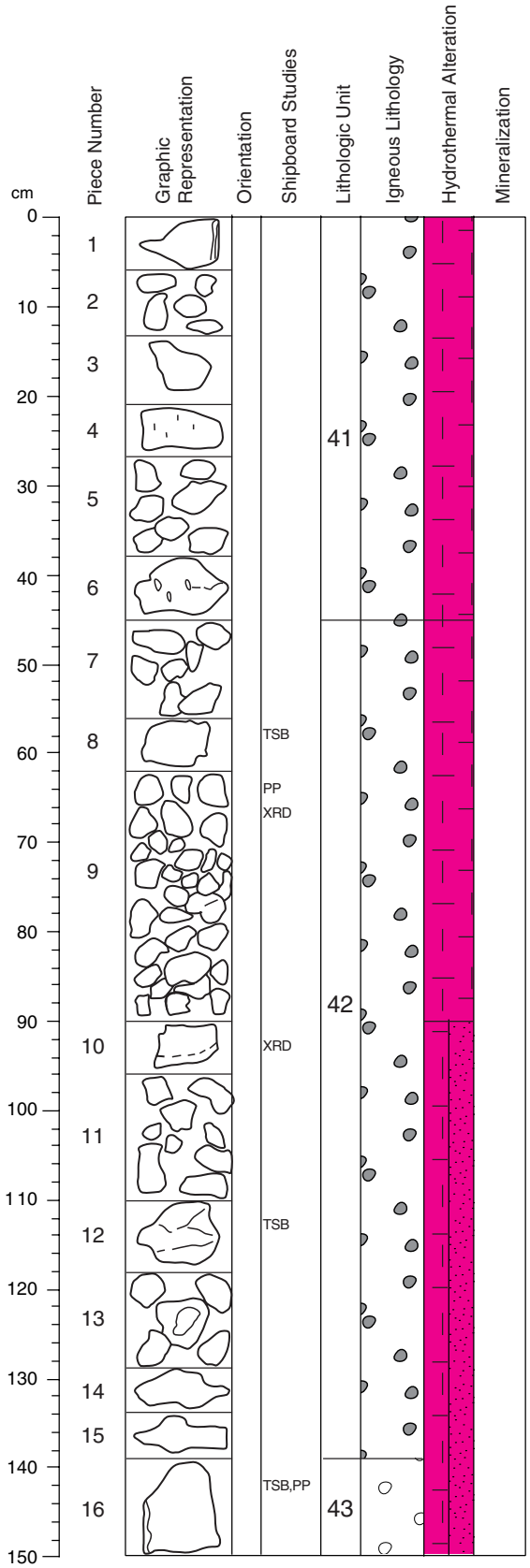
STRUCTURE: Massive.

ALTERATION: Highly silicified. Remnant plagioclase phenocrysts replaced by bluish white clay. Microvesicles (?) filled by anhydrite and pyrite.

VEINS/FRACTURES: Hairline to several mm thick anhydrite-pyrite veins and veinlets, predominantly with mm to cm wide siliceous alteration halo.

COMMENTS: Occasional spherical, irregular dark gray siliceous patches within the groundmass.

Core Photo



193-1188F-15Z-1 (Section top: 250.4 mbsf)

ROCK NAME: Completely altered, silicified, aphyric, massive volcanic rock.

UNIT: 42

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15Z	1	7	44	250.84
Lower contact:	15Z	1	15	139	251.79

Thickness (m): 0.95

CONTACTS: None.

PHENOCRYSTS: None to traces of clay altered plagioclase.

GROUNDMASS: Very fine-grained.

VESICLES: Locally 1%, maximum dimensions 1 mm x 2 to 3 mm.

COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Highly silicified. Vesicles filled or lined with silica-pyrite.

VEINS/FRACTURES: Hairline anhydrite-pyrite veins and veinlets, commonly with <1 to 3 mm wide siliceous alteration halos.

COMMENTS: This unit is distinct from Units 41 and 43 because of the near absence of phenocrysts.

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric volcanic rock.

UNIT: 43
Pieces: 16

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15Z	1	16	139	251.79
Lower contact:	16Z	1	1B	18	255.08

Thickness (m): 3.29

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1%, lath-shaped, size range: 0.1 mm to 1 mm (locally 3 mm). Typically altered to clay.

GROUNDMASS: Very fine-grained.

VESICLES: Locally 1%, round to elongate, maximum dimensions 2 mm x 10 mm.

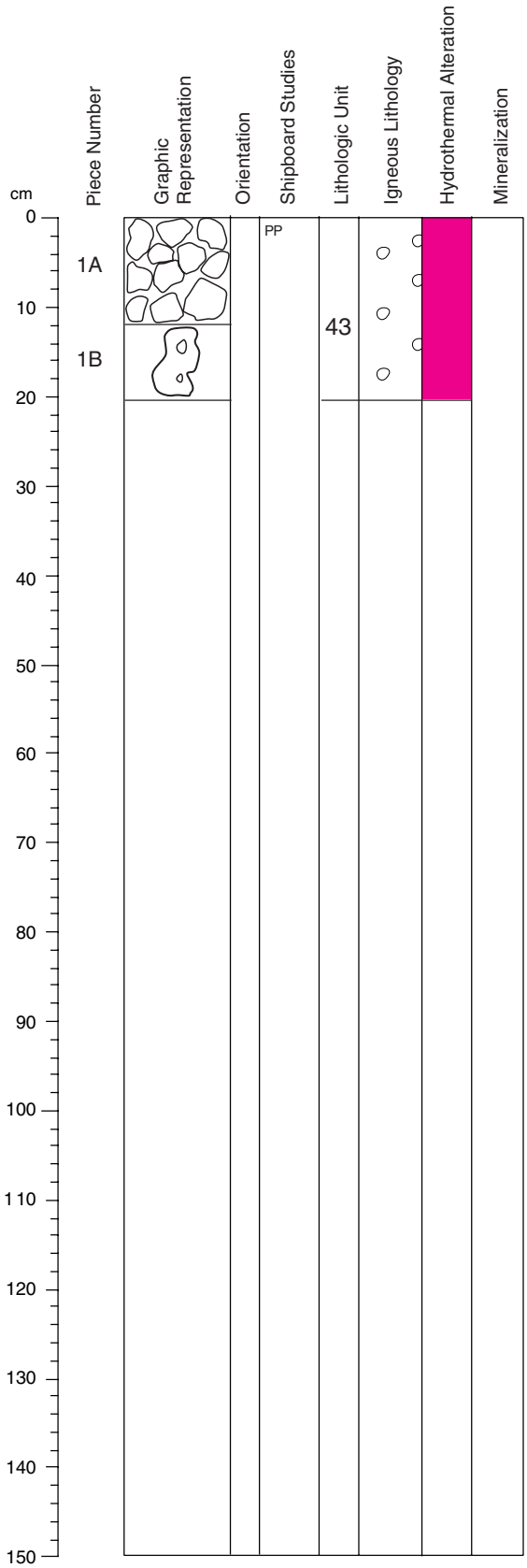
COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Highly silicified. Vesicles filled or lined with silica-pyrite.

VEINS/FRACTURES: 1 to 2 mm wide subvertical anhydrite veins with 5 mm siliceous halo surrounded in turn by 10 mm wide halo of bleaching.

Core Photo



ADCB Core Description

193-1188F-15Z-2 (Section top: 251.9 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric volcanic rock.

UNIT: 43
Pieces: 1A to 1B

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15Z	1	16	139	251.79
Lower contact:	16Z	1	1B	18	255.08

Thickness (m): 3.29

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1%, lath-shaped, size range: 0.1 mm to 1 mm (locally 3 mm). Typically altered to clay.

GROUNDMASS: Very fine-grained.

VESICLES: Locally 1%, round to elongate, maximum dimensions 2 mm x 10 mm.

COLOR: Light gray.

STRUCTURE: Massive.

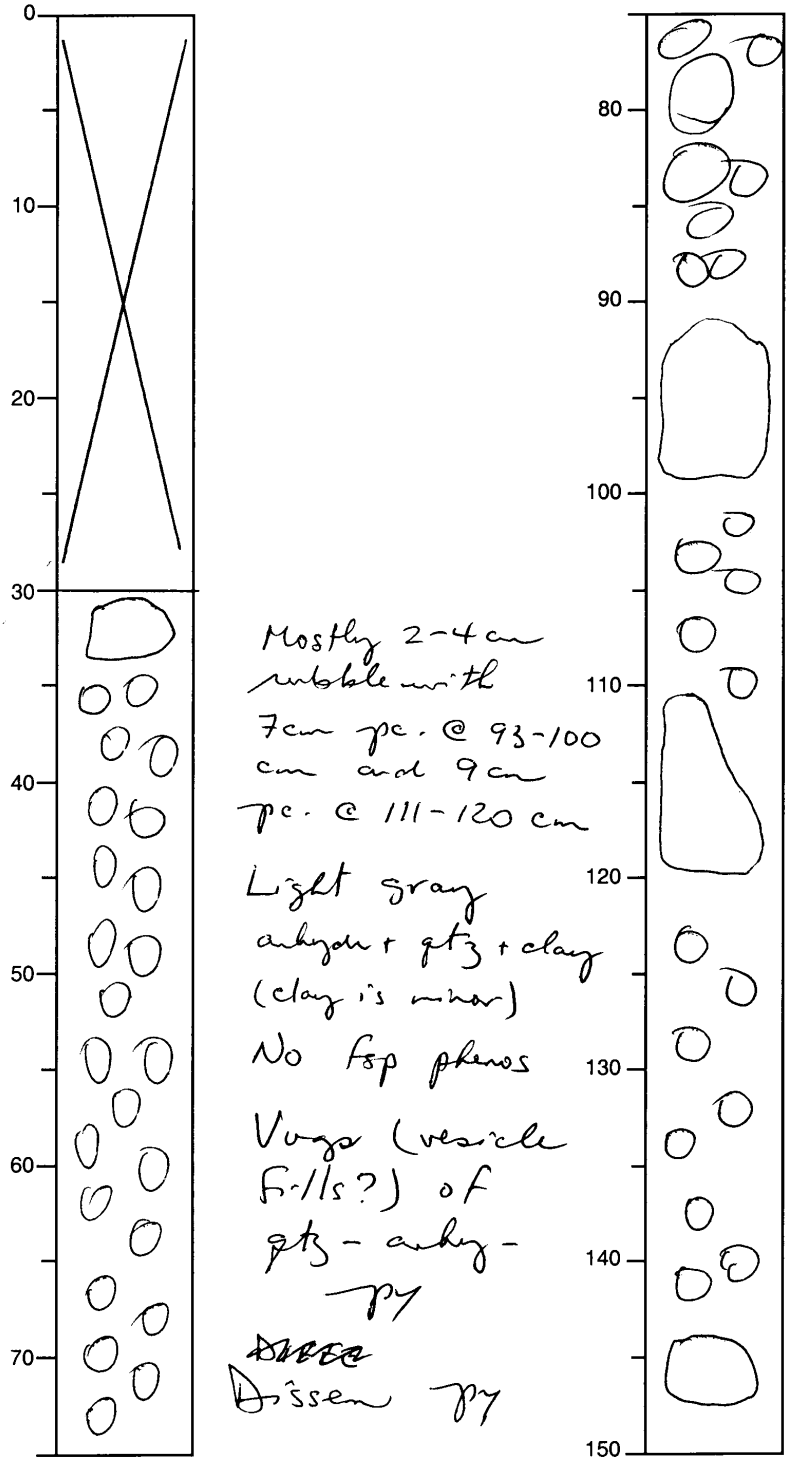
ALTERATION: Highly silicified. Vesicles filled or lined with silica-pyrite.

VEINS/FRACTURES: Few hairline pyrite veinlets with up to 0.5 mm wide anhydrite selvages in Piece 1B.

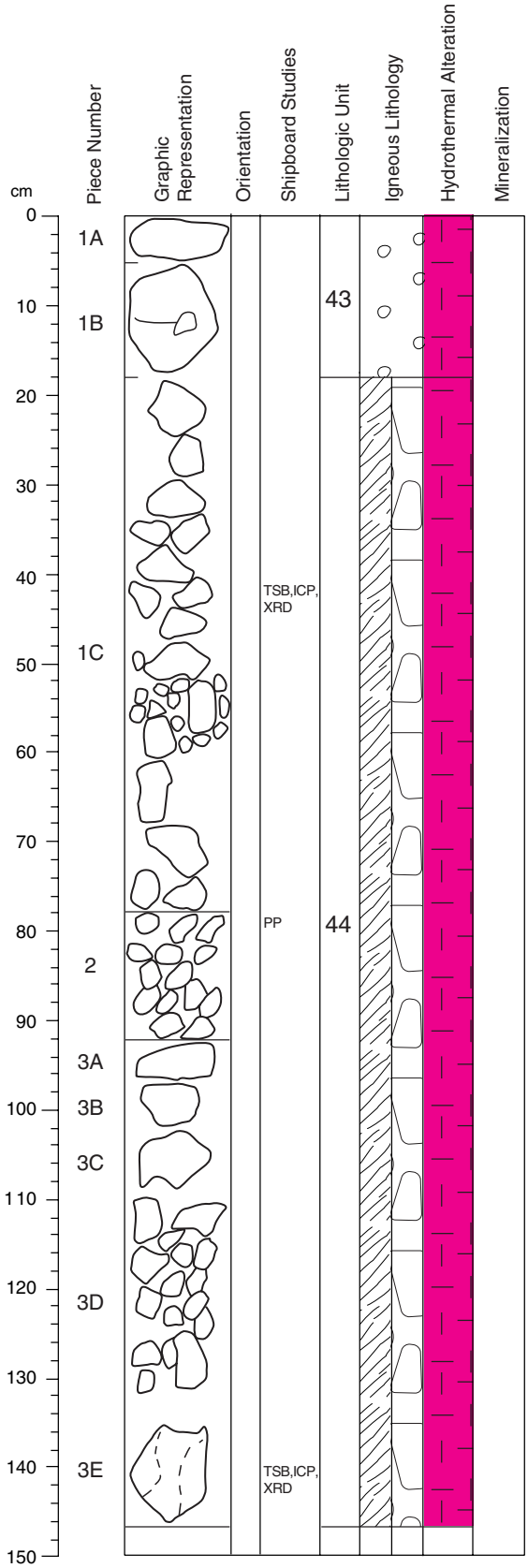
Core Photo

STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
193	1188F	15Z	1	SDS



Core Photo



ADCB Core Description

193-1188F-16Z-1 (Section top: 254.9 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric volcanic rock.

UNIT: 43
Pieces: 1A to 1B

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15Z	1	16	139	251.79
Lower contact:	16Z	1	1B	18	255.08

Thickness (m): 3.29

CONTACTS: None.

PHENOCRYSTS: Plagioclase. Around 1 %, lath-shaped, size range: 0.1 mm to 1 mm (locally 3 mm). Typically altered to clay.

GROUNDMASS: Very fine-grained.

VESICLES: Locally 1%, round to elongate, maximum dimensions 2 mm x 10 mm.

COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Highly silicified. Vesicles filled or lined with silica-pyrite.

VEINS/FRACTURES: None.

ROCK NAME: Completely altered, silicified, brecciated volcanic rock.

UNIT: 44
Pieces: 1C to 3E

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16Z	1	1C	18	255.08
Lower contact:	16Z	1	3E	148	256.38

Thickness (m): 1.30

CONTACTS: None.

PHENOCRYSTS: None except for occasional plagioclase in some pieces (<<1%).

GROUNDMASS: Very fine-grained.

VESICLES: None, except for one piece, which contains elongate vesicles in top part of Piece 1C.

COLOR: Light gray.

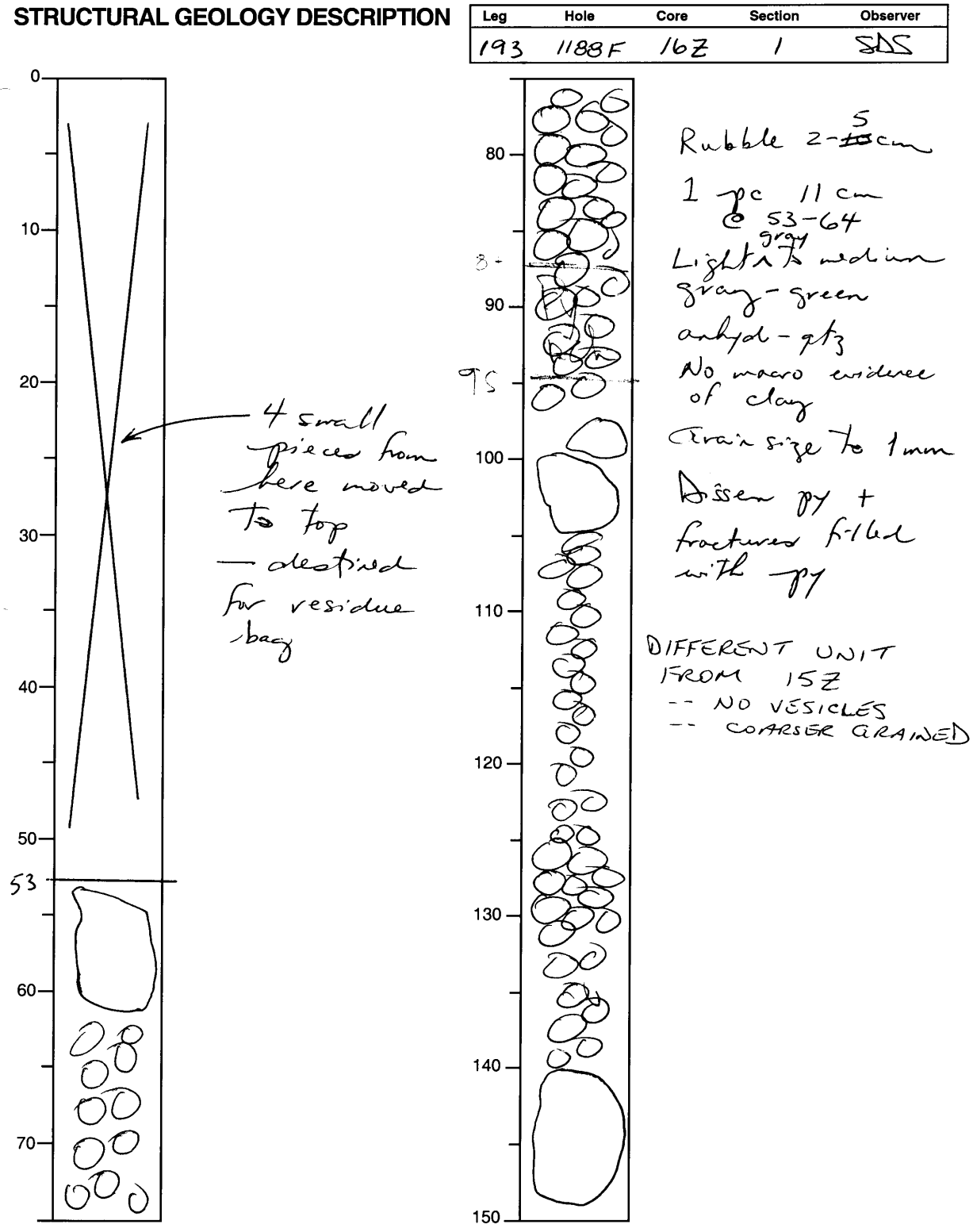
STRUCTURE: Clastic. Abundant light gray siliceous aphyric clasts with fibrous, laminar internal texture (flow banding, tube vesicles?), densely packed in a dark gray siliceous groundmass.

ALTERATION: Highly silicified.

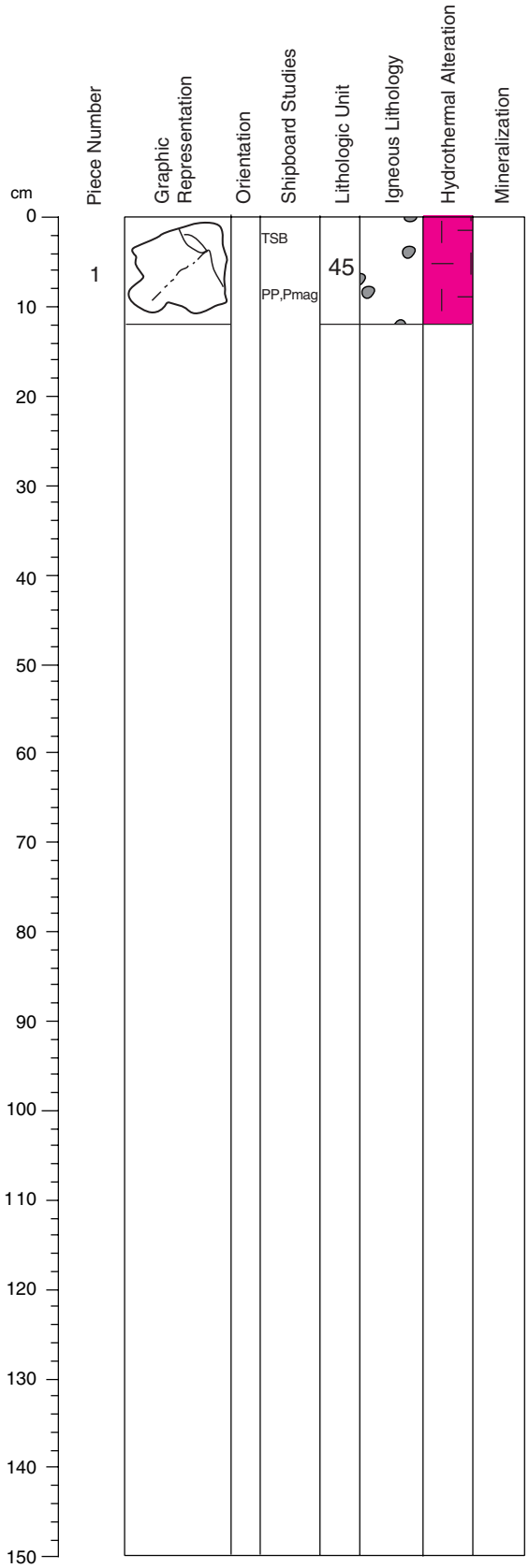
VEINS/FRACTURES: Hairline veinlets of pyrite±quartz, <1 to 2 cm in length.

COMMENTS: Piece 3E contains a coherent elongate domain enveloped in clastic material.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 16Z
Section 1
Observer SDS
4 small pieces from here moved to top — destined for residue bag
Rubble 2-5 cm
1 pc 11 cm @ 53-64
Light to medium gray-green gray
anhyd-qtz
No macro evidence of clay
Grain size to 1mm
Dissem py + fractures filled with py
DIFFERENT UNIT FROM 15Z
-- NO VESICLES
-- COARSER GRAINED

Core Photo



ADCB Core Description

193-1188F-17Z-1 (Section top: 259.4 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, sparsely vesicular volcanic rock.

UNIT: 45
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17Z	1	1	0	259.40
Lower contact:	19Z	1	1E	41	268.81

Thickness (m): 9.41

CONTACTS: None.

PHENOCRYSTS: Plagioclase, 1%, up to 1 mm long laths, replaced by white clay.

GROUNDMASS: Very fine-grained.

VESICLES: 4% vesicles, <1 mm in diameter.

COLOR: Light gray.

STRUCTURE: None.

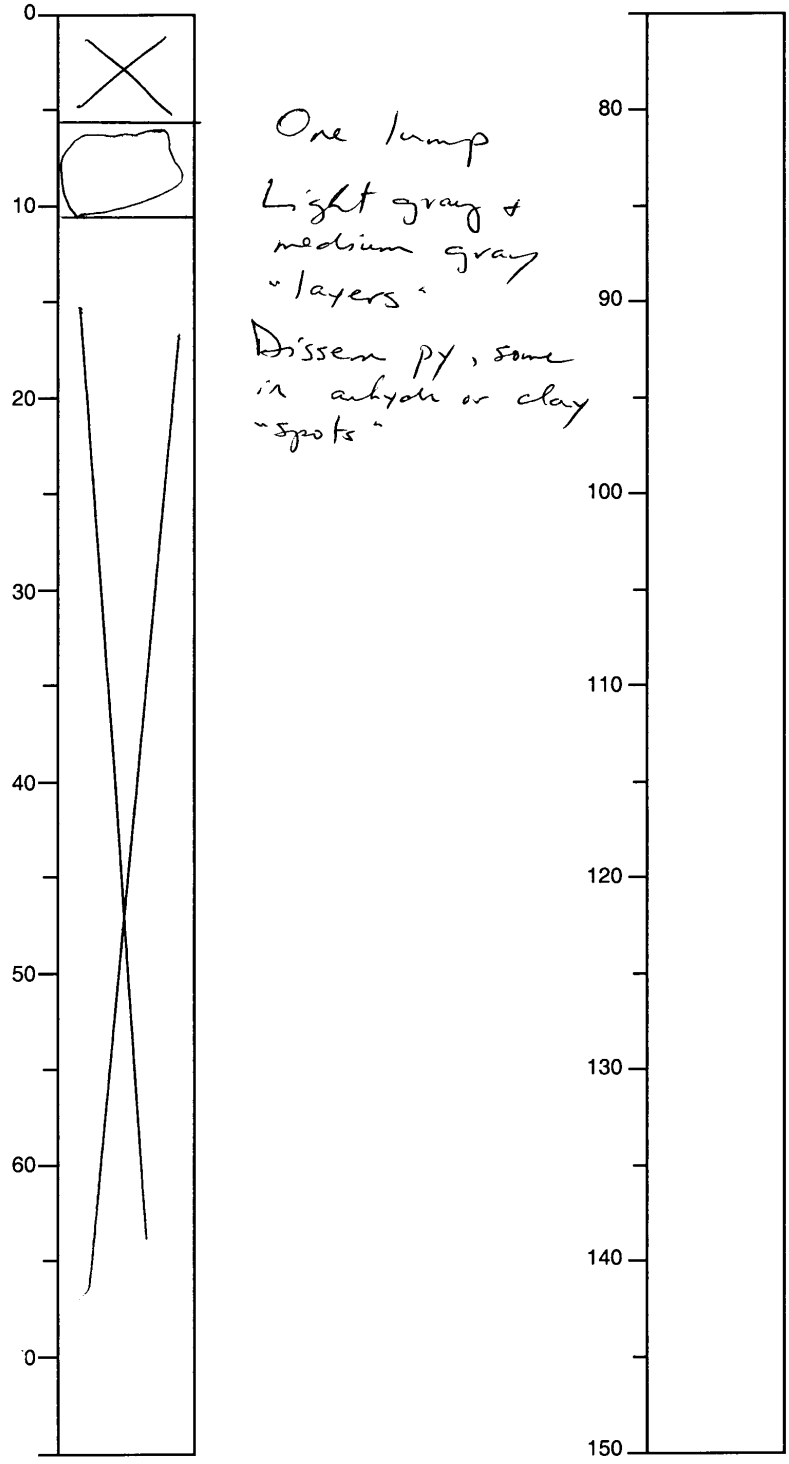
ALTERATION: Highly silicified. Plagioclase replaced by clay. Gray siliceous patches up to 0.5 cm are composed of quartz. Vesicles are partly or completely filled by pyrite-anhydrite.

VEINS/FRACTURES: Pyrite-quartz veins (0.5 to 1 mm wide) with 1 to 10 mm wide anhydrite selvages and/or halos.

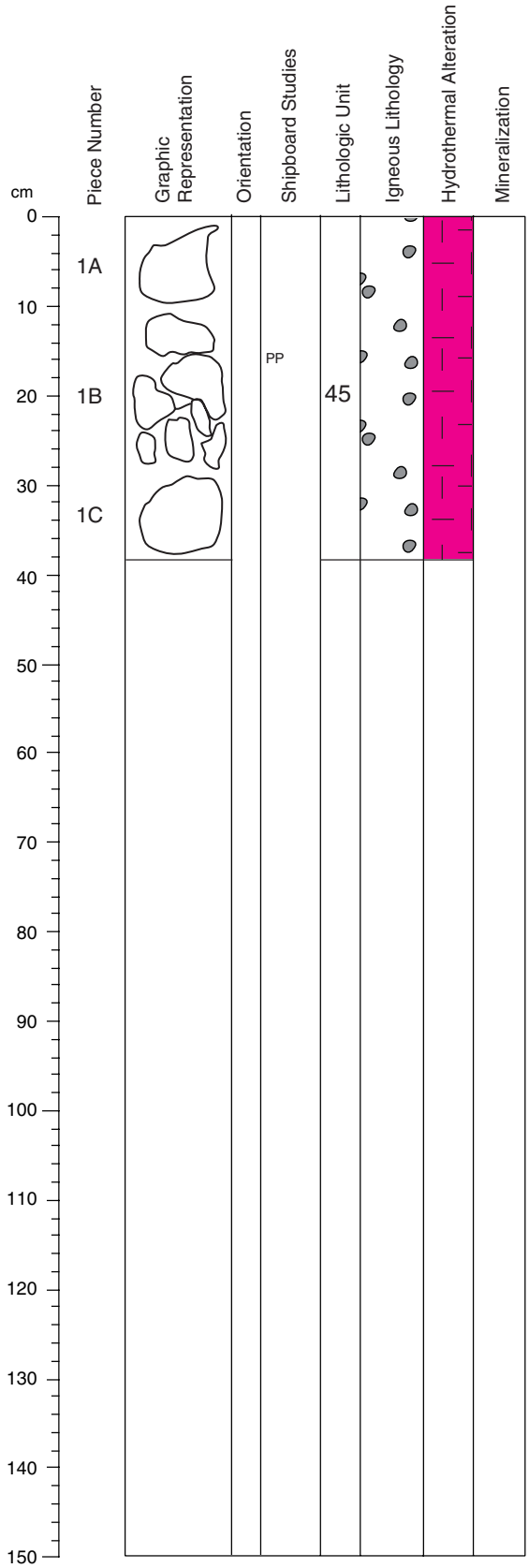
Core Photo

STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
193	1188F	17Z	1	SDS



Core Photo



ADCB Core Description

193-1188F-18Z-1 (Section top: 263.9 mbsf)

ROCK NAME: Completely altered, silicified, sparsely vesicular volcanic rock.

UNIT: 45
Pieces: 1A-1C

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17Z	1	1	0	259.40
Lower contact:	19Z	1	1E	41	268.81

Thickness (m): 9.41

CONTACTS: None.

PHENOCRYSTS: Plagioclase, trace percentage, up to 3 mm long laths, replaced by white clay.

GROUNDMASS: Very fine-grained.

VESICLES: 2%-3% vesicles, <5 mm in diameter.

COLOR: Light gray.

STRUCTURE: None.

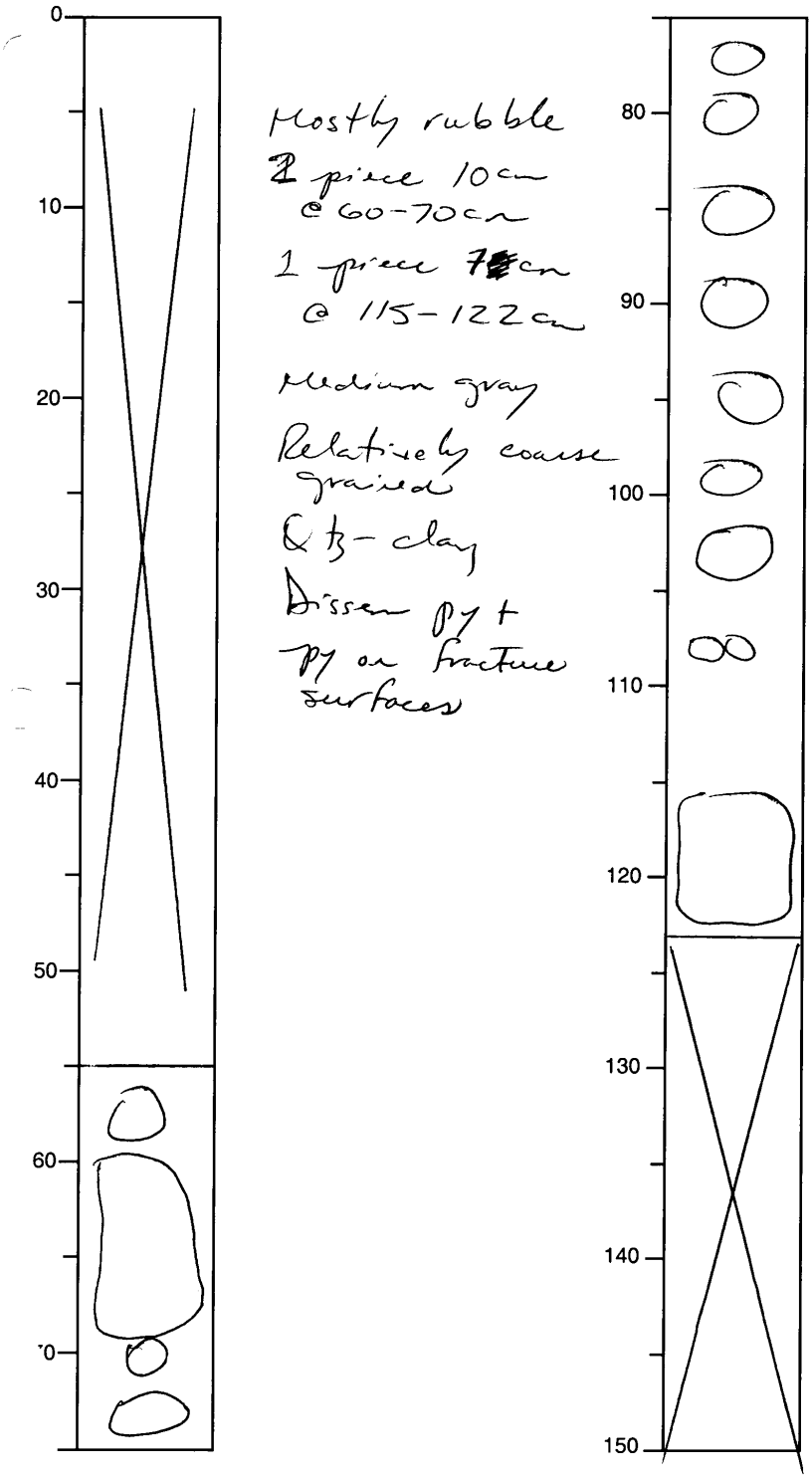
ALTERATION: Highly silicified. Plagioclase replaced by clay. Vesicles are partly or completely filled by pyrite anhydrite.

VEINS/FRACTURES: Anhydrite-pyrite veins in Piece 1A with 1 to 5 mm cyclicity, siliceous alteration halos.

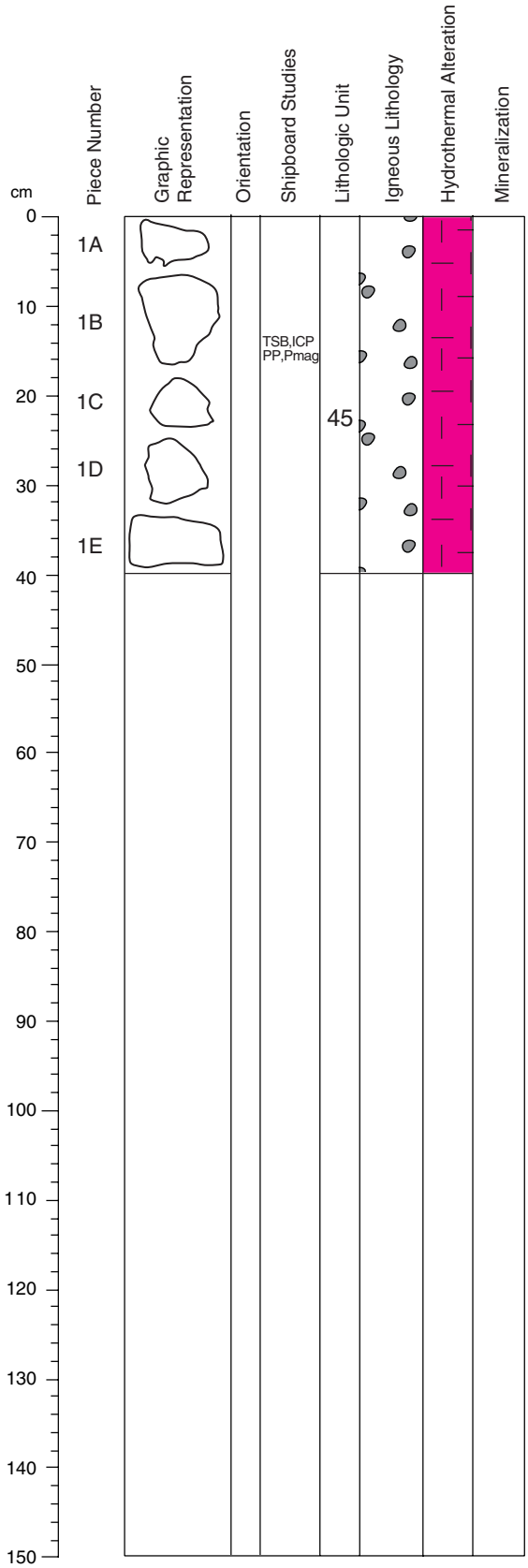
Core Photo

STRUCTURAL GEOLOGY DESCRIPTION

Leg	Hole	Core	Section	Observer
193	1188F	18Z	1	SDS



Core Photo



1188F-20Z NO RECOVERY
1188F-21Z NO RECOVERY

ADCB Core Description

193-1188F-19Z-1 (Section top: 268.4 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, sparsely vesicular volcanic rock.

UNIT: 45
Pieces: 1A-1E

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17Z	1	1	0	259.40
Lower contact:	19Z	1	1E	41	268.81

Thickness (m): 9.41

CONTACTS: None.

PHENOCRYSTS: Plagioclase, up to 2%, up to 3 mm long laths, replaced by white clay.

GROUNDMASS: Very fine-grained.

VESICLES: 1%-5% vesicles, <5 mm.

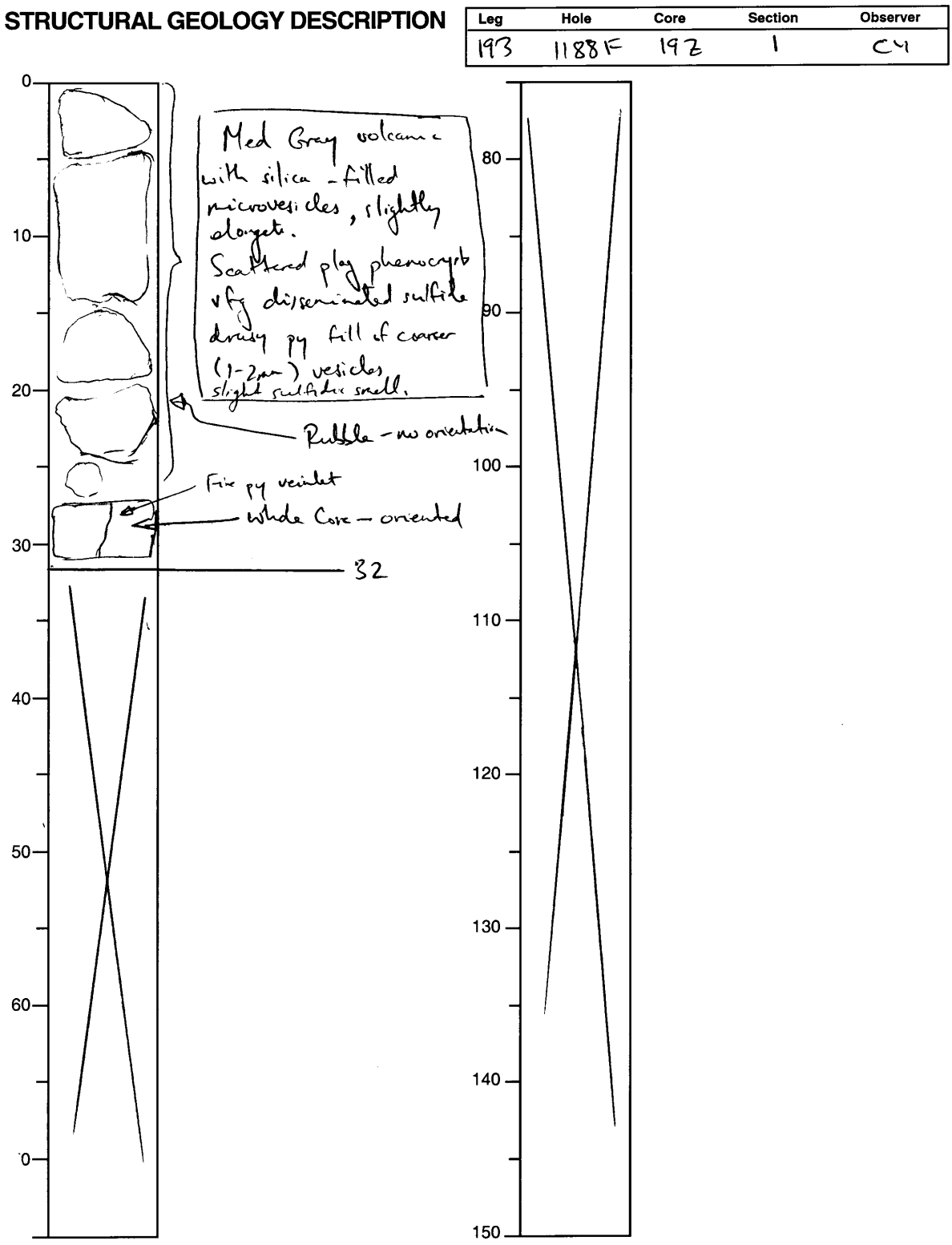
COLOR: Light gray.

STRUCTURE: None.

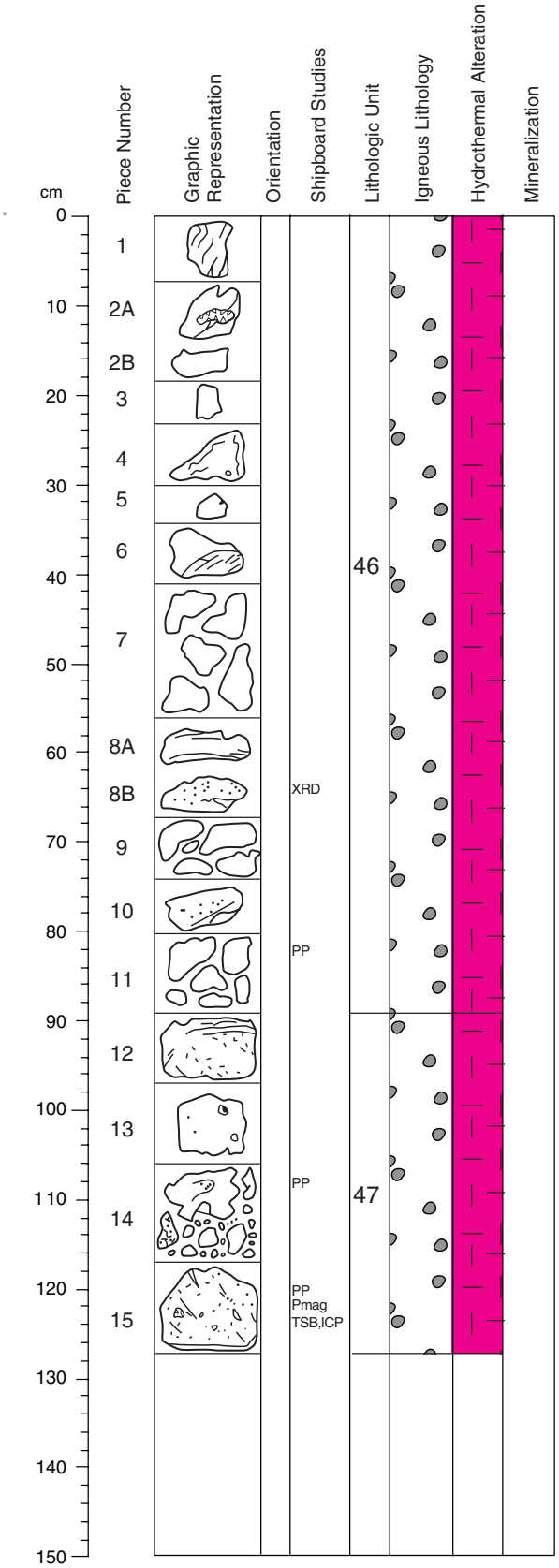
ALTERATION: Highly silicified. Plagioclase replaced by clay. Vesicles are partly or completely filled by pyrite-anhydrite.

VEINS/FRACTURES: Pyrite-anhydrite veins (mm-scale) with siliceous, cyclic alteration halos (up to 2 cm wide).

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 192
Section 1
Observer CM
Med Gray volcanic with silica-filled microvesicles, slightly elongate. Scattered plag phenocrysts vfg disseminated sulfide dusty py fill of coarser (1-2mm) vesicles, slight sulfidic smell.
Rubble - no orientation
Fine py veinlet
Whole Core - oriented
32
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-22Z-1 (Section top: 282.1 mbsf)

ROCK NAME: Completely altered, silicified, aphyric, massive volcanic rock.

UNIT: 46
Pieces: 1-11

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	22Z	1	1	0	282.10
Lower contact:	22Z	1	11	89	282.99

Thickness (m): 0.89

CONTACTS: None.

PHENOCRYSTS: Generally none, except for a trace in Piece 6.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, <1%), except for 1% in Piece 2B (minor pyrite aggregates that may represent filled vesicles).

COLOR: Light gray.

STRUCTURE: None.

ALTERATION: Highly silicified.

VEINS/FRACTURES: Minor anhydrite-pyrite hairline veins.

COMMENTS: Brecciated zone (1 to 2 cm wide) in Pieces 8A and 10. Irregular nodular silicification in some pieces.

ROCK NAME: Completely altered, green clay bearing, aphyric, massive volcanic rock.

UNIT: 47
Pieces: 12-15

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	22Z	1	12	89	282.99
Lower contact:	22Z	1	15	126	283.36

Thickness (m): 0.37

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm, <1%).

COLOR: Light greenish-gray.

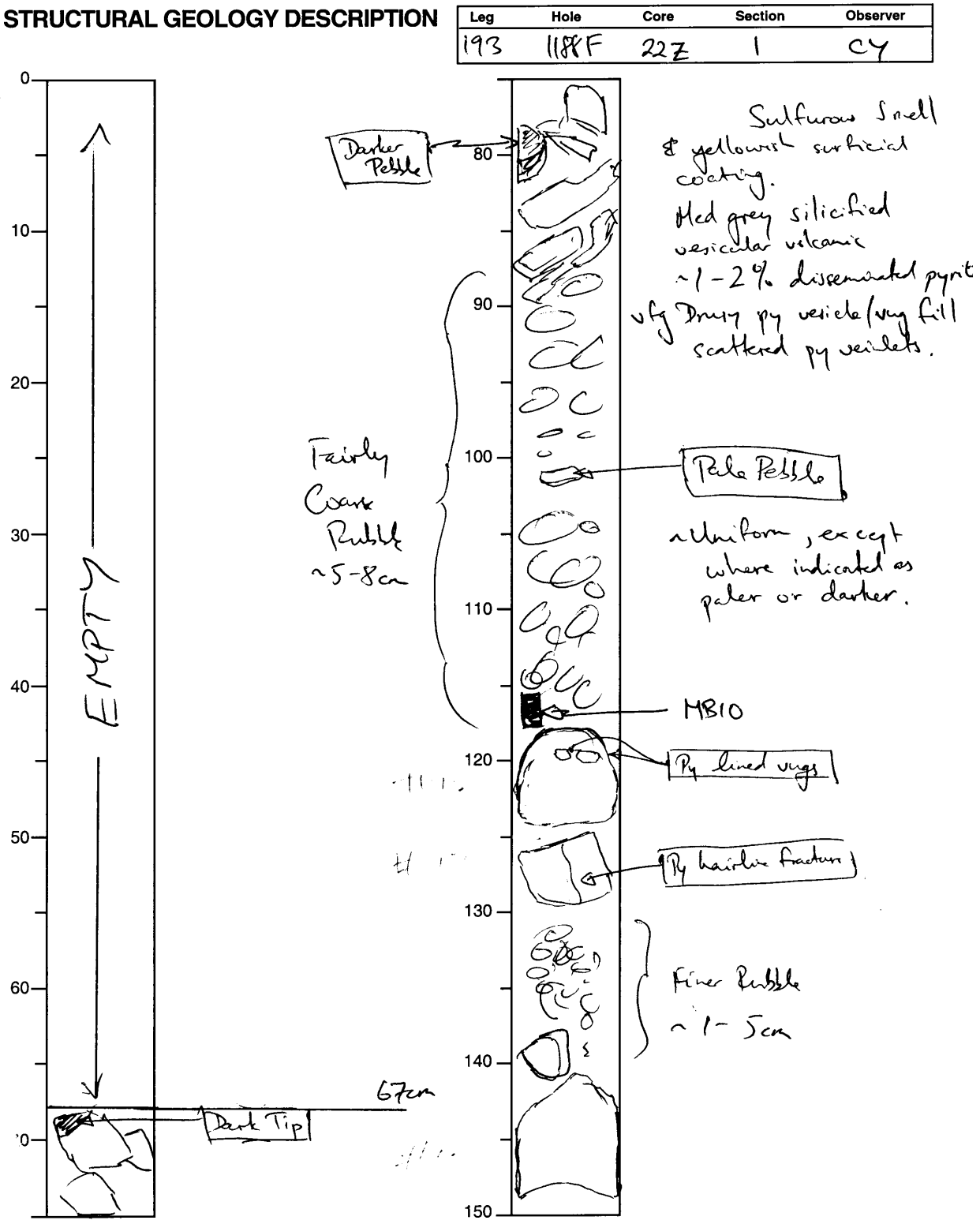
STRUCTURE: Massive.

ALTERATION: Highly silicified, lightly “chloritic”. Occasional dark gray, round to lensoidal (<1 cm diameter) silica patches.

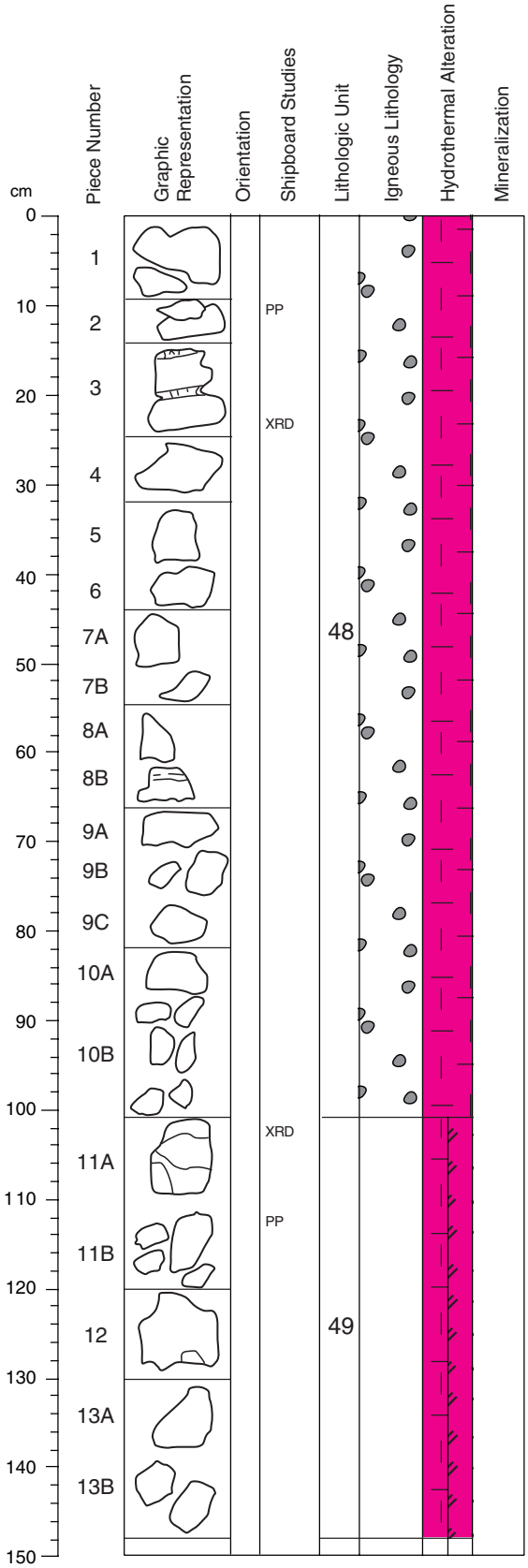
VEINS/FRACTURES: Anhydrite-pyrite hairline veins in Piece 15.

COMMENTS: Fine, sub-millimeter spotted texture in Pieces 13 and 15.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 22Z
Section 1
Observer CY
Darker Pebble
Sulfurous smell & yellowish surficial coating.
Med grey silicified vesicular volcanic
~1-2% disseminated pyrit
vfg Dusty py vesicle/vug fill
scattered py veinlets.
Fairly Coarse Rubble ~5-8cm
Pale Pebble
~Uniform, except where indicated as paler or darker.
MB10
Py lined vugs
Py hairline fracture
Finer Rubble ~1-5cm
67cm
Dark Tip
EMPTY
0
10
20
30
40
50
60
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-23Z-1 (Section top: 286.6 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 48
Pieces: 1-10B

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	23Z	1	1	0	286.60
Lower contact:	23Z	1	10B	101	287.61

Thickness (m): 1.01

CONTACTS: None.

PHENOCRYSTS: Plagioclase, up to 2%, up to 7 mm (mostly 1 mm).

GROUNDMASS: Very fine-grained.

VESICLES: Rare. Pyrite-filled vesicles (2%) in Piece 7B.

COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Highly silicified.

VEINS/FRACTURES: Anhydrite-pyrite hairline veins predominate. Piece 3: Vein with evidence for multiple opening (crack-seal) with anhydrite-silica halo, latest void in vein filled with anhydrite.

COMMENTS: Brecciated bands (1 to 2 cm wide) in Piece 8B. Flow banding in Pieces 7A and 7B.

ROCK NAME: Completely altered, silicified, green clay bearing, aphyric, massive volcanic rock.

UNIT: 49
Pieces: 11A-14

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	23Z	1	11A	101	287.61
Lower contact:	26Z	1	2	26	300.36

Thickness (m): 12.75

CONTACTS: None.

PHENOCRYSTS: Locally traces of plagioclase.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Gray, light green.

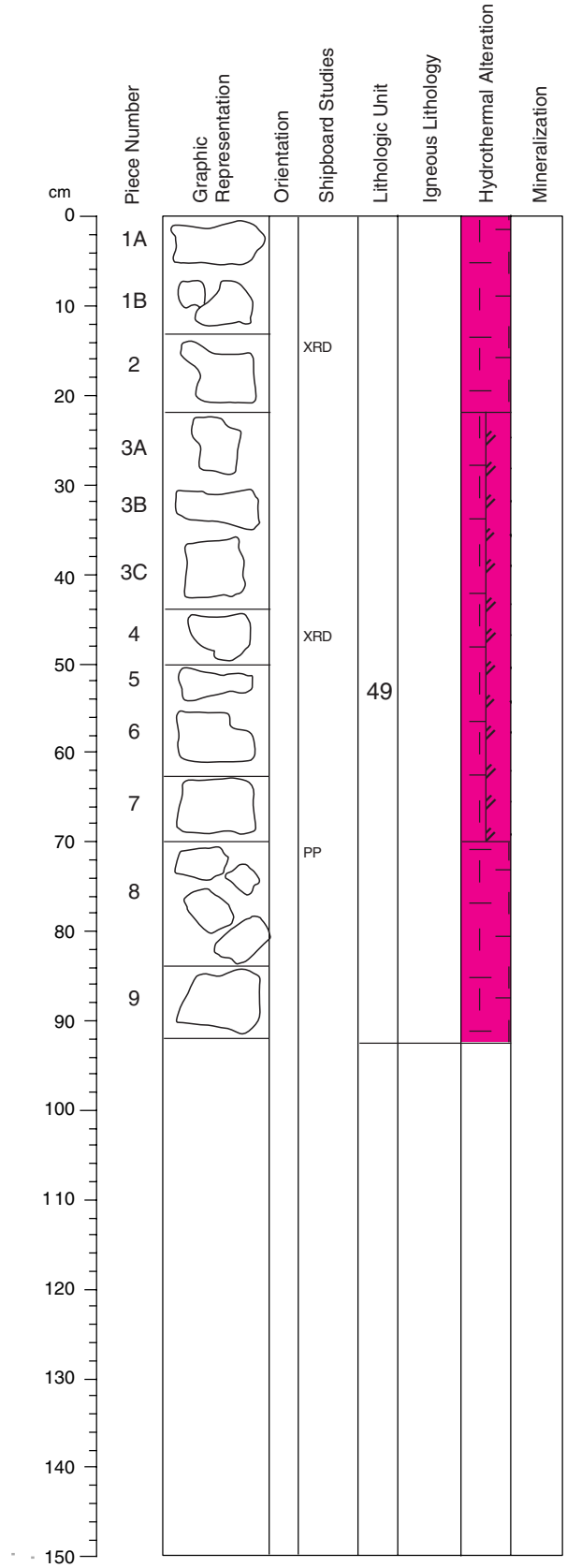
STRUCTURE: Massive.

ALTERATION: Silicified gray, and with green and greenish-gray colors, owing to the presence of green clay/chlorite.

VEINS/FRACTURES: Hairline pyrite veins with chloritic halos.

COMMENTS: Contains quartz nodules or patches. Pyrite veinlet in Piece 12 has a green clay/chlorite-rich halo.

Core Photo



1188F-24Z NO RECOVERY

ADCB Core Description

193-1188F-23Z-2 (Section top: 288.1 mbsf)

ROCK NAME: Completely altered, silicified, green clay bearing, aphyric, massive volcanic rock.

UNIT: 49
Pieces: 1A-9

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Interval Location:					
Upper contact:	23Z	1	11A	101	287.61
Lower contact:	26Z	1	2	26	300.36

Thickness (m): 12.75

CONTACTS: None.

PHENOCRYSTS: Local plagioclase.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Gray, light green.

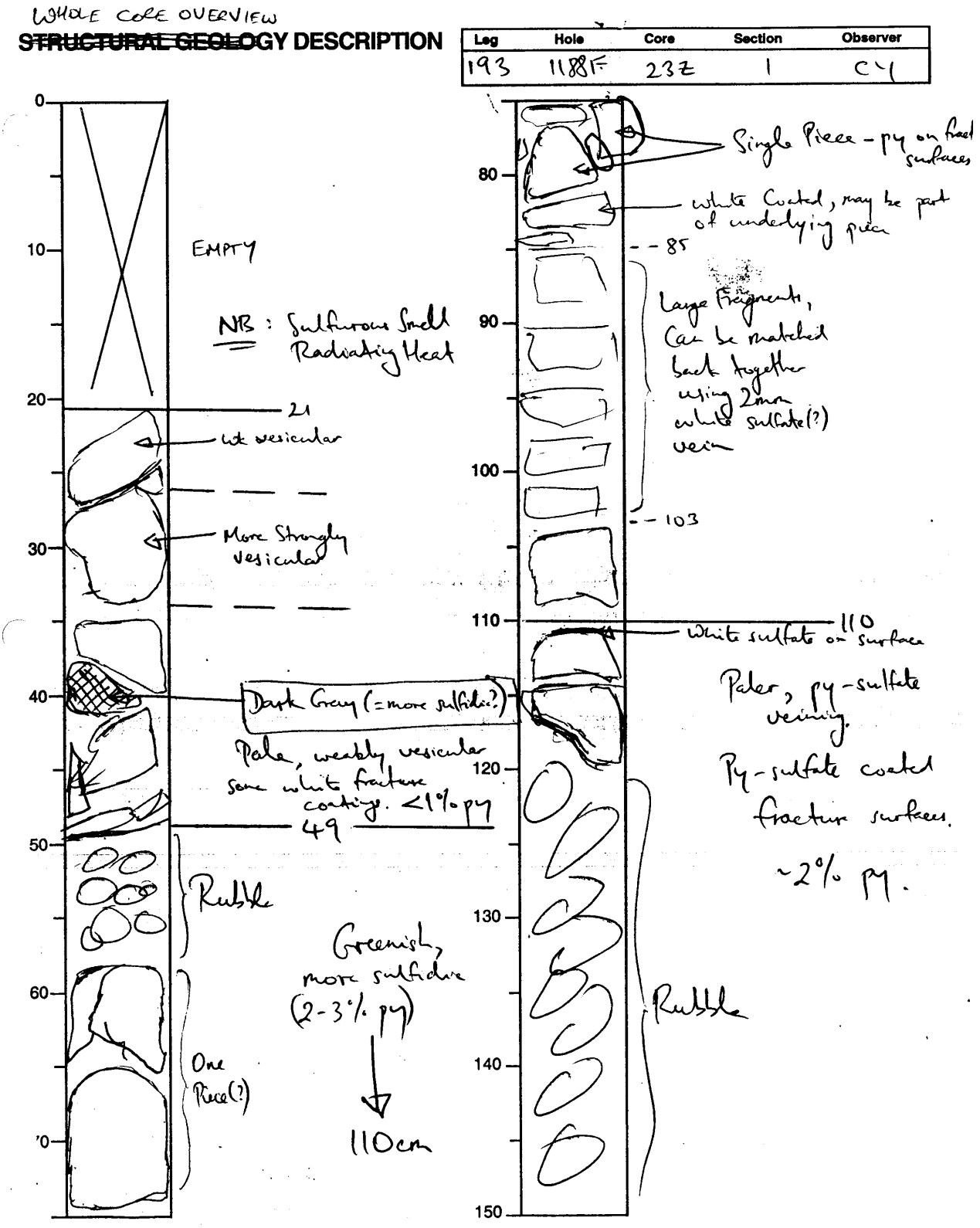
STRUCTURE: Massive.

ALTERATION: Silicified.

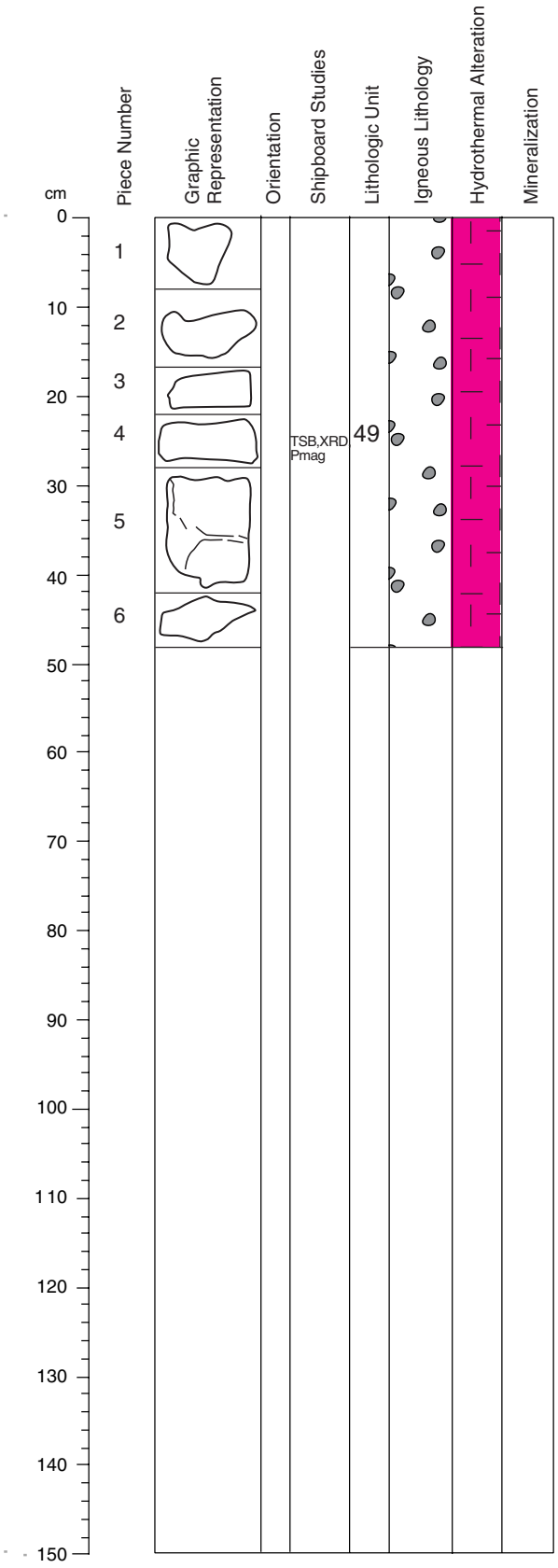
VEINS/FRACTURES: Hairline pyrite veins.

COMMENTS: Contains numerous quartz nodules or patches. Minor pyrite aggregates, which are commonly surrounded by green clay/chlorite.

Core Photo


WHOLE CORE OVERVIEW
~~STRUCTURAL GEOLOGY~~ DESCRIPTION
Leg 193
Hole 1188F
Core 23Z
Section 1
Observer CY
EMPTY
NB: Sulfurous Smell
Radiating Heat
21
Lt vesicular
More Strongly vesicular
Dark Grey (=more sulfide?)
Pale, weakly vesicular
some white fracture
coating. <1% py
49
Rubble
Greenish, more sulfidic (2-3% py)
110cm
One Piece(?)
Single Piece - py on fract surfaces
White Coated, may be part of underlying piece
85
Large Fragments, Can be matched back together using 2mm white sulfate(?) vein
103
110
White sulfate on surface
Paler, py-sulfate veining.
Py-sulfate coated fracture surfaces.
~2% py.
Rubble

Core Photo



ADCB Core Description

193-1188F-25Z-1 (Section top: 295.6 mbsf)

ROCK NAME: Completely altered, silicified, green clay bearing, aphyric, massive volcanic rock.

UNIT: 49
Pieces: 1-6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	23Z	1	11A	101	287.61
Lower contact:	26Z	1	2	26	300.36

Thickness (m): 12.75

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Up to 3% in Piece 2, and 1% in Piece 4.

COLOR: Light greenish-gray.

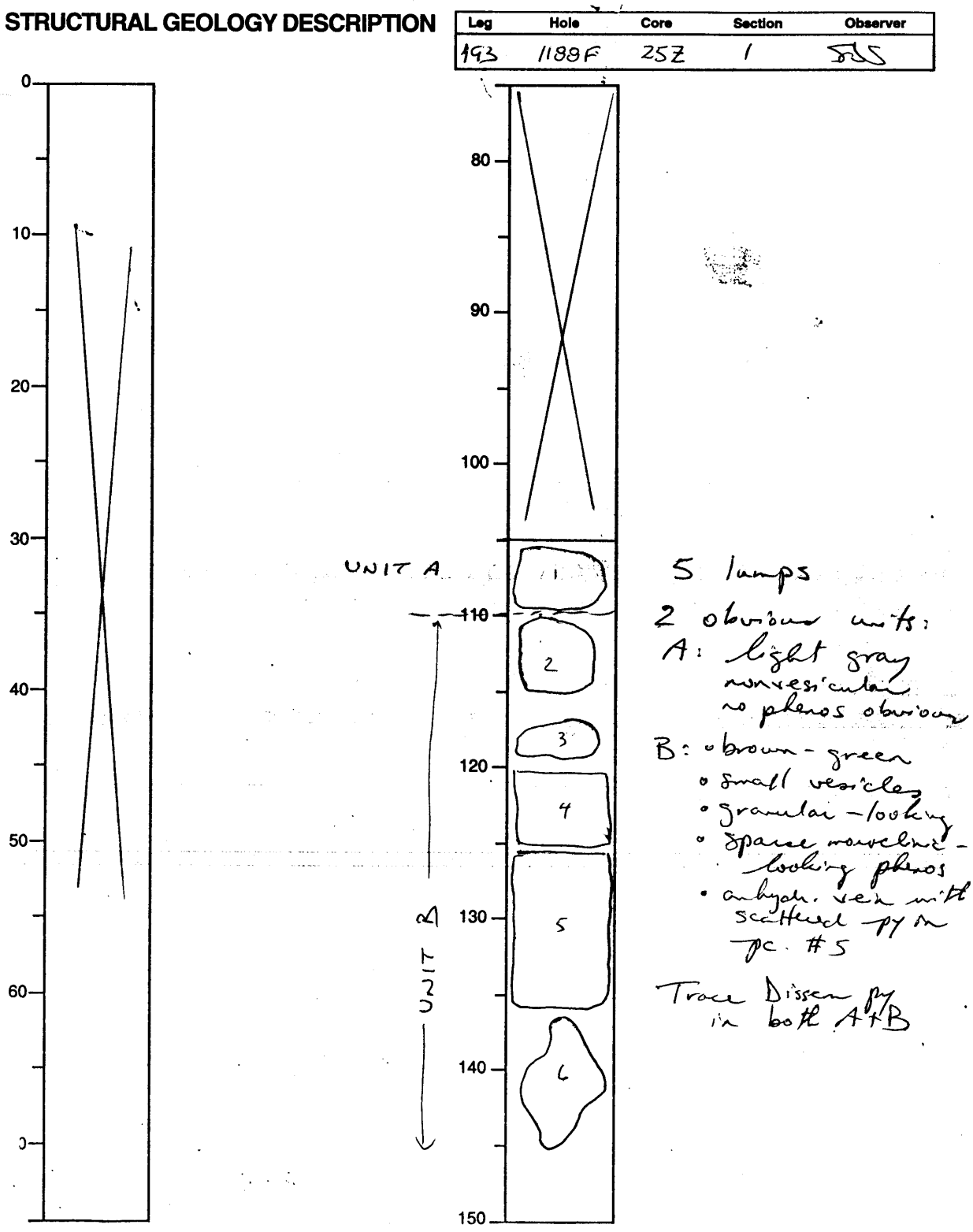
STRUCTURE: Massive.

ALTERATION: Silicified (gray) and silicified with green and greenish-gray colors, owing to the presence of green clay/chlorite.

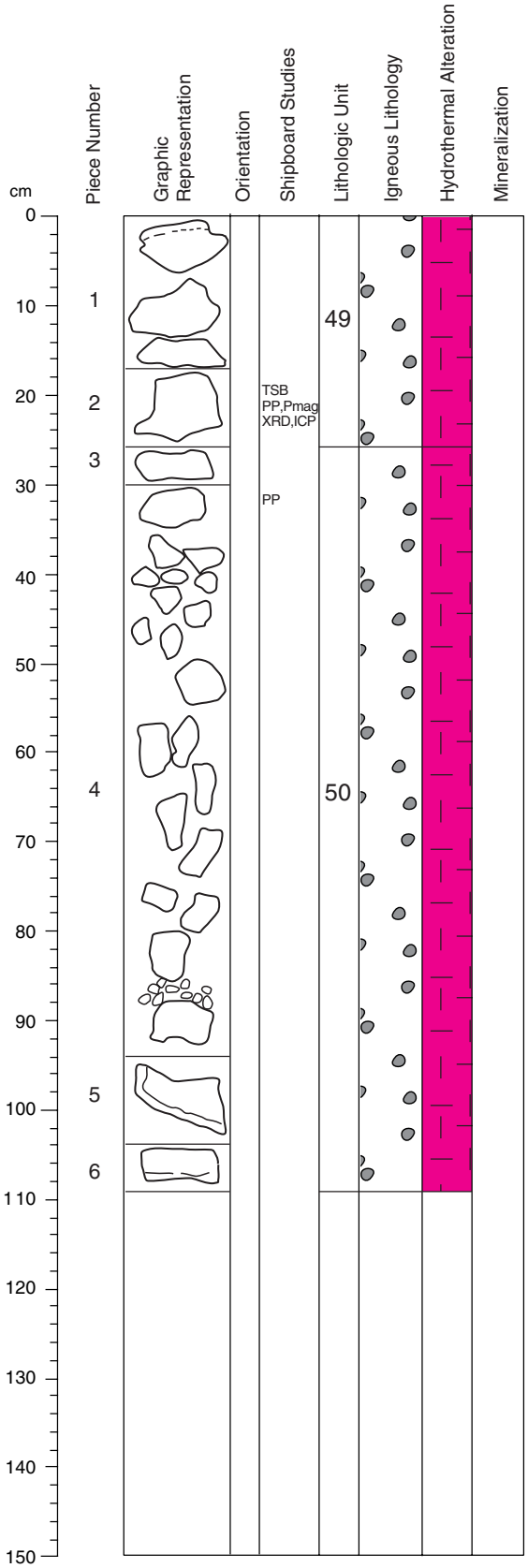
VEINS/FRACTURES: Anhydrite-pyrite veins with siliceous alteration halos, crosscut by anhydrite veins in Piece 5.

COMMENTS: Piece 2 contains numerous quartz ovoids that resemble quartz-filled vesicles (amygdales).

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg Hole Core Section Observer
193 1188F 25Z 1 SJS
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
UNIT A
UNIT B
1
2
3
4
5
6
5 lumps
2 obvious units:
A: light gray
nonvesicular
no phenos obvious
B: • brown-green
• small vesicles
• granular-looking
• sparse nonvesicular-looking phenos
• anhydr. vein with scattered py in pc. #5
Trace Diss py in both A+B

Core Photo



ADCB Core Description

193-1188F-26Z-1 (Section top: 300.1 mbsf)

ROCK NAME: Completely altered, silicified, green-clay bearing, aphyric, massive volcanic rock.

UNIT: 49
Pieces: 1-2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	23Z	1	11A	101	287.61
Lower contact:	26Z	1	2	26	300.36

Thickness (m): 12.75

CONTACTS: None.

PHENOCRYSTS: Rare plagioclase (<1%; <1 mm; clay altered).

GROUNDMASS: Very fine-grained.

VESICLES: Minor (<1%) sub-mm, dark gray silica amygdales.

COLOR: Light greenish-gray.

STRUCTURE: Massive.

ALTERATION: Silicified (gray) and silicified with green and greenish-gray colors, owing to the presence of green clay/chlorite.

VEINS/FRACTURES: Anhydrite-pyrite veins with siliceous alteration halos.

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 50
Pieces: 3 to 6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	26Z	1	3	26	300.36
Lower contact:	27Z	1	2	31	304.91

Thickness (m): 4.55

CONTACTS: None.

PHENOCRYSTS: Plagioclase laths, 1 to 2%, size range: 0.1 to 3 mm, rarely up to 5 mm, typically altered to clay.

GROUNDMASS: Very fine-grained.

VESICLES: Minor (<1%) sub-mm, dark gray silica amygdales.

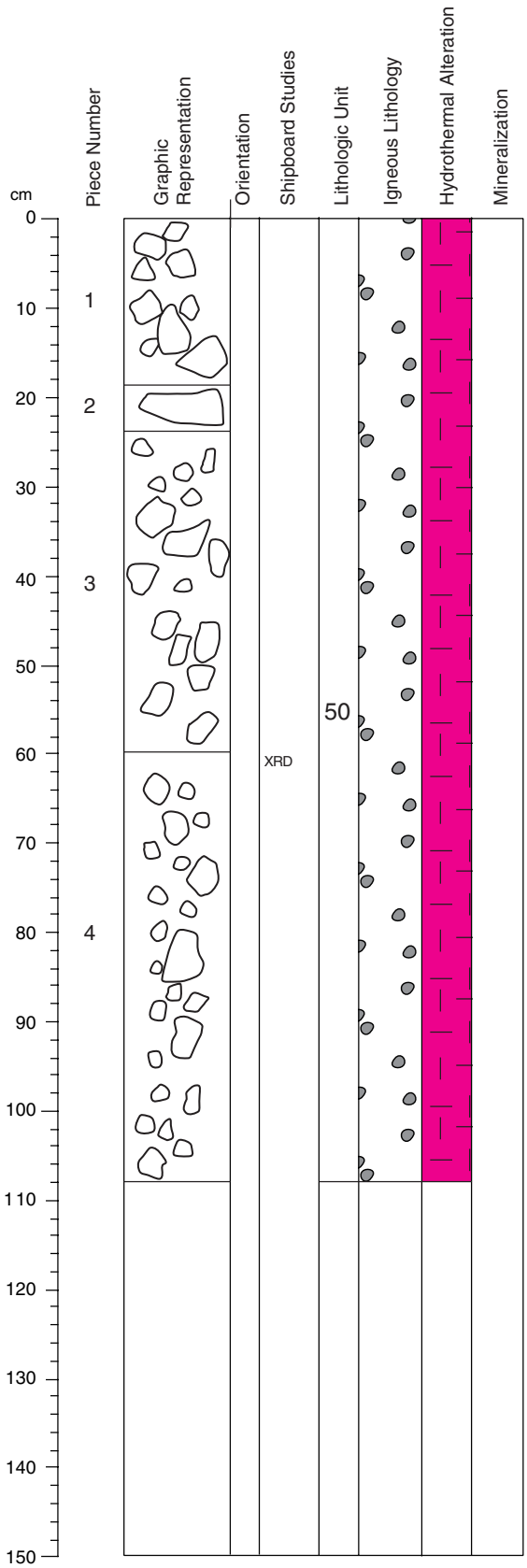
COLOR: Gray.

STRUCTURE: Massive.

ALTERATION: Complete silicification. White silica-sulfate crusts on some pieces have zoned alteration halos. Fine quartz-pyrite spotting appears to be vesicle fill (amygdales).

VEINS/FRACTURES: Anhydrite-pyrite veins with siliceous alteration halos.

Core Photo



ADCB Core Description

193-1188F-26Z-2 (Section top: 301.18 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 50
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	26Z	1	3	26	300.36
Lower contact:	27Z	1	2	31	304.91

Thickness (m): 4.55

CONTACTS: None.

PHENOCRYSTS: Plagioclase laths, 1% to 2%, size range: 0.1 to 3 mm, rarely up to 5 mm, typically altered to clay.

GROUNDMASS: Very fine-grained.

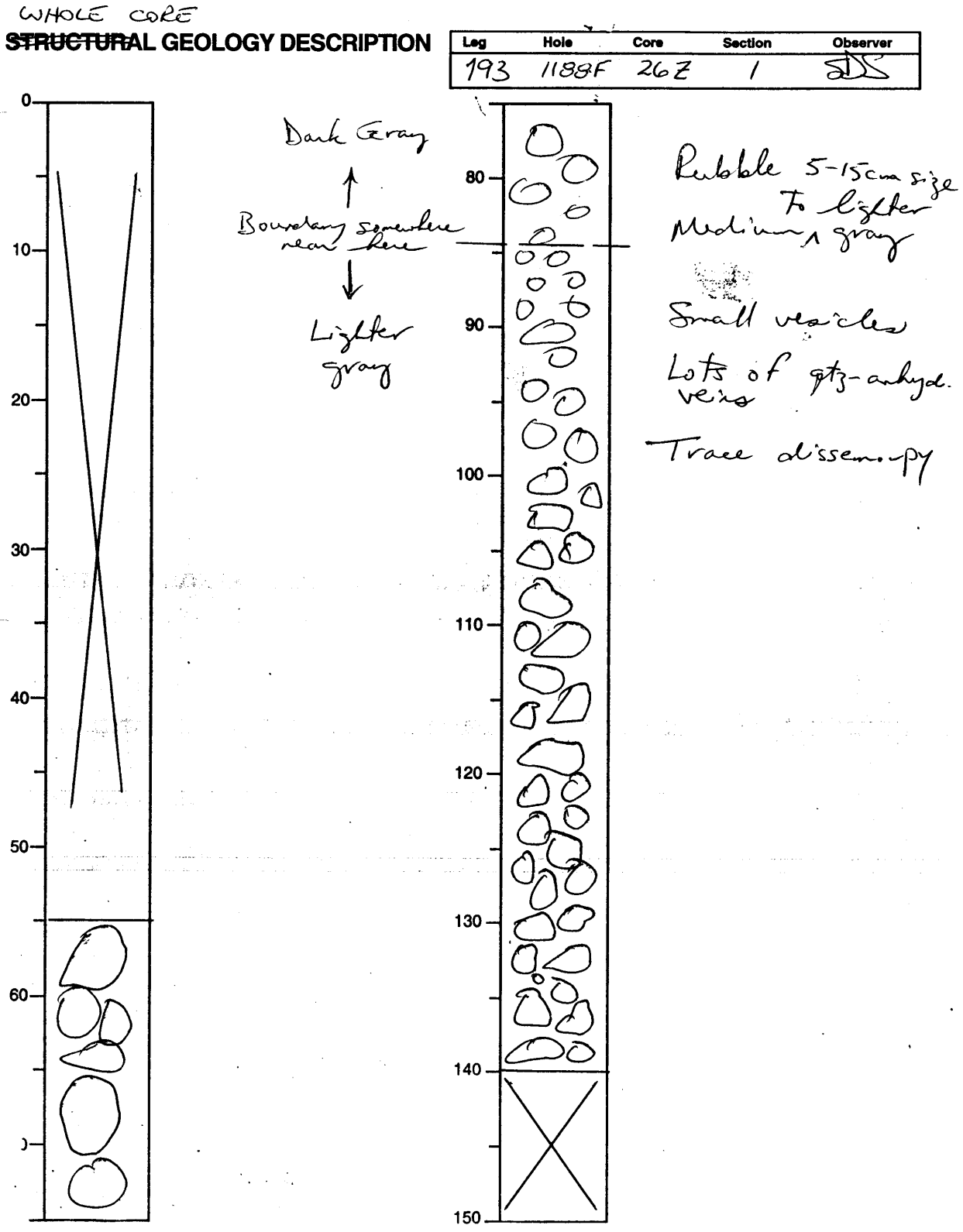
VESICLES: Minor (<1%) sub-mm, dark gray silica amygdales.

COLOR: Gray.

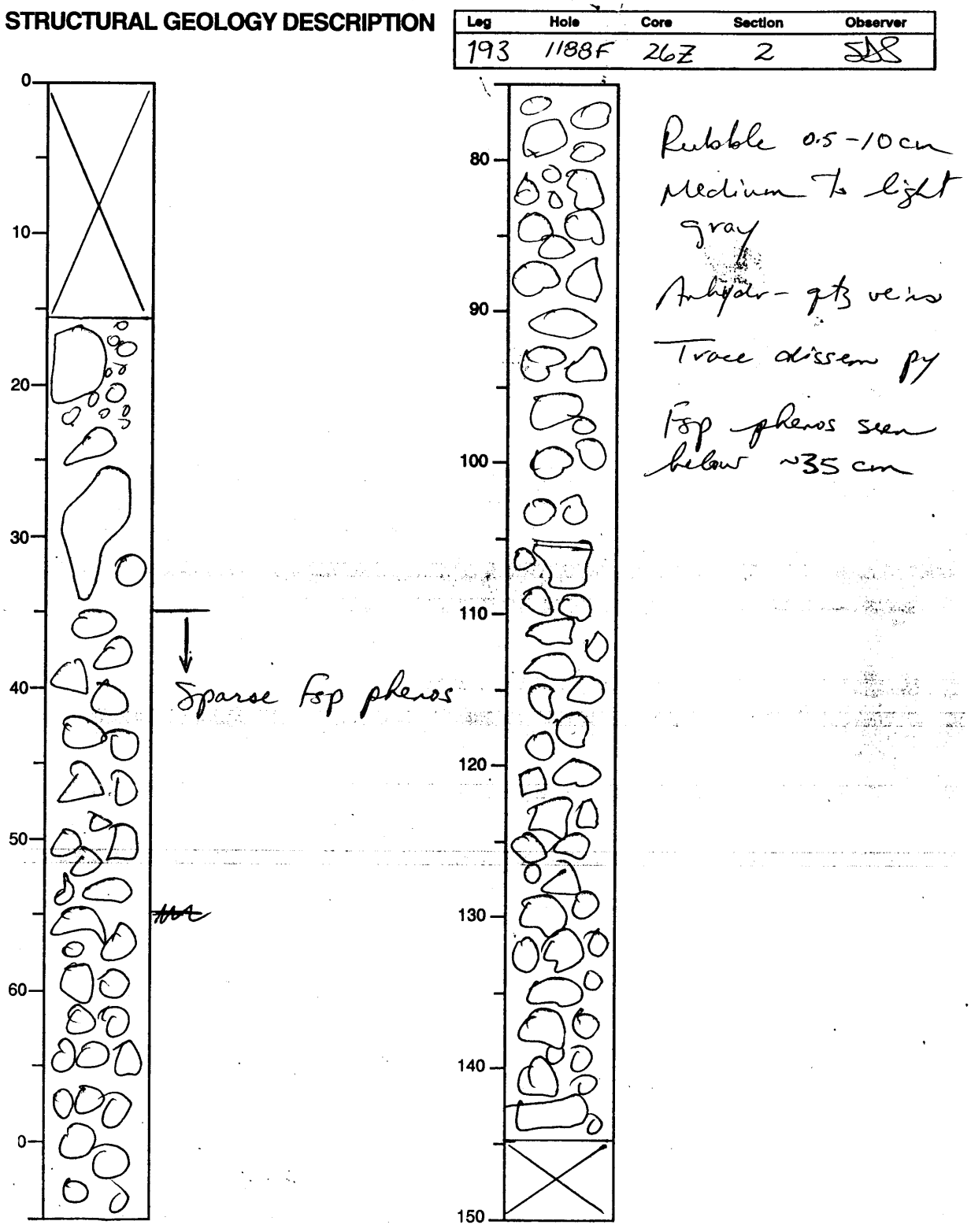
STRUCTURE: Massive.

ALTERATION: Complete silicification. White silica-sulfate crusts on some pieces have zoned alteration halos. Fine quartz-pyrite spotting appears to be vesicle fill (amygdales).

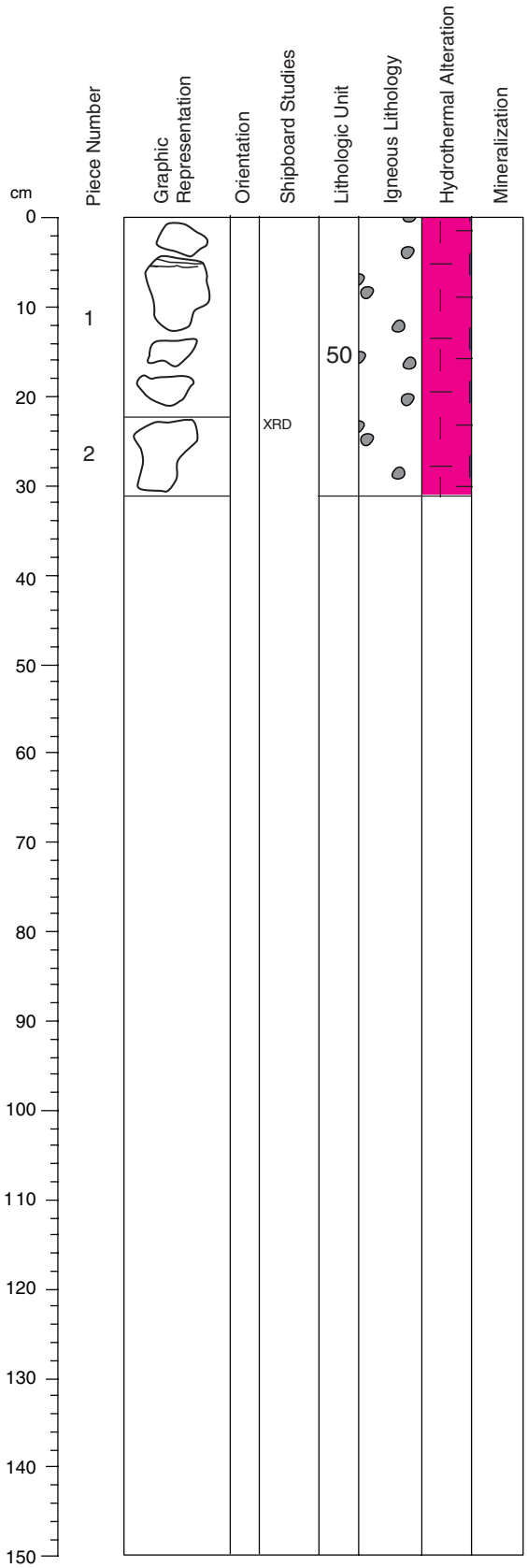
Core Photo


WHOLE CORE
STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 26Z
Section 1
Observer
Dark Gray
Boundary somewhere near here
Lighter gray
Rubble 5-15cm size To lighter
Medium gray
Small vesicles
Lots of qtz-anhyd. veins
Trace dissem. py
0
10
20
30
40
50
60
80
90
100
110
120
130
140
150

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 26Z
Section 2
Observer SAS
Rubble 0.5-10 cm
Medium to light gray
Anhydr-qtz veins
Trace dissem py
Fsp phenos seen below ~35 cm
Sparse fsp phenos

Core Photo



1188F-28Z NO RECOVERY
1188F-29Z NO RECOVERY

ADCB Core Description

193-1188F-27Z-1 (Section top: 304.6 mbsf)

ROCK NAME: Completely altered, silicified, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 50
Pieces: 1 to 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	26Z	1	3	26	300.36
Lower contact:	27Z	1	2	31	304.91

Thickness (m): 4.55

CONTACTS: None.

PHENOCRYSTS: Plagioclase laths, 1% to 2%, size range: 0.1 to 3 mm, rarely up to 5 mm, typically altered to clay.

GROUNDMASS: Very fine-grained.

VESICLES: Minor (<1%) sub-mm, dark gray silica amygdales.

COLOR: Gray.

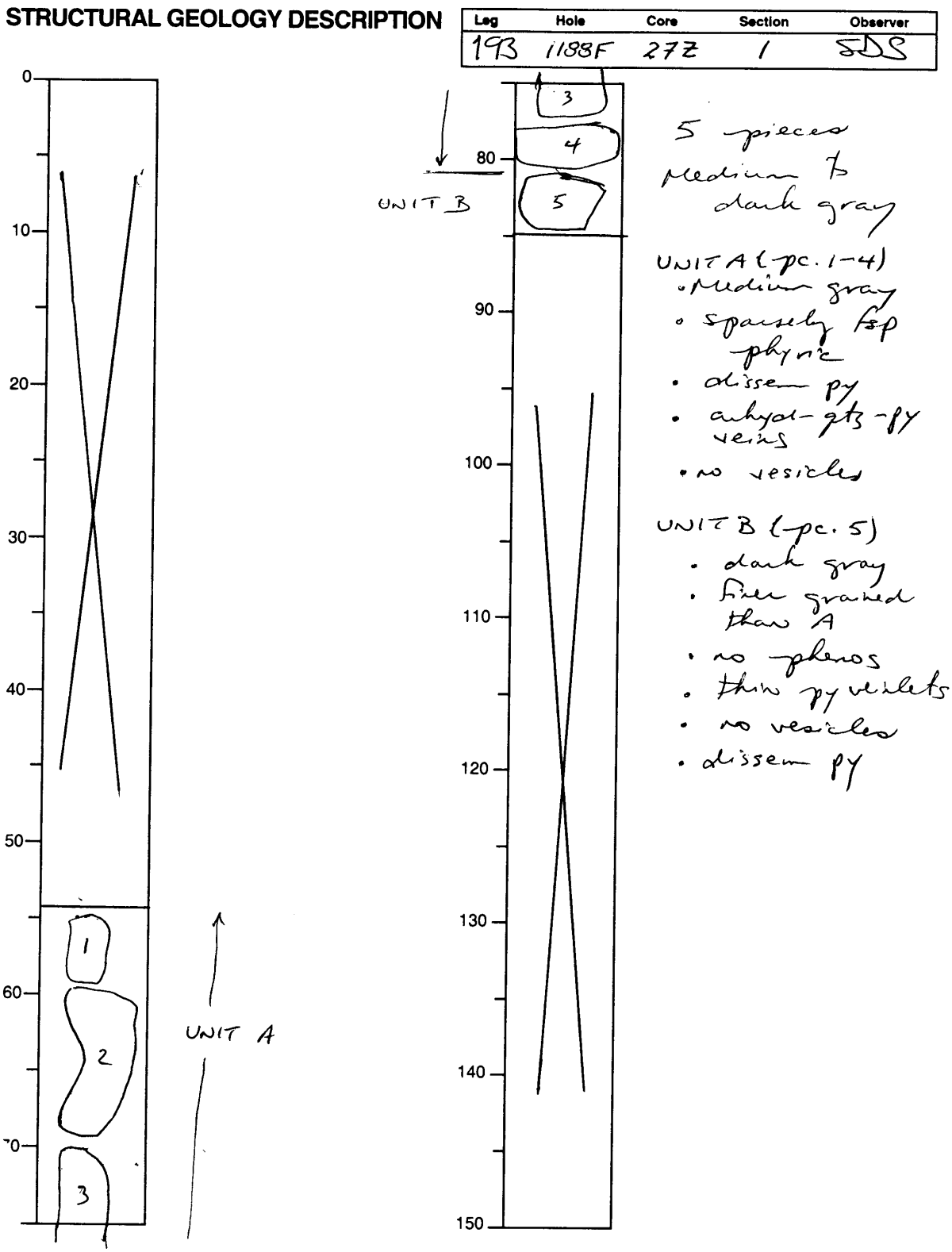
STRUCTURE: Massive.

ALTERATION: Complete silicification. White silica-sulfate crusts on some pieces have zoned alteration halos. Fine quartz-pyrite spotting appears to be vesicle fill (amygdales). Magnetite in Piece 2.

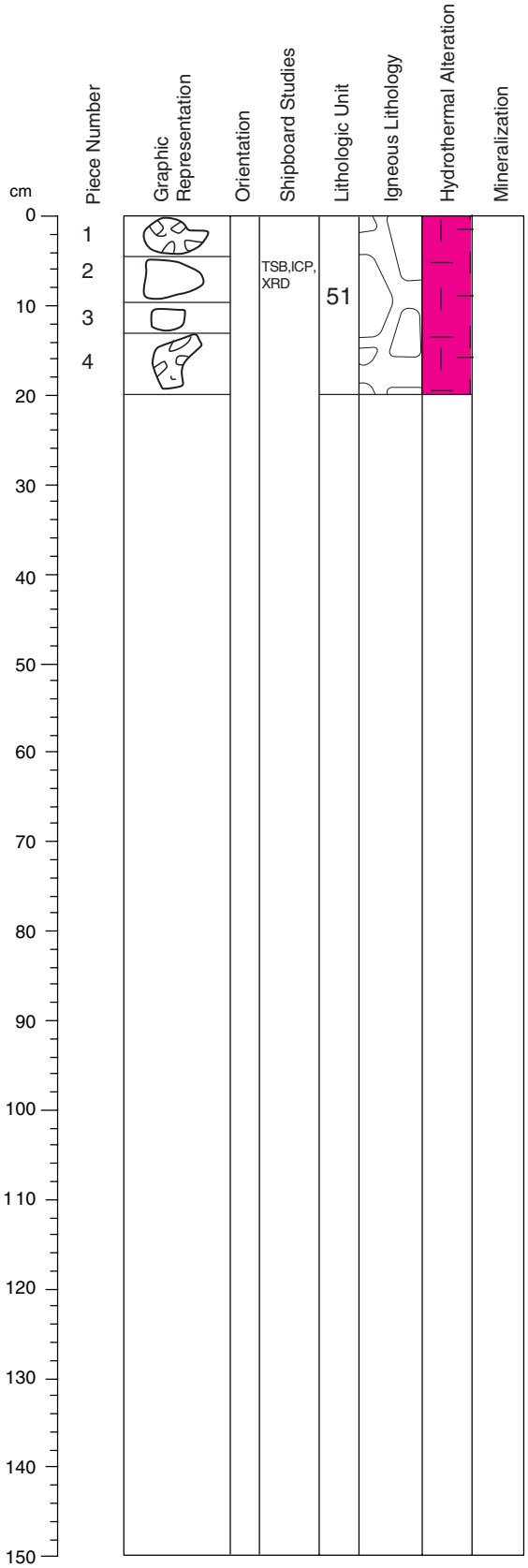
VEINS/FRACTURES: Anhydrite veins with siliceous alteration halos.

COMMENTS: One fragment of Piece 1 contains up to 5 mm, etched, skeletal plagioclase laths, shows remnant flow banding and contains remnants of another altered phenocryst phase (K-feldspar?).

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 27Z
Section 1
Observer SDS
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
1
2
3
4
5
UNIT A
UNIT B
5 pieces
Medium to dark gray
UNIT A (pc. 1-4)
• Medium gray
• Sparsely fsp phyric
• dissem py
• anhyd-gtz-py veins
• no vesicles
UNIT B (pc. 5)
• dark gray
• finer grained than A
• no phenos
• thin py veinlets
• no vesicles
• dissem py

Core Photo



ADCB Core Description

193-1188F-30Z-1 (Section top: 318.1 mbsf)

ROCK NAME: Completely altered, variably silicified breccia.

UNIT: 51
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	30Z	1	1	0	318.10
Lower contact:	30Z	1	4	19	318.30

Thickness (m): 0.20

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray to dark gray.

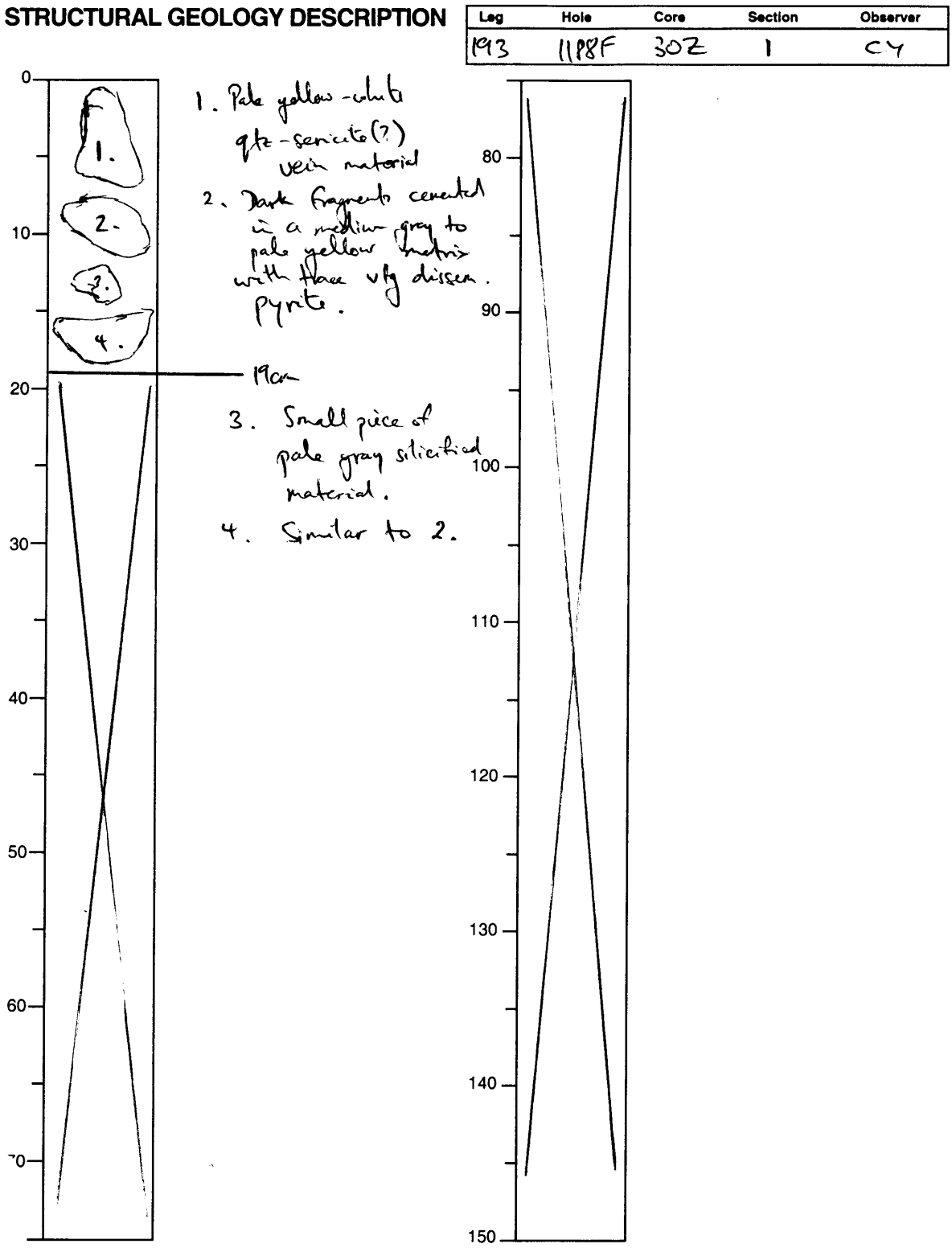
STRUCTURE: Clastic, pseudoclastic, or irregularly mottled in Pieces 1 and 3; brecciated to conglomeratic in Pieces 2 and 4.

ALTERATION: Matrix is generally soft, light gray material. Clast domains are variably colored: pale gray-blue, gray, greenish-gray, dark gray, and black. Clasts are generally hard to very hard. Late stage anhydrite-pyrite crystals in veins and pockets in the matrix.

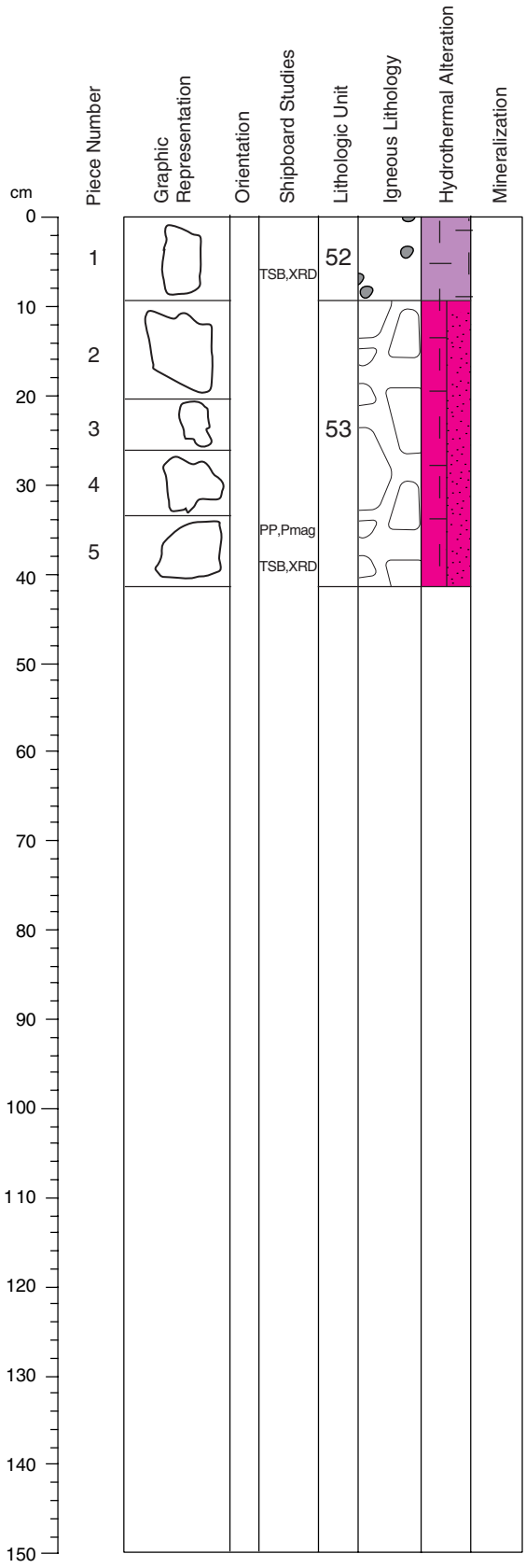
VEINS/FRACTURES: None.

COMMENTS: Fractured unit of completely altered rock, presumably volcanic. Clasts are variably silicified. Matrix is variably clay- and anhydrite-bearing. Piece 4 is considerably darker than the other pieces, and may contain more abundant magnetite.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 30Z
Section 1
Observer CY
1. Pale yellow-white qtz-sericite(?) vein material
2. Dark fragments cemented in a medium gray to pale yellow matrix with trace vfg disseminated pyrite.
19cm
3. Small piece of pale gray silicified material.
4. Similar to 2.
1.
2.
3.
4.
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-31Z-1 (Section top: 322.6 mbsf)

ROCK NAME: Silicified, slightly plagioclase-magnetite phyric, massive volcanic rock.
UNIT: 52.
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	31Z	1	1	0	322.60
Lower contact:	31Z	1	1	9	322.69

Thickness (m): 0.09

CONTACTS: None.

PHENOCRYSTS: Plagioclase laths (1%, up to 2 mm, apparently unaltered) and magnetite (<1%, 0.5 mm).

GROUNDMASS: Very fine-grained.

VESICLES: Sparsely amygdaloidal (up to 1 mm).

COLOR: Gray.

STRUCTURE: Massive.

ALTERATION: Pervasive silicification of the groundmass with disseminated magnetite and pyrite (very high alteration intensity).

VEINS/FRACTURES: Anhydrite vein with dark silicified halo. Magnetite-pyrite-quartz vein (1 mm wide) with pale silicified halo.

COMMENTS: Magnetite is associated with quartz in the groundmass.

ROCK NAME: Completely altered, variably silicified breccia.
UNIT: 53
Pieces: 2-5

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	31Z	1	1	9	322.69
Lower contact:	31Z	1	5	42	323.02

Thickness (m): 0.33

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Gray to light green.

STRUCTURE: Clastic, pseudoclastic, or irregularly mottled in Pieces 2 and 5; massive in Pieces 3 and 4.

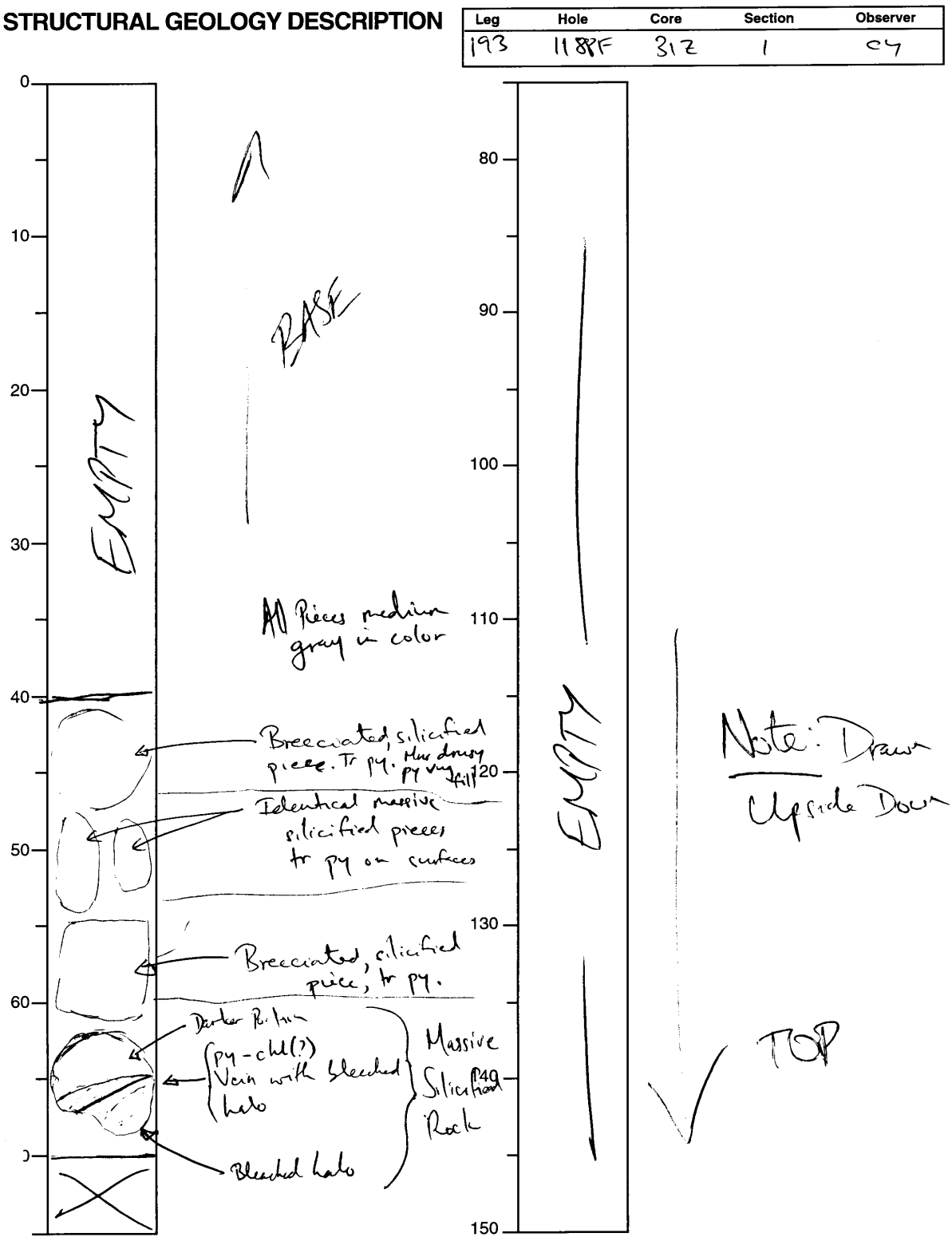
ALTERATION: Matrix is generally soft, light green-gray material. Clast domains are variably colored: gray, light green, pale greenish-gray, dark gray, and reddish gray. Clasts vary from soft to hard.

VEINS/FRACTURES: None.

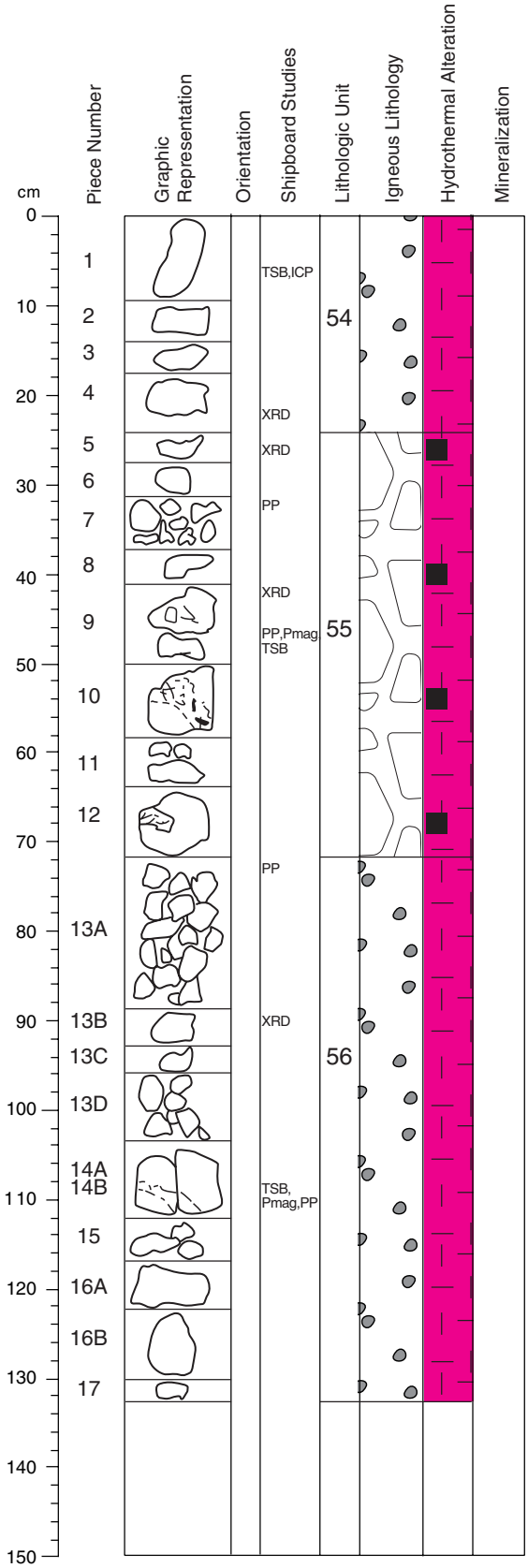
COMMENTS: This is a clastic or pseudoclastic unit of completely altered rock, presumably volcanic. Clasts are variably silicified. Matrix is variably clay- and anhydrite-bearing. Pieces 3 and 4 (3 to 5 cm in diameter) are massive aphyric volcanic rock with diffuse light gray and light green domains resembling previous units (such as Unit 50). They may represent incipient stages of mottled alteration or may have fallen down from above.

1188F-32Z NO RECOVERY
1188F-33Z NO RECOVERY

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 3R
Section 1
Observer CY
EMPTY
BASE
All Pieces medium gray in color
Brecciated, silicified piece. Tr py.
Identical massive silicified pieces tr py on surfaces
Brecciated, silicified piece, tr py.
Darker R. Inv
(py-chl(?) Vein with bleached halo
Massive Silicified Rock
Bleached halo
EMPTY
Note: Drawn Upside Down
TOP

Core Photo



ADCB Core Description

193-1188F-34Z-1 (Section top: 336.4 mbsf)

ROCK NAME: Completely altered, aphyric, massive volcanic rock.

UNIT: 54
Pieces: 1-4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	34Z	1	1	0	336.40
Lower contact:	34Z	1	4	24	336.64

Thickness (m): 0.24

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray, dark gray, tan-gray.

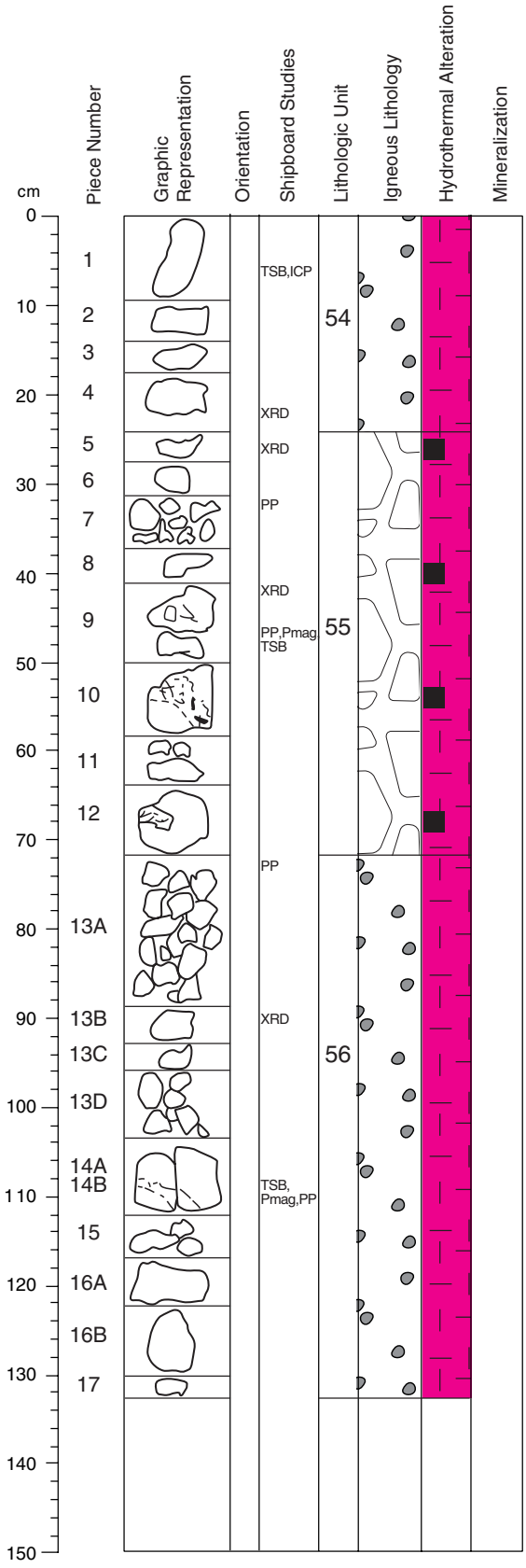
STRUCTURE: Pieces 1 and 2 are massive rocks with multiply-zoned alteration halos. Piece 4 has a clastic or mottled structure.

ALTERATION: Silicified, with zoned halos. There is disseminated pyrite + magnetite in the quartz-dominated clayey matrix.

VEINS/FRACTURES: None.

COMMENTS: Piece 4 resembles Unit 53 from Core 193-1188F-31Z-1. The other pieces resemble the typical completely altered volcanic rocks of Hole 1188F. The pieces are all small and could be out of order or sampled from higher in the hole.

Core Photo



193-1188F-34Z-1 (Section top: 336.4 mbsf)

ROCK NAME: Completely altered volcanic rock and breccia with variable black magnetite-bearing alteration.

UNIT: 55
Pieces: 5-12

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	34Z	1	5	24	336.64
Lower contact:	34Z	1	12	71	337.11

Thickness (m): 0.47

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: The rocks have mm- and cm-scale vugs with drusy mineral growth on the walls.

COLOR: Light gray, gray, black.

STRUCTURE: Vuggy, mottled, clastic.

ALTERATION: Highly silicified gray clasts, clasts of coarse-grained quartz ± pyrite, and tannish-gray, clay rich clasts are embedded in a highly silicified and magnetite-impregnated matrix. Bluish fine-grained silica patches. Vugs are filled with pyrite, anhydrite, quartz, and red hexagonal plates of wurtzite or hematite.

VEINS/FRACTURES: Pyrite veins and veinlets are common.

COMMENTS: This unit is basically a clastic unit similar in some respects to Units 51 and 53, yet is distinguished on the basis of the heterogeneous development of black, magnetite-bearing material in the matrix portions of the rocks. Piece 6 is an exception: it may be an aphanitic black volcanic rock. Piece 8 is another exception: it is a light gray, completely altered volcanic rock. Both of these pieces are small and may have fallen in.

ROCK NAME: Completely altered, variably silicified volcanic rock breccia.

UNIT: 56
Pieces: 13-17

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	34Z	1	13A	71	337.11
Lower contact:	34Z	1	17	133	337.73

Thickness (m): 0.62

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray.

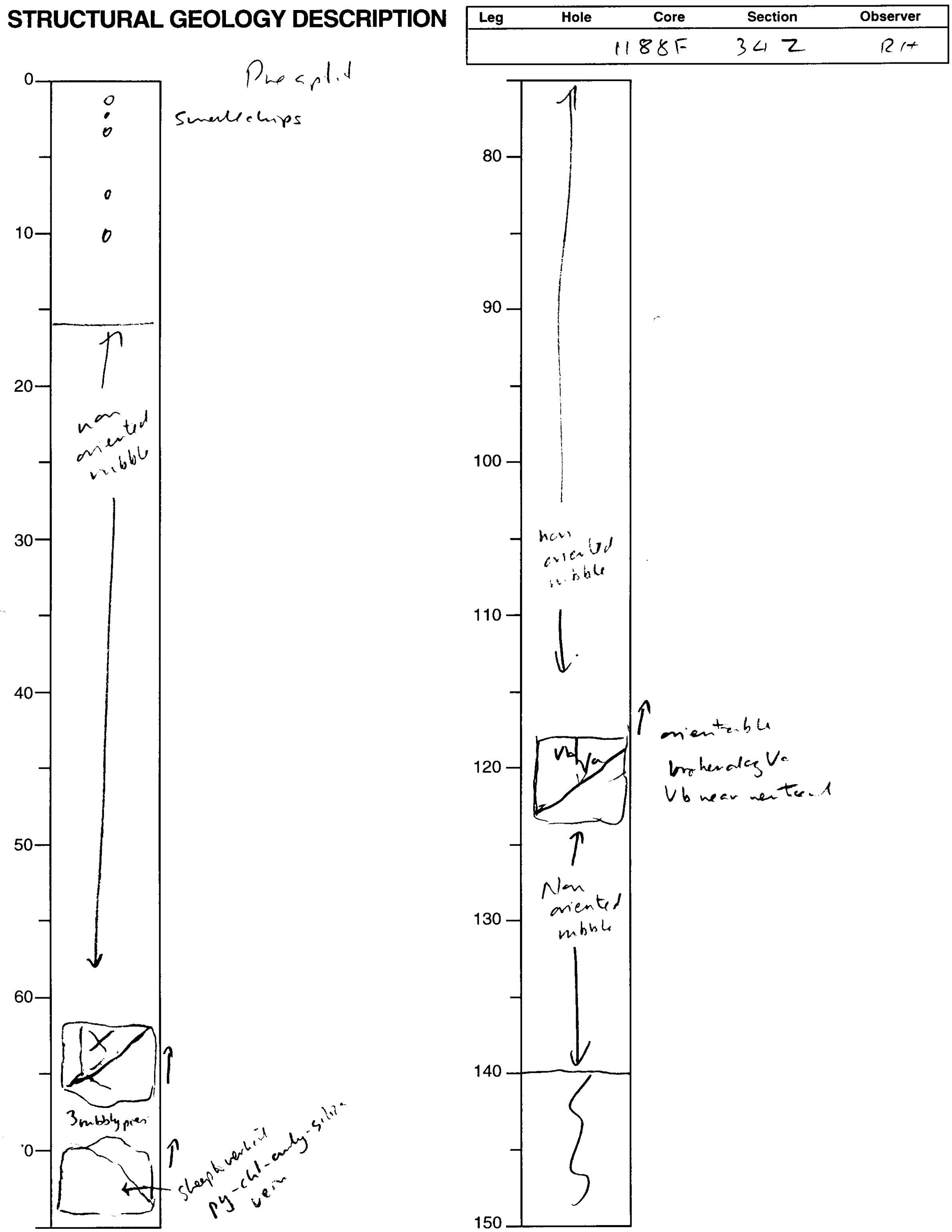
STRUCTURE: Clastic, mottled.

ALTERATION: Silicified rocks. The lighter gray portions have more clay ± anhydrite.

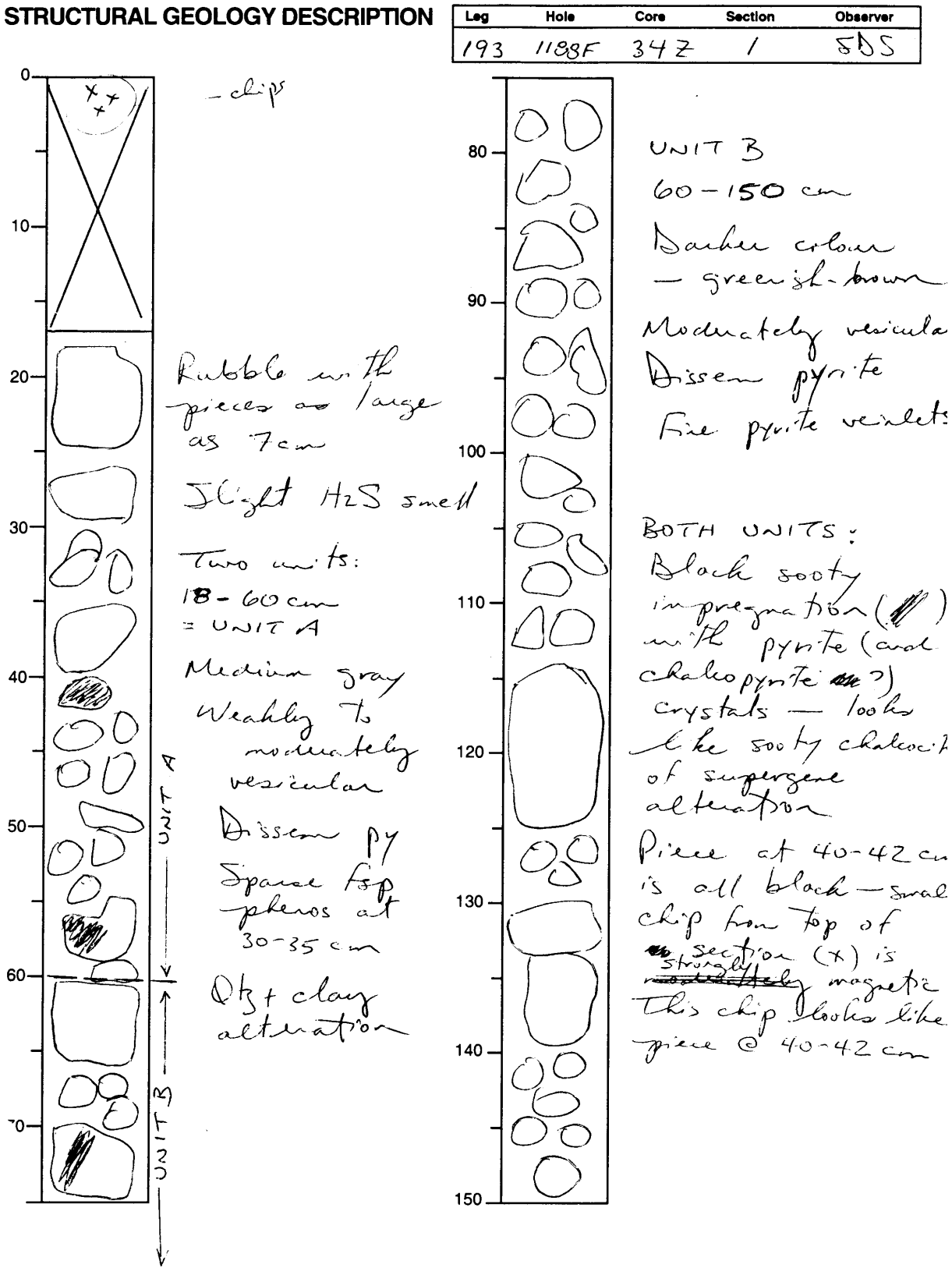
VEINS/FRACTURES: None.

COMMENTS: This unit continues the pattern of clastic-looking rock types from Units 51, 53, the last piece of Unit 54, and Unit 55. It is distinguished from Unit 55 by a lack of any black, magnetite-bearing material in the matrix portions of the rocks.

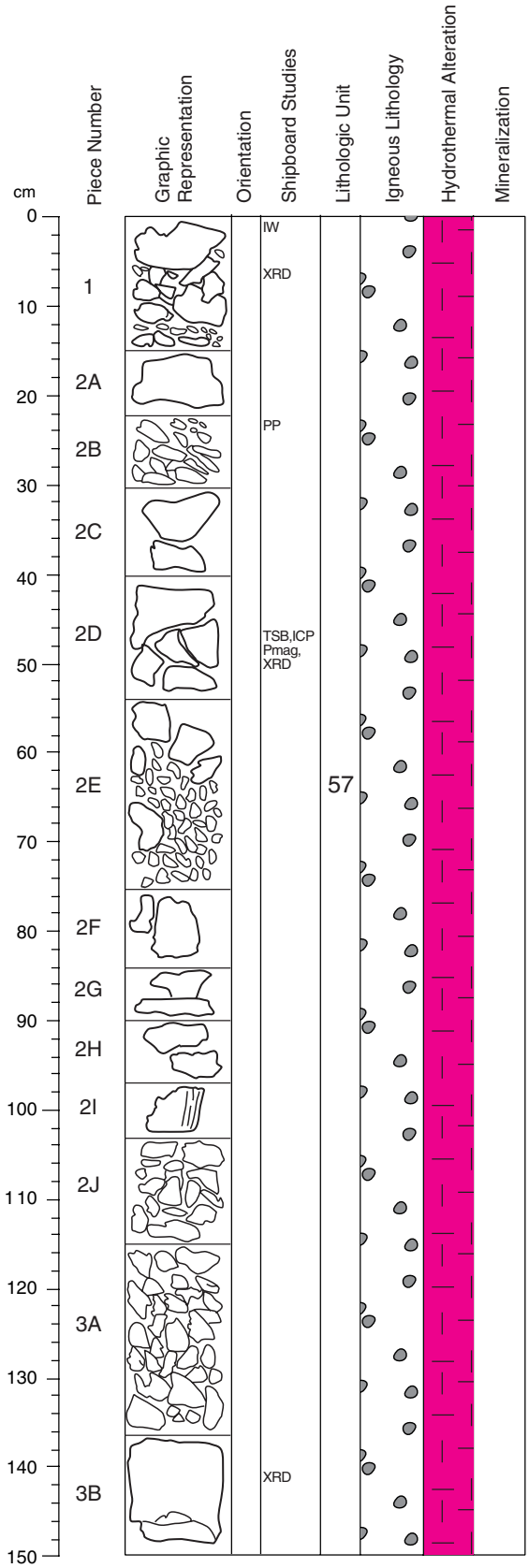
Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg
Hole
Core
Section
Observer
1188F
34 Z
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 34Z
Section 1
Observer SDS
- chips
Rubble with pieces as large as 7 cm
Slight H2S smell
Two units:
1B - 60 cm = UNIT A
Medium gray
Weakly to moderately vesicular
Dissem py
Sparse fsp phenos at 30-35 cm
Qtz + clay alteration
UNIT A
UNIT B
UNIT B
60-150 cm
Darker colour - greenish-brown
Moderately vesicular
Dissem pyrite
Fine pyrite veinlets
BOTH UNITS:
Black sooty impregnation ( ) with pyrite (and chalcopyrite ?) crystals — looks like sooty chalcocite of supergene alteration
Piece at 40-42 cm is all black — small chip from top of section (x) is strongly magnetic
This chip looks like piece @ 40-42 cm

Core Photo



ADCB Core Description

193-1188F-35Z-1 (Section top: 340.0 mbsf)

ROCK NAME: Silicified, sparsely amygdaloidal, aphyric, massive volcanic rock.

UNIT: 57
Pieces: 1 to 3.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	35Z	1	1	0	340.0
Lower contact:	37Z	2	2	29	346.11

Thickness (m): 6.11

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Gray silica amygdales (1 to 3%), generally <1 mm in diameter.

COLOR: Light gray.

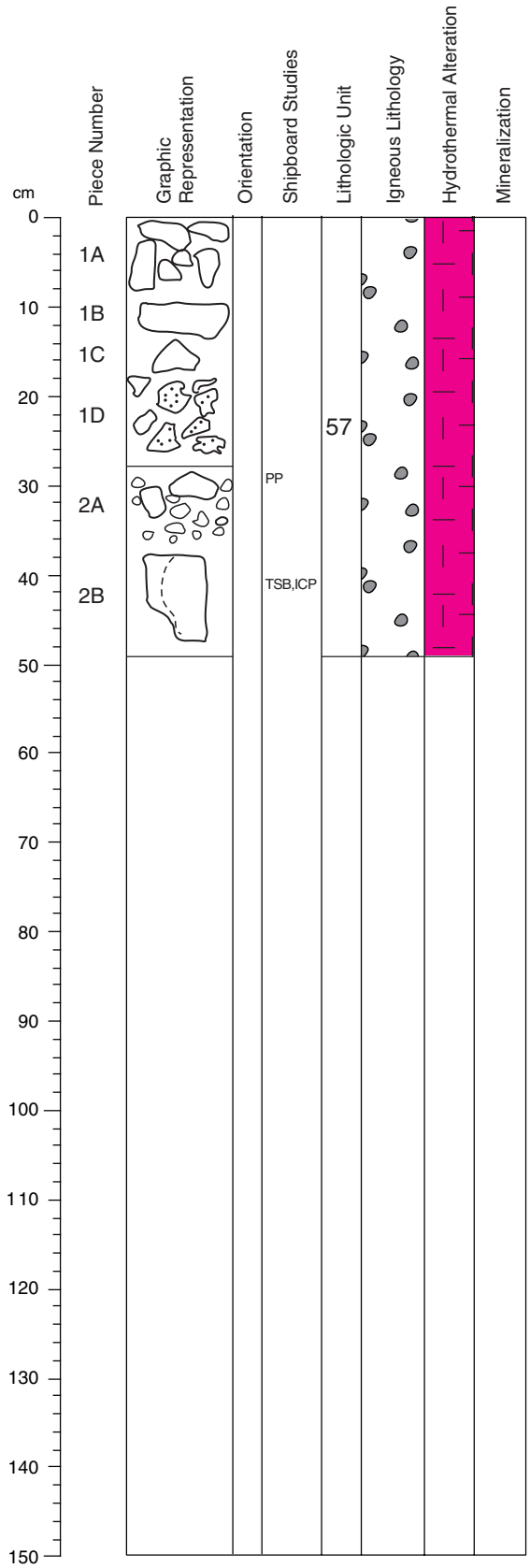
STRUCTURE: Massive.

ALTERATION: Highly silicified rocks with scattered, ovoid, fine-grained quartz amygdales. Traces of disseminated magnetite in Pieces 1, 2D, and 2E.

VEINS/FRACTURES: Widespread anhydrite veins, typically on the margins of fragments/pieces. Siliceous halos are common around the veins.

COMMENTS: Gray siliceous pieces are massive with spotty texture due to dark gray silica amygdales (<1 mm in diameter). Banded textures are common and related to anhydrite±pyrite veins. Pieces 1 and 2B are rubble with abundant, soft, magnetite-rich fragments.

Core Photo



ADCB Core Description

193-1188F-35Z-2 (Section top: 341.36 mbsf)

ROCK NAME: Silicified, sparsely amygdaloidal, aphyric, massive volcanic rock.

UNIT: 57
Pieces: 1 to 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	35Z	1	1	0	340.00
Lower contact:	37Z	2	2	29	346.11

Thickness (m): 6.11

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Gray-green silica-pyrite amygdales (1% to 3%, generally <2 mm in diameter).

COLOR: Light gray.

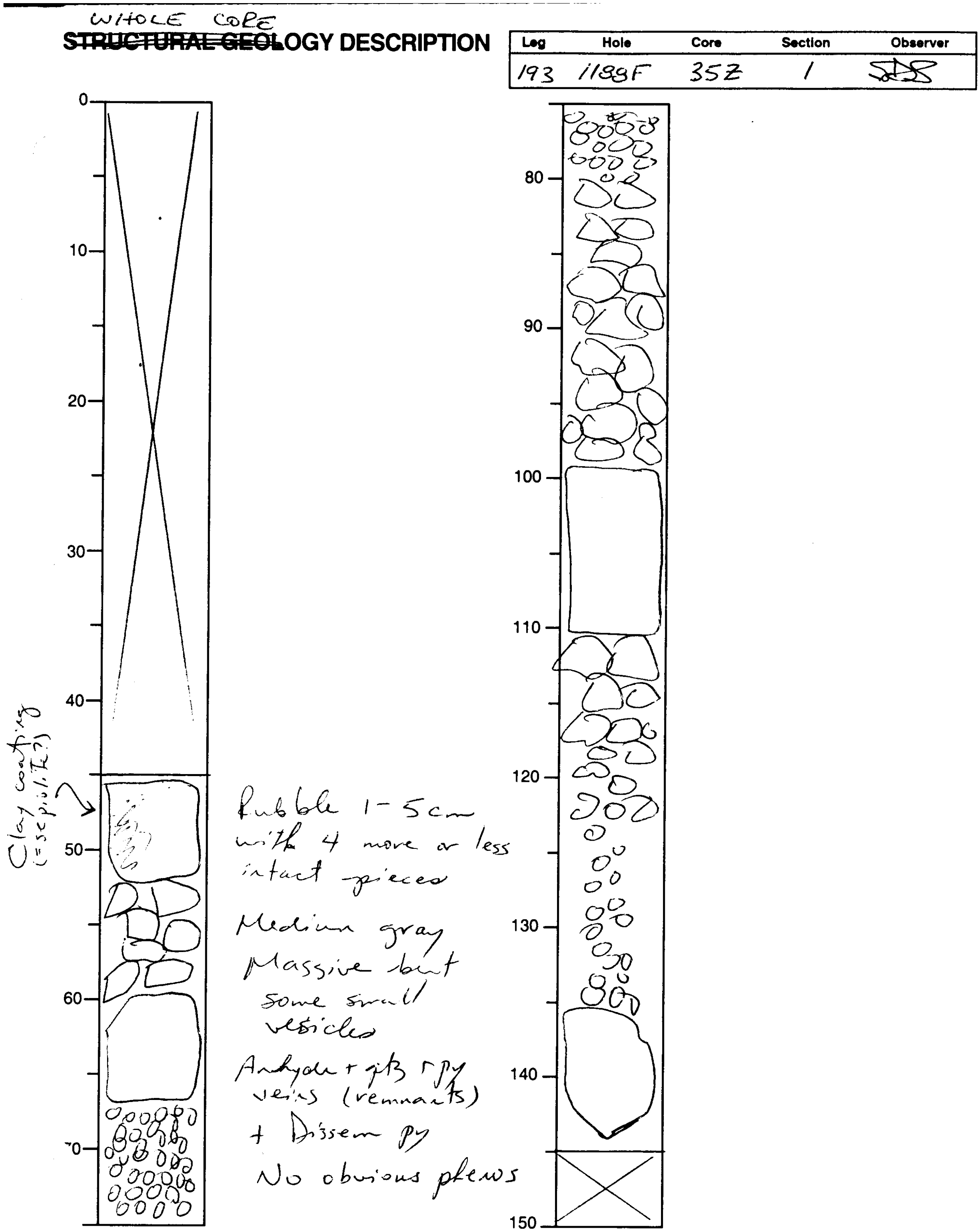
STRUCTURE: Massive.

ALTERATION: Silicified. Piece 1D is rubble embedded in sticky white grit and clay (drill flour?).

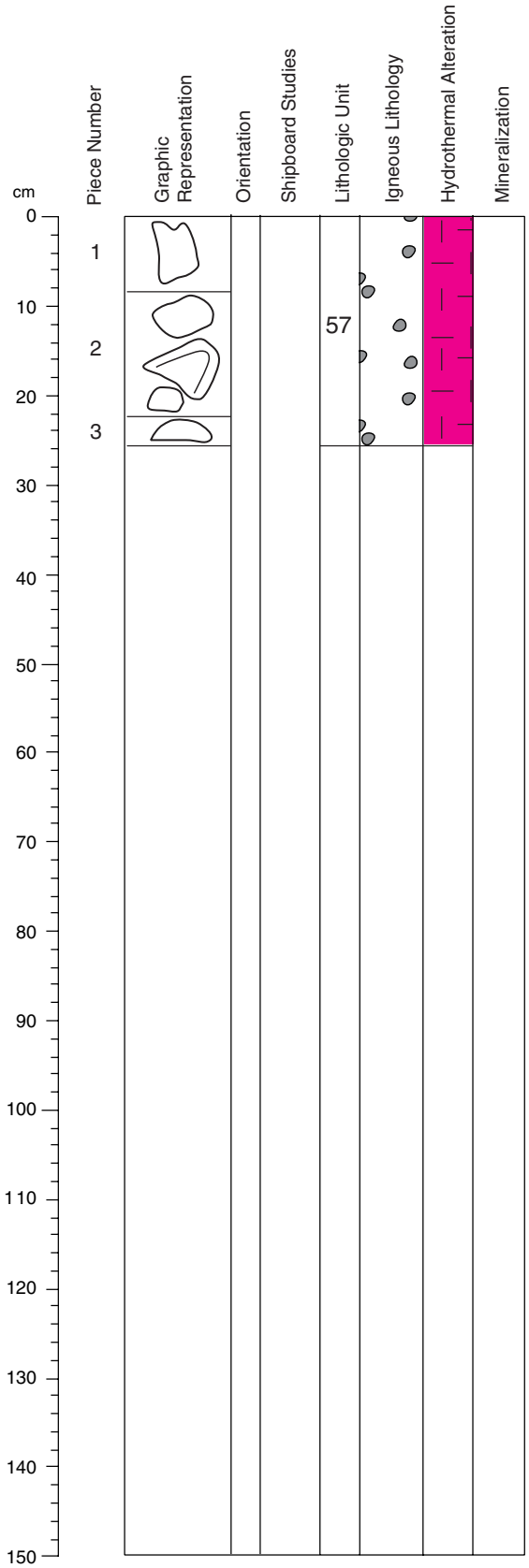
VEINS/FRACTURES: Anhydrite-pyrite-quartz veins with distinct, zoned halos.

COMMENTS: Gray siliceous pieces are massive with spotty texture due to dark gray silica-pyrite amygdales (<2 mm in diameter). Piece 1A includes a fragment of crustiform anhydrite vein.

Core Photo


WHOLE CORE
~~STRUCTURAL GEOL~~OGY DESCRIPTION
Leg 193
Hole 1188F
Core 35Z
Section 1
Observer
Rubble 1-5cm with 4 more or less intact pieces
Medium gray
Massive but some small vesicles
Anhydrite + qtz + py veins (remnants)
+ Dissem py
No obvious planes
Clay coating (=sepiol. Fe?)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-36G-1
(Ghost core)

ROCK NAME: Silicified, sparsely vesicular, aphyric, massive volcanic rock.

UNIT: 57.
Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	35Z	1	1	0	340.00
Lower contact:	37Z	2	2	29	346.11

Thickness (m): 6.11

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Gray-green silica-pyrite amygdales (up to 3%, generally <2 mm in diameter).

COLOR: Light gray.

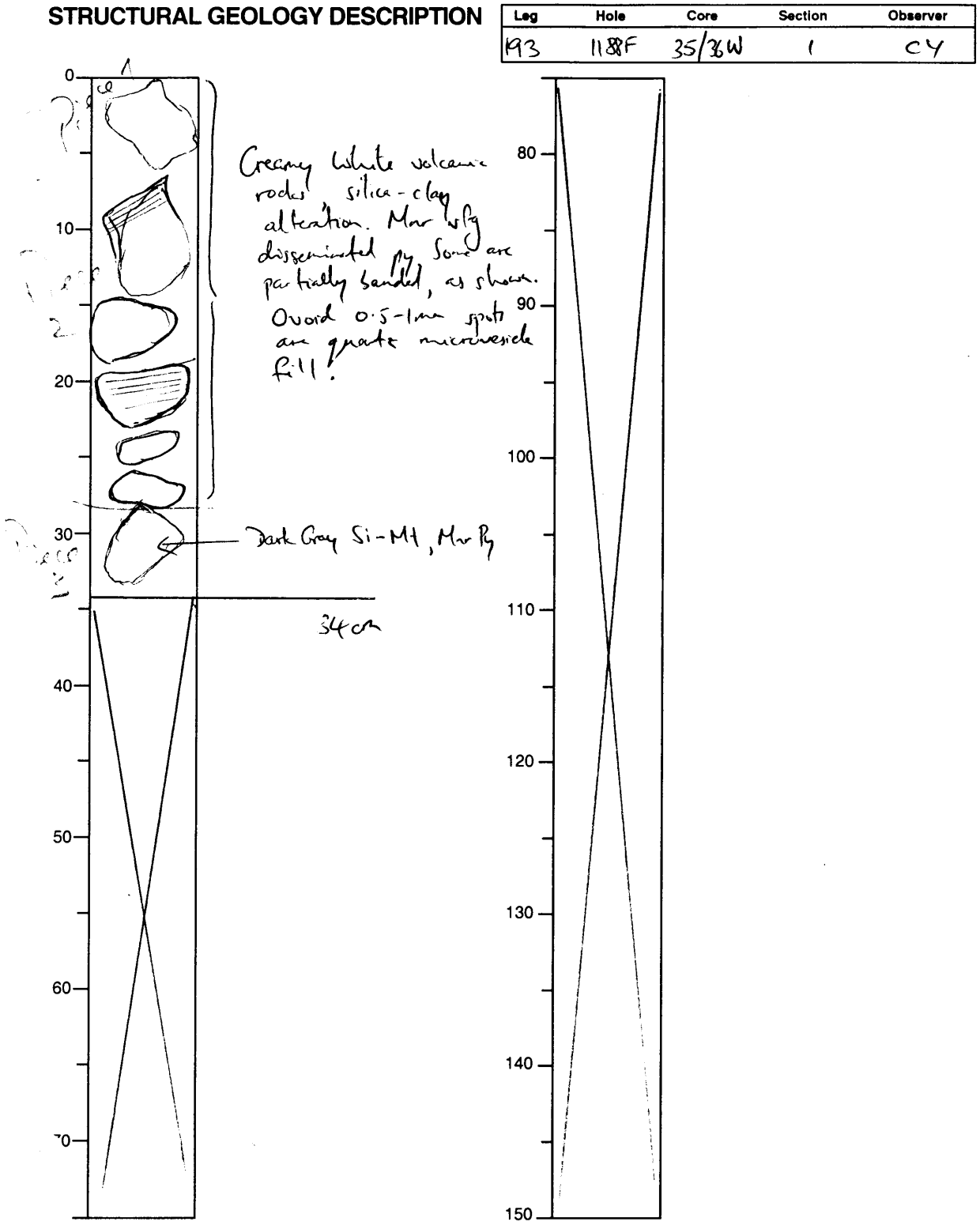
STRUCTURE: Massive.

ALTERATION: Silicified with fine quartz amygdales.

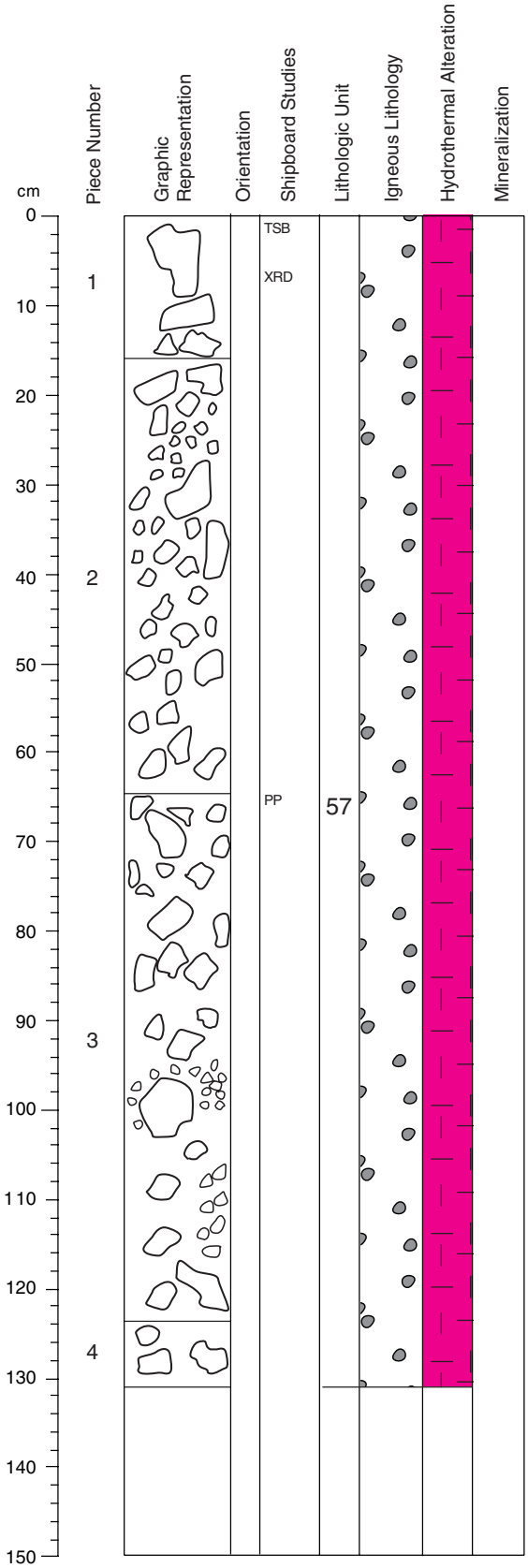
VEINS/FRACTURES: Anhydrite-pyrite veins typically with siliceous alteration halos.

COMMENTS: Prominent alteration halos along margins of several pieces (halos of anhydrite veins). Piece 3 is a 3 cm diameter fragment of a magnetite+quartz-rich rock with a clastic texture (similar to Unit 55 in 34Z), and is interpreted to be fall back.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 35/36W
Section 1
Observer CY
Creamy white volcanic rocks, silica-clay alteration. Mor wfg disseminated Py. Some are partially banded, as shown. Ovoid 0.5-1mm spots are quartz microvesicle fill!
Dark Gray Si-Mt, Mor Py
34cm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-37Z-1 (Section top: 344.5 mbsf)

ROCK NAME: Silicified, sparsely amygdaloidal, aphyric, massive volcanic rock.

UNIT: 57
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	35Z	1	1	0	340.0
Lower contact:	37Z	2	2	29	346.11
Thickness (m): 6.11					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Gray-green silica-pyrite amygdales (up to 2%, generally <1 mm in diameter).

COLOR: Light gray.

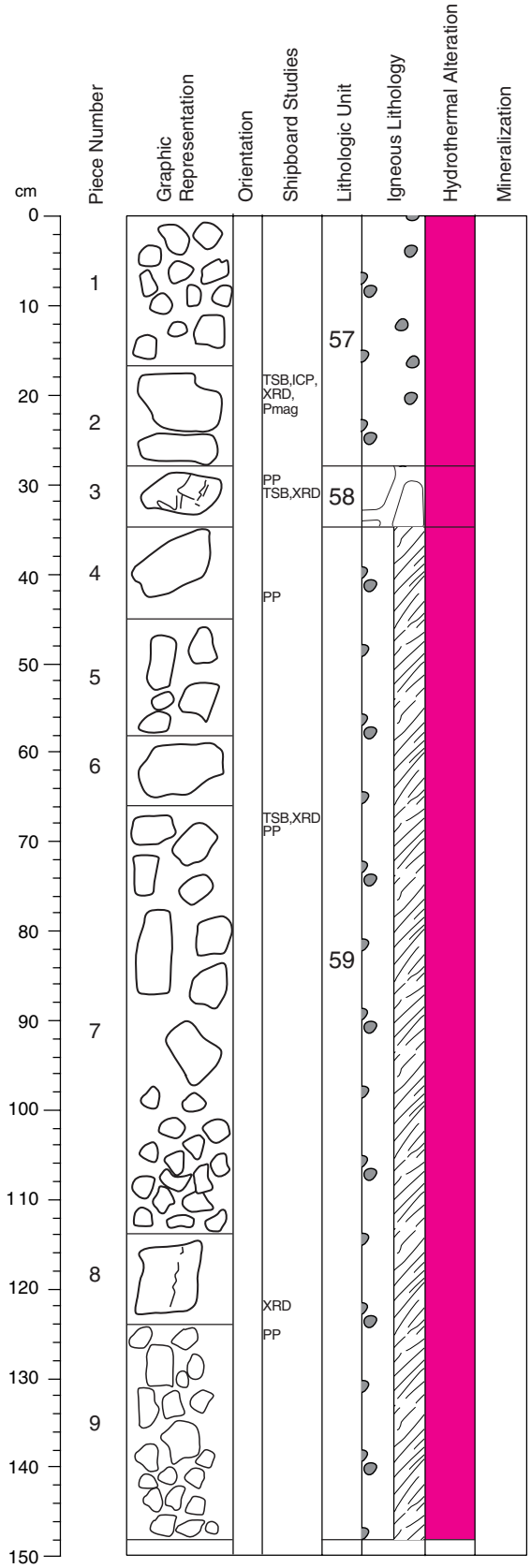
STRUCTURE: Massive.

ALTERATION: Silicified rock with banded zoned alteration. Darker kernels contain very fine grained, disseminated magnetite and up to 2% pyrite. Paler outer zones contain no magnetite and <<1% pyrite.

VEINS/FRACTURES: Anhydrite -pyrite veins and rare fine quartz veins. Siliceous halos are common.

COMMENTS: Prominent alteration halos along margins of several pieces, particularly well-developed in Piece 1. Some dark gray to black fragments with fine-grained, disseminated magnetite (Piece 3).

Core Photo



ADCB Core Description

193-1188F-37Z-2 (Section top: 345.82 mbsf)

ROCK NAME: Silicified, sparsely vesicular, aphyric, massive volcanic rock.

UNIT: 57
Pieces: 1 to 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	35Z	1	1	0	340.00
Lower contact:	37Z	2	2	29	346.11

Thickness (m): 6.11

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Gray-green silica±pyrite±clay amygdales (up to 2%, generally <1 mm in diameter). Rare vesicles (up to 5 mm in diameter) are lined by anhydrite in Piece 1.

COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Silicified with fine quartz amygdales.

VEINS/FRACTURES: Anhydrite±pyrite veins and veinlets commonly with siliceous alteration halos. Piece 2 contains a 0.5 to 2 mm wide quartz vein with magnetite surrounded by a 2 cm wide light gray, siliceous alteration halo.

ROCK NAME: Magnetite-rich clastic rock.

UNIT: 58
Pieces: 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	36Z	2	3	29	346.11
Lower contact:	36Z	2	3	35	346.17

Thickness (m): 0.06

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Pyrite±anhydrite-filled vesicles/vugs and very fine quartz amygdales (<0.5 mm).

COLOR: Light gray.

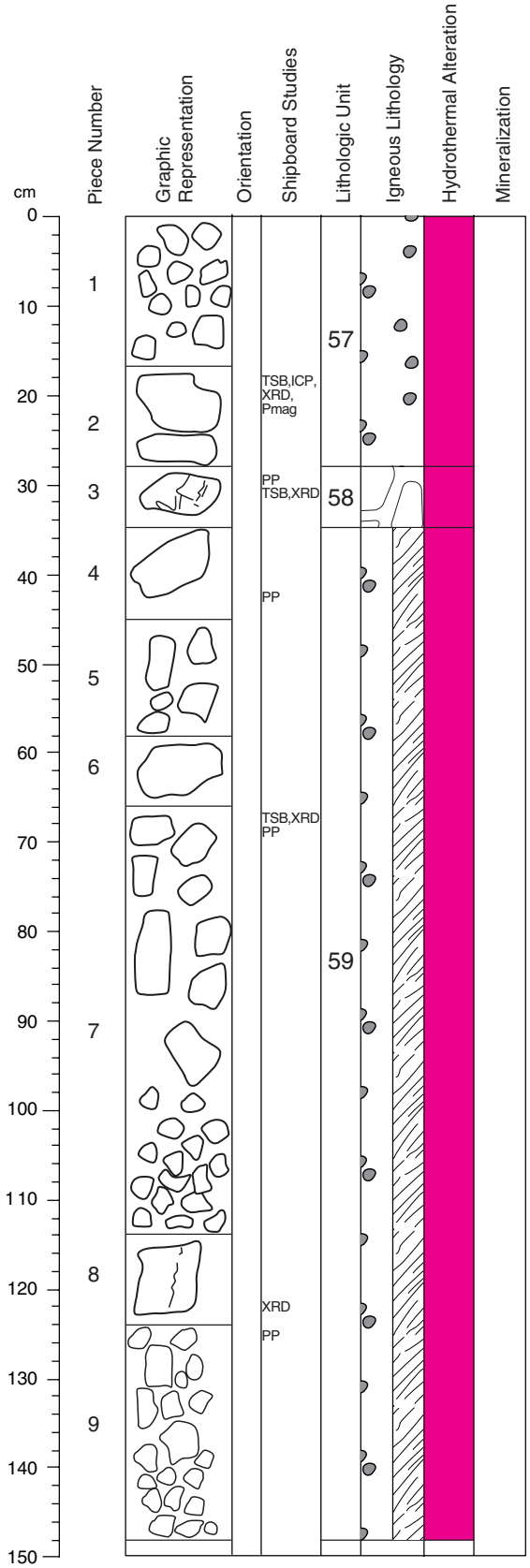
STRUCTURE: Fragmented. Magnetite-rich domains and minor white anhydrite-rich domains which may represent the filling of intraclast space or disintegrated vein.

ALTERATION: Disseminated magnetite (5%-8%) throughout the dark siliceous groundmass. Quartz-anhydrite pyrite domains have near massive, 2 mm wide magnetite alteration halos.

VEINS/FRACTURES: None.

COMMENTS: It is uncertain, whether the clastic texture of this rock is due to brecciation prior or during alteration.

Core Photo



193-1188F-37Z-2

ROCK NAME: Silicified, flow banded, locally magnetite-bearing, aphyric volcanic rock.

UNIT: 59
Pieces: 4 to 9

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	37Z	2	4	35	346.17
Lower contact:	37Z	2	9	147	347.29

Thickness (m): 1.12

CONTACTS: None.

PHENOCRYSTS: Generally none. Piece 6 contains rare, white, clay altered plagioclase (1 to 2 mm).

GROUNDMASS: Very fine-grained.

VESICLES: Gray-green quartz amygdales (up to 2%, <1 mm). Some fragments in Piece 7 contain pyrite silica filled elongate vesicles (1 mm x 2 to 4 mm, 8 %).

COLOR: Light gray, banded (light gray, gray, olive gray) or dark gray.

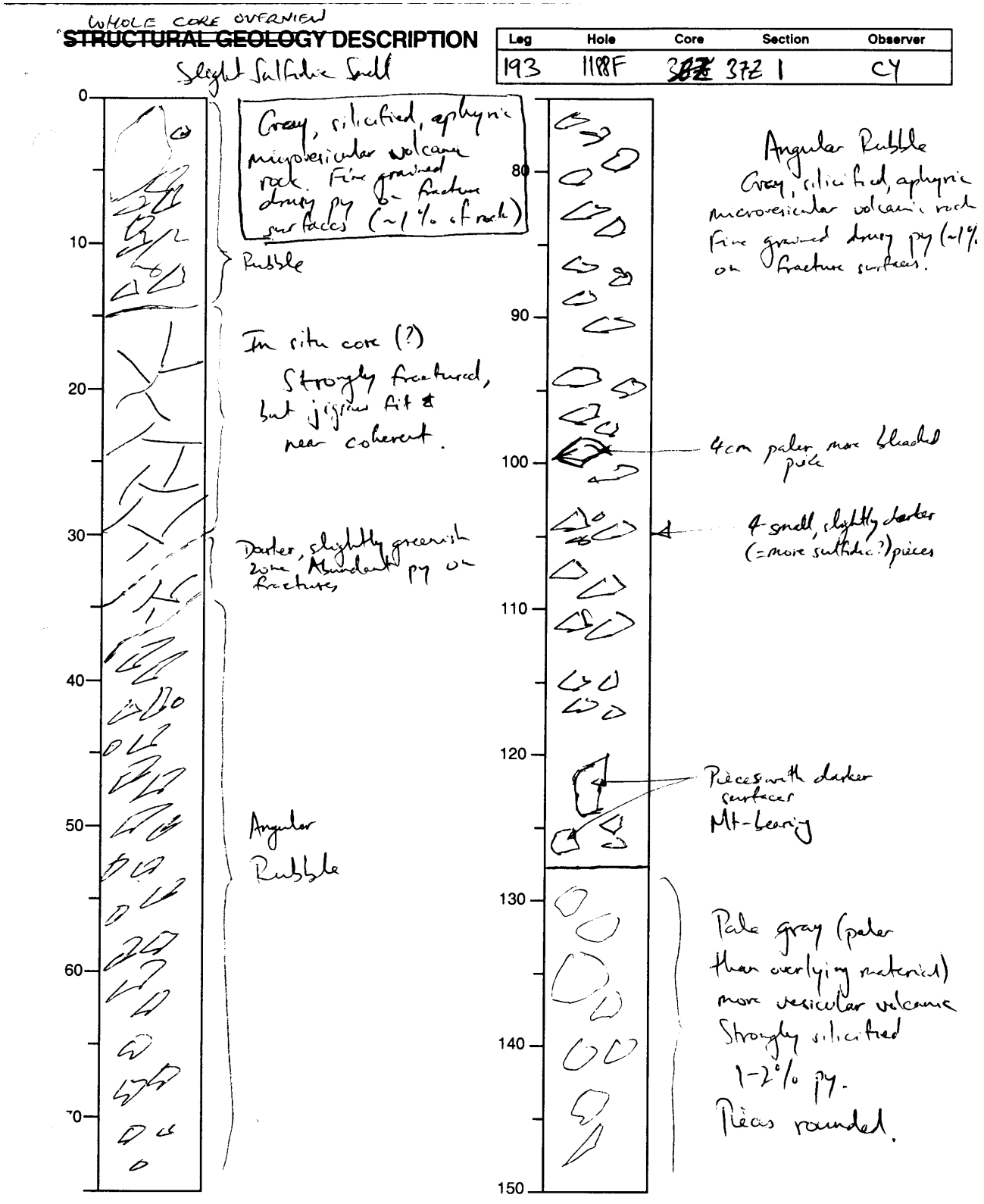
STRUCTURE: Massive to vesicular and flow banded.

ALTERATION: Banded, variably colored, silicified rock with fine quartz amygdales. Darker bands and domains are magnetite-bearing. Pyrite occurs as crystals lining small vesicles.

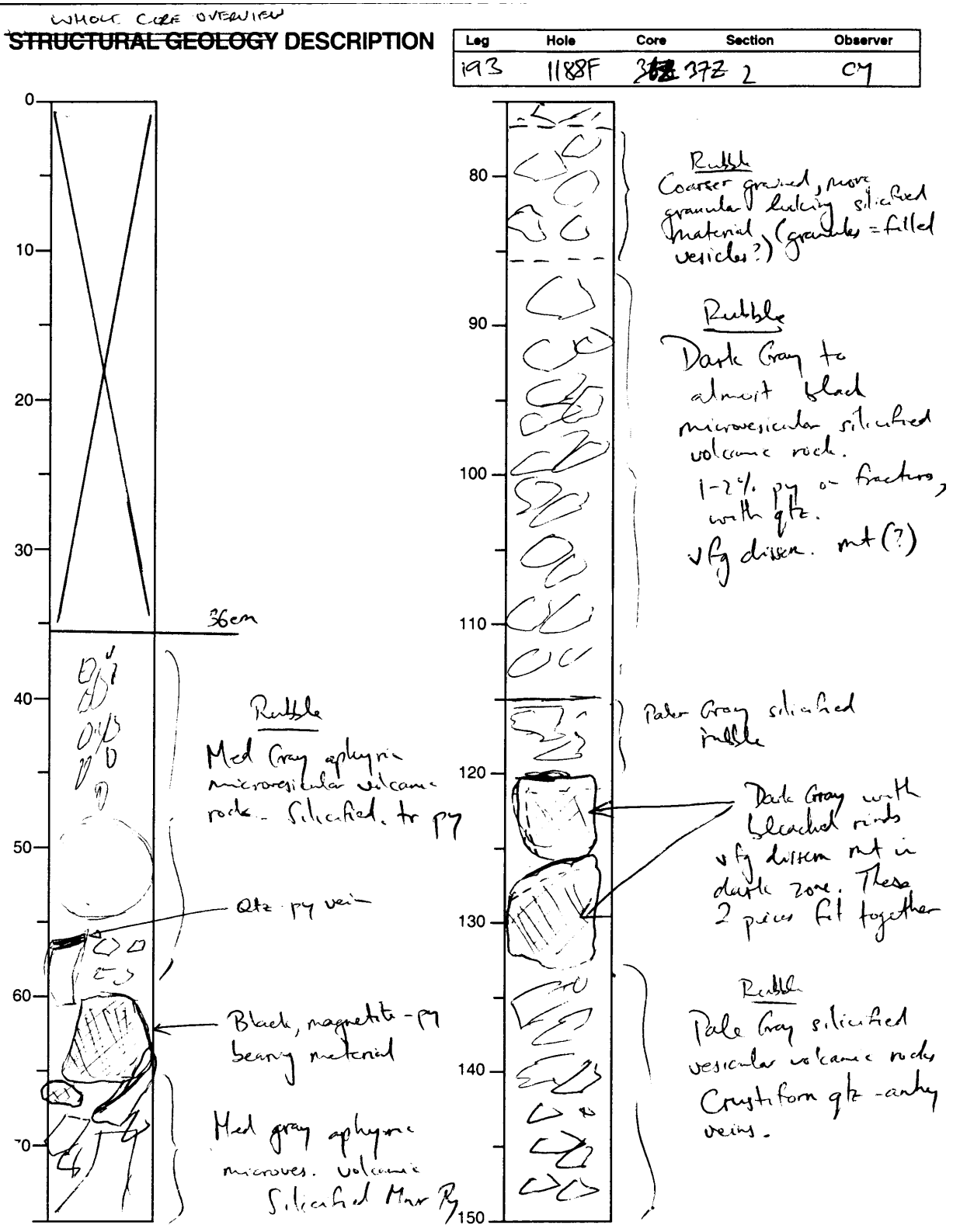
VEINS/FRACTURES: Anhydrite veins with minor pyrite. Siliceous alteration halos along veins are common. One of the rubble fragments in Piece 7 contains magnetite in a clay-silica halo.

COMMENTS: The groundmass of Piece 7 and several fragments in Piece 7 is dark gray to black with disseminated fine grained magnetite. Banding, defined by variations in the color of the groundmass, is generally restricted to halos along anhydrite veins. However, some pieces (e.g., Piece 6 and several fragments in Piece 7) show banding defined by variations in the abundance of fine silica amygdales that is cross cut by veins and is, therefore, inferred to represent primary flow banding.

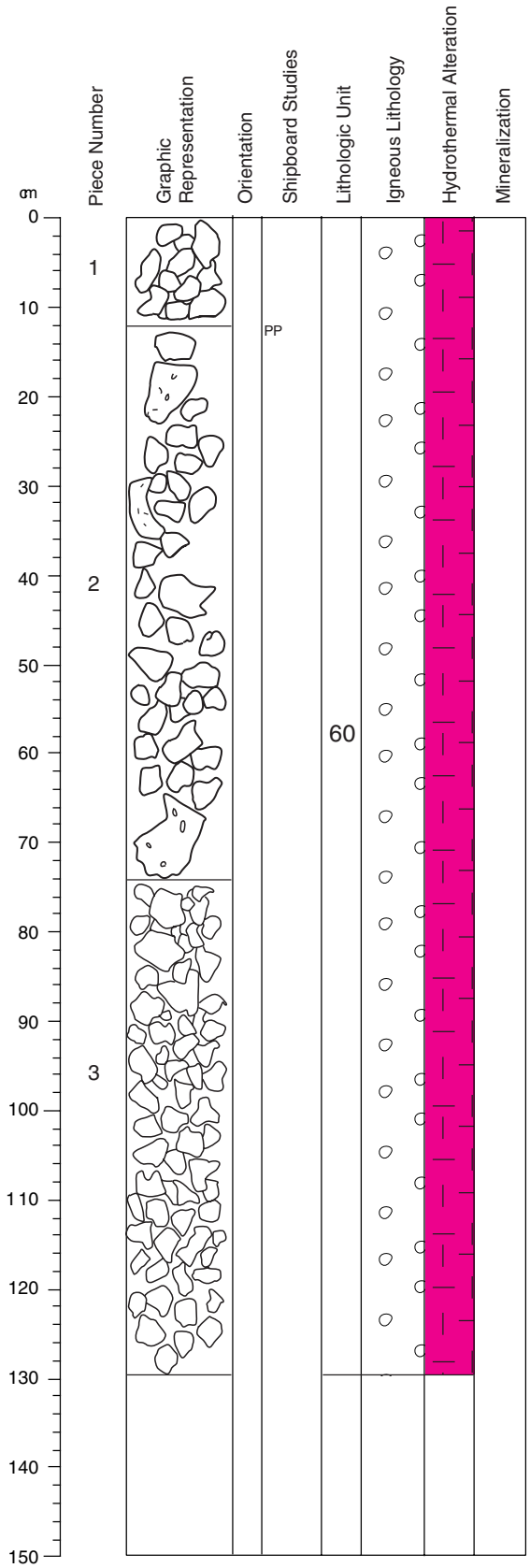
Core Photo


WHOLE CORE OVERVIEW
STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 372
Section 1
Observer CY
Slight Sulfide Smell
Gray, silicified, aphyric microvesicular volcanic rock. Fine grained dusty py on fracture surfaces (~1% of rock)
Rubble
In situ core (?)
Strongly fractured, but jigsaw fit & near coherent.
Darker, slightly greenish zone. Abundant py on fractures
Angular Rubble
Angular Rubble
Gray, silicified, aphyric microvesicular volcanic rock Fine grained dusty py (~1% on fracture surfaces.
4cm paler more bleached piece
4 small, slightly darker (=more sulfide?) pieces
Pieces with darker surfaces
Mt-bearing
Pale gray (paler than overlying material) more vesicular volcanic
Strongly silicified
1-2% py.
Pieces rounded.

Core Photo


WHOLE CORE OVERVIEW
STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 372
Section 2
Observer CM
Rubble
Coarser grained, more granular looking silicified material (granules = filled vesicles?)
Rubble
Dark Gray to almost black microvesicular silicified volcanic rock.
1-2% py on fractures, with qtz.
vfg diseem. mt (?)
36cm
Rubble
Med Gray aphyric microvesicular volcanic rock. Silicified, tr py
Qtz-py vein
Black, magnetite-py bearing material
Med gray aphyric microves. volcanic Silicified Minor Py
Pale Gray silicified rubble
Dark Gray with bleached rinds vfg diffuse mt in dark zone. These 2 pieces fit together
Rubble
Pale Gray silicified vesicular volcanic rocks
Crystiform qtz-anhy veins.

Core Photo



ADCB Core Description

193-1188F-38Z-1 (Section top: 349.0 mbsf)

ROCK NAME: Completely altered, sparsely plagioclase-phyric, slightly vesicular volcanic rock.

UNIT: 60
Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	38Z	1	1	0	349.00
Lower contact:	38Z	1	3	130	350.30

Thickness (m): 1.30

CONTACTS: None.

PHENOCRYSTS: Piece 2 contains sparse plagioclase phenocrysts up to 2 mm long, pseudomorphed by clay.

GROUNDMASS: Very fine-grained.

VESICLES: Unfilled vesicles up to 8 mm in maximum dimension are ovoid and are oriented parallel to aligned phenocrysts defining a flow texture.

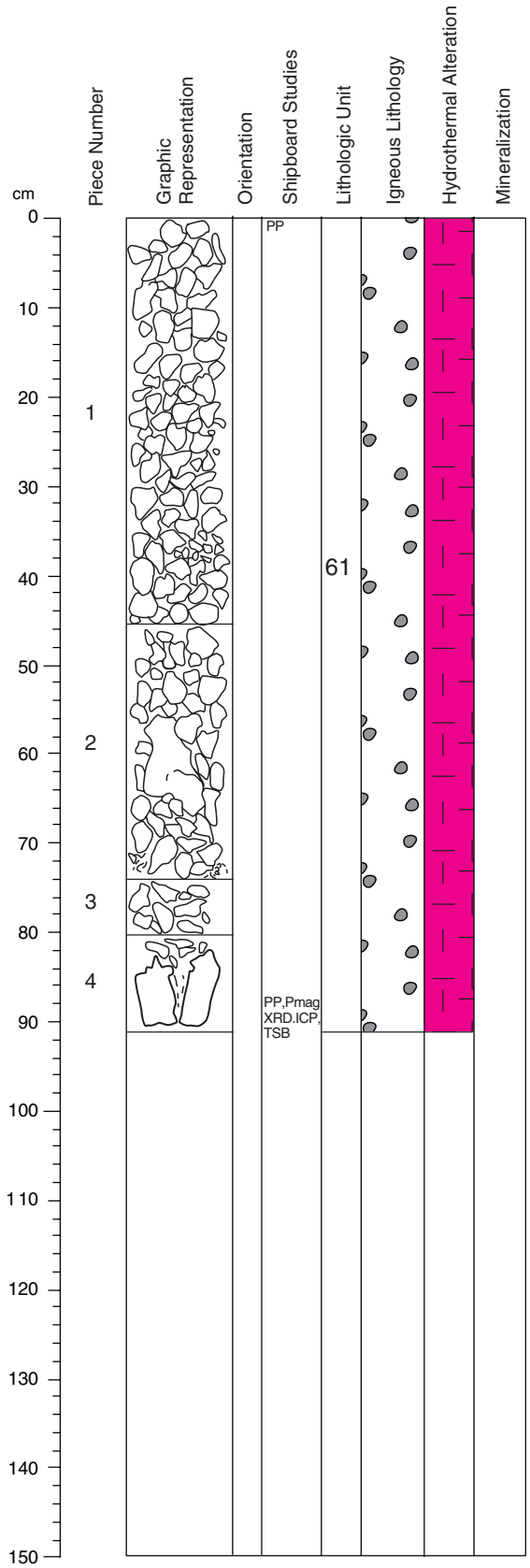
COLOR: Light gray.

STRUCTURE: Massive to flow aligned.

ALTERATION: Uniformly silicified light gray to greenish gray rocks. Groundmass is dominantly quartz with clay and very minor disseminated pyrite and magnetite.

VEINS/FRACTURES: None.

Core Photo



ADCB Core Description

193-1188F-38Z-2 (Section top: 350.30 mbsf)

ROCK NAME: Completely altered, sparsely amygdaloidal volcanic rock.

UNIT: 61
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	38Z	2	1	0	350.30
Lower contact:	38Z	2	4	92	351.22

Thickness (m): 0.92

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: A spotted texture of soft green ovoids, <1 mm, interpreted as amygdales.

COLOR: Dark green-gray.

STRUCTURE: Massive.

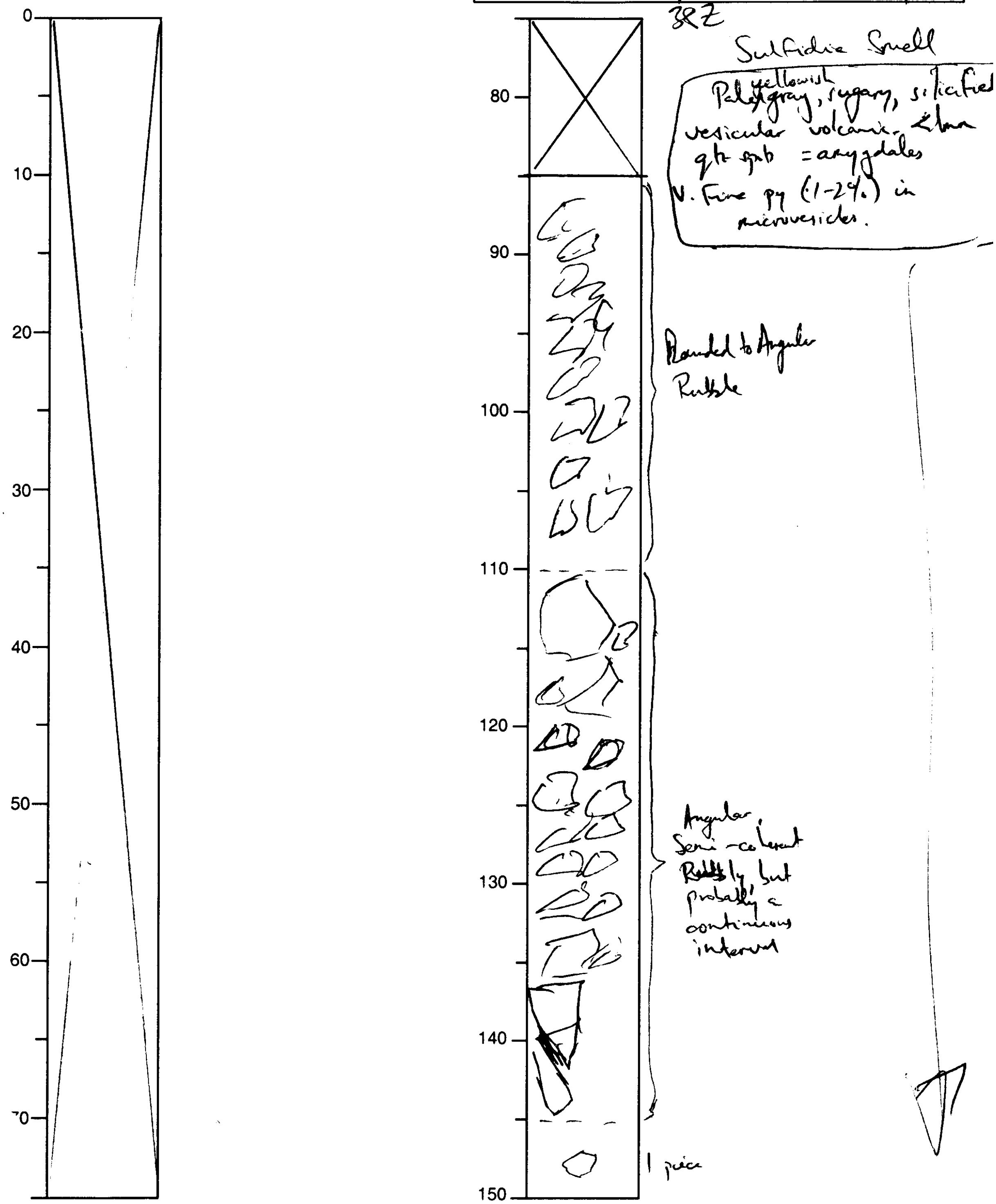
ALTERATION: Silicified, greenish-gray rocks with disseminated very fine-grained magnetite and pyrite (up to 1% each) in groundmass. Groundmass is gray, greenish-gray, or green silica-clay. Plagioclase microlites are replaced by white clay.

VEINS/FRACTURES: None.

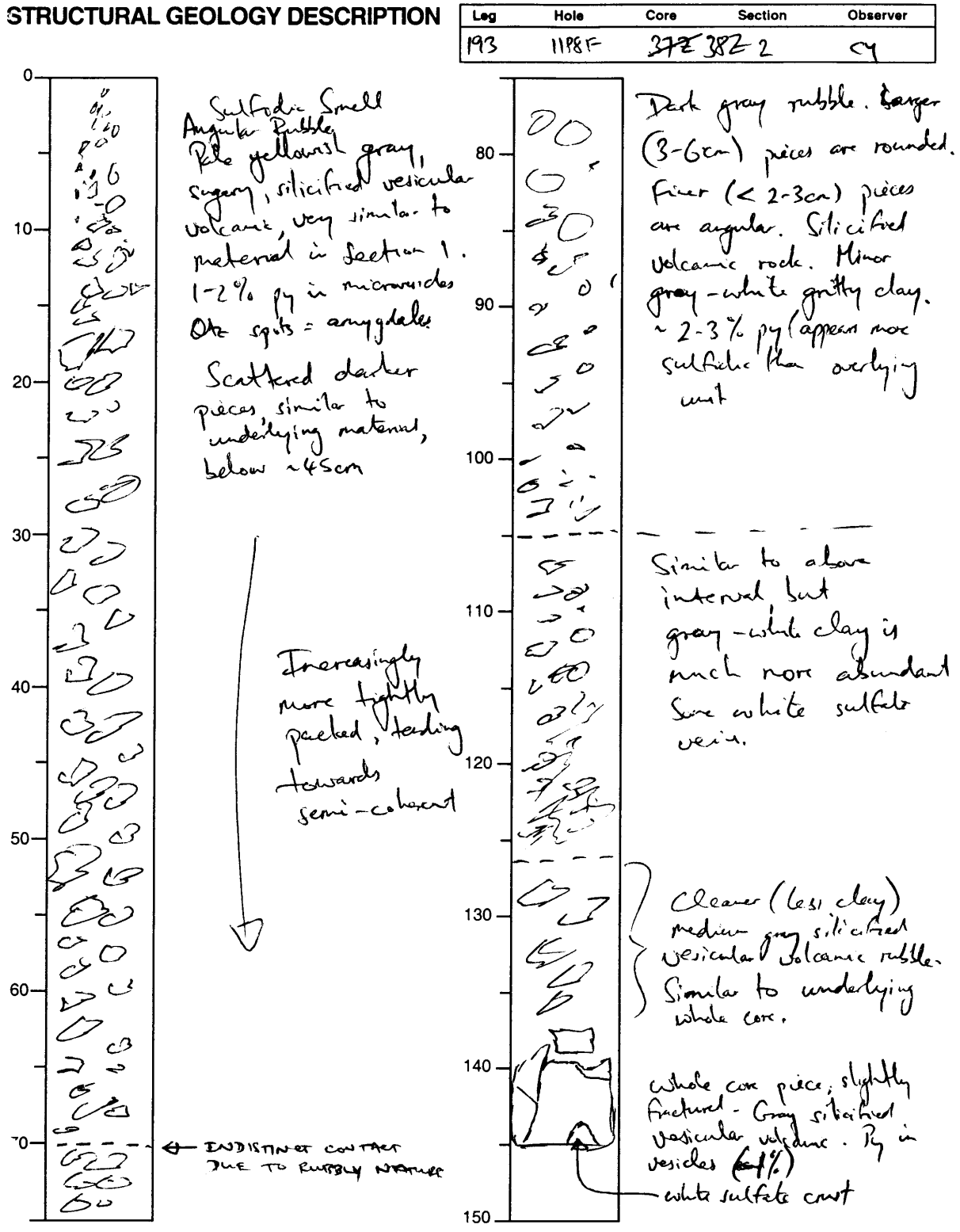
Core Photo

STRUCTURAL GEOLOGY DESCRIPTION

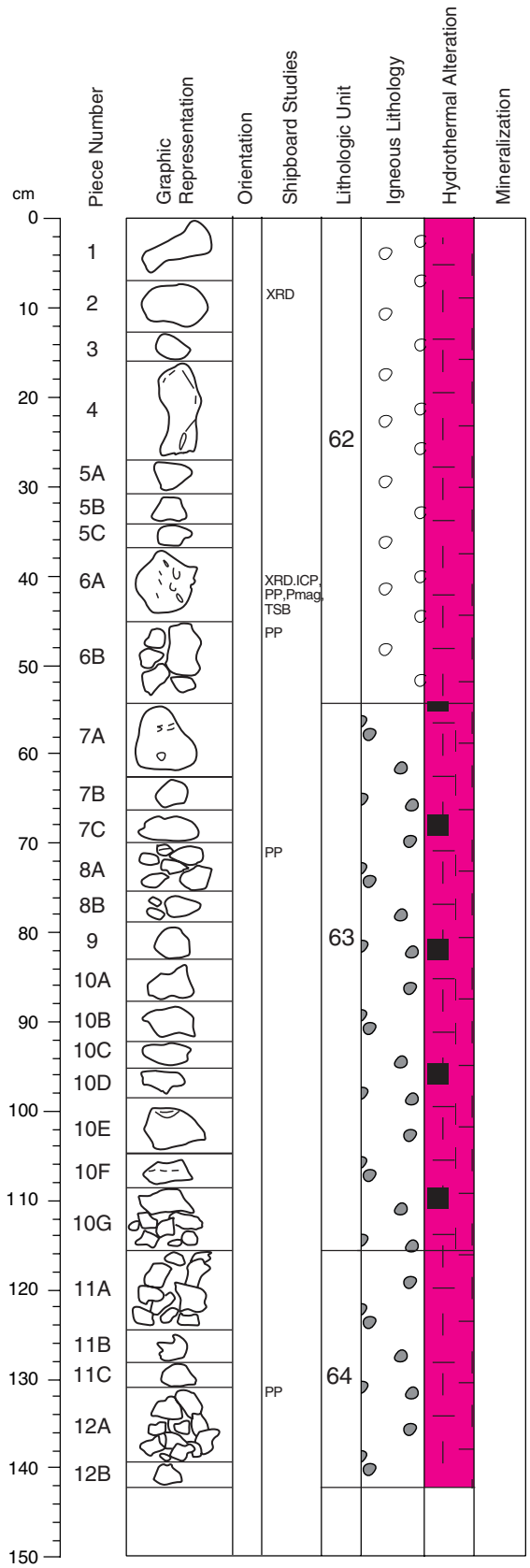
Leg	Hole	Core	Section	Observer
193	1188F	~~37Z~~ 38Z	1	CY



Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 3R 3R 2
Section
Observer CY
Sulfidic Smell
Angular Rubble
Pale yellowish gray, sugary, silicified vesicular volcanic, very similar to material in Section 1.
1-2% py in microvesicles
Other spots = amygdales
Scattered darker pieces, similar to underlying material, below ~45cm
Increasingly more tightly packed, fading towards semi-coherent
Dark gray rubble. Larger (3-6cm) pieces are rounded. Finer (< 2-3cm) pieces are angular. Silicified volcanic rock. Minor gray-white gritty clay. ~2-3% py (appears more sulfidic than overlying unit
Similar to above interval but gray-white clay is much more abundant
Some white sulfate veins.
Cleaner (less clay) medium gray silicified vesicular volcanic rubble. Similar to underlying whole core.
whole core piece, slightly fractured - Gray silicified vesicular volcanic. Py in vesicles (<1%)
white sulfate crust
EROSIONAL CONTACT DUE TO RUBBLY NATURE
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-39Z-1 (Section top: 353.5 mbsf)

ROCK NAME: Completely altered, sparsely plagioclase-phyric, sparsely vesicular volcanic rock.

UNIT: 62
Pieces: 1 to 6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	39Z	1	1	0	353.50
Lower contact:	39Z	1	6	55	354.05

Thickness (m): 0.55

CONTACTS: None.

PHENOCRYSTS: Trace to 1% plagioclase phenocrysts, pseudomorphed by clay

GROUNDMASS: Very fine-grained.

VESICLES: Gray-green ovoids (up to 5%, <2 mm). Vesicles up to 10 mm in Piece 6A are lined by pyrite anhydrite.

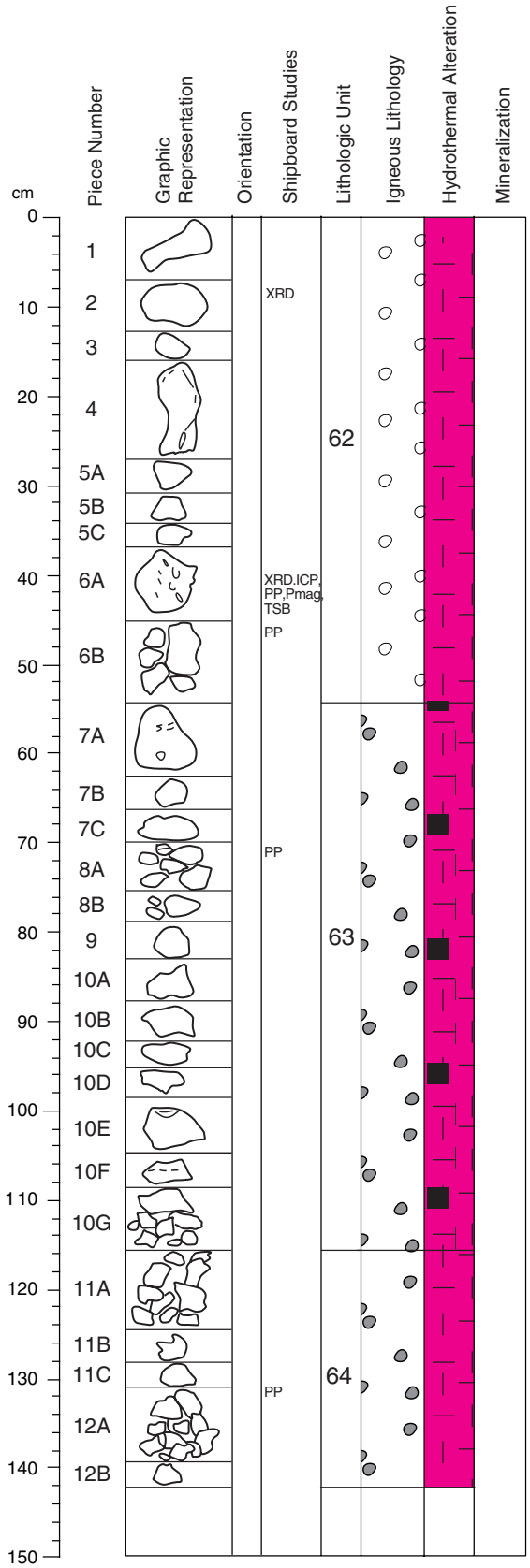
COLOR: Light gray to dark gray.

STRUCTURE: Massive to flow aligned.

ALTERATION: Silicified gray to light gray rocks. Groundmass is dominantly quartz with clay and very minor disseminated pyrite and magnetite (up to 1%). Zoned halos are developed in Pieces 1 and 2 and consist of gray silicified and light gray, slightly softer bands. Plagioclase phenocrysts are replaced by white clay or dark gray clay+quartz.

VEINS/FRACTURES: Anhydrite-pyrite vein with zoned halo in Piece 1, 0.1 mm wide pyrite veinlet with a 0.2 mm wide light gray halo in Piece 3. Anhydrite-pyrite vein with a 1 cm wide dark gray halo is crosscut by pyrite veinlet with a mm-wide silicified halo in Piece 4.

Core Photo



193-1188F-39Z-1 (Section top: 353.5 mbsf)

ROCK NAME: Completely altered, variably magnetite-enriched, aphyric, massive volcanic rock.

UNIT: 63
Pieces: 7 to 10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	39Z	1	7	55	354.05
Lower contact:	39Z	1	10	115	354.65

Thickness (m): 0.60

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Limited to Piece 7A, where amygdules and partly-filled vugs reach 7 mm across.

COLOR: Black to dark gray to light gray.

STRUCTURE: Massive.

ALTERATION: Abundant magnetite (up to 5%) imposes a dark gray to black color to the rock. Magnetite is intergrown with clay and quartz. Dark spots are soft and magnetic ->clay+magnetite. Vugs are filled with pyrite and clay or pyrite and anhydrite. Pyrite in groundmass is rare. Plagioclase phenocrysts are altered to white clay.

VEINS/FRACTURES: None.

ROCK NAME: Completely altered, aphyric, massive volcanic rock.

UNIT: 64
Pieces: 11 to 12.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	39Z	1	11	117	354.65
Lower contact:	39Z	2	4	55	355.48

Thickness (m): 0.81

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None, but the rock contains light green spots (<1 mm amygdales).

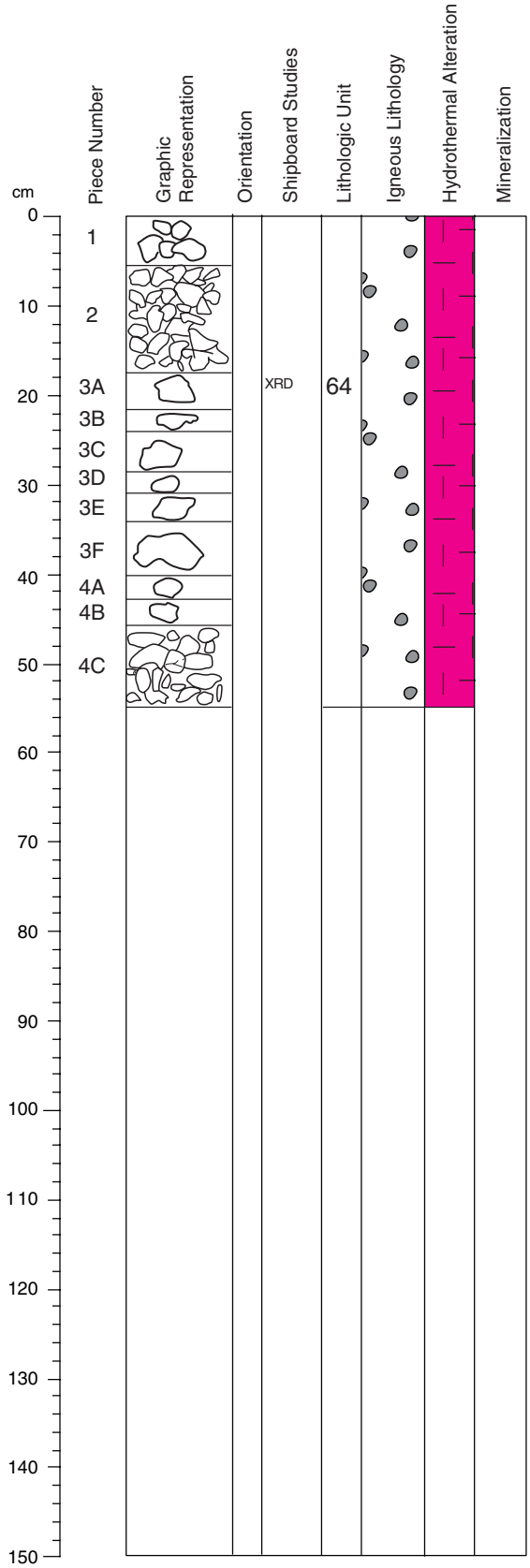
COLOR: Light gray and light green-gray.

STRUCTURE: Massive.

ALTERATION: Silicified rock with quartz-clay dominated light gray groundmass. Rocks have a spotty texture, owing to pyrite+anhydrite filled vugs with clay-rich halos.

VEINS/FRACTURES: None.

Core Photo



ADCB Core Description

193-1188F-39Z-2 (Section top: 354.4 mbsf)

ROCK NAME: Completely altered, aphyric, massive volcanic rock.

UNIT: 64
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact	39Z	1	11	117	354.65
Lower contact:	39Z	2	4	55	355.38

Thickness (m): 0.71

CONTACTS: None.

PHENOCRYSTS: Plagioclase phenocrysts, up to 1 mm long and replaced by clay, represent about 1% of Piece 3 only.

GROUNDMASS: Very fine-grained.

VESICLES: None.

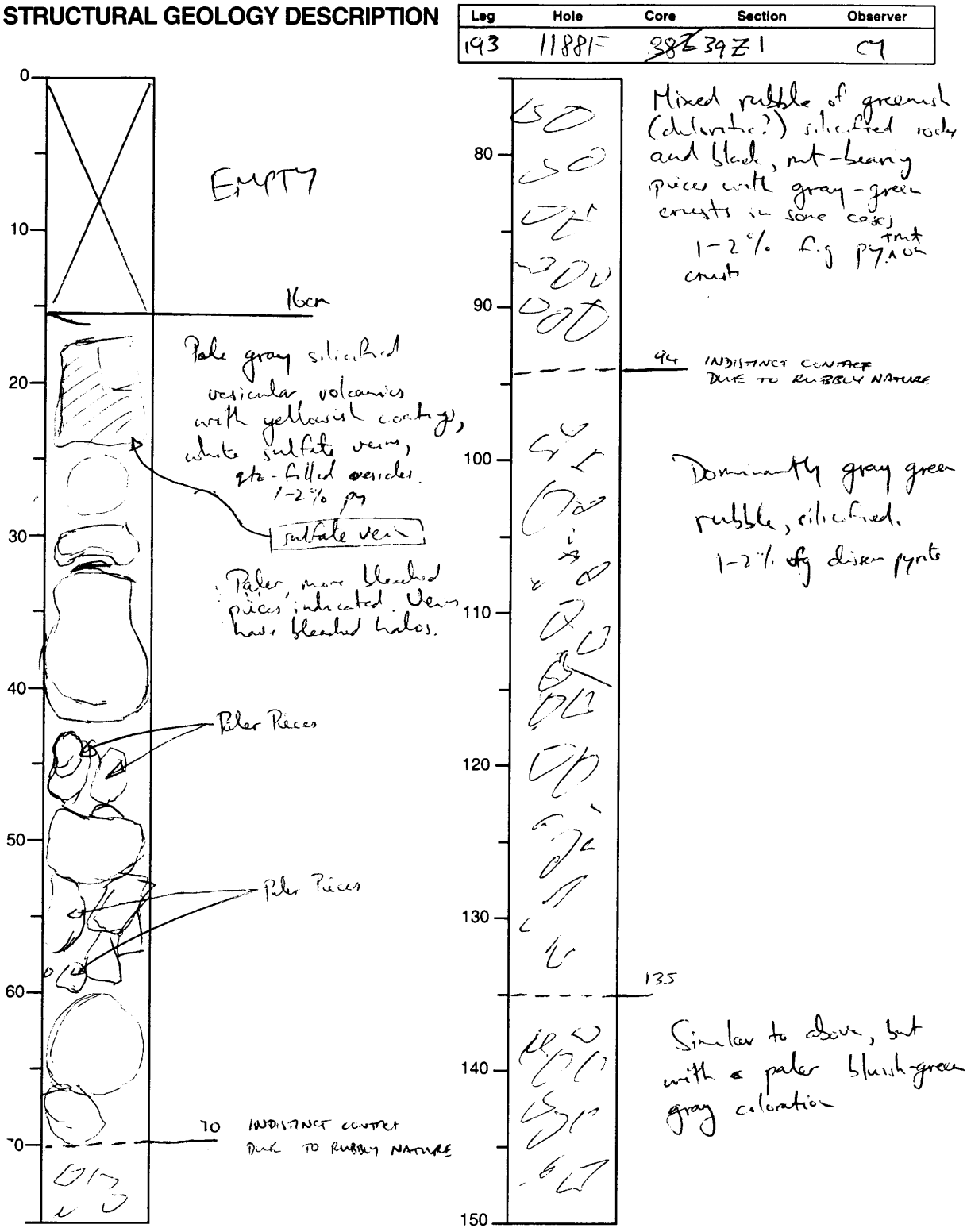
COLOR: Light gray to light green-gray.

STRUCTURE: Massive.

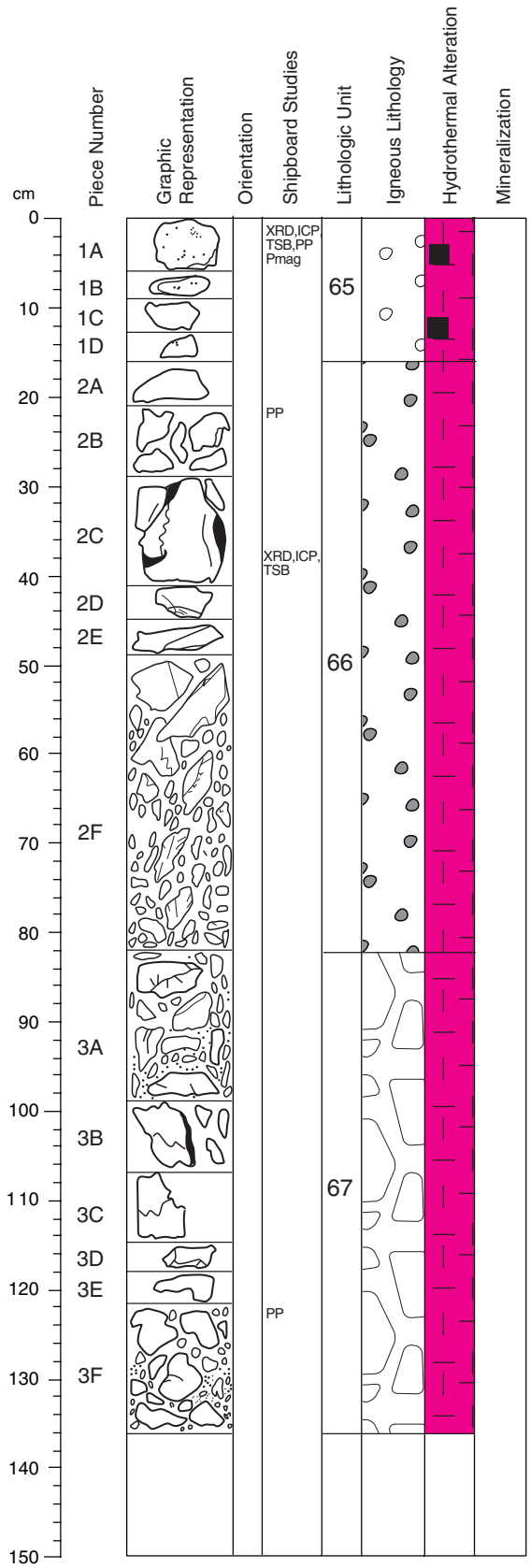
ALTERATION: Silicified rock with quartz-clay dominated light gray groundmass. Rocks have a spotty texture, owing to pyrite+anhydrite filled vugs with clay rich halos. Minor magnetite and pyrite disseminated in groundmass.
Pieces 3 and 4 are greenish-gray rocks with tan alteration halos along anhydrite+pyrite veins (Piece 4). Plagioclase phenocrysts are replaced by white to bluish white clay.

VEINS/FRACTURES: Pyrite veinlet in Piece 1. Anhydrite+pyrite vein in Pieces 3 and 4.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg
Hole
Core
Section
Observer
193
1188F
38Z 39Z 1
CY
EMPTY
16cm
Pale gray silicified vesicular volcanics with yellowish coating, white sulfate veins, qtz-filled vesicles. 1-2% py
sulfate vein
Paler, more bleached pieces indicated. Veins have bleached halos.
Paler Pieces
Paler Pieces
70 INDISTINCT CONTACT DUE TO RUBBLY NATURE
Mixed rubble of greenish (chloritic?) silicified rocks and black, mt-bearing pieces with gray-green crusts in some cases. 1-2% f.g py TRACE mt crust
94 INDISTINCT CONTACT DUE TO RUBBLY NATURE
Dominantly gray green rubble, silicified. 1-2% vfg disem pyrite
135
Similar to above, but with a paler bluish-green gray coloration

Core Photo



ADCB Core Description

193-1188F-40Z-1 (Section top: 358.0 mbsf)

ROCK NAME: Completely altered, magnetite-bearing, aphyric, sparsely vesicular volcanic rock.

UNIT: 65
Pieces: 1A to 1D

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	40Z	1	1A	0	358.00
Lower contact:	40Z	1	1D	16	358.16

Thickness (m): 0.16

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 5% vesicles and vugs.

COLOR: Black.

STRUCTURE: Massive.

ALTERATION: Silicified microcrystalline groundmass. Vesicles lined/filled with green clay, anhydrite, pyrite, and magnetite. Commonly, pyrite occurs in the centers of magnetite-filled vesicles.

VEINS/FRACTURES: None.

ROCK NAME: Completely altered, sparsely plagioclase-phyric, massive volcanic rock.

UNIT: 66.
Pieces: 2A to 2F

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	40Z	1	2A	16	358.16
Lower contact:	40Z	1	2F	82	358.82

Thickness (m): 0.66

CONTACTS: None.

PHENOCRYSTS: Plagioclase phenocrysts up to 1 mm long, now replaced by clay, make up 1% of the rock.

GROUNDMASS: Very fine-grained.

VESICLES: None. Spotted texture due to <1-mm amygdales locally.

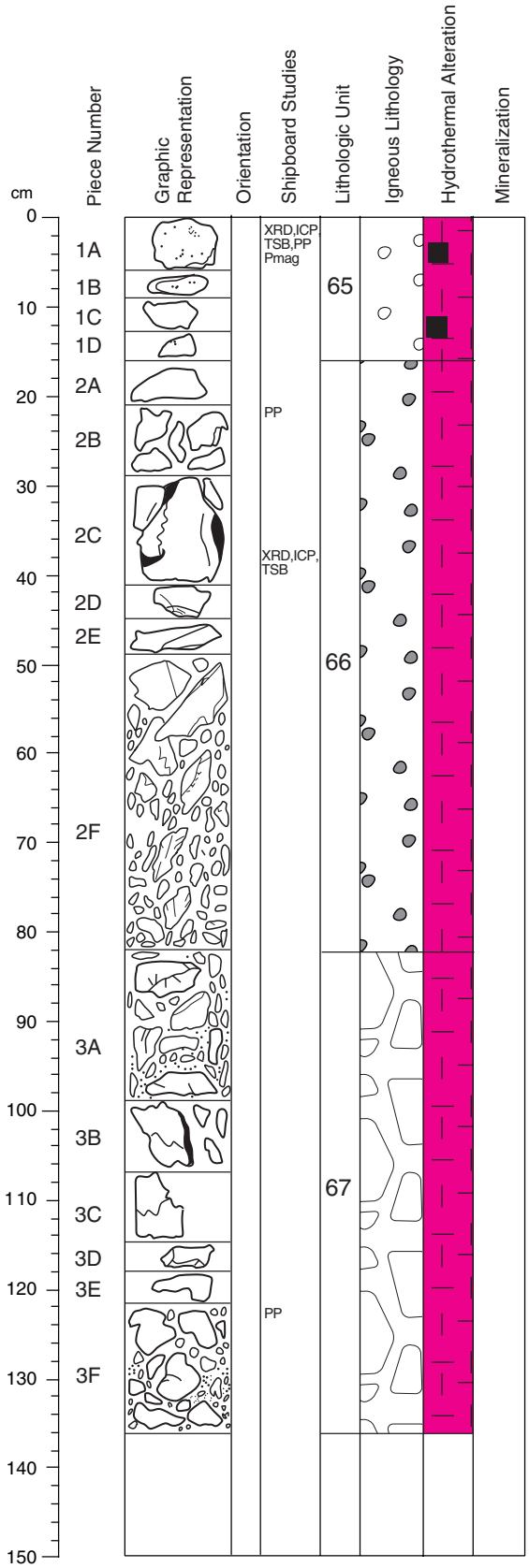
COLOR: Light gray-green to light gray.

STRUCTURE: Massive.

ALTERATION: Silicified rock with quartz-clay dominated light gray groundmass. Rocks have a spotty texture, owing to pyrite+anhydrite filled vugs with clay rich halos. Minor magnetite and pyrite disseminated in groundmass.

VEINS/FRACTURES: None.

Core Photo



193-1188F-40Z-1 (Section top: 358.0 mbsf)

ROCK NAME: Completely altered, clastic-textured volcanic rock.

UNIT: 67
Pieces: 3A to 3F

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	40Z	1	3A	82	358.82
Lower contact:	40Z	2	2B	83	360.33

Thickness (m): 1.40

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

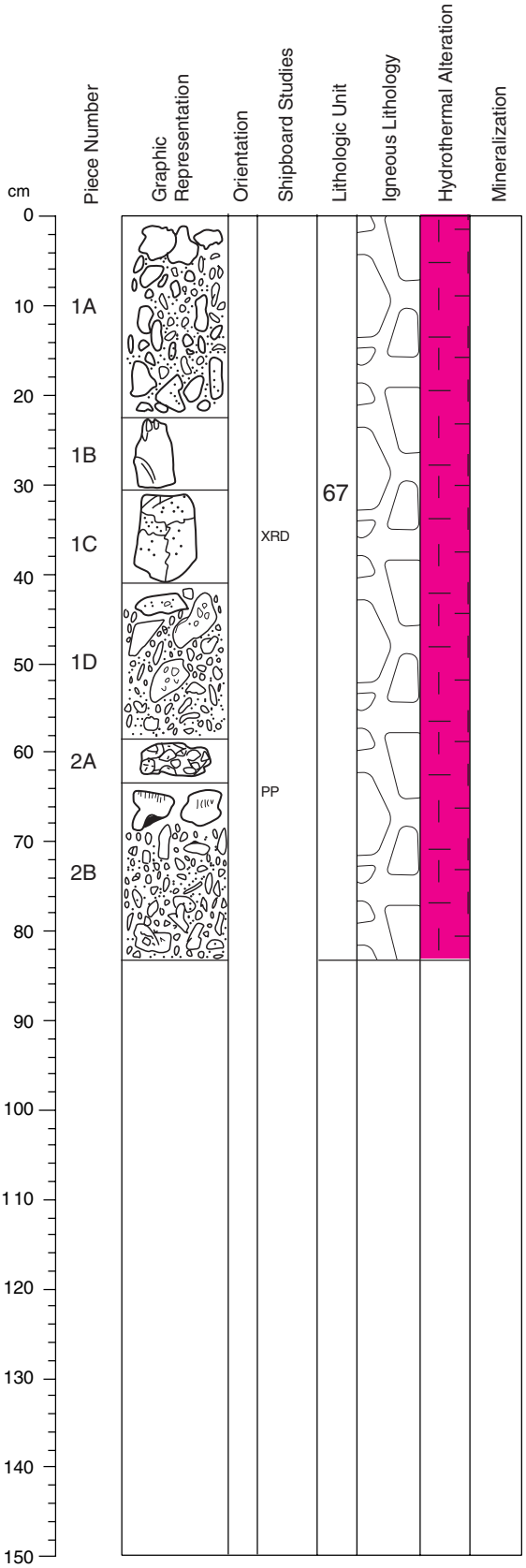
COLOR: Light green to dark gray.

STRUCTURE: Massive to clastic.

ALTERATION: Brecciated and silicified. Dark gray highly silicified and gray, soft, more clayey domains, some of which have angular shapes.

VEINS/FRACTURES: Clay-anhydrite-pyrite veinlets.

Core Photo



ADCB Core Description

193-1188F-40Z-2 (Section top: 359.5 mbsf)

ROCK NAME: Completely altered, clastic-textured volcanic rock.

UNIT: 67
Pieces: 1 to 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	40Z	1	3A	82	358.82
Lower contact:	40Z	2	2B	83	360.33

Thickness (m): 1.40

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

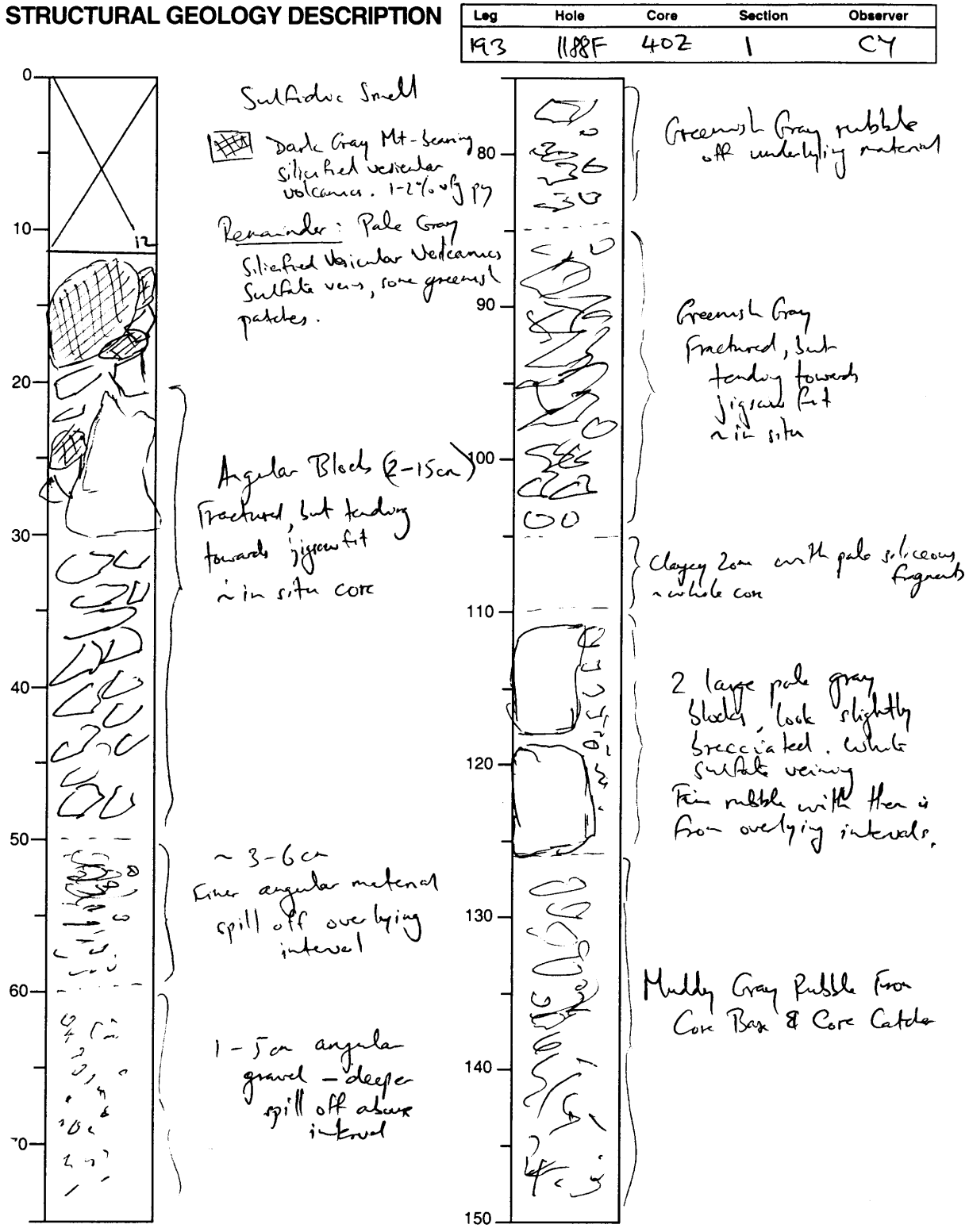
COLOR: Light green to light gray.

STRUCTURE: Massive.

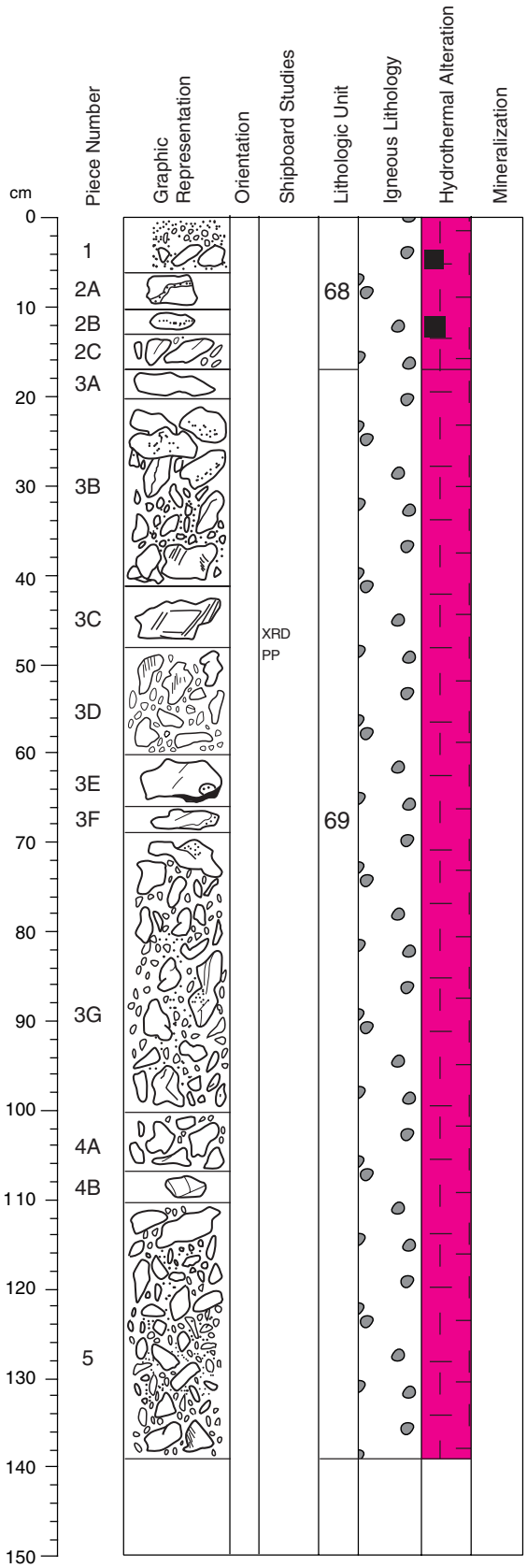
ALTERATION: Brecciated with cm-sized, angular, highly silicified clasts that are surrounded by a light gray to tarnish gray silica-clay matrix. The matrix is completely recrystallized which makes distinguishing the original texture difficult. However, relict textures suggest it is composed of clay-silica altered clasts embedded in a silica-rich cement. Minor pyrite is disseminated throughout the rock.

VEINS/FRACTURES: None.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 402
Section 1
Observer CY
Sulfidic Smell
Dark Gray Mt-bearing silicified vesicular volcanics. 1-2% of pg
Remainder: Pale Gray Silicified Vesicular Volcanics Sulfide veins, some greenish patches.
Angular Blocks (2-15cm) Fractured, but tending towards jigsaw fit in situ core
~3-6cm Finer angular material spill off overlying interval
1-5cm angular gravel - deeper spill off above interval
Greenish Gray rubble off underlying material
Greenish Gray Fractured, but tending towards Jigsaw fit in situ
Clayey 2cm with pale siliceous fragments in whole core
2 large pale gray blocks, look slightly brecciated. White Sulfate veining Fine rubble with them is from overlying intervals.
Muddy Gray Rubble From Core Bag & Core Catch

Core Photo



ADCB Core Description

193-1188F-41Z-1 (Section top: 362.5 mbsf)

ROCK NAME: Completely altered, magnetite-enriched volcanic rock.

UNIT: 68
Pieces: 1 to 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	41Z	1	1	0	362.50
Lower contact:	41Z	1	2C	17	362.67

Thickness (m): 0.17

CONTACTS: None.

PHENOCRYSTS: A trace of fresh plagioclase phenocrysts (2 mm long, identified by perfect (010) cleavage reflections) noted in Piece 2B.

GROUNDMASS: Very fine-grained.

VESICLES: None. The rock has dark spots, 1 mm in diameter, thought to be amygdales.

COLOR: Black.

STRUCTURE: Massive.

ALTERATION: Silicified rock. Magnetite is abundant (3%) finely disseminated in groundmass.

VEINS/FRACTURES: Magnetite-rich vein with pyrite in center and a narrow gray halo in Piece 2.

ROCK NAME: Completely altered, aphyric, sparsely amygdaloidal volcanic rock.

UNIT: 69
Pieces: 3 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	41Z	1	3A	17	362.67
Lower contact:	41Z	2	6	81	364.05

Thickness (m): 1.38

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray to light green.

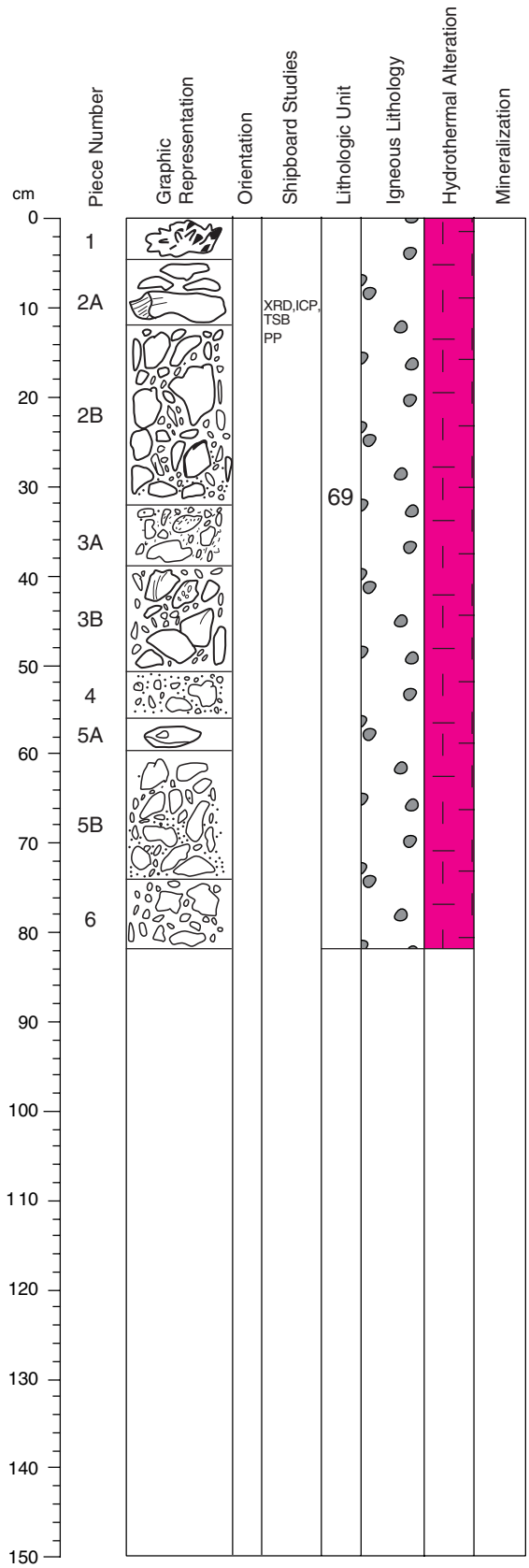
STRUCTURE: Massive.

ALTERATION: Silicified rock with finely disseminated pyrite and trace magnetite. Rocks are commonly spotty, owing to quartz-clay-pyrite vug fill. Highly silicified very fine-grained gray halos in Piece 3C.

VEINS/FRACTURES: None.

COMMENTS: Similar to Units 62, 64, and 66.

Core Photo



ADCB Core Description

193-1188F-41Z-2 (Section top: 363.88 mbsf)

ROCK NAME: Completely altered, aphyric, sparsely amygdaloidal volcanic rock.

UNIT: 69
Pieces: 1 to 6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	41Z	1	3A	17	362.67
Lower contact:	41Z	2	6	81	364.05

Thickness (m): 1.38

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Stretched tiny vesicles are filled with pyrite in Piece 5A and possibly in Piece 2A.

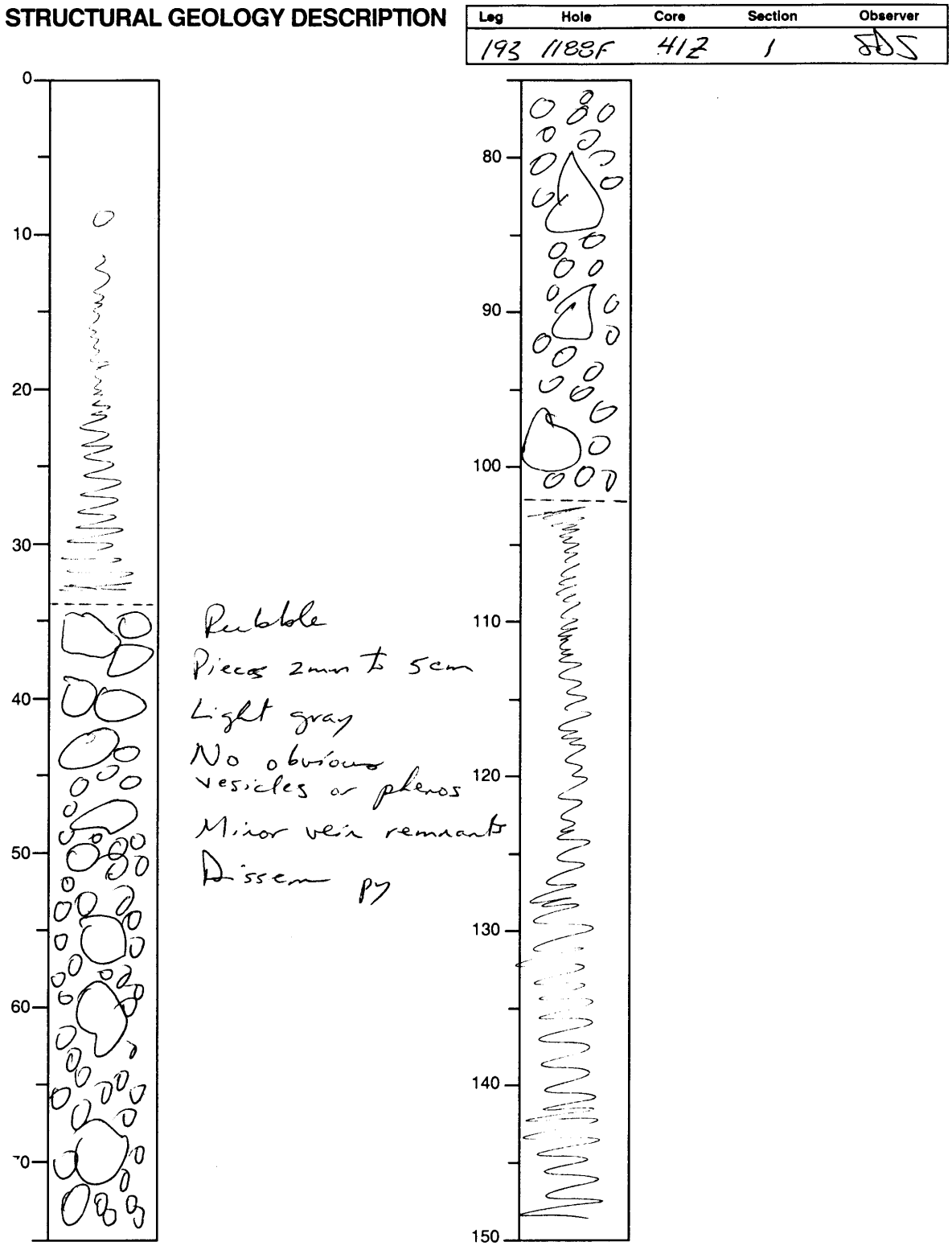
COLOR: Light gray to light green.

STRUCTURE: Massive.

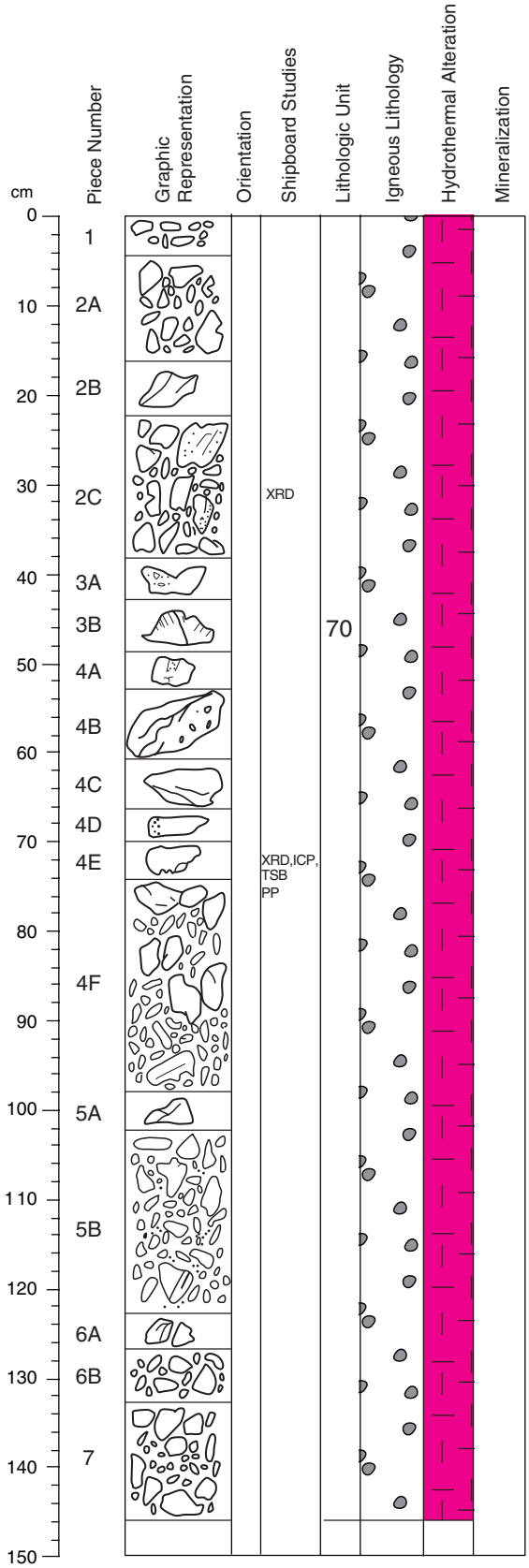
ALTERATION: Silicified rock with finely disseminated pyrite. Tan to light gray clay in matrix. Pieces 1, 3A, and 4A are gray and muddy with fragments of silicified rock.

VEINS/FRACTURES: Minor anhydrite and pyrite veinlets.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg Hole Core Section Observer
193 1188F 41Z 1 SDS
Rubble
Pieces 2mm to 5cm
Light gray
No obvious vesicles or phenos
Minor vein remnants
Dissem py
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-42Z-1 (Section top: 367.00 mbsf)

ROCK NAME: Completely altered, aphyric, sparsely amygdaloidal volcanic rock.

UNIT: 70
Pieces: 1 to 7

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	42Z	1	1	0	367.00
Lower contact:	42Z	2	3	29	368.79

Thickness (m): 1.75

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Between 2% and 10%, mainly white, anhydrite-filled amygdales, generally round to slightly elongate (1 to 3 mm in diameter). Locally vesicles are filled by green clay-silica or silica-pyrite.

COLOR: Pale gray.

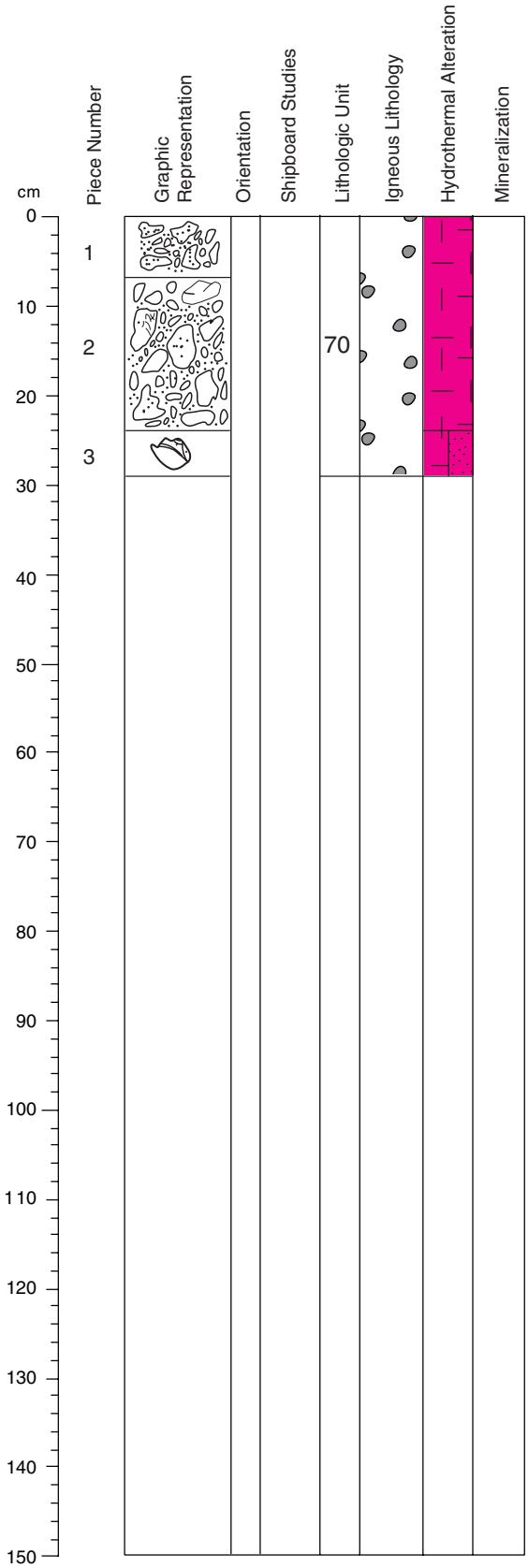
STRUCTURE: Massive.

ALTERATION: Silicified rock with anhydrite veins showing zoned alteration halos.

VEINS/FRACTURES: Anhydrite-pyrite veins. In some pieces (4A and 4D) the composition of amygdales changes from silica-green clay or pyrite to anhydrite-pyrite approaching anhydrite vein.

COMMENTS: Pieces 3A and 3B have a mottled texture.

Core Photo



ADCB Core Description

193-1188F-42Z-2 (Section top: 368.5 mbsf)

ROCK NAME: Completely altered, aphyric, sparsely amygdaloidal volcanic rock.

UNIT: 70
Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	42Z	1	1	0	367.00
Lower contact:	42Z	2	3	29	368.79
Thickness (m): 1.75					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Between <1% and 10% amygdales, mainly <1 mm across, filled with anhydrite, silica or silica pyrite.

COLOR: Gray.

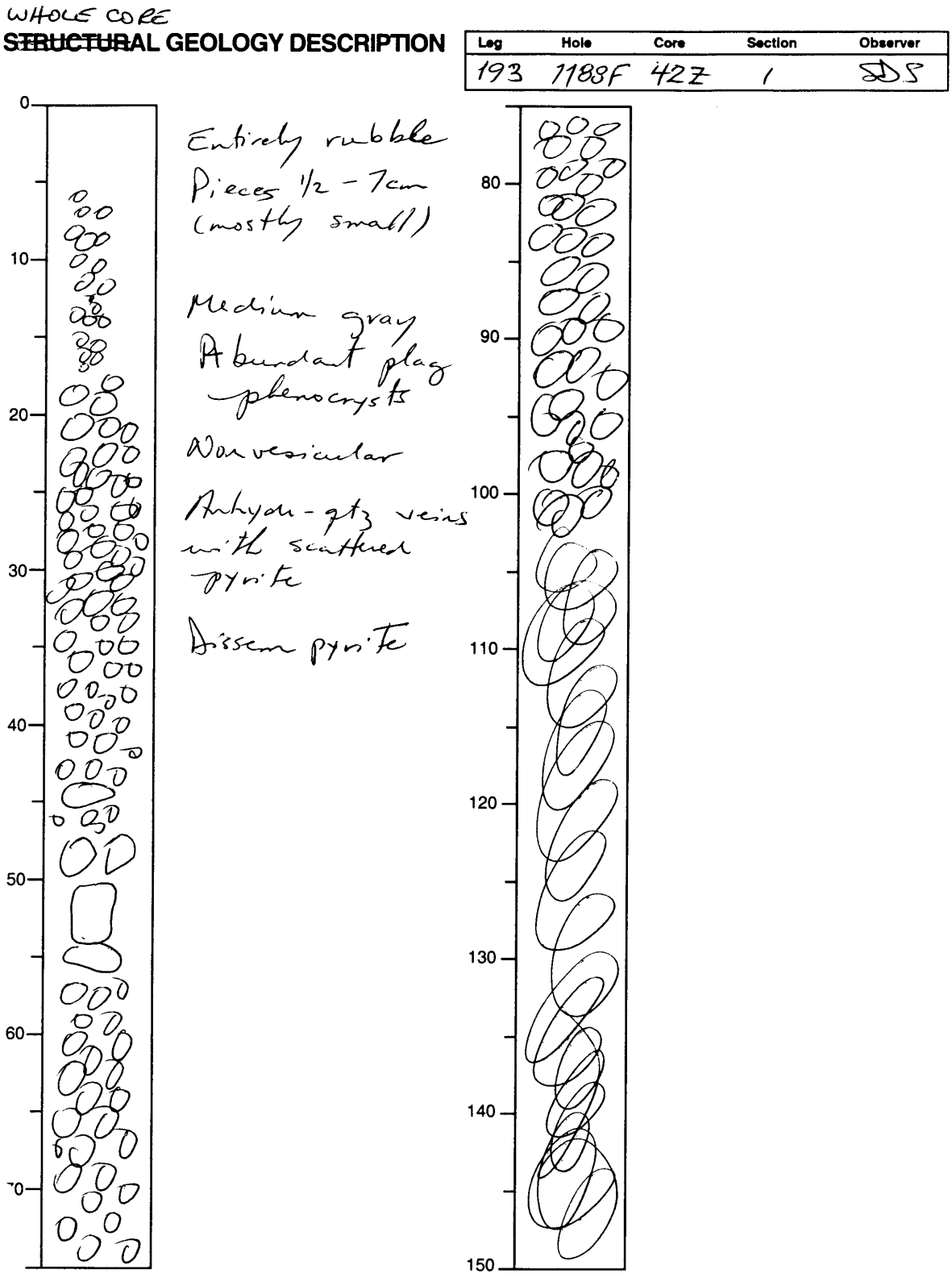
STRUCTURE: Massive.

ALTERATION: Silicified, bleached rubble with clayey grit.

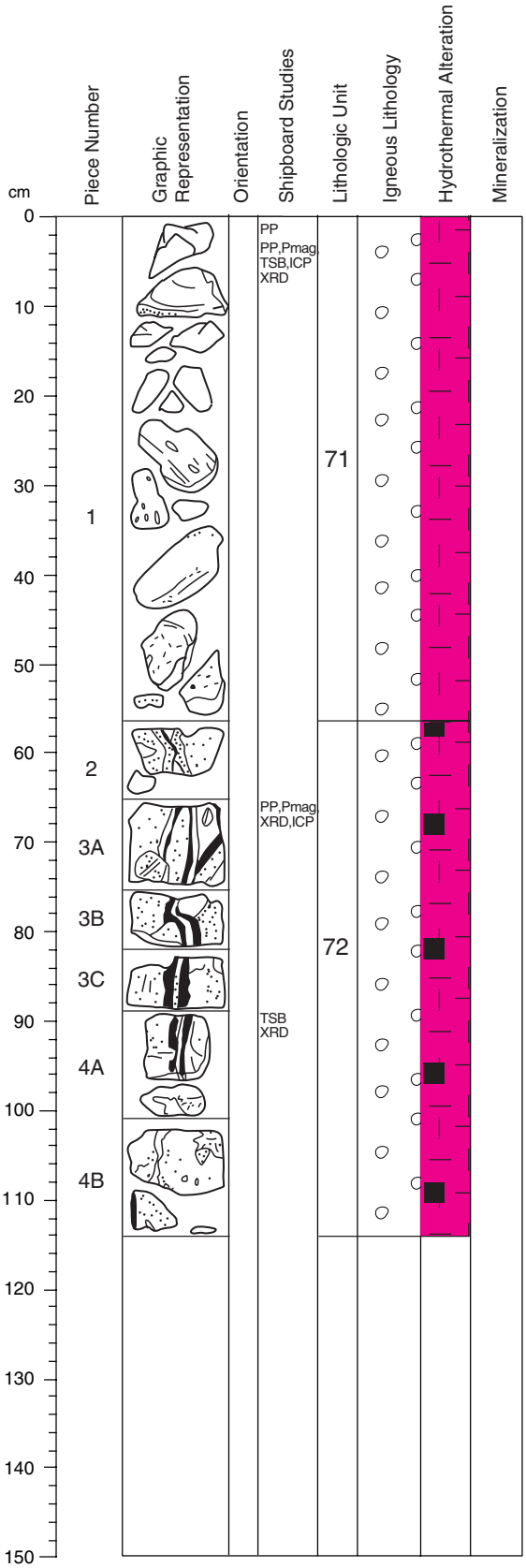
VEINS/FRACTURES: Fine anhydrite veins with trace pyrite.

COMMENTS: Pieces 1 and 2 consist of rubble. Piece 3 is a small (2 cm), gray-light gray mottled fragment.

Core Photo


WHOLE CORE
~~STRUCTURAL~~ GEOLOGY DESCRIPTION
Leg Hole Core Section Observer
193 1188F 42Z 1 SDS
Entirely rubble
Pieces 1/2 - 7cm
(mostly small)
Medium gray
Abundant plag
phenocrysts
Nonvesicular
Anhyd - qtz veins
with scattered
pyrite
Dissem pyrite
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150

Core Photo



ADCB Core Description

193-1188F-43Z-1 (Section top: 371.5 mbsf)

ROCK NAME: Completely altered, aphyric, sparsely vesicular volcanic rock.

UNIT: 71
Pieces: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	43Z	1	1	0	371.50
Lower contact:	43Z	1	1	56	372.06

Thickness (m): 0.25

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 5%, mainly elongate, size range: 1 to 3 mm x 2 to 10 mm, lined or partially filled by green clay (chlorite?), silica, pyrite, and minor anhydrite.

COLOR: Gray, spotty,light green.

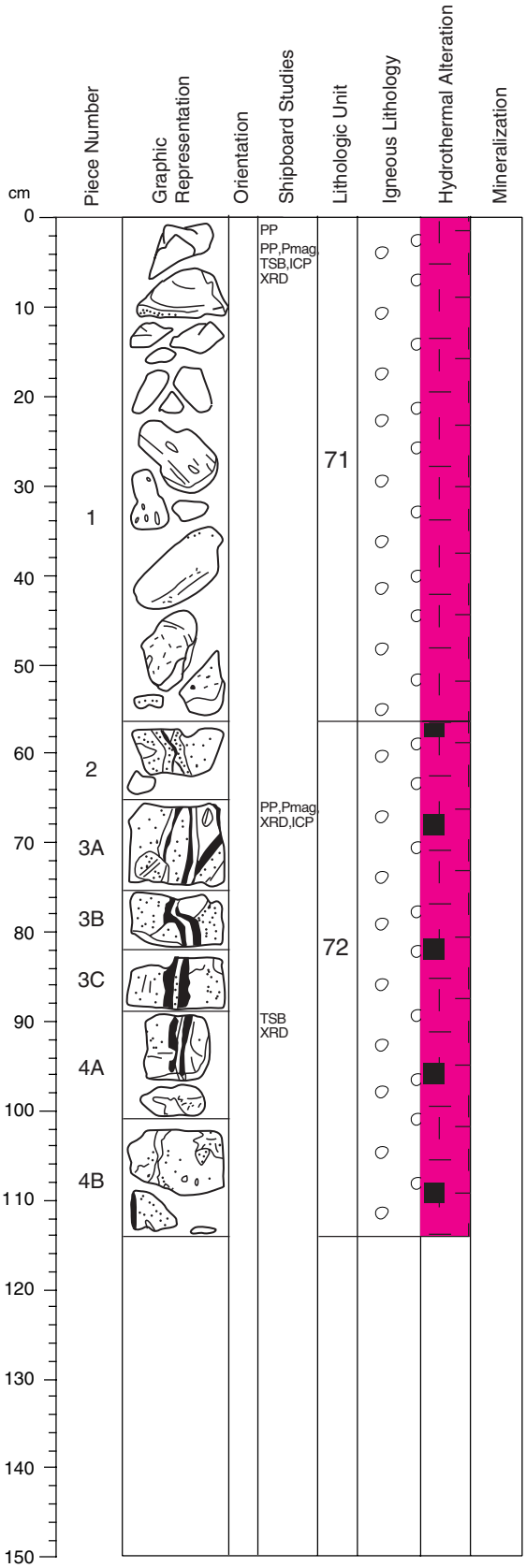
STRUCTURE: Massive.

ALTERATION: Silicified rock with anhydrite-chlorite or quartz-chlorite lined vesicles and small (<1 mm) quartz, quartz-pyrite and pyrite-chlorite amygdales.

VEINS/FRACTURES: None.

COMMENTS: This piece contains 3 different types of fragments. The gray fragments with partially filled vesicles represent Unit 71. Gray fragments with fine silica amygdales (<1 mm) resemble Unit 70. Gray fragments with black amygdales of silica, magnetite, and pyrite are similar to Unit 72.

Core Photo



193-1188F-43Z-1 (Section top: 371.5 mbsf)

ROCK NAME: Completely altered, magnetite-bearing, aphyric, sparsely vesicular volcanic rock.

UNIT: 72
Pieces: 2 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	43Z	1	2	56	372.06
Lower contact:	44Z	1	3	91	374.91

Thickness (m): 2.16

CONTACTS: None.

PHENOCRYSTS: Rare plagioclase in Pieces 2A and 3B (unaltered or white clay altered).

GROUNDMASS: Very fine-grained.

VESICLES: Round and elongate vesicles (2% to 8%; maximum dimensions: 1 to 2 mm x 2 to 10 mm), lined or filled by blue quartz, magnetite, and pyrite.

COLOR: Gray, black.

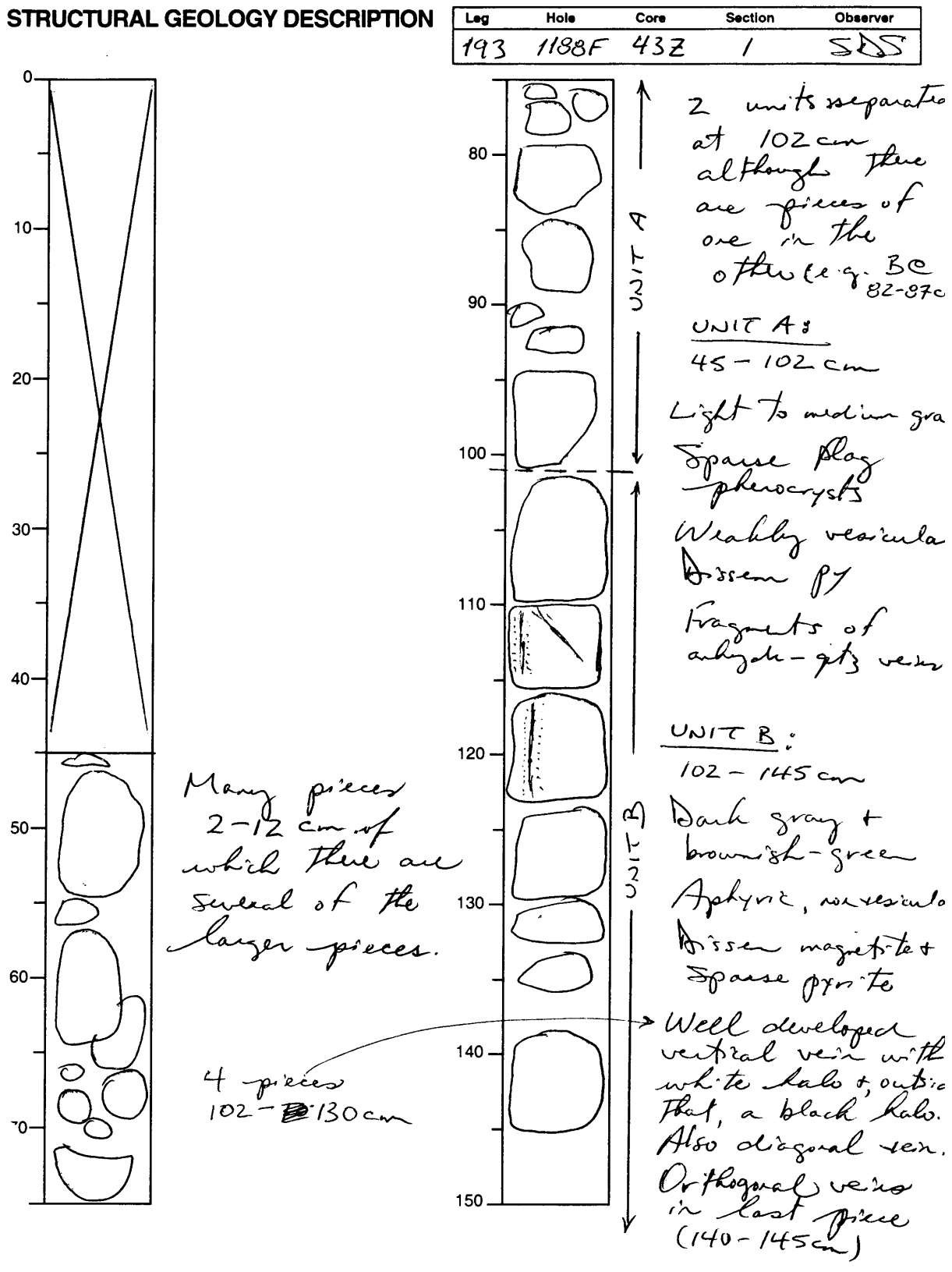
STRUCTURE: Massive.

ALTERATION: Pervasive silicification. Magnetite (1% to 5%) occurs throughout the rock as very fine-grained disseminations and as vesicle fill with blue quartz and pyrite, with occasional late anhydrite. In the vesicles magnetite-quartz represents an early assemblage followed by pyrite±anhydrite. Magnetite increases in abundance towards anhydrite-pyrite veins.

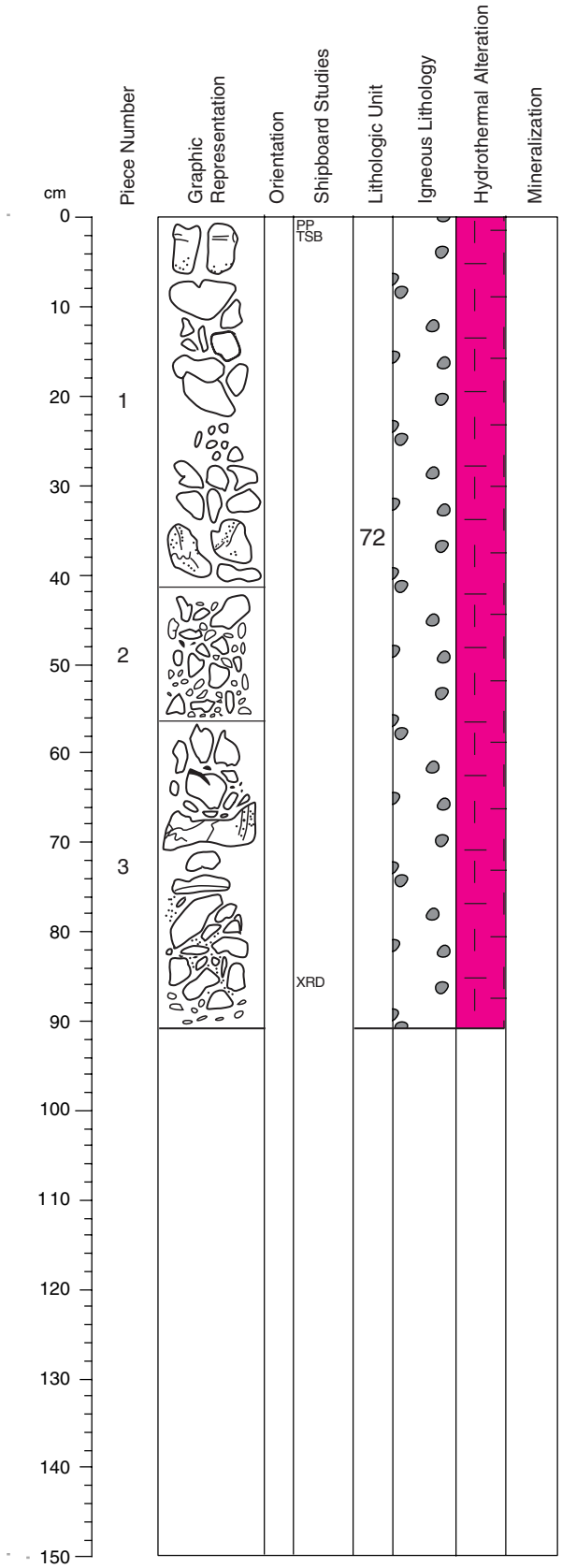
VEINS/FRACTURES: Prominent subvertical anhydrite-pyrite (magnetite, quartz, and chlorite) vein with 2 to 5 mm wide halo. This vein is continuous though Pieces 2, 3, and 4. The center of the vein consists of anhydrite, pyrite and locally magnetite surrounded by chlorite and further outward rimmed by quartz. A magnetite-bearing siliceous halo extended for about 1 cm out from the vein. Locally, the halo may contain K-feldspar(?). Late pyrite and pyrite anhydrite veins were observed crosscutting this vein structure.

COMMENTS: Pieces 2A, 3A, and 3B contain ovoid silica patches (1 cm to 3 cm in diameter) in the groundmass.

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg 193
Hole 1188F
Core 43Z
Section 1
Observer SDS
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
UNIT A
UNIT B
2 units seperate at 102 cm although there are pieces of one in the other (e.g. BC 82-87c
UNIT A:
45 - 102 cm
Light to medium gra
Sparse plag phenocrysts
Weakly vesicula
Fragments of anhydr - qtz vein
UNIT B:
102 - 145 cm
Dark gray + brownish-green
Aphyric, non vesicula
Sparse magnetite + sparse pyrite
Well developed central vein with white halo + outside that, a black halo. Also diagonal vein. Orthogonal veins in last piece (140 - 145 cm)
Many pieces 2 - 12 cm of which there are several of the larger pieces.
4 pieces 102 - 130 cm

Core Photo



ADCB Core Description

193-1188F-44Z-1 (Section top: 374.0 mbsf)

ROCK NAME: Completely altered, magnetite-bearing, aphyric, sparsely amygdaloidal volcanic rock.

UNIT: 72

Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	43Z	1	2	56	372.06
Lower contact:	44Z	1	3	91	374.91
Thickness (m): 2.16					

CONTACTS: None.

PHENOCRYSTS: Remnant plagioclase in Piece 1.

GROUNDMASS: Very fine-grained.

VESICLES: Mainly amygdales (<1% to 3%, <1 to 3 mm across). Amygdales consist of pyrite-anhydrite, green clay, silica, magnetite (in vicinity of anhydrite-pyrite veins or crusts on margin of fragments).

COLOR: Gray, light gray, black.

STRUCTURE: Massive.

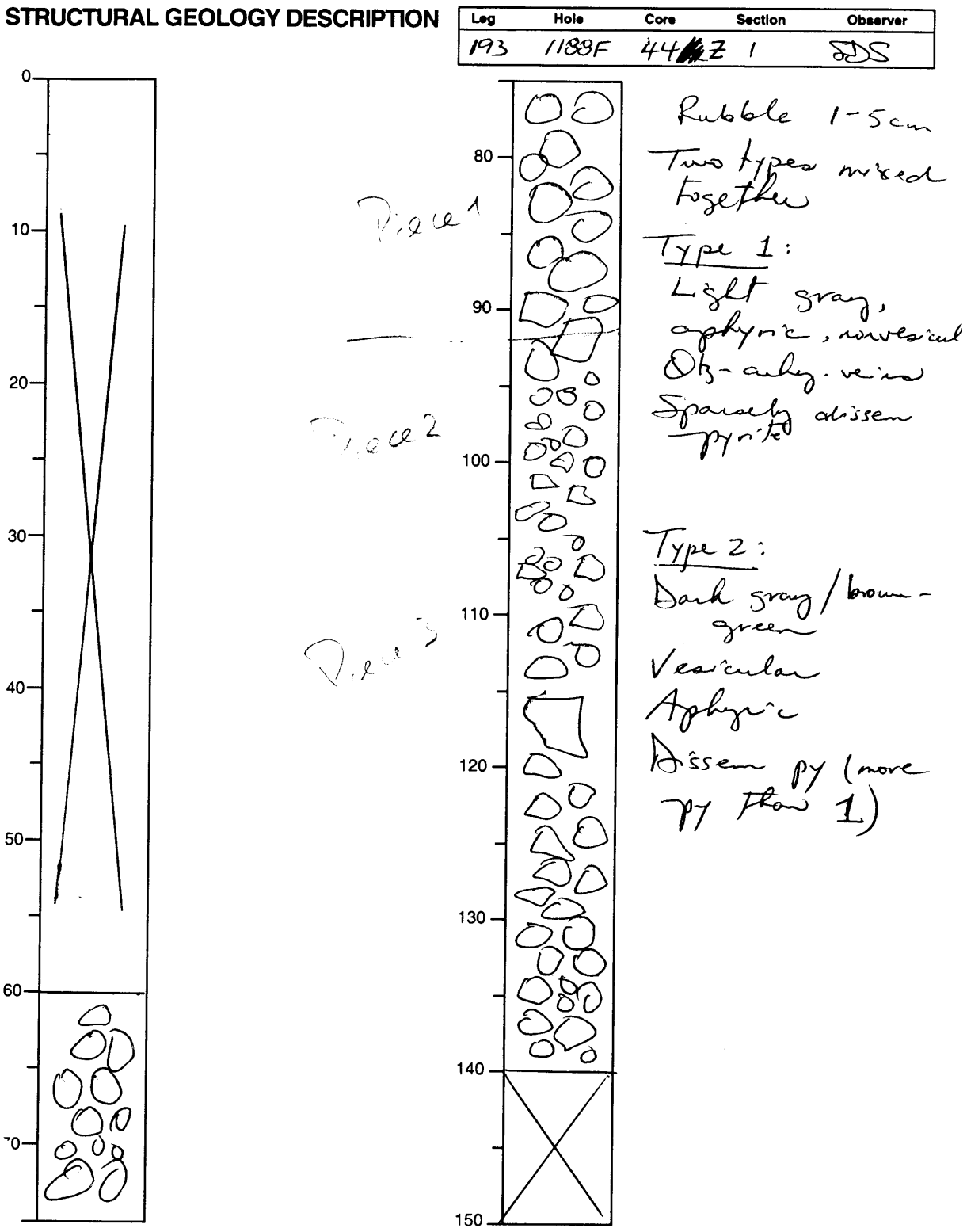
ALTERATION: Pervasive silicification. Magnetite (1% to 5%) is disseminated in some fragments (generally adjacent to anhydrite-pyrite veins or crusts).

VEINS/FRACTURES: Anhydrite-pyrite veins are generally present as crusts on the outer margins of individual fragments. Hairline magnetite-pyrite veins are also present.

COMMENTS: The pieces in this section consist of rubble. In Piece 2 the fragments are generally light gray, siliceous and massive without any magnetite. However, some fragments have anhydrite-pyrite crusts with associated magnetite-bearing halos.

1188F-45Z NO RECOVERY
1188F-46Z NO RECOVERY
1188F-47Z NO RECOVERY

Core Photo


STRUCTURAL GEOLOGY DESCRIPTION
Leg Hole Core Section Observer
193 1188F 44Z 1 SDS
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Piece 1
Piece 2
Piece 3
Rubble 1-5cm
Two types mixed Together
Type 1:
Light gray, aphyric, nonvesicular
Qtz-anhy. veins
Sparsely dissem pyrite
Type 2:
Dark gray/brown-green
Vesicular
Aphyric
Dissem py (more py than 1)

THIN SECTION SUMMARY - HOLE 1188A

				Mineralogy												
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
1	193-1188A-2R1-9-12 #3	1	Vesicular plagioclase-clinopyroxene-phyric dacite.	45	1	53								1		Twinned feldspar grains. Skeletal and other quench textures are absent. Ti-magnetite finely disseminated in the groundmass, moderately to strongly corroded. Partially and completely enclosed in plagioclase and clinopyroxene. Fe(O,OH) coatings on vesicle walls.
2	193-1188A-3R1-0-2 #1	1	Moderately plagioclase-clinopyroxene-magnetite-phyric moderately vesicular dacite.	46	Tr	53								Tr		A small number of zoned crystals exhibiting one or two broad oscillations. Some skeletal feldspar and minor quench growth. Some well preserved melt inclusions.
3	193-1188A-5R1-35-38 #7	2	Highly altered volcanic glass.	Tr					88	10	2					Glassy to slightly microlitic texture is preserved in center of “islands”. Relict fresh glass. Towards the margins the volcanic glass is progressively replaced by tan alteration products. The islandsare commonly replaced by a green smectitite?, which is developed at the interface with the smectite/opaline silica/pyrite assemblage replacing the rock along an irregular fracture network.
4	1188A-7R1-62-64 #12	4	Completely altered volcanic rock.				9		40	50	1	Tr		Tr		Some microlites observable, but altered. Silica forms low-birefringence prisms in vesicles, and is coated with tan, low-birefringence chalcedony. The vesicle fill shows a cyclic paragenesis: cristobalite -> anhydrite -> cristobalite -> anhydrite.
5	1188A-7R1-120-124 #18	5	Completely altered volcanic rock.				10		25	62	3					Pyrite concentrated in upper part of thin section where an anastomosing network of pyrite-cristobalite+anhydrite veins is developed. In that part of the section, the groundmass appears dark gray, due to extremely fine-grained pyrite disseminated in the altered glass. Vesicle often show cristobalite lining and anhydrite in center.Alteration is obviously fracture-controlled and developed as fine siliceous halos around veins which generally mimic perlitic fracture networks. Anhydrite is present only as late-stage vein- and vug-fill and does not seem to be a major component of the more pervasive alteration style.
6	1188A-7R2-39-41 #2	6	Completely altered volcanic rock.				15		30	45	10					Two generations of anhydrite within veins: 1. Within fractures crosscutting the original volcanic rock - Cristobalite-Pyrite 2. Late stage veins - predominantly anhydrite - cross cut earlier veins and altered rock (clay minerals). Anhydrite is not part of the pervasive alteration - late veins and vug fill only.
7	193-1188A-8R1-66-68 #8	6	Completely altered volcanic rock.				7	1	59	30	3					Anhydrite and pyrite veinlet. Obvious replacement of glass by cristobalite, partly preserving perlitic texture. Some groundmass domains contain abundant isolated and coalesced microspherulites => high temperature devitrification. Vugs/ vesicles often lined with cristobalite with blocky anhydrite in the center.
8	193-1188A-8R1-124-127 #11	6	Completely altered volcanic rock.				10	Tr	25	60	5					Suggestion of later anhydrite filling center of veins and open space.Bulk of slide replaced by tan brown clay - most likely a microcrystalline silica-clay intergrowth. Intense clay replacement appears to be confined to spheroidal textural domains, which are hosted in pervasive cristobalite.
9	193-1188A-9R1-68-70 #7	8	Completely altered volcanic rock.				5	12	40	40	3					Alteration utilizing intial perlitic fractures. Pyrite in patches where silicification is intense. Original clast outlines marked by rim of axiolitic devitrification. Commonly fractured due to later hydothermal alteration.
10	193-1188A-11R1-35-38 #3	9	Moderately altered aphyric volcanic rock.	31			7	5	30	23	3				Ba (1)	Vesicles filled with quartz, anhydrite, barite and pyrite. A diffuse cristobalite+anhydrite-pyrite vein cuts through the section.The presence of igneous plagioclase implies relatively moderate alteration. The microcrysts are unoriented - massive flow interior. Increased silicification and significant clay alteration of groundmass along vein halos. There is an early fracture partly filled with pyrite, which was later re-opened by an anhydrite-quartz-pyrite vein.

THIN SECTION SUMMARY - HOLE 1188A

				Mineralogy												
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
11	193-1188A-12R1-123-124 #12	10	Completely altered volcanic rock.				Tr	10	57	32	1			Tr		Flow banding defined by variable abundance of coalesced, altered spherulites.Some domains consist entirely of altered spherulites replaced by gray-brown clay+cristobalite. Mostly isolated altered spherulites in matrix of cristobalite and altered glass. Chlorite has an antithetic relationship to pyrite.
12	193-1188A-12R2-48-51 #4	10	Completely altered, hydrofractured, flow banded volcanic rock.				Tr	10	55	30	2			1	Hm (2)	No apparent anhydrite within the veins - predominantly composed of a - qtz-py+magnetite/rutile with chlorite-hematite halos.Flow bandiing defined by variable abundance of spherulites (completely coalesed domains).
13	193-1188A-14R1-47-51#7	13	Altered and brecciated volcanic rock.				3		40	55	2			Tr		Pyrite distributed throughout the section - increased concentration towards anhydrite bearing veins. Magnetite breaking down to “leucoxene”. Either overgrowns pyrite, or pyrite is a breakdown product.
14	193-1188A-14R1-105-106 #15	14	Completely altered volcaniclastic pebble breccia.				16	42	21	21	Tr					Anhydrite veins and veinlets with silica alteration halos, very minor pyrite and magnetite.Vugs with silicified walls are lined with “white mica” (talc?) and show blocky anhydrite in center. It appears that cristobalite, anhydrite and pyrite come in late and fill in void space.
15	193-1188A-16R1-31-38#6	17	Highly altered sparsely plagioclase-phyric vesicular volcanic rock.	31			3	30		33	3					Vesicles are filled with quartz, pyrite and (rarely) anhydrite. Consistent paragenesis: qtz->py->anhy. Whitish “flames” are areas of increased anhydrite in groundmass.
16	193-1188A-16R1-74-78#10	17	Highly alterered sparsely plagioclase-phyric volcanic rock.	2			1	50	30	10	7					Irregular veins and venlets of quartz with pyrite. Previous vesicles are filled with quartz and pyrite (rare anhydrite). Silicification is most intense along a quartz-pyrite vein. Same vesicle fill paragenesis as seen in section #15 (16R1-Piece 6): qtz->py->anhy (when present).
17	193-1188A-16R1-95-98 #14	17	Highly altered volcanic rock.	3			5	40		50	2					Quartz+pyrite+anhydrite in veinlets and vesicle fill. Rock is Poor polish, difficult to see more details.
18	193-1188A-16R2-12-15 #2	18	Highly alterered sparsely plagioclase-phyric volcanic rock.	27				40		30	3			Tr		One aciclar plagioclase crystal is 2.5 mm long, bent into a gentle curve, and broken numerous times along its length. This crystal probably was fractured brittly during ductile flow of the lava.
19	193-1188A-16R2-40-43#7	18	Silicified flow-banded volcanic rock.	37				42		15	5			1		Silicified sparsely plagioclase-phyric rock with a trachytic texture. Some sort of crystal sorting has occurred during flow emplacement, giving the rock a laminated structure.
20	193-1188A-17R1-90-93, #20	19	Silicified, bleached volcanic rock.				Tr	20	28	50	Tr			2		Fine-grained rock with remnant vesicles.
21	193-1188A-17R2-33-37#6	19	Completely altered volcanic rock.				20	55		20	Tr			5		Rock is pervasively altered and replaced by qtz+anhy+white mica. Good evidence of pyrite replacing magnetite.
22	193-1188A-19R1-73-76#15	22	Moderately altered highly vesicular aphyric volcanic rock.	35		15	1		35	10	Tr			3	FeOx (1)	Microcrystalline rock with weakly developed flow structure. Silica and anhydrite fill vesicles. vfg igneous magnetite disseminated throughout groundmass.
23	193-1188A-20R1-46-48#8	23	Completely altered aphyric volcanic rock.	10			1	60		21	3			5		Fine-grained rock with remnant saussuritized plagioclase. Pyrite rich.In the tan colored area, there are large subhedral/anhedral py with inclusions of mt. The py clearly postdates the mt. Elsewhwere you can see a very distinctive vermicular textured magnetite incorporated in py, clear evidence of py postdating mt.
24	193-1188A-20R1-74-76#9	23	Highly altered volcanic rock.	13				60		15	10			2		Fine-grained rock with remnant saussuritized plagioclase. Pervasive silicification (quartz) of groundmass.
25	193-1188A-20R1-92-95#12	23	Highly altered volcanic rock.	15				54		24	3	Tr		4	Hm (Tr)	Relict perlitic structure. Trellis-like magnetite lamellae. Silicification of groundmass.
26	193-1188A-21R1-20-24#3	25	Completely altered volcanic rock.	5			2	55		35	Tr	Tr		3		Completely altered volcanic rock - with complete silification of the groundmass.
27	193-1188A-21R-1-68-70#8	25	Highly altered volcanic rock.	10			1	63		20	5			1		Completely altered volcanic rock - with complete silification of the groundmass.

THIN SECTION SUMMARY SHEET - HOLE 1188F

				Mineralogy															
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Leuc.**	**Hem.**	**Po**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
56	193-1188F-1Z1-36-38#2	27	Completely altered volcanic rock.				17	39		43				1			Tr		This section shows the nature of the banding in one of the complex halos adjacent to a pyrite-anhydrite vein. Banding appears to be related to modal amount of clay within the sample.
57	193-1188F-1Z1-92-95#5b	27	Completely altered volcanic rock.				7	46		47	Tr			1			Tr		Highly altered rock - little to no evidence of relict precursor minerals. 0.1 mm anhydrite vein with 0.1-0.2 mm halo of fine-grained quartz.
58	193-1188F-1Z2-8-10 #1	27	Very fine grained quartz-anhydrite clasts within a quartz-anhydrite-mica matrix?				10	45		45				Tr			Tr		Matrix consists of anhydrite, pyrite, quartz and spherules of illite in a groundmass of brown clay minerals. Both the clasts and and matrix are intersected by a thin, irregular vein of anhydrite.
59	1188F-1Z2-22-25 #2	27	Completely altered volcanic rock.				10	50		39				1			Tr		Micro quartz with anhydrite and clay.0.1-0.5 mm anhydrite-pyrite veins with halos of very fine grained illite(?) and minor quartz.
60	1188F-1Z3-35-38 #2	27	Completely altered bleached and silicified volcanic rock.				12	50		37	Tr	Tr		1			Tr		Micro quartz with anhydrite and clay. Anhydrite finely disseminated within the groundmass and Filling void space within an anhydrite, pyrite vein. Clays replacing groundmass and filling vugs.
61	1188F-1Z3-86-89 #3	28	Completely altered silicified, and green clay-bearing volcanic rock.				2	60		37			Tr	1			Tr		Relict flow texture is manifested in illite(?) pseudomorphing plagioclase microlites and in subparallel elongate aggregates of quartz and pyrite replacing plagioclase crystals or filling stretched vesicles.
62	1188F-1Z4-55-57 #1	28	Completely altered, silicified green-clay bearing volcanic rock.				12	45		42	Tr			1			Tr		Vugs (vesicles?) mainly filled with mozaic quartz (=> amygdales) are abundant (20%). Anhydrite-pyrite vein with phyllosilicate-rich (kaolinite) halos (photo).Flow texture of rock is partly preserved by oriented illite? that possibly replaces plagioclase microlites. Rarely, aggregates of illite? and quartz resemble the shape of plagioclase phenocrysts.
63	193-1188F-2Z1-44-47#2C	29	Completely altered aphyric volcanic rock.				10	54		35	Tr			1			Tr		Anhydrite and pyrite veins running parallel and cutting through a very fine-grained zoned alteration halo. Varying amounts of quartz, anhydrite, and clay/illite produce irregular banding in halo. Anhydrite and quartz rich portions are commonly coarser grained than clay/ illite and quartz rich parts. Groundmass of rock is replaced by clay/illite and less abundant micro quartz, with quartz, pyrite, and minor anhydrite filling vugs (could be vesicles).
64	1188F-2Z1-105-107 #2H	29	Completely altered aphyric volcanic rock.				12	50		36	Tr			2			Tr		Micro quartz with anhydrite and clay. Coarser-grained quartz in vugs with anhydrite and pyrite. Replacing plagioclase?Finely disseminated within the groundmass. Anhydrite within patches in groundmass and filling void space in an anhydrite, pyrite vein.
65	1188F-2Z1-133-135 #3B	29	Completely altered bleached and silicified volcanic rock.				12	50		37	Tr			1			Tr	Ba (Tr)	Several anhyrite pyrite veins crosscutting each other. Extremely fine grained matrix of presumably phyllosilicates and quartz. Coarser-grained quartz, sometimes accompanied by pyrite and/or anhydrite, is developed in patches in the groundmass.
66	1188F-3Z2-118-124 #2C	30	Completely altered brecciated, volcanic rock.				5	65		29	Tr	Tr	Tr	1			Tr		Micro quartz with anhydrite and clay. Coarser grained quartz filling vugs (vesicles?). Anhydrite, finely disseminated within the groundmass particularly in upper part of section.Clays replacing groundmass and filling vugs.

THIN SECTION SUMMARY SHEET - HOLE 1188F

				Mineralogy															
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Leuc.**	**Hem.**	**Po**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
67	1188F-6Z1-45-47 #2	31	Highly altered aphyric volcanic rock.	20			Tr	8	31	40				1	Tr		Tr		Intensely altered, brown, isolated and coalesced spherulites (generally 0.7 to 1 mm in diameter, 50%). Brown clay rims spherulite margins and forms concentric rings in some spherulites. Certainly not a classical spherulitic texture but on balance probably an igneous spherulitic type texture.
68	1188F-6Z1-76-79 #3C	32	Completely altered aphyric volcanic rock.				15	60		25	Tr			Tr			Tr		Veins are dominantly anhydrite-pyrite and may contain some quartz. Vuggy coarse grained quartz and anhydrite may be vesicle fill. High anhydrite content. Anhydrite fills void space and replaces groundmass and plagioclase.
69	1188F-7Z1-41-44 #1C	33	Completely altered aphyric volcanic rock.				1	60		38	Tr		Tr	1			Tr		Quartz replacing groundmass and filling vugs. Anhydrite, replacing groundmass and in veins with pyrite. Replacing groundmass and plagioclase.
70	193-1188F-7Z1-104-107#2A	35	Completely altered aphyric volcanic rock.				7	60		30			Tr	3			Tr		Quartz shows two morphologies - very fine grained microcrystalline quartz is intergrown with white mica/ clay in the groundmass and pseudomorphing skeletal plagioclase. Coarser macro crystalline quartz occurs as ovoid aggregates (mostly with pyrite +/-anhydrite) which are probably filled vesicles.
71	1188F-8Z1-68-71 #1F	36	Completely altered silicified volcanic rock.				8	55		35	Tr			2			Tr		Plagioclase phenocrysts are completely replaced by illite, anhydrite, quartz, and pyrite. Vuggy coarse-grained quartz and anhydrite may be vesicle fill. Anhydrite-pyrite vein with noticable amounts of quartz. Brown clay (kaolinite?) is abundant in parts of the section that appear whitish.
72	1188F-9Z1-9-12 #1B	37	Completely altered sparsely plagioclase-phyric volcanic rock.					50		45	1			1	Tr		Tr		Patchy variation of grain size and quartz-phyllosilicate proportions throughout the slide. It appears that some of this patchy variation is related to vein halos, while some domains seem to reveal a remanant flow banding(?) manifested in alternating silicieous and clay-rich bands. Large (up to 2 mm) quartz+/-anhydrite aggregates with angular outlines are likely to represent pseudomorphed plagioclase phenocrysts. Upper part of section looks like it was very vesicular with vesicles now being filled mainly with quartz.
73	1188F-11G1-53-56 #5	38	Completely altered aphyric volcanic rock.				3	45		52			Tr	Tr					This thin section was cut to investigate a zoned rock that has a light gray core (with pyrite-rich blebs) surrounded by a very-fine-grained tan-white mantle that contained little white blebs and tiny hairline veinlets. The white blebs are brown grungy clay concentrations in thin section. The veinlets are anhydrite with grungy clay halos. The rock core is typical silica-illite fine-grained rock with vugs filled by pyrite-anhydrite-quartz. The mantle (or halo) contains considerably more brown grungy clay, and is nearly devoid of pyrite.
74	193-1188F-11G1-108-111#9	39	Completely altered, sparsely plagioclase-phyric volcanic rocks.				5	64		28		Tr	Tr	3			Tr		The large ovoid quartz-pyrite patch noted in hand specimen appears to be a large amygdale, as suspected. It consists primarily of granular crystalline quartz intergrown with relatively coarse grained pyrite. Minor phases located interstitially include anhydrite and chlorite.
75	1188F-11G1-138-141 #12	39	Completely altered volcanic rock.	Tr			2	54		41	Tr			3			Tr		Plagioclase pheneocrysts are commonly replaced by illite and silica. Fresh plagioclase is present in trace amounts. Plagioclase microlites are replace by illite (colorless phyllosilicate) and a brown clay (probably kaolinite with significant internal reflections (see photomicrographs). Kaolinite(?) is enriched in patches -> whitish, soft parts of the core are probably rich in kaolinite.
76	1188F-13Z1-30-36 #2A	39	Very highly altered sparsely plagioclase-phyric volcanic rock.	7			1	40		50	Tr		Tr	2	Tr				This thin section was cut from the end of a physical properties mini-core. It contains some fresh plagioclase phenocrysts as well as completely-altered ones. The replacement mineralogy is diverse (clay, quartz, and anhydrite). Pyrrhotite and chalcopyrite occur as inclusions in pyrite.

THIN SECTION SUMMARY SHEET - HOLE 1188F

				Mineralogy															
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Leuc.**	**Hem.**	**Po**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
77	1188F-13Z1-47-50 #3B	39	Completely altered autoclastic breccia.				1	50		48	Tr			1			Tr		This thin section was cut from a hand specimen that contained vesicular volcanic rock grading into a zone of layered “autoclastic” breccia. One end of the section contains the volcanic rock, which is completely replaced as others in this hole. Continuing through the section, there is a layer of silica-clay clasts (avg. 2-mm diameter, subangular) cemented by mosaic quartz. Then there are about three layers that look volcanic, with flow textures and pseudomorphed phenocrysts replaced either by quartz, illite?, kaolinite?, or combinations of these. There is also a fragment that looks like altered glass. Finally, there is another clastic unit with mm-scale quartz-rich clasts in a silica-clay matrix. Partial replacement of Ti-magnetite by leucoxene (photomicrograph). Magnetite inclusions in pyrite of same size and morphology as magnetite in quartz of the groundmass.
78	1188F-13Z1-118-121 #5B	41	Completely altered sparsely plagioclase-phyric volcanic rock.				1	52		47			Tr	1			Tr		There is an angular clot of mosaic quartz with a clay-silica clast inside of it. Plagioclase phenocrysts are pseudomorphed by illite and quartz. Pyrrhotite and magnetite occur as inclusions in pyrite.
79	1188F-14Z1-62-64 #3	41	Highly altered sparsely plagioclase-phyric volcanic rock.	12			Tr	45		42	Tr			1			Tr		This thin section is from the end of a 1″-round Physical Properties mini-core. Abundant fresh plagioclase (An64), both phenocrysts and groundmass (in many areas). Partial replacement of magnetite by leucoxene. Inclusion of magnetite, quartz and another mineral that may be chalcocite in pyrite.
80	1188F-14Z1-102-105 #6	41	Completely altered sparsely plagioclase-phyric volcanic rock.				Tr	46		51				3			Tr		Quartz replaces groundmass and forms coarse mosaic patches. Anhydrite as small anhedral crystals intergrown with quartz in the groundmass; coarser anhedral crystals with illite after plagioclase; with pyrite as vein filling material. Clays replacing plagioclase phenocrysts and groundmass.
81	1188F-15Z1-55-58 #8	42	Completely altered aphyric volcanic rock.				Tr	39		60			Tr	1			Tr		Quartz replaces groundmass and forms coarse mosaic patches. Anhydrite as small anhedral crystals intergrown with quartz in the groundmass; coarser anhedral crystals with illite after plagioclase; with pyrite as vein filling material. Clays replacing plagioclase phenocrysts and groundmass.
82	1188F-15Z1-111-114 #12	42	Completely altered aphyric volcanic rock.				8	59		32	Tr	Tr		1	Tr		Tr		Quartz with clay as fine grained groundmass to the sample. Anhydrite within groundmass and as large crystals within void fill and veins. Increased brown clay content in proximity to cross cutting anhydrite vein. Illite? finely intergrown with quartz in the groundmass.
83	1188F-15Z1-142-144 #16	43	Completely altered silicified volcanic rock.				10	59		30				1			Tr		Quartz with clay as fine grained groundmass to the sample and as vesicle fill linings with anhydrite and pyrite. Anhydrite mostly as larger crystals within vesicle linings and relatively rare fine crystals in the groundmass.
84	1188F-16Z1-41-43 #1c	44	Completely altered aphyric volcanic rock.				1	59		37				3			Tr		Flow) banding preserved by modal variations in clay and quartz contents - cross cut by pyrite veins. The clastic texture of the rock, observed in hand specimen, is not evident in thin section.
85	1188F-16Z1-139-141 #3e	44	Completely altered aphyric volcanic rock.				Tr	48		47			Tr	5			Tr		This section was cut from a piece of core which displayed “...a coherent (lava) finger sandwiched within clastic material.” The section contains 2 textural domains, with a fairly distinct, but very irregular contact. The bulk of the slide is composed of microcrystalline quartz and illite (=coherent domain?). The E edge (when view upright) of the TS is composed of coarse crystalline aggregates and apparent crystal fragments of quartz with undulose extinction with abundant dirty brown clay (=clastic domain?). Pyrite more or less evenly distributed throughout the section, but tends to be coarser in the clastic domain.

THIN SECTION SUMMARY SHEET - HOLE 1188F

				Mineralogy															
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Leuc.**	**Hem.**	**Po**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
86	1188F-17Z1-04-07 #1	45	Completely altered sparsely plagioclase-phyric volcanic rock.				5	30		60				5			Tr		Relict feldspar laths - variably altered - in places by fibrous (Clay?) minerals elsewhere by quartz. Quartz with with clay (illite) as fine grained groundmass to the sample and as aggregates of macro quartz.
87	1188F-19Z1-13-15 #1b	45	Completely altered silicified volcanic rock.				2	26		67			Tr	5			Tr		Stretched aligned vesicles filled with pyrite, quartz and anhydrite, together with aligned feldspar laths defines volcanic layering. Patches in section is dominated by illitic clay minerals, whereas other patches are dominated by brown clay minerals.
88	1188F-22Z1-121-123 #15	46	Highly altered silicified volcanic rock.	40			2	25		30			Tr	3			Tr		Quartz with clay as fine grained groundmass and as vesicle fill with minor anhydrite. Trace anhydrite in the groundmass and as vesicle fill with quartz.
89	1188F-25Z1-24-26 #4	46	Highly altered aphyric volcanic rock.	5			Tr	30		64				1			Tr		Plagioclase is at least An51 by Michel-Levy technique (only 5 determinations - a bit low; An51 is a minimum). Magnetite inclusions in pyrite of same morphology as magnetite in quartz of the groundmass.
90	193-1188F-26Z1-20-23#2	49	Completely altered, sparsely plagioclase-phyric volcanic rock.	5			2	65		28	Tr			Tr			Tr		Unaltered feldspar, but hosted in a pervasively quartz-clay altered groundmass.Quartz dominant groundmass with clays, also as coarser aggregates (=vug fill).
91	193-1188F-30Z1-5-7#2	51	Very lightly altered breccia.	8				54		35	Tr			1	Tr		2		Fresh to incipiently altered feldspar crystals. Quartz in groundmass with clays, also as coarser aggregates (=vug fill) and rounded to subrounded silicified clasts. Some fine granular aggregates have prismatic shapes - plagioclase phenocryst pseudomorphs? Magnetite as fine skeletal grains and subhedra altering to leucoxene in the matrix of the rock. Coarse (up to 6 mm) granular aggregates of fine equant subhedra intergrown with quartz contain traces of pyrite and chalcopyrite.
92	1188F-31Z1-1-3 #1	52	Highly altered, sparsely plagioclase-phyric volcanic rock.	21			1	51		25				1			1		Well preserved palgioclase only slightly altered along rims and cracks. Magnetite occurs as scattered grains in groundmass and concentrated within a vein. The larger grains are often disintegrated with leucoxene? along crystallographic directions, however fresh euhedra are present, often overgrown by clear quartz. Tiny magnteite inclusions occur in pyrite, including the grains in the vein.
93	193-1188F-31Z1-39-42#5	53	Completely altered silicified breccia.	1			Tr	73		25				1			Tr		Rock is heavily recrystallized. However, clay-rich and quartz rich “clasts” can still be picked. The apparent fragments of quartz are the strongest evidence for the clastic nature of this rock. Overall just trace of plagioclase microlites and even those appear to be mostly replaced by qtz. Some angular qtz “clasts” could have been plagioclase phenocrysts.
94	193-1188F-34Z1-05-07#1	54	Completely altered, sparsely vesicular volcanic rock.				2	50		47	Tr			1			Tr		Vesicles filled with qtz-py-anhy. Rare plagioclase phenocrysts(?) replaced by quartz and anhydrite in many cases and white clay (brown in transmitted light) in others. Quartz-dominated matrix with brown clay, white mica (illite?) and pale green, low birefringence clay/ chlorite in groundmass. Pale bands in thin section are rich in brown clay.

THIN SECTION SUMMARY SHEET - HOLE 1188F

				Mineralogy															
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Leuc.**	**Hem.**	**Po**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
95	193-1188F-34Z1-45-47#9A	55	Completely altered, aphyric volcanic rock.					57		40		Tr	Tr	1	Tr		2	Spinel (Tr), Zeolite (Tr)	Magnetite forms granular aggregates. It is also present in the groundmass and as inclusions in quartz and pyrite crystals. Pyrite overgrows quartz-magnetite assemblage, replacing first the quartz, keeping magnetite as inclusions for longer. Chalcopyrite forms inclusions in magnetite, pyrrhotite as inclusions in pyrite, Clear green octahedral crystals (gahnite-hercynite?), some with stepped growth surfaces, are associated with magnetite. Hematite (and possibly maghemite) forms inclusions in quartz and is associated with granular magnetite. Chlorite as spherulitic structures - possibly chamosite (?) - lining voids and/or vesicles, associated with late quartz or zeolite and also as fine fibrous intergrowths with granular magnetite and hematite.
96	193-1188F-34Z1-108-110#14A	56	Highly altered, sparsely vesicular volcanic rock.	7			Tr	60		32		Tr		1			Tr		The rock had a mottled appearance in hand specimen and this is reflected in thin section by patchy domains composed of quartz+illite and others dominated by brown clay. There are 0.5mm irregular to ovoid-shaped quartz-illite spots hosted in brown clay in one part of the section. These are most likely amygdales. The shapes of brown clay pseudomorphed plagioclase phenocrysts are faintly visible in places. Relict acicular plagioclase microlites, many are corroded looking, suggesting partial replacement.
97	193-1188F-35Z2-41-43#2B	57	Completely altered, aphyric, sparsely vesicular volcanic rock.				3	55		40	Tr			2			Tr		This section cut from a minicore. Quartz, anhydrite, and pyrite fill vesicles. Rock is rich in brown clay (white in hand specimen), the distribution of which is patchy. Magnetite as inclusions in pyrite.
98	193-1188F-35Z1-44-46#2D	57	Highly altered, aphyric, sparsely vesicular volcanic rock.	15			1	50		31	Tr	Tr	Tr	3			Tr		This thin section, cut from a minicore, is very similar to Section 97 (35Z1, 44-46#2D), but contains 25% of fresh plagioclase microlites and much less brown clay. Vesicles are filled with quartz and pyrite and minor anhydrite.
99	193-1188F-37Z1-2-4#1	57	Completely altered, sparsely vesicular volcanic rock.				Tr	40		58	Tr			2			Tr		Anhydrite vein along one edge. Patchy distribution of brown clay. Significant amounts of chlorite in groundmass imposes green color to rock. Quartz and pyrite filling vesicles.
100	193-1188F-37Z2-18-20#2	57	Highly altered, sparsely vesicular volcanic rock.	20			Tr	45		30		Tr	Tr	5			Tr	Il-menite (Tr)	Abundant fresh plagioclase microlites in groundmass. Incipient alteration of plagioclase ot clay. Rare pink, anisotropic inclusions in pyrite are clearly pyrrhotite.
101	193-1188F-37Z2-31-33#3	58	Completely altered, magnetite bearing rock.	Tr				52		40		Tr	Tr	2	Tr		2	Spinel (3)	Magnetite and spinel occur as fine inclusions in quartz. They are absent from clay-dominated domains in the rock.Spectacular red hematite occurs in clusters, generally set in a mat of colorless, high-birefringent alunite/brucite (looks like talc, but XRD said there is alunite here). Quartz vugs have little to do with alunite-hematite vugs, although there are a few cases where hematite alone is included in quartz.
102	193-1188F-37Z2-65-68#7	59	Highly altered, sparsely vesicular volcanic rock.	25			Tr	48		25				Tr			2		The sample contains a thin anhydrite-pyrite vein and its associated halo (concentrations of pyrite, anhydrite, and brown clay). The host rock is typical aphyric (only one plagioclase phenocryst) volcanic rock with trachytic groundmass and small, flattened and aligned quartz- and pyrite-filled vesicles. The plagioclase laths are fresh, with clay corrosion.The brown clay with magnetite is more pronounced towards the vein halos. Magnetite phenocrysts are variably undergoing alteration within the igneous groundmass.

THIN SECTION SUMMARY SHEET - HOLE 1188F

				Mineralogy															
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Leuc.**	**Hem.**	**Po**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
103	193-1188F-43Z1-87-91#4A	62	Highly altered sparsely plagioclase-phyric magnetite impregnated volcanic rock.	26			2	40		29	Tr			1			2		Vesicles filled with quartz-pyrite-magnetite-anhydrite. Rare plagioclase phenocrysts? replaced by clay (brown in transmitted light).Quartz dominated matrix with brown clay, white mica (illite?) and pale green, low birefringence clay/chlorite in groundmass. Anhydrite minor quartz, pyrite vein has a white clay-minor quartz halo and, outside of that, a dark clay-quartz magnetite halo in which the magnetite content is higher than in the white halo.
104	193-1188F-38Z2-88-90#4	62	Highly altered, sparsely plagioclase-phyric volcanic rock.	32			2	30		35				1			Tr		Porphyritic rock with trachytic groundmass texture. Incipient alteration of plagioclase to clay. Mosaic quartz filling vesicles. Pyrite and anhydrite as vesicle fill. Coroded pyrite crystals in the groundmass.
105	193-1188F-39Z1-41-42#6	62	Completely altered, sparsely plagioclase-phyric volcanic rock.				1	60		39				Tr			Tr		This is a soft, gray rock in hand specimen. Plagioclase is completely clay/chlorite altered.
106	193-1188F-40Z1-3-5#1A	65	Highly altered, magnetite-bearing, sparsely plagioclase-phyric volcanic rock.	32			2	44		20				1			3		In hand specimen this rock has vugs filled with green clay, anhydrite, pyrite, and magnetite. Many of the vugs had a single pyrite grain surrounded by soft black magnetic material. In thin section, these vugs are present. In many vugs a grain of coarse pyrite is surrounded by opaque material that, in reflected light, comprises poorly-polished material with inclusions of long thin fine magnetite crystals. Other vugs contain anhydrite + chlorite + quartz + pyrite + magnetite. Incipient alteration of plagioclase to clay.
107	193-1188F-40Z1-36-38#2C	66	Completely altered, sparsely vesicular volcanic rock.				Tr	50		49				1			Tr		The vesicles, now filled with quartz, pyrite and some anhydrite, are small (< 0.5 mm), flattened, and aligned. Clays, pseudomorphing plagioclase phenocrysts, are aligned parallel to the same trend.
108	193-1188F-41Z2-7-10#2A	69	Very highly altered volcanic rock.	5			Tr	50		44		Tr		1		Tr	Tr		Trachytic groundmass texture. Plagioclase partly altered to clay. Magnetite and hematite inclusions in quartz. Trace of sphalerite accompanied by pyrite and anhydrite as vesicle fill.
109	193-1188F-42Z1-72-74#4E	70	Completely altered volcanic rock.	Tr			Tr	45		54				1					Poor quality section - full of holes and a lousy polish. Hand specimen contained quartz-pyrite amygdales, which appear to have been plucked during manufacture. There is an anhydrite-clay-rich halo along two edges of the thin section. Corroded remnant plagioclase phenocrysts (trace amounts).
110	193-1188F-43Z1-3-5#1	71	Highly altered volcanic rock.	15			Tr	45		39				1			Tr		Plagioclase phenocrysts and quartz are much less abundant in brown clay rich domains.

THIN SECTION SUMMARY SHEET - HOLE 1188F

				Mineralogy															
No.	**ID**	**Unit**	**Name**	**Plag**	**Px**	**Glass**	**Anhy**	**Qtz**	**Sil/ Cris**	**Clays**	**Leuc.**	**Hem.**	**Po**	**Py**	**Cpy**	**Sphal**	**Mt**	**Others**	**Comments**
111	193-1188F-43Z1-67-69#3A	72	Highly altered, magnetite-impregnated, sparsely plagioclase-phyric volcanic rock.	10			1	60		25	Tr			1			3		Similar to TS #103. The vein is a 3.6mm wide zone of intergrown quartz - brown clay and pyrite, with very rare extremely fine grained (5µm) magnetite as inclusions in the quartz. There is no clear continuous flow path. The vein has a distinct dark halo, approximately 5mm wide, which comprises quartz and very fine granular magnetite (1-5 µm grains) with dirty brown clay. The outer margin of the vein halo is marked by a zone of scattered 50-300 µm pyrite and the appearance of plagioclase crystals in the groundmass of the rock. Two apparent clasts are present in the rock. The larger of the two (approx 1.5 cm across) is composed of quartz (75%), brown clay (12%), illite (11%) and remant plagioclase microlites (2%). Other than the low abundance of plagioclase, the mineralogy of the clast is similar to that of the groundmass of the rock, so its contact is indistinct. However, the clast is wrapped by banding defined by plagioclase microlites. The smaller of the 2 clasts (approximately 6mm, on the edge of the TS) is distinctly siliceous and is composed of granular quartz with scattered aggregates of dark clay and trace magnetite. The composition of this clast contrasts sharply with the groundmass and it has a sharp contact with the remainder of the rock.
112	193-1188F-44Z1-1-3#1	72	Completely altered, magnetite-impregnated, aphyric volcanic rock.				1	65		30	1			1			2		This rock has a stockwork veined appearance in hand specimen, with a network of fine (<1mm wide) veins cutting a dark gray silicified rock. The veins are represented in TS by a very fine grained intergrowth of granular quartz - brown clay - illite - leucoxene (after magnetite) - chlorite with rare patches of coarser anhydrite with pyrite. The veins have poorly defined margins and a very thin, variably developed halo of dark brown clay and magnetite, which has almost entirely broken down to leucoxene like material. The halo is best devloped at an intersection between 2 veins. In some parts of the veins quartz appears to be pseudomorphig prismatic plagioclase, implying that the veins are replacive, rather than fracture fills.

TS: 1 193-1188A-2R1-9-12 #3 **UNIT 1**

OBSERVERS:
HP/SR/WB/CY
DAV

ROCK NAME: **Vesicular plagioclase-clinopyroxene-phyric dacite.**
TEXTURE:

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	5		1.65	1	Laths, euhedral.	Twinned feldspar grains. Skeletal and other quench textures are absent.
Clinopyroxene	1		2.4	1	Subhedral, elongate prisms.	
Ti-magnetite	1		<0.20		Euhedral (cubic), to anhedral.	Finely disseminated in the groundmass, moderately to strongly corroded. Partially and completely enclosed in plagioclase and clinopyroxene.
GROUNDMASS						
Glass						
Plagioclase microcrysts	40			0.1	Acicular.	
Ti-magnetite microcrysts	Trace	0.005	0.01	0.01	Euhedral.	
Vesicles						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Fresh	Trace					Fe(O,OH) coatings on vesicle walls, corroded Ti-magnetite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
None.						

COMMENTS AND SKETCH: Numerous melt inclusions within plagioclase phenocrysts, Ti-magnetite inclusions within clinopyroxene and plagioclase.

TS: 2 193-1188A-3R1-0-2 #1 **UNIT: 1**

OBSERVERS:
WB, CY,SR
DAV

ROCK NAME: **Moderately plagioclase-clinopyroxene-magnetite-phyric, moderately vesicular dacite.**
TEXTURE: **Moderately vesicular, pilotaxitic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	6		1.5		Acicular, euhedral to subhedral; seriate size range.	A small number of zoned crystals exhibiting one or two broad oscillations. Some skeletal feldspar and minor quench growth. Some well preserved melt inclusions.
Clinopyroxene	0.5	0.1	0.6		Euhedral and subhedral stubby laths.	Some glass inclusions. May be enclosed partially in plagioclase.
Ti-magnetite	0.5	0.1	0.2		Cubic, subhedral.	May be partly or wholly enclosed in both plagioclase and pyroxene.
GROUNDMASS						
Glass	53					
Plagioclase	40			0.08	Acicular.	Typically 5 microns wide, 80 microns across.
Clinopyroxene	Trace	0.002	0.01			
Magnetite	Trace	0.002	0.01			
Vesicles		0.2	4		Elongate, flattened, aligned.	

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Relatively unaltered.						Traces of Fe(O,OH)x and microcrystalline silica coating a large elongate vesicle.
Opaques, and a clear mineral.						There is a 100-micron rind of lighter-colored (altered) glass around the edges and extending into vesicles. Vesicle walls have a trace of pyrite and tiny clear crystals (blocky, low birefringence).

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
None						

COMMENTS AND SKETCH: Rare magnetite inclusions in plagioclase
See photomicrographs 1188A_15, 1188A_17, and 1188A_21

TS: 3 193-1188A-5R1-35-38 #7			UNIT 2			OBSERVERS: AP/WB/CY/SR
ROCK NAME:	**Highly altered volcanic glass.**					**DAV**
TEXTURE:	**Perlitic.**					

PRIMARY	PERCENT	SIZE (mm)				
MINERALOGY		min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	**Trace**				Laths	Microphenocrysts
GROUNDMASS						
Perlitic Texture						

ALTERATION		SIZE (mm)				
MINERALOGY	PERCENT	min.	max.	av.	MORPHOLOGY	COMMENTS
Tan cryptocrystalline material	**80**					
Green smectite	**10**					
Silica	**8**					

SULFIDE		SIZE (mm)				
MINERALOGY	PERCENT	min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	**2**		**0.05**		Euhedral Grains.	Euhedral crystals within the fracture network

COMMENTS AND SKETCH: Preservation of microlitic texture. Glassy to slightly microlitic texture is preserved in center of “islands”. Relict fresh glass? Towards the margins the volcanic glass is progressively replaced by tan alteration products. The “islands” are commonly replaced by a green smectite?, which is developed at the interface with the smectite/opaline silica/pyrite assemblage replacing the rock along an irregular fracture network.

See Chapter 3, Figure F38

TS: 4 193-1188A-7R1-62-64 #12			UNIT 4			OBSERVERS: AP/WB/CY/FB
ROCK NAME:	**Completely altered volcanic rock.**					**DAV / TB**
TEXTURE:	**Fine grained.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Trace relict glassy to microlitic						Some microlites observable, but altered (see comments below).

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Altered Glass	50					Mainly clay minerals and silica?
Anhydrite	9					
Cristobalite	40	0.05	0.2	0.1	Euhedral prismatic; microcrystalline.	Forms low-birefringence prisms in vesicles, and is coated with tan, low-birefringence chalcedony(?) or similar silica?
Magnetite	Trace					

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.1		Discrete grains.	Disseminated euhedra dominant, very rare framboidal pyrite.
Chalcopyrite	Trace					
Magnetite	trace		0.05		Euhedral.	Alteration product - vesicle fill with cristobalite.

COMMENTS AND SKETCH: Anhydrite in veins and replacing glass/altered glass (see image 1188A_27). It appears the rock was highly vesicular, with the vesicles now filled with cristobalite and anhydrite. The vesicle fill shows a cyclic paragenesis: cristobalite -> anhydrite -> cristobalite -> anhydrite The acicular morphology of the plagioclase microcrysts (randomly oriented - no flow structure) is still visible in the altered glass, but the laths are completely replaced (by clay?) <=0.1 mm wide anhydrite veins with rather coarse anhydrite, no alteration halos around the veins.

See photomicrographs 1188A_11, 1188A_12, 1188A_18, 1188A_19, 1188A_20, and 1188A_27

TS: 5 193-1188A-7R1-120-124 #18		UNIT 5				OBSERVERS: AP/WB/CY/FB DAV/SR/TB
ROCK NAME:	**Completely altered volcanic rock.**					
TEXTURE:	**Dominately microsperulitic, some remnant perlitic texture, minor partially filled vesicles.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Previously glassy, spherulitic with minor vesicles (<5%). Alteration along perlitic cracks. ? Flow banding.						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Brown clay	10					Replacing glass near bottom of thin section.
Anhydrite	10					In veins with pyrite, in vugs and veiscle, and replacing glass.
Cristobalite/Chalcedony	25					In vugs, vesicles, and replacing glass. Radial textures to clasts of altered groundmass.
Altered glass	52					Probably clay and silica.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3		0.1		Discrete grains.	In veins.

COMMENTS AND SKETCH: Pyrite concentrated in upper part of thin section where an anastomosing network of pyrite-cristobalite+anhydrite veins is developed. In that part of the section, the groundmass appears dark gray, due to extremely fine-grained pyrite disseminated in the altered glass. Vesicles often show cristobalite lining and anhydrite in center. Alteration is obviously fracture controlled and developed as fine siliceous halos around veins which generally mimic perlitic fracture networks. Anhydrite is present only as late-stage vein- and vug-fill and does not seem to be a major component of the more pervasive alteration style. Many of the images below show detail of alteration.

See Chapter 3, Figures F38, F19, F44, and F101B; see photomicrographs 1188A_14, 1188A_15, 1188A_17, 1188A_18, 1188A_19, 1188A_29, 1188A_30, 1188A_109, and 1188A_113

TS: 6 193-1188A-7R2-39-41 #2			UNIT 6			OBSERVERS: AP/SR/WB DAV/ CY
ROCK NAME:	**Completely altered volcanic rock.**					
TEXTURE:	**Perlitic pseudoclastic.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Previously glassy						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Anhydrite	15	0.1	0.5		Euhedral.	Anhydrite contains 15-20 µm - 2 phase fluid inclusions along planes. Some inclusions contain daughter/trapped phases? [Inclusions are between 2 and 10 micrometers in diameter.]
Clay	45					
Silica	30				Spheroidal, massive.	Remnant spheroidal texture away from vein alteration halos. Massive very fine grained silica-clay alteration in vein halos

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	10		<1		Subhedral.	Subhedral crystals closely associated with silica-anhydrite veins. Finely disseminated pyrite crystals within clay minerals in proximity to veins.

COMMENTS AND SKETCH: Two generations of anhydrite within veins: 1. Within fractures crosscutting the original volcanic rock - cristobalite-pyrite. 2. Late stage veins - predominantly anhydrite - cross cut earlier veins and altered rock (clay minerals). Anhydrite is not part of the pervasive alteration - late veins and vug fill only.

See Chapter 3, Figures F72, F71, F14A and B, and F101D; see photomicrographs 1188A_34, 1188A_35, 1188A_39, 1188A_41, 1188A_42, 1188A_43, 1188A_120, 1188A_121, 1188A_122, 1188A_123, 1188A_124, 1188A_126, 1188A_127, 1188A_128, and 1188A_129

TS: 7 193-1188A-8R1-66-68 #8			UNIT 6			OBSERVERS: WB/SR/HP DAV/CY
ROCK NAME:	**Completely altered volcanic rock.**					
TEXTURE:	**Dominantly microspherulitic texture, subordinately perlitic.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Clay	30					
Cristobalite	59					
Anhydrite	7					2-phase (liquid + vapor) fluid inclusions with 2-10% vapor.
Quartz	1			0.2	Anhedral patches.	

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3		0.1		Subhedral grains.	Pyrite along discrete fractures and in part along original perlitic fractures. Pyrite clearly associated with silica-clay alteration.

COMMENTS AND SKETCH: Anhydrite and pyrite veinlet. Obvious replacement of glass by cristobalite, partly preserving perlitic texture. Some groundmass domains contain abundant isolated and coalesced microspherulites => high temperature devitrification. Vugs/vesicles often lined with cristobalite with blocky anhydrite in the center.
See Chapter 3, Figure F15

TS: 8 193-1188A-8R1-124-127 #11			UNIT 6			OBSERVERS: SR/HP/CY
ROCK NAME:	**Completely altered volcanic rock.**					**DAV**
TEXTURE:	**Relict perlitic textures, minor vesicles.**					

PRIMARY		SIZE (mm)				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
None						
GROUNDMASS						
None						Some relict perlitic texture within less altered cores
Vesicles	**<5**				Round to lensoidal.	

ALTERATION		SIZE (mm)				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	10					Suggestion of later anhydrite filling center of veins and open space.
Clay	60					Bulk of slide replaced by tan brown clay - most likely a microcrystalline silica-clay intergrowth. Intense clay replacement appears to be confined to spheroidal textural domains, which are hosted in pervasive cristobalite.
Silica	25					Within groundmass and as selvages to fracture margins
Quartz	Trace			0.2	Anhedral.	

SULFIDE		SIZE (mm)				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	5		0.05		Subhedral grains.	Very fine pyrite is in vein margins associated with silica, later coarser pyrite occurs with anhydrite infill.

COMMENTS AND SKETCH: Picture to right shows vein lined by silica - then pyrite - with anhydrite core 1188A_22. Fracturing and alteration along anastomising veins and preexisting cracks enclosing less altered material. Some finer, less altered fragments resemble glass shards. Anhydrite appears to be late in the paragenetic sequence - center of veins, occasional vug fill. However, there is significant pyrite associated with anhydrite in this section, unlike Thin sections #6 and #7, which are higher up in the same unit. Remnant spheroidal texture, with clay replacement of original mineralogy.
See Chapter 3, Figure F42; see photomicrographs 1188A_47, 1188A_48, 1188A_49, 1188A_50, 1188A_51, 1188A_52, 1188A_53, 1188A_54, 1188A_130, 1188A_131, and 1188A_132

TS: 9 193-1188A-9R1-68-70 #7			UNIT 8			OBSERVERS: WB/SR/HP/CY
ROCK NAME:	**Completely altered volcanic rock.**					**DAV**
TEXTURE:	**Flow lamination, vitriclastic texture, axiolitic devitrification.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
In-situ fragmented and vitriclastic textures						
Rock probably glassy						Remnant perlitic texture
Minor vesicles	<5				Lensoidal.	
Axiolitic devitrification (brown bands flollowing clast margins)						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Clay	10					
Cristobalite/chlacedony	40					
Altered glass	30					Alteration utilizing intial perlitic fractures. Pronounced wavy extinction
Anhydrite	5					
Quartz	12					

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3		1		Equant.	In patches where silicification is intense

COMMENTS AND SKETCH: Uppermost part of the section is highly silicified. Similar vein paragenesis as sample 1188A-8R1-124-127cm. Vitriclastic texture (clasts don't fit together) + jigsaw fit brecciation. Flow lamination in some clasts (unsystematic orientation) defined by aligned partially collapsed tube vesicles. Original clast outlines marked by rim of axiolitic devitrification. Commonly fractured due to later hydothermal alteration. Later silica (looks like microcrystalline quartz??)-pyrite veins exploit flow banding, but are linked by cross cutting structures, leading to ladder vein textures

See Chapter 3, Figures F18A, B and C and F45; see photomicrographs 1188A_23, 1188A_24, 1188A_46, 1188A_56, 1188A_58, 1188A_59, 1188A_60, 1188A_133, 1188A_134, 1188A_135, 1188A_136, 1188A_137, and 1188A_138

TS: 10 193-1188A-11R1-35-38 #3			UNIT 9			OBSERVERS: WB/HP/CY/SR
ROCK NAME:	Moderately altered aphyric volcanic rock.					DAV
TEXTURE:	Amygdaloidal, microcrystalline.					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Plagioclase	31			0.05		In groundmass - remnant igneous phase.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Anhydrite	7		0.7			Vein, vesicle fill.
Cristobalite	30					Filling void space, replacing groundmass.
Fine clay	15					Dark, extremely fine grained clay in groundmass, concentrated around anhydrite vein.
Illite	8					White mica/clay in groundmass, highly birefringent - alteration product of plagioclase.
Barite	1		0.2			Vesicle fill (see images below).
Quartz	5					Vesicle fill, in late veins with anhydrite, and possibly present in groundmass alteration.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	3		0.05	0.01		Forms an early vein, and disseminated thorugh groundmass. Vesicle fill.

COMMENTS AND SKETCH: Vesicles filled with quartz, anhydrite, barite and pyrite. A diffuse cristobalite+anhydrite-pyrite vein cuts through the section. Increased silicification and significant clay alteration of groundmass along vein halos.The presence of igneous plagioclase implies relatively moderate alteration. The microcrysts are unoriented - massive flow interior. There is an early fracture partly filled with pyrite, which was later re-opened by an anhydrite-quartz-pyrite vein.

See photomicrographs 1188A_61 and 1188A_62

TS: 11 193-1188A-12R1-123-124 #12 **UNIT 10** **OBSERVERS: WB/SR/HP DAV/CY/TB**

ROCK NAME: **Completely altered volcanic rock.**
TEXTURE: **Flow banded, spherulitic (clay-cristobalite altered).**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Relict spherulitic						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Clay	25					Dirty brown clay after volcanic glass in outer parts of spherules.
Cristobalite/chalcedony	57					Spherule interiors.
Quartz	10	0.04	1	0.5	Anhedral.	Always has wavy extinction.
Anhydrite	Trace					In a late quartz-sulfate vein.
Chlorite	7					Patchy, fine grained chlorite aggregates, associated with hematite and clear late quartz.
Hematite	Trace					With chlorite and quartz.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.5			Disseminated, but more concetrated proximal to old volcanic fractures.
Magnetite	Trace		0.02			Needles of magnetite locally associated with Fe-Oxides.

COMMENTS AND SKETCH: Flow banding defined by variable abundance of coalesed, altered spherulites. Some domains consist entirely of altered spherulites replaced by gray-brown clay+cristobalite.Mostly isolated altered spherulites in matrix of cristobalite and altered glass Chlorite has an antithetic relationship to pyrite - clearly associated with hematite and quartz. Quartz and anhydrite veins. Cristobalite - quartz veins XRD indicated plagioclase - possibly in spherules?

See Chapter 3, Figures F16, F46, and F101E; see potomicrographs 1188A_25, 1188A_64, 1188A_65, 1188A_66, 1188A_68, 1188A_70, 1188A_71, 1188A_72, and 1188A_73

TS: 12 193-1188A-12R2-48-51 #4			UNIT 10			OBSERVERS: AP/SR/HP/CY
ROCK NAME:	**Completely altered, hydrofractured, flow banded volcanic rock.**					**DAV**
TEXTURE:	**Flow banded.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Abundant altered spherulites.	50 to 90	<0.1	0.3	0.1	Round, necklace, coalesed groups. Fairly homogeneous in size.	Coalesed islands (<10 individual spherulites), and domains with bulbous margins. Clay-silica alteration destroyed internal organisation.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Clay	20					Alteration of remnant spherules.
Quartz	10					No apparent anhydrite within the veins - predominantly composed of a - quartz-pyrite+magnetite with chlorite-hematite halos.
Cristobalite	55					Silicification of body of rock.
Anhydrite	Trace					
Chlorite	10					
Hematite	2					
Magnetite	1			<0.1mm	Prismatic	At margins of quartz veins.
Rutile	Trace				Acicular	In late clear quartz veins.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	2			<0.5	Anhedral-subhedral.	Discrete grains with inclusions of magnetite(?) Corroded, minor pyrite in quartz veins.

COMMENTS AND SKETCH: Flow banding defined by variable abundance of spherulites (completely coalesed domains <=> domains with recognizable individual spherulites). Anastomosing vein-network of quartz veins with very minor anhydrite, minor pyrite and traces of hematite.
See Chapter 3, Figures F43; see photomicrographs 1188A_07, 1188A_74, and 1188A_112

TS: 13 193-1188A-14R1-47-51#7			**UNIT 13**			**OBSERVERS:** **SR/HP/CY**
ROCK NAME:	**Altered and brecciated volcanic rock.**					**DAV**
TEXTURE:	**Vein network.**					
PRIMARY	**PERCENT**	**SIZE (mm)**				
MINERALOGY		**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
None						
GROUNDMASS						
Very fine grained; no original protolith preserved.						
ALTERATION		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Anhydrite	3	<.1	0.5			Anhydrite within late fractures and as vesicle fill.
Silica	40		0.02			
Clay	55					
Magnetite	Trace		0.2			Magnetite breaking down to “leucoxene.” Either overgrowns pyrite, or pyrite is a breakdown product.
SULFIDE		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	2		<.1			Pyrite distributed throughout the section - increased concentration towards anhydrite bearing veins.
COMMENTS AND SKETCH:	No volcanic textures. Alteration outwards from veins generating apparent clastic texture in hand specimen. See photomicrographs 1188A_83, 1188A_84, 1188A_85, and 1188A_86					

TS: 14 193-1188A-14R1-105-106 #15 **UNIT 14** **OBSERVERS: AP/WB/SR/CY**

ROCK NAME: **Completely altered volcaniclastic pebble breccia.** **DAV**
TEXTURE: **Clast-supported texture.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Clasts: Microcrystaline quartz, cristobalite, clay some with about 10% vesicles (<1 mm).						
Matrix: Quartz, cristobalite, relatively coarse (up to 0.5 mm) anhydrite growing in intraclast voids.						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	42		<0.1		Subhedral.	Replaces clasts together with anhydrite and white mica.
Cristobalite/chalcedony	21					Patchy distribution (late vug fill?), associated with anhydrite and pyrite. Pronounced wavy extinction.
Anhydrite	16		0.5		Sub- to euhedral.	In veins, filling void space, and replacing clasts.
White mica	21		<0.1			Lining vugs, could be talc (noted in XRD), post dates silicification. White mica is also disseminated in altered clasts that appear to be mainly replaced by quartz. Also occurs as fine felted halos around silica veinlets

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace		<0.1		Discrete grains.	

COMMENTS AND SKETCH:: Anhydrite veins and veinlets with silica alteration halos, very minor pyrite and magnetite. Vugs with silicified walls are lined with “white mica” (talc?) and show blocky anhydrite in center. It appears that cristobalite, anhydrite and pyrite come in late and fill in void space. Intensely altered volcanic clasts rimmed by very fine ?quartz needles growing into intraclast space. Intraclast space is locally filled with relatively coarse anhydrite.

See Chapter 3, Figure F49; see photomicrograph 1188A_28

TS: 15 193-1188A-16R1-31-38#6			UNIT 17			OBSERVERS: WB/CY DAV
ROCK NAME:	**Highly altered sparsely plagioclase-phyric vesicular volcanic rock.**					
TEXTURE:	**Fine-grained.**					
PRIMARY	**PERCENT**	**SIZE (mm)**				
MINERALOGY		**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
Plagioclase	1		2	1.5	Tabular to equant.	Fresh, zoned, with some oscillation. Altering to quartz.
GROUNDMASS						
Plagioclase	30					Acicular microlites.
Altered Glass	30					Dark, dirty material, probably mostly altered to microcrystalline silica and clay.
ALTERATION		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	30				Anhedral.	Occurs in groundmass and filling vesicles along with pyrite and anhydrite.
Anhydrite	3		0.2		Anhedral.	Filling vesicles and replacing groundmass.
Chlorite	3					Replacing groundmass.
White mica	Trace					Rarely observed in vesicles, may be present in matrix.
SULFIDE		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	3			0.2	Subhedral grains.	Disseminated pyrite throughout the section. Large, vuggy pyrite crystals in vesicles.
COMMENTS AND SKETCH:	Vesicles are filled with quartz, pyrite and (rarely) anhydrite. Consistent paragenesis: quartz > pyrite >anhydrite. Whitish “flames” are areas of increased anhydrite in groundmass. See photomicrographs 1188A_75, 1188A_87, 1188A_88, 1188A_89, and 1188A_90					

TS: 16 193-1188A-16R1-74-78#10 **UNIT 17** **OBSERVERS: AP/WB / HP/ CY**

ROCK NAME: **Highly alterered sparsely plagioclase-phyric volcanic rock.** **DAV**

TEXTURE:

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2		1.2		Tabular to equant	Fresh.
Clinopyroxene	Trace					Altering to quartz.
GROUNDMASS						
Plagioclase						Microlitic.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50				Anhedral	Occurs in groundmass and filling vesicles along with pyrite and rare anhydrite.
Anhydrite	1		0.7		Anhedral	Rarely observed as vesicle fill.
Chlorite	5					Replacing glass.
White mica	5					Lining some of the large quartz-pyrite filled voids. Replacing glass.
Fine grained silica	30					Light gray-brown, cryptocrystalline, intergrown with clay?

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	7			0.2	Subhedral grains.	Disseminated pyrite throughout the section. The pyrite is porous but with no apparent inclusions. Late irregular pyrite-quartz veinlets. Highly variable pyrite grain size throughout section.

COMMENTS AND SKETCH: Irregular veins and veinlets of quartz with pyrite. Previous vesicles are filled with quartz and pyrite (rare anhydrite). Silicification is most intense along a quartz-pyrite vein.

TS: 17 193-1188A-16R1-95-98 #14 **UNIT 17** **OBSERVERS: SR/CY DAV WB**

ROCK NAME: **Highly altered volcanic rock.**
TEXTURE: **Microlitic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace					Fresh
Clinopyroxene	Trace					Altered to clay.
GROUNDMASS						
Plagioclase	3					Microlitic.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Anhydrite	5		0.05		Discrete grains.	Intergrown with quartz in vesicle linings. Also occurs in groundmass.
Quartz	40					Replacing groundmass, filling vesicles. Possibly a lot more? Lack of polish tends to make everything look like clay.
White mica	5					Replacing groundmass.
Brown clay	44					Replacing groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	2		0.05		Subhedral.	Distributed throughout the groundmass. Replacing clinopyroxene in one example.

COMMENTS AND SKETCH: Quartz+pyrite+anhydrite in veinlets and vesicle fill. Rock is poor polish, difficult to see more details.

TS: 18 193-1188A-16R2-12-15 #2		UNIT 18				OBSERVERS: AP/SR DAV/CY
ROCK NAME:	**Highly altered, sparsely plagioclase-phyric volcanic rock.**					
TEXTURE:						
PRIMARY	**PERCENT**	**SIZE (mm)**				
MINERALOGY		**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
Plagioclase	1		2.5	1.2	Euhedral, elongate.	Relict twinned plagioclase phenocrysts. Some are clustered together.
GROUNDMASS						
Plagioclase laths	26					
ALTERATION		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	40					Alteration of groundmass - quartz + clay + relict laths of plagioclase.
Clay	30					
Magnetite	Trace					Very fine-grained. Could be more than a trace.
SULFIDE		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	3			0.2	Rounded crystals	Disseminated throughout the slide.
COMMENTS AND SKETCH:	One acicluar plagioclase crystal is 2.5 mm long, bent into a gentle curve, and broken numerous times along its length. This crystal probably was fractured brittly during ductile flow of the lava. Like #17, this section has a very poor polish, making it difficult to work with. This material is much more like the overlying unit (17) than the remainder of unit 18. See photomicrograph 1188A_76					

TS: 19 193-1188A-16R2-40-43 #7			UNIT 18			OBSERVERS: AP / HP / KL
ROCK NAME:	Silicified flow-banded volcanic rock.					DAV/SR/WB/FB
TEXTURE:	Flow banded, pilotaxitic.					

PRIMARY		SIZE (mm)				
MINERALOGY	PERCENT	min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2		3.8	0.4	Equant euhedral and elongate.	Plagioclase crystals are aligned and partially altered.
GROUNDMASS						
Plagioclase	35					Microlites are all aligned the same as the plagioclase phenocrysts.
Magnetite	1					

ALTERATION		SIZE (mm)				
MINERALOGY	PERCENT	min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	42					Replacive.
Brown clay	15					Replacing institial glass.

SULFIDE		SIZE (mm)				
MINERALOGY	PERCENT	min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	5		0.05		Anhedral.	Pyrite crystals with silicate inclusions disseminated through the groundmass.

COMMENTS AND SKETCH: Rather than a mudstone or volcaniclastic sediment, this rock is a silicified volcanic rock with original flow alignment of phenocrysts and groundmass.
See Chapter 3, Figure F52; see photomicrographs 1188A_69, 1188A_78, and 1188A_82

TS: 20 193-1188A-17R1-90-93 #19			UNIT 19			OBSERVERS: AP / HP DAV/CY/SR
ROCK NAME:	**Silicified, bleached volcanic rock.**					
TEXTURE:	**Fine grained, equigranular, remnant vesicles?**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None.						
GROUNDMASS						
Microcrystalline.						Pervasively altered to silica-clay.
Titanomagnetite -> leucoxene	2					Remnant igneous magnetite completely altered to non-reflected opaque masses (="leucoxene")

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	20					Optically identifiable quartz.
Silica	28					Microcrystalline, intergrown with clay - probably microcrystalline quartz (from XRD).
Clay (gray-brown)	50					
Anhydrite	Trace					

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace		0.1		Euhedral.	Produced by magnetite breakdown, generally surrounded/ adjacent to leucoxene patches. (see image links below)

COMMENTS AND SKETCH: Irregular shaped voids.
See photomicrograph 1188A_91

TS: 21 193-1188A-17R2-33-37 #06 **UNIT 19** **OBSERVERS: AP/WB DAV/CY/SR**

ROCK NAME: **Completely altered volcanic rock.**
TEXTURE: **Relict perlitic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None.						
GROUNDMASS						
Altered						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	55				Equant to prismatic.	Pervasive silicification.
Anhydrite	20		0.5		Bladed to prismatic.	Dominantly in poorly defined veins, with magnetite.
White mica/clay	20					Clearly developed in vein selvages, but probably also present in groundmass.
Magnetite -> “leucoxene”	5		0.6		Subhedral grains breaking down.	Magnetite has broken down to “leucoxene”. Occur in anhydrite-magnetite veins and in the body of the rock.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace	0.3	0.5		Discrete subhedral grains.	Mostly associated with magnetite breakdown.

COMMENTS AND SKETCH: Top right image: Anhydrite vein with white mica/clay (illite? from XRD) developed along it. The groundmass of the rock is pervasively replaced by quartz, white mica, and anhydrite. Rare fluid of the rock is pervasively replaced by quartz, white mica, and anhydrite. Rare fluid breakdown of magnetite to leucoxene +/- pyrite (illustrated in remaining images).
See Chapter 3, Figure F53; see photomicrographs 1188A_31, 1188A_79, 1188A_92, and 1188A_94

TS: 22 193-1188A-19R1-73-76 #15			UNIT 22			OBSERVERS: DAV CY
ROCK NAME:	**Moderately altered, highly vesicular, aphyric volcanic rock.**					
TEXTURE:	**Microcrystalline.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace	1	1	1	Euhedral.	Zoned with a broad oscillation and a rounded core.
GROUNDMASS						
Plagioclase	35			0.2	Laths.	Define weak flow structure. Most are 10-20 microns across and 100-200 microns long.
Volcanic glass	15					

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Cristobalite	35					Vesicle fill and very fine grained material after altered volcanic glass, intergrown with fine dark brown clay.
Anhydrite	1					Vesicle fill.
Brown clay	10					Partly replacing groundmass.
Magnetite	3				Subhedral.	Igneous magnetite disseminated throughout groundmass, slighty coarser grains show some evidence of breakdown.
Fe-oxide	1					Fine amorphous patches in groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace				Subhedral.	Very rare. Mostly vug fill.

COMMENTS AND SKETCH: An extremely fine-grained, low birefringence mineral, tentatively described as cristobalite, partly replaces groundmass of rock, giving it a bleached appearance. The same mineral also fills vesicles, together with minor anhydrite and quartz, both of which seem to have formed later (see image 1188A_81).There is also a colorless optically isotropic mineral developed as infill in some vesicles (halite?). Vesicles are spherical. Images 1188A_95 and 1188A_96 show an anhydrite filled vesicle with plagioclase trapped in the center.

See photomicrographs 1188A_80, 1188A_81, 1188A_95, and 1188A_96

TS: 23 193-1188A-20R1-46-48 #08 **UNIT 23** **OBSERVERS: AP/SR/SDS WB/CY/TB**

ROCK NAME: **Completely altered aphyric volcanic rock.**
TEXTURE: **Fine-grained.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace				Tabular.	
GROUNDMASS						
Remnant sauss. Plagioclase	10					"Dirty" looking, otherwise similar to quartz.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	60	<0.5	0.25			Pervasive replacement.
Anhydrite	1				Stubby crystals.	Appears to mainly fill void space.
Brown to colorless clay	21					Replaces groundmass.
Magnetite -> leucoxene	5					2 types (=2 generations?). Very fine scattered euhedral (=igneous) and coarser subhedral masses associated with quartz (+/-hematite). Magnetite is breaking down to leucoxene, resulting in low reflectance opaque subhedral masses with scattered fine lamellae of remnant magnetite, visible in coarser grained masses.
Hematite	Trace					

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3	0.005	0.4	0.1	subhedral aggregates.	Extremely fine inclusions of magnetite in some pyrite near contact zone (see below). Rare pyrite-silica veins.

COMMENTS AND SKETCH: In the tan colored area, there are large subhedral/anhedral pyrite with inclusions of magnetite. The pyrite clearly postdates the magnetite. Elsewhwere you can see a very distinctive vermicular textured magnetite incorporated in pyrite. Also, in image 1188A_106, it is clear that pyrite postdates magnetite. In the darker area, magnetite + quartz (?) patches contain atolls of magnetite-free pyrite. The darker area of theslide has less pyrite than the tan colored area.

See photomicrographs 1188A_97, 1188A_107, and 1188A_110

TS: 24 193-1188A-20R1-74-76 #09			UNIT 23			OBSERVERS: AP/SR/CY/WB
ROCK NAME:	**Highly altered volcanic rock.**					
TEXTURE:	**Fine-grained.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
GROUNDMASS						
Remnant saussuratized. Plagioclase.	13					"Dirty" looking, otherwise similar to quartz.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	60	<0.01	0.5			Subhedral coarser quartz is late vug/recystallized vein fill? Pervasive silcification of groundmass.
Tan brown clay	5					
Clay	10					Felted sheaf-like aggregates in patches in the groundmass.
Magnetite -> leucoxene	2					Mostly dark leucoxene aggregates with minor magnetite. Very fine grained inclusions in pyrite, plus rare apparent overgrowths. Magnetite inclusions in quartz are common.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	10	0.01	0.5	0.07	Pitted subhedral grains and aggregates.	Small inclusions of magnetite.

COMMENTS AND SKETCH: Magnetite commonly enclosed within pyrite suggesting pyrite after magnetite, as in sections # 20, 21 & 23.
See photomicrographs 1188A_99 and 1188A_100

TS: 25 193-1188A-20R1-92-95 #12 **UNIT 23** **OBSERVERS: AP/CY/WB/SR**

ROCK NAME: **Highly altered volcanic rock.**
TEXTURE: **Relict perlitic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
GROUNDMASS						
Remnant igneous plagioclase	16					Dirty saussuritised groundmass, rare twinning.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	60					Coarser subhedral grains and pervasive groundmass replacement.
Clay	27				Sheaf-like to acicular.	
Magnetite	4	0.005	0.02	0.01	Bladed to acicular.	Equant grains to acicular lamellae. Intergrown with radiating quartz. Also occurs as inclusions in pyrite and (rare) overgrowths on pyrite. Many of the small grains are not reflective (breaking down?). Lamellae are associated with maghemite (?).
Maghemite - Hematite (?)	Trace				Lamella - Acicular.	Exsolution/oxidation lamellae.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3	0.005	0.4	0.1	Subhedral grains and aggregates.	Occur throughout the rock. Inclusions of magnetite.
Chalcopyrite	Trace				Anhedral.	Small and rare inclusions in quartz.

COMMENTS AND SKETCH: Ovoid spots (observed in hand specimen) are composed of a microcrystalline aggregate of silica, clay and minor magnetite and pyrite. Magnetite is extremely fine grained and disseminated throughout the rock. Magnetite (partly replaced by hematite or maghemite) laths sometimes form trellis-like aggregates, the form of which resembles magnetite phenocrysts. These features seem to be overgrown by pyrite in some instances. Pyrite replacing quartz-magnetite association. The darker gray mineral is magnetite and the lighter gray mineral could be either maghemite or hematite. Inside pyrite, magnetite remains unoxidized (?) and the size of the magnetite inclusions decreases from the margin to the center. It appears that (1) oxidation post-dates pyrite formation, and (2) the reaction between pyrite-magnetite and subsequent replacement of magnetite by pyrite is a function of time (kinetically controlled). This mechanism explains the abundance of magnetite inclusions near the margins of pyrite crystals and their general lack in the center.

See Chapter 3, Figures F76 and F77; see photomicrographs 1188A_101 and 1188A_102

TS: 26 193-1188A-21R1-20-24 #03			UNIT 25			OBSERVERS: AP/CY/SR
ROCK NAME:	**Completely altered volcanic rock.**					
TEXTURE:						

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
GROUNDMASS						
Remnant igneous plagioclase	5					

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	55					Pervasive.
Clay	33					Fine grained in g'mass, occasional sheaf-like aggregates. Mottled structure of rock is due to variations in clay.
Illite	2					Platy crystals .
Anhydrite	2					Stubby to bladed crystals associated with possible healed fractures.
Magnetite	3	0.005	0.02		Lamellae.	Magnetite occurs throughout the rock as rotted subhedral aggregates, breaking down to leucoxene and as small anhedral grains included in late clear quartz.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace	0.01	0.05	0.02	Scattered subhedral.	Coarser grains are associated with quartz, very fine grained pyrite associated with magnetite breakdown - see image below.
Chalcopyrite	Trace				Anhedral.	Small and rare inclusions in quartz.

COMMENTS AND SKETCH: Pervasive silicification of groundmass.
See Chapter 3, Figure F55

TS: 27 193-1188A-21R1-68-70 #08 **UNIT: 25** **OBSERVERS: AP/CY/SR**

ROCK NAME: **Highly altered volcanic rock.**
TEXTURE:

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
GROUNDMASS						
Remnant igneous plagioclase	10					
Spinel?			0.01			Golden brown, high relief, isotropic (or perhaps very high biref. masked by color).

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	63					Pervasive silicification, later pyrite-silica veins.
Clay	20					Scatttered in groundmass, concentrated in halos to pyrite-silica veins.
Anhydrite	1				Prismatic.	Rare crystals in late vuggy pyrite-silica veins.
Hematite	Trace					Fine red spots.
Magnetite -> leucoxene	1					Fine inclusions of fresh magnetite in quartz and pyrite. Subhedral dirty aggregates of leucoxene with remnant magnetite laths, intergrown or breaking down to pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	**5**	**0.01**	**0.5**	**0.2**	Subhedral.	Vuggy, pitted grains with inclusions of magnetite and unidentified silicates (most likely quartz) throughout the rock. Cleaner, coarser crystals in late pyrite-silica veins.

COMMENTS AND SKETCH: Vuggy magnetite breakdown to leucoxene and pyrite
See photomicrograph 1188A_104

TS: 28 DOES NOT EXIST

TS: 55 193-1188A-9R2-79-81#6 **UNIT: 8** **OBSERVERS: SR**

ROCK NAME: **Altered aphyric volcanic rock.**
TEXTURE: **Perlitic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Altered Glass	80					With microlites and perlitic texture.
Magnetite	1					Finely distributed within the glass.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Cristobalite	8		<0.01			Often found at vein margins.
Anhydrite	10			0.1	Subhedral/Anhedral.	Within crosss cutting veins and perlitic fractures.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	1			0.05	Euhedral, subhedral.	Predominantly within anhydrite veins in proximity to vein margins.

COMMENTS AND SKETCH: Tan coloured variably altered volcanic glass. Microlites within glass and perlitic texture. Cross cutting anhdrite with pyrite and silica veins.

TS: 56 193-1188F-1Z1-36-38#2			**UNIT: 27**			**OBSERVERS:** **AP/SR** **DAV**
ROCK NAME:	**Completely altered volcanic rock.**					
TEXTURE:	**Bands of variable silicification.**					

PRIMARY	**PERCENT**	**SIZE (mm)**				
MINERALOGY		**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	39	0.02	0.3			Clusters of macro quartz, former vesicle infill? Micro and macro quartz in groundmass with clay and anhydrite.
Clay	43		<0.02			
Anhydrite	17	<0.02	0.1			Finely dissseminated anhydrite within the groundmass, and also within veins.
Magnetite	Trace		< 0.005			Fine inclusions within pyrite.

SULFIDE		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1	0.02	0.2		Euhedral/anhedral	Grains distributed throughout the groundmass and in anhydrite veins on two edges of the thin section.

COMMENTS AND SKETCH: This section shows the nature of the banding in one of the complex halos adjacent to a pyrite-anhydrite veins. Banding appears to be related to modal amount of clay within the sample. See photomicrographs 1188F_10 and 1188F_66

TS: 57 193-1188F-1Z1-92-95#5b	**UNIT: 27**	**OBSERVERS:** **SR/TB** **AP/SDS**
ROCK NAME:	**Completely altered volcanic rock.**	**CY**
TEXTURE:	**Bands of variable alteration.**	**DAV**

PRIMARY MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	46	0.02	0.3			Micro and macro quartz in groundmass with clay and anhydrite. Granular ovoid quartz aggregates up to ~1mm in length are vesicle fill. One euhedral phenocryst appears to have been replaced by a mosaic of quartz.
Clay	47		<0.02			
Anhydrite	7	<0.02	0.1			In groundmass, veins and as late vesicle fill.
Magnetite	Trace					Fine inclusions within pyrite
Leucoxene	Trace		0.1			In groundmass.

SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1	0.025	0.8		Euhedral/anhedral	Grains distributed throughout the groundmass.

COMMENTS AND SKETCH: The banding in this section forms a complex halo near a pyrite-anhydrite vein. Highly altered rock - little to no evidence of relict precursor minerals. 0.1 mm anhydrite vein with 0.1-0.2 mm halo of fine-grained quartz. Few grains of pyrite in the vein. Banding on mm-scale due to different proportions of anhydrite, quartz and clay minerals. Mostly due to presence/absence of the dark brown (in TS) clay which is white in HS. Ovoid dark clay patches are amygdales. Quartz filled vesicles with anhydrite in the center.

TS: 58 193-1188F-1Z2-8-10 #1			UNIT: 27			OBSERVERS: SR/TB AP HP
ROCK NAME:	**Very fine grained quartz-anhydrite clasts within a quartz-anhydrite-mica matrix?**					**DAV**
TEXTURE:	**Breccia.**					**CY**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	45	<0.02			Anhedral.	Micro-quartz within matrix of clasts and within matrix to clasts.
Anhydrite	10		0.4		Subhedral.	Interlocking crystals up to 0.4 mm within fractures.
Brown Clay	30	<0.02			Anhedral.	Brown masses within the section - clasts and matrix.
Illite	15	<0.02			Acicular/fibrous.	Fibers after feldspar showing anomalous interference colors. Fine acicular coatings on vesicle walls.
Magnetite	Trace		0.04		Anhedral.	As inclusions within the pyrite grains.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace		0.2		Subhedral	Predominantly within matrix to clasts.

COMMENTS AND SKETCH: Suggestion of relict microlitic (feldspar) laths within the fine grained clasts. Matrix consists of anhydrite, pyrite, quartz and spherules of illite in a groundmass of brown clay minerals. Both the clasts and and matrix are intersected by a thin, irregular vein of anhydrite. Matrix consists of altered, isolated or coalesced microspherulites hosted by brown clay forming wispy, irregular domains. Margins of clasts are locally outlined by pyrite. Domainal - Volcaniclastic?: ~1cm rounded microcrystalline siliceous domains (clasts?) have sharp boundaries, contain very rare possible pseudomorphed microlites and are composed of quartz, illite, relatively little brown clay and almost no pyrite. They contrast sharply with the remainder (matrix?) of the rock which is porous, contains 2-3% plagioclase pseudomorphed by clay and is dominantly composed of brown clay and illite, with very little quartz.

See Chapter 3, Figure F60

TS: 59 193-1188F-1Z2-22-25 #2 **UNIT: 27** **OBSERVERS:** SR/TB, AP, DAV

ROCK NAME: **Completely altered volcanic rock.**
TEXTURE:

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	50		0.1		Anhedral.	Micro quartz with anhydrite and clay.
Anhydrite	10		0.05		Anhedral.	Finely disseminated within the groundmass.
Illite?	39		<0.01		Anhedral.	
Magnetite	Trace		0.025		Anhedral.	As inclusions within pyrite grains.
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1		0.3		Subhedral	With anhydrite filling veins. With magnetite inclusions.

COMMENTS AND SKETCH: 0.1-0.5 mm anhydrite-pyrite veins with halos of very fine grained illite(?) and minor quartz.

TS: 60 193-1188F-1Z3-35-38 #2 **UNIT: 27** **OBSERVERS:** WB, AP, SDS, DAV

ROCK NAME: Completely altered bleached and silicified volcanic rock.
TEXTURE: Massive.

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50		0.1		Anhedral.	Micro quartz with anhydrite and clay. Contains fluid inclusions (liquid + vapor, about 10% vapor).
Anhydrite	12		0.1		Anhedral in groundmass, subhedral in voids and vein.	Finely disseminated within the groundmass. Filling void space, In an anhydrite, pyrite vein.
Illite?	30		<0.01		Anhedral, fibrous.	Replacing groundmass and filling vugs.
Pyrophyllite?	5		<0.01			Replacing groundmass.
Chlorite	2		<0.01		Anhedral.	Replacing goundmass. Minor phase, but blue anomalous birefringence is obvious in places.
Magnetite	Trace		0.025		Anhedral.	As inclusions within pyrite grains.
Hematite	Trace		0.02		Subhedral.	One crystal seen in groundmass.
Leucoxene	Trace		0.1		Anhedral.	

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.3		Subhedral.	Disseminated and in anhydrite, pyrite veins. In vugs with white mica.

COMMENTS AND SKETCH: Vugs might have been vesicles. Photomicrograph shows vug filled with anhydrite, quartz (containing fluid inclusions), white mica, and pyrite. Where kaolinite(?) is more abundant, the rock has a whitish, bleached appearance. A pyrophyllite(?) rich vug is developed in the lowermost part of the thin section.
See photomicrograph 1188F_05

TS: 61 193-1188F-1Z3-86-89 #3			**UNIT: 28**			**OBSERVERS:** **AP/SDS** **WB/SR** **DAV**
ROCK NAME:	**Completely altered silicified, and green clay-bearing volcanic rock.**					
TEXTURE:	**Massive, amygdaloidal.**					

PRIMARY	**PERCENT**	**SIZE (mm)**				
MINERALOGY		**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
None						
GROUNDMASS						
None						
ALTERATION		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	60		0.2		Anhedral.	Replacing groundmass, filling vugs, and in a quartz veinlet. Recrystallized quartz aggregates with fluid inclusions along grain boundaries
Illite?	34		<0.01		Anhedral.	Replacing groundmass and plagioclase microlites.
Pyrophyllite?	3		<0.01			Replacing groundmass in whitish alteration halo.
Anhydrite	2		0.2		Subhedral.	Filling voids and vugs.
Magnetite	Trace		0.025		Anhedral.	As inclusions within pyrite grains. Occasionally there are some magnetite crystals in the groundmass.
SULFIDE		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1		0.3		Subhedral.	Pyrite occurs almost always in association with crystal quartz aggregates. It seems to be an equilibrium assemblage, however pyrite may be later than the quartz.
Pyrrhotite (?)	Trace		0.006		Anhedral.	Inclusion in the pyrite.

COMMENTS AND SKETCH: Relict flow texture is manifested in illite(?) pseudomorphing plagioclase microlites and in subparallel elongate aggregates of quartz and pyrite replacing plagioclase crystals or filling stretched vesicles. Quartz veinlet with minor pyrite. Abundant (20%) quartz +/- pyrite filled vesicles (amygdales) mainly 0.2 to 0.4 mm diameter.

See Chapter 3, Figures F81 and F29

TS: 62 193-1188F-1Z4-55-57 #1	**UNIT: 28**	**OBSERVERS:** **WB** **SDS/AP**
ROCK NAME:	**Completely altered, silicified green-clay bearing volcanic rock.**	**HP/SR**
TEXTURE:	**Massive, amygdaloidal.**	**DAV**

PRIMARY MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
Altered plagioclase	Trace.			0.5	Anhedral	Completely altered, replaced by quartz and clay.
GROUNDMASS						
None						

ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	45		0.1		Anhedral.	Replacing groundmass. Filling vugs.
Anhydrite	12		0.1		Anhedral in groundmass subhedral in voids and vein.	Finely disseminated within the groundmass. Filling void space, In an anhydrite pyrite vein.
Illite?	39		<0.01		Anhedral, fibrous.	Replacing groundmass and filling vugs.
Pyrophyllite?	3		<0.01		Anhedral.	In vein halo. In patches in groundmass and occasional as vug fill (or possibly pseudomorphing plagioclase) with anhydrite.
Magnetite	Trace		0.025		Anhedral.	Inclusions within pyrite grains.
Leucoxene	Trace		0.1		Anhedral.	In groundmass.

SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1		0.3		Subhedral.	Disseminated. In anhydrite, pyrite veins and within vugs with quartz .

COMMENTS AND SKETCH: Vugs (vesicles?) mainly filled with mosaic quartz (=> amygdales) are abundant (20%). Anhydrite-pyrite vein with phyllosilicate-rich (kaolinite) halos (photo). Flow texture of rock is partly preserved by oriented illite? that possibly replaces plagioclase microlites. Rarely, aggregates of illite? and quartz resemble the shape of plagioclase phenocrysts.

See photomicrographs 1188F_07 and 1188F_13

TS: 63 193-1188F-2Z1-44-47#2C **UNIT: 29** **OBSERVERS: AP/SDS WB HP DAV/CY**

ROCK NAME: **Completely altered aphyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Altered Plagioclase.	Trace.			1	Anhedral.	One phenocryst pseudomorphed by clay and quartz.
GROUNDMASS						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	54		0.1		Anhedral.	Replacing groundmass. Filling voids.
Anhydrite	10		0.1		Anhedral to subhedral.	In veins with pyrite, filling voids with quartz and pyrite, replacing rock in halo.
Illite?	23		<0.01			Replacing groundmass away from halo.
Pyrophyllite?	12		<0.01			Replacing groundmass in alteration halo.
Magnetite	Trace		<0.01		Anhedral.	Rare inclusions in pyrite.
Leucoxene	Trace		0.1		Anhedral.	In groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.2		Subhedral to anhedral.	Intergrown with quartz and filling small veins.

COMMENTS AND SKETCH: Anhydrite and pyrite veins running parallel and cutting through a very fine-grained zoned alteration halo. Varying amounts of quartz, anhydrite, and clay/illite produce irregular banding in halo. Anhydrite and quartz rich portions are commonly coarser grained than clay/illite and quartz rich parts. Groundmass of rock is replaced by clay/illite and less abundant micro quartz, with quartz, pyrite, and minor anhydrite filling vugs (could be vesicles). Overall, quartz, kaolinite, and anhydrite contents in the halo are higher than in the rock away from the halo, and the pyrite content of the halo is much lower than the pyrite content of the host rock. Contains quartz +/- pyrite amygdales (<0.3 mm diameter) in groundmass domain distal to alteration halo. Rare altered plagioclase phenocrysts and microcrysts are pseudomorphed by clay and quartz.

TS: 64 193-1188F-2Z1-105-107 #2H **UNIT: 29**

OBSERVERS:
WB
SDS
HP
DAV
WB/CY

ROCK NAME: **Completely altered aphyric volcanic rock.**
TEXTURE: **Massive, amygdaloidal.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Altered plagioclase.	Trace			0.8	Anhedral.	Pseudomorphed by clay and microcrstalline quartz.
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50		0.6		Anhedral.	Micro quartz with anhydrite and clay. Coarser-grained quartz in vugs with anhydrite and pyrite. Replacing plagioclase?
Anhydrite	12		0.1		Anhedral in groundmass, subhedral in voids and vein.	Finely disseminated within the groundmass. Abundant in patches in groundmass. Filling void space in an anhydrite, pyrite vein.
Illite?	28		<0.01		Anhedral.	Replacing groundmass and filling vugs.
Pyrophyllite?	8		<0.01		Anhedral.	Replacing groundmass.
Magnetite	Trace		0.025		Anhedral.	As inclusions within pyrite grains.
Leucoxene	Trace		0.05		Anhedral.	In groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	2		0.3		Subhedral.	Disseminated. In anhydrite, pyrite veins. In vugs with quartz and anhydrite.

COMMENTS AND SKETCH: Vugs (might have been vesicles) are mainly filled with course grained quartz and anhydrite. Anhydrite pyrite vein. One example of a 0.8 mm long quartz crystal that possibly replaces a plagioclase phenocryst (photo). Amygdales are defined by polycrystalline aggregates of quatz +/- pyrite, generally 0.2 to 0.4 mm in diameter, 5 vol.% of section. Plagioclase phenocryst is partically replaced by quartz and clay.
See photomicrographs 1188F_08 and 1188F_14

TS: 65 193-1188F-2Z1-133-135 #3B **UNIT: 29**

OBSERVERS:
WB
SDS/AP
DAV
RAB
CY

ROCK NAME: **Completely altered bleached and silicified volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Altered plagioclase.				2	Anhedral.	Intensively corroded and relaced by clay and microcrystalline quartz.
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50		0.1		Anhedral	Micro quartz with anhydrite and clay. Coarser-grained quartz in vugs with anhydrite and pyrite.
Anhydrite	12		0.1		Anhedral in groundmass, subhedral in voids and vein.	Finely disseminated within the groundmass, particularly in vein halos. Filling void space. In anhydrite, pyrite veins.
Illite?	32		<0.01		Anhedral.	Replacing groundmass and filling vugs.
Pyrophyllite?	5		<0.01		Anhedral.	Replacing groundmass in vein halos.
Magnetite	Trace		0.025		Anhedral	Rare inclusions within pyrite grains.
Leucoxene	Trace				Anhedral.	In groundmass.
Barite	Trace					Possibly replacing plagioclase phenocryst.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.3		Subhedral.	Disseminated, In anhydrite pyrite veins. In vugs with quartz and anhydrite.

COMMENTS AND SKETCH: Several anhydrite pyrite veins crosscutting each other. Extremely fine grained matrix of presumably phyllosilicates and quartz. Coarser-grained quartz, sometimes accompanied by pyrite and/or anhydrite, is developed in patches in the groundmass (some of these appear to be vesicle fill). Quartz and anhydrite abundance is noticably higher in halos (becomes obvious in reflected light). Kaolinite? is restricted to vein halos.

See photomicrograph 1188F_09 and 1188F_15

TS: 66 193-1188F-3Z2-118-124 #2C **UNIT: 30**

OBSERVERS:
WB
HP
DAV
SDS
CY

ROCK NAME: **Completely altered, brecciated volcanic rock.**
TEXTURE: **Veined.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	65		0.1		Anhedral.	Micro quartz with anhydrite and clay. Coarser grained quartz filling vugs (vesicles?).
Anhydrite	5		0.1		Anhedral in groundmass, subhedral in voids and vein.	Finely disseminated within the groundmass particularly in upper part of section.
Illite?	19		<0.01		Anhedral.	Replacing groundmass and filling vugs.
Pyrophyllite?	10		<0.01		Anhedral.	Replacing groundmass.
Magnetite	Trace		0.025		Anhedral	As inclusions within pyrite grains.
Hematite?	Trace				Anhedral.	One example of hematite rimming magnetite included in pyrite.
Leucoxene	Trace		0.1		Anhedral.	In groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.3		Subhedral.	Disseminated.
Pyrrhotite	Trace		0.006		Anhedral.	Inclusions in pyrite. Both magnetite and pyrrhotite inclusions in some pyrite.

COMMENTS AND SKETCH: Several crosscutting veins. Vein fill was not preserved during preparation of the slide, but there is some anhydrite and pyrite suggesting they may have been anhydrite pyrite veins. Veins have narrow light gray halos, apparently rich in phyllosilicates. Dark gray 3-5 mm wide silicified halos are also developed along the veins and grade into more phyllosilicate rich domains away from the veins. Rock in upper part of section appears slightly brecciated and is rich in anhydrite, both in the "clasts" as well as in the "cement" Brown clay is abundant in bleached patch and along veins. Round to lensoidal microcrystalline quartz aggregates are amygdales (generally around 0.2 mm in diameter), however there are abundant rectangular quartz aggregates which probably represent pseudomorphs of plagioclase microcrysts.

TS: 67 193-1188F-6Z1-45-47 #2			UNIT: 31			OBSERVERS: WB HP CY DAV SDS
ROCK NAME:	Highly altered aphyric volcanic rock.					
TEXTURE:	Spherulitic.					
PRIMARY	PERCENT	SIZE (mm)				
MINERALOGY		min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
Plagioclase	20		0.2		Laths.	Present as microlites and as radiating aggregates centered on microlitic glass.
Altered volcanic glass	30					Groundmass of microlitic domains, partially devitrified to cristobalite.
ALTERATION		SIZE (mm)				
MINERALOGY	PERCENT	min.	max.	av.	MORPHOLOGY	COMMENTS
Cristobalite	31		0.5		Variable.	Partly replacing spherules. Coarse (0.1-1mm), prismatic radiating crystal aggregates in between spherules (microlitic domains). Fine mosaic textured aggregates of interlocking 10-15 µm crystals between microlitic domains.
Quartz	8					Subhedral aggregates. Late stage space fill (?) However, some preserve vestiges of microlites, indicating a replacement origin.
Anhydrite	Trace		0.1		Subhedral.	Few large crystals with quartz filling void space in between spherules.
Clay/chlorite	5		<0.01		Anhedral.	Replacing formerly glassy parts of microlitic domains in unusual concentric rings.
Brown clay	5		0.025		Anhedral.	Surrounding spherulites.
Magnetite	Trace		0.02		Anhedral.	Rare inclusions in pyrite.
SULFIDE		SIZE (mm)				
MINERALOGY	PERCENT	min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.25		Subhedral.	Disseminated throughout rock, but less abundant within spherulitc domains. Largest crystals are hosted in mosaic-textured cristobalite domains.
Chalcopyrite	Trace		0.15		Subhedral.	In mosaic-textured cristobalite domains. Discrete grains and replaces pyrite.

COMMENTS AND SKETCH: Intensely altered, brown, isolated and coalesced spherulites (generally 0.1 to 1 mm in diameter, 50%). Brown clay rims spherulite margins and forms concentric rings in some spherulites. Internal organization: very fine grained interlocking randomly oriented <0.05 mm to 0.1 mm low birefingence lath shaped minerals (feldspar). Rarely, radiating crystal aggregates are preserved in the center (photo). Groundmass between spherulites is silica-rich and locally radiating aggregates are attached to spherulites. Certainly not a classical spherulitic texture, but on balance probably an igneous spherulitic-type texture. There is some radiating texture: some of the spheres have a central point with radiating acicular crystals, surrounded by a mantle of microlite-in-glass, which is in turn surrounded by the radiating coarser cristobalite.

See Chapter 3, Figure F31A, B, C, and D; see photomicrographs 1188F_17, 1188F_25, 1188F_27, 1188F_28 and 1188F_43

TS: 68 193-1188F-6Z1-76-79 #3C **UNIT: 32** **OBSERVERS: WB/SR SDS CY**

ROCK NAME: **Completely altered aphyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	60		0.1		Anhedral.	Replacing groundmass, filling vugs and veins. Preserving relatively large, >0.01 mm, liquid + vapor fluid inclusions.
Anhydrite	15		0.3		Anhedral to subhedral.	Replacing groundmass and plagioclase, filling vugs and veins.
Illite?	15		<0.01		Anhedral.	Replacing groundmass and plagioclase.
Pyrophyllite?	10		<0.01		Anhedral.	Replacing groundmass.
Leucoxene	Trace		0.15		Four and six sided.	Replacing Ti-magnetite.
Magnetite	Trace		0.05		Anhedral.	Inclusions in pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace		0.1		Subhedral to euhedral.	In veins with anhyrite and quartz. Diseeminated in groundmass.

COMMENTS: Veins are dominantly anhydrite-pyrite and may contain some quartz. Vuggy coarse grained quartz and anhydrite may be vesicle fill. High anhydrite content. Anhydrite fills void space and replaces groundmass and plagioclase. Banded halos reflect rather subtle variations in grain size and relative proportions of illite, quartz, and anhydrite.

TS: 69 193-1188F-7Z1-41-44 #1C **UNIT: 33** **OBSERVERS:**
DAV
SDS
ROCK NAME: **Completely altered aphyric volcanic rock.** **WB**
TEXTURE: **Massive.** **CY**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None.						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	60	0.02	0.3		Anhedral.	Replacing groundmass, filling vugs.
Anhydrite	1	0.02	0.2		Anhedral.	Replacing groundmass, in veins with pyrite.
Illite?	28		0.01		Anhedral.	Replacing groundmass and plagioclase.
Pyrophyllite?	10		0.1			In groundmass.
Leucoxene	Trace		0.1			In groundmass.
Magnetite	Trace		0.01		Anhedral.	Inclusions in pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1	0.04	0.2		Anhedral.	In veinlets and disseminated in groundmass.
Pyrrhotite	Trace		0.01		Anhedral.	Inclusions in pyrite.

COMMENTS: Cut by a thin (0.1 mm) pyrite-anhydrite veinlet. Brown clay (pyrophyllite?) along veins. Poor polish makes estimation of modes difficult.

TS: 70 193-1188F-7Z1-104-107#2A **UNIT 35**

OBSERVERS:
CY
DAV/SR
SDS

ROCK NAME: **Completely altered aphyric volcanic rock.**

TEXTURE: **Porphyritic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace.	0.6	4.5	2	Euhedral lath shapes.	Remnant skeletal prisms, completely replaced by clays +/- silica (see images below). One blocky lath is completely replaced by sericite/illite. Another one nearby is replaced by quartz. A 3-mm lath is replaced by illite (around the edge and along transverse septae, maybe along cleavage cracks) and silica (in the windows between the illite septae).
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**SIZE (mm) max.**	**SIZE (mm) av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	60	0.02	0.3		Granular crystalline aggregates and microcrystalline groundmass.	Two morphologies - very fine grained microcrystalline quartz is intergrown with white mica/clay in the groundmass and pseudomorphing skeletal plagioclase. Coarser macro crystalline quartz occurs as ovoid aggregates (mostly with pyrite +/-anhydrite) which are probably filled vesicles.
Muscovite/Sericite/Illite	15		0.01		Felted-acicular.	High birefringence, colorless mica/clay. Extremely fine felted aggregates occur in intergrowths with quartz or dark brown clay pseudomorphing plagioclase phenocrysts. Fine (40-100 µm) prismatic crystals occur in the groundmass (??after microlitic plagioclase)
Dark brown clay	15				Felted-amorphous.	Intergrown with fine felted aggregates of white mica/clay, pseudomorphing plagioclase. Occurs as dirty groundmass.
Anhydrite	7	0.02	0.2		Subhedral.	Medium-coarse grained, mostly vesicle fill.
Magnetite	Trace.		0.01		Anhedral.	Inclusions in pyrite.
Leucoxene	Trace.		0.15		Six sided .	In groundmass.
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**SIZE (mm) max.**	**SIZE (mm) av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	3				Subhedral to anhedral.	Mostly intergrown with quartz and anhydrite in vesicles.
Pyrrhotite	Trace.		0.01		Anhedral.	Inclusions in pyrite. Instances of both magnetite and pyrrhotite inclusiomns in the same pyrite.

COMMENTS AND SKETCH: See photomicrographs 1188F_01, 1188F_02, 1188F_03 and 1188F_04

TS: 71 193-1188F-8Z1-68-71 #1F **UNIT: 36** **OBSERVERS:**
WB
ROCK NAME: **Completely altered silicified volcanic rock.** **AP/SR**
TEXTURE: **Massive.** **CY**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	55		0.3		Anhedral.	Replacing groundmass, filling vugs, in veins.
Anhydrite	8		0.35		Anhedral to subhedral.	Replacing groundmass and plagioclase, filling vugs, in veins.
Illite?	25		<0.01		Anhedral.	Replacing groundmass and plagioclase.
Kaolinite?	10		0.04			Replacing groundmass.
Leucoxene	Trace.		0.04		Irregular shapes.	Replacing Ti-magnetite
Magnetite	Trace.		0.01		Irregular shapes.	Rare inclusions in pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	2		0.4		Subhedral to euhedral.	In veins with anhydrite and quartz. Disseminated in groundmass.

COMMENTS: Plagioclase phenocrysts are completely replaced by illite, anhydrite, quartz, and pyrite. Vuggy coarse-grained quartz and anhydrite may be vesicle fill. Anhydrite-pyrite vein with noticable amounts of quartz. Brown clay (kaolinite?) is abundant in whitish bands of the section (associated with vein halos).

TS: 72 193-1188F-9Z1-9-12 #1B **UNIT: 37**

OBSERVERS:
WB
AP
DAV
CY

ROCK NAME: **Completely altered sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Relict plagioclase	1		2		Euhedral.	Replaced by quartz (+/-anhydrite, pyrite, white mica).
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	50		0.3		Anhedral.	Replacing groundmass, filling vesicles, replacing plagioclase phenocrysts.
Anhydrite	Trace.		0.15		Anhedral to subhedral.	Filling vugs.
Phyllosilicates	45		<0.01		Anhedral.	Replacing groundmass and plagioclase.
Leucoxene	1		0.03		Irregular shapes.	Replacing Ti-magnetite in groundmass, rimming larger magnetite crystals.
Magnetite	Trace.		0.1			Rare inclusions in pyrite. Euhedral crystals in groundmass, often surrounded by leucoxene. Inclusions in quartz.
Hematite	Trace.		0.1		Anhedral.	In the groundmass and as inclusions in the pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.45		Subhedral to euhedral.	In veins with anhydrite and quartz. Diseeminated in groundmass.
Pyrrhotite	Trace.		0.1		Anhedral.	As inclusions in the pyrite.

COMMENTS: Patchy variation of grain size and quartz-phyllosilicate proportions throughout the slide. It appears that some of this patchy variation is related to vein halos, while some domains seem to reveal a remnant flow banding(?) manifested in alternating siliceous and clay-rich bands. Large (up to 2 mm) quartz+/-anhydrite aggregates with angular outlines are likely to represent pseudomorphed plagioclase phenocrysts. Upper part of section looks like it was very vesicular with vesicles now being filled mainly with quartz. The texture of this TS is reminiscent of TS #58, which is volcaniclastic. The groundmass is near-identical and rare microcrystalline quartz-illite clasts are also present.

See Chapter 3, Figure F84

TS: 73 193-1188F-11G1-53-56 #5 **UNIT: 38** **OBSERVERS:**
DAV
WB
ROCK NAME: **Completely altered aphyric volcanic rock.** **AP/SR**
TEXTURE: **Massive.** **CY**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None.						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	45	0.1	0.2		Anhedral.	Replacing groundmass.
Anhydrite	3	0.02	0.5		Anhedral.	Replacing groundmass, in veinlets, and coarse crystals with 2-phase fluid inclusions in vugs.
Illite?	37		0.01		Anhedral.	Replacing groundmass.
Pyrophyllite?	15		0.01		Anhedral.	Replacing groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace.	0.04	0.5		Anhedral.	Coarser pyrite in vugs, finer in rock groundmass. Nearly absent from halo portion.
Pyrrhotite	Trace.		0.015		Anhedral.	Inclusions within pyrite.

COMMENTS: This thin section was cut to investigate a zoned rock that has a light gray core (with pyrite-rich blebs) surrounded by a very-fine-grained tan-white mantle that contained little white blebs and tiny hairline veinlets. The white blebs are brown grungy clay concentrations in thin section. The veinlets are anhydrite with grungy clay halos. The rock core is typical silica-illite fine-grained rock with vugs filled by pyrite-anhydrite-quartz. The mantle (or halo) contains considerably more brown grungy clay, and is nearly devoid of pyrite.

TS: 74 193-1188F-11G1-108-111#9 **UNIT 39** **OBSERVERS:**
CY
AP/SR

ROCK NAME: **Completely altered, sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **DAV**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1-2					Remnant skeletal prisms, completely replaced by clays +/- silica.
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	64				Granular; microcrystalline.	Granular crystalline aggregates as vesicle fill. Fine microcrystalline quartz in the groundmass. Greatest amount of macro quartz so far obseved in thin section.
Muscovite/sericite/illite	18				Fibrous.	Fibrous aggregates pseudomorphing plagioclase, fine intergrowth with quartz in the groundmass.
Brown clay	10				Amorphorous.	Throughout the fine groundmass, but most abundant in halos around anhydrite veins and around the large 1cm quartz-pyrite amygdale in the section
Anhydrite	5				Bladed to equant.	In veins and more rarely as vesicle fill, with quartz and/or pyrite.
Hematite	Trace.				Stubby rounded crystals.	Fine inclusions in quartz in large amygdale (see image links below).
Magnetite	Trace.				Subhedral equant.	Fine inclusions in pyrite (see image link below).
Chlorite	Trace.				Fine-grained matted.	Occurs interstitial to pyrite-anhydrite associations within the quartz-rich patch.
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	3			0.02	Subhedral to rounded, equant.	Bimodal size distribution: Coarser (0.1-0.6 mm) grains are mostly in veins and amygdale fill. Finer (5-50 µm) crystals are scattered throughout the groundmass of the rock. Larger grains intergrown with macro quartz.
Pyrrhotite	Trace.				Subhedral equant.	Fine inclusions in pyrite (see image link below)

COMMENTS AND SKETCH: The large ovoid quartz-pyrite patch noted in hand specimen appears to be a large amygdule,as suspected. It consists primarily of granular crystalline quartz intergrown with relatively coarsegrained pyrite. Minor phases located interstitially include anhydrite and chlorite.
See Chapter 3, Figure F82; see photomicrographs 1188F_20, 1188F_21, and 1188F_22

TS: 75 193-1188F-11G1-138-141 #12 **UNIT: 39** **OBSERVERS:**
WB
SDS
ROCK NAME: **Completely altered volcanic rock.** **DAV**
TEXTURE: **Massive.** **CY**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Relict plagioclase	Trace		0.6		Euhedral.	Commonly replaced by illite and silica but trace of apparently fresh plagioclase can also be found.
GROUNDMASS						
Plagioclase					Laths.	Trachytic texture. Commonly replaced by illite.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	54		0.3		Anhedral.	Replacing groundmass, filling vesicles.
Anhydrite	2		0.3		Anhedral to subhedral.	Filling vesicles with pyrite and quartz.
Illite?	25		<0.01		Anhedral.	Replacing groundmass and plagioclase.
Pyrophyllite?	16		<0.01		Anhedral.	Replacing plagioclase.
Leucoxene	Trace.		0.4		Irregular shapes.	In groundmass.
Magnetite	Trace.		0.1			Inclusions in pyrite often towards the center of the grains.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3		0.45		Subhedral to euhedral.	In veins with anhydrite and quartz. Disseminated in groundmass.

COMMENTS: Plagioclase pheneocrysts are commonly replaced by illite and silica.Fresh plagioclase is present in trace amounts. Plagioclase microlites are replace by illite (colorless phyllosilicate) and a brown clay (probably pyrophyllite) with significant internal reflections (see photomicrographs). Kaolinite(?) is enriched in patches -> whitish, soft parts of the core are probablyrich in kaolinite.
See Chapter 3, Figure F57A and B; see photomicrographs 1188F_33 and 1188F_34

TS: 76 193-1188F-13Z1-30-36 #2a **UNIT: 39**

OBSERVERS:
DAV
WB
AP/SDS
CY

ROCK NAME: **Very highly altered sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1	0.5	2	1	Euhedral to subhedral laths.	Some are fresh, others are completely replaced by clay, or quartz, or anhydrite (but not by mixtures of these).
GROUNDMASS						
Plagioclase	6		0.1		Acicular.	Groundmass is generally completely replaced, but in areas there are relict plagioclase microlites.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	40		0.5		Anhedral.	Replacing groundmass and plagioclase, filling 1-mm vesicles.
Anhydrite	1		0.5		Anhedral.	Replacing plagioclase, filling vesicles.
Illite?	40				Anhedral.	Replacing groundmass and plagioclase microlites.
Kaolinite?	10				Anhedral.	Replacing groundmass and plagioclase microlites.
Leucoxene	Trace.		0.2			Surrounding by pyrite. Large crystal remaining the Ti-magnetite crystal shape.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	2					Associated with quartz. With some inclusions of pyrrhotite.
Pyrrhotite	Trace.				Anhedral	Small inclusions in the pyrite crystals.
Chalcopyrite	Trace.		0.02		Anhedral	Rare inclusions in pyrite.

COMMENTS AND SKETCH: This thin section was cut from the end of a physical properties mini-core. It contains some fresh plagioclase phenocrysts as well as completely-alteredones. The replacement mineralogy is diverse (clay, quartz, and anhydrite).

TS: 77 193-1188F-13Z1-47-50 #3b **UNIT: 39**

OBSERVERS:
DAV
WB
SDS
AP
CY

ROCK NAME: **Completely altered autoclastic breccia.**
TEXTURE: **Clastic, layered.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace.		2	1		Pseudomorphed by illite + silica, by quartz in other cases.

GROUNDMASS

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50		0.5		Anhedral.	Replacing groundmass and plagioclase, filling 1-mm vesicles, cementing mm-scale silica-clay clasts.
Anhydrite	1		1		Anhedral.	Filling vesicles, with pyrite.
Illite	35				Anhedral.	Replacing groundmass and plagioclase.
Dark brown clay	13				Anhedral.	Replacing groundmass and plagioclase.
Magnetite	Trace.		0.05		Anhedral, corroded.	In groundmass, partly replaced by leucoxene. Magnetite with same morphology and size occurs as inclusions in pyrite.
Leucoxene	Trace.		0.05		Resembling magnetite.	Replacing Ti-magnetite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1	0.015	0.2			

COMMENTS AND SKETCH: This thin section was cut from a hand specimen that contained vesicular volcanic rock grading into a zone of layered "autoclastic" breccia. One end of the section contains the volcanic rock, which is completely replaced as others in this hole. Continuing through the section, there is a layer of silica-clay clasts (avg. 2-mm diameter, subangular) cemented by mosaic quartz. Then there are about three layers that look volcanic, with flow textures and pseudomorphed phenocrysts replaced either by quartz, illite?, kaolinite?, or combinations of these. There is also a fragment that looks like altered glass. Finally, there is another clastic unit with mm-scale quartz-rich clasts in a silica-clay matrix. Partial replacement of Ti-magnetite by leucoxene (photomicrograph). Magnetite inclusions in pyrite of same size and morphology as magnetite in quartz of the groundmass.

See Chapter 3, Figure F91; see photomicrograph 1188F_41

TS: 78 193-1188F-13Z1-47-50 #3b **UNIT: 41** **OBSERVERS:** DAV, WB, SDS, CY

ROCK NAME: Completely altered sparsely plagioclase-phyric volcanic rock.
TEXTURE: Massive.

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1		4	1		Pseudomorphed by illite + quartz. Rare examples are incompletely replaced.
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	52				Anhedral.	Replacing groundmass and plagioclase, filling 1-mm vesicles, cementing mm-scale silica-clay clasts.
Anhydrite	1		1		Anhedral.	Vein filling, with pyrite, and trace of small crystals in the groundmass.
Illite	38				Anhedral.	Replacing groundmass and plagioclase.
Dark brown clay	8				Anhedral.	Replacing groundmass, particularly microlites that define a flow texture.
Magnetite	Trace.		0.004		Anhedral.	Inclusions in pyrite.
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1		0.1		Subhedral to euhedral	In veins with anhydrite and lesser quartz, filling vugs with quartz and anhyrite, and disseminated in groundmass.
Pyrrhotite	Trace.		0.01		Anhedral.	Rare inclusion in pyrite.

COMMENTS: Section contains an amygdule? A 0.3 mm wide anhydrite-quartz-pyrite vein with a brown clay halo runs NNW-SSE across the section and is cut bya similar vein 0.05 mm wide which runs EW.

TS: 79 193-1188F-14Z1-62-64 #3 **UNIT: 41**

OBSERVERS:
DAV
WB
AP
CY

ROCK NAME: **Highly altered sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2		2	1	Euhedral to subhedral laths.	Fresh plagioclase crystals. An64 by the Michel-Levy method (9 determinations).
GROUNDMASS						
Plagioclase	10			0.3	Skeletal laths.	Aligned crystals appear slightly corroded, commonly with altered cores.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	45	0.1	1	0.25	Anhedral.	Replaces groundmass. In coarse mosaic, quartz pseudomorphs 2-4 mm elongate rectangular objects (original mineral unknown).
Anhydrite	Trace.		0.5		Anhedral.	Small anhedral crystals intergrown with quartz in the groundmass.
Illite	32				Anhedral.	Replacing groundmass.
Dark brown clay	10				Anhedral.	Replaces groundmass, including microlites in more altered areas, and cores of plagioclase microlites in less altered areas.
Magnetite	Trace.		0.04			Relict magnetite in groundmass.
Leucoxene	Trace.		0.08			Replacing magnetite.
Hematite	Trace.		0.005		Anhedral	Small inclusions in the pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1	0.01	0.9		Subhedral.	Disseminated. Inclusion of magnetite, quartz and another mineral that may be chalcocite.

COMMENTS AND SKETCH: This thin section is from the end of a 1″-round Physical Properties mini-core. Abundant fresh plagioclase (An64), both phenocrysts and groundmass (in many areas). Partial replacement of magnetite by leucoxene (photomicrograph). Inclusion of magnetite, quartz and hematite in pyrite.

See photomicrographs 1188F_42 and 1188F_63

TS: 80 193-1188F-14Z1-102-105 #6 **UNIT: 41**

OBSERVERS:
DAV
AP
TB
CY

ROCK NAME: **Completely altered sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2	1	4		Euhedral laths.	Completely replaced by illite +/- minor anhydrite.
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	45	0.1	1	0.25	Anhedral.	Replaces groundmass. Forms coarse mosaic in patches.
Anhydrite	Trace (ignoring veins).	0.2	2	0.5	Anhedral.	Small anhedral crystals intergrown with quartz in the groundmass; coarser anhedral crystals with illite after plagioclase; with pyrite as vein filling material.
Illite	35				Anhedral.	Replacing plagioclase phenocrysts and groundmass.
Dark brown clay	15				Anhedral.	Replaces groundmass.
Magnetite	Trace					Small anhedral crystals as inclusions in pyrite and quartz
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	3	0.005	0.8		Anhedral to subhedral.	Filling veins in association with quartz and anhydrite. Dissemitation in groudmass.

COMMENTS AND SKETCH: Quartz patches are made of coarse quartz mosaic, with wavy extinction, numerous inclusions (including 2-phase L+V with 20% vapor or more), and associated pyrite.The vein running from the bottom of the section has no halo around it, while the one going across from lower right to upper left has a halo of brown clay. The former vein is crosscutting the halo of the latter, and also the alternating clay-silica bands in the lower part of the section, whichis actually the cyclic halo around one of the thick veins in the piece (see photos to the left). The 2 veins have identical mineralogy, suggesting that they are similar fluids. The “halo-less” vein seems to merge into the larger vein. The smaller vein does have a poorly defined fine siliceous halo (visible in XP light as a lower birefringence zone around it.

See Chapter 3, Figures F58 and F107; see photomicrographs 1188F_68, 1188F_69, and 1188F_70

TS: 81 193-1188F-15Z1-55-58 #8 **UNIT: 42** **OBSERVERS:**
DAV
ROCK NAME: **Completely altered aphyric volcanic rock.** **AP**
TEXTURE: **Massive.** **CY**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None.						
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	39		1	0.5	Anhedral.	Replaces groundmass. Forms coarser crystals in veins and mosaic in patches.
Anhydrite	Trace.				Anhedral.	One small anhedral crystal inside one of the quartz veins.
Illite	25				Anhedral.	Replacing groundmass.
Dark brown clay	35				Anhedral.	Replaces groundmass.
Magnetite	Trace.		0.005		Anhedral.	Rare inclusions in pyrite
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1	0.005	0.5		Subhedral	Together with quartz and clay minerals filling veins. Disseminated in the groudmass.
Pyrrhotite	Trace.		0.001		Anhedral	Very rare inclusions in pyrite.

COMMENTS AND SKETCH: This thin section was cut to study a specimen logged as having altered “perlitic” texture. Quartz veins- The coarse quartz crystals contain numerous arrays of fluid inclusions subparallel to the vein margin, strongly suggesting a crack-seal mechanism for development of the vein fill. Inclusion arrays can cross crystal boundaries.
See Chapter 3, Figure F111

TS: 82 193-1188F-15Z1-111-114 #12 **UNIT: 42** **OBSERVERS:** SR, DAV, AP, CY

ROCK NAME: **Completely altered aphyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	59	<0.025	0.1		Anhedral.	With clay as fine grained groundmass to the sample.
Anhydrite	8	<0.050	0.3		Anhedral/euhedral.	Within groundmass and as large crystals within void fill and veins.
Brown Clay	25		<.005		Anhedral.	Increased brown clay content in proximity to cross cutting anhydrite vein.
Illite	7					Finely intergrown with quartz in the groundmass.
Magnetite	Trace.		0.008		Anhedral.	As inclusion within pyrite. Often as disseminations within the cores of the pyrite crystals.
Hematite	Trace.		0.003		Anhedral.	Rare inclusions within pyrite in contact with magnetite crystals.
Leucoxene	Trace.					In groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.25			Pyrite within groundmass and strongly developed along the vein margin.
Chalcopyrite	Trace.		<0.005			As inclusion within pyrite grain.

COMMENTS AND SKETCH: Inclusion of magnetite and hematite in pyrite.
See photomicrograph 1188F_64

TS: 83 193-1188F-15Z1-142-144 #16 **UNIT: 43** **OBSERVERS:** SR, DAV, AP, CY

ROCK NAME: **Completely altered silicified volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Relict Feldspar	Trace.		1.5		Euhedral laths.	Completely replaced (by silica and illite) feldspar pseudomorphs irregularly distributed throughout the section.
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	59	<0.025	0.1		Anhedral.	With clay as fine grained groundmass to the sample and as vesicle fill linings with anhydrite and pyrite.
Anhydrite	10	<0.050	0.3		Anhedral/euhedral.	Mostly as larger crystals within vesicle linings. Relatively rare fine crystals in the groundmass.
Brown Clay	20		<.005		Anhedral.	Groundmass.
Illite	10				Anhedral.	Groundmass.
Magnetite	Trace.		0.008		Anhedral.	As inclusion within pyrite. Often as disseminations within the cores of the pyrite crystals.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.5			Pyrite disseminated within groundmass larger grains developed within vesicle fill.

COMMENTS AND SKETCH:

See Chapter 3, Figure F79; see photomicrograph 1188F_45

TS: 84 193-1188F-16Z1-41-43 #1c **UNIT: 44**

OBSERVERS:
SR
HP
DAV
AP
CY

ROCK NAME: **Completely altered aphyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Feldspar	Trace.	0.16	0.22		Euhedral.	One feldspar phenocryst, a rectangular cross-section measuring 220 x 160 micorns, is present in the section. It may be replaced by quartz.
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	59	<0.025	0.3		Anhedral.	With clay as fine grained groundmass to the sample and as aggregates of macro quartz.
Anhydrite	1	<0.050	0.3		Anhedral/euhedral.	Sparsley distributed throughout the slide
Brown Clay	22		<.005		Anhedral.	
Illite	15				Fine acicular intergrowths.	Possibly pseudomorphing microlitic plagioclase. Intergrown with microquartz.
Magnetite	Trace.		0.008		Anhedral.	As inclusion within pyrite. Often as disseminations within the cores of the pyrite crystals. Rare inclusions in macrocrystalline quartz.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3		0.25			Pyrite disseminated and crosscutting veins. Many pyrite veins contain abundant silicate inclusions.

COMMENTS AND SKETCH: (Flow) banding preserved by modal variations in clay and quartz contents - cross-cut by pyrite veins.The clastic texture of the rock, observed in hand specimen, is not evident in thin section.
See photomicrographs 1188F_50 and 1188F_51

TS: 85 193-1188F-16Z1-139-141 #3e **UNIT: 44** **OBSERVERS:** SR, DAV, SDS, CY

ROCK NAME: Completely altered aphyric volcanic rock.
TEXTURE: Massive.

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	48	<0.025	0.6		Anhedral.	With clay as fine grained groundmass to the sample and as aggregates of macro quartz.
Anhydrite	Trace.	<0.050	0.3		Anhedral/euhedral.	Sparsley distributed throughout the slide.
Clay-Brown (White in reflected light.)	17		<.005		Anhedral.	
Clay - Illite?	30		<.005		Anhedral.	As matrix to slide with quartz.
Magnetite	Trace.		0.008		Anhedral.	As inclusion within pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	5		0.25		Anhedral.	Pyrite disseminated and crosscutting veins. Many pyrite veins contain abundant silicate inclusions.
Pyrrhotite	Trace.		0.01		Anhedral.	Rare inclusion in pyrite.

Comments and sketch: Macro quartz contains small fluid inclusions along fracture planes, as well as very sparse larger, two-phase liquid + vapor inclusions (one has a 6-micron diameter vapor bubble). This section was cut from a piece of core which displayed "...a coherent (lava) finger sandwiched within clastic material". The section contains 2 textural domains, with a fairly distinct, but very irregular contact. The bulk of the slide is composed of microcrystalline quartz and illite (=coherent domain?). The eastern edge (when view upright) of the thin section is composed of coarse crystalline aggregates and apparent crystal fragments of quartz with undulose extinction with abundant dirty brown clay (=clastic domain?). Pyrite more or less evenly distributed throughout the section, but tends to be coarser in the clastic domain.

TS: 86 193-1188F-17Z1-04-07 #1 **UNIT: 45** **OBSERVERS:**
SR
DAV

ROCK NAME: **Completely altered sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Massive.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Feldspar pseudomorphs	2	0.5	1.5	1	Euhedral laths.	Completely altered plagioclase laths (1-2% originally) common within the section. Replaced by clays and quartz.
GROUNDMASS						
Fine feldspar pseudomorphs						As for phenocrysts, above.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	30	<0.025	0.6		Anhedral.	With clay as fine grained groundmass to the sample and as aggregates of macro quartz.
Anhydrite	5	<0.050	0.1		Anhedral/euhedral.	Sparsley distributed throughout the slide.
Clay-Brown (White in reflected light.)	40		<.005		Anhedral.	
Clay - Illite?	20		<.005		Anhedral.	As matrix to slide with quartz.
Magnetite	Trace.		0.008		Anhedral.	As inclusion within pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	5		0.6			Pyrite disseminated throughout slide. Coarser pyrite associated with macro quartz anhydrite clusters.

COMMENTS AND SKETCH: Relict feldspar laths - variably altered - in places by fibrous (clay?) minerals elsewhere by quartz. Identification of the clay minerals replacing plagioclase is tricky. Illite and the brown dirty clay mineral are present, as well as a new, very highly birefringent phyllosilicate (possibilities include muscovite, talc, brittle mica?).

TS: 87 193-1188F-19Z1-13-15 #1b **UNIT: 45** **OBSERVERS:** TB DAV CY

ROCK NAME: **Completely altered silicified volcanic rock.**
TEXTURE: **Massive with pyrite, quartz and anhydrite filled vesicles.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Feldspar pseudomorphs	1	1	3	2	Euhedral laths.	Few completely altered plagioclase laths, replaced by silica and lesser clay minerals.
GROUNDMASS						
Feldspar microlites		0.05	0.1			Totally replaced by clay minerals (partly illite?).

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	26	<0.01	0.15	0.05	Anhedral.	With clay as fine grained groundmass. As vesicle fill with pyrite and minor anhydrite.
Anhydrite	2	<0.05	0.1		Anhedral/euhedral.	Sparsley distributed throughout the slide. As vesicle fill with quartz and pyrite.
Clay-Brown (White in reflected light.)	32		<.005		Anhedral.	Replacing plagioclase microlites.
Clay - Illite?	35	<0.005	0.02		Anhedral.	Replacing plagioclase fenocrysts, microliths and in groundmass.
Magnetite	Trace.		0.008		Anhedral.	As inclusions within pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	5	0.01	0.6		Anhedral to euhedral.	Pyrite disseminated throughout slide.As vesicle fills with quartz and minor anhydrite.
Pyrrhotite	Trace.			0.005	Rounded.	Very rare inclusions in pyrite.

COMMENTS AND SKETCH: Stretched aligned vesicles filled with pyrite, quartz and anhydrite, together with aligned feldspar laths defines volcanic layering. Patches in section is dominated by illitic clay minerals, whereas other patches are dominated by brown phylosilicates. Photomicrograph (XN) of altered plagioclase fov 200um. OL photo is somewhere (1188F_102.jpeg)
See photomicrograph 1188F_102

TS: 88 193-1188F-22Z1-121-123 #15 **UNIT: 46**

OBSERVERS:
TB
DAV
AP
CY

ROCK NAME: **Highly altered silicified volcanic rock.**
TEXTURE: **Massive with quartz and anhydrite filled vesicles.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2	0.1	2.75	0.5	Euhedral.	Partially clay-altered, most are unaffected or only altered along the rims.
GROUNDMASS						
Feldspar microlites	38	0.05	0.1			Abundant alligned microlites, partially clay-altered.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	25	<0.01	0.5	0.1	Anhedral.	With clay as fine grained groundmass. As vesicle fill with minor anhydrite.
Anhydrite	2	0.05	0.5	0.1	Anhedral.	Trace in groundmass. As vesicle fill with quartz.
Clay-Brown (White in reflected light.)	5		<.005		Anhedral.	Rare patches in groundmass.
Clay - Illite?	20	<0.005	0.02		Anhedral.	Round aggregates in groundmass, partially replacing plagioclase, overgrowing other clay minerals?
Chlorite(?)	5				Fibrous aggregates.	Distinct patches of low birefringence clay in the groundmass..
Magnetite	Trace.		0.008		Anhedral.	Fine inclusions in pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3	0.01	0.4		Anhedral.	Disseminated.
Pyrrhotite	Trace.		0.004		Anhedral.	Very fine inclusions in pyrite.

COMMENTS AND SKETCH:

TS: 89 193-1188F-25Z1-24-26 #4 **UNIT: 46**

OBSERVERS:
TB
DAV
AP
CY

ROCK NAME: **Highly altered aphyric volcanic rock.**
TEXTURE: **Massive with quartz and anhydrite filled vesicles.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace.	0.2	2	1	Euhedral.	Partially clay-altered along the rims; a few are completely replaced by quartz.
GROUNDMASS						
Feldspar microlites	5	0.05	0.1			Partially clay-altered.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	30	<0.01	0.5	0.1	Anhedral.	With clay in groundmass. As vesicle fill with very minor anhydrite
Anhydrite	Trace.	0.05	0.5	0.1	Anhedral.	As vesicle fill with quartz.
Clay-Brown (White in reflected light.)	59		<.005		Anhedral.	Groundmass.
Clay - Illite?	5	<0.005	0.02		Anhedral.	Few small aggregates in groundmass, partially replacing plagioclase.
Magnetite	Trace.		0.015		Anhedral.	As inclusions within pyrite, few scattered grains. Fine (up to 20 µm) skeletal grains enclosed in quartz.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1	0.01	0.4		Anhedral to subhedral.	Disseminated, in vesicles with quartz.

COMMENTS AND SKETCH: Plagioclase is at least An51 by Michel-Levy technique (only 5 determinations - a bit low; An51 is a minimum).Magnetite inclusions in pyrite of same morphology as magnetite in quartz of the groundmass. Magnetite inclusion in pyrite decrease in size deeper inside the crystal. Late fractures crosscutting quartz and pyrite

See Chapter 3, Figure F92; see photomicrograph 1188F_72

TS: 90 193-1188F-26Z1-20-23#2 **UNIT 49**

OBSERVERS:
CY
AP

ROCK NAME: **Completely altered, sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Massive.**

HP
DAV

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2	0.3	1.6	0.8	Prismatic, acicular.	Unaltered, but hosted in a pervasively quartz-clay altered groundmass.
GROUNDMASS						
Plagioclase	3			0.1	Microlite laths.	

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	65					In groundmass with clays, also as coarser aggregates (=vug fill).
White Clay (illite)	15					In groundmass.
Dirty brown clay	13					In groundmass.
Anhydrite	2					With coarser quartz vug fill.
Magnetite	Trace.					Overgrows pyrite and occurs as discrete granular aggregates. Associated with late clean quartz.
Leucoxene	Trace.					Showing lamella structure with magnetite inclusion. Later pyrite includes magnetite grains.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	Trace.					Partially replaces late quartz and magnetite assemblage. With small magnetite inclusions.

COMMENTS AND SKETCH:

See Chapter 3, Figures F94 and F95; see photomicrographs 1188F_29, 1188F_30, 1188F_35, 1188F_38, 1188F_39 and 1188F_49

TS: 91 193-1188F-30Z1-5-7#2 **UNIT 51** **OBSERVERS:**
HP
CY
ROCK NAME: **Very lightly altered breccia.** **AP**
TEXTURE: **Clastic.** **DAV/SR**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace.			1	Prismatic to acicular.	Fresh to incipiently altered crystals.
GROUNDMASS						
Plagioclase microcrysts.	8			0.1	Acicular.	Scattered fine, randomly oriented crystals.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	54					In groundmass with clays, also as coarser aggregates (=vug fill) and rounded to subrounded silicified clasts. Some fine granular aggregates have prismatic shapes - plagioclase phenocryst pseudomorphs?
Dirty brown clay (pyrophyllite?)	35					Pervasive flooding of groundmass.
Magnetite and Ti-magnetite	2					Fine skeletal grains and subhedra altering to leucoxene in the matrix of the rock. Coarse (up to 6 mm) granular aggregates of fine equant subhedra intergrown with quartz contain traces of pyrite and chalcopyrite.
Leucoxene	Trace.					After magnetite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1					Disseminated in the groundmass. Also found within magnetite aggregates.
Chalcopyrite	Trace.					In magnetite aggregates.

COMMENTS AND SKETCH: There are siliceous, quartz-rich domains that appear to be clasts and dark gray-brown quartz/clay domains which appear to be a matrix. Rare plagioclase phenocrysts occur in both types of groundmass. Plagioclase microcrysts cross the margin between the groundmass domains (image). Siliceous domains vary in shape from rectangular with sharp margins to irregular shapes (image). The contact between a larger part of the section consisting of siliceous material and dark gray/brown groundmass with isolated siliceous domains is gradational (image). The siliceous groundmass was paritially and incompletely replaced by brown clay alteration. There are abundant examples of subrounded to rounded aggregates with distinct compositions and sharp boundaries.Grain size varies by an order of magnitude between these aggregates, but is remarkably consistent within them.

See Chapter 3, Figures F34A, B and C and F86; see photomicrographs 1188F_52, 1188F_53, 1188F_54, 1188F_55, 1188F_56, 1188F_57, 1188F_58, and 1188F_59

TS: 92 193-1188F-31Z1-1-3 #1 **UNIT: 52**

OBSERVERS:
TB
DAV
AP
CY

ROCK NAME: **Highly altered, sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Massive with quartz and anhydrite filled vesicles.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1	0.1	2	1	Euhedral laths.	Slightly altered along rims and cracks.
GROUNDMASS						
Feldspar microlites	20	0.02	0.05	0.04		Partially clay-altered.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	51	<0.01	0.1	0.1	Anhedral.	With clay in groundmass, with anhydrite and pyrite in vein.
Anhydrite	1	0.02	0.1	0.1	Anhedral.	Scattered grains in groundmass and together with quartz in vein.
Clay-Brown (White in reflected light.)	20		<.005		Anhedral.	Groundmass, more abundant in vein margin.
Clay - Illite?	5	<0.005	0.02		Anhedral.	Few small aggregates in groundmass, partially replacing plagioclase.
Magnetite	1	0.005	0.4		Subhedral to euhedral.	Scattered grains in groundmass, concentrated in vein. The larger grains are often disintegrated with leucoxene? along crystallographic directions, however fresh grains are present, often overgrown by clear quartz. Tiny magnetite inclusions occur in pyrite, including the grains in the vein.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1	0.01	0.4		Anhedral to subhedral.	Disseminated grains and concentrated in vein with quartz and anhydrite.
Chalcocite (?)	Trace.		0.002		Anhedral.	Extremely rare inclusions in pyrite (one example).

COMMENTS AND SKETCH: 0.5 mm vein with quartz, anhydrite, pyrite and magnetite. On each side of the vein a mm halo enriched in dark clay minerals (see image links). Magnetite in the vein disintegrates (as in the rock) and is overgrown by pyrite. Tiny magnetite inclusions also within the pyrite grains.
See Chapter 3, Figure F30; see photomicrograph 1188F_84

TS: 93 193-1188F-31Z1-39-42#5			UNIT 53			OBSERVERS: CY DAV WB
ROCK NAME:	**Completely altered silicified breccia.**					
TEXTURE:	**Clastic.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None.						
GROUNDMASS						
Plagioclase microlites	**1**					Partially replaced, mainly by quartz.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	73					In groundmass with clays, also as coarser aggregates (=vug fill) and crystalline fragments (=clastic?). Some granular aggregates have prismatic shapes - plagioclase phenocryst pseudomorphs?
Dirty brown clay (kaolinite?)	25					Pervasive flooding of groundmass.
Anhydrite	Trace.					
Magnetite	Trace.					Fine equant inclusions in coarser pyrite crystals. Inclusions in quartz.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1			0.1		Mostly fine grains, disseminated throughout the groundmass.

COMMENTS AND SKETCH: Rock is heavily recrystallized. However, clay-rich and quartz rich “clasts” can still be picked. The apparent fragments of quartz are the strongest evidence for the clastic nature of this rock. Overall just trace of plagioclase microlites and even those appear to be mostly replaced by quartz. Some angular quartz “clasts” could have been plagioclase phenocrysts.
See photomicrographs 1188F_60 and 1188F_61

TS: 94 193-1188F-34Z1-05-07#1 **UNIT 54**

OBSERVERS:
WB
AP
DAV
CY

ROCK NAME: **Completely altered, sparsely vesicular volcanic rock.**
TEXTURE: **Vesicular.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace.		0.8		Subhedral.	Replaced by quartz + anhydrite or brown clay (white in reflected light).
GROUNDMASS Very fine-grained. No primary texture.						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	50		0.3		Anhedral.	Replacing groundmass, fiiling vesicles, replacement of plagioclase.
Brown clay (pyrophyllite?)	20					Replacing groundmass and plagioclase phenocrysts?
Colorless to pale green clay (illite and chloritic clay)	27					Replacing groundmass.
Anhydrite	2		0.2			Filling vugs and rare in groundmass.
Magnetite	Trace.		0.005		Anhedral.	As inclusions in pyrite.
Leucoxene	Trace.					In the groundmass. A few examples.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	1	0.02	0.25		Subhedral.	Disseminated in the groudmass. Rare small inclusions of magnetite. Occasionally quartz inclusions.

COMMENTS AND SKETCH: Vesicles filled with quartz-pyrite-anhydrite. Rare plagioclase phenocrysts? replaced by quartz and anhydrite in many cases and white clay (brown in transmitted light) in others. Quartz dominated matrix with brown clay, white mica (illite?) and pale green, low birefringence clay/chlorite ingroundmass. Pale bands in thin section are rich in brown clay.

TS: 95 193-1188F-34Z1-45-47#9A **UNIT: 55**

OBSERVERS:
DAV
AP
SDS
CY/SR
WB

ROCK NAME: **Completely altered, aphyric volcanic rock.**
TEXTURE:

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None.						
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**SIZE (mm) max.**	**SIZE (mm) av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	57					Coarsely crystalline aggregates which mostly appear to fill vugs (vesicles?). Some aggregates have prismatic shapes, suggesting they are pseudomorphing plagioclase. Microcrystalline quartz in the groundmass.
Illite	20					Fine intergrowth with quartz in the groundmass, stubby prismatic crystals lining voids.
Brown Clay	15					Groundmass.
Chlorite	5					Occurs as spherulitic structures - possibly chamosite (?). Lining voids and or vesicles, associated late quartz or zeolite. Also as fine fibrous intergrowths with granular magnetite and hematite.
Magnetite	2	0.005	0.05			Granular aggregates. Also in groundmass and as inclusions in quartz and pyrite crystals.
Hematite	Trace.	0.005	0.008			Inclusions in quartz, associated with granular magnetite
Maghemite	Trace.					Rare lamellae in quartz, associated with granular magnetite
Spinel (Hercynite?)	Trace.	0.001	0.02		Euhedral.	Clear green octahedral grains. Some with stepped growth surfaces. Associated with magnetite. Very difficult to confirm if they actually are isotropic. Intimately associated with quartz - local rutile?
Zeolite(?)	Trace.		0.025		Euhedral.	Forms bladed and rhombohedral, low-birefringence crystals along the walls of open vugs, along with spherulitic-shaped chlorite/chamosite(?).
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**SIZE (mm) max.**	**SIZE (mm) av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	1	0.01	0.4		Anhedral to subhedral.	Disseminated in the groundmass. Replace magnetite that occurs as inculsions.
Chalcopyrite	Trace.	0.0005	0.003		Anhedral.	As inclusions in magnetite.
Pyrrhotite	Trace.	0.005			Rounded, equant.	Rare incluions in pyrite.

COMMENTS AND SKETCH: Quartz illite altered rock, with local brown clay. Quartz closely associated with magnetite and spinel (Uercynite?) Pyrite overgrows quartz magnetite assemblage, replacing first the quartz, keeping magnetite as inclusions for longer.
See Chapter 3, Figures F65 and F93; see photomicrograph 1188F_74

TS: 96 193-1188F-34Z1-108-110#14A **UNIT 56** **OBSERVERS:**
CY
DAV

ROCK NAME: **Highly altered, sparsely vesicular volcanic rock.**
TEXTURE: **Vesicular, apparent brecciated appearance.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase			0.7		Subhedral laths.	Completely replaced by clay.
GROUNDMASS						
Remant Plagioclase	7		0.15		acicular	Acicular microlites, many are corroded looking, suggesting partial replacement.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	60					Macrocrystalline aggregates and fine microcrystalline groundmass, intergrown with clays
Brown Clay	15				Amorphous	Groundmass
Illite and chlorite	17				Fibrous, acicular	Fibrous groundmass, fine acicular aggregates on vesicle walls.
Anhydrite	Trace					Rare crystals with quartz and pyrite as void fill
Hematite	Trace					Fine inclusions in quartz crystals which are overgrown by pyrite
Magnetite	Trace					Fine inclusions in quartz crystals which are overgrown by pyrite

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.8			Coarser euhedral crystals associated with quartz and anhydrite in vug fill. Fine (<0.1mm) disseminated pyrite in groundmass.

COMMENTS AND SKETCH: The rock had a mottled appearance in hand specimen and this is reflected in thin section by patchy domains composed of quartz+illite and others dominated by brown clay. There are 0.5mm irregular to ovoid-shaped quartz-illite spots hosted in brown clay in one part of the section. These are most likely amygdales. The shapes of brown clay pseudomorphed plagioclase phenocrysts are faintly visible in places. Relict acicular plagioclase microlites, many are corroded looking, suggesting partial replacement.
See photomicrograph 1188F_81

TS: 97 193-1188F-35Z2-41-43#2B **UNIT : 57** **OBSERVERS:**

DAV
SDS
WB
CY

ROCK NAME: **Completely altered, aphyric, sparsely vesicular volcanic rock.**
TEXTURE:

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace		2		Lath	A single plagioclase phenocryst is replaced by clay, anhydrite, and pyrite.
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	55		0.4	0.2	Anhedral mosaic.	Fills flattened vesicles that are 1mm and less in length; and replaces groundmass.
Brown Clay	20					In the groundmass, heterogeneously distributed.
Illite	20					Groundmass
Anhydrite	3		0.4	0.2		With quartz and pyrite in vesicles.
Magnetite	Trace.	0.001	0.02		Anhedral mosaic.	Inclusions in pyrite and quartz
Leucoxene	Trace.		0.35		Subhedral mass.	In groundmass.
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	2		0.2			

COMMENTS AND SKETCH: This section cut from minicore. Quartz, anhydrite, and pyrite fill vesicles. Rock is rich in brown clay (white in hand specimen), the distribution of which is patchy.

TS: 98 193-1188F-35Z1-44-46#2D **UNIT: 57**

OBSERVERS:
AP
DAV
ROCK NAME: **Highly altered, sparsely vesicular volcanic rock.** **SDS**
TEXTURE: **WB**

CY

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace		0.5		Euhedral lath.	One fresh phenocryst is present in the thin section.
GROUNDMASS						
Plagioclase	15			0.1	Acicular, skeletal laths.	Corroded laths are partially altered to illitic clay. Texture is trachytic.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown Clay	10					In the groundmass, heterogeneously distributed.
Illite	6					
Chlorite	15					Groundmass
Anhydrite	1		0.4	0.2		With quartz and pyrite in vesicles, and in groundmass.
Hematite	Trace.			0.01	Anhedral.	In quartz.
Magnetite	Trace.			0.01	Anhedral.	Inclusions in pyrite and quartz
Leucoxene	Trace.		0.25		Euhedral outline	In groundmass. Remnant magnetite.
Ilmenite	Trace.		0.001			As very rare inclusions in hematite that occurs inside pyrite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	3		0.2	0.1	Anhedral	
Pyrrhotite	Trace.		0.006		Anhedral	Rare inclusions in pyrite.

COMMENTS AND SKETCH: This thin section, cut from a minicore, is very similar to Section 97 (1188F-35Z1, 44-46#2D), but contains fresh plagioclase microlites, significant chlorite and much less brown clay and illite. Vesicles are filled with quartz and pyrite and minor anhydrite. Magnetite inclusion in Hematite that occurs as an inclusion in pyrite. Red internal reflections in hematite.Small ilmenite inclusion in hematite.

See Chapter 3, Figure F83

TS: 99 193-1188F-37Z1-2-4#1			**UNIT 57**			**OBSERVERS:** **DAV** **SDS** **WB** **CY**
ROCK NAME:	**Completely altered, sparsely vesicular volcanic rock.**					
TEXTURE:						

PRIMARY MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS						
None.						
GROUNDMASS						
Plagioclase	Trace				Anhedral.	Remnant laths.

ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	**40**		**0.2**		Anhedral.	Replacing groundmass, filling vesicles.
White Clay (illite)	28		<0.01		Anhedral.	Replacing groundmass and plagioclase microlites.
Dirty brown clay	15					Replacement of original plagioclase microlites in groundmass.
Chlorite	15				Anhedral.	Groundmass, interstitial.
Anhydrite	Trace.				Anhedral.	In vein and in groundmass.
Leucoxene	Trace.		0.025		Anhedral.	In groundmass.
Magnetite	Trace.		0.001		Anhedral.	In groundmass. Fine inclusions in quartz

SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	2		0.25	0.15	Anhedral.	Disseminated, heterogeneously. Rare very fine incluions in quartz
Chalcopyrite	Trace		0.025		Anhedral	A single fine dirty aggregate in the groundmass was seen

COMMENTS AND SKETCH: A majority of pyrite grains within the sample contain magnetite inclusions. Anhydrite vein with a brown clay halo along one edge. Patchy distribution of brown clay. Significant amounts of chlorite in groundmass imposes green color to rock. Quartz and pyrite filling vesicles.

TS: 100 193-1188F-37Z2-18-20#2			UNIT 57			OBSERVERS: DAV SDS WB CY
ROCK NAME:	Highly altered, sparsely vesicular volcanic rock.					
TEXTURE:						

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace		0.3		Euhedral blocky laths.	
GROUNDMASS						
Plagioclase	20		0.2		Subhedral acicular laths, skeletal.	Trachytic alignment.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	45					Primarily as vesicle fill, and in groundmass interstices
White clay (illite)	20					Replacing groundmass and partially replacing plagioclase microlites.
Dirty brown clay	10					Replacing groundmass and partially replacing plagioclase microlites.
Anhydrite	Trace.					With quartz-pyrite in vesicle fills.
Hematite	Trace.					Enclosed in quartz in a few vesicle fills.
Magnetite	Trace.					Fine inclusions in vesicle fill quartz and pyrite
Ilmentite	Trace.					Very rare fine inclusions in pyrite, intergrown with magnetite (see image link below- image is not high quality) = recrystallized titanomagnetite?

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	5		0.5	0.25	Anhedral.	Disseminated and with quartz in vesicles.
Pyrrhotite	Trace.		0.01		Anhedral	Rare inclusions in pyrite.

COMMENTS AND SKETCH: Abundant fresh plagioclase microlites in groundmass. Incipient alteration of plagioclase ot clay. Rare pink, anisotropic inclusions in pyrite are pyrrhotite.
See photomicrograph 1188F_86

TS: 101 193-1188F-37Z2-31-33**#1** **UNIT 58** **OBSERVERS:**
DAV
AP
SDS
WB/SR
CY

ROCK NAME: **Completely altered, magnetite bearing rock.**
TEXTURE: **Fine-grained, vuggy, heterogeneous granular.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace					One remnant phenocryst, partially replaced by alunite/brucite.
GROUNDMASS						
None.						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	52			0.1	Anhedral.	Fills vugs with pyrite, and occurs throughout the groundmass.
Illite	30					In groundmass, especially in ovoid areas surrounded by the black rock.
Chlorite	5					In groundmass. Some “chlorite” is green, pleochroic mats with a combination of low birefringence, high birefringence (1st order orange), and anomalous birefringence (Berlin blue).
Alunite-Brucite	5				Fine radiating books	Occurs as late stage intergrowths in voids with chlorite and hematite. Rare occurrence replacing plagioclase(?).
Hematite	Trace		0.2		Subhedral flakes.	As inclusions in pyrite and quartz. Occurs in pockets with alunite/brucite. Most abundant hematite yet encountered.
Magnetite	2		0.2			Magnetite occurs as rare relatively coarse rotten crystals (0.2-0.5 mm) and more typically as fine (generally 10-20 µm) equant to acicular grains in quartz which are associated with spinel. Magnetite forms fine rims overgrowing spinel (see images). Even where apparently overgrown by spinel crytals, careful examination reveals fine rims of magnetite on the spinel.
Maghemite	Trace	0.001	0.5			Rare fine inclusions in coarser magnetite
Spinel (hercynite-gahnite?)	3	0.001	0.01	0.005	Equant - octahedral	Multitudes of tiny opaque and nearly-opaque grains included in quartz which impart the black color to the rock. The ones that are nearly-opaque are brown-green and must be spinel rather than magnetite. They are readily distinguished from the magnetite in reflected light by their lower reflectance. Magnetite overgrows spinel.
Ilmenite	Trace	0.001	0.002			Intergrown with magnetite in the spinel, magnetite, hematite assemblage.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	2		0.5			Disseminated in the groundmass. Has inclusions of magnetite and hematite.
Chalcopyrite	Trace		0.15			Irregular aggregates with pyrite and quartz. One example as inclusion in pyrite. Also in the groundmass. Considerably more chalcopyrite than in previous thin sections.
Pyrrhotite	Trace		0.003			Very rare inclusions in pyrite.

COMMENTS AND SKETCH: Magnetite and spinel occur as fine inclusions in quartz. They are absent from clay-dominated domains in the rock. Spectacular red hematite occurs in clusters, generally set in a mat of colorless, high-birefringent alunite/brucite (looks like talc, but XRD results indicate there is alunite here). See photo. Quartz vugs have little to do with alunite-hematite vugs. Although there are a few cases where hematite alone is included in quartz. The modal proportion of quartz is a guess. Quartz that you can see, in vugs, is only about 10% of the rock. But the black areas generally take a high polish suggesting that quartz encloses the dark tiny grains. Thus, the higher modal estimate.

See Chapter 3, Figures F66A and B, F85, F87, and F90; see photomicrographs 1188F_76, 1188F_77, 1188F_79, 1188F_87, 1188F_88, 1188F_90, 1188F_91, 1188F_92, 1188F_93, 1188F_97, and 1188F_104

TS: 102 193-1188F-37Z2-65-68#7 **UNIT: 59**

OBSERVERS:
DAV
SDS
CY
SR

ROCK NAME: **Highly altered, sparsely vesicular volcanic rock.**
TEXTURE:

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace		1.2		Euhedral lath	The thin section contains one unaltered phenocryst.
GROUNDMASS						
Plagioclase	25			0.1	Acicular, skeletal laths.	Corroded laths are partially altered to illitic clay. Texture is trachytic, with complex folds and curves.
Magnetite - discussed below						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Quartz	48		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown Clay	10					In the groundmass, particularly concentrated in the vein halo.
Illite	7					Heterogeneously distributed throughout the groundmass.
Chlorite	8					Heterogeneously distributed throughout the groundmass.
Anhydrite	Trace		0.4	0.2		Trace anhydrite in the groundmass and abundant anhydrite in the vein with pyrite.
Magnetite	2	0.004		0.1		Skeletal corroded igneous titanomagentite in the groundmass. Also very fine inclusions in pyrite and quartz. In more pyrite-rich portions of the section, pyrite appears to overgrow magnetite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Pyrite	Trace		0.2	0.1	Anhedral	Concentrated in vein with anhydrite and in halo near vein. Pyrite both in groundmass and in vein contains magnetite inclusions.

COMMENTS AND SKETCH: The sample contains a thin anhydrite-pyrite vein and its associated halo (concentrations of pyrite, anhydrite, and brown clay). The host rock is typical aphyric (only one plagioclase phenocryst) volcanic rock with trachytic groundmass and small, flattened and aligned quartz- and pyrite-filled vesicles. The plagioclase laths are fresh, with clay corrosion.The brown clay with magnetite is more pronounced towards the vein halos. Magnetite phenocrysts are variably altered within the igneous groundmass.
See photomicrographs 1188F_98, 1188F_99, and 1188F_110

TS: 103 193-1188F-43Z1-87-91#4A **UNIT : 72** **OBSERVERS:**
WB
AP

ROCK NAME: **Highly altered sparsely plagioclase-phyric magnetite impregnated volcanic rock.**
TEXTURE: **Porphyritic.** **SDS**
CY/SR

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1		0.15		Subhedral	Replaced by brown clay (white in reflected light). Unaltered away from vein
GROUNDMASS						
Plagioclase	25				Laths	Aligned. Trachytic texture. Replaced in vein halo, fresh away from it

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	40		0.3		Anhedral	Replacing groundmass, fiiling vesicles.
Brown clay (kaolinite?)	11					Replacing groundmass and plagioclase phenocrysts?
Colorless to pale green clay (illite and chloritic clay)	18					Replacing groundmass and less commonly with quartz in vesicles
Anhydrite	2		0.2			Filling vugs and rare in groundmass.
Magnetite	2	0.001	0.025		Anhedral. Rare cubes.	As inclusions (anhedra, rare cubes) in pyrite up to 10% in some pyrite. Aggregates in the groundmass = corroded igneous titanomagnetite?
Leucoxene	Trace					In the groudmass. A few examples.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1	0.02	0.25		Subhedral	Disseminated in the groudmass and in prominent anhydrite vein with white and black halos. Rare small inclusions of magnetite. Occasionally quartz inclusions.

COMMENTS AND SKETCH: Vesicles filled with quartz-pyrite-magnetite-anhydrite. Rare plagioclase phenocrysts? replaced by white clay (brown in transmitted light). Quartz dominated matrix with brown clay, white mica (illite?) and pale green, low birefringence clay/chlorite in Anhydrite minor quartz, pyrite vein has a white clay-minor quartz halo and, outside of that, a dark clay-quartz magnetite halo in which groundmass. the magnetite content is higher than in the white halo.
See photomicrograph 1188F_100

TS: 104 193-1188F-38Z2-88-90#4 **UNIT: 61** **OBSERVERS: DAV WB**

ROCK NAME: **Highly altered, sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Porphyritic, trachytic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2	0.4	1.6	1	Euhedral laths.	Replaced around margins by clay. Some primary zoning with rounded cores.
GROUNDMASS						
Plagioclase	30			0.1	Acicular, skeletal laths.	Corroded laths are partially altered to illitic clay. Trachytic texture.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	30		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown Clay	30					In the groundmass.
Illite and chlorite	5					Heterogeneously distributed throughout the groundmass.
Anhydrite	2		0.4	0.2		In the groundmass and in vesicles with quartz and pyrite.
Magnetite	Trace			0.005		Fine inclusions in quartz

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.2	0.1	Anhedral	In vesicles with quartz and anhydrite, and groundmass. Rotten, corroded looking crystals.

COMMENTS AND SKETCH: Porphyritic rock with trachytic groundmass texture. Incipient alteration of plagioclase to clay. Mosaic quartz filling vesicles. Pyrite and anhydrite as vesicle fill. Corroded pyrite crystals in the groundmass.

TS: 105 193-1188F-39Z1-41-42#6 **UNIT 62** **OBSERVERS:**

DAV
CY

ROCK NAME: **Completely altered, sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Porphyritic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	1	0.2	0.8	0.5	Euhedral laths.	Completely replaced by clay (illite)
GROUNDMASS						
ALTERATION MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Quartz	60		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown Clay	10					In the groundmass.
Illite	24					Groundmass, pseudomorphing plagioclase microlites. Also replaces plagioclase pheocrysts
Chlorite	5					Groundmass.
Anhydrite	1		0.4	0.2		In the groundmass and in vesicles with quartz and pyrite.
Magnetite	Trace			0.005		Fine inclusions in quartz
SULFIDE MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
Pyrite	Trace		0.2	0.1	Anhedral	In vesicles with quartz and anhydrite, and groundmass.

COMMENTS AND SKETCH: This is a soft gray rock in hand specimen.

TS: 106 193-1188F-40Z1-3-5#1A		UNIT 65				OBSERVERS: DAV CY
ROCK NAME:	**Highly altered, magnetite-bearing, sparsely plagioclase-phyric volcanic rock.**					
TEXTURE:	**Porphyritic, trachytic.**					

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	2	0.5	1.6	0.8	Euhedral laths.	Slightly corroded to clay.
GROUNDMASS						
Plagioclase	30			0.1	Euhedral skeletal laths.	Slightly corroded to clay.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	44		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Illite	5					Groundmass.
Chlorite	10					In groundmass and vugs..
Brown Clay	5					In groundmass and vugs.
Anhydrite	2	0.2	1.2			In vugs with quartz and pyrite.
Magnetite	3				Anhedral.	Very fine grained in clay in vugs with pyrite. Aggregates could be corroded Ti-magnetite?? Some are rimmed by brown Fe-oxide. They also occur as fine approximately cubic “crystals” in the groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.8	0.2	Anhedral	In vesicles with quartz and anhydrite, replacing magnetite and in groundmass.

COMMENTS AND SKETCH: In hand specimen this rock has vugs filled with green clay, anhydrite, pyrite, and magnetite, many of the vugs have a single pyrite grain surrounded by soft black magnetic material. In thin section, these vugs are present. In many vugs a grain of coarse pyrite is surrounded by opaque material that, in reflected light, comprises poorly-polished material with inclusions of long thin fine magnetite crystals. Other vugs contain anhydrite + chlorite + quartz + pyrite + magnetite.

See Chapter 3, Figures F63A and B and F67

TS: 107 193-1188F-40Z1-36-38#2C **UNIT 66** **OBSERVERS:**

ROCK NAME: **Completely altered, sparsely vesicular volcanic rock.** **DAV**
TEXTURE: **Vesicular, trachytic.** **CY**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	0	0.8	1.6	1	Euhedral laths.	Completely replaced by dark brown clay, or chlorite-anhydrite.
GROUNDMASS						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown clay	30					Groundmass.
Illite	14					In groundmass and vugs.
Chlorite	5					In groundmass and vugs.
Anhydrite	Trace			0.2	Anhedral.	In vesicles with quartz and pyrite.
Magnetite	Trace		0.005			Fine inclusions in quartz

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.3	0.1	Anhedral	In vesicles with quartz and anhydrite, and in groundmass.

COMMENTS AND SKETCH: The vesicles, now filled with quartz, pyrite and some anhydrite, are small (< 0.5 mm), flattened, and aligned. Clays, pseudomorphing plagioclase phenocrysts, are aligned parallel to the same trend.

TS: 108 193-1188F-41Z2-7-10#2A **UNIT 69** **OBSERVERS:**
DAV
CY

ROCK NAME: **Very highly altered volcanic rock.**
TEXTURE: **Porphyritic, vesicular, trachytic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace	0.3	0.4	0.4	Euhedral laths.	Corroded remnant plagioclase.
GROUNDMASS						
Plagioclase	5			0.1	Euhedral, skeletal laths.	Corroded remnants.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	50		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown clay	35					Groundmass.
Illite and chlorite	9					In groundmass and vugs.
Chlorite	Trace					
Anhydrite	Trace			0.2	Anhedral.	In vesicles with quartz and pyrite.
Hematite	Trace					Within quartz.
Magnetite	Trace			0.005		Fine inclusions withing quartz

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.3	0.1	Anhedral	In vesicles with quartz and anhydrite, and in groundmass.
Sphalerite	Trace			0.1	Anhedral.	One green-brown grain observed, stuck between pyrite and anhydrite in a vesicle filling.

COMMENTS AND SKETCH: Trachytic groundmass texture. Plagioclase partly altered to clay. Magnetite and hematite inclusions in quartz.

TS: 109 193-1188F-42Z1-72-74#4E **UNIT 70** **OBSERVERS: DAV CY**

ROCK NAME: **Completely altered volcanic rock.**
TEXTURE: **Trachytic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace	0.3	0.4	0.4	Euhedral laths.	Corroded remnant plagioclase.
GROUNDMASS						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	45		0.4	0.2	Anhedral mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown clay	29					Groundmass.
Illite	15					In groundmass and amydales.
Chorite	10					
Anhydrite	Trace			0.2	Anhedral.	In groundmass.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.3	0.1	Anhedral	In groundmass.

COMMENTS AND SKETCH: Hand specimen contained quartz-pyrite amygdales, which appear to have been plucked during manufacture. There is an anhydrite-clay-rich halo along two edges of the thin section.

TS: 110 193-1188F-43Z1-3-5#1 **UNIT 71** **OBSERVERS: DAV CY**

ROCK NAME: **Highly altered volcanic rock.**
TEXTURE: **Trachytic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace		0.45		Euhedral lath.	A single slightly corroded remnant plagioclase.
GROUNDMASS						
Plagioclase	15			0.1	Euhedral, skeletal laths.	Corroded crystals altered to clay.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	45		0.4	0.2	Anhedral, mosaic.	Crystal mosaics fill vesicles with pyrite; individual crystals replace groundmass.
Brown clay	19					Groundmass.
Illite	10					In groundmass.
Chlorite	10					In groundmass.
Anhydrite	Trace			0.2	Anhedral.	In groundmass.
Magnetite	Trace			0.005		Fine inclusions in quartz

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1		0.3	0.1	Anhedral	In groundmass.

COMMENTS AND SKETCH: Plagioclase phenocrysts and quartz are much less abundant in brown clay-rich domains.

TS: 111 193-1188F-43Z1-67-69#3A **UNIT 72** **OBSERVERS: DAV/HP CY**

ROCK NAME: **Highly altered, magnetite-impregnated, sparsely plagioclase-phyric volcanic rock.**
TEXTURE: **Porphyritc/microlitic. Clastic.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
Plagioclase	Trace		0.45		Prismatic to acicular	Rare phenocrysts, partially altered to clay. Absent in the vein halo.
GROUNDMASS						
Plagioclase	10			0.1	Acicular	Slightly altered to clay, absent in the vein halo.

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	60					Rounded coarsely crystalline aggregates fill vesicles and occur in the vein and associated halo. Fine quartz in the groundmass of the rock and in the 2 siliceous clasts.
Brown clay	15					Most abundant in the vein. Also occurs in the groundmass of the rock as interstitial fill.
Illite	3					Vesicle fill with anhydrite, rare replacement of feldspar in groundmass.
Chlorite	7					In groundmass, apparently partially pseudomorphing feldspar.
Anhydrite	1					Vesicle fill with illite, particularly within the vein halo.
Magnetite	3					Abundant fine grains (5%) in the vein halo, some occurring within quartz. Corroded fine grains in the matrix of the rock away from the vein.
Leucoxene	Trace		0.3		Equant	Dirty brown with remnant magnetite lamelle - breakdown product of magnetite.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	**1**			**0.1**		Vuggy, anhedral grains, concentrated in vein and on the outer margin of the vein halo. Also occurs scattered throughout the groundmass.

COMMENTS AND SKETCH: Similar to Thin section #103. The vein is a 3.6 mm wide zone of intergrown quartz - brown clay and pyrite, with very rare extremely fine grained (5 µm) magnetite as inclusions in the quartz. There is no clear continuous flow path. The vein has a distinct dark halo, approximately 5 mm wide, which comprises quartz and very fine granular magnetite (1-5 µm grains) with dirty brown clay. The outer margin of the vein halo is marked by a zone of scattered 50-300 µm pyrite and the appearance of plagioclase crystals in the groundmass of the rock. Two apparent clasts are present in the rock. The larger of the two (approx 1.5 cm across) is composed of quartz (75%), brown clay (12%), illite (11%) and remant plagioclase microlites (2%). Other than the low abundance of plagioclase, the mineralogy of the clast is similar to that of the groundmass of the rock, so its contact is indistinct. However, the clast is wrapped by banding defined by plagioclase microlites. The smaller of the two clasts (approximately 6 mm, on the edge of the TS) is distinctly siliceous and is composed of granular quartz with scattered aggregates of dark clay and trace magnetite. The composition of this clast contrasts sharply with the groundmass and it has a sharp contact with the remainder of the rock.

See Chapter 3, Figures F32 and F33

TS: 112 193-1188F-44Z1-1-3#1 **UNIT 72** **OBSERVERS:** **CY**

ROCK NAME: **Completely altered, magnetite-impregnated, aphyric volcanic rock.**
TEXTURE: **Veined.**

PRIMARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS						
None						
GROUNDMASS						
None						

ALTERATION MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Quartz	65					Coarser crystals in amgydales. Fien grained granular intergrowths in veins and the groundmass of the rock.
Brown clay	15					Dominant clay species in veins and in vein halos. Dominant in the white lower portion of the thin section. Also present elsewhere in groundmass of rock.
Illite	10					Dominant clay species in the darker portion of the groundmass of the rock.
Chlorite	5					Scattered throughout the groundmass
Anhydrite	1					Coarse vesicle fill and rare crystals in vuggy portions of veins, with pyrite.
Magnetite + Leucoxene	3			0.3		Corroded aggregates with remnant lamelle of magnetite surrounded by what appear to be breakdown products (leucoxene). The aggregates are shaped like magnetite crystals and were probably igneous titanomagnetite prior to breakdown. Quartz often partially overgrows the aggregates, resulting in fine magnetite inclusions in quartz.

SULFIDE MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
Pyrite	1			0.1		Coarser crystals in vesicles and (less commonly) in veins with anhydrite. Finer pyrite in the groundmass.

COMMENTS AND SKETCH: This rock has a stockwork veined appearance in hand specimen, with a network of fine (<1mm wide) veins cutting a dark gray silicified rock. The veins are represented in TS by a very fine grained intergrowth of granular quartz - brown clay - illite - leucoxene (after magnetite) - chlorite with rare patches of coarser anhydrite with pyrite. The veins have poorly defined margins and a very thin, variably developed halo of dark brown clay and magnetite, which has almost entirely broken down to leucoxene like material. The halo is best devloped at an intersection between two veins. In some parts of the veins quartz appears to be pseudomorphing prismatic plagioclase, implying that the veins are replacive, rather than fracture fills.