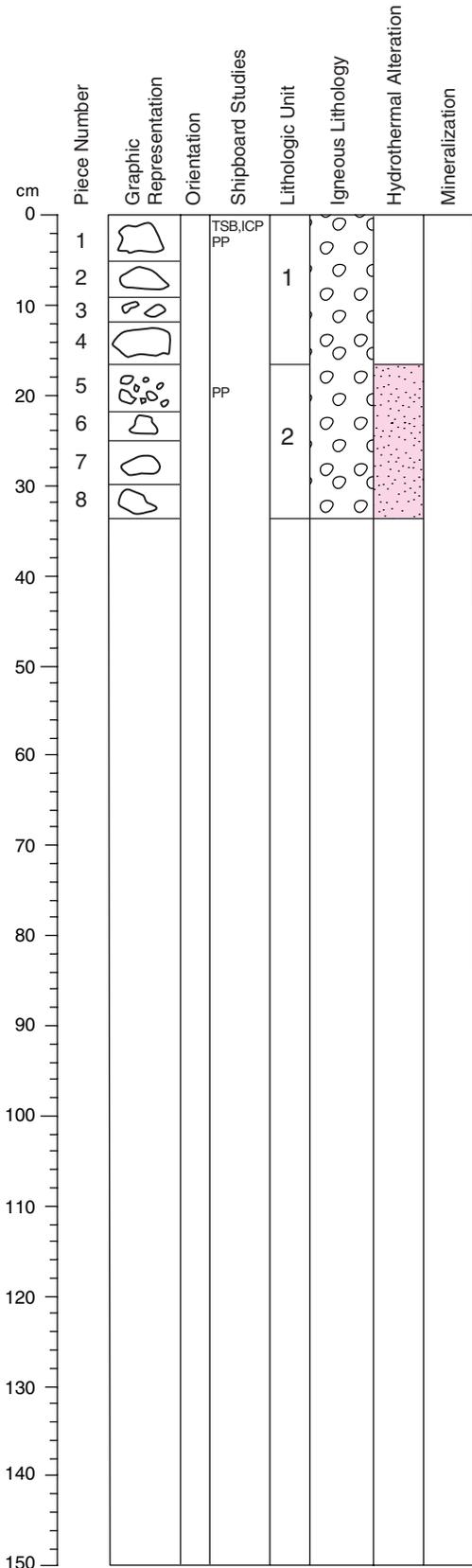


Core Photo



193-1189A-1R-1 (Section top: 0.0 mbsf)

ROCK NAME: Fresh to slightly altered, moderately vesicular, aphyric dacite.

UNIT: 1

Pieces: 1 to 4

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1R	1	1	0	0.00
Lower contact:	1R	1	4	17	0.17
Thickness (m): 0.17					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Microlitic glass.

VESICLES: Round (1 to 3 mm) to elongate (1 mm x 2 to 7 mm).

COLOR: Black.

STRUCTURE: Massive.

ALTERATION: Fresh to slight alteration (films of sulfate and Fe-oxides and vesicle fills of pyrite and anhydrite, prominent in Piece 4).

VEINS/FRACTURES: None.

COMMENTS: Refractive Index (R.I.) measurement on glass of Piece 1: R.I.=1.526 => 66 wt% SiO₂ (dacite)

ROCK NAME: Moderately to completely altered, moderately vesicular aphyric dacite.

UNIT: 2

Pieces: 5 to 8

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1R	1	5	17	0.17
Lower contact:	2R	1	13	93	10.63
Thickness (m): 10.46					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Dominantly large elongate vesicles: 1 to 3 mm x 2 mm to 10 mm.

COLOR: Gray.

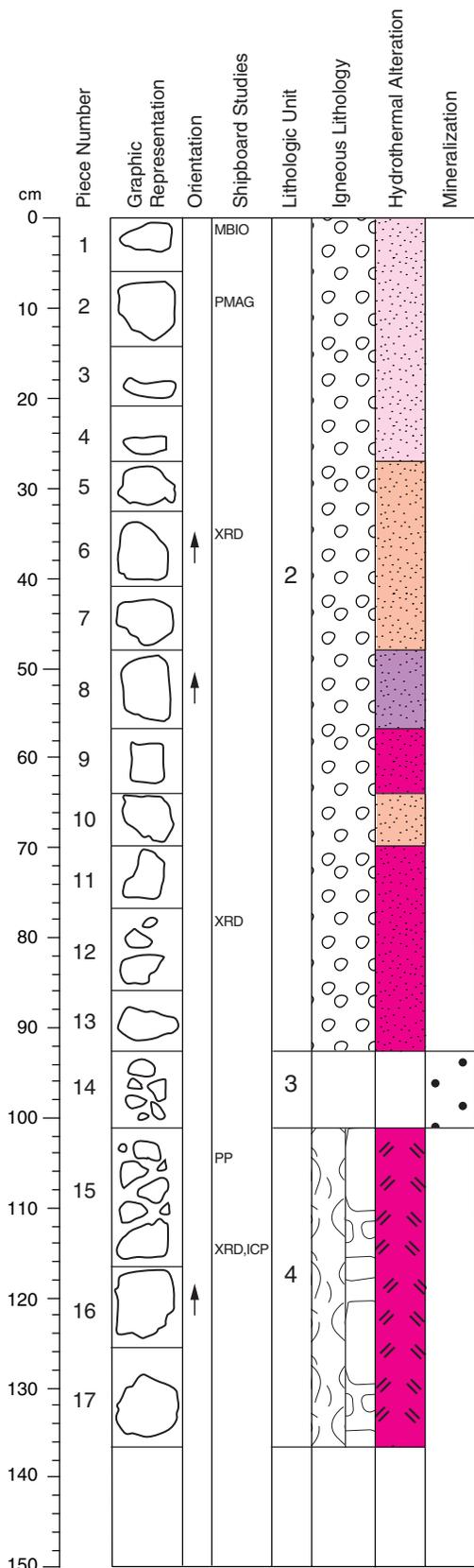
STRUCTURE: Massive.

ALTERATION: Moderate pervasive sulfate-silica bleaching. Vesicles typically filled/lined by anhydrite and/or trace pyrite ± sphalerite euhedra.

VEINS/FRACTURES: None.

COMMENTS: Unit continues in Core 1189A-2R showing an excellent example of gradually increasing alteration intensity (pieces in Core 1189A-1R are moderately altered, below Piece 7 in Core 1189A-2R alteration is complete).

Core Photo



193-1189A-2R-1 (Section top: 9.7 mbsf)

ROCK NAME: Moderately to completely altered, moderately vesicular aphyric dacite.

UNIT: 2

Pieces: 1 to 13

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1R	1	5	17	0.17
Lower contact:	2R	1	13	93	10.63
Thickness (m): 10.46					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Dominantly large elongate vesicles: 1 to 5 mm x 2 to 20 mm.

COLOR: Gray, light gray, white.

STRUCTURE: Massive.

ALTERATION: Moderate to complete pervasive silica, sulfate bleaching. Vesicles typically filled/lined by anhydrite and/or pyrite.

VEINS/FRACTURES: Thin veins of anhydrite (Pieces 2 and 12).

COMMENTS: Gradual increase in alteration intensity (Moderate alteration in Pieces in 1 to 4, complete alteration starting from Piece 8). Pieces 1 and 2 show good examples of fracture controlled fluid flow alteration.

ROCK TYPE: Coarse-grained quartz-sulfate vein.

Unit: 3

Piece: 14.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	14	93	10.63
Lower contact:	2R	1	14	101	11.07
Thickness (m): 0.08					

CONTACTS: None.

COLOR: Gray to medium gray

MINERALIZATION:

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Quartz+Silica	65	Very fine-grained	Granular
Anhydrite	15	Very fine-grained	Granular
Pyrite	15	Very fine-grained	Druse

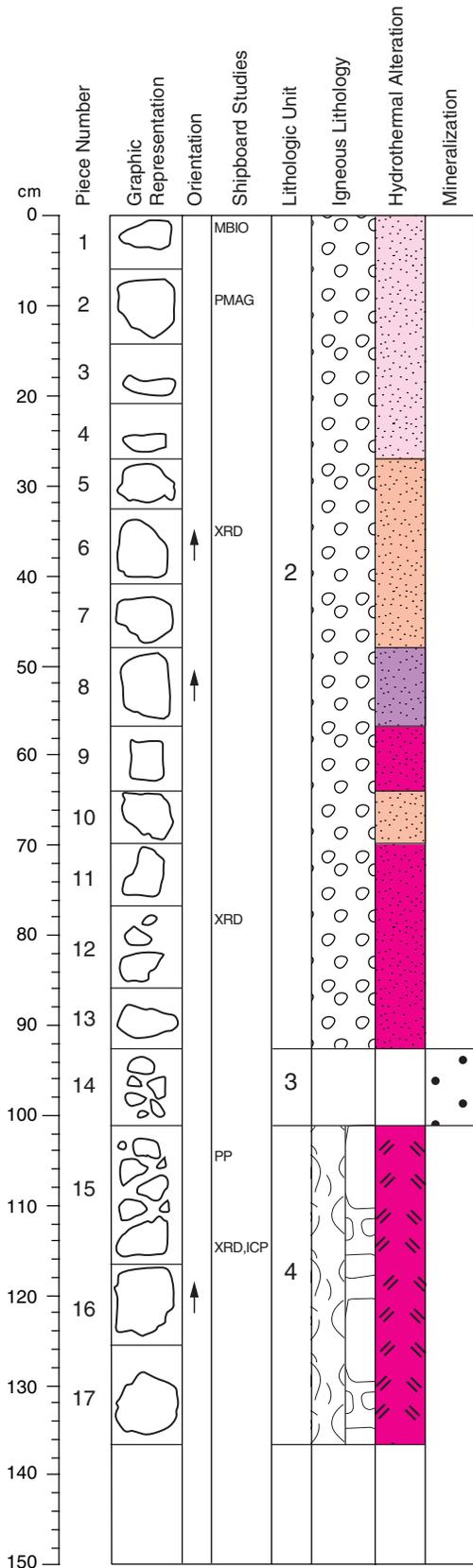
Minor minerals:

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

Trace minerals (<2%): None.

TEXTURAL DESCRIPTION: Disseminated pyrite in altered rock and drusy pyrite in quartz-anhydrite veinlets.

Core Photo



193-1189A-2R-1 (Section top: 9.7 mbsf)

ROCK NAME: Hydrothermal jig-saw breccia with completely altered, perlitic volcanic clasts.

UNIT: 4

Pieces: 15 to 17

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1R	1	15	101	10.71
Lower contact:	2R	1	17	137	11.07
Thickness (m): 0.36					

CONTACTS: None.

PHENOCRYSTS: None

GROUNDMASS: Clasts: very fine-grained blue-green clay. Matrix: fine to medium-grained anhydrite-silica pyrite.

VESICLES: Subordinate microvesicular clasts with 2% vesicles <1 mm to 1 mm across, lined or filled by anhydrite and/or pyrite

COLOR: Clasts: light green, blue green. Matrix: white, gray.

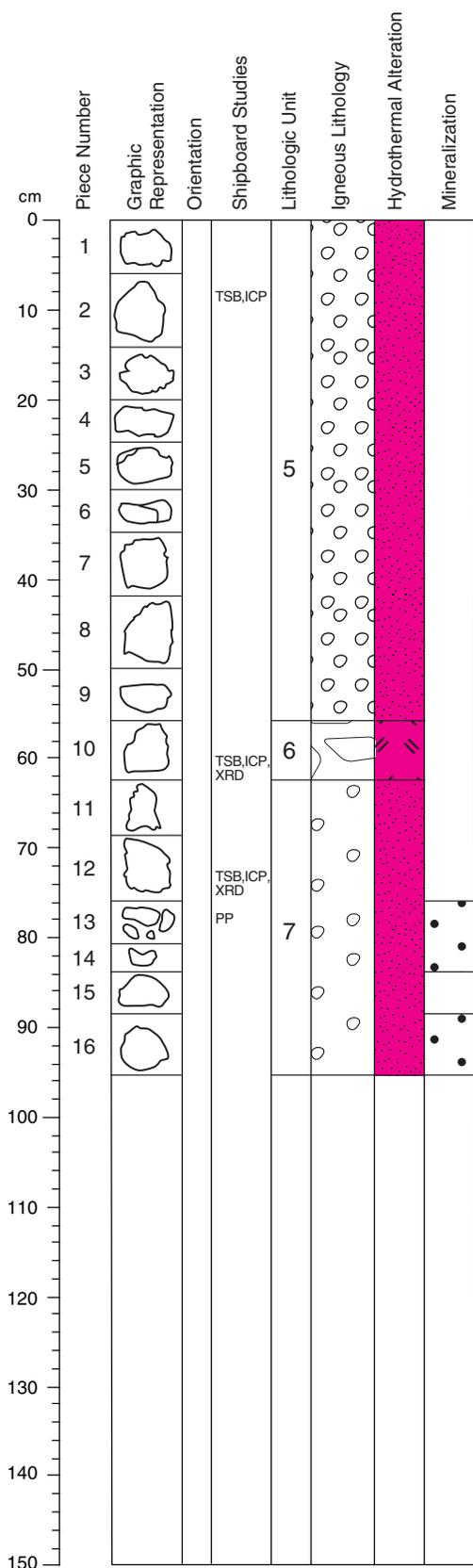
STRUCTURE: Clastic: 80% to 90% angular, altered, volcanic clasts (1 to 5 cm maximum dimension). Jig-saw texture.

ALTERATION: Completely GSC altered volcanic clasts cemented by anhydrite, silica, and pyrite.

VEINS/FRACTURES: Anhydrite-silica-pyrite infill of 10% - 20% irregular intraclast space.

COMMENTS: Some clasts show perlitic texture indicating that they consisted of volcanic glass prior to hydrothermal alteration.

Core Photo



193-1189A-3R-1 (Section top: 19.4 mbsf)

ROCK NAME: Highly bleached, moderately vesicular, aphyric dacite.

UNIT: 5

Pieces: 1 to 9

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	3R	1	1	0	19.40
Lower contact:	3R	1	9	56	19.96
Thickness (m): 0.56					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Mainly large, elongate vesicles: 2 to 4 mm x10 to 20 mm (general range: 1 to 4 mm x 3 to 20 mm).

COLOR: Gray, light gray.

STRUCTURE: Massive, flowbanding in Piece 8.

ALTERATION: High to complete, pervasive bleaching. Vesicles lined or filled by anhydrite ± traces of pyrite.

VEINS/FRACTURES: Scattered, coarse-grained anhydrite veins (e.g., Piece 1).

COMMENTS: Very similar to unit 2. Vesicle alignment indicates flow direction.

ROCK NAME: Hydrothermal breccia.

UNIT: 6

Piece: 10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	3R	1	10	56	19.96
Lower contact:	3R	1	10	63	20.03
Thickness (m): 0.07					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Patchy, green (70%), white (30%).

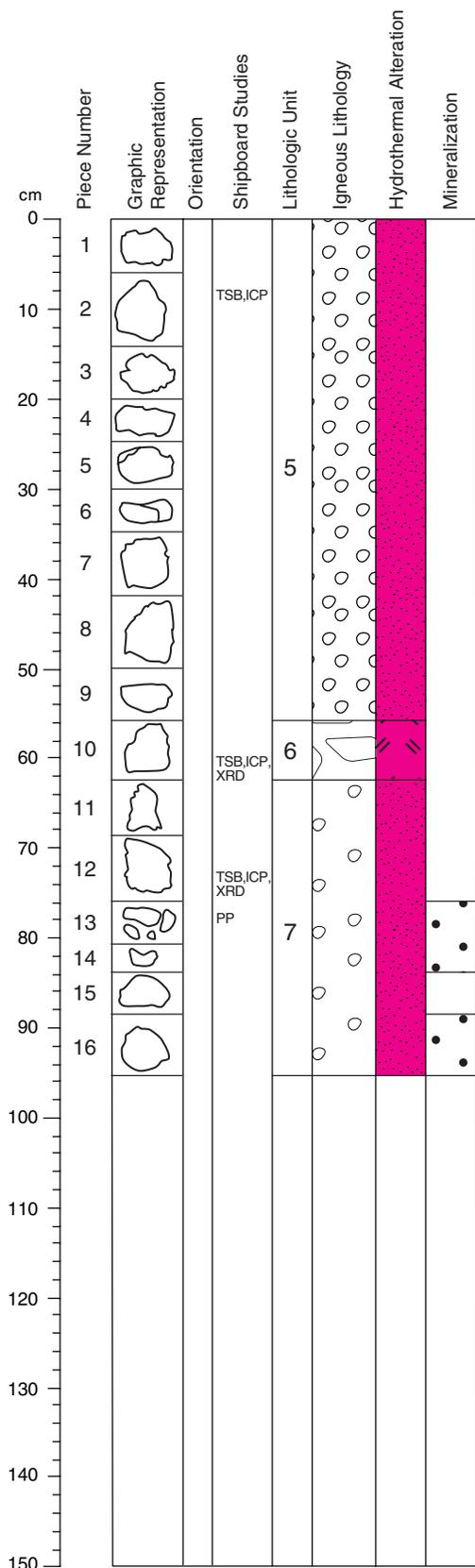
STRUCTURE: Clastic.

ALTERATION: White sulfate-rich volcanic clasts cemented in bluish green altered material and coarse anhydrite. Pyrite is disseminated throughout. A single blue-clay altered rounded fragment contains anhydrite laths that do not extend into the body of the rock, implying earlier alteration. XRD mineralogy: Anhydrite, quartz dominant, minor pyrite and traces of illite.

VEINS/FRACTURES: Smectite filled fractures in sulfate altered clasts. Coarse anhydrite infill between clasts.

COMMENTS: Variably altered clasts. Green clasts: pervasive smectite, white clasts: pervasive sulfate alteration.

Core Photo



193-1189A-3R-1 (Section top: 19.4 mbsf)

ROCK NAME: Bleached, silicified veined sparsely vesicular volcanic rock.

UNIT: 7

Pieces: 11 to 16

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	3R	1	11	63	20.03
Lower contact:	3R	1	16	96	20.36
Thickness (m): 0.33					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Poorly vesicular (1 to 2 mm across) to moderately vesicular (1 mm x 2 to 5 mm)

COLOR: Light gray.

STRUCTURE: Massive.

ALTERATION: Silicified bleached vesicular volcanic rock. Medium-grained anhydrite-quartz-pyrite veins with silica-pyrite halos cut the rock. Pyrite occurs in vein halos, but also scattered throughout the rock. XRD mineralogy: Quartz dominant, minor orthoclase, pyrite and traces of illite.

VEINS/FRACTURES: Quartz-anhydrite veins with silica-pyrite halos. Piece 16 is a crustiform silica-anhydrite pyrite vein.

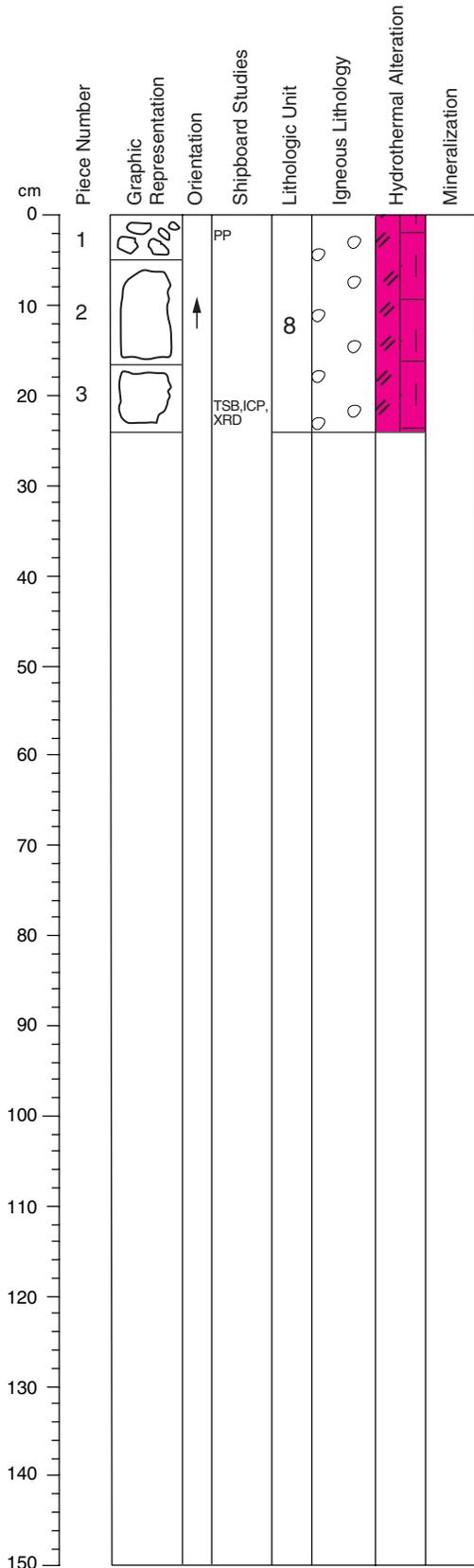
COMMENTS: Chalcopyrite in veins in Piece 12 (at intersection of two veins)

MINERALIZATION: Pieces 13 and 14 (both rubble) are granular pyrite in rock highly altered to silica + anhydrite. Piece 16 is a banded pyrite + anhydrite vein (cockade structure). Banding is produced by alternating granular pyrite and coarse bladed anhydrite.

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Silica	15-50	Very fine-grained	Granular
Anhydrite	34-80	Very fine-to coarse-grained	Granular to blocky
Pyrite	5-20	Very fine-grained	Granular

Core Photo



193-1189A-4R-1 (Section top: 29.1 mbsf)

ROCK NAME: Completely altered, moderately vesicular volcanic rock.

UNIT: 8

Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	4R	1	1	0	29.10
Lower contact:	4R	1	3	24	29.34
Thickness (m): 0.24					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Round and lenticular vesicles, generally <1 mm. Range: <1 mm to 2 mm x <1 mm to 20 mm, 5%. Typically partially filled by quartz.

COLOR: Light green-gray.

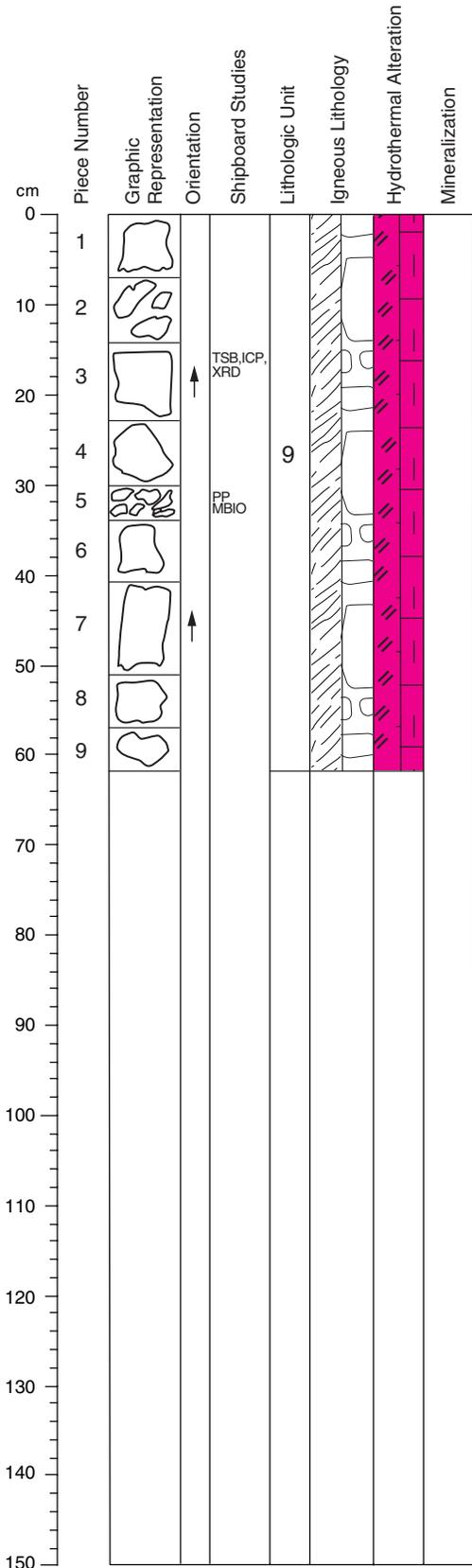
STRUCTURE: Massive.

ALTERATION: Pervasive GSC alteration, cut by irregular quartz-pyrite veins. Silicate fills vesicles, implying silica flooding of the rock. Rock cut by late anhydrite vein. XRD mineralogy: Quartz dominant, minor plagioclase, chlorite, pyrite, "illite").

VEINS/FRACTURES: Irregular silica-pyrite veinlets (<3 mm thick).

COMMENTS: Even though the rock appears to be soft when scratched, it contains about 40% very fine-grained quartz crystals in the groundmass (observed under the binocular microscope).

Core Photo



193-1189A-5R-1 (Section top: 38.8 mbsf)

ROCK NAME: Completely altered, hydrothermal breccia with flow laminated volcanic clasts.

UNIT: 9

Pieces: 1 to 9

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	5R	1	1	0	38.80
Lower contact:	6R	1	10	69	49.29
Thickness (m): 10.49					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Blue-green, white.

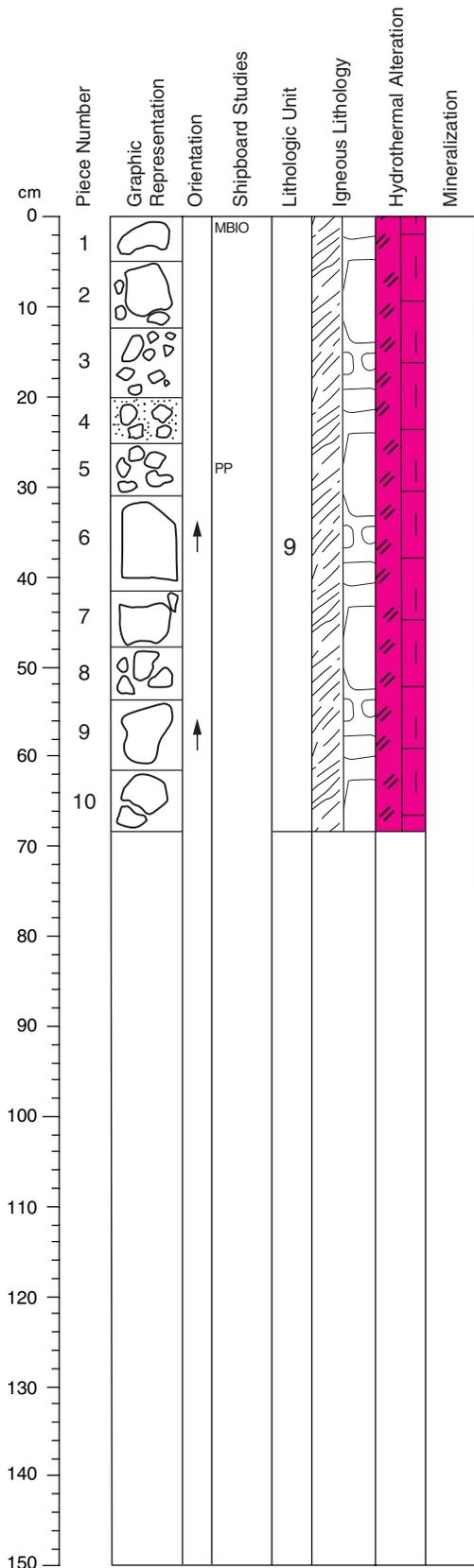
STRUCTURE: Clastic.

ALTERATION: Patchy to pervasive, multiphase alteration. Stage 1: Alteration of volcanics to white clay anhydrite-silica (locally preserving flow banding). Stage 2: Hydraulic brecciation with chlorite-smectite alteration associated with anhydrite veining. Stage 3: Quartz-pyrite veining with associated chlorite-smectite alteration. XRD mineralogy: Quartz dominant, minor anhydrite, chlorite/smectite mixed-layer, pyrite and illite.

VEINS/FRACTURES: Anhydrite veining (medium- to coarse-grained). Irregular, fine quartz-pyrite veins.

COMMENTS: Prominent jigsaw textures.

Core Photo



193-1189A-6R-1 (Section top: 48.6 mbsf)

ROCK NAME: Completely altered, hydrothermal breccia with flow laminated volcanic clasts.

UNIT: 9

Pieces: 1 to 10

	Core	Section	Piece	Depth (cm)	Depth
				in Section	(mbsf)
Upper contact:	5R	1	1	0	38.80
Lower contact:	6R	1	10	69	49.29
Thickness (m): 10.49					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

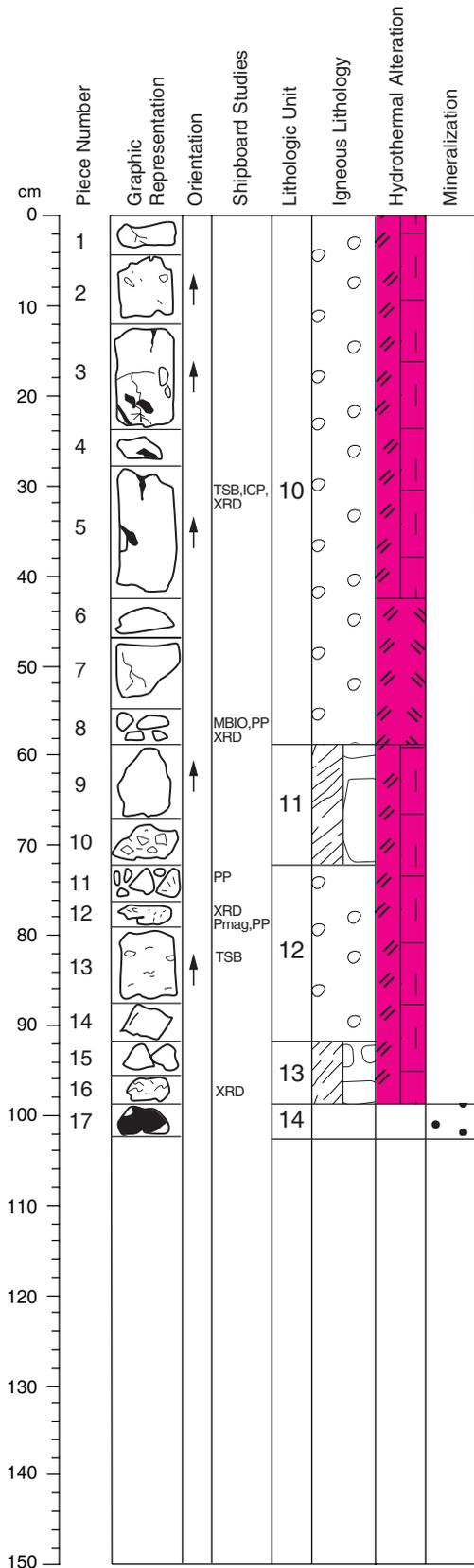
COLOR: Blue-green, white.

STRUCTURE: Clastic.

ALTERATION: Patchy to pervasive, multiphase alteration. Stage 1: Alteration of volcanics to white clay anhydrite-silica (locally preserving flow banding). Stage 2: Hydraulic brecciation with chlorite-smectite alteration associated with anhydrite veining. Stage 3: Quartz-pyrite veining with associated chlorite-smectite alteration. XRD mineralogy: Quartz dominant, minor anhydrite, chlorite/smectite mixed-layer, pyrite and illite.

COMMENTS: Prominent jigsaw breccia texture.

Core Photo



193-1189A-7R-1 (Section top: 58.3 mbsf)

ROCK NAME: Completely altered, sparsely vesicular volcanic rock.

UNIT: 10

Pieces: 1 to 8

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	1	0	58.30
Lower contact:	7R	1	8	59	58.89
Thickness (m): 0.59					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Varying from about 5% in Pieces 2 and 3, to non-vesicular in the others.

COLOR: Blue-green, gray.

STRUCTURE: Massive.

ALTERATION: Pervasive GSC alteration overprinted by silicification, which is most intense along quartz-pyrite veins. Anhydrite in the centers of some veins. Elongate vesicles sometimes form tube-like structures that are lined with quartz and pyrite and rare late anhydrite. XRD mineralogy: Quartz, plagioclase dominant, minor anhydrite, pyrite, chlorite, illite.

VEINS/FRACTURES: <1 to 3 mm anhydrite-quartz-pyrite veins and veinlets, some showing zonation with anhydrite in the core of the veins and pyrite and quartz along the rims.

ROCK NAME: Completely altered hydrothermal breccia with flow laminated volcanic clasts.

UNIT: 11

Pieces: 9 to 10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	9	59	58.89
Lower contact:	7R	1	10	72	59.02
Thickness (m): 0.13					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

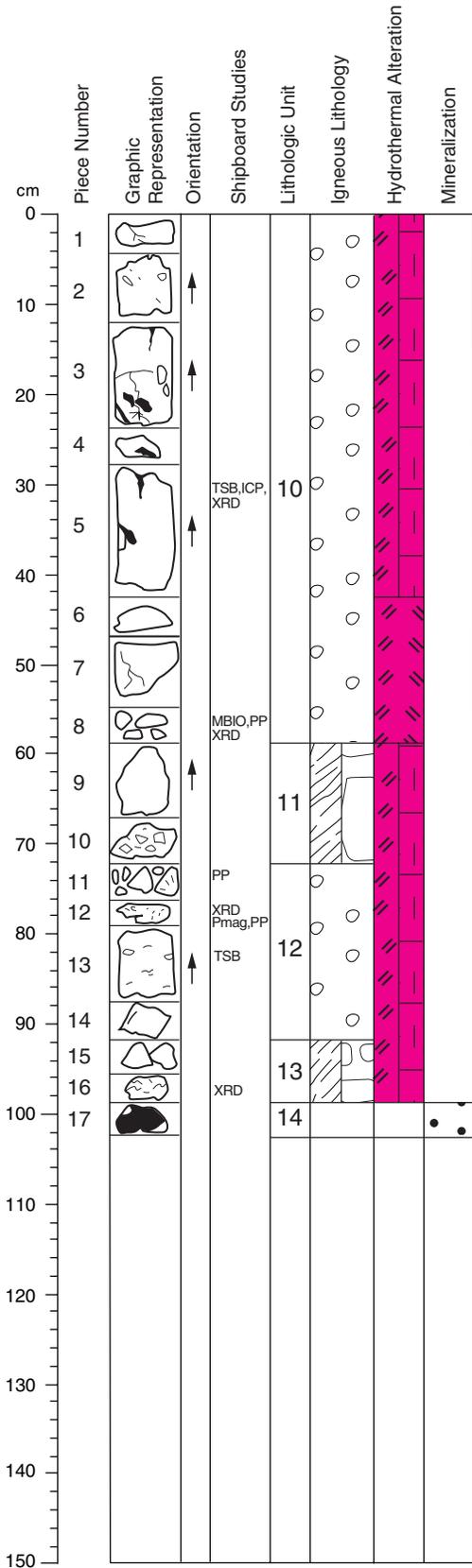
COLOR: Blue-green, white.

STRUCTURE: Clastic.

ALTERATION: Clasts show GSC alteration and are cemented in fine-grained silica.

COMMENTS: Prominent jigsaw breccia texture.

Core Photo



193-1189A-7R-1 (Section top: 58.3 mbsf)

ROCK NAME: Completely altered, sparsely vesicular volcanic rock.

UNIT: 12

Pieces: 11-14

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	11	72	59.02
Lower contact:	7R	1	14	92	59.22
Thickness (m): 0.20					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Flattened and aligned, typically 1 mm x 10 mm.

COLOR: Gray.

STRUCTURE: Massive.

ALTERATION: Extensive pervasive silicification overprinting GSC alteration. Vesicles are lined with large euhedral quartz and pyrite crystals.

ROCK NAME: Hydrothermal breccia with flow banded clasts.

UNIT: 13

Pieces: 15 to 16

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	15	92	59.22
Lower contact:	7R	1	16	99	59.29
Thickness (m): 0.07					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

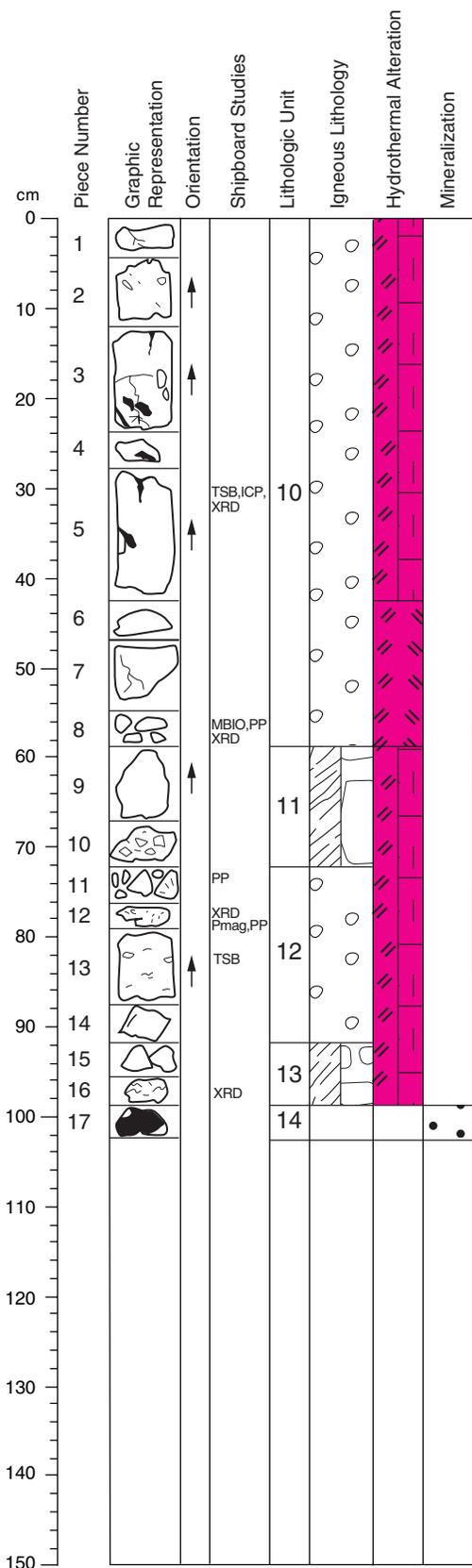
VESICLES: None.

COLOR: Green, gray.

STRUCTURE: Clastic.

ALTERATION: Clasts show GSC alteration and are cemented in fine-grained silica. XRD mineralogy: Quartz dominant, minor plagioclase, chlorite and traces of pyrite.

Core Photo



193-1189A-7R-1 (Section top: 58.3 mbsf)

ROCK NAME: Silica-Fe-oxide-pyrite with minor pale green altered clasts.

UNIT: 14

Piece: 17

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	17	99	59.29
Lower contact:	7R	1	17	102	59.32
Thickness (m): 0.03					

CONTACTS: None.

PHENOCRYSTS: None

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Red, green, gray

STRUCTURE: Clastic.

ALTERATION: Rare, whitish green altered clasts and fine pyrite euhedra are cemented in a red jasperoid cement.

COMMENTS: Breccia with soft, greenish-white clasts embedded in jasper-like material that is dotted with anhydrite and pyrite.

MINERALIZATION:

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Quartz+			
Silica	65	Very fine-grained	Granular
Anhydrite	15	Very fine-grained	Granular
Iron oxides	10	Very fine-grained	Granular

Minor minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	8	Very fine-grained	Granular

Trace minerals (<2%):

Name	Abundance (%)	Size	Morphology, Characteristics
Chalcopyrite	2	Very fine-grained	

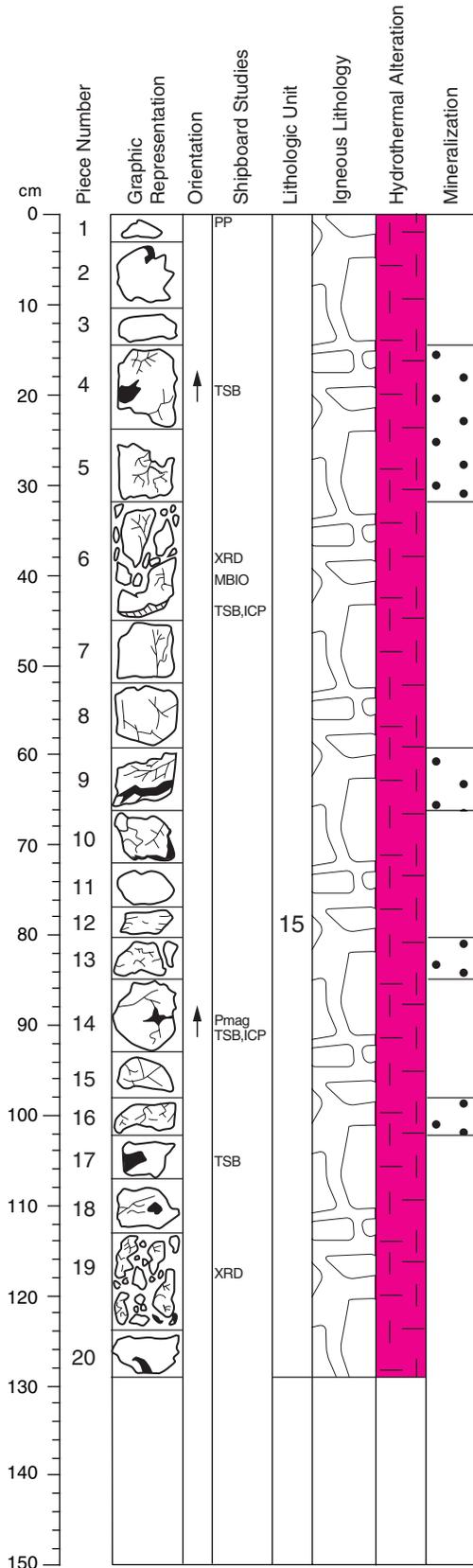
TEXTURAL DESCRIPTION:

Rounded aggregates of sulfides, mainly pyrite and trace chalcopyrite. Quartz veins crosscutting the clay.

STRUCTURES/ VEINS/FRACTURES:

Size	Veins < 0.5 mm.
Orientation	Anastomosing.
Minerals	Quartz and minor sulfides.

Core Photo



193-1189A-8R-1 (Section top: 68.0 mbsf)

ROCK NAME: Volcanic rock with patchy silicification and prominent quartz-pyrite veining.

UNIT: 15
Pieces: 1 to 20

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	8R	1	1	0	68.00
Lower contact:	8R	1	20	128	69.28
Thickness (m): 1.28					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Tan, white, gray, green.

STRUCTURE: Clastic. Jigsaw fit texture.

ALTERATION: Silicification in patches and along veins, except for Pieces 1 and 2, which show pervasive silicification. XRD mineralogy: plagioclase dominant, minor quartz, k-feldspar, pyrite, traces of smectite, chlorite and illite.

VEINS/FRACTURES: Mainly <1 to 3 mm anhydrite-pyrite veins in Pieces 2 to 4. Quartz-pyrite veins in Pieces 5 to 19, and form network in Pieces 11-19. Quartz and pyrite in about equal proportions. Veins are <0.5 mm. One is 3 mm.

COMMENTS: This unit is distinguished from others by a dominant tan color.

MINERALIZATION: Pieces: 4, 5, 9, 13 and 16. Mineralization occurs mainly as quartz-pyrite veins or quartz-anhydrite-pyrite with minor chalcopyrite

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Quartz	10-20	Very fine-grained	Granular
Anhydrite	60-80	Very fine-grained	Massive/granular
Clay	10-15	Very fine-grained	Massive

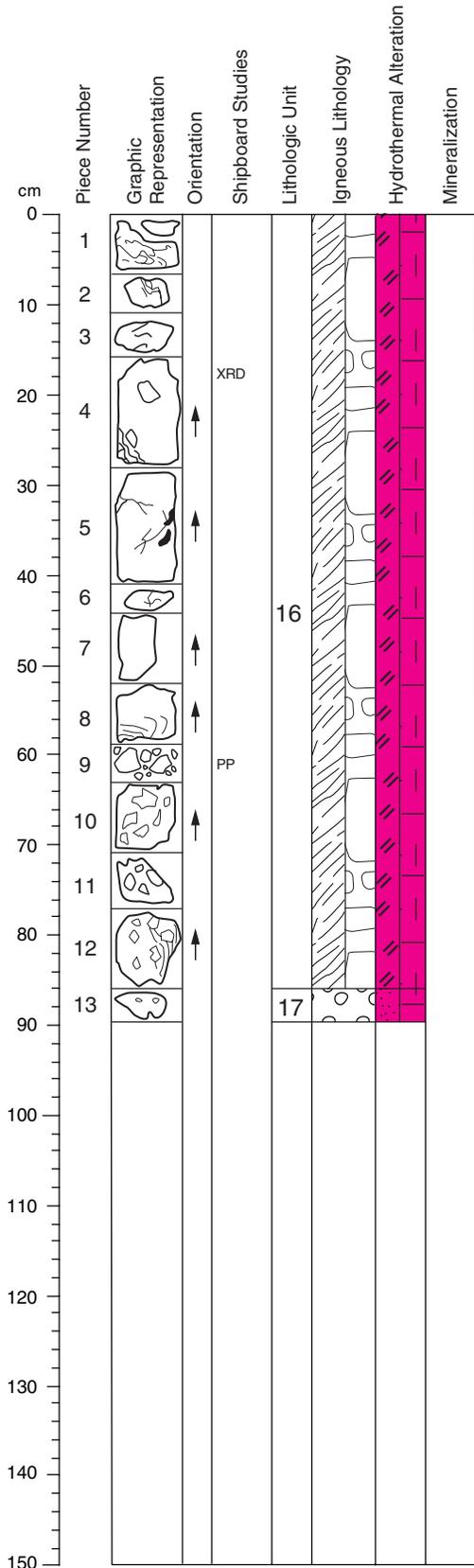
Minor minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Pyrite	4-10	Very fine-grained	Granular

Trace minerals (<2%):

Name	Abundance (%)	Size	Morphology, Characteristics
Chalcopyrite	up to 1%	Very fine-grained	Interstitial/granular

Core Photo



193-1189A-9R-1 (Section top: 77.7 mbsf)

ROCK NAME: Completely altered hydrothermal breccia with flow banded clasts.

UNIT: 16

Pieces: 1 to 12

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9R	1	1	0	77.70
Lower contact:	9R	1	12	86	78.56
Thickness (m): 0.86					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Green, white, gray.

STRUCTURE: Clastic.

ALTERATION: Rocks are composed of GSC altered material, which is cut by a network of quartz and pyrite veins with heavily silicified halos along the veins. XRD mineralogy: Anhydrite, quartz dominant, minor plagioclase, pyrite and traces of chlorite.

VEINS/FRACTURES: <1-5 mm anhydrite-quartz-pyrite veins are abundant in Pieces 5 and 8.

COMMENTS: Clasts have abundant flow banding with kink and disharmonic folds in Pieces 1, 8, and 12. There are rotated, transported flow laminated clasts (Pieces 4, 10 and 12).

ROCK NAME: Completely bleached, moderately vesicular volcanic rock.

UNIT: 17

Piece: 13

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9R	1	13	86	78.56
Lower contact:	10R	1	2	8	87.38
Thickness (m): 8.82					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

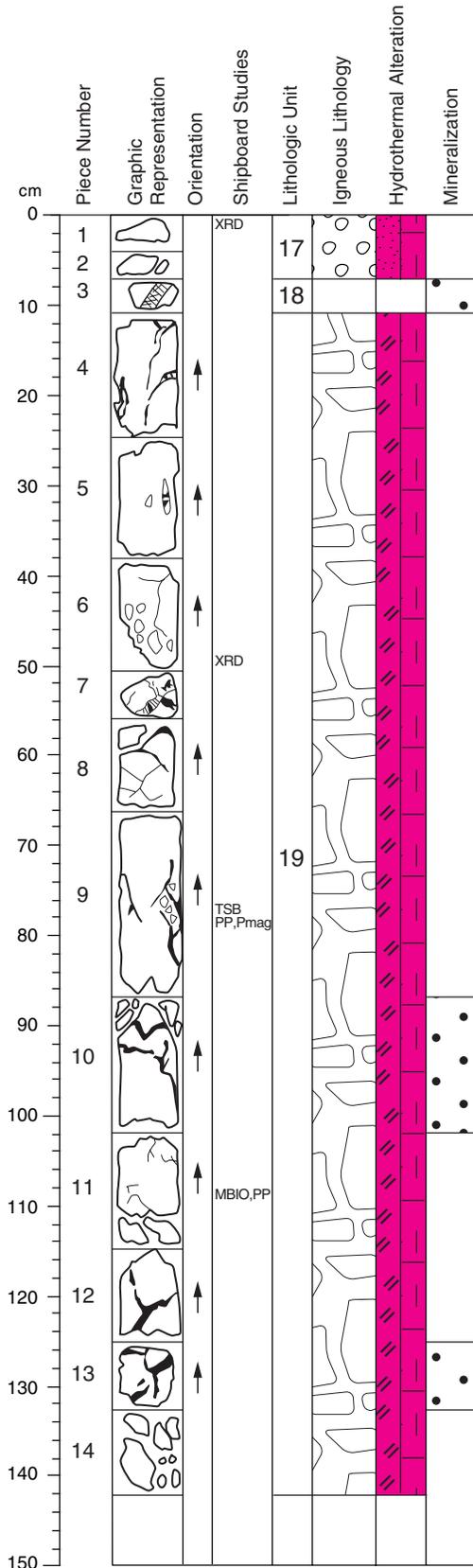
VESICLES: Tubular vesicles 1 mm across and 1 cm long.

COLOR: White, gray.

STRUCTURE: Massive.

ALTERATION: Completely bleached and slightly silicified. XRD mineralogy: Quartz dominant, minor plagioclase, pyrite and traces of chlorite.

Core Photo



193-1189A-10R-1 (Section top: 87.3 mbsf)

ROCK NAME: Completely bleached, moderately vesicular volcanic rock.

UNIT: 17

Pieces: 1 to 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	9R	1	13	86	78.56
Lower contact:	10R	1	2	8	87.38
Thickness (m): 8.82					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Green, white, gray.

STRUCTURE: Clastic.

ALTERATION: Completely bleached and slightly silicified. XRD mineralogy: Quartz dominant, minor plagioclase, pyrite and traces of chlorite.

ROCK TYPE: Completely altered and mineralized breccia.

Unit: 18

Piece: 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	3	8	87.38
Lower contact:	10R	1	3	11	87.41
Thickness (m): 0.03					

CONTACTS: None.

COLOR: Greenish gray.

MINERALIZATION:

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Quartz	50	Very fine-grained	Granular
Anhydrite	35	Very fine-grained	Granular
Pyrite	15	Very fine-grained	Granular

Minor minerals: None.

Trace minerals (<2%): None.

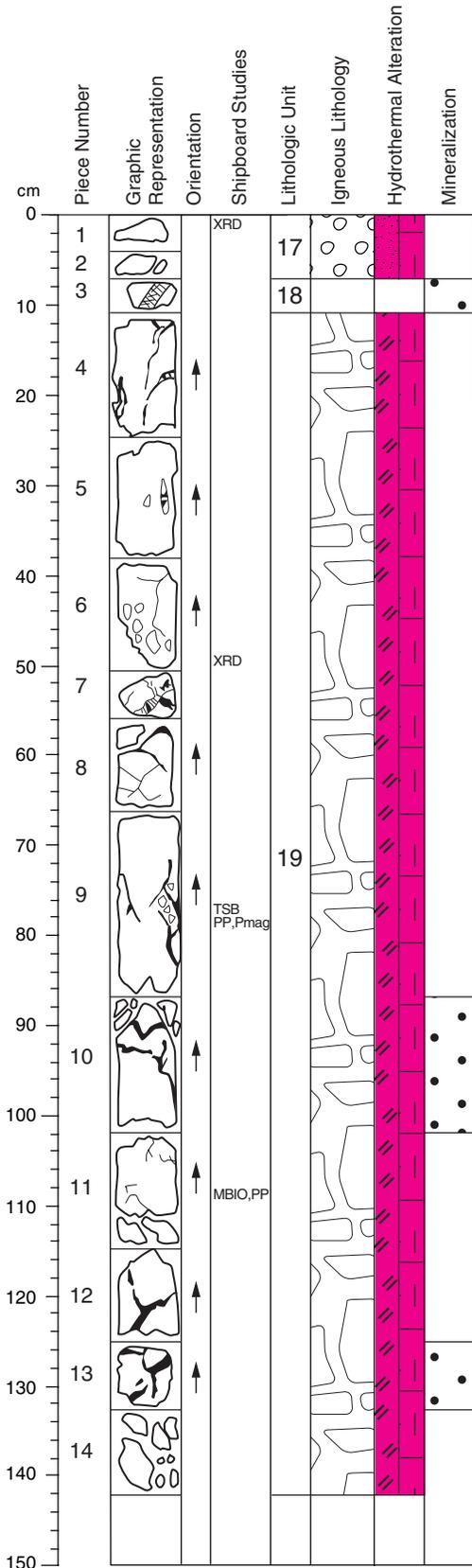
TEXTURAL DESCRIPTION: Pyrite occurs as disseminations and in veins within a quartz-anhydrite altered volcanic rock.

STRUCTURES/ VEINS/FRACTURES:

Size	Veins < 0.5 mm.
Orientation	
Minerals	>50% pyrite

ADDITIONAL COMMENTS: Similar material is in Pieces 10 and 13 in Unit 19.

Core Photo



193-1189A-10R-1 (Section top: 87.3 mbsf)

ROCK NAME: Completely altered and veined hydrothermal breccia.

UNIT: 19

Pieces: 4 to 14

Interval Location:	Core	Section	Piece in Section	Depth (cm)	Depth (mbsf)
Upper contact:	10R	1	4	11	87.41
Lower contact:	10R	1	14	142	88.72
Thickness (m): 1.31					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Green, white, gray, tan, blue.

STRUCTURE: Clastic.

ALTERATION: GSC alteration overprinted by silicification. Bluish-gray domains in the core are heavily silicified, while greenish domains are soft (clayey). Quartz and pyrite veins often have anhydrite vug fill. XRD mineralogy: Quartz and anhydrite dominant, minor plagioclase and pyrite, traces of chlorite and illite.

VEINS/FRACTURES: Abundant 0.1 to 3 mm anhydrite-quartz-pyrite veins with minor chalcopyrite.

MINERALIZATION: Pieces: 10 and 13.
 Pyrite occur as disseminations and in veins within a quartz-anhydrite altered volcanic rock.

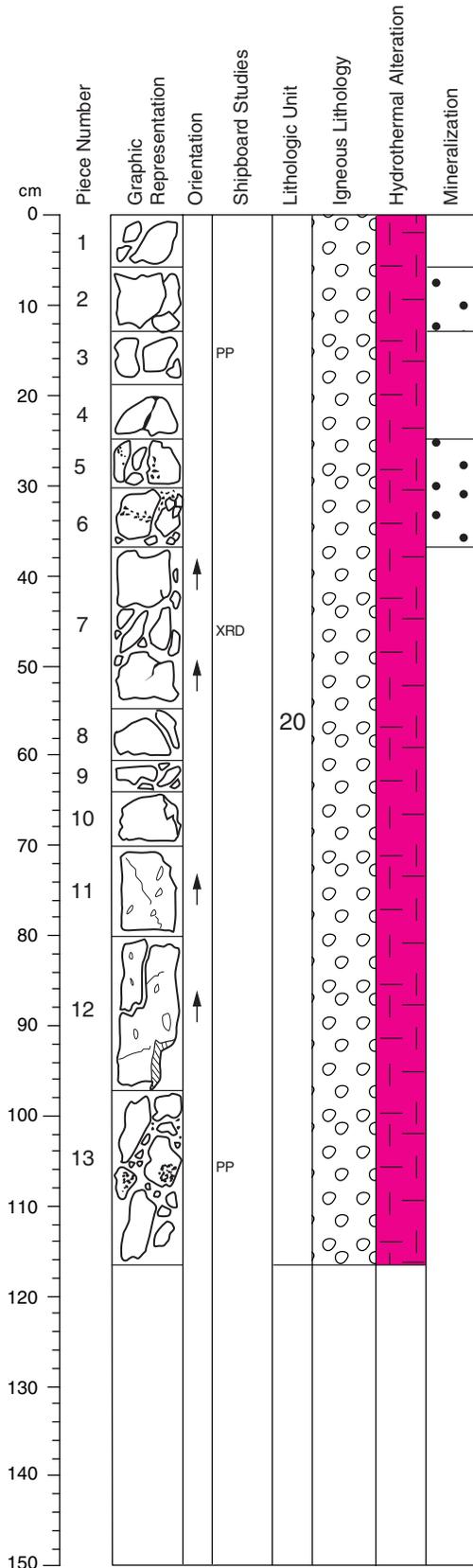
Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
(Pieces 10, 13)			
Quartz	20, 7	Very fine-grained	Granular
Anhydrite	70, 80	Very fine-grained	Granular
Pyrite	7, 10	Very fine-grained	Granular

STRUCTURES/VEINS/FRACTURES:
 Size Veins < 0.5 mm.
 Minerals >50% pyrite

COMMENTS: Prominent jigsaw breccia texture.

Core Photo



193-1189A-11R-1 (Section top: 96.9 mbsf)

ROCK NAME: Completely silicified, moderately vesicular volcanic rock.

UNIT: 20

Pieces: 1 to 13

Interval Location:	Core	Section	Piece	Depth (cm)	Depth (mbsf)
Upper contact:	11R	1	1	0	96.90
Lower contact:	12R	1	15	120	107.70
Thickness (m): 10.80					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Vesicles vary from mm-scale to cm-scale vugs that appear to be coalesced vesicles. Vesicles are elongated and steeply-oriented in Pieces 8 and 10, and define a curved flow direction in Piece 7.

COLOR: White, gray.

STRUCTURE: Massive.

ALTERATION: Intense silicification overprinting patchily preserved green clay alteration. Vugs and vesicles are often lined with quartz and pyrite. Quartz-pyrite veins commonly have silicified halos. XRD mineralogy: quartz dominant, minor pyrite, illite, and chlorite.

VEINS/FRACTURES: 1 to 3 mm quartz-pyrite veins in Pieces 3, 6 to 9 and 13.

COMMENTS: Entire unit is noticeably coarser-grained than previous units, imposing a sugary appearance to the rock.

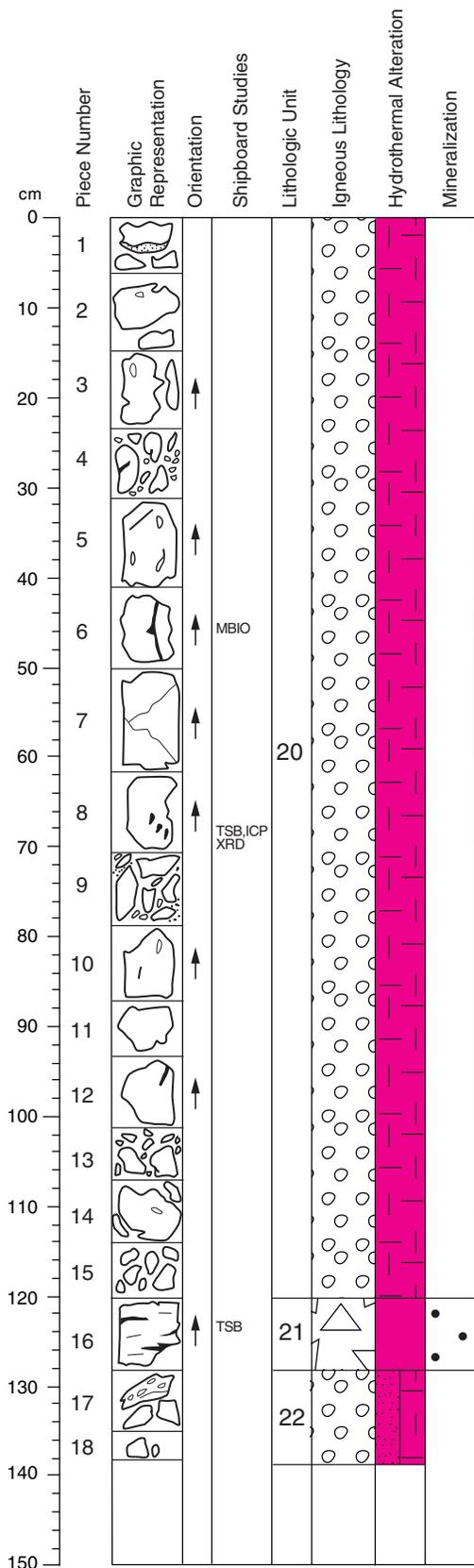
MINERALIZATION: Pieces: 2, 5, and 6.

Pyrite occurs as discrete subhedral to euhedral crystals lining vesicles, overlapping quartz in Piece 2. Piece 5 contains disseminated pyrite and Piece 6 contains, in addition, quartz-pyrite veinlets.

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Quartz	40-85	Very fine-grained	Granular
Anhydrite	45-55	Very fine-grained	Granular
Pyrite	5-15	Very fine-grained	Granular

Core Photo



193-1189A-12R-1 (Section top: 106.5 mbsf)

ROCK NAME: Completely silicified, moderately vesicular volcanic rock.

UNIT: 20

Pieces: 1 to 15.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	1	0	96.90
Lower contact:	12R	1	15	120	107.70
Thickness (m): 10.80					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: Vesicles vary from mm-scale to cm-scale vugs that appear to be coalesced vesicles and are typically elongated.

COLOR: White, gray.

STRUCTURE: Massive.

ALTERATION: Intense silicification overprinting patchily preserved green clay alteration. Vugs and vesicles are often lined with quartz and pyrite. Pyrite veins commonly have silicified halos. XRD mineralogy: quartz dominant, minor pyrite, illite, and chlorite.

VEINS/FRACTURES: Quartz-anhydrite-pyrite veins in Pieces 1, 2 6 and 7. Thickness between 0.5 and 3 mm.

ROCK NAME: Altered and mineralized volcanoclastic breccia.

UNIT: 21

Piece: 16

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	12R	1	16	120	107.70
Lower contact:	12R	1	16	128	107.78
Thickness (m): 0.08					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

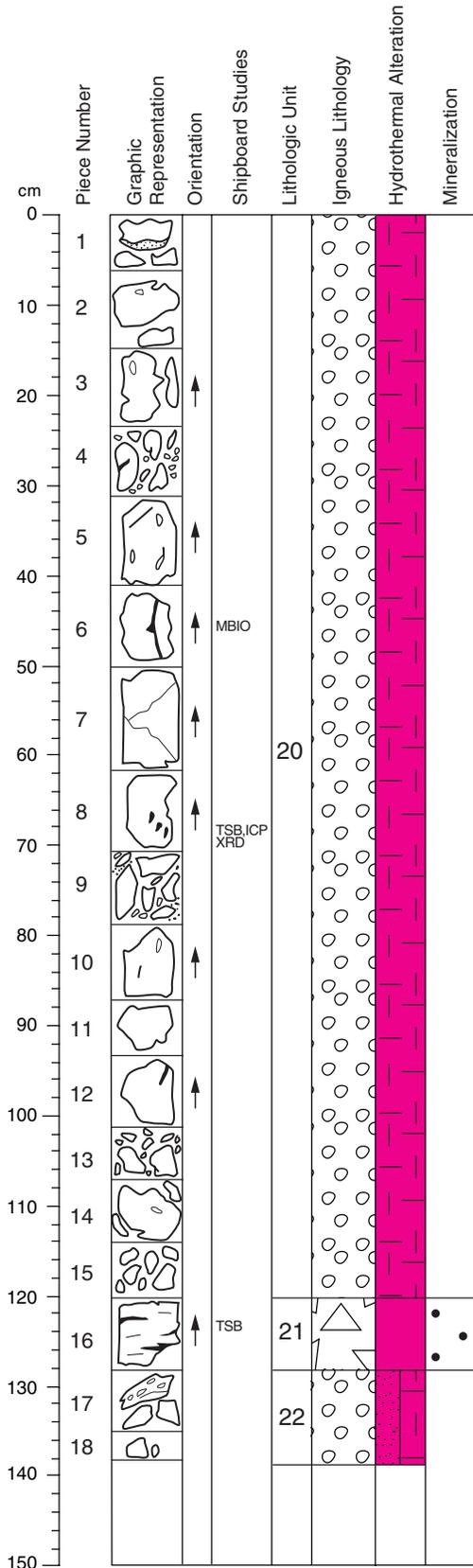
COLOR: Black, green, yellow.

STRUCTURE: Clastic.

ALTERATION: Clasts of anhydrite and sulfide (pyrite+minor chalcocopyrite) in a very fine-grained silica-pyrite cement. Volcanic clasts consist of silica and/or chlorite altered glass.

COMMENTS: Sulfide impregnated volcanoclastic breccia with abundant pumice clasts with well-preserved tube vesicles.

Core Photo



193-1189A-12R-1 (Section top: 106.5 mbsf)

MINERALIZATION:

Sulfide mineralization. Patches (clasts ?) of disseminated chalcopyrite and pyrite in quartz-anhydrite matrix.

Major minerals:

Name	Abundance (%)	Size	Morphology, Characteristics
Anhydrite	40	Very fine-grained	Granular
Quartz	30	Very fine-grained	Granular
Chalcopyrite	20	Very fine-grained	Granular
Pyrite	10	Very fine-grained	Granular

ROCK NAME: Pervasively bleached, moderately vesicular volcanic rock with patchy silicification.

UNIT: 22.

Pieces: 17 to 18

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	12R	1	17	128	107.78
Lower contact:	12R	1	18	138	107.88
Thickness (m): 0.10					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

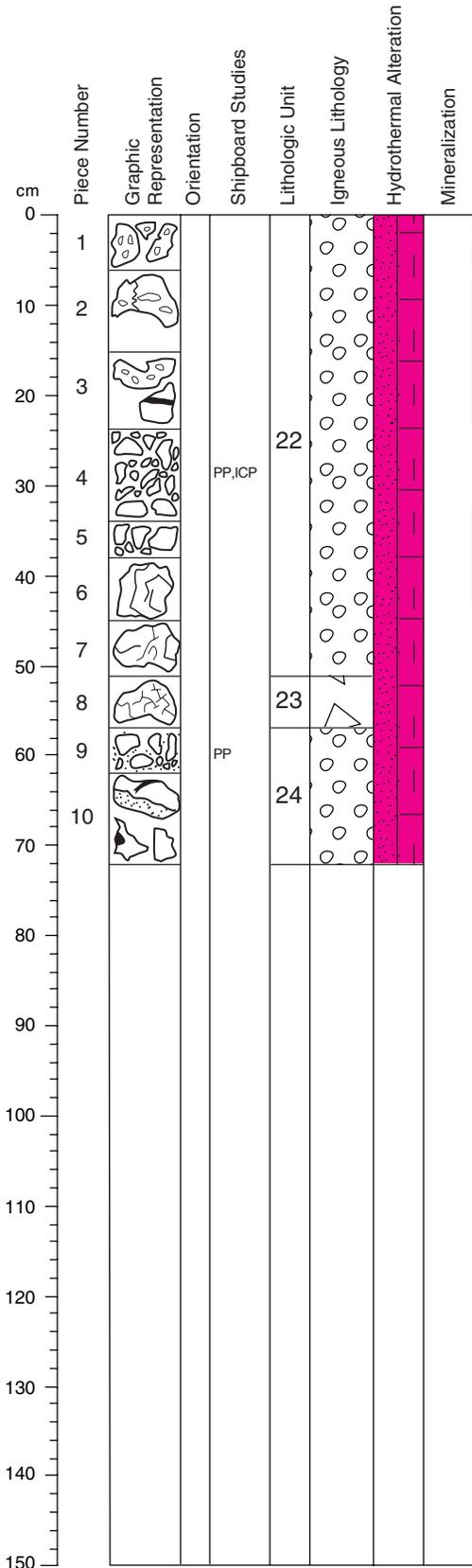
VESICLES: Moderately vesicular to amygdaloidal.

COLOR: Gray, white.

STRUCTURE: Massive.

ALTERATION: Vesicular intensely bleached volcanic unit with patchily developed indurated silicification. Widespread pyrite as vesicle lining. XRD mineralogy: Quartz dominant, minor chlorite, pyrite, illite.

Core Photo



193-1189A-13R-1 (Section top: 116.1 mbsf)

ROCK NAME: Pervasively bleached, moderately vesicular volcanic rock with patchy silicification.

UNIT: 22.

Pieces: 1 to 7

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	1	0	116.10
Lower contact:	13R	1	7	51	116.61
Thickness (m): 0.51					

CONTACTS: None.

PHENOCRYSTS: Aphyric.

GROUNDMASS: Very fine-grained.

VESICLES: 10% to 15%. Large size range, many large, elongate vesicles: 2 to 3 mm x 3 to 20 mm.

COLOR: Gray, light gray.

STRUCTURE: Massive.

ALTERATION: Vesicular intensely bleached volcanic unit with patchily developed indurated silicification. Widespread pyrite as vesicle lining. XRD mineralogy: Quartz dominant, minor chlorite, pyrite, illite.

VEINS/FRACTURES: 1-1.5 mm quartz-anhydrite-pyrite veins with mm halos of gray clay minerals in Pieces 2-5 and 7. Piece 6 resembles a breccia with abundant quartz veinlets with minor pyrite forming a network.

ROCK NAME: Altered, polymict volcanic breccia.

UNIT: 23.

Piece: 8

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	8	51	116.61
Lower contact:	13R	1	8	59	116.69
Thickness (m): 0.08					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

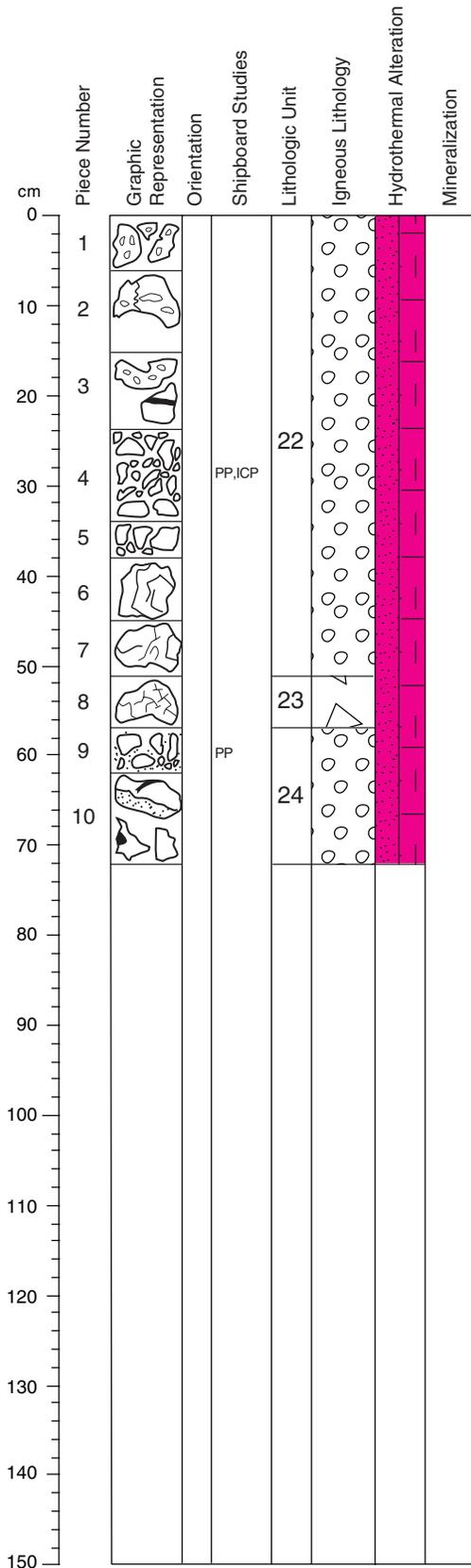
COLOR: Green, light gray, gray.

STRUCTURE: Clastic. Green (clay-rich) clasts and light gray (silicified and bleached) clasts cemented in silica (gray).

ALTERATION: Three distinct clast types, all showing differing alteration types, suggesting a polymict nature. Most of the more clay-rich pieces have silicified rims adjacent to the siliceous cement. Traces of disseminated pyrite.

COMMENTS: Rotated flow laminated clasts. Resembles Piece 6 in unit 22.

Core Photo



193-1189A-13R-1 (Section top: 116.1 mbsf)

ROCK NAME: Pervasively bleached, moderately vesicular volcanic rock with patchy silicification.

UNIT: 24.

Pieces: 9 to 10.

	Core	Section	Piece	Depth (cm)	Depth
			in Section		(mbsf)
Upper contact:	13R	1	9	59	116.69
Lower contact:	13R	1	10	72	116.82
Thickness (m):	0.13				

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 10% to 15%. Large size range, many large, elongate vesicles: 2 to 3 mm x 3 to 20 mm.

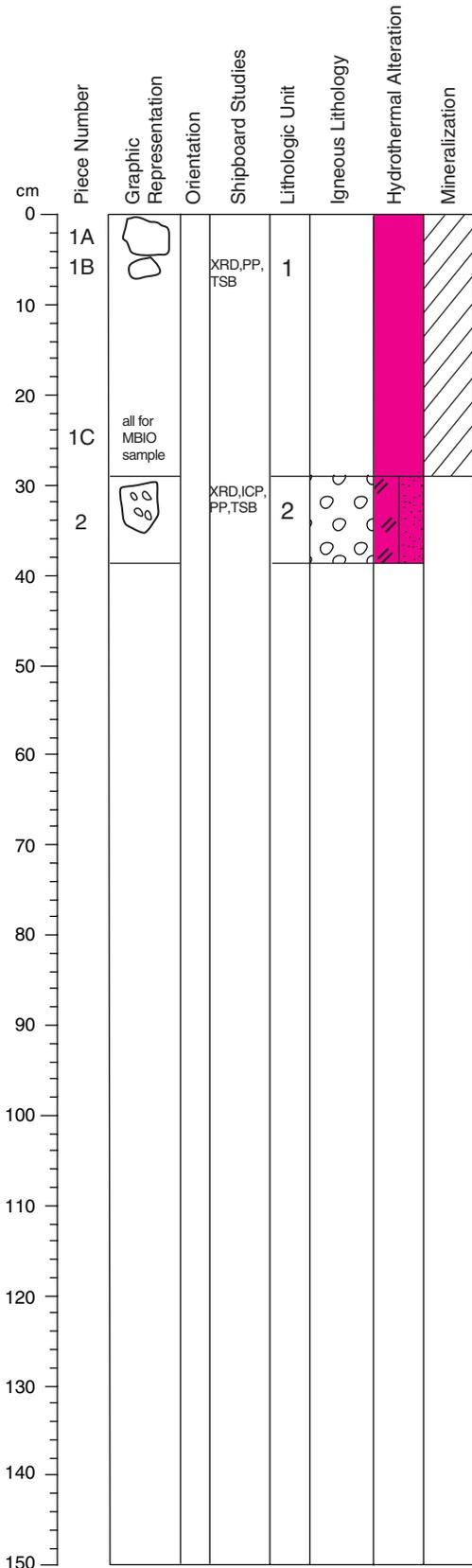
COLOR: Gray, light gray.

STRUCTURE: Massive.

ALTERATION: Vesicular intensely bleached volcanic unit with patchily developed indurated silicification.

VEINS/FRACTURES: 10 mm vein of quartz, anhydrite and pyrite at the rim of Piece 10.

Core Photo



193-1189B-1R-1 (Section top: 31.0 mbsf)

ROCK NAME: Semi-massive sulfide with sparse volcanic rock clasts.

UNIT: 1

Piece: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1R	1	1	0	31.00
Lower contact:	1R	1	1	29	31.29
Thickness (m): 0.29					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained pyrite-anhydrite-quartz matrix.

VESICLES: Present in some volcanic rock clasts.

COLOR: Gold, dark gray.

STRUCTURE: Massive granular and clastic.

ALTERATION: Clasts are completely-altered to GSC.

VEINS/FRACTURES: None.

COMMENTS: The semi-massive sulfide contains 2- to 3-mm clasts of altered volcanic rock that are vesicular.

MINERALIZATION: Pieces 1A and 1B are semimassive sulfides containing 30% very fine-grained pyrite and 20% very fine-grained chalcocopyrite as patches in the groundmass and coating anhydrite crystals.

ROCK NAME: Completely-altered, moderately-vesicular, aphyric volcanic rock.

UNIT: 2

Piece: 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	1R	1	2	29	31.29
Lower contact:	1R	1	2	39	31.39
Thickness (m): 0.10					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 10%, elongated and aligned vesicles up to 5 mm long and 2 mm high.

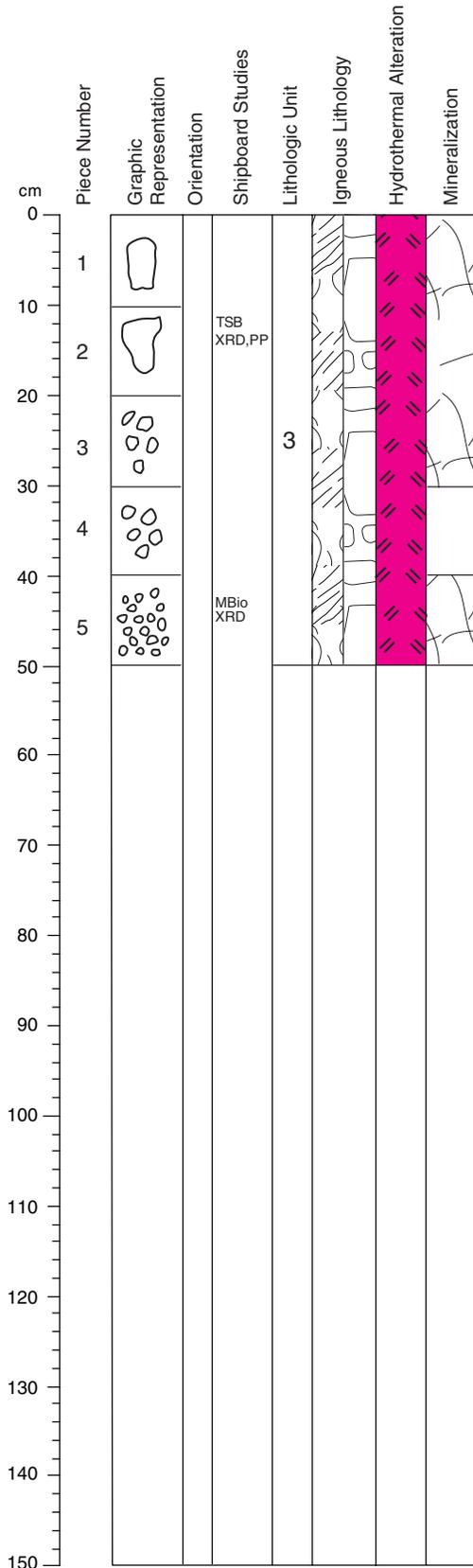
COLOR: Light green-gray.

STRUCTURE: Vesicular.

ALTERATION: Soft GSC altered. Pyrite lines vesicles.

VEINS/FRACTURES: None.

Core Photo



193-1189B-2R-1 (Section top: 40.1 mbsf)

ROCK NAME: Breccia of completely-altered volcanic rock clasts in a pyrite-anhydrite matrix.

UNIT: 3

Pieces: 1-5

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	1	0	40.10
Lower contact:	3R	1	8	84	50.54
Thickness (m): 10.44					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 5% in Piece 4.

COLOR: Light blue-green clasts in dark matrix.

STRUCTURE: Clastic.

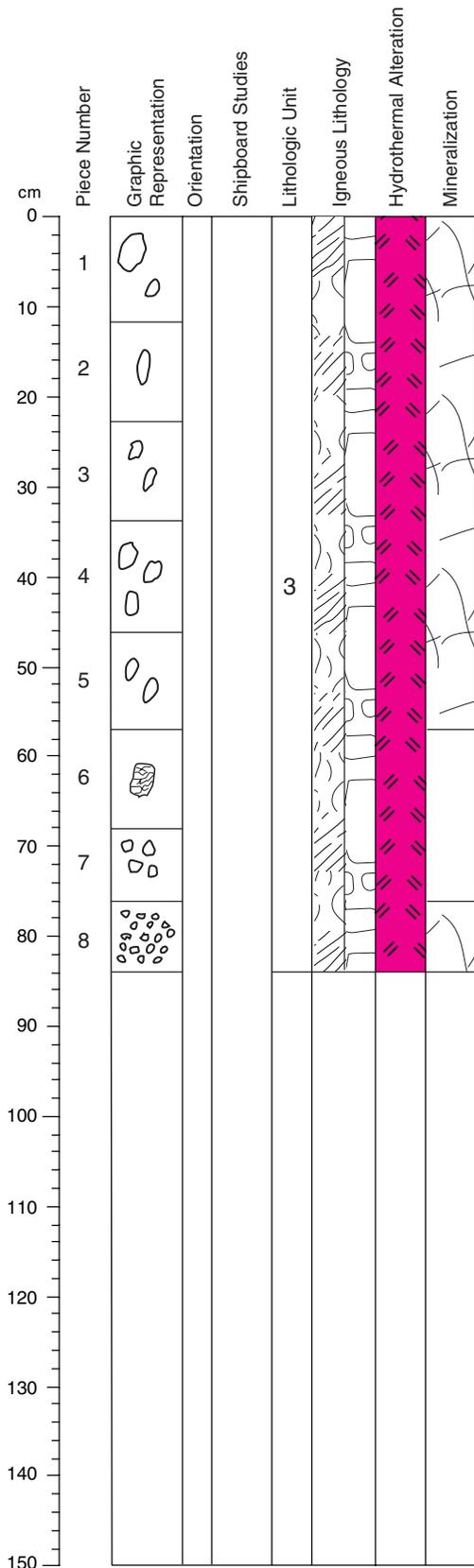
ALTERATION: Complete GSC alteration and disseminated pyrite in volcanic rock clasts.

VEINS/FRACTURES: Pyrite-anhydrite±silica stockwork veinlets show ladder textures that parallel and crosscut flow banding in clasts (Piece 1).

COMMENTS: Piece 4 has no veins but hosts disseminated pyrite (8%). Piece 1 contains clasts with laminar internal texture (flow banding?). These show random orientations.

MINERALIZATION: Pieces 1, 2, 3, and 5 contain 5% to 15% very fine-grained pyrite as disseminations in the matrix and the clasts, in vugs and cementing altered clasts. Piece 5 contains trace very fine-grained chalcopyrite and trace bornite as a film coating pyrite.

Core Photo



193-1189B-3R-1 (Section top: 49.7 mbsf)

ROCK NAME: Breccia of completely-altered volcanic rock clasts in a pyrite-anhydrite matrix.

UNIT: 3

Pieces: 1-8.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	2R	1	1	0	40.10
Lower contact:	3R	1	8	84	50.54
Thickness (m): 10.44					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 1% in Piece 6, 2% in Piece 3, and 5% in Pieces 7 and 8.

COLOR: Light blue-green clasts in dark matrix.

STRUCTURE: Clastic.

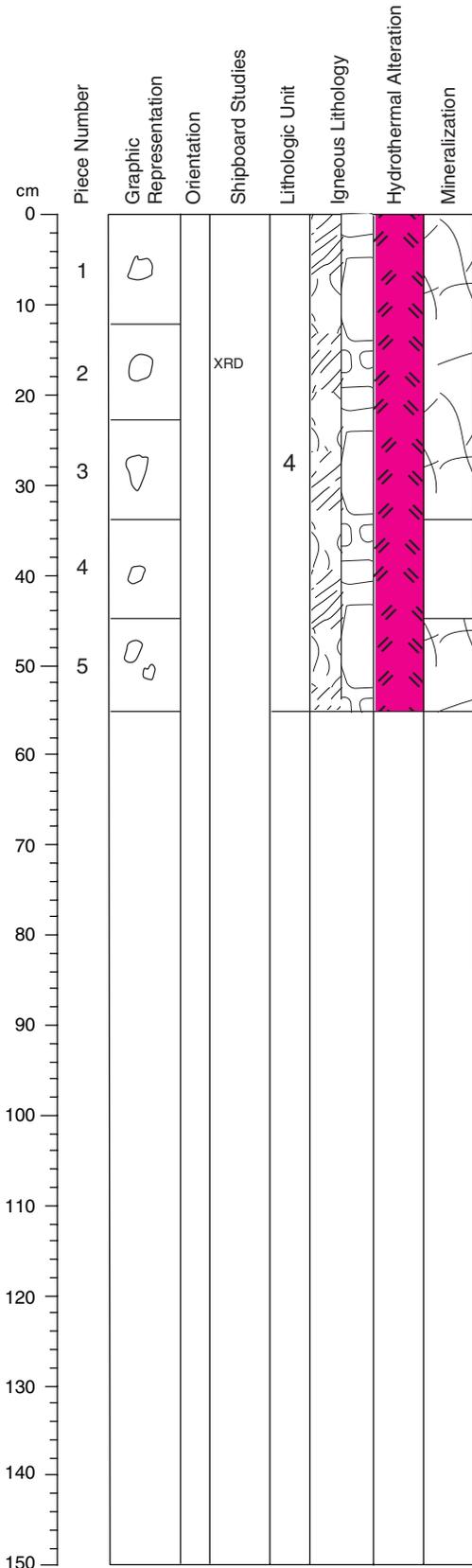
ALTERATION: Complete GSC alteration and disseminated pyrite in volcanic rock clasts.

VEINS/FRACTURES: Pyrite-anhydrite±silica stockwork. Pyrite vein with anhydrite selvages in Piece 3.

COMMENTS: Piece 6 has an unusual striped texture that may represent sub-mm scale flow banding. It has a few elongated vesicles and disseminated pyrite as well.

MINERALIZATION: Pieces 1-5 contain 10% to 60% of very fine-grained semimassive and vein pyrite. Piece 5 contains disseminated pyrite as well. The veins are anhydrite. Piece 4 also contains 3% chalcopyrite, 1% of a dark mineral that appears to be sphalerite and traces of a blue tarnish on pyrite that is probably a film of bornite. Both chalcopyrite and sphalerite (?) overgrow pyrite. The paragenetic relationship between chalcopyrite and sphalerite is unknown.

Core Photo



193-1189B-5R-1 (Section top: 69.3 mbsf)

ROCK NAME: Breccia of completely-altered volcanic rock clasts in a pyrite-quartz matrix.

UNIT: 4

Pieces: 1-5.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	5R	1	1	0	69.30
Lower contact:	5R	1	5	55	69.85
Thickness (m): 0.55					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light blue-green clasts in dark matrix.

STRUCTURE: Clastic. Clasts are angular.

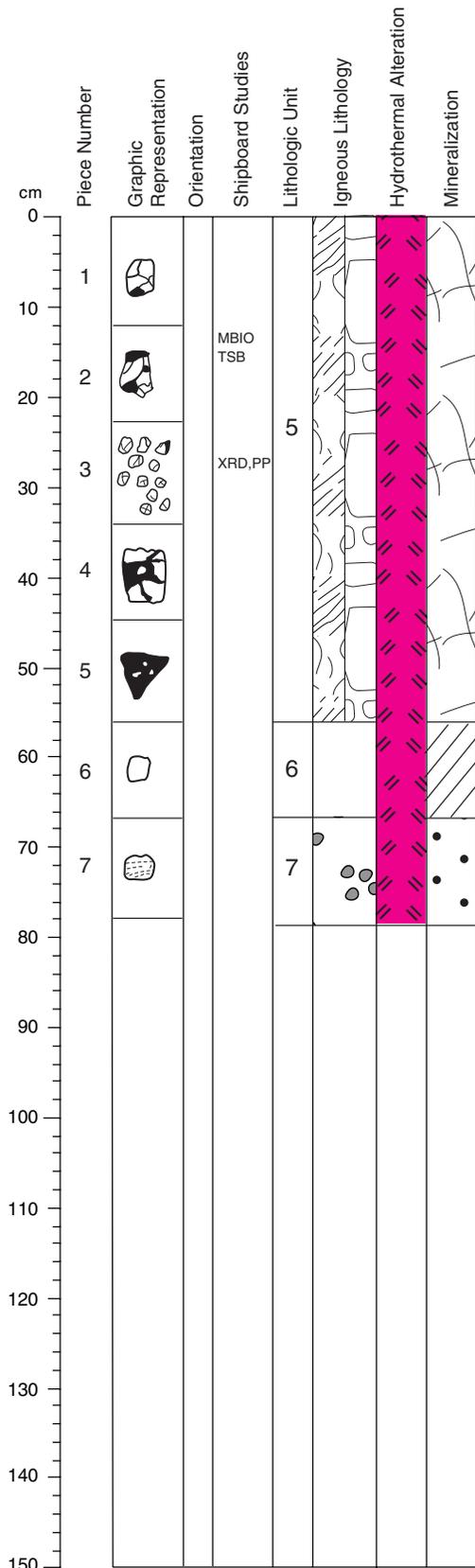
ALTERATION: Complete GSC alteration and disseminated pyrite in volcanic rock clasts. Minor anhydrite lining vugs in Piece 2. Euhedral quartz crystals line vugs in Piece 5.

VEINS/FRACTURES: Quartz-pyrite stockwork.

COMMENTS: Pieces 1, 2, and 5 contain between 40% and 70% pyrite, and are semimassive sulfides. Piece 4 is a completely-altered volcanic rock with 3-mm diameter concentric circular structures resembling an altered perlite.

MINERALIZATION: Pieces 1, 2, and 5 are semimassive with 70, 40, and 50%, respectively, of very fine grained vuggy pyrite in a quartz matrix cementing altered volcanic fragments. Quartz overgrows pyrite showing that it formed later than pyrite. Piece 3 contains 5% of very fine-grained disseminated pyrite.

Core Photo



193-1189B-6R-1 (Section top: 79.0 mbsf)

ROCK NAME: Breccia of completely-altered volcanic rock clasts in a pyrite-quartz matrix.

UNIT: 5

Pieces: 1-5.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6R	1	1	0	79.00
Lower contact:	6R	1	5	56	79.56
Thickness (m): 0.56					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green-gray to red.

STRUCTURE: Clastic.

ALTERATION: Complete GSC alteration in volcanic rock clasts, some of which are slightly silicified, and some of which are highly porous (up to 50% pores).

VEINS/FRACTURES: Quartz-hematite-pyrite stockwork. Quartz hairline-veinlets in some of the clayey clasts. Anhydrite overgrows quartz in Piece 5.

COMMENTS: Thick veins are enriched in hematite, which is situated at the center of the veins, commonly with drusy quartz.

ROCK NAME: Massive sulfide.

UNIT: 6

Piece: 6.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6R	1	6	56	79.56
Lower contact:	6R	1	6	67	79.67
Thickness (m): 0.11					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: None.

VESICLES: None.

COLOR: Gold.

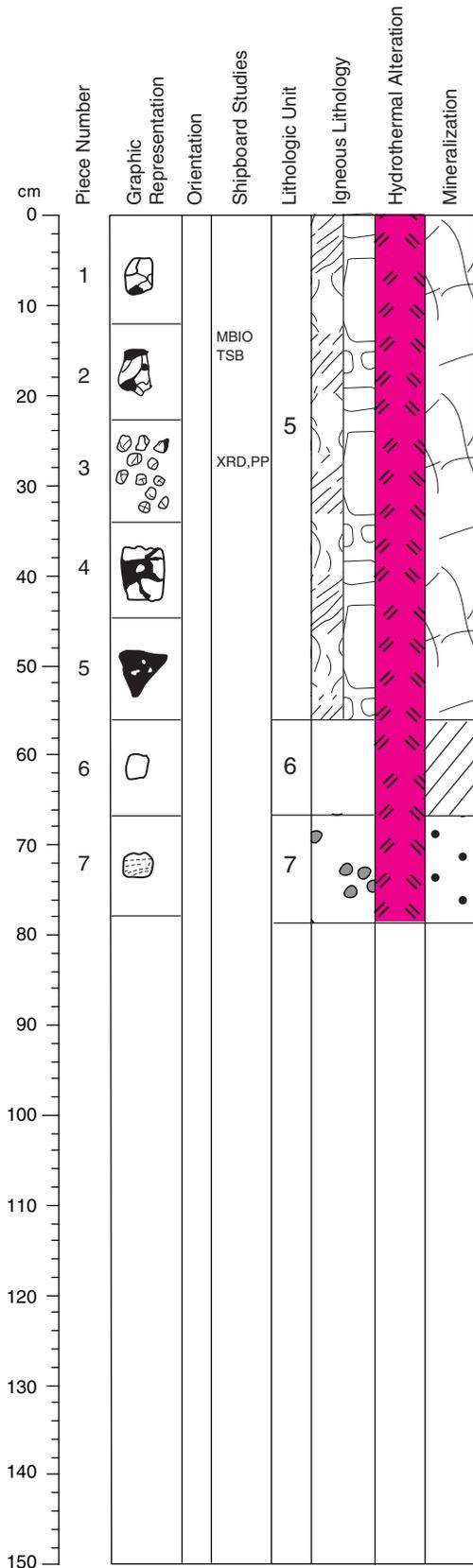
STRUCTURE: Massive.

ALTERATION: 90% pyrite with 9% quartz and 1% anhydrite.

VEINS/FRACTURES: None.

COMMENTS: None.

Core Photo



193-1189B-6R-1 (Section top: 79.0 mbsf)

MINERALIZATION: Approximately 1 cc piece of massive sulfide consisting of 90% very fine-grained vuggy euhedral pyrite with traces of chalcopyrite and reddish brown sphalerite.

ROCK NAME: Completely-altered moderately amygdaloidal volcanic rock.

UNIT: 7
Piece: 7.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	6R	1	7	67	79.67
Lower contact:	6R	1	7	78	79.78
Thickness (m): 0.11					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green-gray to dark gray.

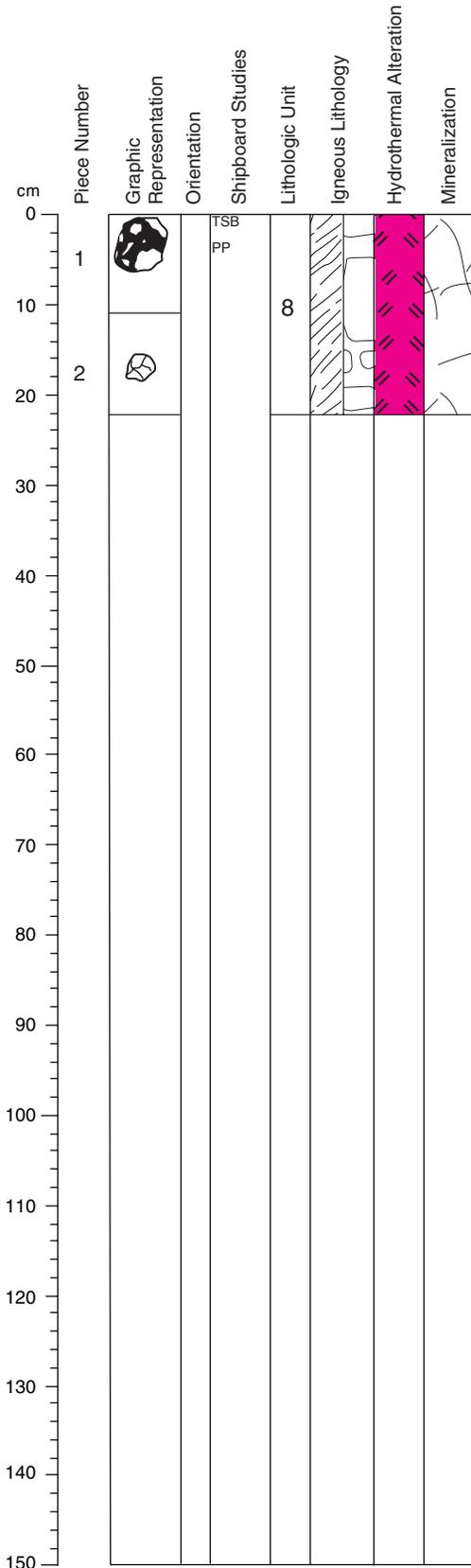
STRUCTURE: Massive.

ALTERATION: Soft clayey rock with quartz amygdules.

VEINS/FRACTURES: None.

COMMENTS: The rock contains vestiges of flow banding and an irregular distribution of <1-mm diameter spherical quartz amygdules making up ~20% of the rock.

Core Photo



193-1189B-7R-1 (Section top: 88.7 mbsf)

ROCK NAME: Breccia of completely-altered volcanic rock clasts in an anhydrite-pyrite-quartz matrix.

UNIT: 8

Pieces: 1-2.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	7R	1	1	0	88.70
Lower contact:	7R	1	2	22	88.92
Thickness (m): 0.22					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green-gray to dark gray.

STRUCTURE: Clastic.

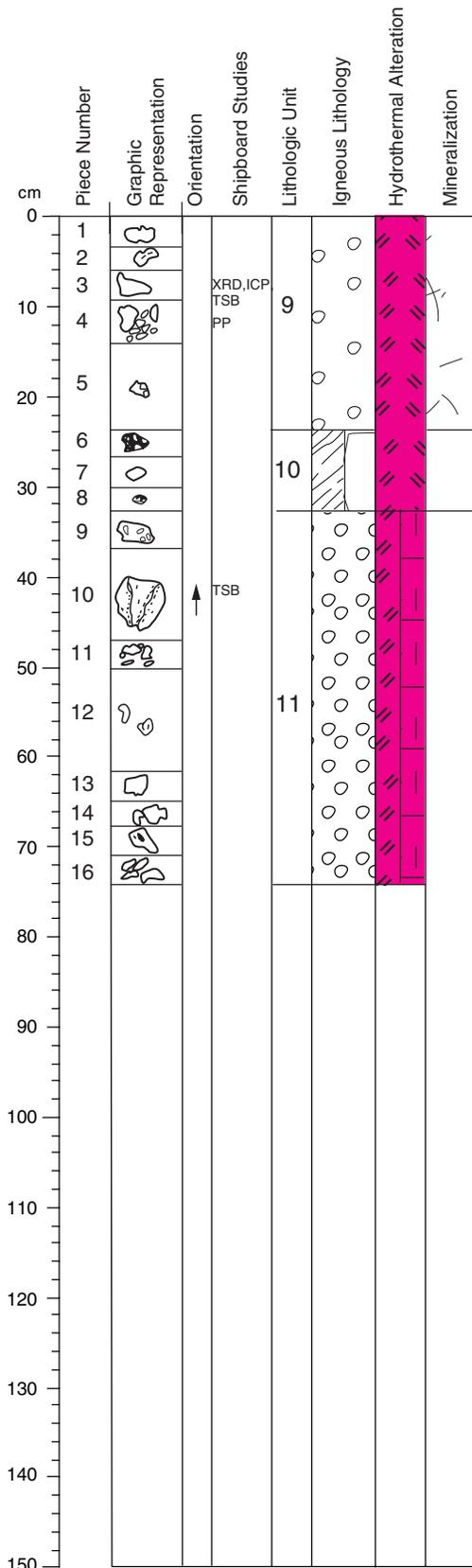
ALTERATION: Soft clayey rock with 2% disseminated pyrite. Late anhydrite fills vugs.

VEINS/FRACTURES: Pyrite-anhydrite-quartz stockwork.

COMMENTS: The rock contains vestiges of flow banding and an irregular distribution of <1-mm diameter spherical quartz amygdales making up about 20% of the rock.

MINERALIZATION: Pieces 1 and 2 contain 15 and 10%, respectively, of very fine-grained pyrite in quartz (predominantly)-anhydrite veins and as disseminations in altered volcanic fragments. Pyrite overgrows quartz in vugs.

Core Photo



193-1189B-8R-1 (Section top: 98.4 mbsf)

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

UNIT: 9

Pieces: 1-5.

Interval Location:	Core	Section	Piece	Depth (cm)	Depth (mbsf)
Upper contact:	8R	1	1	0	98.40
Lower contact:	8R	1	5	24	98.64
Thickness (m): 0.24					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Between 2% and 7%, many of which are elongate and oriented.

COLOR: Light green-gray to dark gray.

STRUCTURE: Vesicular.

ALTERATION: Completely GSC altered, with patchy silicification. Quartz is a common vesicle fill. Piece 5 has 5% pyrite lining vugs, which also have silicified dark gray halos. The vugs also contain solitary anhydrite crystals.

VEINS/FRACTURES: Quartz-pyrite veins in Piece 2.

COMMENTS: More silicified than previous units.

ROCK NAME: Breccia of completely-altered volcanic rock clasts in a pyrite-quartz matrix.

UNIT: 10

Pieces: 6-8.

Interval Location:	Core	Section	Piece	Depth (cm)	Depth (mbsf)
Upper contact:	8R	1	6	24	98.64
Lower contact:	8R	1	8	33	98.75
Thickness (m): 0.11					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

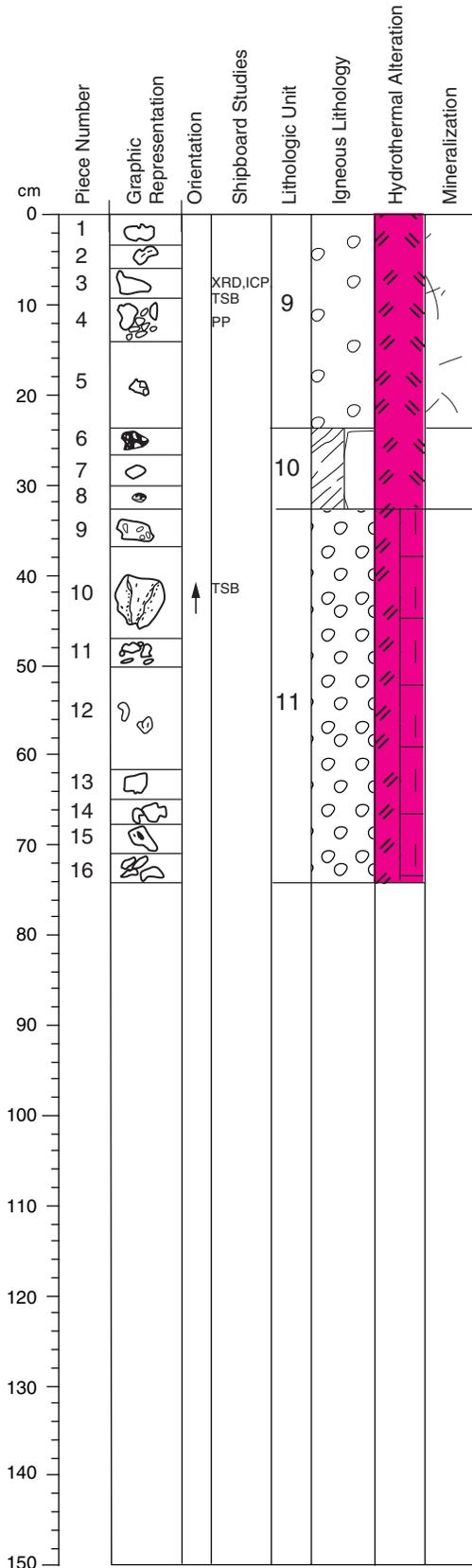
COLOR: Light green-gray and light tan to dark gray.

STRUCTURE: Clastic.

ALTERATION: Rock fragments are either greenish-gray and very soft or light tannish-gray and silicified.

VEINS/FRACTURES: Stockwork.

Core Photo



193-1189B-8R-1 (Section top: 98.4 mbsf)

COMMENTS: Clasts (up to 1 cm) are densely and chaotically packed. In Piece 1 there are clasts with vesicles that have been broken at the margin of the clast.

ROCK NAME: Completely-altered, silicified, moderately vesicular volcanic rock.

UNIT: 11

Pieces: 9-16.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	8R	1	9	33	98.75
Lower contact:	8R	1	16	73	99.15
Thickness (m):	0.40				

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 1 to 8% vesicles, up to several mm across, ovoid in shape.

COLOR: Light green-gray and light tan to dark gray.

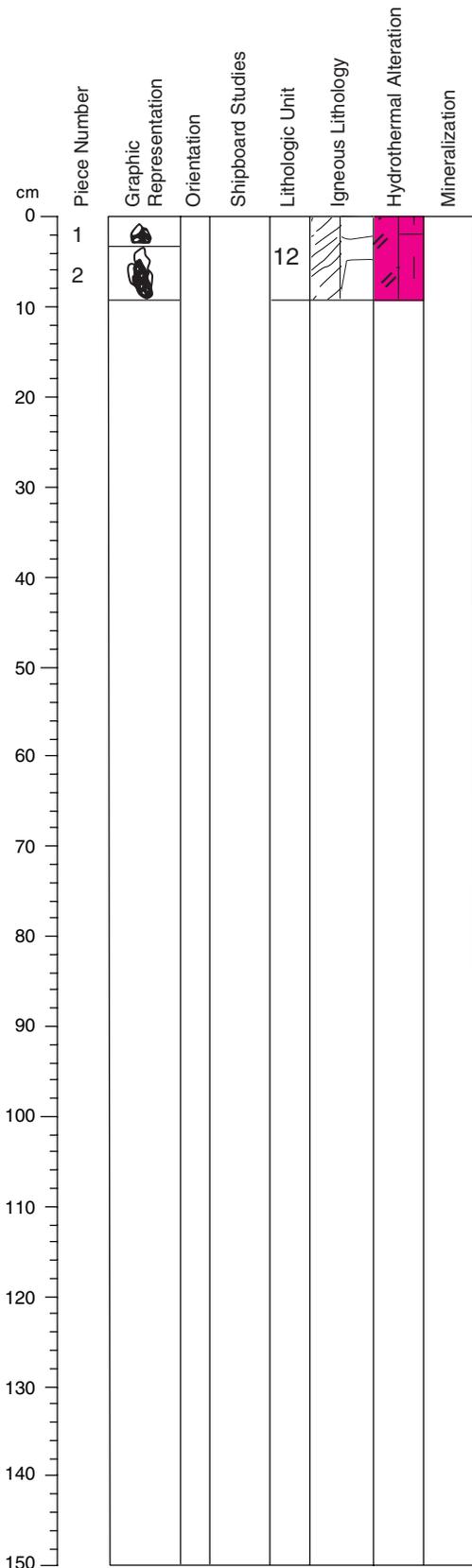
STRUCTURE: Vesicular.

ALTERATION: Vesicles are lined by very fine euhedral quartz that is overgrown by pyrite. Rock is moderately silicified with highly-silicified dark gray halos along anhydrite-pyrite veins in Piece 10.

VEINS/FRACTURES: Anhydrite-pyrite veins in Piece 10.

COMMENTS: Piece 9, in addition to vesicles, contains abundant and uniformly-distributed round quartz spots, about 0.1-mm diameter, that are nearly close-packed. Pieces 13 and 14 have a clastic or microstockwork texture as in Units 4 and 8.

Core Photo



193-1189B-9R-1 (Section top: 108.1 mbsf)

ROCK NAME: Breccia of completely-altered volcanic rock clasts in a pyrite-quartz matrix.

UNIT: 12

Pieces: 1 to 2.

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Interval Location:					
Upper contact:	9R	1	1	0	108.10
Lower contact:	9R	1	2	9	108.19
Thickness (m):	0.09				

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green-gray to dark.

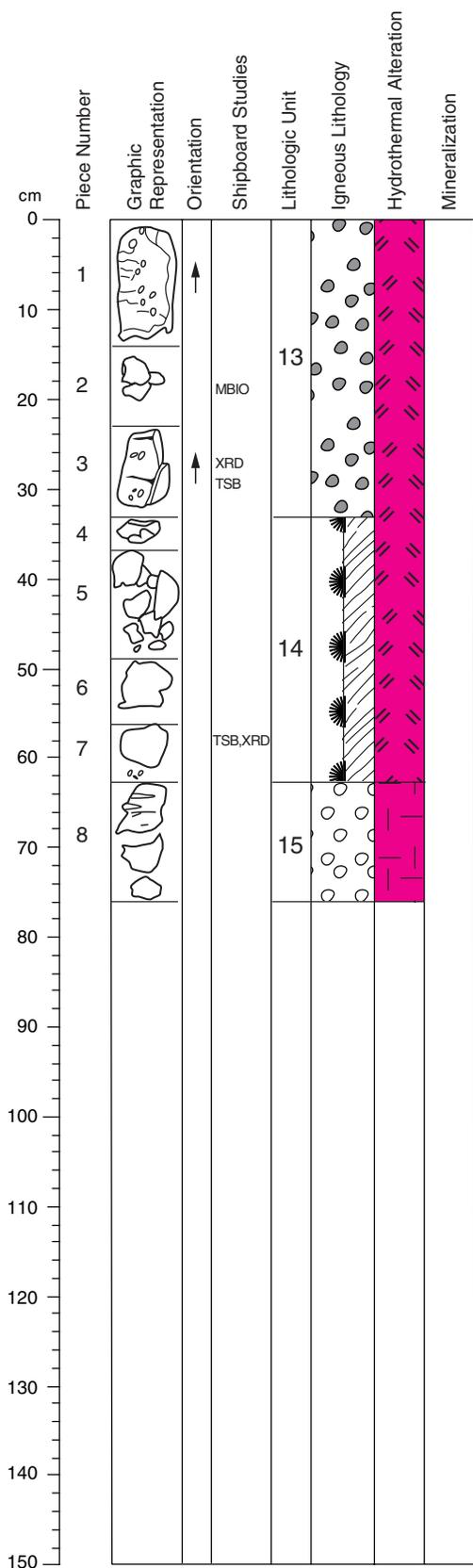
STRUCTURE: Clastic.

ALTERATION: Very soft clayey rock fragments dissected by pyrite microveinlets. Pyrite is also disseminated.

VEINS/FRACTURES: Stockwork.

COMMENTS: Reminiscent of Unit 4 and may have fallen down the hole.

Core Photo



193-1189B-10R-1 (Section top: 117.9 mbsf)

ROCK NAME: GSC altered, moderately amygdaloidal, aphyric volcanic rock.

UNIT: 13

Pieces: 1 to 3.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	1	0	117.90
Lower contact:	10R	1	3	33	118.23
Thickness (m): 0.33					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Round to slightly lensoidal vesicles/amygdules. Range: 1 to 10 mm (maximum 6 mm x 10 mm). Commonly filled by quartz, anhydrite, green clay (rare pyrite). Some amygdules are connected to each other by anhydrite-pyrite veins.

COLOR: Light green-gray.

STRUCTURE: Massive.

ALTERATION: Pervasive silica-clay alteration. Vesicles are filled by variable assemblages: green clay-silica, anhydrite-silica (with minor pyrite).

VEINS/FRACTURES: Prominent anhydrite-pyrite veins.

ROCK NAME: GSC altered, spherulitic, flow banded aphyric volcanic rock.

UNIT: 14

Pieces: 4 to 7.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	4	33	118.23
Lower contact:	10R	1	7	63	118.53
Thickness (m): 0.30					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained. Spherulitic.

VESICLES: None.

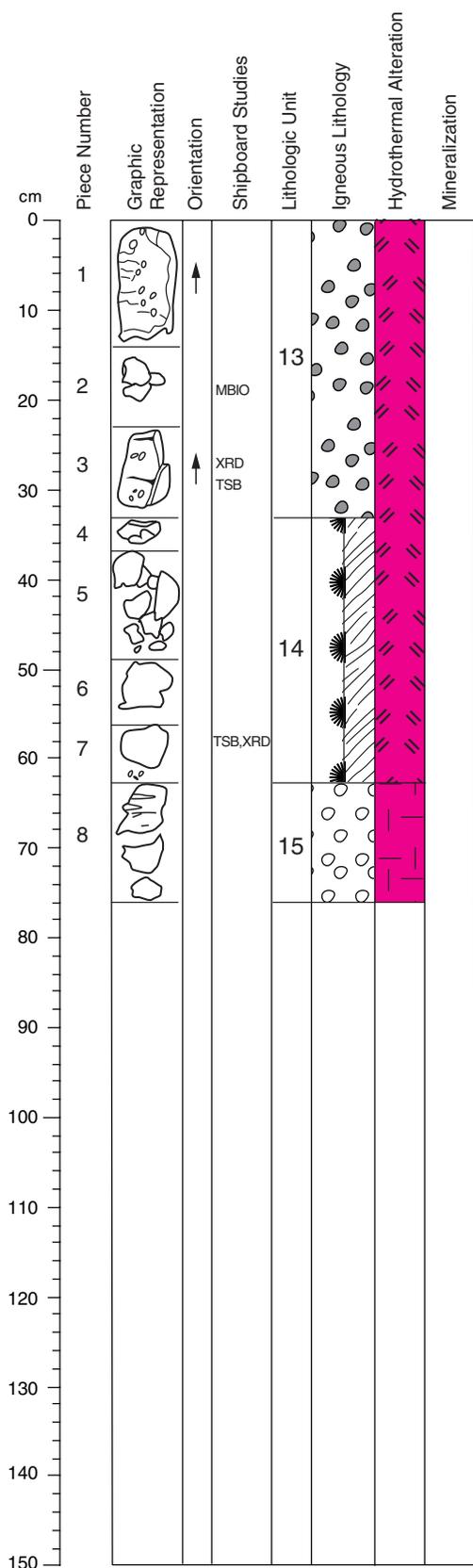
COLOR: Light green, gray, dark green.

STRUCTURE: Massive.

ALTERATION: Spherulites are white clay altered and locally contain silica-pyrite kernels. The groundmass consists of dark green (chloritic?) domains with patches of dark-gray silica pyrite and minor wispy domains of anhydrite-quartz.

VEINS/FRACTURES: Minor silica-pyrite veins.

Core Photo



193-1189B-10R-1 (Section top: 117.9 mbsf)

COMMENTS: Contains up to 50% white, (clay-altered?) isolated and coalesced spherulites (up to 1 mm) which define a prominent flow texture in Piece 7. Piece 4 and 5 contain a variety of fragments some of which are spherulitic whereas other show pseudoclastic textures with light or dark-green volcanic groundmass and silica-pyrite or white clay alteration along fine fractures.

MINERALIZATION: Piece 4 contains 10% of very fine-grained disseminated pyrite both as disseminations in altered fragments, in the silica/quartz matrix to the fragments and with quartz crystals in vugs. Piece 6 contains 5% of very fine-grained pyrite along silica vein selvages and trace chalcopyrite in the groundmass. Piece 7 contains 5% of very fine-grained pyrite in clay-rich veins.

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

UNIT: 15
Pieces: 8.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	10R	1	8	63	118.53
Lower contact:	10R	1	8	77	118.67
Thickness (m): 0.14					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Abundant (20%), extremely flattened tabular vesicles/amygdules. Size range: generally <1 mm x 2 to 3 mm; maximum: 2 mm x 10 mm x 20 mm. Filled or lined by bluish white clay, minor anhydrite and traces of pyrite.

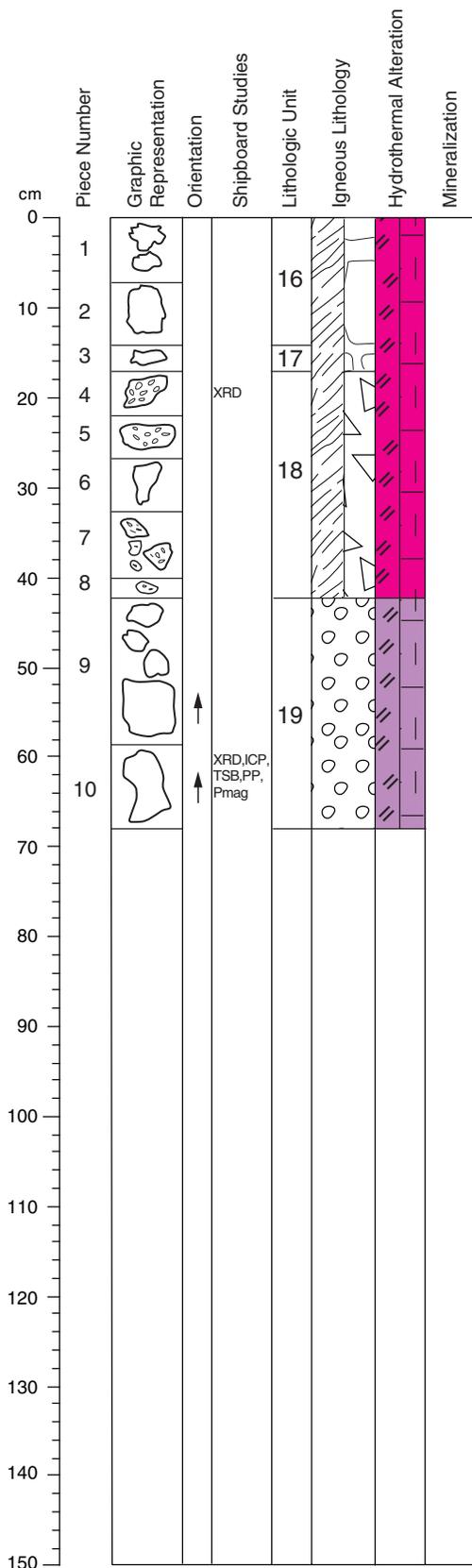
COLOR: Black, gray.

STRUCTURE: Massive.

ALTERATION: Pervasive silica-pyrite alteration. Light gray domain in one fragment contains abundant, <1 mm, round, quartz crystal aggregates of uncertain origin.

VEINS/FRACTURES: Minor silica-pyrite veinlets.

Core Photo



193-1189B-11R-1 (Section top: 127.6 mbsf)

ROCK NAME: Breccia of completely altered volcanic clasts.

UNIT: 16
Pieces: 1 to 2.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	1	0	127.60
Lower contact:	11R	1	2	14	127.74
Thickness (m): 0.14					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green, dark gray.

STRUCTURE: Clastic (60% clasts which are up to 1 cm in diameter).

ALTERATION: Soft, light green clay(chlorite?)-rich clasts are completely altered and hosted in a dark gray siliceous matrix. Locally the matrix also contains very fine-grained magnetite.

VEINS/FRACTURES: None.

COMMENTS: Orientations defined by flow banded clasts are random.

ROCK NAME: Jasperoidal breccia of completely altered volcanic clasts.

UNIT: 17
Piece: 3.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	3	14	127.74
Lower contact:	11R	1	3	17	127.77
Thickness (m): 0.03					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Porous texture in jasperlitic material may represent remnants of primary vesicles. However, green volcanic fragments are non-vesicular.

COLOR: Red, light green.

STRUCTURE: Clastic.

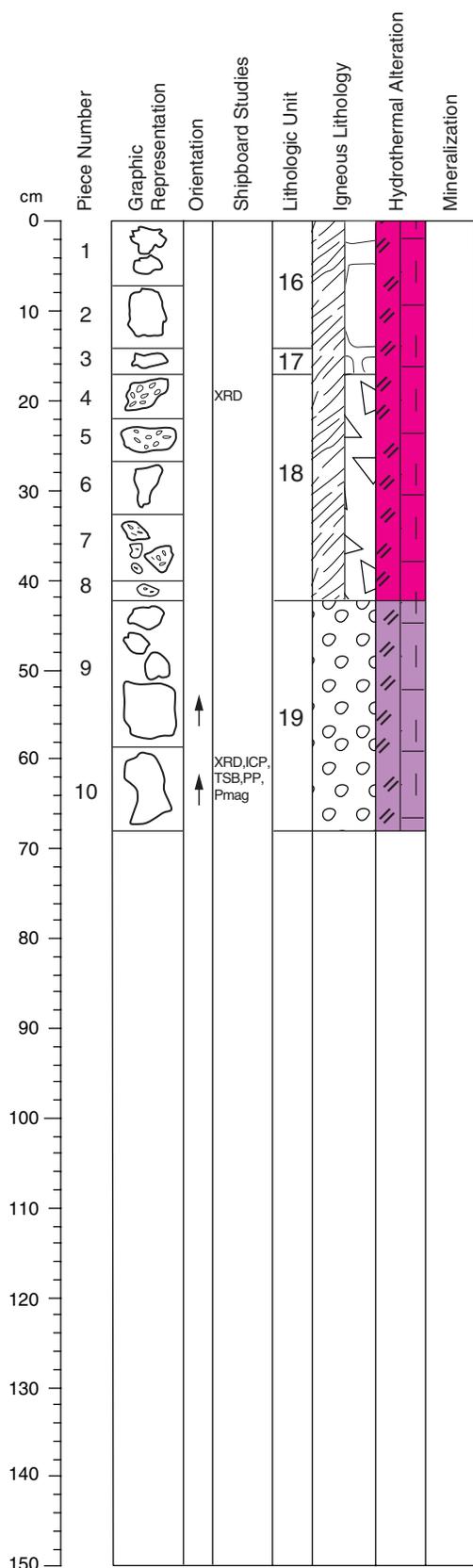
ALTERATION: Porous, vuggy jasperlitic silica - Fe-oxide with dark very fine-grained disseminated magnetite in patches. Drusy pyrite and shaded anhydrite occur as vug fill. Volcanic clasts are completely altered and green clay (chlorite?) -rich.

VEINS/FRACTURES: Minor silica-pyrite veinlets.

COMMENTS: Remnant flow banding in light green volcanic clasts (represent about 10% of the Piece).

MINERALIZATION: 5% very fine-grained pyrite in clay-rich veins.

Core Photo



193-1189B-11R-1 (Section top: 127.6 mbsf)

ROCK NAME: Polymict breccia of completely altered volcanic clasts.

UNIT: 18

Pieces: 4 to 8.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	4	17	127.77
Lower contact:	11R	1	8	43	128.03
Thickness (m): 0.26					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green, gray, white.

STRUCTURE: Clastic.

ALTERATION: Complete alteration of volcanic clasts. Green clasts are rich in green clay (chlorite?), white, soft clasts are rich in white clay, and gray clasts are silicified (locally with minor magnetite). The dark gray matrix is silica with minor magnetite and pyrite.

VEINS/FRACTURES: None.

COMMENTS: Clasts (about 50%) are aphyric and up to 1 cm in maximum dimension. There are green clay volcanic clasts (40%, some show remnant flow banding which is randomly oriented), white clay altered clasts (5%) and light gray, siliceous clasts (5%) in a gray siliceous matrix.

MINERALIZATION: Piece 5 contains 3% of very fine-grained pyrite in veins and dissemination, and 2% very fine-grained chalcopyrite aggregates.

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 19

Pieces: 9 to 10.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	9	43	128.03
Lower contact:	13R	1	3	20	147.20
Thickness (m): 19.17					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Abundant (6% to 10%), extremely stretched vesicles (up to 2 mm x 10 mm), which are vertically to subvertically oriented.

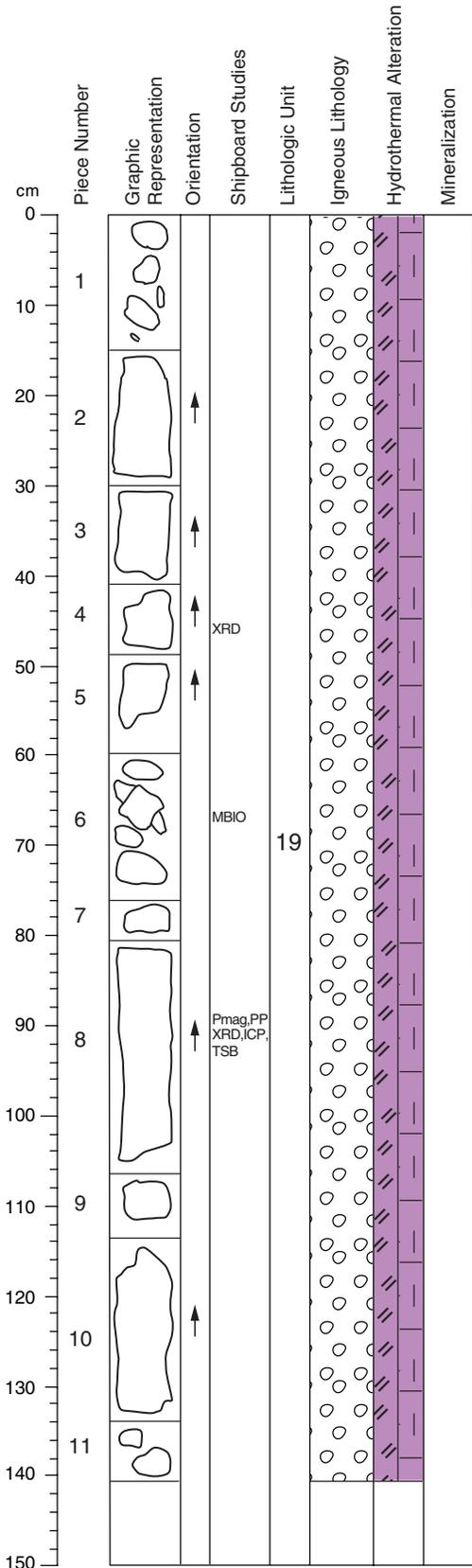
COLOR: Black.

STRUCTURE: Massive.

ALTERATION: Silicified groundmass with fine (up to 0.1 mm) spots of clay. Vesicles are generally lined or partially filled with green clay (chlorite?) and/or anhydrite and traces of pyrite.

VEINS/FRACTURES: Anhydrite-pyrite veins.

Core Photo



193-1189B-11R-2 (Section top: 128.28 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 19

Pieces: 1 to 11.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	9	43	128.03
Lower contact:	13R	1	3	20	147.20
Thickness (m): 19.17					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Abundant (6 to 10%), extremely stretched vesicles (up to 2 mm x 10 mm), which are vertically to subvertically oriented.

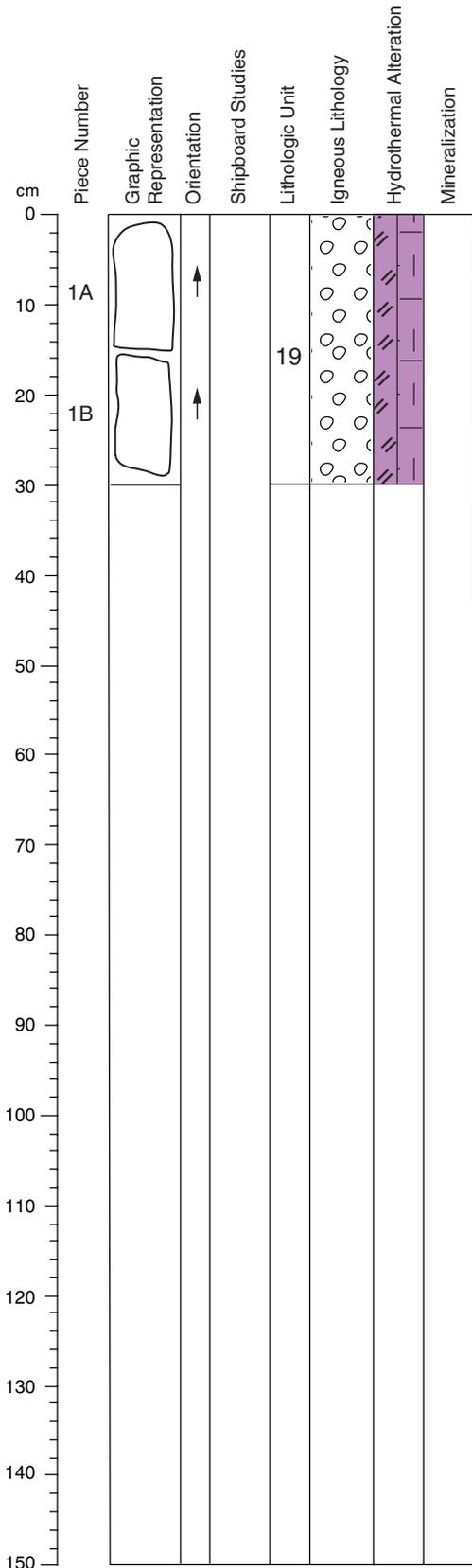
COLOR: Black.

STRUCTURE: Massive.

ALTERATION: Silicified groundmass with fine (up to 0.1 mm) spots of clay. Vesicles are generally lined or partially filled with green clay (chlorite?) and/or anhydrite and traces of pyrite.

VEINS/FRACTURES: Anhydrite-pyrite veins.

Core Photo



193-1189B-11R-3 (Section top: 129.69 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 19

Piece: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	9	43	128.03
Lower contact:	13R	1	3	20	147.20
Thickness (m): 19.17					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Abundant (6 to 10%), extremely stretched vesicles (up to 2 mm x 10 mm), which are vertically to subvertically oriented.

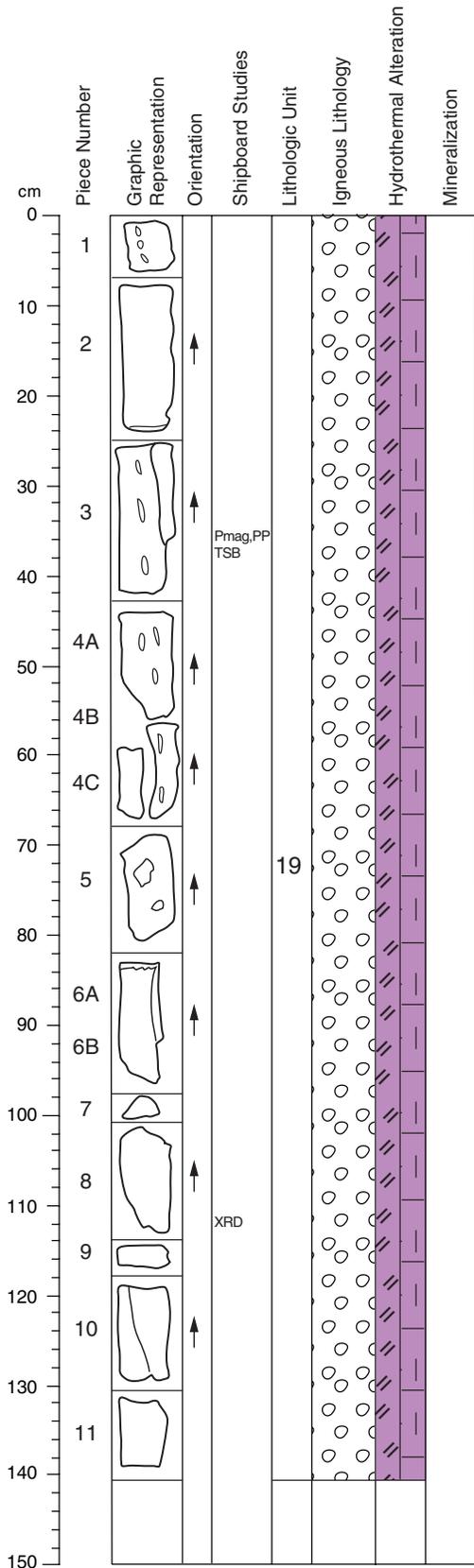
COLOR: Black.

STRUCTURE: Massive.

ALTERATION: Silicified groundmass with fine (up to 0.1 mm) spots of clay. Vesicles are generally lined or partially filled with green clay (chlorite?) and/or anhydrite and traces of pyrite.

VEINS/FRACTURES: Anhydrite-pyrite veins.

Core Photo



193-1189B-12R-1 (Section top: 137.3 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 19

Pieces: 1 to 11

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	9	43	128.03
Lower contact:	13R	1	3	20	147.20
Thickness (m): 19.17					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Abundant (6 to 10%), extremely stretched vesicles (up to 2 mm x 10 mm), which are vertically to subvertically oriented.

COLOR: Black.

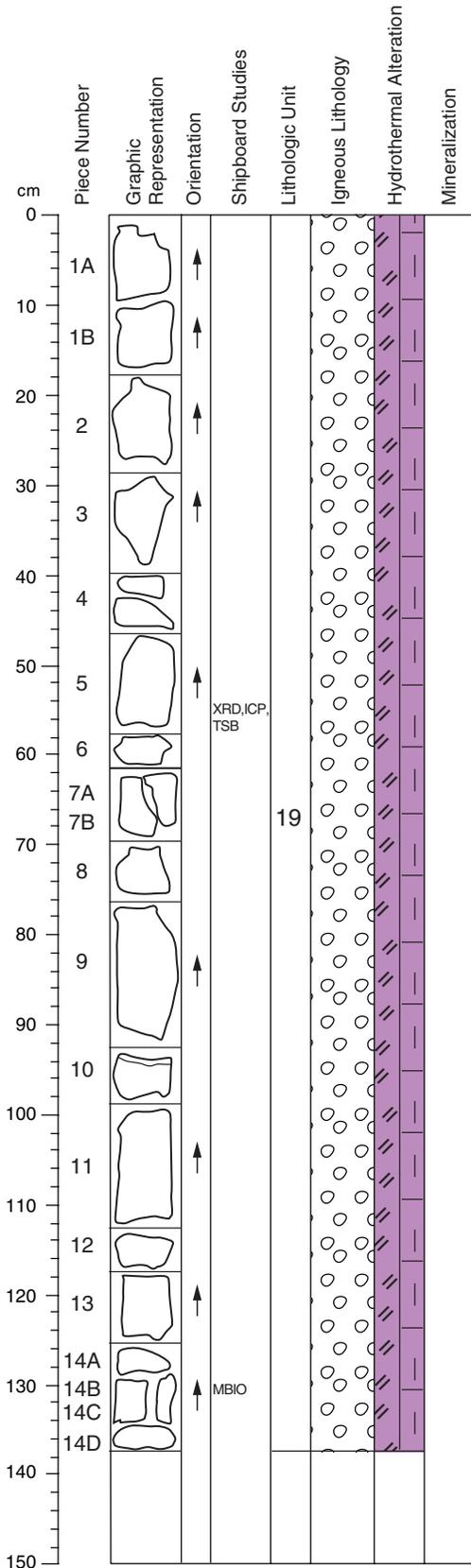
STRUCTURE: Massive.

ALTERATION: Silicified groundmass with fine (up to 0.1 mm) spots of clay. Vesicles are generally lined or partially filled with green clay (chlorite?) and/or anhydrite and traces of pyrite. Exceptionally large vug in Piece 5 contains green clay, pyrite, barite lining.

VEINS/FRACTURES: Anhydrite-pyrite veins.

COMMENTS: Piece 5 contains one black xenolithic patch (1 cm) with filled vesicles aligned normal to the general orientation of vesicles in the surrounding groundmass.

Core Photo



193-1189B-12R-2 (Section top: 138.71 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 19

Pieces: 1 to 14

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	9	43	128.03
Lower contact:	13R	1	3	20	147.20
Thickness (m):	19.17				

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Range in size and abundance (3 to 10%), mainly round (1 to 2 mm in diameter), some pieces with stretched vesicles (up to 2 mm x 10 mm).

COLOR: Black.

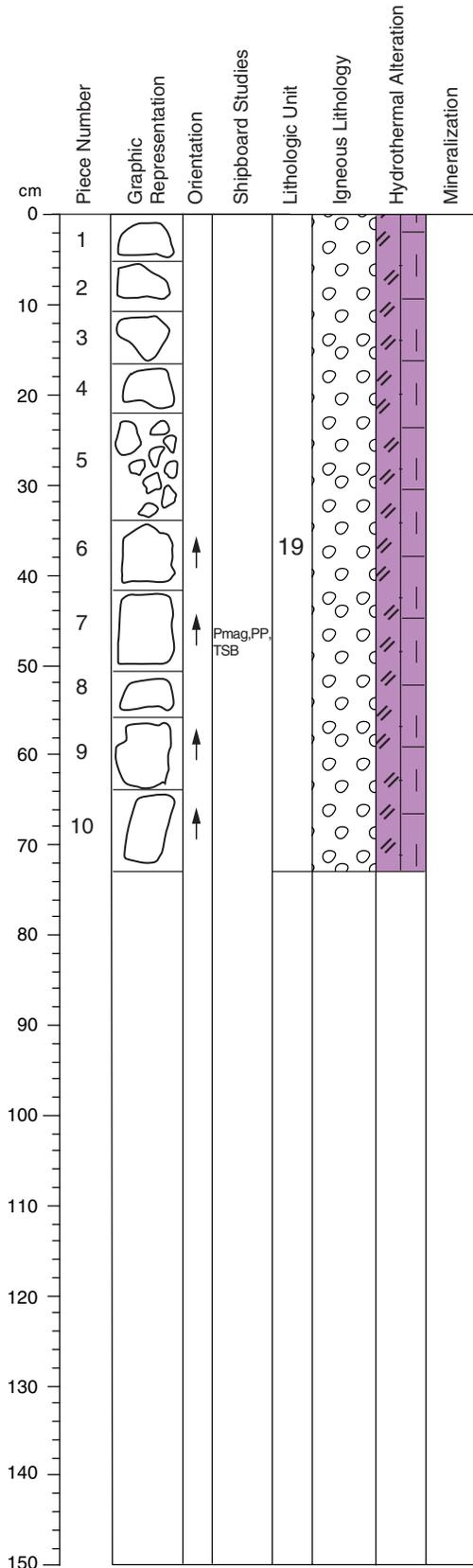
STRUCTURE: Massive.

ALTERATION: Silicified groundmass with fine (up to 0.1 mm) spots of clay. Vesicles are generally lined or partially filled with green clay (chlorite?) and/or anhydrite and traces of pyrite.

VEINS/FRACTURES: Anhydrite-pyrite veins.

COMMENTS: Barite-quartz lines a large vesicle/vug in Piece 7. Possible fine plagioclase phenocrysts in Piece 9.

Core Photo



193-1189B-12R-3 (Section top: 140.08 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 19

Pieces: 1 to 10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	9	43	128.03
Lower contact:	13R	1	3	20	147.20
Thickness (m): 19.17					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Stretched, round and irregular vesicles (3 to 8%; up to 3 mm x 15 mm).

COLOR: Dark to light gray.

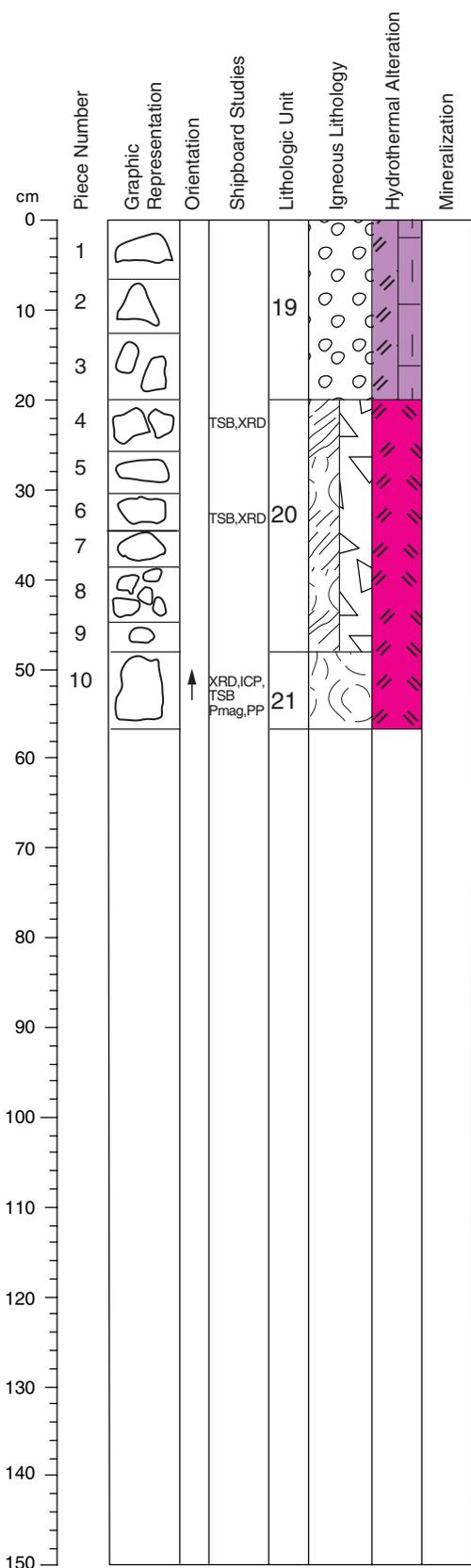
STRUCTURE: Massive.

ALTERATION: Silicified groundmass with fine (up to 0.1 mm) spots of clay. Vesicles are generally lined or partially filled with green clay (chlorite?) and/or anhydrite and traces of pyrite.

VEINS/FRACTURES: Anhydrite-pyrite veins.

COMMENTS: Possible, fine plagioclase phenocrysts in Piece 9.

Core Photo



193-1189B-13R-1 (Section top: 147.0 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 19

Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	11R	1	9	43	128.03
Lower contact:	13R	1	3	20	147.20
Thickness (m): 19.17					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Extremely stretched vesicles (5%, up to 1 mm x 10 mm).

COLOR: Dark gray to light gray.

STRUCTURE: Massive.

ALTERATION: Silicified groundmass with fine (up to 0.1 mm) spots of clay. Vesicles are generally lined or partially filled with green clay (chlorite?) and/or anhydrite and traces of pyrite.

VEINS/FRACTURES: None.

ROCK NAME: Breccia with completely altered volcanic clasts.

UNIT: 20

Pieces: 4 to 9

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	4	20	147.20
Lower contact:	13R	1	39	49	147.49
Thickness (m): 0.29					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green, light gray, gray.

STRUCTURE: Massive.

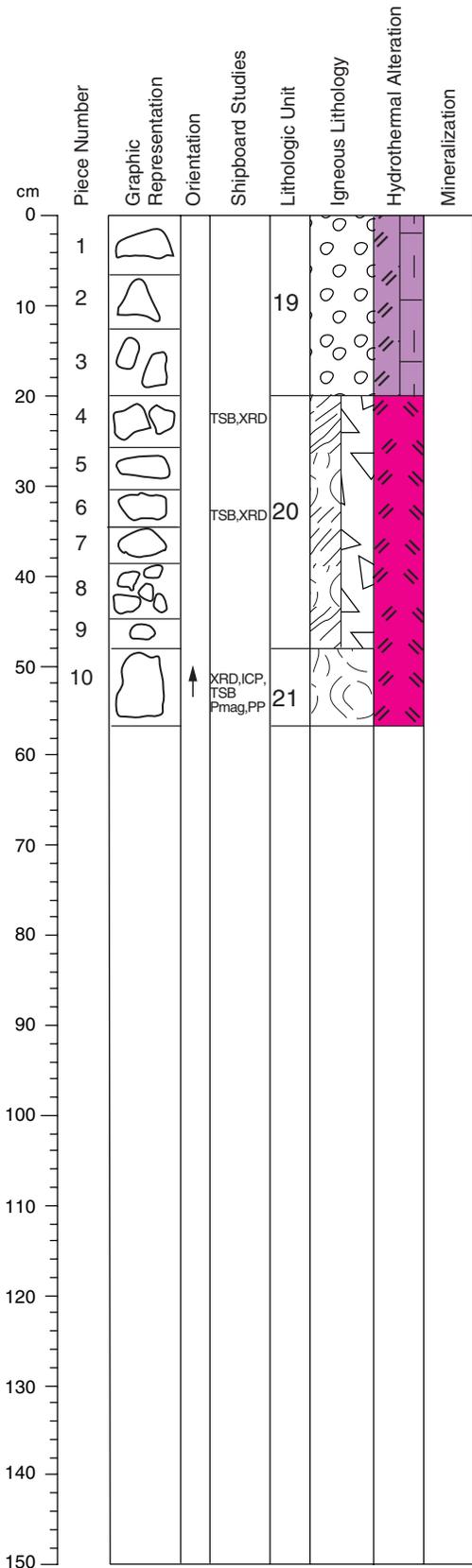
ALTERATION: Light green and light gray clasts are completely clay altered. There are some dark gray silicified clasts. Matrix is quartz-anhydrite with minor pyrite.

VEINS/FRACTURES: None.

COMMENTS: Breccia with about 50% light gray (locally perlitic) and light green (locally flow banded) clasts, minor siliceous clasts. Piece 5 is massive, green clay altered and resembles Unit 21. Piece 9 is spherulitic.

MINERALIZATION: Pieces 6 and 7 contain 5% and 7%, respectively, of very fine-grained pyrite in fractures between altered clasts. Piece 6 contains additionally traces of sphalerite and tennantite(?).

Core Photo



193-1189B-13R-1 (Section top: 147.0 mbsf)

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

UNIT: 21

Piece: 10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	13R	1	10	49	147.49
Lower contact:	13R	1	10	56	147.56
Thickness (m): 0.07					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

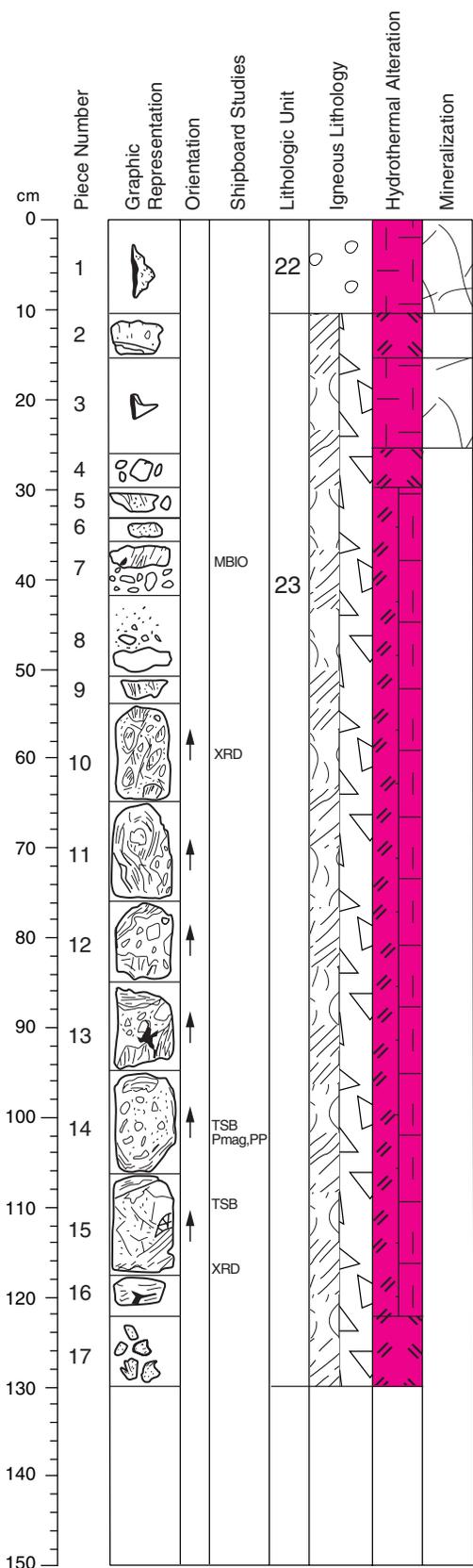
COLOR: Dark green.

STRUCTURE: Massive.

ALTERATION: Green clay (chlorite?) rich, pervasively GSC alteration cut by a fine network of silica-pyrite veinlets.

VEINS/FRACTURES: Silica-pyrite veinlets.

Core Photo



193-1189B-14R-1 (Section top: 156.5 mbsf)

ROCK NAME: Silicified and mineralized, sparsely vesicular, aphyric volcanic rock

UNIT: 22

Piece: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	1	1	0	156.50
Lower contact:	14R	1	1	10	156.60
Thickness (m): 0.10					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 2%.

COLOR: Dark gray to gold.

STRUCTURE: Massive.

ALTERATION: Highly silicified and mineralized. Alternating irregular hematite-bearing and hematite-free bands created layered structure that mimics flow banding. Pyrite abundance varies between different bands.

VEINS/FRACTURES: Pyrite veins cut banding. Anhydrite vein on one surface of piece.

COMMENTS: Piece contains about 10% pyrite.

ROCK NAME: Breccia of completely altered volcanic rock fragments.

UNIT: 23

Pieces: 2-17.

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	1	2	10	156.60
Lower contact:	14R	2	6	29	158.09
Thickness (m): 1.49					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

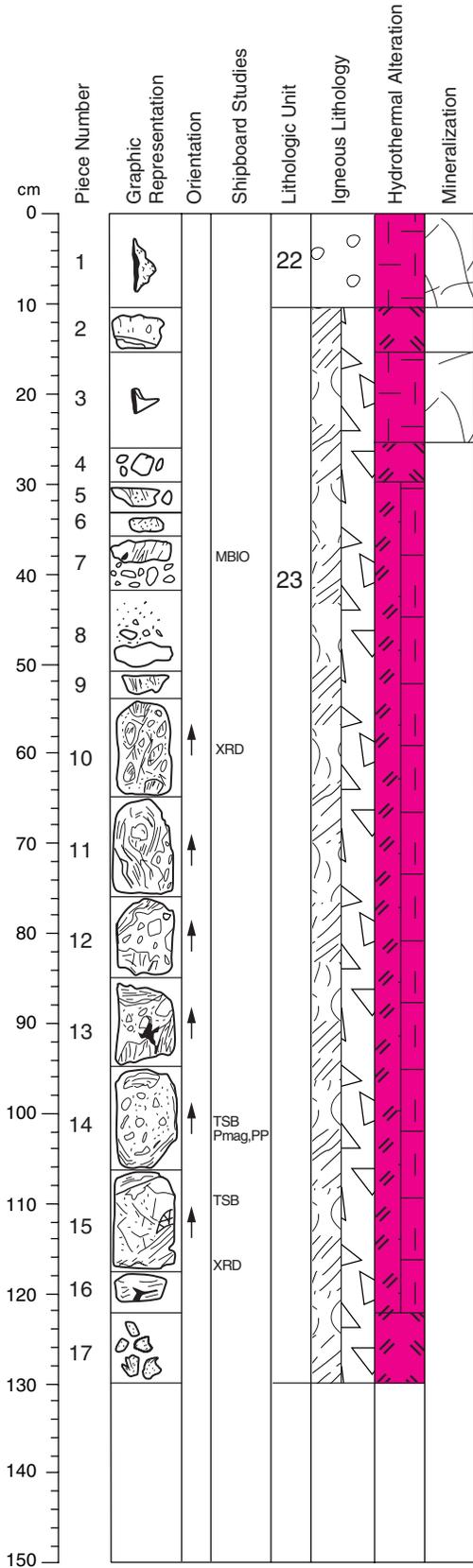
VESICLES: Trace vesicles in Pieces 2 and 3.

COLOR: Light greenish-gray to gray.

STRUCTURE: Clastic, in parts massive. Flow banding.

ALTERATION: Completely GSC-altered rocks. Flow banding is well preserved in clay-anhydrite rich layers intercalating with rare gray quartz-rich layers. Flow-banded, soft, white to light greenish-gray, incipiently silicified clasts (clay>anhydrite>quartz) are set in a quartz-rich, gray cement (quartz>clay>anhydrite). Large anhydrite crystals in clasts and matrix, probably late vug fill. Sphalerite in vugs with quartz and pyrite in Pieces 6 and 15.

Core Photo

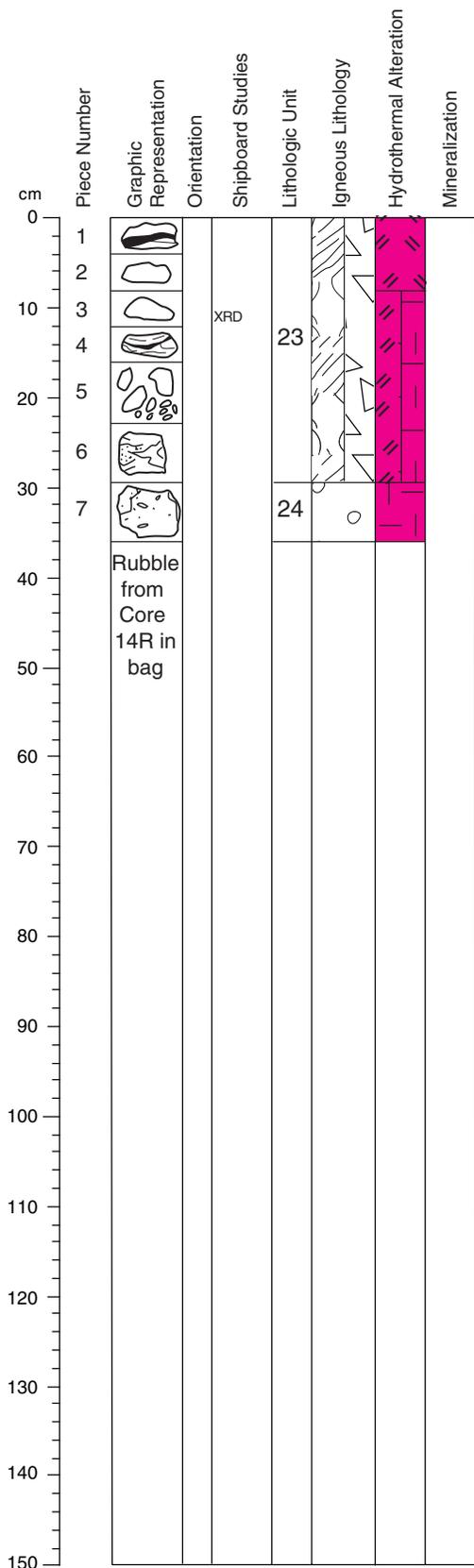


193-1189B-14R-1 (Section top: 156.5 mbsf)

VEINS/FRACTURES: Quartz-pyrite veinlets in Pieces 5, 14, and 16, and anhydrite-pyrite veins in Pieces 2, 6, and 8.

COMMENTS: Piece 11 contains a coherent flow-banded volcanic rock that extrudes into an adjacent zone of probable autoclastic brecciation.

Core Photo



193-1189B-14R-2 (Section top: 157.79 mbsf)

ROCK NAME: Breccia of completely altered volcanic rock fragments.

UNIT: 23

Pieces: 1-6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	1	2	10	156.60
Lower contact:	14R	2	6	29	158.09
Thickness (m): 1.49					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Trace vesicles in Pieces 2 and 3.

COLOR: Light greenish-gray to gray.

STRUCTURE: Clastic, in parts massive. Flow banding.

ALTERATION: Completely GSC-altered rocks. Flow banding is well preserved in clay-anhydrite rich layers intercalating with rare gray quartz-rich layers. Flow-banded, soft, white to light greenish-gray, incipiently silicified clasts (clay>anhydrite>quartz) are set in a quartz-rich, gray cement (quartz>clay>anhydrite). Large anhydrite crystals in clasts and matrix, probably late vug fill.

VEINS/FRACTURES: Piece 1 contains a 1 cm-wide anhydrite vein with trace pyrite and a quartz-rich halo. Quartz veins with trace pyrite in Piece 4. Quartz-anhydrite vein in Piece 6. Quartz-hematite-pyrite vein network and an anhydrite vein on the edge of Piece 2.

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

UNIT: 24

Piece: 7

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	2	7	29	158.09
Lower contact:	15R	1	1	6	166.16
Thickness (m): 8.07					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 2%, up to 5 mm long and elongated.

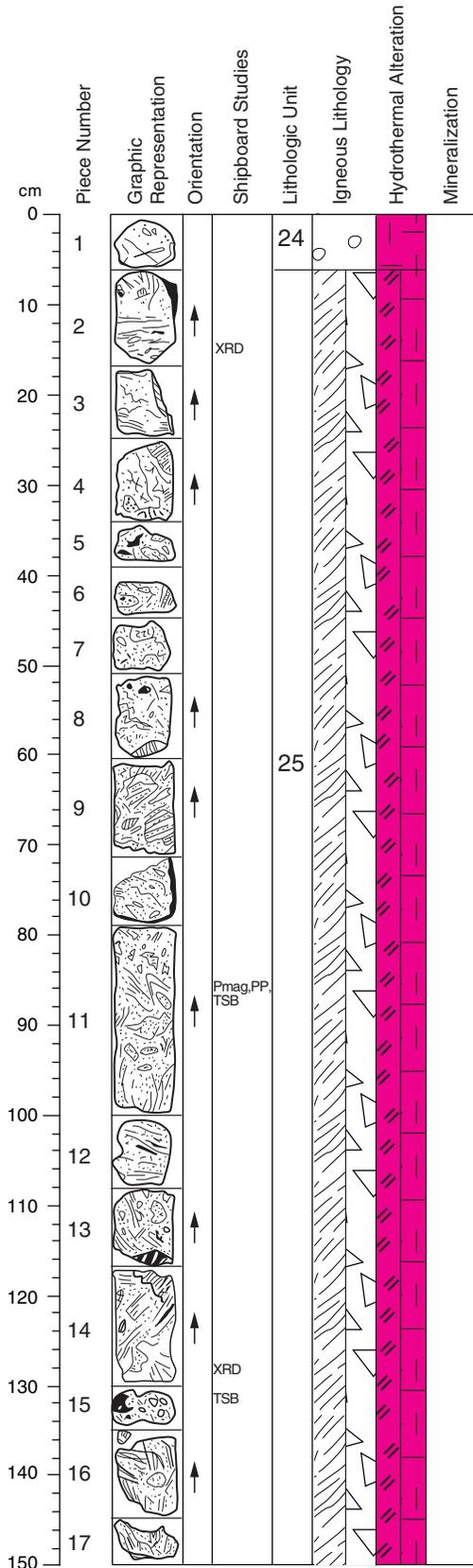
COLOR: Gray.

STRUCTURE: Vesicular.

ALTERATION: Highly silicified. Narrow bleached halos along pyrite veinlets. Vugs and vesicles are lined with quartz and pyrite, and are overgrown by anhydrite.

VEINS/FRACTURES: Pyrite ± quartz veinlet.

Core Photo



193-1189B-15R-1 (Section top: 166.1 mbsf)

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

UNIT: 24
Piece: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	14R	2	7	29	158.09
Lower contact:	15R	1	1	6	166.16
Thickness (m): 8.07					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: 2%, up to 5 mm long and elongated.

COLOR: Gray.

STRUCTURE: Vesicular.

ALTERATION: Highly silicified. Narrow gray silicified halos along pyrite veinlets. Vugs and vesicles are lined by quartz and pyrite, and are overgrown by anhydrite.

VEINS/FRACTURES: Pyrite ± quartz veinlet.

ROCK NAME: Breccia of completely altered and silicified, flow-banded volcanic rock.

UNIT: 25
Pieces: 2-17

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15R	1	2	6	166.16
Lower contact:	15R	2	5	37	167.97
Thickness (m): 1.81					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

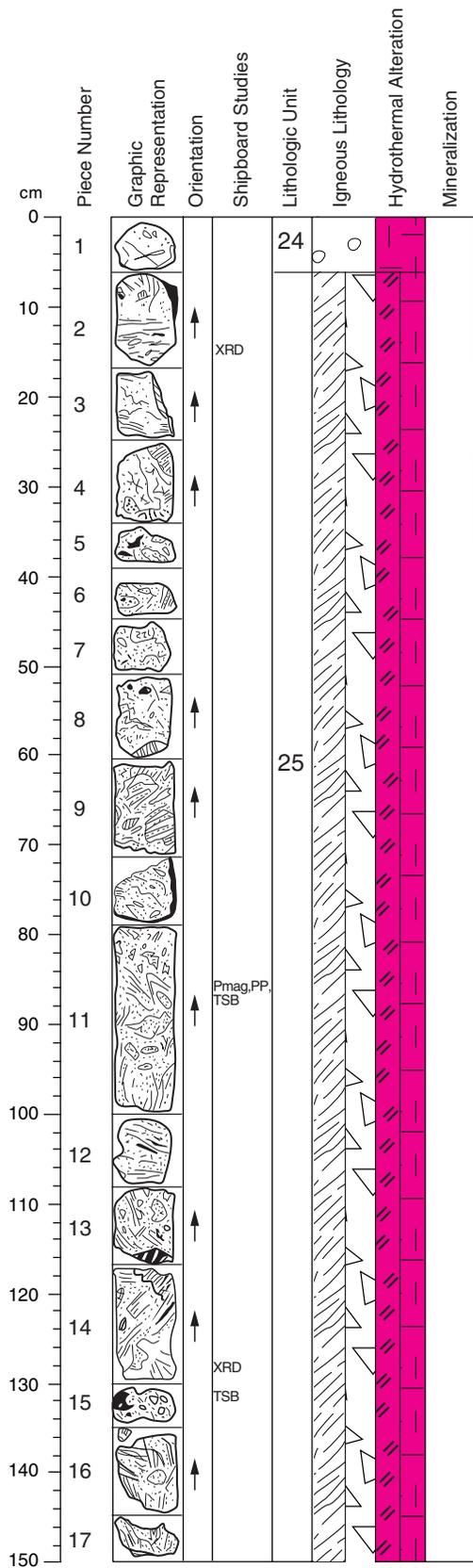
COLOR: Light gray-green.

STRUCTURE: Clastic, flow banded.

ALTERATION: Completely GSC-altered and pervasively silicified.

VEINS/FRACTURES: Hairline anhydrite veinlets throughout. Quartz veinlets in Pieces 5, 9, and 12. Anhydrite-quartz-pyrite veinlet in Piece 8.

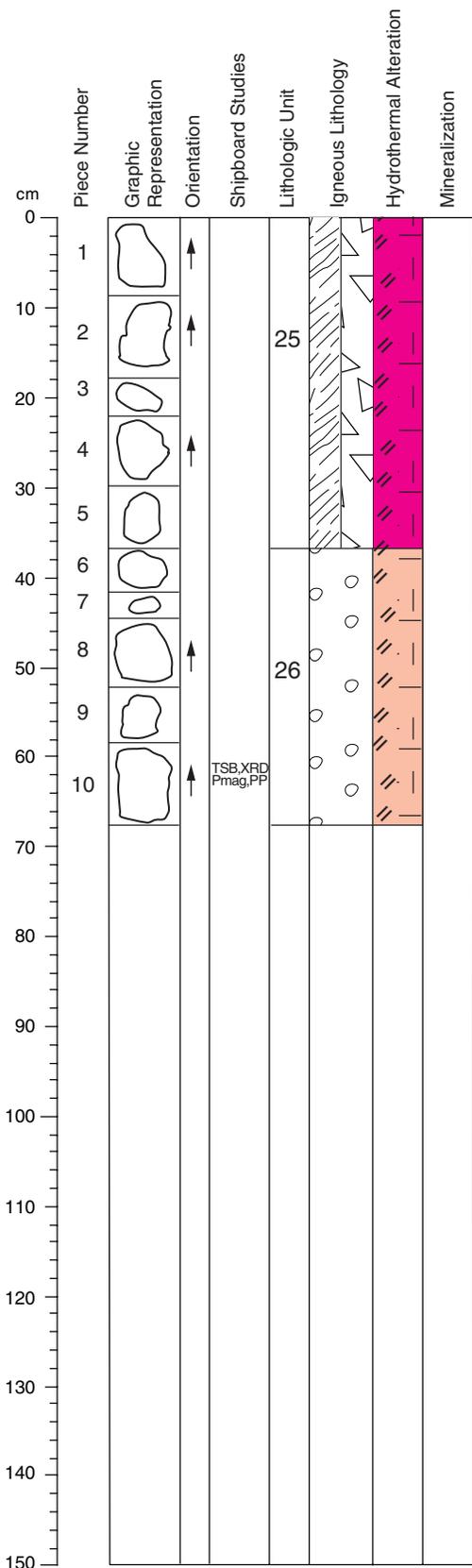
Core Photo



193-1189B-15R-1 (Section top: 166.1 mbsf)

COMMENTS: This flow-banded unit is partly coherent and partly autoclastic with abundant rotated clasts. Light gray (siliceous) and light green (green clay-bearing) flow bands are generally <1 mm wide. Bands are generally straight with sharp contacts but locally wavy or folded textures can be observed. In Piece 15 the flow banding is wrapping around a dark gray, highly siliceous, irregular shaped xenolith (maximum dimension is 3 cm, contains one 5 mm vesicle which is lined with silica). Locally, Unit 25 shows nodular alteration textures (well developed in Pieces 15 and 16), which overprint the flow banding and locally give rise to a pseudoclastic texture. There are also areas of pseudobrecciation by alteration along microcracks. This unit is similar to Unit 23 but is much more silicified.

Core Photo



193-1189B-15R-2 (Section top: mbsf)

ROCK NAME: Breccia of completely altered and silicified, flow-banded volcanic rock.

UNIT: 25

Pieces: 1 to 5

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15R	1	2	6	166.16
Lower contact:	15R	2	5	37	167.97
Thickness (m): 1.81					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray-green.

STRUCTURE: Clastic, flow banded.

ALTERATION: Completely GSC-altered and pervasively silicified.

VEINS/FRACTURES: None.

COMMENTS: This unit is intensely altered and flow-banded texture is locally obscured by pervasive green-clay bearing alteration. Some pieces show coherent flow-banded texture or brecciated texture with rotated clasts.

ROCK NAME: Silicified, sparsely vesicular, aphyric volcanic rock with prominent quartz(-pyrite-magnetite) vein network.

UNIT: 26

Pieces: 6 to 10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15R	2	6	37	167.97
Lower contact:	16R	1	10	74	176.44
Thickness (m): 8.47					

CONTACTS: None.

PHENOCRYSTS: None, except for traces of fine plagioclase in Piece 8.

GROUNDMASS: Very fine-grained.

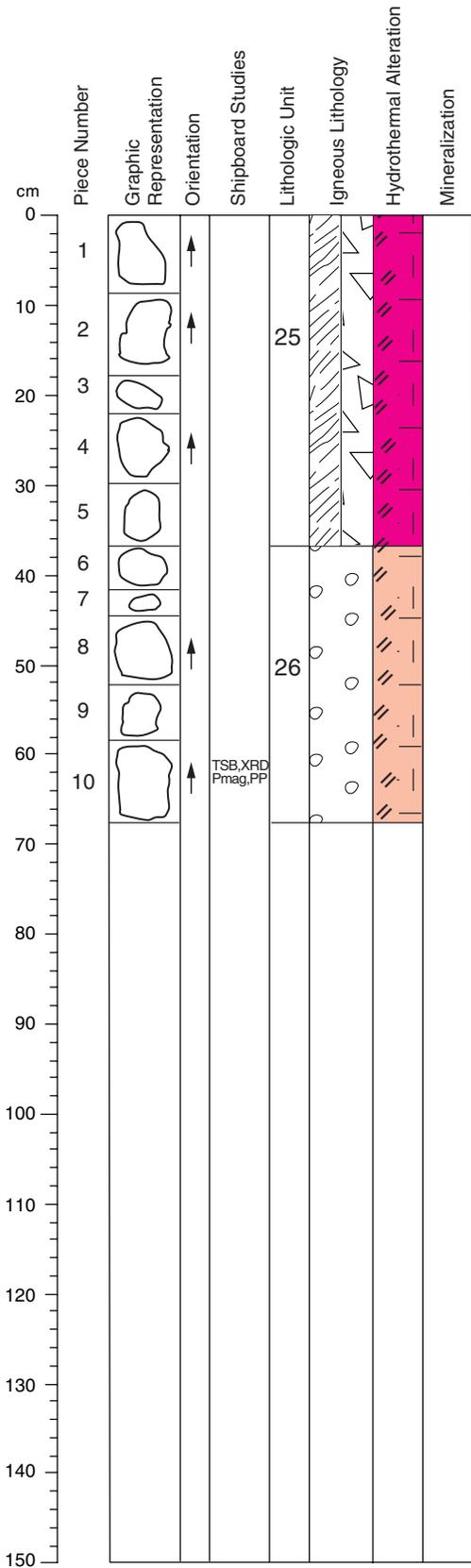
VESICLES: Small (generally <1 mm diameter, 1 to 3%) vesicles filled or lined by anhydrite.

COLOR: Gray-brown.

STRUCTURE: Massive, pseudoclastic.

ALTERATION: Silicified rock cut by a fine network of quartz-pyrite and quartz-magnetite veins. Siliceous alteration halos (mm-scale) along veins. Magnetite occurs in halos of quartz-pyrite veins.

Core Photo

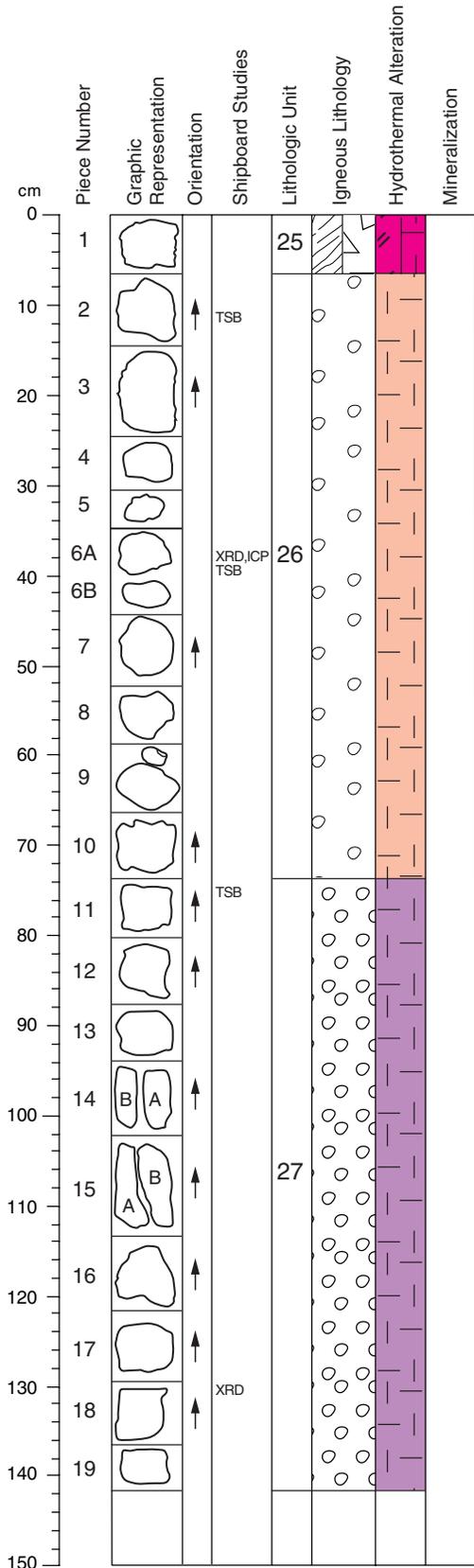


193-1189B-15R-2 (Section top: mbsf)

VEINS/FRACTURES: Mainly quartz-pyrite or quartz-magnetite veins and veinlets; minor, late anhydrite veins.

COMMENTS: Prominent pseudoclastic texture (strict jigsaw fit arrangement of apparent clasts) due to vein network which is associated with alteration halos.

Core Photo



193-1189B-16R-1 (Section top: 175.7 mbsf)

ROCK NAME: Breccia of completely altered and silicified, flow banded volcanic rock.

UNIT: 25
Piece: 1

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	1	1	0	175.70
Lower contact:	16R	1	1	7	175.77
Thickness (m): 0.07					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light gray-green.

STRUCTURE: Flow banded.

ALTERATION: Completely GSC-altered and pervasively silicified.

VEINS/FRACTURES: None.

COMMENTS: This piece is interpreted as fall back from the previous, prominently flow-banded Unit 25 above.

ROCK NAME: Silicified, sparsely vesicular, aphyric volcanic rock with prominent quartz(-pyrite-magnetite) vein network.

UNIT: 26
Pieces: 2 to 10

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	15R	2	6	37	167.97
Lower contact:	16R	1	10	74	176.44
Thickness (m): 8.47					

PHENOCRYSTS: Traces of fine plagioclase in Piece 8 and 10.

GROUNDMASS: Very fine-grained.

VESICLES: Small (generally <1 mm diameter, <1% to 3%) vesicles filled or lined by anhydrite.

COLOR: Gray-brown.

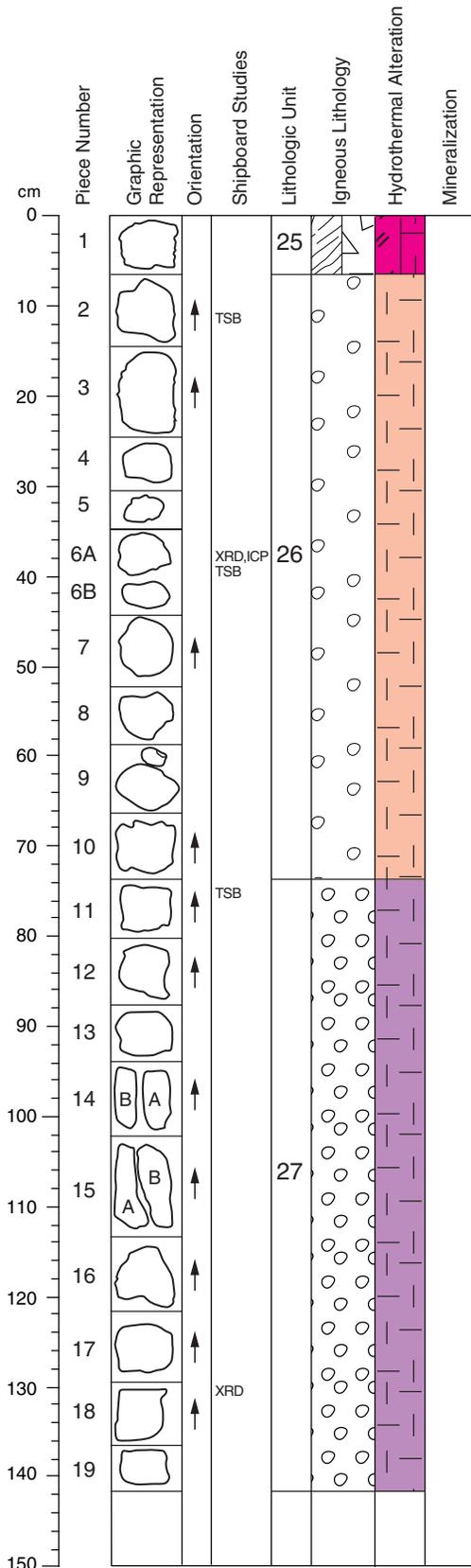
STRUCTURE: Massive, pseudoclastic.

ALTERATION: Silicified rock cut by a fine network of quartz-pyrite and quartz-magnetite veins. Siliceous alteration halos (mm-scale) along veins. Magnetite occurs in halos of quartz-pyrite veins.

VEINS/FRACTURES: Mainly quartz-pyrite or quartz-magnetite veins and veinlets; minor, late anhydrite veins.

COMMENTS: Prominent pseudoclastic texture (strict jigsaw fit arrangement of apparent clasts) due to vein network which is associated with alteration halos.

Core Photo



193-1189B-16R-1 (Section top: 175.7 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 27

Pieces: 11 to 19

	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	1	11	74	176.44
Lower contact:	16R	2	4	39	177.52
Thickness (m): 1.08					

CONTACTS: None.

PHENOCRYSTS: Extremely rare (1 or 2 in some pieces), fine plagioclase.

GROUNDMASS: Very fine-grained.

VESICLES: Round to lensoidal vesicles (3% to 10%, range 1 mm to 5 mm x 10 mm in diameter; abundant large vesicles). Generally lined (locally filled) by drusy quartz and/or anhydrite.

COLOR: Dark gray, white.

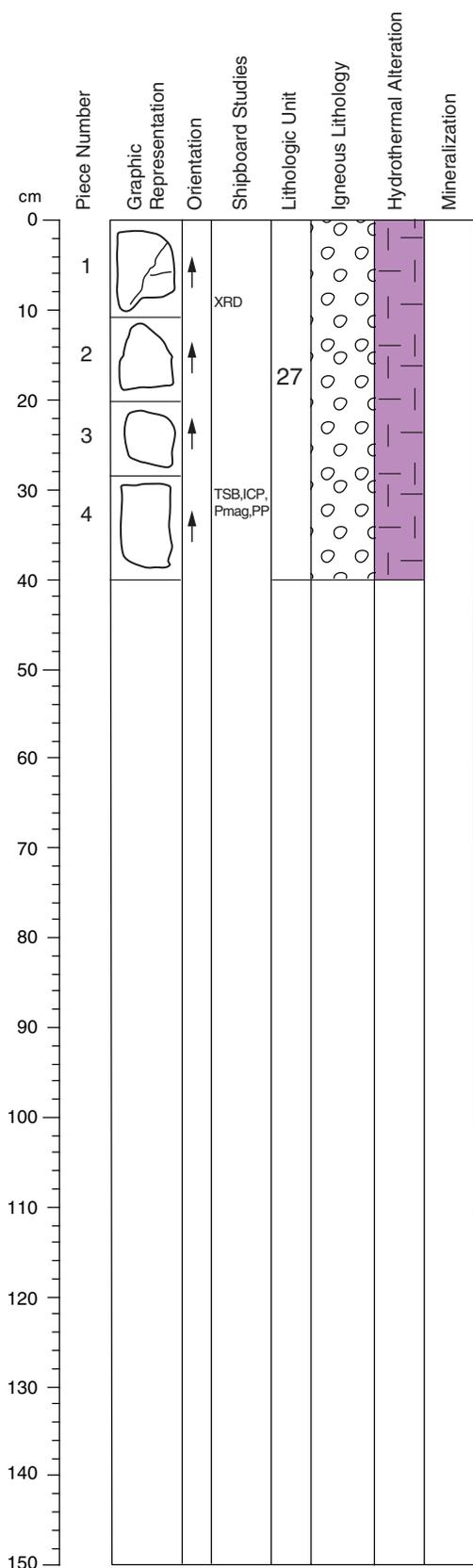
STRUCTURE: Massive with abundant hieroglyphic, shard-like white spots.

ALTERATION: Very highly altered, silicified rock with fine, white anhydrite/white clay-rich domains (angular irregular shapes, maximum dimensions are 1 to 3 mm). Vesicles are lined/filled by drusy quartz and/or anhydrite. Locally chalcopyrite, pyrite and/or covellite occur in quartz lined vesicles and on fracture surfaces.

VEINS/FRACTURES: Minor quartz-pyrite veinlets.

COMMENTS: The groundmass shows a peculiar texture with a dark gray, siliceous interconnected network encircling angular to irregularly shaped (shard-like, bubble wall, hieroglyphic shapes) white, anhydrite-white clay domains. The white domains are never in direct contact and show extremely delicate, branching textures. It is inferred that this groundmass texture is related to alteration.

Core Photo



193-1189B-16R-2 (Section top: 177.13 mbsf)

ROCK NAME: Very highly altered, moderately vesicular, aphyric volcanic rock.

UNIT: 27

Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	16R	1	11	74	176.44
Lower contact:	16R	2	4	39	177.52
Thickness (m): 1.08					

CONTACTS: None.

PHENOCRYSTS: Extremely rare (1 or 2 in some pieces), fine plagioclase.

GROUNDMASS: Very fine-grained.

VESICLES: Round to lensoidal vesicles (3% to 10%, range 1 mm to 5 mm x 10 mm in diameter; abundant large vesicles). Generally lined (locally filled) by drusy quartz and/or anhydrite.

COLOR: Dark gray, white.

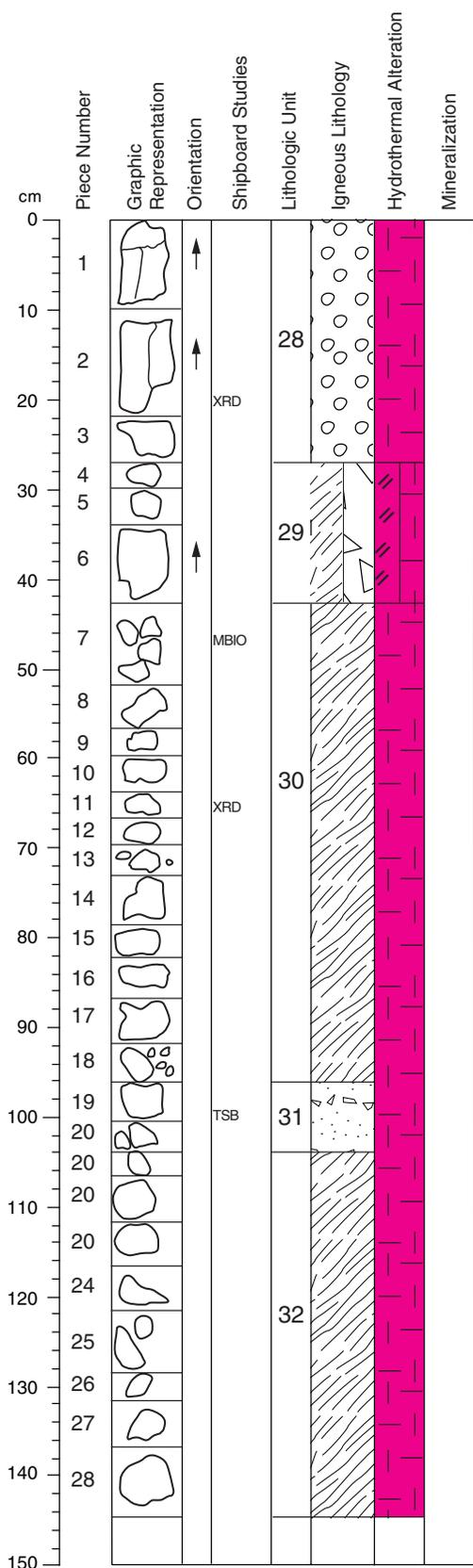
STRUCTURE: Massive with abundant hieroglyphic, shard-like white spots.

ALTERATION: Very highly altered, silicified rock with fine, white anhydrite/white clay-rich domains (angular irregular shapes, maximum dimensions are 1 to 3 mm). Vesicles are lined/filled by drusy quartz and/or anhydrite. Locally chalcopyrite, pyrite and/or covellite occur in quartz lined vesicles and on fracture surfaces.

VEINS/FRACTURES: Minor quartz-pyrite veinlets.

COMMENTS: The groundmass shows a peculiar texture with a dark gray, siliceous interconnected network encircling angular to irregularly shaped (shard-like, bubble wall, hieroglyphic shapes) white, anhydrite-white clay domains. The white domains are never in direct contact and show extremely delicate, branching textures. It is inferred that this groundmass texture is related to alteration.

Core Photo



193-1189B-17R-1 (Section top: 185.3 mbsf)

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

UNIT: 28

Pieces: 1 to 3

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17R	1	1	0	185.30
Lower contact:	17R	1	3	28	185.58
Thickness (m): 0.28					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: Round to irregular/angular shapes (up to 10%, size range: <1 mm to 7 mm in maximum dimension).

COLOR: Gray to light gray.

STRUCTURE: Massive.

ALTERATION: Intense silicification. Cut by a fine quartz-pyrite vein with a pale halo (silicification overprinting silicification). Vesicles are lined by quartz and traces of pyrite. Some vesicles in vein halo are filled with quartz-pyrite.

VEINS/FRACTURES: Quartz-pyrite veinlets.

COMMENTS: Minor lensoidal patches (<0.5 cm) of blue-gray clay in the groundmass may be xenoliths.

ROCK NAME: Breccia of completely altered, silicified, flow banded volcanic clasts.

UNIT: 29

Pieces: 4 to 6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17R	1	4	28	185.58
Lower contact:	17R	1	6	44	185.74
Thickness (m): 0.16					

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Gray-green.

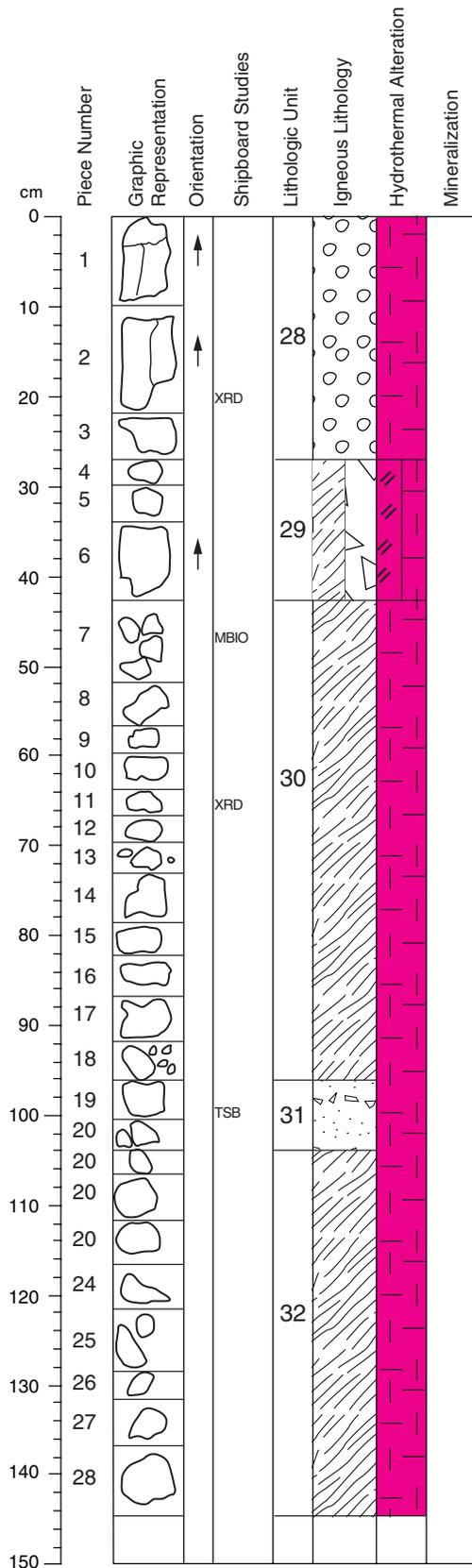
STRUCTURE: Clastic.

ALTERATION: Strongly silicified. Dark spots in groundmass contain magnetite+hematite+clay.

VEINS/FRACTURES: Fine quartz+pyrite veins in Piece 6.

COMMENTS: Clasts with folded flow banding in Piece 6 are rotated and are truncated at clast margin indicating abrasion during transport. Pseudoclastic, alteration-related nodular textures in Piece 5.

Core Photo



193-1189B-17R-1 (Section top: 185.3 mbsf)

ROCK NAME: Silicified, flow-banded volcanic rock.

UNIT: 30

Pieces: 7 to 18

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17R	1	7	44	185.74
Lower contact:	17R	1	18	96	186.26
Thickness (m): 0.52					

CONTACTS: None.

PHENOCRYSTS: Trace of fresh plagioclase phenocrysts in Piece 7.

GROUNDMASS: Very fine-grained.

VESICLES: Trace to 2% in most pieces.

COLOR: Gray. Green and gray in Pieces 17 and 18.

STRUCTURE: Most pieces are flow-banded. The flow-banding is commonly contorted and extremely stretched (locally resembling tube pumice).

ALTERATION: Strongly silicified. Drusy quartz-lined and filled vugs in Pieces 7, 10 and 14. Pieces 17 and 18 contain green clay.

VEINS/FRACTURES: Fine quartz-pyrite veinlets in Pieces 2, 8, 11, 14, 15, 17, and 18.

COMMENTS: A covellite crystal occurs in a vug in Piece 17. Piece 12 contains a dark green xenolith (1 cm in diameter) which is wrapped by flow banding.

ROCK NAME: Volcaniclastic sediment or volcanic rock.

UNIT: 31

Pieces: 19 to 20

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17R	1	19	96	186.26
Lower contact:	17R	1	20	104	186.34
Thickness (m): 0.08					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: None.

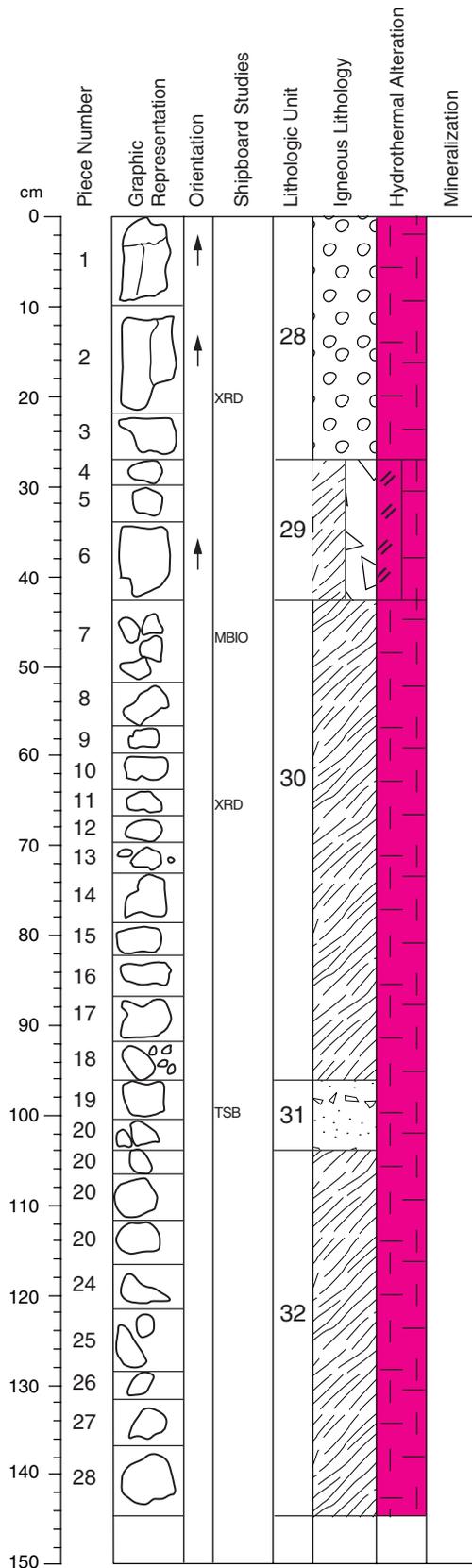
VESICLES: None. Vugs up to 1 mm with quartz linings occur.

COLOR: Gray and green.

STRUCTURE: Clastic. Clasts up to 3 mm are concentrated in layers.

ALTERATION: White, green, and blue clay fragments are hosted in a hard silicified matrix. Pyrite occurs as fine drusy crystals in voids and as fine disseminated crystals. Trace disseminated chalcopyrite.

Core Photo



193-1189B-17R-1 (Section top: 185.3 mbsf)

ROCK NAME: Flow-banded silicified volcanic rock.

UNIT: 32

Pieces: 21 to 28

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17R	1	21	104	186.34
Lower contact:	18R	1	2	12	195.12
Thickness (m): 8.78					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

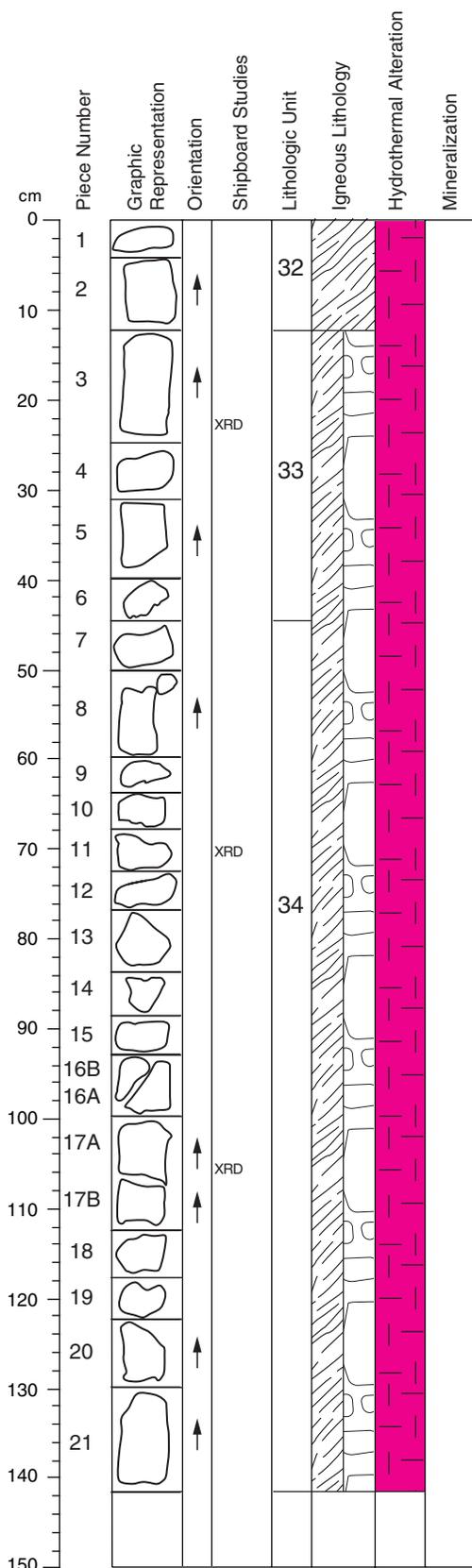
COLOR: Gray and green.

STRUCTURE: Flow-banded and veined.

ALTERATION: Silicified. Flow banding defined by green clay-rich layers. Trace of disseminated magnetite and pyrite. Magnetite occurs in patches of reddish-brown clay and as disseminations in Piece 28.

VEINS/FRACTURES: Fine network of quartz-pyrite veins in all samples.

Core Photo



193-1189B-18R-1 (Section top: 195.0 mbsf)

ROCK NAME: Flow-banded silicified volcanic rock.

UNIT: 32

Pieces: 1 to 2

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	17R	1	21	104	186.34
Lower contact:	18R	1	2	12	195.12
Thickness (m): 8.78					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Gray and green.

STRUCTURE: Flow-banded and veined.

ALTERATION: Silicified. Flow banding defined by green clay-rich layers. Trace of disseminated magnetite and pyrite.

VEINS/FRACTURES: Fine network of quartz-pyrite veins in both pieces.

ROCK NAME: Completely-altered, flow-banded volcanic rock breccia.

UNIT: 33

Pieces: 3 to 6

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	18R	1	3	12	195.12
Lower contact:	18R	1	6	45	195.45
Thickness (m): 0.33					

CONTACTS: None.

PHENOCRYSTS: Trace fresh plagioclase in all pieces.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Dark green to gray-green.

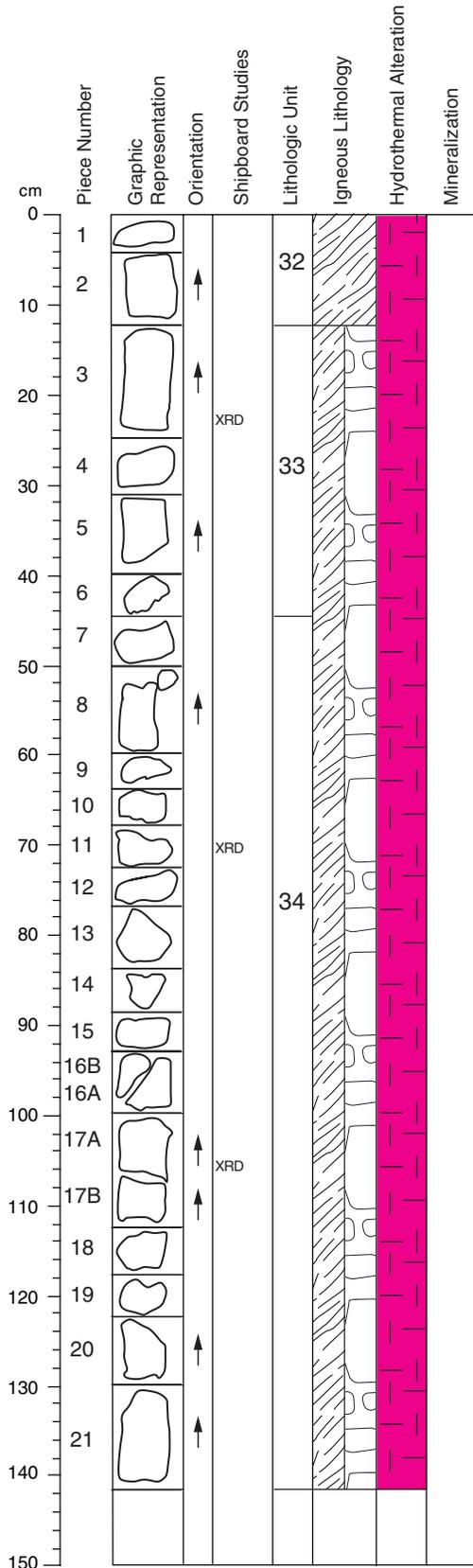
STRUCTURE: Clastic and flow banded.

ALTERATION: Silica-sulfate-clay-altered clasts, with moderate silicification, set in a dark gray matrix of quartz+hematite+pyrite.

VEINS/FRACTURES: Quartz-hematite-pyrite vein network in all pieces.

COMMENTS: Rare inclusions of chalcopyrite in quartz-hematite-pyrite veins in Piece 4. Quartz in the dark green clasts occurs as rounded coalesced spheres (spherulites) in a green clay matrix.

Core Photo



193-1189B-18R-1 (Section top: 195.0 mbsf)

ROCK NAME: Completely-altered, veined, flow-banded volcanic rock with a pseudoclastic texture.

UNIT: 34

Pieces: 7 to 21

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	18R	1	7	45	195.45
Lower contact:	18R	2	4	36	196.78
Thickness (m): 1.33					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green.

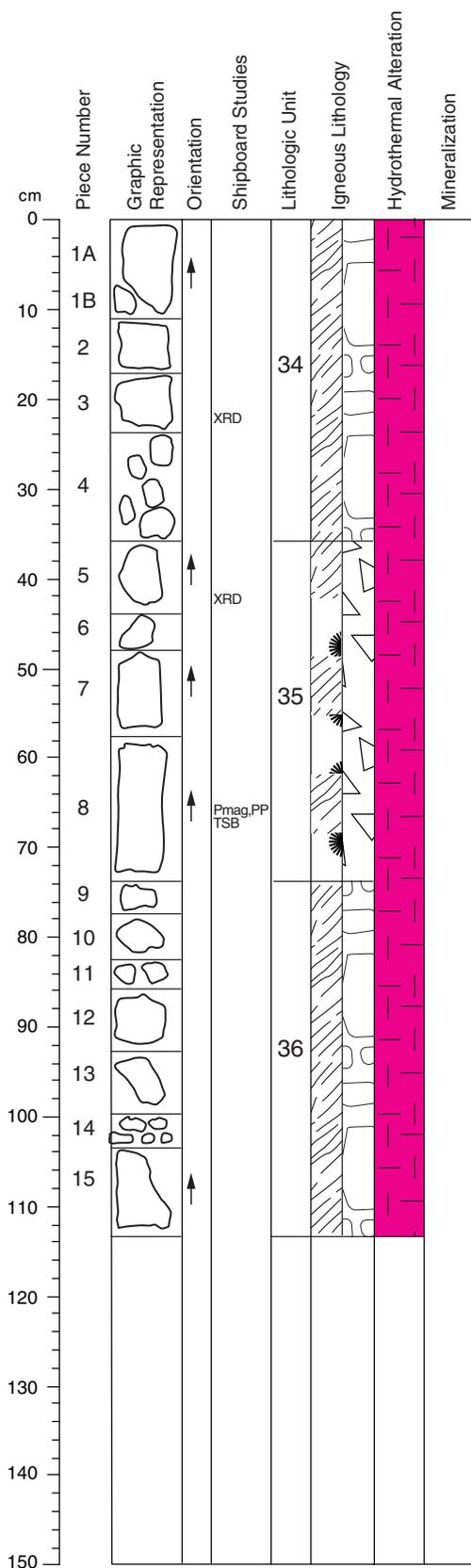
STRUCTURE: Pseudoclastic to clastic (with slight grain rotation).

ALTERATION: GSC-altered clasts, with gray silicified blebs and silicification along quartz-hematite vein network.

VEINS/FRACTURES: Quartz-hematite vein network in all pieces.

COMMENTS: Trace of sphalerite in Pieces 7, 8, 11; trace of chalcopyrite in Pieces 11 and 14.

Core Photo



193-1189B-18R-2 (Section top: 196.42 mbsf)

ROCK NAME: Completely-altered, veined, flow-banded volcanic rock with a pseudoclastic texture.

UNIT: 34
Pieces: 1 to 4

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	18R	1	7	45	195.45
Lower contact:	18R	2	4	36	196.78
Thickness (m): 1.33					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Light green.

STRUCTURE: Pseudoclastic to clastic (with slight grain rotation).

ALTERATION: GSC-altered clasts, with gray silicified blebs and silicification along quartz-hematite vein network.

VEINS/FRACTURES: Quartz-hematite vein network in all pieces.

COMMENTS: Magnetite-bearing blebs in kernels and in matrix in Pieces 1 to 3. Piece 3 also has a trace of sphalerite as vug fill. Piece 4 has a trace of anhydrite as vug fill.

ROCK NAME: Completely-altered, clast-supported polymict breccia.

UNIT: 35
Pieces: 5 to 8

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	18R	2	5	36	196.78
Lower contact:	18R	2	8	74	197.16
Thickness (m): 0.38					

CONTACTS: None.

PHENOCRYSTS: None.

GROUNDMASS: Very fine-grained.

VESICLES: None.

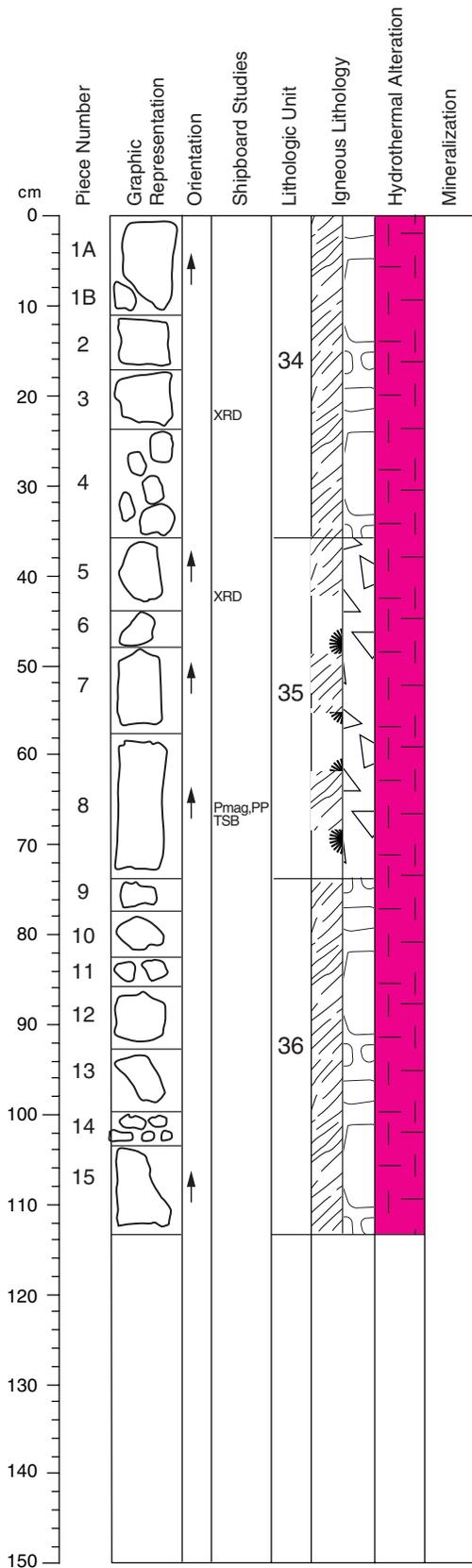
COLOR: Green to gray.

STRUCTURE: Clastic, clast-supported. Flow banding and some spherulitic and perlitic textures in clasts.

ALTERATION: Various types of GSC-altered clasts, with quartz-hematite-sulfide-bearing matrix.

VEINS/FRACTURES: Piece 7 contains pyrite veins in the flow-banded clasts that are terminated at the clast boundary.

Core Photo



193-1189B-18R-2 (Section top: 196.42 mbsf)

ROCK NAME: Breccia of completely-altered, flow-banded volcanic rock clasts.

UNIT: 36

Pieces: 9 to 15

Interval Location:	Core	Section	Piece	Depth (cm) in Section	Depth (mbsf)
Upper contact:	18R	2	9	74	197.16
Lower contact:	18R	2	15	115	197.57
Thickness (m): 0.41					

CONTACTS: None.

PHENOCRYSTS: Trace of fresh plagioclase phenocrysts in Piece 15.

GROUNDMASS: Very fine-grained.

VESICLES: None.

COLOR: Green to gray.

STRUCTURE: Flow-banded and pseudobrecciated to brecciated (clast rotation in Pieces 12 and 15).

ALTERATION: GSC-altered clasts, with quartz-pyrite-bearing matrix.

VEINS/FRACTURES: None.

THIN SECTION SUMMARY - HOLE 1189A															
No.	ID	Unit	Name	Mineralogy					Sil/ Cris	Chlorite					Comments
				Plag	Px	Glass	Anhy	Qtz		Alt. Glass	Clays	Py	Cpy	Sp	
35	193-1189A-01R-0-4#1	1	Fresh, moderately vesicular, aphyric dacite.	40		60				Tr	Tr	Tr		Tr	Fresh rock with microlitic groundmass.
33	193-1189A-2R1-113-115#15	4	Hydrothermal breccia with completely altered volcanic clasts.	15			15		10	58	2	Tr	Tr	Tr	Perlitic texture. Some fresh glass may still be present.
32	193-1189A3R1-6-12-#12	5	Highly bleached, moderately vesicular aphyric dacite.	51	Tr			Tr	3	42	3	Tr		1	Pilotaxitic texture.
31	193-1189A-3R1-59-63	6	Hydrothermal breccia.			Tr	20	30		45	4	Tr	Tr	1	Fine-grained clasts with some flow-banding. Quartz+anhy+py veins. Py is also disseminated.
30	193-1189A-3R1-70-73#12	7	Bleached, silicified, veined sparsely vesicular volcanic rock.	25			8	50		12	5	Tr			Zoned veins with anhy in center that is rimmed by qtz.
29	193-1189A-4R1-21-24#3	8	Completely altered, moderately vesicular volcanic rock.	15			5	30		46	3	Tr		1	Fine-grained, equigranular rock with elongate to irregular vesicles, filled with qtz + py.
34	193-1189A-5R1-14-16#3	9	Completely altered hydrothermal breccia with laminated clasts.	2			Tr	65		28	3			2	Pieces show jigsaw fit. Clasts are flow-banded and cut by network of qtz+py+/- anhy veins.
37	193-1189A-7R1-27-35#5	10	Completely altered sparsely vesicular volcanic rock.	30		10		20		38	2	Tr	Tr		Amygdaloidal, aphanitic rock. Pyrite fills center of quartz-lined vesicles.
36	193-1189A-7R1-83-86	12	Highly altered, sparsely vesicular volcanic rock.	25				15		58	2	Tr	Tr	Tr	Very fine-grained, aphanitic rock. Timing of mineralization appears to be: py->qtz->py+cp.
53	193-1189A-8R1-17-20 #4	15	Moderately/completely altered volcanic rock (Xenolith).	30				30		39	Tr	Tr		1	Network of unusually elongated plagioclase laths - suggesting the rock preserves a relict quench texture, now partially replaced by quartz and clay minerals.
38	193-1189A-8R1-42-44#6	15	Poikiloblastically silicified, intensely veined volcanic rock.	32			Tr	25		40	3	Tr		Tr	Network of unusually elongated plagioclase laths - suggesting the rock preserves a relict quench texture, now partially replaced by quartz and clay minerals.
39	193-1189A-8R1-90-92#14	15	Poikiloblastically silicified volcanic rock.	41	Tr			3		55	1	Tr		Tr	Network of unusually elongated plagioclase laths - suggesting the rock preserves a relict quench texture, now partially replaced by quartz and clay minerals.
54	193-1189A-8R1-103-105 #17	15	Altered plagioclase aphyric volcanic rock with local quench textures (Xenolith).	30				30		39	Tr	Tr		1	Plagioclase phenocrysts within fine grained matrix, with inclusions of magnetite.
40	193-1189A-10R1-75-77#9	19	Completely altered an veined hydrothermal breccia.	21			15	10		50	3	Tr		1	Slightly aphyric rock. Py and cp in silica selvages of anhy veins. Large magnetite inclusions in plagioclase, partly recrystallized to pyrite.
41	193-1189A-12R1-67-69#8	20	Completely silicified, moderately vesicular volcanic rock.	21				40		57	3	Tr	Tr		Aphyric, microcrystalline rock. Chalcopyrite and pyrite fill centers of quartz-lined vesicles. Pyrite in gm.
42	193-1189A-12R1-122-125#16	21	Semi-massive sulfide.				Tr	30		20	35	15	Tr	Tr	Sulfides precipitated into fractures within chloritized clasts. Cpy enclosing py and intergrown with qtz. Rare sp inclusions in py.

THIN SECTION SUMMARY - HOLE 1189B

No.	ID	Unit	Name	Mineralogy							Chlorite Alt. Glass							Comments		
				Plag	Px	Glass	Anhy	Gyp	Qtz	Sil/ Cris	Clays	Py	Cpy	Sphal	Hem	Mt	Others			
113	193-1189B-1R1-0-4#1	1	Semi-Massive sulfide (chimney material?).				30	14				1	35	20	Tr		Tr		100	Massive aggregates of chalcopyrite. Sometimes enclosing pyrite grains, elsewhere aggregate rims mantled by pyrite. Also occurs as small inclusions within pyrite. Anhydrite replaced by gypsum.
114	1189B-01R1-21-23 #2	2	Completely altered, moderately vesicular, aphyric volcanic rock.				Tr		22			75	3						100	Fine grained, clay altered samples. Alteration shows a vague zonation around vesicles, with clearer (more siliceous?) alteration adjacent to them and more brown clay further away.
115	1189B-2R1-11-14 #2	3	Stockwork anhydrite-pyrite veins in volcanic rock.			10	35	40	10				5						100	Shows remnant domains of perilitic volcanic glass surrounded by anhydrite-gypsum-(pyrite-quartz).
116	1189B-6R1-13-15 #2	5	Altered volcanic fragments hosted in a jasperoidal siliceous matrix.	17					25	20	22	1				15			100	Clasts of moderately plagioclase-phyric highly altered and pervasively silicified volcanic rock in a quartz-hematite matrix. Remnant perilitic fractures.
117	193-1189B-7R1-0-3 #1	8	Completely altered and mineralized, brecciated volcanic rock.	3			Tr		45	10	27	15			Tr				100	Brecciated volcanic rock. Cross-cut by veins of quartz and pyrite with minor anhydrite. Dendritic plagioclase in formerly glassy groundmass appears to be pseudomorphed by brown clay.
118	193-1189B-8R1-37-40 #10	11	Completely altered, moderately vesicular, aphyric volcanic rock.						45		52	3	Tr		Tr				100	Silicified volcanic rock. Vesicles filled or partly filled by quartz and sulfides. Abundance of circular to subcircular domains defined by quartz+/-pyrite and illite+/-quartz+/-pyrite. They vary from obvious amygdale which are up to 2mm in size, to fine (0.1 mm and less) ovoid spots filled with illite+/-quartz+/-pyrite, which are most likely to be remnants of very fine vesicles.
119	193-1189B-8R1-7-9 #3	9	Highly altered aphyric volcanic rock.	10			Tr		15		70	5	Tr			Tr			100	Altered volcanic rock, silicified with macro quartz as vesicle fill and thin veins.
120	193-1189B-10R1-28-3 1#3	14	Cherty, pyritic silicified volcanic rock.	10			30		30		20	8	2	Tr			Cov (Tr)		100	Silicified volcanic rock, with fine microlitic plagioclase and fine grained quartz within the groundmass. Elevated sulfide modes.
121	193-1189B-10R1-57-60 #7	14	Completely altered, flow-banded, spherulitic volcanic rock.	10					30		66	3	Tr	1					100	Altered, laminated volcanic rock with abundance of altered spherulitic structures.
122	193-1189B-11R1-63-65 #10	19	Aphyric, vesicular volcanic rock.	40			Tr		0	40	20	Tr	Tr			Tr			100	Plagioclase phenocrysts, microlites and cristobalite appears as the major vesicle fill.
123	193-1189B-11R2-89-91 #8	19	Aphyric vesicular volcanic rock.	35	Tr				5	35	25	Tr			Tr	Tr			100	Xenolith of skeletal plagioclase laths and elongate clinopyroxene crystals, with a matrix of green smectitic clay and quartzofeldspathic material, is about 1 cm across.
124	193-1189B-12R1 34-36#3	19	Aphyric vesicular volcanic rock.	25			Tr			45	30	Tr				Tr			100	Green, non- to weakly-pleochroic, low to moderate birefringence; mats of smectite are 50-100 microns across, dispersed throughout the groundmass. Also occurs as partial linings to vesicles. Cristobalite distributed throughout the groundmass probably altered glass.
125	193-1189B-12R2 55-57#5	19	Highly altered, aphyric, vesicular volcanic rock.	40			Tr		Tr	30	30	Tr				Tr			100	Original vesicularity comprises about 20% of the specimen now filled by cristobalite.

THIN SECTION SUMMARY - HOLE 1189B

No.	ID	Unit	Name	Mineralogy							Chlorite Alt. Glass							Others	Comments
				Plag	Px	Glass	Anhy	Gyp	Qtz	Sl/ Cris	Clays	Py	Cpy	Sphal	Hem	Mt			
126	193-1189B-12R-3-46-48 #7	19	Highly altered, aphyric, vesicular volcanic rock.	20					2	38	40	Tr	Tr	Tr		Tr		100	As above!
127	193-1189B-13R1 22-24#4	20	Altered volcanic breccia.	20		18	Tr		40		20	2	Tr	Tr	Tr	Tr	Leuc. (Tr)	100	Altered volcanic rock with contrasting fragments, including perlitic volcanic glass, flow banded and quench textured rhyolites.
128	193-1189B-13R1 34-36#6	20	Silicified glassy volcanic rock.				1		53		42	2	Tr	Tr	Tr		Gal (Tr), Ba (2)	100	Abundant large (>2 cm) perlitic clasts. One (3 mm) perlitic clast with stretched, chlorite filled vesicles. Pronounced silicification of volcanic groundmass.
129	193-1189B-13R1 52-54#10	21	Completely altered silicified volcanic rock.						50		49	1	Tr	Tr	Tr			100	Perlitic rock pervasively altered and silicified.
130	193-11889B-14R1-100-102 #14	23	Altered glassy volcanic rock.	Tr		55	4		31		5	1		Tr			Kspar (4)	100	Altered volcanic glass with perlitic texture, brecciated and veined by quartz-anhydrite veins.
131	193-1189B-14R1-108-110 #15	23	Completely altered volcanic rock.				50		20		22	2	Tr	1			Kspar (5)	100	Altered volcanic rock brecciated by anhydrite, quartz, sulfide veins.
132	193-1188B-15R1-86-88 #11	25	Completely altered volcanic rock.	5					5	10	80	Tr	Tr		Tr	Tr	Zeol(Tr) ,Kspar(Tr) ,Ep(Tr) ,Preh- nite(Tr)	100	Highly altered volcanic rock, with relict flow banding and spherulitic textures. Cross cut by fine quartz filled fractures with framboidal pyrite.
133	193-1189B-15R1-131-134 #15	25	Completely altered, flow banded volcanic rock.	1	Tr				1	50	45	Tr	Tr		Tr	Tr		100	Flow banding is defined by domains consisting of coalesced microspherulites (white bands) and domains consisting of chlorite (altered volcanic glass?) with isolated microspherulites.
134	193-1189B-15R2-61-64 #10	26	Highly altered, moderately plagioclase-phyric, nonvesicular, xenolith-bearing volcanic rock.	37	5				13	35	10	Tr	Tr	Tr	Tr	Tr	Ol. (Tr)	100	Two large xenoliths, embedded in a moderately plagioclase-phyric altered volcanic rock, make up 50% of thin section.
135	193-1189B-16R1-11-14 #2	26	Highly altered breccia.	26					2	40	23	3	Tr			Tr	Kspar (6)	100	Cristobalite clay alteration - pyrite framboids.
136	193-1189B-16R1-11-14 #2	26	Highly altered, sparsely plagioclase-phyric volcanic rock.	31	Tr				1	38	30	Tr	Tr	Tr		Tr		100	Vesicular rock with plagioclase and pyroxene vesicles.
137	193-1189B-16R1-75-78 #11	27	Highly altered, moderately vesicular volcanic rock.	5					55		40	Tr	Tr		Tr	Tr		100	This section is of a volcanic rock that was described as having a heiroglyphic groundmass texture. This texture involves domains where groundmass microlites are enclosed in green low-birefringent clay, intergrown with domains where groundmass microlites are enclosed in brown clay.
138	193-1189B-16R2-31-33 #4	27	Highly altered, moderately vesicular volcanic rock.	20					50		30	Tr	Tr		Tr	Tr		100	Relatively unaltered plagioclase as phenocrysts and predominantly microlites. Pyrite disseminated in the groundmass.
139	193-1189B-17R2-96-100 #19	27	Completely altered volcaniclastic sediment.						65	3	30	2	Tr	Tr				100	Highly silicified sediment with graded bedding. Some clasts have perlitic texture.
140	193-1189B-18R2-65-67#8	35	Completely altered breccia.	3					35	46	15	1	Tr		Tr	Tr	Act(Tr), Ep(Tr)	100	Breccia with microlitic clasts, altered to chlorite (with relict plagioclase microlites) and spherulitic clasts. Quartz dominates in breccia cement along with sulfides and oxides.

TS: 29 193-1189A-4R1-21-24 #3		UNIT 8			OBSERVERS: HP AP / SR SDS CY WB / DAV	
ROCK NAME:	Completely altered, moderately vesicular volcanic rock.					
TEXTURE:	Fine grained, microlitic, equigranular, vesicular to amygdaloidal					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS	None.					
GROUNDMASS	Altered volcanic glass					
	36					
	15			<0.1	Acicular.	No preferred orientation. Microlitic crystals, weakly saussuritised.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	30				Subhedral crystal aggregates.	Veins and vesicle fill. Undulose extinction.
Chlorite	10				Very fine grained amorphous to fibrous.	Concentrated in halos around quartz-pyrite veins.
Anhydrite	5				Rounded prismatic crystals.	In quartz-anhydrite-pyrite vein centers and halos.
Magnetite	1				Equant to acicular.	Rare magnetite in quartz veins and quartz vesicle fill. Very fine grained equant magnetite in igneous groundmass, breaking down to "leucoxene."
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3	0.01	0.2	0.05	Subhedral to euhedral crystals.	Fine pyrite disseminated in the groundmass. Coarser crystals in quartz-pyrite-anhydrite veins and (rarely) as vesicle fill. Rare magnetite inclusions.
Chalcopyrite	Trace		0.1		Vuggy.	Vuggy chalcopyrite is intergrown with subhedral pyrite in a vesicle. The relationship between the two minerals is equivocal, although chalcopyrite inclusions are clearly trapped in some of the pyrite crystals.
Sphalerite	Trace			0.1	Anhedral.	With fine lattice-like lamellae of chalcopyrite - chalcopyrite disease. (Only seen with 50X and 100x objectives).
COMMENTS AND SKETCH:	Vesicles and vugs are elongate to irregular, generally filled with quartz and minor pyrite. Relatively unaltered fragments of volcanic rock are caught up in anastomosing quartz-pyrite-anhydrite veins. At least two generations of veining observed within this sample. 1. Cristoblite/chalcedonic veins. 2. Quartz - anhydrite - pyrite veins. A <2 mm thick quartz+pyrite vein with chlorite-rich alteration halos is well developed within the section. See photomicrographs 1189A_28, 1189A_29, 1189A_30, 1189A_31, 1189A_32, and 1189A_73					

TS: 30 193-1189A-3R1-70-73 #12		UNIT: 7			OBSERVERS: AP SDS HP/SR TB CY/DAV	
ROCK NAME:	Bleached, silicified, veined sparsely vesicular volcanic rock.					
TEXTURE:						
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
GROUNDMASS						
Glass-microlitic feldspar	25					Remnant microlitic domains with feldspar showing evidence of incipient alteration
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	50					Vesicle fill, vein quartz and pervasive groundmass silicification
Clay	12					Very fine grained pervasive groundmass alteration
Anhydrite	8					In center of quartz-anhydrite-pyrite veins. Rare anhydrite in vein halo.
Magnetite	Trace			0.1		Inclusion in pyrite (1 example)
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	5	<0.05	1		Subhedral crystals.	Distributed throughout the section. Also with chalcopyrite in a quartz - anhydrite vein. Lining vesicles together with quartz.
Chalcopyrite	Trace		0.5		Corroded subhedral aggregates.	In a quartz - anhydrite - pyrite vein. Chalcopyrite occurs mostly in association with anhydrite, and minor association with quartz and pyrite.
COMMENTS AND SKETCH:						
Vesicles generally lined and occasionally filled with quartz aggregates. Good example of an 0.8 mm zoned vein rimmed with quartz and with anhydrite in the center. Pyrite in the vein is mainly associated with anhydrite. Chalcopyrite is only found associated with anhydrite in the vein. See Chapter 4, Figures F105D, and F53; see photomicrograph 1189A_11						

TS: 31 193-1189A-3R1-59-63 #10		UNIT: 6			OBSERVERS: AP / HP/ TB/ CY / SR DAV
ROCK NAME:	Hydrothermal breccia.				
TEXTURE:	Fractured, veined, very fine grained, flow banding.				
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
PHENOCRYSTS		min.	max.	av.	MORPHOLOGY
None.					
GROUNDMASS					
Volcanic glass	Trace				Rare, relatively unaltered fragments with undulose extinction. Rare plagioclase microlites preserved in some clasts.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
		min.	max.	av.	MORPHOLOGY
Quartz	30				Irregular quartz-anhydrite-pyrite, quartz-pyrite veins form an interlocking network.
Anhydrite	20				In quartz-anhydrite-pyrite veins. Always rimmed by quartz, probably late infill.
Clay+?	45				Dark brown amorphous groundmass. Probably a mix of clay and microcrystalline silica, often retaining primary volcanic layering. Rare faintly microlitic domains. Dendritic iron oxides developed in some of the clay-rich domains.
Magnetite	1				Very fine grained euhedra disseminated in some of the banded volcanic fragments, rare very fine grained euhedra scattered in vein quartz, rare very fine grained inclusions in pyrite.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
		min.	max.	av.	MORPHOLOGY
Pyrite	4	<0.05	0.2		Subhedral, equant grains.
Chalcopyrite	Trace		<0.1		Pitted subheral grains.
Sphalerite	Trace				Anhedral.
COMMENTS AND SKETCH:	Fragments of volcanic clasts with flow banding cross cut by quartz-anhydrite-pyrite and quartz pyrite veins. Small grains of chalcopyrite in quartz as pyrite-chalcopyrite intergrowths. There are some occurrences of sphalerite in association with chalcopyrite (chalcopyrite disease) as inclusions in pyrite. Usually that assemblage occurs as the center of an earlier vein later filled by pyrite. This could indicate that at least one generation of pyrite is later than the associated sphalerite-chalcopyrite. See Chapter 4, Figures F51, F72, and F86; see photomicrographs 1189A_03, 1189A_21, 1189A_23, 1189A_33, and 1189A_34				

TS: 32 193-1189A-3R1-06-10 #02		UNIT: 5			OBSERVERS: AP HP CY / SR WB / DAV	
ROCK NAME:	Highly bleached, moderately vesicular aphyric dacite.					
TEXTURE:	Pilotaxitic, vesicular.					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace			0.3	Euhedral.	Completely replaced by phyllosilicate (pyrophyllite?, saponite?, chlorite?), chalcopryrite and pyrite.
Clinopyroxene	Trace			0.3	Euhedral.	
GROUNDMASS						
Plagioclase microlites.	51				Needle shaped.	Aligned plagioclase microlites wrap around vesicles.
Volcanic glass	35					
Magnetite	1				Euhedral, equant.	Very fine grained igneous magnetite in groundmass.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Chlorite	7				Radiating aggregates.	Scattered in radiating aggregates throughout the groundmass, also on vesicle walls in places.
Zeolites	Trace			0.1	Radiating aggregates and single blocky crystals.	On vesicle walls - radiating, bladed crystals. Overgrown by cristobalite. At least two different types of zeolite are probably present as inferred from the difference in morphology and birefringence. One type could be clinoptilolite or phillipsite. R.I. of zeolites is slightly larger than that of the overgrowing silica. Zeolites are preferentially on one side of vesicles (geopetal texture).
Cristobalite	3				Globular/colloform.	Globular, banded isopachous linings, 20 microns thick, on vesicle walls.
Quartz	Trace					
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3	<0.05	0.1		Sub-euhedral.	Very fine grained pyrite disseminated in the groundmass. Slightly coarser py (sometimes intergrown with chalcopryrite) as late-stage vesicle fill.
Chalcopryrite	Trace			0.08	Pitted subhedral grains and aggregates.	Often, but not always, intergrown with pyrite. Occurs as crystals and aggregates in vesicles (late) and associated with what appears to be a quartz vein, cut off the very base of the slide, which has chalcopryrite on the vein margin and in vugs within the alteration halo. Replaces clinopyroxene phenocrysts with pyrite, chlorite, and phyllosilicate.
COMMENTS AND SKETCH:	Some small vesicles are filled, but generally only show a lining. Microlitic groundmass of rock is essentially unaltered See Chapter 4, Figures F52 and F5; see photomicrographs 1189A_35, 1189A_36, 1189A_37, and 1189A_97					

TS: 33 193-1189A-2R1-113-115 # 15		UNIT: 4			OBSERVERS: AP SDS HP CY DAV / SR	
ROCK NAME:	Hydrothermal breccia with completely altered volcanic clasts.					
TEXTURE:	Perlitic, fractured, veined.					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS	None.					
GROUNDMASS	Weakly altered perlitic volcanic glass					
	30					
	15					Contain plagioclase microlites and are clay altered (see below).
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Anhydrite in veins.	15		2	0.5	Bladed.	Medium to coarse grained vein fill.
Silica (XRD=Cristobalite)	10				Microcrystalline botryoidal aggregates.	Mostly in vein margins, forming botryoidal aggregates. Radial texture.
Clay	28					Dirty brown clay, around vein margins and developed in microlitic domains.
Magnetite	Trace					Fine euhedra. Trace inclusions in pyrite.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	2	<0.005	<0.5		Subhedral to euhedral.	Very fine euhedra disseminated through clay altered domains. Coarser crystals associated with anhydrite veins.
Sphalerite	Trace					Associated with chalcopyrite. Replaces pyrite and is replaced by chalcopyrite. Growth zoning with the center free of inclusions and the border with chalcopyrite disease texture. Occurs inside a 0.3 mm wide quartz vein.
Chalcopyrite	Trace					Filling a quartz vein. Replace sphalerite and pyrite. Occurs as small inclusions in sphalerite (chalcopyrite disease).
Galena	Trace					Very fine anhedral crystal as inclusion in pyrite that is being replaced by sphalerite (one example only).
Marcasite	Trace		0.01			Extremely rare small inclusions in pyrite.
COMMENTS AND SKETCH:	Relict perlitic texture. Alteration initially controlled by the preexisting perlitic fracture network. Subsequent jigsaw fit texture of perlitic clasts supports brecciation due to hydrofracturing. Rare vesicles (only in microlitic domains). Sphalerite occurs in association with pyrite and chalcopyrite filling a quartz vein. Sphalerite shows growth zonation, internal reflections and polishing hardness greater than chalcopyrite. (Although chalcopyrite trellis textures are suggestive of bornite.) The core of the crystals are limpid and darker. Sphalerite partially replaces pyrite. The outer portions of sphalerite grains have chalcopyrite disease; i.e., small dots of chalcopyrite in the sphalerite. Chalcopyrite formed later and partially replaces the sphalerite and pyrite. Colloform marcasite->chalcopyrite->subhedral pyrite overgrowth. See Chapter 4, Figures F82, F87, F80, and F83; see photomicrographs 1189A_07, 1189A_13, 1189A_38, 1189A_39, and 1189A_66					

TS: 34 193-1189A-SR1-14-16 #03		UNIT: 9			OBSERVERS:	
ROCK NAME:	Completely altered hydrothermal breccia with flow laminated clasts.				DAV	
TEXTURE:	Clastic, jigsaw fit, flow laminated, veined.				AP	
					SDS	
					CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
PHENOCRYSTS		min.	max.	av.		
None.						
GROUNDMASS						
Plagioclase	2			0.005	Acicular.	Remnant microlitic plagioclase which has not been altered to clay.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Microcrystalline Silica (XRD: quartz)	45				Massive.	Massive pervasive microcrystalline silica, intergrown with the clay.
Clay	28			0.005	Acicular.	Extremely fine interlocking, low birefringence acicular crystals, possibly pseudomorphing original plagioclase microcrysts.
Quartz	20				Interlocking subhedra.	Medium grained interlocking quartz in quartz-pyrite veins.
Magnetite	2		0.03		Acicular to equant.	Very fine grained, disseminated throughout the rock, probably remnant igneous phase. Evidence of breakdown to "leucoxene."
Anhydrite	Trace					Rare late vuggy infill in quartz-pyrite veins.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3		<0.05		Equant subhedral grains.	Fine grained pyrite scattered throughout the rock. Vein pyrite is generally more pitted, and slightly coarser grained. It occurs along quartz-quartz grain boundaries.
COMMENTS AND SKETCH:	Very fine grained, flow laminated clasts cut by an irregular network of quartz veins. Unoriented fragments of flow-laminated altered volcanics, crosscut by network of quartz-pyrite veins with trace of anhydrite. Weak halos of silicification+/-clay around the veins. Veinlets branch off major veins along the flow-laminae in the volcanics. Most of the pyrite is related to quartz veins and veinlets. Clast margins are altered (silica-clay) along the contact with the veins. Network of coarse-grained quartz+pyrite plus minor anhydrite veins. Flow lamination defined by linear domains of light gray and dark gray silica-clay. See Chapter 4, Figure F50; see photomicrographs 1189A_15, 1189A_40, 1189A_41, and 1189A_42					

TS: 35 193-1189A-1R1-0-4#1		UNIT: 1			OBSERVERS:	
ROCK NAME:	Fresh, moderately vesicular, aphyric dacite.				HP	
TEXTURE:	Vesicular, microlitic, aphanitic.				AP/SR	
					CY	
					WB	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
None.						
GROUNDMASS						
Plagioclase	40				Acicular.	Microlitic groundmass, no preferred orientation.
Incipiently altered glass	60					
Magnetite	Trace			0.05	Equant subhedra.	Fine disseminated igneous magnetite.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Clay	Trace					Incipient glass alteration.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.05		Anhedral.	Very rare, inside vesicles, with quartz and "gunge" (=clay?). Possibly contamination during polishing.
Chalcopyrite	Trace		0.02		Subhedral, equant.	Very rare, inside vesicles, with quartz and "gunge" (=clay?). Possibly contamination during polishing.
COMMENTS AND SKETCH:	The rock is approximately 30% by volume vesicular. Vesicles only rarely show signs of alteration (films or linings on the walls) and often have irregular shapes indicative of coalescence of several smaller vesicles.					

TS: 36 193-1189A-7R1-83-86 #13		UNIT: 12			OBSERVERS: DAV AP SDS / HP CY / SR	
ROCK NAME:	Highly altered, sparsely vesicular volcanic rock.					
TEXTURE:	Very fine grained, microlitic, aphanitic.					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)		MORPHOLOGY	COMMENTS	
		min.	max.	av.		
PHENOCRYSTS	None.					
GROUNDMASS						
Plagioclase.	25			0.05	Acicular.	Randomly oriented microlitic igneous plagioclase.
ALTERATION						
MINERALOGY	PERCENT	SIZE (mm)		MORPHOLOGY	COMMENTS	
		min.	max.	av.		
Quartz.	15			0.5	Irregular aggregates.	Amygdales and rare associated veining.
Clay+Microcrystalline silica	58					Pervasive alteration of groundmass.
Magnetite	Trace					Rare fine inclusions in pyrite.
SULFIDE						
MINERALOGY	PERCENT	SIZE (mm)		MORPHOLOGY	COMMENTS	
		min.	max.	av.		
Pyrite	2		0.5		Euhedral.	Euhedral crystals, containing abundant inclusions of plagioclase. Rare, fine inclusions of magnetite.
Chalcopyrite	Trace		0.05		Pitted subhedral crystals.	Always in the center of quartz aggregates - late amygdale fill.
Sphalerite	Trace				Equant euhedra.	Fine euhedra growing from vesicle walls, overgrown by quartz.
COMMENTS AND SKETCH:	Relative timing of pyrite-quartz-chalcopyrite. Small crystals of pyrite do not show inclusions of the groundmass material as found in many larger crystals. This could indicate two generations of pyrite formation. Chalcopyrite is always the central fill in quartz lined amygdale suggesting chalcopyrite later than quartz. Pyrite overgrows late quartz with quartz inclusions in pyrite optically continuous with quartz crystals outside. Late intergrown (coincident) chalcopyrite - pyrite infill of a quartz amygdale/vein also suggests chalcopyrite/pyrite later than quartz. Anhedral pyrite is observed surrounded by chalcopyrite suggesting chalcopyrite is younger than pyrite. These observations suggest at least 2 generations of pyrite: With a paragenesis of pyrite-quartz-pyrite-chalcopyrite. See Chapter 4, Figure F81; see photomicrographs 1189A_09, 1189A_10, 1189A_43, and 1189A_45					

TS: 37 193-1189A-7R1-27-31 #05		UNIT: 10			OBSERVERS:		
ROCK NAME:		Completely altered, sparsely vesicular volcanic rock.				TB	
TEXTURE:		Aphanitic, pilotaxitic, microlitic, amygdaloidal.				AP	
						SDS / HP	
						DAV / CY / SR	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
PHENOCRYSTS							
None.							
GROUNDMASS							
Plagioclase.	30			0.05	Acicular.	Weakly aligned microlites.	
Remnant volcanic glass	10					Scattered domains of weakly altered to unaltered glass.	
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Quartz	20				Subhedral aggregates.	Lensoidal aggregates filling stretched vesicles. Size range of vesicles: 1.5 mm to <0.1 mm.. Rare veins.	
Clay+Microcrystalline silica	38					Pervasive alteration of groundmass.	
Magnetite	Trace		0.015	<0.01	Equant euhedra.	Extremely fine igneous magnetite scattered through the rock and as fine inclusions in pyrite, rare coarser euhedra in quartz filled amygdaloids.	
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Pyrite	2		0.5		Equant euhedra	Euhedral crystals, containing abundant inclusions of plagioclase. Rare, fine inclusions of magnetite. Mostly disseminated through groundmass. Irregular rare quartz-pyrite veining. Pyrite generally doesn't occur as vesicle fill, however the largest vug in the rock (6mm long) contains fine pyrite euhedra concentrated near the wall, overgrown by subhedral quartz. Unlike all the other cavities in the section, the vug is not fully filled (image 1189A-105).	
Chalcopyrite	Trace		0.05		Pitted subhedral crystals	Always in the center of quartz aggregates - late amygdale fill.	
Sphalerite	Trace				Equant euhedra	Fine euhedra growing from vesicle walls, overgrown by quartz.	
COMMENTS AND SKETCH:		Pyrite occurs once in the same situation described for chalcopyrite (Filling the central part of quartz lined vesicles). This rock is almost identical to TS #36 (Unit 12) - 193-1189A-7R1-83-86 #13. One very thin (0.02 mm) irregular quartz vein with 0.02-0.07 mm euhedral pyrite crystals. See photomicrographs 1189A_46, 1189A_47, and 1189A_105					

TS: 38 193-1189A-8R1-42-44 #6		UNIT: 15			OBSERVERS: HP / TB / WTFAYA WB DAV CY / SR / SDS	
ROCK NAME:	Poikiloblastically silicified, intensely veined volcanic rock.					
TEXTURE:	Porphyritic, trachytic, veined.					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	2	0.2	0.6	0.5	Subhedral, rounded corners.	Appear fresh.
Quartz	Trace				Subhedral, rounded.	Scattered quartz phenocrysts(?).
GROUNDMASS						
Plagioclase	30			0.05	Acicular.	Microlitic, weakly alligned.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	25				Subhedral / granular / poikiloblastic / fibrous.	4 types & 3 generations: Early subhedral quartz occurs as vesicle fill +/-pyrite (common) +/-chalcopyrite (rare); 2nd generation fine grained granular quartz-pyrite veins have poikiloblastic quartz halos. Poikiloblastic quartz also overgrows earlier amygdaloidal and phenocrystic quartz (often with optical continuity) and presumably also overgrows groundmass quartz (poikiloblasts scattered throughout the rock); late fine fibrous quartz veinlets which crosscut the quartz-pyrite veins and halos.
Anhydrite	Trace				Blocky.	Rare in vein halos.
Clay+Microcrystalline silica	40					Dirty brown altered groundmass, interstitial to microlites.
Magnetite	Trace	<0.01	0.05			Anhedral grain in quartz-pyrite vein and fine inclusions in pyrite.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3				Euhedral, rare framboids.	As vesicle fill and in quartz-pyrite veins. Some relatively coarse crystals are hosted by very fine veins, replacing the surrounding rock (see image, bottom R).
Chalcopyrite	Trace					Very rare vesicle fill, with quartz and pyrite.
COMMENTS AND SKETCH:						
Pyrite crystals occur in <0.01 to 0.2 mm wide quartz-pyrite veins, both in the vein centers (most commonly) and at the outer margin of silicified vein halos. Pyrite also occurs as euhedra in the central portion of vesicle fill, overgrown by quartz. Irregular poikiloblastic quartz, containing microlitic plagioclase, occurs as 0.1-0.5 mm overgrowths on quartz amygdale, quartz phenocrysts and quartz vein halos. The poikiloblasts are often optically continuous with the crystals they overgrow (including segments of vein). One feldspar phenocryst (1189A 50) contains a large inclusion of an unknown mineral, possibly a mica. Plagioclase phenocrysts and microlites exhibit a primary igneous texture. Patchy silicification surrounding quartz-pyrite veins and within the groundmass, and silica-clay alteration of the groundmass are the only styles of alteration observed. See Chapter 4, Figures F56A, B,C, and D and F105A; see photomicrographs 1189A_24, 1189A_51, and 1189A_53						

TS: 39 193-1189A-8R1-90-92 #14		UNIT: 15			OBSERVERS:	
ROCK NAME:	Poikiloblastically silicified volcanic rock.				AP / WB / DAV / FIIKWIA	
TEXTURE:	Porphyritic, pilotaxitic.				SDS / CY / TB	
					HP / SR	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	1	0.1	1	0.5	Laths, corners are rounded.	Phenocrysts. Some could be slightly altered.
Clinopyroxene	Trace			0.3	Rounded subhedral.	Appears to be fresh.
GROUNDMASS						
Plagioclase	40			0.05	Acicular.	Microlitic, aligned.
Magnetite	Trace		0.05		Discrete grains.	Discrete grains - locally acicular aggregates. Distributed throughout the section.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	3				Poikiloblastic, granular.	Scattered poikiloblastic quartz with microlitic plagioclase inclusions, often developed on vein margins. Fine granular quartz-pyrite veins.
Clay+Microcrystalline silica	55					Dirty brown altered groundmass, interstitial to microlites.
Sericite?	Trace				Fibrous aggregate.	Pseudomorphing acicular feldspar (?).
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	1		0.5		Pitted subhedra	Subhedral pitted crystals with fine acicular inclusions of microlitic plagioclase are developed on hairline fractures and overgrow the groundmass of the rock
Chalcopyrite	Trace		0.1		Anhedral crystals.	Occurs as inclusions in poikiloblastic quartz
Tennantite?	Trace			0.02	Anhedral crystal	In groundmass.
COMMENTS AND SKETCH:						
Numerous 0.1 mm veins and veinlets of pyrite, with minor quartz. Many of the veins are parallel to subparallel to the volcanic fabric of aligned plagioclase microliths. Plagioclase phenocrysts and microlites exhibit a primary igneous texture. Patchy silicification surrounding quartz-pyrite veins and within the groundmass, and silica-clay alteration of the groundmass are the only styles of alteration observed.						
See photomicrograph 1189A_55						

TS: 40 193-1189A-10R1-75-77#9		UNIT: 19			OBSERVERS:	
ROCK NAME:	Completely altered and veined hydrothermal breccia.				SDS	
TEXTURE:	Slightly porphyritic, clastic.				HP	
					AP / DAV	
					CY / SR	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase.	1	0.1	0.6	0.5	Subhedral, laths and tabular.	Exclusive to fine grained clasts. Aligned with groundmass microlites. One glomeroporphyritic cluster with around six individuals intergrown.
GROUNDMASS						
Plagioclase	20				Acicular.	Aligned in some domains, some probably partially altered to clay.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz.	10				Subhedral granular intergrowths.	Vein quartz (quartz-anhydrite-pyrite veining).
Anhydrite.	15				Bladed.	Coarse bladed crystals in veins with two phase liquid plus vapor inclusions with constant fill.
Clay+microcrystalline quartz	50					Alteration of glassy groundmass.
Magnetite	1	0.01	0.1			Large euhedral to subhedral crystals in the groundmass and in quartz masses associated with pyrite. Smaller grains disseminated in the groundmass. Rare inclusions in pyrite. These inclusions contain tiny inclusions themselves of pyrite (?).
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3	0.01	0.07			In silica selvage of anhydrite veins associated with chalcopyrite. Small amount in anhydrite. Anhedral grains in groundmass are crowded with plagioclase inclusions.
Chalcopyrite	Trace			0.1		Subhedral grains in veins with pyrite. Chalcopyrite inclusions along fluid inclusion bearing fracture planes in plagioclase phenocrysts.
COMMENTS AND SKETCH:	Contacts between plagioclase-phyric clasts are quartz-anhydrite veins are sharp but irregular. Magnetite aggregate in the groundmass. Magnetite and pyrite inclusions within plagioclase. It appears that pyrite is replacing magnetite where the plagioclase crystal is broken. Rare very fine grained pyrite (?) inclusions in magnetite within pyrite indicate two generations of pyrite, the earlier replaced by magnetite. Pyrite and chalcopyrite inclusions observed within plagioclase phenocrysts. See photomicrographs 1189A_16, 1189A_26, 1189A_56, 1189A_57, 1189A_58, 1189A_59, 1189A_60, 1189A_61, 1189A_62, 1189A_63, and 1189A_106					

TS: 41 193-1189A-12R1-67-69 #8		UNIT: 20			OBSERVERS:		
ROCK NAME:		Completely silicified, moderately vesicular volcanic rock.				HP	
TEXTURE:		Aphyric, vesicular, microcrystalline.				AP	
						DAV	
						CY / SR	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
PHENOCRYSTS							
None.							
GROUNDMASS							
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Quartz	40			0.1	Subhedral aggregates.	Quartz fills elongate, flattened amygdales and occurs as patchy aggregates in the groundmass, implying pervasive silicification.	
Clay+microcrystalline silica	17					Altered volcanic glass, probably quartz + chlorite/illite (from XRD).	
Sericite/clay	40				Microcrystalline aggregates.	Microcrystalline aggregates with fine acicular shapes, pseudomorphing groundmass plagioclase microlites and larger aggregates with approximately prismatic shapes, pseudomorphing plagioclase phenocrysts.	
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Pyrite.	3	0.02	0.4	0.05	Subhedral to euhedral cubes.	Idiomorphic cubes in the groundmass (<0.05 mm) and larger (>0.1 mm) crystal aggregates in the center of quartz lined vesicles.	
Chalcopyrite	Trace	0.05	1	0.2	Pitted sub- to euhedra.	Filling the central part of quartz amygdales, intergrown with pyrite in rare cases.	
Sphalerite	Trace		0.05		Euhedral.	Rare honey-gold/brown sphalerite euhedra in quartz filled amygdales, mostly towards the rim and included in quartz patches.	
COMMENTS AND SKETCH:		Pyrite in groundmass and chalcopyrite is filling the central part of quartz lined vesicles. Chalcopyrite and pyrite filling the central part of quartz lined vesicles. See Chapter 4, Figure F54; see photomicrographs 1189A_17, 1189A_25, and 1189A_71					

TS: 42 193-1189A-12R1-122-125 #16		UNIT: 21			OBSERVERS:	
ROCK NAME:	Semi-Massive sulfide.				AP / SR	
TEXTURE:	Breccia, tube pumice clasts				WB	
					DAV / CY / HP	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
PHENOCRYSTS		min.	max.	av.		
None						
GROUNDMASS						
Chlorite					Massive anhedral.	The clasts are altered predominantly to transparent, soft, low-birefringence material with undulose domainal extinction. It hosts fine red-brown dendrites. It appears to be a phyllosilicate.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	30		0.1		Small anhedral grains.	Intimate association with sulphides.
Chlorite	20					Predominant mineralogy of variably oriented clasts, up to 2.5 mm long.
Anhydrite	Trace					
Magnetite	Trace				Discrete grains.	Associated with quartz.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	35	0.005	> 0.8	0.1	Anhedral aggregates.	Associated with chalcopyrite as a matrix of quartz / anhydrite "clasts." Framboidal pyrite inclusions in some bigger pyrite crystals.
Chalcopyrite	15	0.001	>1		Anhedral aggregates.	Intergrown with pyrite. Interstitial growth in quartz.
Sphalerite	Trace				Discrete grains.	Rare inclusions in pyrite.
COMMENTS AND SKETCH:	<p>Photos illustrate: Sulfides precipitating into fracture within chloritized clasts. Chalcopyrite enclosing pyrite and intergrown with quartz. Chalcopyrite - pyrite-quartz association. Clasts in the breccia commonly preserve tube pumice texture, outlined by fine dark granular material. There are abundant clasts with fibrous, delicate internal fabric which is characteristic of tube pumice. They have been preserved because the inner walls have been lined by some dark mineral (clay?, iron oxides?) during early (diagenetic?) alteration. Other clasts are non-vesicular. There is no consistent difference in alteration mineralogy between tube pumice and non-vesicular clast. Clast supported texture in sulfide-poor part of the section indicate volcanoclastic origin of this unit. Are the sulfides clasts or the product of replacement of the volcanoclastic breccia? Two types of clast are recognised: 1. Relatively unaltered volcanic glass, typically with undulose extinction, flow banding and very fine grained disseminated (igneous?) magnetite. 2. Strongly altered (probably clay+microcrystalline silica) clasts, also flow banded, but with no disseminated magnetite and a dirty grainy appearance under PPL. One of the sections shows a clear progression through volcanic clasts in a limited matrix of silica with a relatively low pyrite content, to an assemblage of clasts with a pyrite quartz matrix, which in turn becomes an assemblage with chalcopyrite aggregates intergrown with pyrite. NOTE: There are 2 thin sections with this number now labelled A & B. See Chapter 4, Figures F75, F12, F13, and F85; see photomicrographs 1189A_01, 1189A_19, 1189A_74, 1189A_75, 1189A_78, 1189A_79, and 1189A_80</p>					

TS: 53 193-1189A-8R1-17-20 #4		UNIT: 15			OBSERVERS: SR	
ROCK NAME:		Moderately/completely altered volcanic rock (Xenolith).				
TEXTURE:						
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
None						
GROUNDMASS						
Plagioclase	30		1.2	0.3	Laths	Interlocking elongated feldspar laths - often as crudely radiating aggregates. Quench texture?
Magnetite	1		0.1		Acicular	
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Clay/Chlorite	39		0.1		Anhedral	Within groundmass
Quartz	30		0.6		Anhedral	As quartz veins, vesicle fill and selectively replacing feldspar laths
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.2		Anhedral / euhedral	Within groundmass often associated with clay minerals also in vesicle fill with chalcopyrite
Chalcopyrite	Trace		0.4		Anhedral / euhedral	Within quartz veins and groundmass locally intergrown with pyrite.
COMMENTS AND SKETCH:		Network of unusually elongated plagioclase laths - suggesting the rock preserves a relict quench texture, now partially replaced by quartz and clay minerals See photomicrographs 1189A_87 and 1189A_88				

TS: 54 193-1189A-8R1-103-105 #17		UNIT: 15			OBSERVERS:	
Leg/Hole/Core/Sec/Interv/Pc					SR	
ROCK NAME:		Altered plagioclase phyric volcanic rock with local quench textures (Xenolith).			AP	
TEXTURE:					SDS	
					DAV	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace		0.6		Tabular.	Plagioclase phenocrysts within fine grained matrix, with inclusions of magnetite.
GROUNDMASS						
Plagioclase/Glass	30					Feldspar microlites within a glass matrix.
Magnetite	1		0.01		Acicular/equant.	Finely disseminated within a glass matrix -also outlines elongate plagioclase laths and their subsequent alteration products.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	30		0.3		Anhedral	Replacing quenched area of the slide in association with clay minerals
Clay/(Chlorite)	39		0.01		Anhedral	Blotchy alteration of fine grained groundmass - chlorite observed within quench textured matrix.
Maghemite	Trace		0.01			As rims to magnetite grains
Hematite	Trace		0.01		Lamella.	A associated with magnetite. Replace the magnetite.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.05		Anhedral-cubes.	Replacing cores of elongate plagioclase laths, locally enclosing magnetite.
Chalcopyrite	Trace		0.04		Anhedral.	Locate at margins of quartz rich vesicle fill and within clay rich material of altered groundmass.
COMMENTS AND SKETCH:		Very fine grained volcanic material - injected? by a medium grained quenched textured volcanic rock. Hematite replaced magnetite. Sulfides are later. Pyrite partially replaces magnetite / hematite assemblage. Chalcopyrite formed later and is the latest sulfide phase. See Chapter 4, Figure F78; see photomicrographs 1189A_89, 1189A_90, and 1189A_94				

TS: 113 193-1189B-1R1-0-4#1		UNIT 1			OBSERVERS: SR SDS AP / CY WB/DAV	
ROCK NAME:	Semi-massive sulfide (chimney material?).					
TEXTURE:	Clastic					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS	None					
GROUNDMASS	None					
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Anhydrite	30		0.4		Laths	Coarse interlocking laths as matrix to semi-massive sulfide.
Gypsum	14		0.1		Fibers	Low relief-fibrous mineral (length slow) intergrown with and replacing anhydrite.
Clay	1					In a small fragment of clay-altered volcanic rock
Magnetite ?? SEE BELOW	Trace		0.01		Anhedral	As inclusions within pyrite
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	35		2.5		Anhedral/subhedral	Massive aggregates of chalcopyrite. In places enclosing pyrite grains, elsewhere aggregate rims mantled by pyrite. Also occurs as small inclusions within pyrite.
Chalcopyrite	20		2.5		Anhedral	
Sphalerite	Trace		0.01		Anhedral	Inclusions in pyrite and rare in chalcopyrite. Distinguished from magnetite by its internal reflections.
COMMENTS AND SKETCH:	Intergrowths of pyrite and chalcopyrite, within an anhydrite, quartz matrix. Possible worm tubes? An arcuate thin band of pyrite forms the outer wall with chalcopyrite inside. If this interpretation is correct, the sample must be a piece of old sulfide chimney that has been buried. However, there are angular fragments of variably altered volcanic clasts, much more irregular chalcopyrite forms are the norm and the anhydrite veins are consistent with the stockwork veinlets observed throughout. Also the pyrite grains show euhedral form around part of the chalcopyrite rims. See Chapter 4, Figure F91; see photomicrographs 1189B_01 and 1189B_02					

TS: 114 193-1189B-1R1-21-23 #2		UNIT: 2			OBSERVERS:	
ROCK NAME:	Completely altered, moderately vesicular, aphyric volcanic rock.				SR	
TEXTURE:					AP	
					WB	
					CY / DAV	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
PHENOCRYSTS		min.	max.	av.		
None						
GROUNDMASS	Completely Altered					
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Brown Clay	50	<0.01			Anhedral	Dominant alteration product. Replacing igneous groundmass - preferentially replacing former plagioclase microlites.
Silica/Quartz?	22		0.1		Anhedral	Fine grained groundmass intergrown with brown clay. Filling vesicles.
Illite(?)	25	<0.01			Anhedral	Replacing groundmass and lining vesicle walls.
Anhydrite	Trace					Lining vesicle walls. Very rare.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3		0.1		Subhedral to euhedral.	Disseminated pyrite grains within clay alteration.
COMMENTS AND SKETCH:	Alteration shows a vague zonation around vesicles, with clearer (more siliceous?) alteration adjacent to them and more brown clay further away.					

TS: 115 193-1189B-2R1-11-14 #2		UNIT: 3			OBSERVERS:	
ROCK NAME:		Stockwork anhydrite-pyrite veins in volcanic rock.			SR	
TEXTURE:					CY	
					DAV	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
None						
GROUNDMASS						
Relict Glass	10					Perlitic fractures, but completely devitrified (non-isotropic) - looks like cristobalite-clay.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Anhydrite	35		0.6		Euhedral/Anhedral	Anhydrite grains being replaced by gypsum
Gypsum (+/- clay or cristobalite?)	40		0.3		Fibrous	Evidence of gypsum replacing anhydrite. Gypsum pseudomorphs after anhydrite projecting into relict volcanic glass.
Quartz	10				Euhedral prismatic to pseudo-hexagonal	Perfect euhedral crystals, which tend to be concentrated in patches in the slide, surrounded by gypsum.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	5		0.25	0.05	Subhedral	Occurs as coarse 'corroded' aggregates with anhydrite-gypsum and as fine rounded-euhedral isolated crystals or groups of crystals in what appear to be voids in perlitic volcanic glass.
COMMENTS AND SKETCH:						
This thin section was taken to investigate the pyrite-anhydrite stockwork veins and shows remnant domains of perlitic volcanic glass surrounded by anhydrite-gypsum-(pyrite-quartz). Careful examination suggests that anhydrite is not in contact with volcanic glass. Fine fibrous gypsum (+/- clay?) is in contact with and appears to be replacing volcanic glass. Gypsum clearly replaces anhydrite crystals along cleavage planes. It is difficult to envisage a process by which gypsum would replace volcanic glass. In some places there are apparent contacts between gypsum in the vein with anhydrite and apparent gypsum replacing volcanic glass. Euhedral quartz crystals are unlikely to have grown in a coherent volcanic rock and must therefore be later growth, most likely in voids.						
See Chapter 4, Figures F37 and F59A and B; see photomicrographs 1189B_03, 1189B_05, 1189B_06, and 1189B_24						

TS: 116 193-1189B-6R1-13-15 #2		UNIT: 5			OBSERVERS: SR WB CY DAV	
ROCK NAME:	Altered volcanic fragments hosted in a jasperoidal siliceous matrix.					
TEXTURE:	Clastic					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	2		1.2	0.8	Tabular, rounded	Plagioclase phenocrysts preserved within altered volcanic clasts.
Quartz	Trace		0.5		Rounded to angular	Classic volcanic quartz with concoidal fracture planes, only positively identified in one of the altered volcanic fragments, although the cores to some of the poikiloblastic quartz patches in other pieces may be phenocrysts.
GROUNDMASS						
Plagioclase	15		<0.1		Laths	Fine grained plagioclase within groundmass of clasts
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	25		0.6	0.2	Anhedral	Quite coarse interlocking crystal aggregates, overgrowing and intergrown with hematite. Patchy poikiloblastic alteration of volcanic rocks.
Silica (Cristobalite?)	20					Microcrystalline groundmass silica in volcanic fragments
Brown Clay	20		<0.01		Anhedral	Replacing glassy groundmass of volcanic rocks and partly replacing plagioclase.
Hematite	15				Anhedral	10-20 micron flakes are agglomerated into rounded masses, average 100 microns across, enclosed by optically continuous quartz grains
Chlorite	2		0.05		Fibrous	Fibrous aggregates grow inward from vesicle walls, forming amygdales.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	1				Euhedral	Discrete grains typically located towards the vein margins.
COMMENTS AND SKETCH:	Clasts of moderately plagioclase-phyric highly altered and pervasively silicified volcanic rock in a quartz-hematite matrix. Remnant perlitic fractures. Poikiloblastic quartz growing in the altered clasts. Fresh phenocrysts and microlites are abundant. See Chapter 4, Figures F60A and B and F36; see photomicrographs 1189B_07, 1189B_08, 1189B_09, 1189B_10, 1189B_11, and 1189B_12					

TS: 117 193-1189B-7R1-0-3 #1		UNIT: 8			OBSERVERS: SR WB CY DAV	
ROCK NAME:	Completely altered and mineralized, brecciated volcanic rock.					
TEXTURE:	Breccia					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace		0.3		Subhedral	Replaced by clay and quartz
GROUNDMASS						
Plagioclase	3		<0.1		Laths	Relict microcrystalline matrix preserving flow banding and locally perlitic texture
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	45		0.2		Anhedral	Macro quartz with pyrite and trace anhydrite as veins in brecciated glassy volcanic precursor.
Anhydrite	Trace		0.5		Anhedral	Trace anhydrite within quartz pyrite vein and as fill to one fine crosscutting fracture.
Brown clay	27		<0.01		Anhedral	Pervasively altering the groundmass and plagioclase microlites within the volcanic clasts
Cristobalite(?)	10					Devitrified, essentially unaltered glassy perlitic volcanic fragments
Hematite	Trace					Rare fine flakes in quartz vein
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	15		0.1		Euhedral/anhedral	As discrete grains within altered volcanics. Intergrown with quartz within veins - although taking a very poor polish.
COMMENTS AND SKETCH:	Brecciated volcanic rock. Crosscut by veins of quartz and pyrite with minor anhydrite. Dendritic plagioclase in formerly glassy groundmass appear to be pseudomorphed by brown clay. The clasts are light greenish-gray and very soft in hand specimen. Two types of clast visible. Strongly clay-altered volcanic clasts and clearer clasts which appear to be composed of essentially unaltered devitrified volcanic glass (cristobalite?). Some of the more strongly altered clasts have fresher domains within them. There do appear to be scattered plagioclase microlites in the groundmass, even in strongly clay-altered pieces. Volcanic clasts have perlitic cracks.					

TS: 118 193-1189B-8R1-37-40 #10		UNIT: 11			OBSERVERS: SR WB AP CY / DAV	
ROCK NAME:	Completely altered, moderately vesicular, aphyric volcanic rock.					
TEXTURE:	Vesicular					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
PHENOCRYSTS		min.	max.	av.		
None						
GROUNDMASS Completely Altered						
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	45		0.4		Subhedral aggregates	Pervasive throughout the section, as vesicle fill and as vein fill to crosscutting pyrite, chalcopyrite vein.
Illite	17		<0.01		Fibrous aggregates	Within groundmass - replacing original spherulitic textures? Some seem to line circular voids (=microvesicle lining)? Others have pseudoprismatic shapes, suggesting pseudomorphic replacement of plagioclase.
Brown Clay	35		<0.01		Anhedral	Alteration of groundmass - increasing toward vein margin? Appears uniform to other observers.
Hematite	Trace		0.15		Euhedral	Inclusions in quartz
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3		0.4		Euhedral	Typically as disseminated grains within the groundmass and intergrown with chalcopyrite in crosscutting vein.
Chalcopyrite	Trace		0.35		Anhedral	Predominantly in crosscutting veinlet and within vein alteration halo.
COMMENTS AND SKETCH: Silicified volcanic rock. Vesicles filled or partly filled by quartz and sulfides. The thin section has a fairly interesting texture, with an abundance of circular to subcircular domains defined by quartz+/-pyrite and illite+/-quartz+/-pyrite. They vary from obvious amygdales which are up to 2mm in size, to fine (0.1 mm and less) ovoid spots filled with illite+/-quartz+/-pyrite, which are most likely to be remnants of very fine vesicles. These spots are angular, irregular ('hieroglyphic') to ovoid in shape and completely surrounded by darker silica and brown clay groundmass. Maybe they are the remnants of early (diagenetic?) alteration and still preserved because subsequent pervasive alteration did not go to completion? See Chapter 4, Figure F31A and B; see photomicrograph 1189B_15						

TS: 119 193-1189B-8R1-7-9 #3		UNIT: 9			OBSERVERS: DAV CY	
ROCK NAME:	Highly altered aphyric volcanic rock.					
TEXTURE:	Massive.					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace	0.4	0.6	0.5	Lath-shaped.	Completely replaced by clay + quartz.
GROUNDMASS						
Plagioclase (XRD = Kspar)	10			0.025	Subhedral lath-shaped microlites.	Is this still plagioclase? It polishes well, like plagioclase or quartz, in contrast to the soft enclosing clay.
ALTERATION MINERALOGY						
	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	15	0.3	0.6	0.4	Anhedral.	Rounded vesicle fill, anhedral within veinlet. Quartz in the groundmass as well?
Illite	20			<0.001	Ahedral.	Groundmass, particularly near veinlets.
Brown Clay	50					Groundmass.
Anhydrite	Trace				Prismatic	One crystal seen as partial vug fill
Chlorite	Trace				Anhedral mat	With quartz and pyrite in a veinlet.
Magnetite	Trace			0.005	Rounded subhedra	Fine inclusions in quartz
SULFIDE MINERALOGY						
	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	5	0.03	0.25	0.1	Euhedral to subhedral	Disseminated and aligned along hairline curved fractures through glassy groundmass. Includes numerous groundmass inclusions (clay altered feldspar microlites?).
Chalcopyrite	Trace		0.04		Anhedral	In groundmass, solitary grains.
?? Reflectant Mineral			0.001		Lath	Fine lath-like inclusions in a magnetite crystal. Highly reflectant with strong white internal reflections
Comments and Sketch:						
See photomicrograph 1189B_53						

TS: 120 193-1189B-10R1-28-3 1#3		UNIT: 14			OBSERVERS:	
ROCK NAME:	Cherty, pyritic silicified volcanic rock.				CY	
TEXTURE:	Amygdaloidal				AP	
					DAV	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
PHENOCRYSTS		min.	max.	av.		
GROUNDMASS						
Plagioclase	10			0.1	Acicular	Fine microlitic plagioclase. Partially clay altered (dirty dusting)
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	30					Coarse amygdale fill, with and without anhydrite and pyrite. 0.1 mm quartz-chalcopyrite-pyrite-(sphalerite) vein, which is crosscut by the anhydrite vein. Finer, granular quartz in groundmass.
Anhydrite	30				Bladed to irregular	Coarse anhydrite intergrowth in vein. Rarer crystals in the center of quartz amygdales.
Brown Clay	20					Replacement of groundmass
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	8				Euhedral	Coarser (0.5mm) cubes in quartz filled amygdale. Also occur as finer (<0.1mm) cubes in quartz vein, in anhydrite vein and throughout the groundmass of the rock. In the latter case, they enclose numerous relict plagioclase microlites.
Chalcopyrite	2				Anhedral	Mostly in quartz vein, rare finer crystals in groundmass of rock and as inclusions in anhydrite. Submicron inclusions in sphalerite.
Sphalerite	Trace			0.02	Anhedral	Fine irregular blebs, generally as inclusions in groundmass quartz, with chalcopyrite disease, occasional covellite inclusions. Rare octahedra with chalcopyrite disease in quartz vein. As inclusions in pyrite. As inclusions in anhydrite.
Covellite	Trace					
COMMENTS AND SKETCH:	This section was cut to determine if the hard siliceous rock was vein material or volcanic rock. Clearly, the rock is volcanic, retaining remnant plagioclase microlites. Clearly, the rock is volcanic, retaining remnant plagioclase microlites. The anhydrite vein is late and postdates quartz-chalcopyrite-pyrite-(sphalerite) veining. Yet the anhydrite contains isolated tiny sphalerite inclusions, so they must have co-precipitated? Perhaps remobilized? The sphalerite is overgrown by anhydrite - not intergrown, implying it predates the anhydrite vein. See photomicrographs 1189B_16 and 1189B_17					

TS: 121 193-1189B-10R1-57-60 #7		UNIT: 14			OBSERVERS:		
ROCK NAME:		Completely altered, flow-banded, spherulitic volcanic rock.				DAV	
TEXTURE:		Laminated, spheroidal.				HP	
						CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
PHENOCRYSTS							
None							
GROUNDMASS							
Kspar (XRD)	10			0.025		Remnant microlites in altered glass - very dirty looking. XRD indicates Kspar rather than plagioclase.	
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Quartz	30	0.05	0.5	0.4	Anhedral grains form mosaic patches.	Abundant microlite and irregular clay inclusions (grunge).	
Chlorite	37	0.005	0.01		Microcrystalline mat.	Clear to pale green, first-order gray birefringence.	
Brown Clay	19			<0.001	Microcrystalline, clots.	Replacement of microlites and forming the granular concentrations at the cores of spherulites.	
Magnetite	Trace			0.02	Rounded subhedra and rare laths	Scattered in groundmass as inclusions in quartz and rarely as inclusions in pyrite	
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Pyrite	3		0.5		Euhedral	Disseminated, aligned aggregates that conform to lamination, associated with quartz-rich domains and with quartz in a thin veinlet.	
Sphalerite	1			0.02	Colloform to irregular	Concentrated in quartz-rich domains. Commonly exhibit chalcopyrite disease and/or rimmed by chalcopyrite.	
Chalcopyrite	Trace		0.2		Anhedral	Disseminated within quartz-rich domains, occurs as isolated grains, overgrowths on pyrite and as chalcopyrite disease and fine overgrowths on colloform sphalerite.	
COMMENTS AND SKETCH:							
<p>These round nodules are strongly altered and lack their characteristic internal texture (radiating, fibrous aggregates of quartz and feldspar). However, they show other characteristics which supports the interpretation of altered spherulites (similar size range within sample, coalescence to form linear domains with bulbous margins). Spherulites 0.4-0.6 mm in diameter, spherical to slightly ovoid. Commonly two or three individuals coalesce. The general structure is concentrically laminated with a core composed of cloudy, granular, weakly-birefringent clay in an isotropic brown material. The core may be elongate or rectangular, perhaps replacing a primary crystal, and giving rise to an ovoid spherulite. Surrounding the core is a layer of clear, low-birefringence, fine-grained chlorite that encloses acicular brown-clay-altered microlites. This is surrounded by a ring of tan, isotropic material which also contains microlites, and this is surrounded by a second layer of the microlite-bearing chloritic material. These layers grade from one to another. The spherulites are ringed by a halo of brown crystalline quartz with abundant microlite inclusions. Some spherulites are presently fine (25-50 micrometer) mosaic quartz, and may be recrystallized. Many spherulites have a pyrite crystal or two within them, at the center or off-center.</p> <p>See Chapter 4, Figure F38; see photomicrographs 1189B_18 and 1189B_19</p>							

TS: 122 193-1189B-11R1-63-65 #10		UNIT: 19			OBSERVERS: DAV CY	
ROCK NAME:	Aphyric, vesicular volcanic rock.					
TEXTURE:	Trachytic, vesicular.					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace	0.25	0.75	0.5	Euhedral, rounded euhedral, and corroded.	Three phenocrysts in the thin section. One is euhedral, rectangular and unzoned. Another is rounded euhedral and has zoned extinction. The third appears corroded at the ends, yet is unzoned.
GROUNDMASS						
Plagioclase	40			0.05	Acicular euhedral.	All microlites are close to 50 x 5 microns, aligned in a trachytic texture. They are set in a clay + quartzofeldspathic matrix.
Magnetite	Trace	0.001	0.005	0.002	Anhedral granular.	Disseminated.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Anhydrite	Trace	0.5	2	1.5	Anhedral.	Fills large vesicles.
Cristobalite	40	0.03	0.2	0.1	Anhedral blebs.	This material fills numerous tiny vesicles. It can occur enclosed in anhydrite. It is nearly isotropic, yet has very weak birefringence. No crystal form. This is almost certainly cristobalite. Also occurs as groundmass with clay, interstitial to feldspar microlites - probably devitrified glass.
Chlorite	20			<0.001	Very fine.	This is present in the groundmass between feldspar microlites, with cristobalite.
Zeolite	Trace			0.1	Euhedral.	One rhombic crystal with a prominent (010) cleavage, possibly representing heulandite or laumontite, occurs with a bleb of near-isotropic silica(?) enclosed within a large anhydrite crystal.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace	0.005	0.02	0.01	Anhedral.	Disseminated.
Chalcopyrite	Trace			0.005	Anhedral.	1 grain seen
COMMENTS AND SKETCH:	The photo shows the little euhedral zeolite(?) that, with the silica(?), is enclosed in anhydrite. The anhydrite is, itself, a large crystal sitting in a highly-stretched vesicle (oriented N-S in the photo). Vesicles comprise about 20% of the rock. See photomicrograph 1189B_20					

TS: 123 193-1189B-11R2-89-91 #8		UNIT: 19			OBSERVERS:		
ROCK NAME:		Aphyric vesicular volcanic rock.				DAV	
TEXTURE:		Vesicular, xenolithic.				AP	
						CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
PHENOCRYSTS							
Plagioclase	Trace	0.1	0.3	0.2	Euhedral, skeletal laths.	Restricted to a phenocryst-rich xenolith.	
Clinopyroxene	Trace	0.125	0.35		Rounded prismatic.	One phenocryst, with a faint green color, high birefringence, and prismatic cleavage.	
Clinopyroxene	Trace		1	0.5	Acicular.	Acicular clinopyroxene is restricted to a spinifex-like xenolith where it occurs with skeletal plagioclase laths.	
GROUNDMASS							
Plagioclase	35	0.025	0.075	0.05	Skeletal subhedral laths.		
Magnetite	Trace	0.001	0.01	0.005	Granular.	Disseminated.	
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Chlorite/Smectite	15			<0.005	Granular mats.	Green, non-pleochroic, moderately birefringent; mats are 50-100 microns across, dispersed throughout the groundmass.	
Cristobalite	35	0.05	0.2	0.1	Anhedral crystals.	Most abundant as partial linings to vesicles and amygdale. Interstitial to plagioclase (devitrified glass) throughout the groundmass.	
Quartz	5					Amygdale fill and vesicle lining	
Illite	10			<0.001		Disseminated in groundmass.	
Hematite	Trace		0.02			Rare fine ovoid spots in the groundmass	
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Pyrite	Trace.				Anhedral.	Rare disseminations in the groundmass.	
COMMENTS AND SKETCH:		Xenolith of skeletal plagioclase laths and elongate clinopyroxene crystals, with a matrix of green smectitic clay and quartzofeldspathic material, is about 1 cm across (photos). crystal from the xenolith sticks out into the host rock. See Chapter 4, Figure F42; see photomicrograph 1189B_22					

TS: 124 193-1189B-12R1-34-36 #3		UNIT:19			OBSERVERS:	
ROCK NAME:	Aphyric vesicular volcanic rock.				DAV	
TEXTURE:	Trachytic, vesicular.				AP	
						CY
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace			0.4	Laths.	One acicular lath, 500 x 50 microns, and one blocky and rounded lath, 350 x 175 microns.
GROUNDMASS						
Plagioclase	25	0.025	0.075	0.05	Skeletal subhedral laths.	Aligned with flow, parallel to stretched vesicles.
Magnetite	Trace	0.001	0.01	0.005	Granular.	Disseminated.
ALTERATION MINERALOGY		SIZE (mm)			MORPHOLOGY	COMMENTS
	PERCENT	min.	max.	av.		
Chlorite/Smectite	20			<0.005	Granular mats.	Green, non- to weakly-pleochroic, low to moderate birefringence; mats of smectite are 50-100 microns across, dispersed throughout the groundmass. Also occurs as partial linings to vesicles.
Cristobalite	35	0.05	0.2	0.1	Anhedral crystals.	Disseminated throughout the groundmass. Probably devitrified glass.
Illite	10			<0.001		Disseminated in groundmass.
Silica(?)	10	0.03	0.2	0.1	Anhedral blebs.	This material fills numerous tiny vesicles. It is nearly isotropic, yet has very weak birefringence and appears multicrystalline.
Anhydrite	Trace	0.5	0.7	0.6	Rounded anhedral.	This may be a polymorph of silica. Vesicle-filling single crystals.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace.				Anhedral.	Rare disseminations in the groundmass.
COMMENTS AND SKETCH:	Original vesicularity is approximately 20%.					

TS: 125 193-1189B-12R2-55-57#5		UNIT: 19			OBSERVERS: DAV	
ROCK NAME:	Highly altered, aphyric, vesicular volcanic rock.					
TEXTURE:	Vesicular.					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace			0.5	Lath.	Just two or three acicular laths and a few rounded (partially resorbed?) phenocrysts
GROUNDMASS						
Plagioclase	40	0.025	0.075	0.05	Skeletal subhedral laths.	
Magnetite	Trace	0.001	0.01	0.005	Granular.	Disseminated.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Chlorite/Smectite	15			<0.005	Granular mats.	Green, moderately to weakly pleochroic, low to moderate birefringence; mats are 50-100 microns across, dispersed throughout the groundmass. Also occurs as partial linings to vesicles.
Cristobalite	15	0.05	0.2	0.1	Anhedral crystals.	Disseminated throughout the groundmass. Probably devitrified volcanic glass
Illite	15			<0.001		Disseminated in groundmass.
Silica(?)	15	0.03	0.2	0.1	Anhedral blebs.	This material fills numerous tiny vesicles. It is nearly isotropic, yet has very weak birefringence and appears multicrystalline. This may be a polymorph of silica. Also cristobalite?
Anhydrite	Trace	0.5	0.7	0.6	Rounded anheda.	Vesicle-filling single crystals.
Quartz	Trace				Rounded subhedra	Rare amygdale fill, vesicle linings
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace				Anhedral.	Extremely rare disseminations in the groundmass.
COMMENTS AND SKETCH:	Original vesicularity comprises about 20% of the specimen.					

TS: 126 193-1189B-12R3-46-48 #7		UNIT: 19			OBSERVERS: SR DAV CY	
ROCK NAME:	Highly altered, aphyric, vesicular volcanic rock.					
TEXTURE:	Vesicular					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Feldspar	Trace		0.8		Rounded elongate crystal.	The crystal appears to be resorbed, possibly from a lath shape into a lozenge shape. Twinning is slightly unusual for a plagioclase, and there is a possibility this grain is an alkali feldspar(?).
Mafic phenocryst	Trace		0.8		Stubby euhedral prism.	Completely replaced by smectite. Possibly originally clinopyroxene on the basis of morphology.
GROUNDMASS						
Plagioclase	20		0.1		Laths	
Magnetite	Trace	0.001	0.01	0.005	Granular	Disseminated.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Chlorite/Smectite	20			<0.005	Granular mats.	Green, moderately to weakly pleochroic, low to moderate birefringence; mats are 50-100 microns across, dispersed throughout the groundmass. Also occurs as partial linings to vesicles.
Cristobalite	20	0.05	0.2	0.1	Anhedral crystals.	Disseminated throughout the groundmass often as vesicle fill
Illite	20			<0.001		Disseminated in groundmass.
Silica(?)	18	0.03	0.2	0.1	Anhedral blebs.	This material fills numerous tiny vesicles. It is nearly isotropic, yet has very weak birefringence and appears multicrystalline.
Quartz	2				Rounded subhedra	This may be a polymorph of silica. Rare amygdales and vesicle linings
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.05		Subhedral	Finley disseminated pyrite locally within fractures.
Chalcopyrite	Trace		0.025		Anhedral	
Sphalerite	Trace		0.015		Anhedral	One grain within the groundmass associated with yellow mineral.
COMMENTS AND SKETCH:						

TS: 127 193-1189B-13R1-22-24#4		UNIT: 20			OBSERVERS: AP SR HP DAV / CY	
ROCK NAME:	Altered volcanic breccia.					
TEXTURE:	Polymict breccia					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace		0.6		Laths	Rare feldspar laths within vesicular part of the section
GROUNDMASS						
Plagioclase	20		0.9			Occurs as branching, interlocking, elongate laths up to 0.9 mm long, suggestive of quench texture, within a distinct 5 mm wide band in a rounded gray siliceous clast Fragments of volcanic glass preserving perlitic texture and tube pumice?
Volcanic Glass	18					
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Anhydrite	Trace		0.5		Anhedral	Spatially restricted toward the edge of the section.
Quartz	40		0.3		Anhedral	As vesicle fill and finely distributed within the groundmass
Illite	20		<0.01		Anhedral	Replacing the volcanic groundmass
Leucoxene	Trace	0.05	0.15		Anhedral	Disseminated in groundmass.
Hematite	Trace					One example.
Magnetite	Trace	0.005	0.05		Anhedral	Small aggregates disseminated in groundmass. Tiny anhedral crystals associated with leucoxene.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	2	0.02	0.4		Anhedral to Subhedral	Fine crystals disseminated in the groundmass.
Chalcopyrite	Trace				Anhedral	Fine irregular blebs, generally as inclusions in groundmass quartz.
Sphalerite	Trace				Anhedral	Fine irregular blebs, generally as inclusions in groundmass quartz, with chalcopyrite disease. As inclusions in pyrite free of chalcopyrite disease.
COMMENTS AND SKETCH:						
Altered volcanic rock with contrasting fragments, including perlitic volcanic glass, flow banded and quench textured rhyolites. There are five different types of clasts: One large (~3 cm) clast with preserved perlitic texture which was glassy originally but consists mainly of quartz and feldspar. This clast has a distinct banded texture and contains the band of quench textured plagioclase. The remainder of the clast is strongly vesicular and silicified, with quartz aggregates pseudomorphing feldspar. One large (~2 cm) clast with minor plagioclase phenocrysts (<1 mm) and ~30%, elongate quartz amygdales (similar to Unit 19) One large (~1 cm) clast with trachytic to variolitic groundmass texture and one, round quartz amygdale Two small (0.3 mm) brown, glassy clasts. Abundant small (up to 0.5 mm) aphanitic clasts with internal lamination defined by fine, aligned, black cryptocrystalline aggregates (representing fill of elongated microvesicles?). See Chapter 4, Figure F40; see photomicrographs 1189B_31 and 1189B_33						

TS: 128 193-1189B-13R1-34-36#6		UNIT: 20			OBSERVERS:	
ROCK NAME:	Silicified glassy volcanic rock.				AP	
TEXTURE:	Clastic with perlitic (and pumiceous) clasts				SR	
					HP	
					DAV /CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
None						
GROUNDMASS						
Altered volcanic glass	40					Preserving a perlitic texture, within brown volcanic glass.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	53		0.4		Anhedral aggregates	Within veins, exploiting perlitic fractures and pervasively replacing volcanic groundmass.
Barite	2				Prismatic	Dirty high relief prisms in quartz veins, locally overgrows anhydrite
Anhydrite	1					In quartz veins, replaced by barite
Chlorite	2		<0.1		Rounded aggregates	Patches of alteration developed on the volcanic glass. Filing fine stretched vesicles.
Hematite	Trace					Extremely fine grained with a red color in groundmass quartz..
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	2	0.002	0.2		Anhedral to Subhedral	Fine crystals disseminated in the groundmass.
Chalcopyrite	Trace	0.01	0.2		Anhedral to Subhedral	As inclusions in sphalerite.
Sphalerite	Trace	0.05	0.2		Anhedral	Fine irregular blebs, generally as inclusions in groundmass quartz, with chalcopyrite disease. Translucent with a brown reddish color. Replaces pyrite.
Galena or Tennantite-tetrahedrite	Trace	0.05	0.1		Anhedral	As inclusions in the groundmass quartz in association with sphalerite. Some small pieces of the mineral were plucked out during polishing, showing characteristic triangular scratches (25.8; 81.2 - image below). No characteristic scratches and the mineral has lower reflectance than pyrite. It's clearly softer than sphalerite. Possibly tennantite-tetrahedrite (photomicrograph)?
COMMENTS AND SKETCH:	Pronounced silicification of volcanic groundmass. Abundant large (>2 cm) perlitic clasts. One (3 mm) perlitic clast with stretched, chlorite filled vesicles => pumiceous clast. See Chapter 4, Figures F35, F70, and F34A and B; see photomicrographs 1189B_34, 1189B_55, 1189B_56, and 1189B_66					

TS: 129 193-1189B-13R1-52-54#10		UNIT: 21			OBSERVERS: AP SR DAV CY / HP
ROCK NAME:	Completely altered silicified volcanic rock.				
TEXTURE:	Remnant perlite				
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
		min.	max.	av.	
PHENOCRYSTS					
Plagioclase	Trace	0.28	0.64	0.5	Rounded. There are three plagioclase phenocrysts. Each one is well rounded such that two of them are nearly circular (corroded laths viewed end-on?).
GROUNDMASS					
Volcanic Glass					Completely replaced - relict perlitic texture is all that remains.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
		min.	max.	av.	
Quartz	50		0.2		Pervasively replacing the groundmass.
Brown clay	20		<0.01		Replacing glass along with quartz. White in reflected light
Chlorite	29		<0.01		Replacing glass along with quartz and brown clay. Not white in reflected light.
Hematite	Trace				Extremely fine grained with a red color in groundmass quartz..
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
		min.	max.	av.	
Pyrite	1	0.002	0.4		Fine crystals disseminated in the groundmass.
Chalcopyrite	Trace	0.01	0.4		Fine irregular blebs, generally as inclusions in groundmass quartz in association with sphalerite. Also as inclusions in sphalerite. Replaces sphalerite.
Sphalerite	Trace	0.05	0.3		Fine irregular blebs, generally as inclusions in groundmass quartz, with chalcopyrite disease. Translucent with a yellow to brown reddish color. Replaces pyrite.
COMMENTS AND SKETCH:	Photo shows relict perlitic cracks within the groundmass cross cutting different types of alteration in the groundmass. This indicated that the entire groundmass consisted originally of volcanic glass which subsequently became replaced by different alteration assemblages generating the patchy appearance. Section contains only one convincing quartz amygdale. See Chapter 4, Figure F33				

TS: 130 193-1189B-14R1-100-102 #14		UNIT: 23			OBSERVERS: SR DAV CY	
ROCK NAME:	Altered glassy volcanic rock.					
TEXTURE:	Perlitic					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace			1.6	Rounded lozenge-shaped.	Rounded shape derives from a corroded lath. The plagioclase is very fresh, though.
GROUNDMASS						
Volcanic Glass	55					Relict volcanic glass showing perlitic texture, crosscut and locally brecciated by quartz/anhydrite veins.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	31		0.4		Anhedral	Within veins and micron scale fractures within the volcanic glass
Anhydrite	4		0.7		Anhedral	Within discrete veins with quartz and exploiting perlitic fractures.
Brown/Green Clay	5		<0.01		Anhedral	Partially replacing the volcanic glass
Kspar?	4				Prismatic to anhedral	Dirty flaky aggregates of prismatic crystals, apparently replacing volcanic glass. Unable to get a decent optic axis figure to confirm if biaxial or uniaxial (=quartz). Some show apparent twinning.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	1		0.05		Subhedral	Disseminated through altered volcanic glass
Sphalerite	Trace		0.1		Euhedral/anhedral	Sphalerite within micro-quartz filled vesicles, containing inclusions of pyrite.
COMMENTS AND SKETCH:	Altered volcanic glass with perlitic texture, brecciated and veined by quartz-anhydrite veins.					

TS: 131 193-1189B-14R1-108-110 #15		UNIT:23			OBSERVERS:	
ROCK NAME:	Completely altered volcanic rock.				SR	
TEXTURE:	Breccia				SDS	
					AP	
					DAV / CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
PHENOCRYSTS		min.	max.	av.		
None						
GROUNDMASS						
None						
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Anhydrite	50		3		Subhedral	Coarse anhydrite crystals, locally enclosing quartz and sulphides (chalcopyrite/spahalerite)
Quartz	20		0.5		Anhedral	Within the anhydrite dominated vein and within altered volcanic within fractures and permeating pre-existing flow banding.
Kspar?	5					Biaxial optic axis figure obtained - flaky radiating aggregates of prismatic crystals, apparently replacing volcanic glass
Brown Clay (pyrophyllite?)	22		<0.01		Anhedral	Pervasive alteration of volcanic groundmass
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	2		0.3		Subhedral/anhedral	Present within ahydrite vein and volcanic groundmass, commonly shows inclusions of sphalerite. Often overgrown by chalcopyrite and chalcopyrite diseased sphalerite.
Chalcopyrite	Trace		0.2		Anhedral	Predominantly within the anhydrite vein, intergrown with sphaerite and as chalcopyrite disease within sphalerite. Inclusions in pyrite.
Sphalerite	1		1.4		Subhedral/anhedral	Large aggregates within the anhydrite vein, showing chalcopyrite disease towards the rims - see photograph. Most is in contact with quartz. Inclusions in chalcopyrite and pyrite.
COMMENTS AND SKETCH:	Altered volcanic rock brecciated by anhydrite, quartz, sulfide veins. Most of the sphalerite is enclosed totally by or is in contact with quartz. Sphalerite appears to have been deposited on a thin quartz substrate. Appears that the quartz and sphalerite are penecontemporaneous and the anhydrite is later. There is some but not much sphalerite in just anhydrite without quartz. Sphalerite masses in transmitted light have reddish brown interiors and opaque exteriors. This appears to be a consequence of the distribution of chalcopyrite disease that turns the sphalerite opaque. Sphalerite inclusions in pyrite do not have chalcopyrite disease. See Chapter 4, Figure F94; see photomicrograph 1189B_57					

TS: 132 193-1189B-15R1-86-88 #11		UNIT: 25			OBSERVERS: SR DAV CY	
ROCK NAME:	Completely altered volcanic rock.					
TEXTURE:	Spherulitic					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
None						
GROUNDMASS						
Relict Spherulites						
Plagioclase	5					Completely altered groundmass, with spheroidal texture, after igneous spherulites? More coherent bands contain abundant aligned plagioclase microlites
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Brown Clay	80		<0.01		Anhedral	Majority of section is a tan colored, cryptocrystalline material. "Multiclay" according to XRD.
Cristobalite	10					Within the altered groundmass and as a microcrystalline fill to fractures crosscutting the layered groundmass.
Quartz	5					As microcrystalline fill to fractures crosscutting the layered groundmass.
Kspar	Trace					Rare dirty macrocrystals in the volcanic glass
Heulandite/Stilbite?	Trace		0.05		Tabular	Low relief and low birefringence crystals, showing spherulitic form.
Epidote?	Trace		0.08		Radiating	Radiating aggregates of greenish yellow-brown weakly pleochroic with bright birefringence colors (almost mica like). Shows a good polish in reflected light (better than quartz). Some appear to be pseudomorphing spherulitic structures.
Prehnite	Trace		0.1		Radiating sheaf	Only one radiating cluster; parallel extinction, characteristic yellow-blue interference. Associated with the epidote and hematite.
Magnetite	Trace		0		Anhedral	Trace amounts associated with pyrite. Also as a rounded skeletal phenocryst in one clast, partially mantled by hematite.
Hematite	Trace		0.05		Blades	Bladed masses developed within the groundmass
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.05		Subhedra/rounded	Pyrite along quartz filled fractures. Occasionally showing "framboidal" form.
Chalcopyrite	Trace		0.1		Anhedral	Discrete grains within the groundmass in proximity to pyrite filled fractures.
COMMENTS AND SKETCH:						
Highly altered volcanic rock, with relict flow banding and spherulitic textures. Cross cut by fine quartz filled fractures with "framboidal" pyrite. Rotated, flow laminated clasts. Flow lamination is defined by microspherulites forming coalesced, white bands and dark, chloritic bands with isolated microspherulites. See photomicrographs 1189B_41, 1189B_59, and 1189B_60						

TS: 133 193-1189B-15R1-131-134 #15		UNIT: 25			OBSERVERS: SR HP WB DAV / CY	
ROCK NAME:	Completely altered, flow banded volcanic rock.					
TEXTURE:	Flow banded					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace	0.13	0.72	0.3	Blocky laths	Fresh feldspars in altered volcanic groundmass, containing euhedral magnetite and devitrified melt inclusions.
Clinopyroxene	Trace		0.2		Subhedral	Completely replaced by clay
GROUNDMASS						
Altered volcanic glass-silicified (cristobalite)	78					With relict spherulitic texture and flow banding
Plagioclase	1				Laths	Sparse microlites.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Cristobalite?	Trace				Fibrous	Replacing glass (up to 80%). Trace as a fibrous cavity fill to some void space, centrally filled by macro quartz.
Quartz	1					In rounded aggregates (amygdales?)
Clay	20					Replacing groundmass and clinopyroxene
Magnetite	Trace			0.12		Occasionally as granular masses with chalcopyrite and hematite
Hematite	Trace			0.1		Bladed masses
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.05		Subhedral	Discrete grains distributed throughout the groundmass, more evident in close proximity to crosscutting fractures
Chalcopyrite	Trace		0.15		Anhedral	Sparsely distributed in proximity to crosscutting fractures, locally enclosing pyrite grains.
COMMENTS AND SKETCH:						
Flow banding is defined by domains consisting of coalesced microspherulites (white bands) and domains consisting of chlorite (altered volcanic glass?) with isolated microspherulites. Masses of bladed hematite with sparse magnetite, pyrite and chalcopyrite together with quartz. These are the dark blebs seen in hand specimen. The convolute Liesegang-type banding which overprints the flow laminations in hand specimen are sometimes associated with hairline fractures and appear to be devitrification and/or clay alteration fronts. See Chapter 4, Figures F39, F30, and F96						

TS: 134 193-1189B-15R2-61-64 #10		UNIT: 26			OBSERVERS: WB DAV CY	
ROCK NAME:	Highly altered, moderately plagioclase-phyric, nonvesicular, xenolith-bearing volcanic rock.					
TEXTURE:	Porphyritic					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	2	0.2	2.5	1	Laths, tabular, rounded	In host rock: More than 2% in host rock, hence moderately phyric
Plagioclase			4			In xenoliths: replaced by quartz
Olivine	Trace		1		Euhedral	One completely altered (talc?) phenocryst with unaltered Cr spinel inclusion.
GROUNDMASS						
Plagioclase microlites	15			0.05	Laths	In host rock: aligned.
Plagioclase	20				acicular, quench growth	In xenoliths, relict microlite, quench crystals in xenoliths and along margins.
Clinopyroxene	5				Anhedral	In xenoliths: one has large acicular crystals, other has relict cpx intergrown with plag.
Magnetite	Trace					In xenoliths
Hematite	Trace					Forms rims on some magnetite crystals.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	13					Replacing quartz, replacing groundmass of host rock, in veinlet cutting host rock
Smectite(?)	10					Replacing clinopyroxene in xenoliths.
Cristobalite(altered glass)	35					Groundmass of host rock. Partially to completely devitrified/hydrated
Hematite	Trace					Patches in groundmass. Rare fine acicular sheaves in amygdales
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.1		Subhedral	In xenoliths, some framboids. Traces in fine quartz veinlets and quartz amygdales in host rock. Rare framboids in vesicles
Chalcopyrite	Trace		0.1		Anhedral	In xenoliths. Also traces in vesicles in host rock
Sphalerite	Trace		0.1		Subhedral	One chalcopyrite diseased, corroded crystal seen in a vesicle
COMMENTS AND SKETCH:	Two large xenoliths, embedded in a moderately plagioclase-phyric altered volcanic rock, make up 50% of thin section. Xenoliths are highly altered, with plagioclase partly replaced by quartz, clinopyroxene partly replaced by smectite(?), and one large olivine phenocryst, replaced by talc(?). Cr spinel inclusions in olivine are preserved (photomicrograph). Xenoliths are surrounded by a reaction rim of quench-growth plumose plagioclase aggregates (photomicrograph). See Chapter 4, Figure F43; see photomicrograph 1189B_39					

TS: 135 193-1189B-16R1-11-14 #2		UNIT: 26			OBSERVERS:	
ROCK NAME:		Highly altered breccia.			WB	
TEXTURE:		Clastic			DAV	
					SDS	
					AP / CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	1	0.28	1.2	0.5	Tabular	Fresh, rounded
GROUNDMASS						
Plagioclase	25		0.15		Laths	Aligned in groundmass of clasts.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Cristobalite	40					Replacing groundmass
Quartz	2					Filling vesicles and in veins.
Kspar?	6					Prismatic to irregular poikiloblasts, replacing groundmass glass
Brown clay	10					Replacing groundmass, concentrated along late quartz veins. Form diffuse veins in lower part of section.
Green clay	13					Replacing groundmass
Magnetite	Trace		0.2	0.3		Rare phenocryst. Small crystals disseminated in rock, probably magmatic. But they are distinctly more abundant adjacent to the vein - implying some hydrothermal component,
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	3		0.05		Subhedral. Framboidal.	Discrete grains distributed throughout the groundmass, more evident in close proximity to crosscutting fractures. Large area of what looks like partially recrystallized frambooids in quartz cement to volcanic clasts. Individual frambooids are 0.01 to 0.05 mm in diameter made up of grains 0.001 to 0.002 mm diameter.
Chalcopyrite	Trace					Rare
COMMENTS AND SKETCH:	Cristobalite is inferred to be the low birefringence material replacing groundmass with similar appearance as quartz in reflected light. Photos are of frambooids. See Chapter 4, Figure F92; see photomicrograph 1189B_69					

TS: 136 193-1189B-16R1-36-39 #2		UNIT: 26			OBSERVERS:		
ROCK NAME:		Highly altered, sparsely plagioclase-phyrlic volcanic rock.				WB	
TEXTURE:		Porphyritic, amygdaloidal				DAV	
						AP	
						CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
PHENOCRYSTS							
Plagioclase	1	0.2	1.6	1	Tabular	Fresh, rounded, plagioclase encloses magnetite phenocrysts. Free-floating and enclosed in both plagioclase and clinopyroxene. Completely replaced by clay; pyroxene encloses magnetite phenocrysts.	
Magnetite	Trace		0.25	0.1	Euhedral		
Clinopyroxene	Trace	0.15	1.4		Prismatic subhedral.		
GROUNDMASS							
Plagioclase	30		0.15		Laths	Aligned in groundmass of clasts.	
Magnetite	Trace			0.005	Anhedral.	Granular groundmass mineral.	
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Cristobalite	38					Replacing groundmass	
Quartz	1					Filling vesicles, poikilobasts in groundmass. In veins.	
Brown clay	10					Replacing groundmass, concentrated in patches	
Chlorite	20					Replacing groundmass	
Magnetite	Trace			0.2		Rare rounded subhedral crystal, overgrowing pyrite	
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS	
		min.	max.	av.			
Pyrite	Trace		0.05		Subhedral	Disseminated. Rare.	
Sphalerite	Trace			0.15	Subhedral	With quartz in vugs.	
Chalcopyrite	Trace					With quartz in vugs.	
COMMENTS AND SKETCH:		Cristobalite is inferred to be the low birefringence material replacing groundmass with similar appearance as quartz in reflected light. Remarkably fresh looking volcanic rock. See Chapter 4, Figure F32; see photomicrograph 1189B_52					

TS: 137 193-1189B-16R1-75-78 #11		UNIT: 27			OBSERVERS: WB SDS DAV CY / AP	
ROCK NAME:	Highly altered, moderately vesicular volcanic rock.					
TEXTURE:	Vesicular, sperulitic					
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace	0.4	2.5	1.2	Laths	Thin acicular laths are 1.7 mm and 2.5 mm long. Stubby rounded plagioclase phenocrysts are 0.4 to 1.2 mm long.
GROUNDMASS						
Plagioclase	5		0.1	0.05	Laths	Microlites
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	55					Replacing groundmass, filling vesicles
Brown clay = SILICA?	15					Replacing groundmass, concentrated in patches
Chlorite	25					Replacing groundmass
Magnetite	Trace			0.1		Disseminated in silicified part of rock.
Hematite	Trace					Small grain of jasper.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace	0.01	0.08		Subhedral	Disseminated in clayey part of rock.
Chalcopyrite	Trace		0.15		Anhedral	Disseminated in clayey part of rock. Some large grains have pyrite inclusions.
COMMENTS AND SKETCH:	This section is of a volcanic rock that was described as having a hieroglyphic groundmass texture. This texture involves domains where groundmass microlites are enclosed in green low-birefringent clay, intergrown with domains where groundmass microlites are enclosed in brown clay. The green clay domains surround vesicles (now filled by quartz), while the brown clay domains represent the "continuous matrix" to the "discontinuous matrix". The "brown clay" domains were hard and siliceous in hand specimen and show a fairly good polish in reflected light (equivalent to the quartz), suggesting that they might be devitrified glass? See photomicrograph 1189B_65					

TS: 138 193-1189B-16R2-31-33 #4		UNIT: 27			OBSERVERS:	
ROCK NAME:	Highly altered, moderately vesicular volcanic rock.				WB	
TEXTURE:	Vesicular				SDS	
					DAV	
					AP / CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	Trace	0.5	1.6	0.8	Tabular, rounded.	Fresh
Clinopyroxene	Trace		25			Rare. Completely altered to chlorite and trace quartz
GROUNDMASS						
Plagioclase	20		0.1		Laths	Microlites, aligned.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Quartz	49					Replacing groundmass, filling vesicles
Brown clay	15					Replacing groundmass.
Chlorite	15					Replacing groundmass. Fibrous intergrowths pseudomorphing plagioclase
Magnetite	Tr		0.25	0.1		Disseminated mainly in silicified part of rock. Two large grains are in contact with hematite and pyrite. One has an embayment of hematite.
Hematite	Trace					Disseminated in groundmass
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	Trace		0.05		Subhedral	Disseminated in groundmass. Rare in vesicles.
Chalcopyrite	Trace	0.005	0.15		Anhedral	In groundmass, in place intergrown with pyrite.
COMMENTS AND SKETCH:		XRD indicates Kspar in this rock - Not observed. Perhaps some of the phenocrysts? Some look more dirty. See Chapter 4, Figure F97				

TS: 139 193-1189B-17R2-96-100 #19		UNIT: 31			OBSERVERS: WB SDS DAV CY / AP
ROCK NAME:	Completely altered volcanoclastic sediment.				
TEXTURE:	Clastic				
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
PHENOCRYSTS		min.	max.	av.	
None					
GROUNDMASS					
Plagioclase	Trace				Microlites in some clasts.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
		min.	max.	av.	
Quartz	65				Replacing groundmass, Partly replacing clasts
Chlorite	13				Replacing clasts with quartz
Green clay	13				Replacing clasts with wavy cristobalite.
Cristobalite	3			0.1	Replacing clasts with green clay.
Brown clay	4				Replacing clasts
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			COMMENTS
		min.	max.	av.	
Pyrite	2		1		Associated with quartz
Sphalerite	Trace		0.01		Rare inclusions in and embayment into (one example) pyrite.
Chalcopyrite	Trace	0.01	0.14		Present in rare clasts Intergrown with pyrite in a quartz-lined void and as rare inclusions in pyrite. Present in rare clasts
COMMENTS AND SKETCH	Highly silicified volcanoclastic sediment with graded bedding. Some fragments have a perlitic texture others are glassy or porphyritic (see image links). Vugs, about 0.5 mm across, are lined with euhedral quartz followed by pyrite (this was noted in hand specimen as well). The pyrite in the sample is distributed throughout the rock and probably postdates sedimentation. However, chalcopyrite and sphalerite occur in a clast, implying mineralization prior to sedimentation and 200 m of volcanic stratigraphy (photos B-61, B-62). See Chapter 4, Figures F69A and B and F44				

TS: 140 193-1189B-18R2-65-67#8		UNIT: 35			OBSERVERS:	
ROCK NAME:	Completely altered breccia.				SDS	
TEXTURE:	Clastic, with abundant spherulitic clasts				AP	
					WB	
					DAV / CY	
PRIMARY MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
PHENOCRYSTS						
Plagioclase	1	0.4	1.8	0.7	Tabular, rounded	Relict phenocrysts
GROUNDMASS						
Plagioclase	2				Laths	Defining microlitic texture in some clasts.
ALTERATION MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Cristobalite	46					Spherules. Radial crystal masses with undulatory extinction. Replacing clasts of volcanic rock. Less abundant in the centers of vein network/breccia cement
Quartz	35				Anhedral	Replacing spherules breccia cement, along margins of volcanic rock clasts.
Chlorite/smectite	15					Replacing some volcanic rock clasts.
Actinolite?	Trace				Acicular	Acicular crystals in quartz
Epidote(?)	Trace				Granular	Granular crystals in quartz.
Plagioclase	Trace				Anhedral	
Magnetite	Trace	0.01	0.2		Anhedral	In quartz with pyrite and hematite. One example of an euhedral crystal crosscut by later pyrite.
Hematite	Trace		0.01		Anhedral	In association with magnetite and pyrite inside quartz. Hematite replaces magnetite.
SULFIDE MINERALOGY	PERCENT	SIZE (mm)			MORPHOLOGY	COMMENTS
		min.	max.	av.		
Pyrite	1	0.005	0.1		Subhedral	Occurs in quartz-chlorite(?) veins.
Chalcopyrite	Trace			0.05	Anhedral	Isolated grains and intergrown with pyrite. Some contains pyrite inclusions.
COMMENTS AND SKETCH:	Breccia with microlitic clasts, altered to chlorite (with relict plagioclase microlites) and spherulitic clasts (photos, cristobalite in center, quartz along margins and overgrowing cristobalite spherulites in poikiloblastic patches, minor chlorite). Quartz dominates in breccia cement along with sulfides and oxides. Clasts with vesicles broken off at the margin => evidence for transport. (this is not an in-situ breccia). See Chapter 4, Figures F95 and F41; see photomicrographs 1189B_38, 1189B_44, 1189B_45, and 1189B_46					