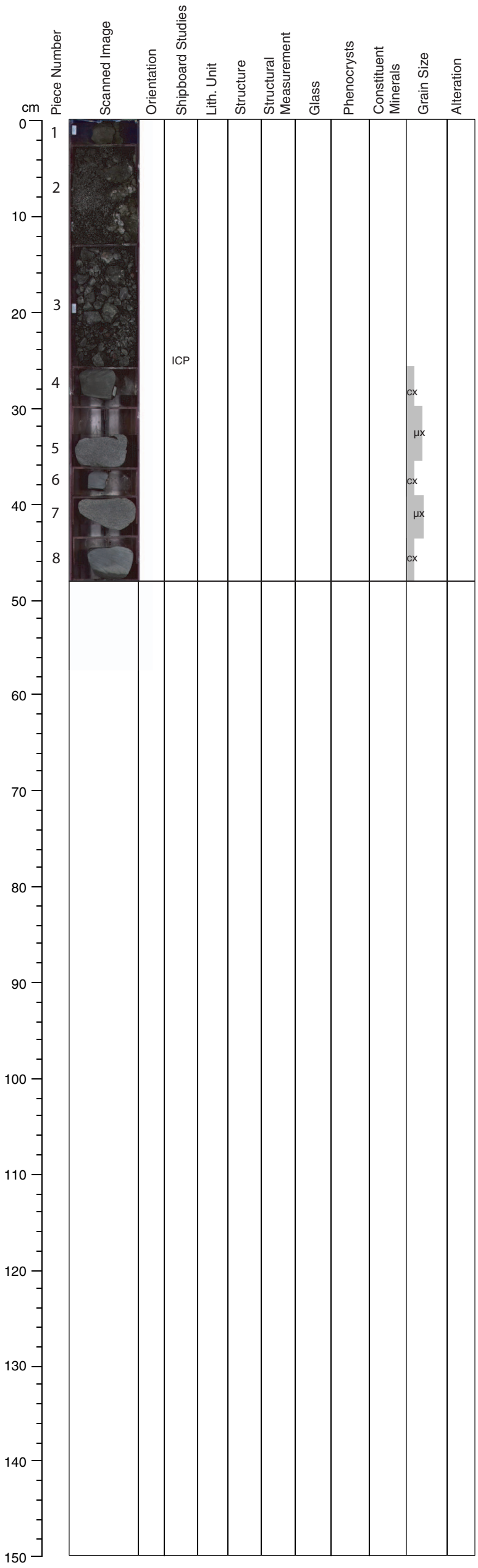
Core Photo



309-1256D-171G-1 (ghost core)

Volcanic rubble from precoring hole cleaning on Expedition 312

UNIT: N/A

ROCK NAME: Aphyric cryptocrystalline to microcrystalline basalt

SUMMARY DESCRIPTION: Massive aphyric cryptocrystalline to microcrystalline basalt

PIECES: 1–8 (description based on Pieces 4–8)

CONTACTS: None

COLOR: Dark gray (4/1)

PHENOCRYSTS:	**%**	**Grain Size (mm):**			
	Mode	**Max**	**Min**	**Avg.**	**Shape/Habit**
Olivine (Pieces 5 and 7):	0.1	0.1	0.5	0.2	Subhedral-completely altered to saponite
Plagioclase (all pieces):	0.1	0.1	0.5	0.2	Subhedral to glomerocrystic

GROUNDMASS: Cryptocrystalline (Pieces 4, 6, and 8) to microcrystalline (Pieces 5 and 7)

VESICLES: None

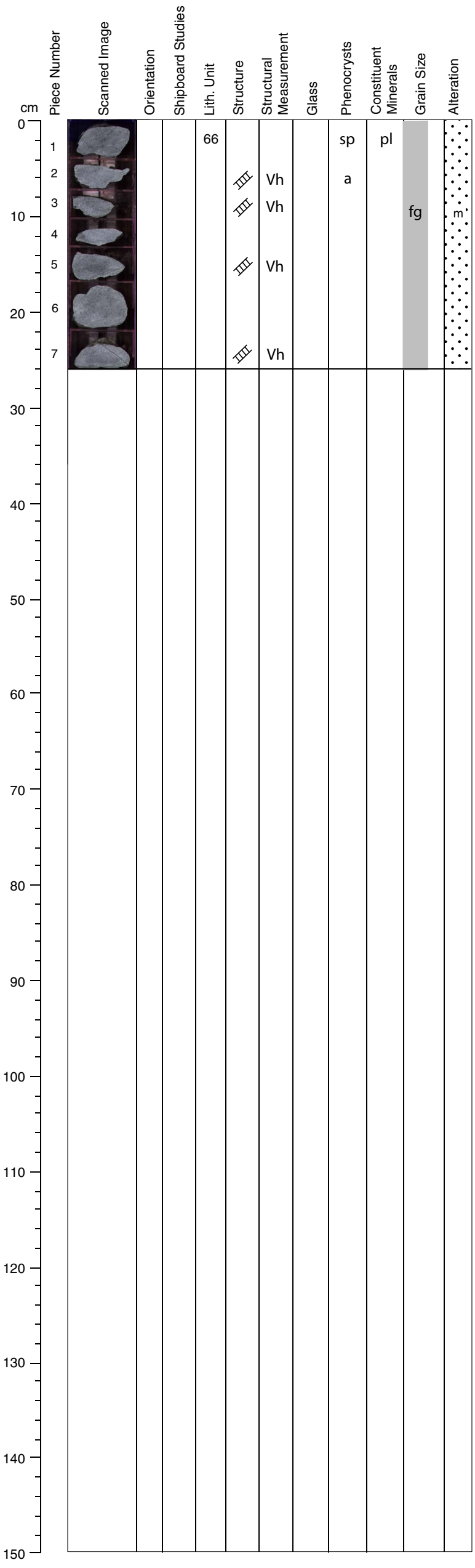
ALTERATION: Dark gray slightly altered basalt

VEINS: None

STRUCTURE: None

ADDITIONAL COMMENTS: Ghost core of basaltic rubble collected during the predrilling reaming and cleaning of Hole 1256D. Pieces 4–8 were cleaned and crushed to make the BAS-309 interlaboratory standard.

Core Photo



312-1256D-172R-1 (Section top: 1255.1 mbsf)

Volcanic Rock

UNIT: 66

ROCK NAME: Sparsely plagioclase-phyric to aphyric fine-grained basalt

SUMMARY DESCRIPTION: Sparsely plagioclase-phyric to aphyric fine-grained basalt

PIECES: 1–7 (igneous description based on Piece 1). Continues to 173R-1

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS:
Dominantly aphyric.
Piece 1 is sparsely plagioclase phyric, with 1% at 0.5–4.0 mm

GROUNDMASS:
Grain size: fine grained
Texture: intergranular

VESICLES: None

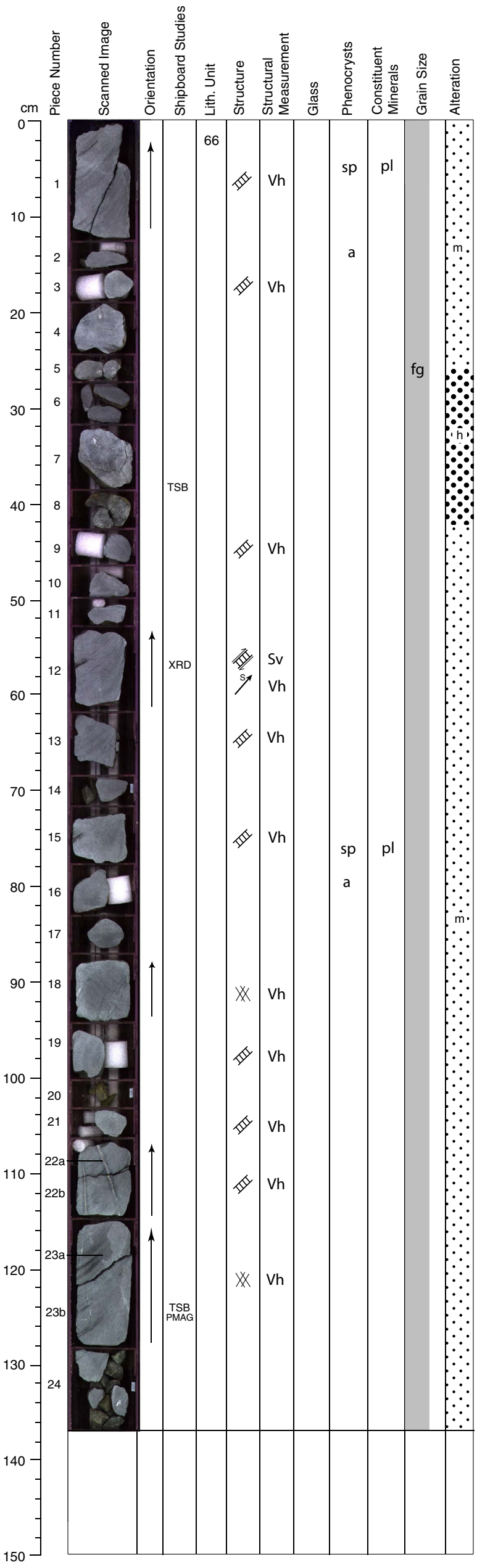
ALTERATION: Moderately altered

VEINS: Several very fine (~0.1 mm) chlorite ± pyrite veins (Pieces 2, 5, and 7), some with ~1–2 mm light green halos

STRUCTURE: Unoriented pieces with 0.5 mm dark green veins (chlorite). Veins have splays and in one place (Piece 2) one vein crosscuts another; some veins have 0.5 mm light green halos.

ADDITIONAL COMMENTS: Grain size variation is present within the fine-grained range, with small patches that are almost medium grained.

Core Photo



312-1256D-173R-1 (Section top: 1260.6 mbsf)

Volcanic Rock

UNIT: 66 (continued from 172R-1)

ROCK NAME: Sparsely plagioclase-phyric to aphyric fine-grained basalt

SUMMARY DESCRIPTION: Sparsely plagioclase-phyric to aphyric fine-grained basalt

PIECES: 1–24 (igneous description based on Piece 1, 172R-1). Continues to 173R-2.

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Dominantly aphyric

GROUNDMASS:
Grain size: fine grained
Texture: Intergranular

VESICLES: None

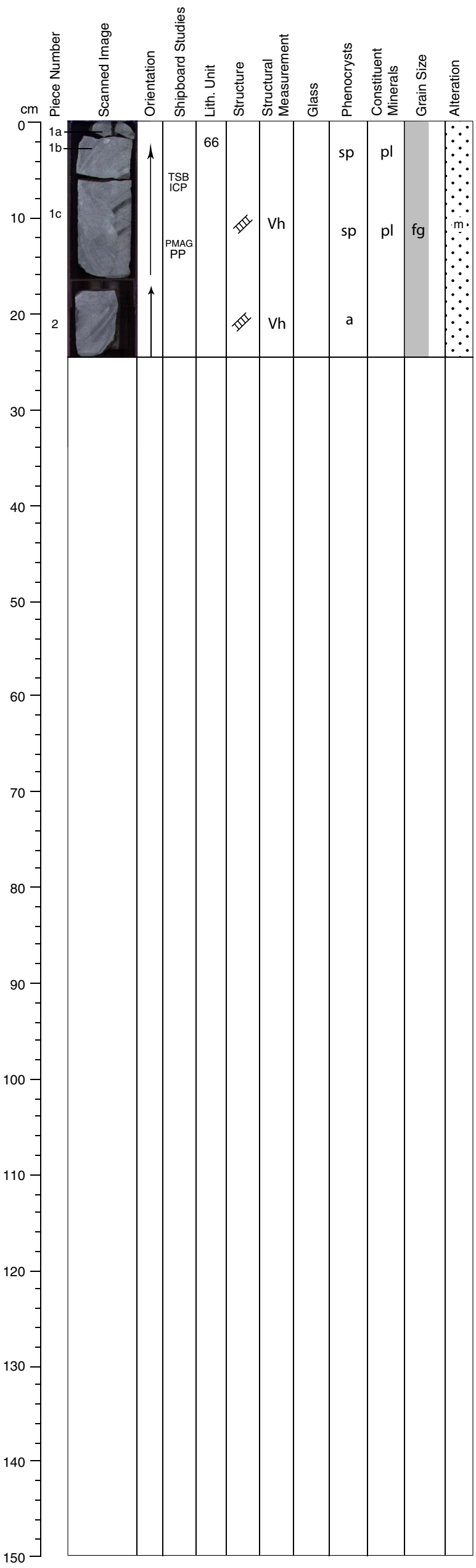
ALTERATION: Moderately to highly (Pieces 5 and 7) altered with more intense alteration along fractures. Piece 7 is composed of a dark green patch surrounded by a 1–2 cm light, porous halo. Piece 5 has a ~1 cm patch of laumontite (anhydrite?), quartz, and epidote.

VEINS: 0.1–2 mm quartz, pyrite, chlorite veins with 1–3 mm dark green halos and/or 2 mm light grey halos. Piece 18 has a vein network of 0.1–1.5 mm quartz, chlorite, pyrite veins with associated halos up to 1 cm wide.

STRUCTURE: Five oriented pieces with two sets of veins, one vertical to subvertical with quartz, chlorite, and pyrite fillings, the other subhorizontal with dark green mineral (chlorite) fillings. Piece 18 has an anastomosing vein network. Piece 22 contains subvertical veins with Y-shaped morphologies. There are several round, coarse-grained mineral patches of ~1–4 cm in diameter.

ADDITIONAL COMMENTS: Grain size variation is present within the fine-grained range, with small patches that are almost medium grained.

Core Photo



312-1256D-173R-2 (Section top:1261.97 mbsf)

Volcanic Rock

UNIT: 66 (continued from 172R-1)

ROCK NAME: Sparsely plagioclase-phyric to aphyric fine-grained basalt

SUMMARY DESCRIPTION: Sparsely plagioclase-phyric to aphyric fine-grained basalt

PIECES: 1–2 (igneous description based on Piece 1, 172R-1). Continues to 174R-1.

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Dominantly aphyric

GROUNDMASS:
Grain size: fine grained
Texture: Intergranular

VESICLES: None

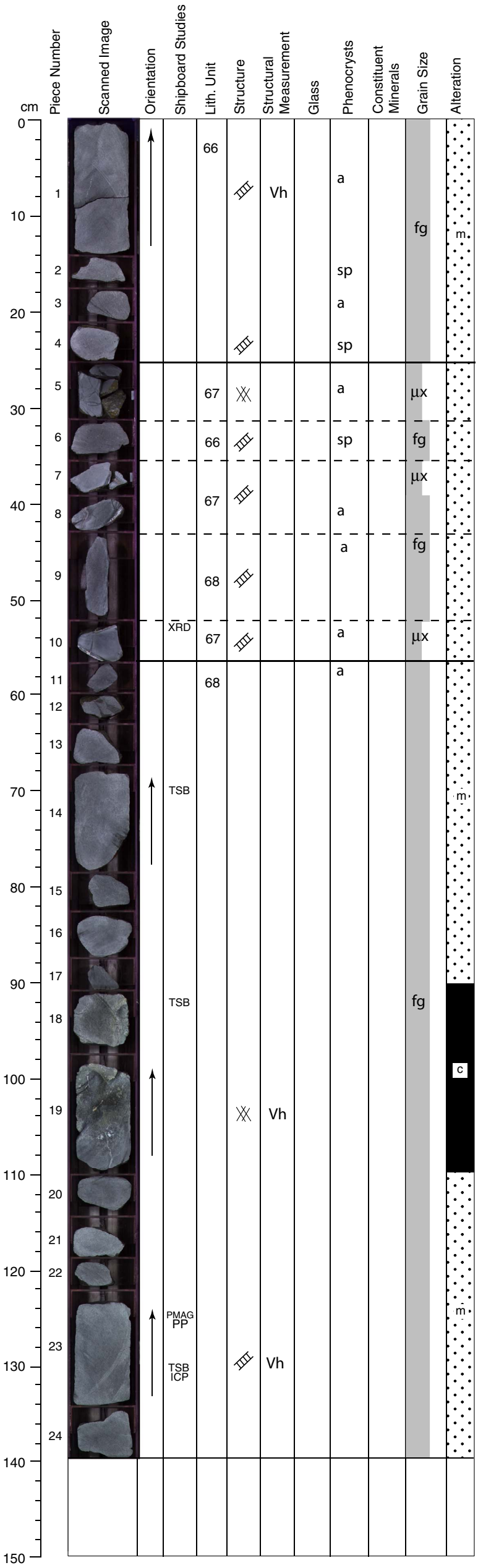
ALTERATION: Moderately altered with common dark green patches

VEINS: Several 0.1–0.5 mm chlorite veins with trace pyrite

STRUCTURE: Two oriented pieces with subhorizontal veins with dark green mineral (chlorite) fillings. In Piece 1b, one subvertical vein is cut by the subhorizontal one. Also in Piece 1b are subvertical elongate coarse-grained mineral patches of ~1 cm thickness.

ADDITIONAL COMMENTS: Grain size variation is present within the fine-grained range, with small patches that are almost medium grained.

Core Photo



312-1256D-174R-1 (Section top: 1265.40 mbsf)

Volcanic Rock

UNIT: 66 (continued from 172R-1)

ROCK NAME: Sparsely plagioclase-phyric to aphyric fine-grained basalt
SUMMARY DESCRIPTION: Sparsely plagioclase-phyric to aphyric fine-grained basalt
PIECES: 1–4, 6

CONTACTS: Upper: not recovered. Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Dominantly aphyric. Pieces 4 and 6 contain 1% of 0.5–1.0 mm plagioclase phenocrysts and 1% of 0.6–2.0 mm altered ferromagnesian phenocrysts (probably olivine).

GROUNDMASS: Grain size: fine grained; Texture: Intergranular

VESICLES: None

ALTERATION: Moderately altered with several dark green (~1 cm) patches

VEINS: Several 0.2–1 mm veins with chlorite, pyrite and trace quartz, some with 1–2 mm diffuse light gray halos

STRUCTURE: Subvertical veins with dark green, white, and pyrite fillings cut by a subhorizontal vein with dark green and pyrite filling (Piece 1)

ADDITIONAL COMMENTS: Grain size variation is present within the fine-grained range, with small patches that are almost medium grained.

UNIT: 67

ROCK NAME: Mixed aphanitic and fine-grained basalts
SUMMARY DESCRIPTION: Aphanitic and fine-grained basalts
PIECES: 5, 7, 8, 10

CONTACTS: Upper: not recovered. Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Dominantly aphyric.

GROUNDMASS: Grain size: microcrystalline and fine grained; Texture: intergranular to subophitic

VESICLES: None

ALTERATION: Moderately altered

VEINS: Common 0.1–1 mm chlorite + pyrite veins with 1 mm light gray halos. Several 0.5–2 mm pyrite, quartz, chlorite veins with 2 mm simple of composite dark and/or light gray/green halos (Pieces 7, 8, and 10)

STRUCTURE: There is more intense veining than in the previous unit. Piece 5, unoriented, has vein networks with planar and curved chlorite- and pyrite-rich veins. Pieces 8 and 10 have ~0.8 cm thick white veins with associated pyrite fillings and some elongate millimeter-sized clasts of host rocks.

ADDITIONAL COMMENTS: This unit appears to be made of aphanitic margins of units 66 or 68, and may include fine-grained pebbles of 66 and 68 that have been mixed in with margins during recovery. Piece 6 looks like Unit 66 and Piece 9 looks like Unit 68.

UNIT: 68

ROCK NAME: Aphyric fine-grained basalt
SUMMARY DESCRIPTION: Aphyric fine-grained basalt
PIECES: 9, 11–24

CONTACTS: Upper: not recovered. Lower: subvertical, intruded by Unit 69

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS: Grain size: fine grained; Texture: intergranular

VESICLES: None

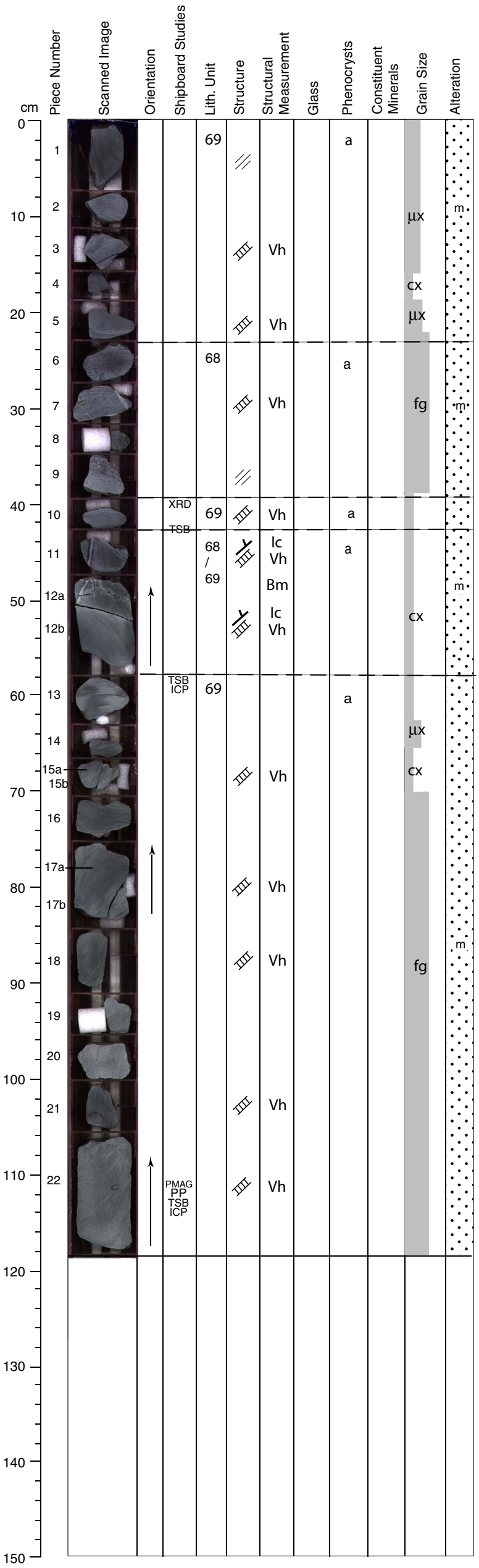
ALTERATION: Moderately to completely altered. Several 1–2 cm dark green patches. Pieces 18 and 19 are highly recrystallized to a 2–6 cm complex dark green patch, with visible acicular albite and epidote-rich areas, associated with a 1–2 mm pyrite, chlorite vein. Portions of the patches include ~5 mm areas of quartz with chlorite.

VEINS: Several 0.1–2 mm chlorite, prehnite, pyrite veins. Complex halos in Pieces 18 and 19 (above).

STRUCTURE: Subvertical veins. Piece 19 contains two sets of veins: east-dipping quartz-rich veins with pyrite, and west-dipping chlorite-rich veins with dark green and white minerals. East dipping veins cut and offset west dipping ones. A subhorizontal chlorite-rich vein is present on Piece 23.

ADDITIONAL COMMENTS: This unit contains groundmass plagioclase with a more pronounced acicular habit than that of the plagioclase in Unit 66.

Core Photo



312-1256D-175R-1 (Section top: 1271.30 mbsf)

Volcanic Rock

UNIT: 68

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric fine-grained basalt

PIECES: 6–9, parts of 11 and 12

CONTACTS:
Upper: not recovered
Lower: subvertical, intruded by Unit 69

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular

VESICLES: None

ALTERATION: Moderately altered with several dark green patches, and common disseminated pyrite. Intense alteration is developed along the chilled margin with Unit 69 in Pieces 11 and 12 with a 1.5 mm dark green halo developed in the coarser-grained material of Unit 68.

VEINS: Several 0.5–1 mm chlorite + pyrite veins. Piece 7 contains a 1 mm quartz + pyrite vein. 0.5 mm laumontite vein in Piece 8.

STRUCTURE: Dark green and sulfide-bearing veins cut lighter colored veins, best demonstrated in unoriented Piece 7. Throughout the section there are steeply and shallowly dipping vein sets with both curved and planar morphologies. Subhorizontal veins cut steeply dipping veins.

ADDITIONAL COMMENTS: This unit contains groundmass plagioclase with a more pronounced acicular habit than that of the plagioclase in Unit 66. The samples from this unit alternate with those from Unit 69 in the upper part of this section, possibly reflecting reordering of the pieces on recovery or, alternatively, changes in the orientation of the sheet margin.

UNIT: 69

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Basalt dike with aphanitic upper chilled margin

PIECES: 1–5, 10, parts of 11 and 12, 13–22

CONTACTS:
Upper: subvertical chilled margin intruding Unit 68
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: variolitic to intergranular (in fine grained portions)

VESICLES: None

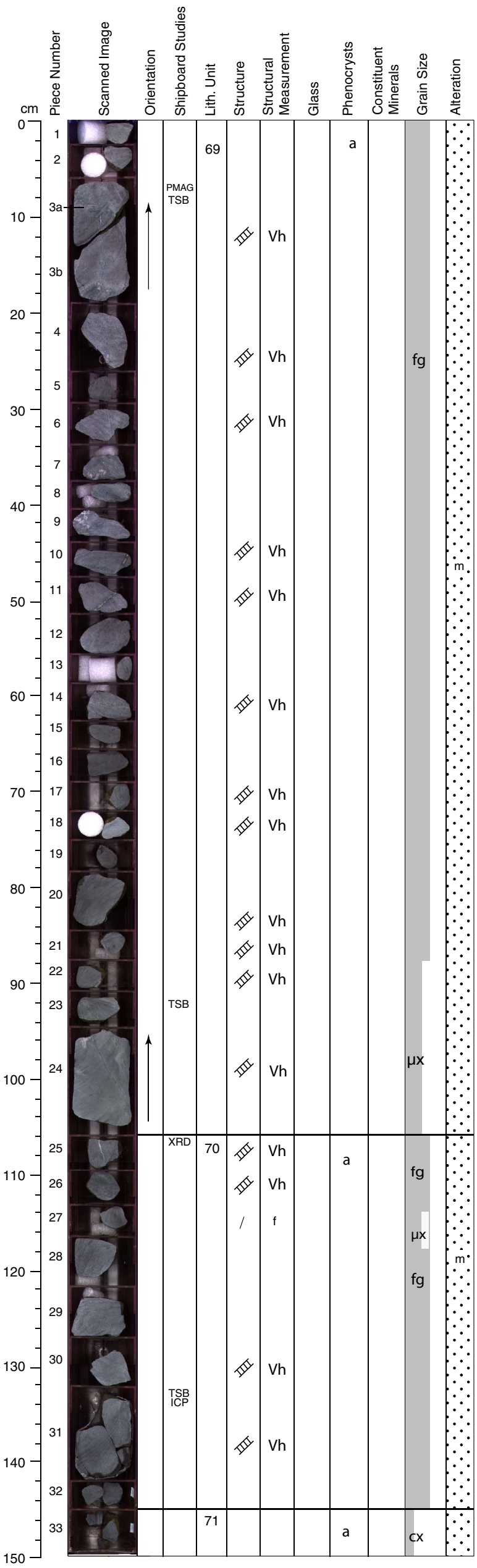
ALTERATION: Moderately altered (dark gray) except along the chilled margin with Unit 68 (Pieces 11 and 12) where a fracture network is developed.

VEINS: Fracture network along chilled margin with Unit 68 (Pieces 11 and 12) comprises 0.2–1 mm chlorite + pyrite veins with 2 mm light gray halos. There are several 0.1–0.2 mm white veins filled with laumontite ± anhydrite (e.g., Pieces 10, 11, and 17). 0.2 mm subvertical chlorite vein in Piece 17.

STRUCTURE: Oriented Piece 12 and unoriented Piece 11 have a steeply dipping chilled margin that is cut by veins protruding from the wall-rock (Unit 69) breccia. Within the chilled margin of Unit 69 are inclusions of microcrystalline basalt (reworked chilled margin?). Vein relationships are the same as in Unit 68, with subhorizontal veins cut steeply dipping veins (e.g., Piece 12).

ADDITIONAL COMMENTS: Unit 69 is cryptocrystalline where it has intruded and cooled rapidly against Unit 68, as seen in Pieces 11 and 12. The outermost 2 mm of the margins may have a spherulitic texture. The grain size increases toward the base of this section, reaching fine-grained size by Piece 16.

Core Photo



312-1256D-176R-1 (Section top: 1276.10 mbsf)

Volcanic Rock

UNIT: 69

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Basalt dike with aphanitic upper chilled margin

PIECES: 1–24

CONTACTS: Upper: subvertical chilled margin intruding Unit 68; Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS: Grain size: cryptocrystalline to fine grained; Texture: variolitic to intergranular (in fine grained portions)

VESICLES: None

ALTERATION: Dark gray moderately altered basalts with 1–2 cm dark green to light gray highly altered patches with abundant pyrite (Pieces 3 and 4). 2 cm quartz + disseminated pyrite patches developed in Pieces 7 and 9.

VEINS: 0.2–1 mm subvertical quartz + pyrite ± chlorite veins transect the dark pyritiferous alteration patches, commonly with 1–2 mm dark green halos and rarely 2 mm light gray halos (Pieces 3, 4, 6, 10, 11, 14, and 22–24).

STRUCTURE: Patches ("alteration patches") of darker, finer-grained minerals relative to the host rock (example in Piece 3) and curved, Y- and T-shaped and planar veins distributed throughout section.

ADDITIONAL COMMENTS: In this section, Unit 69 is fine grained in Pieces 1–22, and then there is a slight change in grain size to microcrystalline in Pieces 23 and 24.

UNIT: 70

ROCK NAME: Aphyric microcrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline to fine-grained basalt dike.

PIECES: 25–32

CONTACTS: Upper: not recovered; Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS: Grain size: microcrystalline to fine grained; Texture: variolitic

VESICLES: None

ALTERATION: Moderately altered dark gray with common disseminated pyrite

VEINS: Several 0.2–1.5 mm quartz + pyrite ± chlorite veins with 1 mm dark green halos

STRUCTURE: Dark green (chlorite) veins with Y-shaped intersections, and one (Piece 25) 2 mm wide subvertical lighter vein cut by a subhorizontal dark green (chlorite) vein with 0.5 mm apparent lateral offset

ADDITIONAL COMMENTS: Unit 70 contains prominent acicular plagioclase, and can therefore be distinguished from Unit 69, which lacks this feature.

UNIT: 71

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline basalt dike

PIECES: 33

CONTACTS: Upper: not recovered; Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS: Grain size: cryptocrystalline; Texture: variolitic to intergranular

VESICLES: None

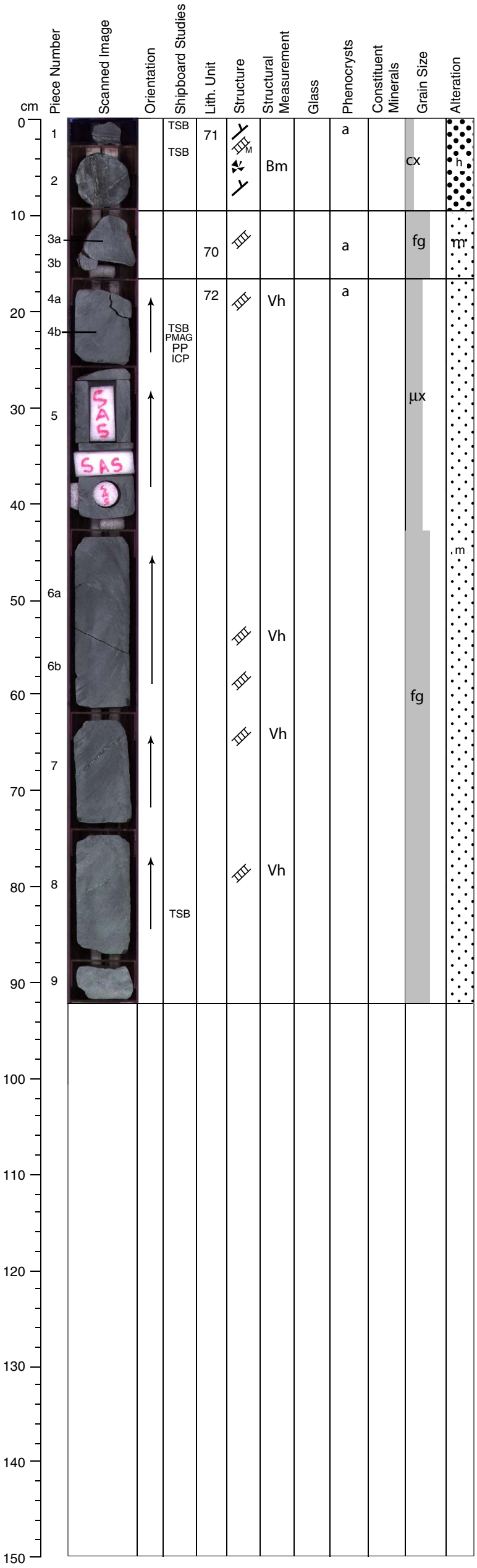
ALTERATION: Dark gray altered chilled margin

VEINS: None

STRUCTURE: Fragments of chilled margin

ADDITIONAL COMMENTS: Fragments of a chilled margin

Core Photo



312-1256D-176R-2 (Section top: 1277.60 mbsf)

Volcanic Rock

UNIT: 70

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline to fine-grained basalt dike

PIECES: 3

CONTACTS: Upper: not recovered; Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS: Grain size: fine grained; Texture: variolitic

VESICLES: None

ALTERATION: Moderately altered, dark gray basalt with disseminated pyrite

VEINS: Several 0.2 mm chlorite + pyrite veins and 1.5 mm quartz + chlorite + chalcopyrite veins

STRUCTURE: Piece 3 of Unit 70 is unoriented and has one thin dark green, pyrite-bearing vein.

ADDITIONAL COMMENTS: This piece does not appear to be in the correct order, and was allocated to Unit 70 on the basis of texture. Its presence at this position in the core may, alternatively, reflect irregular subvertical unit boundaries which were not recovered.

UNIT: 71

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Brecciated basalt dike margin

PIECES: 1, 2

CONTACTS: Upper: not recovered; Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS: Grain size: cryptocrystalline; Texture: variolitic to intergranular

VESICLES: None

ALTERATION: Highly altered and mineralized dike margin brecciated and replaced by silica + pyrite + chlorite

VEINS: Brecciated vein network in Pieces 1 and 2

STRUCTURE: Millimeter-scale inclusions of micro-to-cryptocrystalline basalt form microfolds and lenses within the cryptocrystalline chilled margin. Brecciation and alteration appears to cut the dike margin structure, but some of the deformation is probably emplacement related

ADDITIONAL COMMENTS: Igneous description based on largest fragments in the breccia.

UNIT: 72

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric fine-grained basalt

PIECES: 4–9

CONTACTS: Upper: not recovered; Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS: Grain size: fine grained; Texture: intergranular/variolitic with plumose plagioclase

VESICLES: None

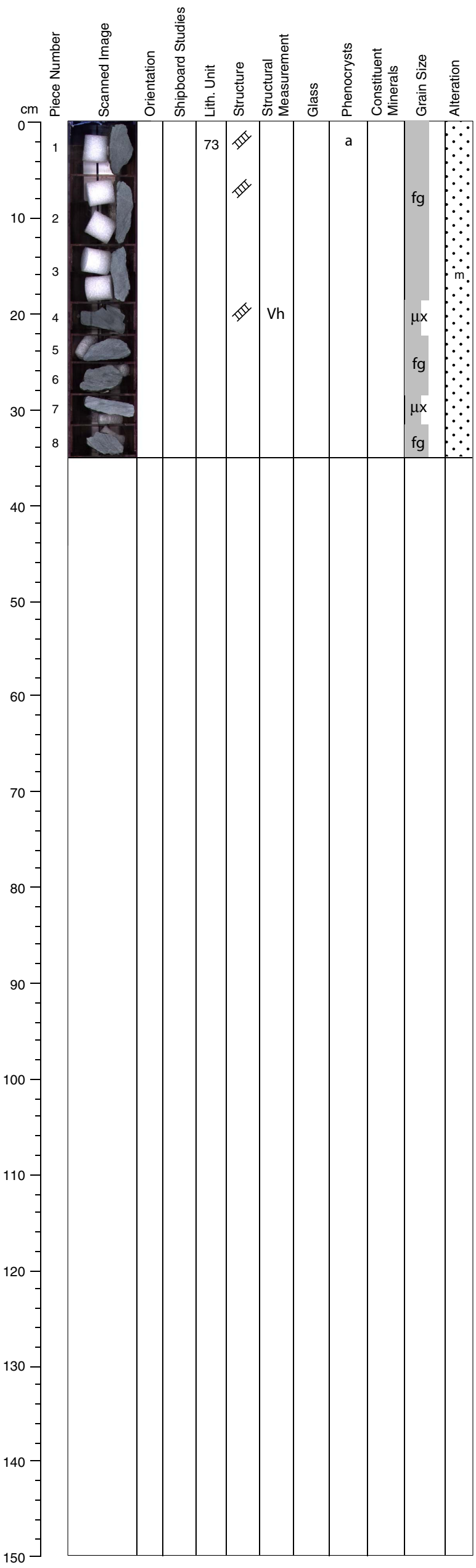
ALTERATION: Moderately altered dark gray basalt, with common dark green (chlorite) + patches with abundant pyrite

VEINS: Several 0.5–1 mm chlorite + quartz + pyrite + chalcopyrite veins with irregular and discontinuous 1–2 mm dark green halos

STRUCTURE: Irregular and splayed dark green (chlorite) veins in oriented pieces, and one mineral patch that is darker and finer grained than the surrounding host rock (Piece 9)

ADDITIONAL COMMENTS: There is variation in grain size within this unit, with grain size increasing from top to bottom of the unit, possibly indicating increasing distance from cooling margin. Prominent acicular plagioclases.

Core Photo



312-1256D-177R-1 (Section top: 1280.90 mbsf)

Volcanic Rock

UNIT: 73

ROCK NAME: Aphyric microcrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline to fine-grained basalt

PIECES: 1–8

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline to fine grained
Texture: intergranular

VESICLES: None

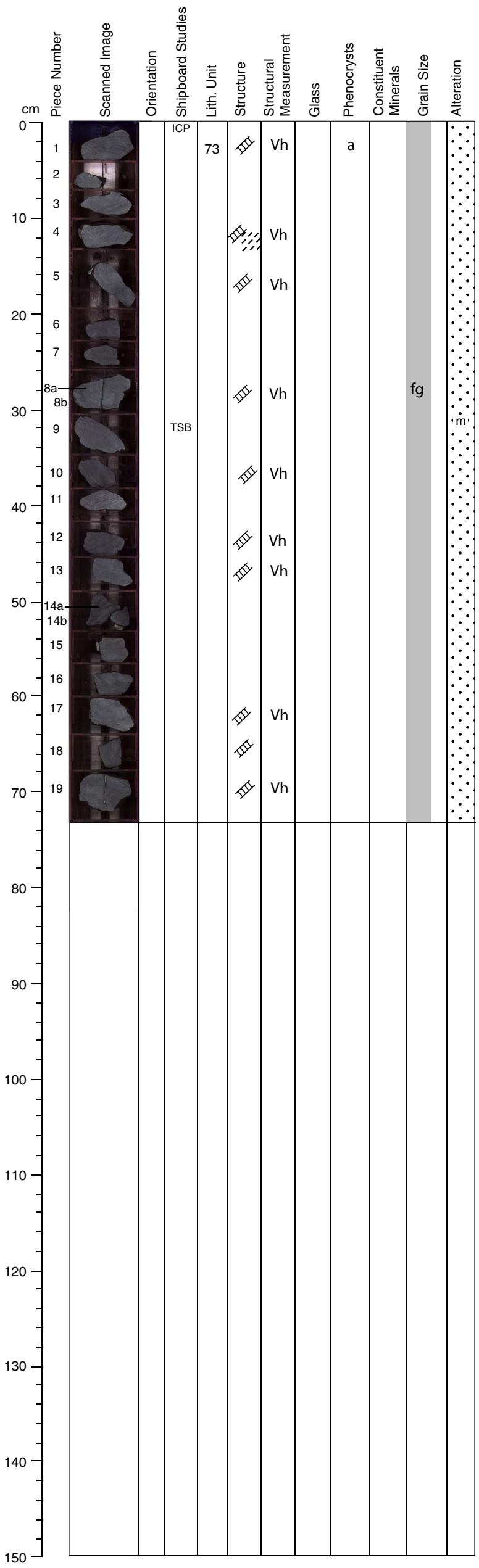
ALTERATION: Dark gray moderately altered basalt

VEINS: Rare 0.1 mm chlorite + pyrite veins with 1 mm dark green halos (Piece 4)

STRUCTURE: Planar, dark (chlorite) and light (actinolite) green millimeter- and submillimeter-wide veins with halos in unoriented pieces.

ADDITIONAL COMMENTS: Poor recovery. Description based on a series of small, subrounded to angular samples.

Core Photo



312-1256D-178R-1 (Section top: 1285.70 mbsf)

Volcanic Rock

UNIT: 73

ROCK NAME: Aphyric microcrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline to fine-grained basalt

PIECES: 1–19

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline to fine grained
Texture: intergranular

VESICLES: None

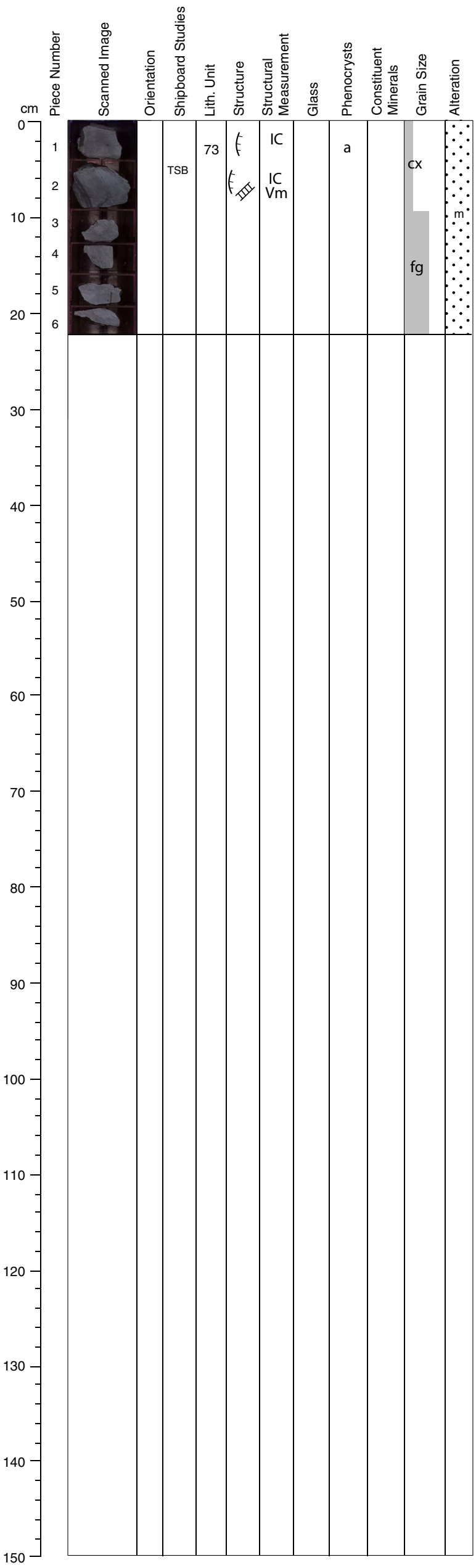
ALTERATION: Moderately altered dark gray basalt.

VEINS: Several 0.1–1 mm quartz + chlorite + pyrite veins with 1 mm dark green halos.

STRUCTURE: Veins are <1 mm wide, with planar, splayed, and curved morphologies, filled with chlorite and pyrite or only pyrite. One thin fracture in Piece 8b.

ADDITIONAL COMMENTS: Poor recovery. Description based on a series of small, rounded nonorientated samples. The samples in this section are exclusively fine grained.

Core Photo



312-1256D-179R-1 (Section top: 1290.50 mbsf)

Volcanic Rock

UNIT: 73

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–6

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: intergranular in fine-grained parts

VESICLES: None

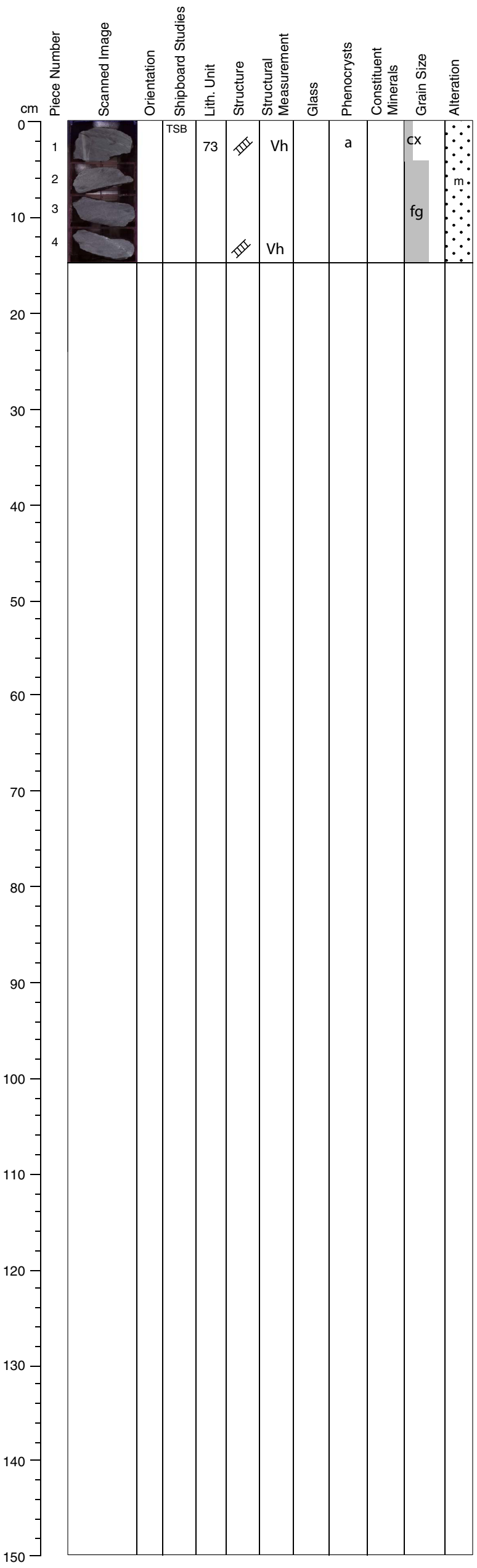
ALTERATION: Moderately altered dark gray basalt. Trace disseminated pyrite.

VEINS: Common <0.1 mm white veins. Piece 2 has a 0.5 mm chlorite vein with a 3 mm dark green halo, subparallel to the intrusive dike margin.

STRUCTURE: Piece 1 contains an irregular shaped, mafic clast of "host rock" included in the light-grey chilled margin. Chloritic veins are parallel (Piece 2) and perpendicular (Pieces 1 and 2) to the chilled margin. The margin in Piece 2 preserves a composite of two intrusive contacts, one of which contains a 0.5 mm wide chloritic vein with a 7 mm wide halo. Piece 2 also has a domain of breccia that does not intersect the chilled margin.

ADDITIONAL COMMENTS: Pieces 1 and 2 contain cryptocrystalline dike margin material. We do not, however, use this margin to define a new unit because the texture and grain size of the rocks above and below Pieces 1 and 2 are similar. It is therefore unclear whether the rocks above and below belong to the same intrusive unit or not. Piece 2 shows evidence for three separate melt injection events. One edge of the piece is microcrystalline, from the interior of the earliest intrusion. This microcrystalline material has been cut by a second intrusion that has a cryptocrystalline margin. Away from this margin, the grain size increases until this intrusion is cut by a third intrusion with a cryptocrystalline margin.

Core Photo



312-1256D-180R-1 (Section top: 1295.30 mbsf)

Volcanic Rock

UNIT: 73

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–4

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric (Piece 1 contains 5–6 microphenocrysts)

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: intergranular

VESICLES: None

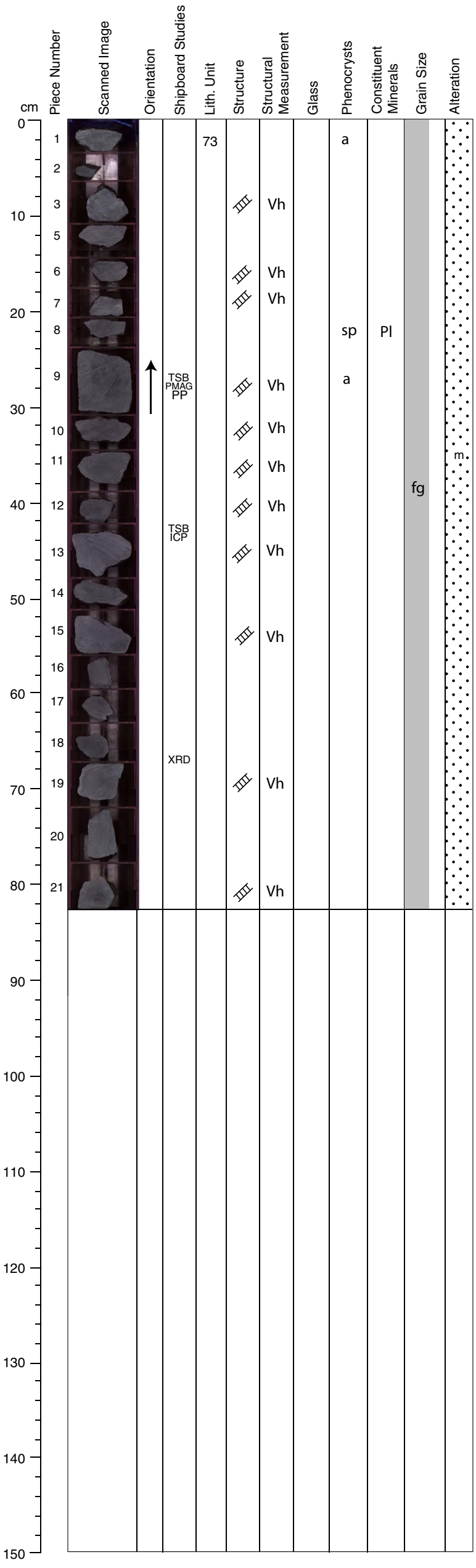
ALTERATION: Moderately altered dark gray basalt with trace disseminated pyrite.

VEINS: <0.1–0.1 mm chlorite veins with 1.5 mm light green halos in Piece 1, and a 0.5 mm quartz + chlorite vein with a 1 mm light gray halo in Piece 4.

STRUCTURE: Veins have planar (four) and curved (one) morphologies with chlorite-quartz filling. One vein is 0.1 mm wide with a 1 mm thick white halo. An adjacent T-shaped intersection of two <1 mm wide chloritic (no quartz) veins has no cross-cutting relationships.

ADDITIONAL COMMENTS: Piece 1 is cryptocrystalline, possibly from a dike margin. But, once more, we do not define a new unit because there is no distinctive change in texture between the rocks below and above this piece. Five to six microphenocrysts are exposed on the surfaces of Piece 1, three of which are plagioclase or plagioclase-rich glomerocrysts (<1mm in size) and the other three are altered mafic phases (<1 mm size).

Core Photo



312-1256D-181R-1 (Section top: 1300.10 mbsf)

Volcanic Rock

UNIT: 73

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–21

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric (Two plagioclases of 1 mm size in Piece 8)

GROUNDMASS:
Grain size: fine grained
Texture: intergranular

VESICLES: None

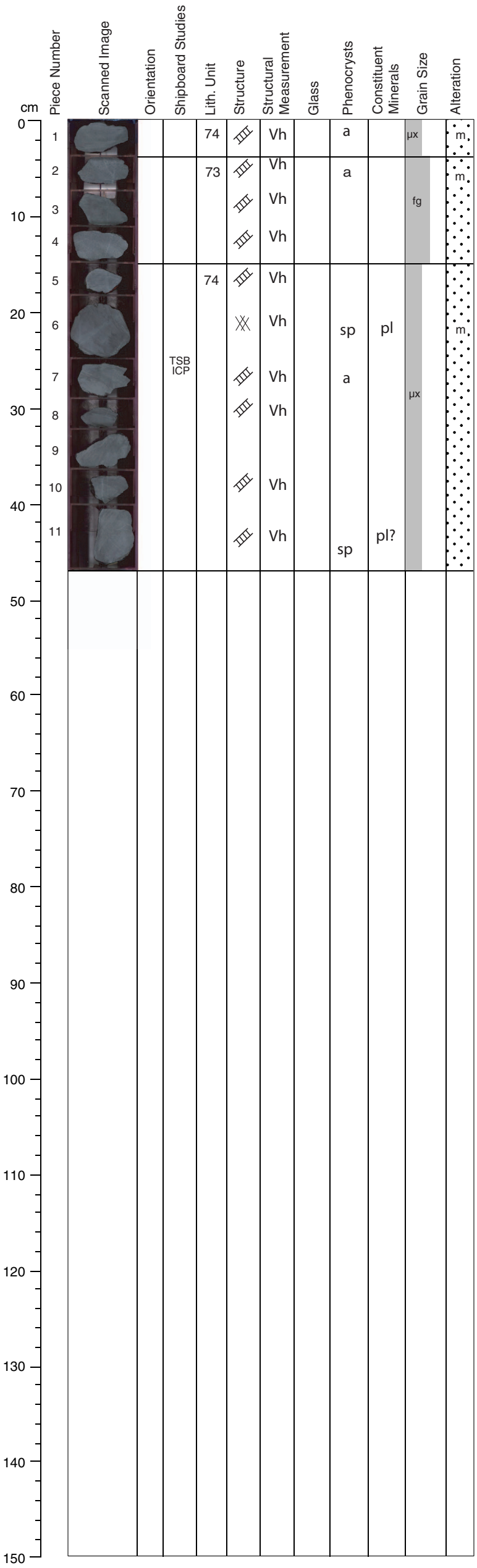
ALTERATION: Moderately altered dark gray basalt.

VEINS: Several 0.1–1 mm quartz + chlorite ± pyrite ± carbonate veins with rare 1 mm dark green halos.

STRUCTURE: One oriented piece in the section, with one shallowly-dipping quartz ± carbonate vein. The rest of the section has three subparallel 0.1 mm wide veins. The lower part of the section (Pieces 18 and 19) has subhorizontal fractures with splayed tips that do not cross the section. These are tentatively interpreted as cooling fractures.

ADDITIONAL COMMENTS: Poor recovery. Description based on a series of small, rounded samples.

Core Photo



312-1256D-182R-1 (Section top: 1304.9 mbsf)

Volcanic Rock

UNIT: 73

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 2–4

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained to microcrystalline
Texture: intergranular

VESICLES: None

ALTERATION: Moderately altered dark gray basalt

VEINS: Several <0.1 mm quartz + chlorite veins, some with ~1 mm light gray halos

STRUCTURE: No oriented pieces in section. Every piece has a set of <1 mm wide dark green and light green (chlorite + quartz) veins with curved and planar morphologies and Y-shaped intersections.

ADDITIONAL COMMENTS: Poor recovery. Description based on a series of small, rounded samples.

UNIT: 74

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1, 5–11

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric (occasional, <1%, 1 mm equant plagioclase)

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

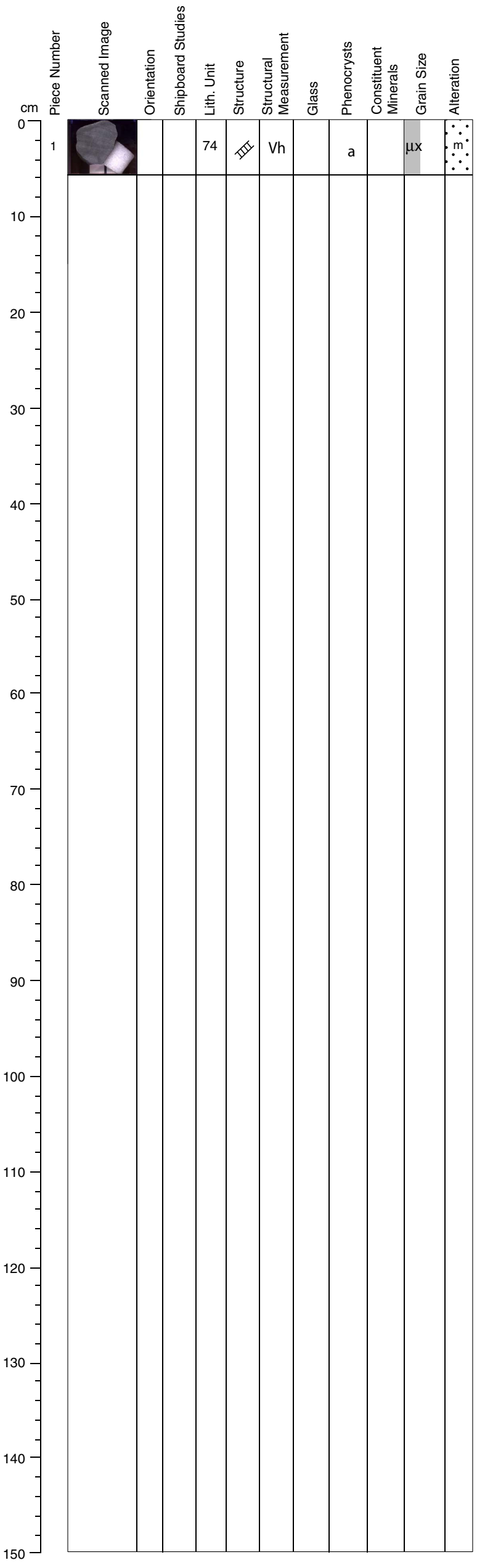
ALTERATION: Moderately altered dark gray basalt

VEINS: Common <0.1 to 2 mm quartz + chlorite veins, some with ~2 mm light gray halos

STRUCTURE: Except for Piece 9, every piece has a set of <1 mm wide dark green and light green (chlorite + quartz) veins, some with ~1 mm wide halos. Vein types include planar, curved, and irregular, including Y-shaped intersections. Pieces 6, 9, and 11 have crosscutting vein relationships between veins of similar compositions.

ADDITIONAL COMMENTS: Poor recovery. Description based on a series of small, rounded samples. This unit is defined as different from Unit 73 on the basis of a change in groundmass grain size that persists for a number of samples. Unit 74 is microcrystalline, and the change in grain size from fine-grained in Unit 73 is rather sharp in the recovered samples. However, we cannot be certain that these Unit 74 samples do not come from the same intrusion as Unit 73, but from closer to the margin.

Core Photo



312-1256D-183R-1 (Section top: 1309.7 mbsf)

Volcanic Rock

UNIT: 74

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

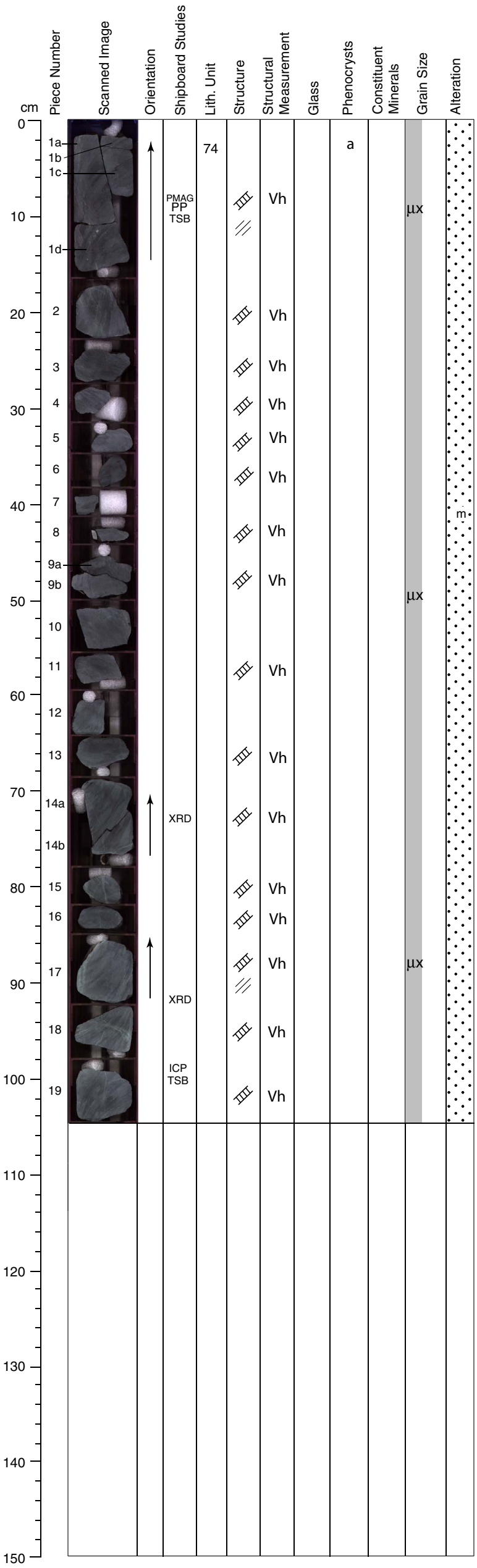
ALTERATION: Moderately altered, dark gray basalt with trace disseminated pyrite

VEINS: Several <0.1 mm quartz-chlorite veinlets, some with 1 mm light gray halos

STRUCTURE: Three green (quartz + chlorite) veins in an unoriented piece. One irregular vein crosscuts a curved vein.

ADDITIONAL COMMENTS: Poor recovery. Description based on a small, rounded sample.

Core Photo



312-1256D-184R-1 (Section top: 1314.5 mbsf)

Volcanic Rock

UNIT: 74

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1–19

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

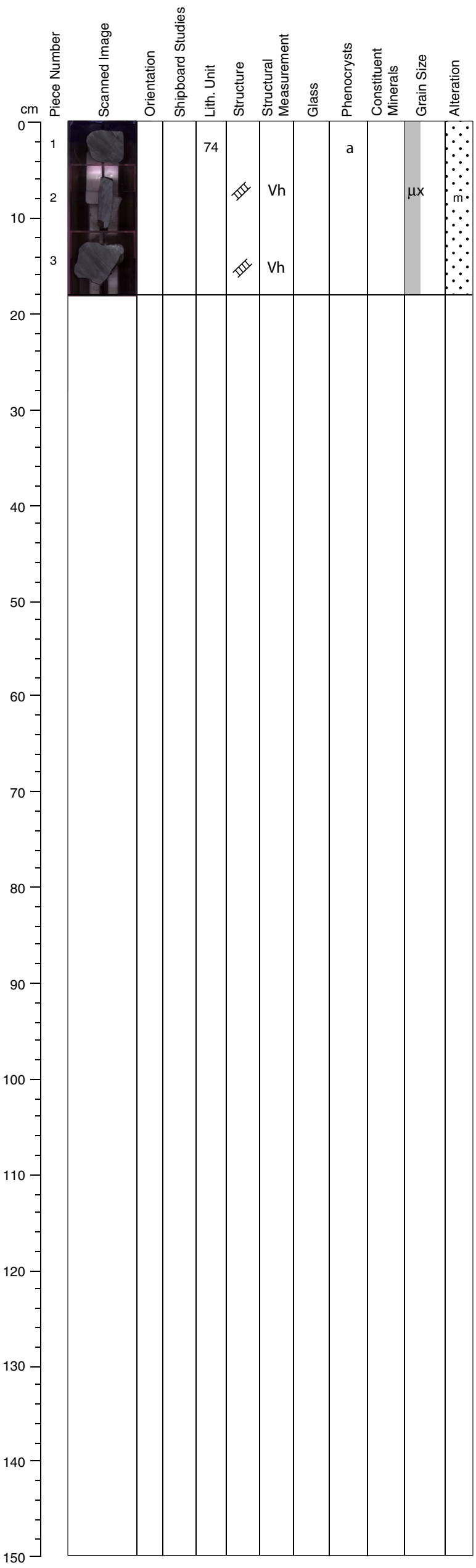
ALTERATION: Moderately altered. Dark gray basalt with disseminated pyrite

VEINS: Common 0.1–1 mm quartz-chlorite ± pyrite veins with 1–2 mm light gray halos or 0.5–1 mm dark green halos with an outer 2 mm light gray halo. Subvertical 0.5 mm prismatic zeolite + chlorite vein on the edge of Piece 14. 0.2 mm white vein (zeolite?) cuts across a subvertical chloritic vein and halo in Piece 14.

STRUCTURE: Subvertical veins within three oriented pieces are filled with quartz-clorite and pyrite and sometimes with zeolites (Piece 14). Although most pieces are unoriented, subvertical veining seems to be more common. The subvertical veins cut and offset subhorizontal veins with an apparent reverse displacement (Piece 1). Subhorizontal veins are filled with chlorite and zeolites. Several subhorizontal, irregular and discontinuous fractures are present (Pieces 1 and 17). The fractures cut subvertical veins with no apparent displacement.

ADDITIONAL COMMENTS: This unit contains a small number of tabular plagioclase crystals (1 mm size). The groundmass grain size is variable within the unit, but always remains within the microcrystalline range. The pieces near the top of this section are approaching cryptocrystalline, whereas those in the middle of the section (Pieces 5–12) are microcrystalline and the lower pieces (Pieces 13–19) approach cryptocrystalline. However, there are no abrupt changes in grain size in the recovered pieces, so a new unit is not defined.

Core Photo



312-1256D-185R-1 (Section top: 1315.5 mbsf)

Volcanic Rock

UNIT: 74

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1–3

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

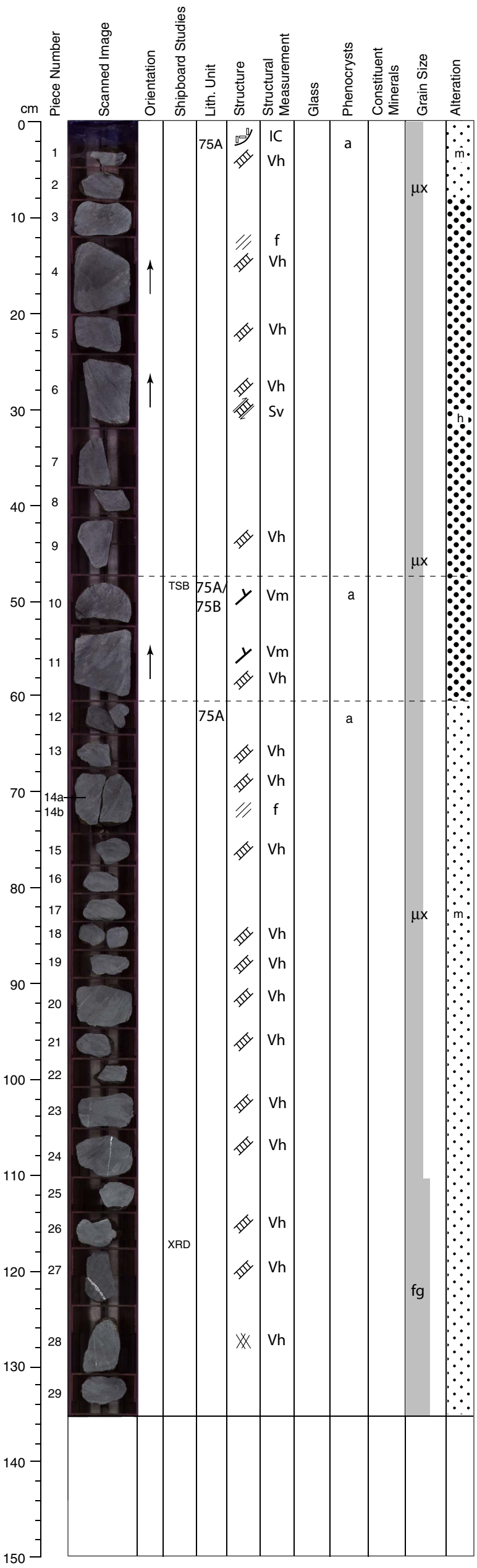
ALTERATION: Moderately altered dark gray basalt with <1 cm light gray alteration patches

VEINS: Common 0.1–0.5 mm quartz-chlorite ± pyrite veins, some with 1–2 mm light gray halos

STRUCTURE: Three unoriented pieces with <0.1–0.5 mm wide dark green and green (chlorite + quartz) veins of irregular, splayed, and planar morphologies, including several crosscutting relationships between veins of similar compositions (Pieces 1 and 3). Some veins have a ~0.2 mm wide halo, and a there is an alteration patch in Piece 3.

ADDITIONAL COMMENTS: Poor recovery. No evidence for change in unit.

Core Photo



312-1256D-186R-1 (Section top: 1319.5 mbsf)

Volcanic Rock

UNIT: 75A

ROCK NAME: Aphyric microcrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt dike with cryptocrystalline margin

PIECES: 1–9, 12–29, parts of 10 and 11

CONTACTS:
Upper: cryptocrystalline margin in Piece 1
Lower: possible lower dike margin in Section 187R-1

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline to fine grained
Texture: variolitic to intergranular

VESICLES: None

ALTERATION: Moderately to highly altered gray-green basalt with cm-scale green halos developed around vein networks. Pieces 15–29 are less intensely altered.

VEINS: Several 0.5 mm laumontite +/- carbonate veins in Pieces 24, 27, and 28

STRUCTURE: The top of the section has an igneous contact in a small unoriented piece (Piece 1) with no chilled margin. A small, irregular dikelet (or magmatic vein) is present in Pieces 10 and 11 and has a small domain of magmatic breccia, entrained clasts of wallrock, and related alteration (Piece 10). In Piece 11 the dike dips 74SE (core reference frame). There are veins and a few fractures throughout the section. Most of the fractures are horizontal and a few are subvertical. A conjugate vein set is present in Piece 6 with a "transfer" vein connecting the two veins with a sigmoidal morphology indicating net sinistral diplacement.

ADDITIONAL COMMENTS: Unit boundary defined by presence of cryptocrystalline dike margin rock in Piece 1. The grain size increases gradually toward the bottom of the section, from microcrystalline in Pieces 1–24 up to fine grained in Pieces 25–29. Acicular plagioclase is present and more prominent in the fine-grained pieces. A 5 mm wide cryptocrystalline dike is present in Pieces 10 and 11. It has sharp margins but with a zig-zagging path. Small angular elongated fragments of the host rock have been incorporated into the edges of the thin dike.

UNIT: 75B

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline basalt dike

UNIT SUMMARY: Thin dike intruding Unit 75A

PIECES: Parts of 10 and 11

CONTACTS: Both margins are visible in Pieces 10 and 11

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

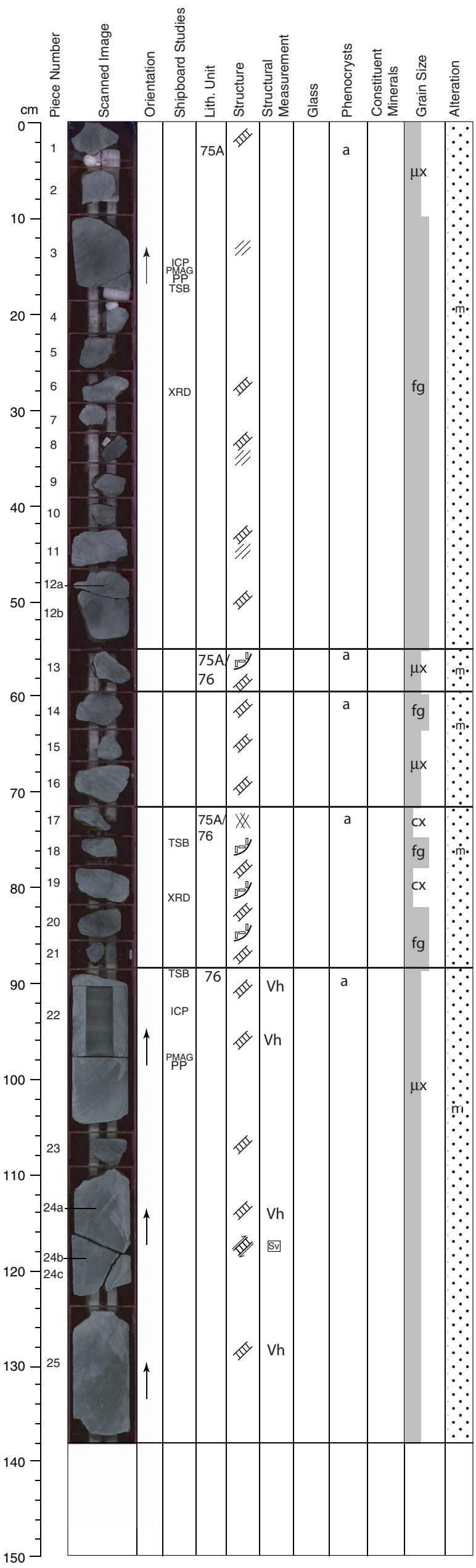
GROUNDMASS:
Grain size: cryptocrystalline
Texture: not resolved

VESICLES: None

STRUCTURE: See description in Unit 75A structure.

ADDITIONAL COMMENTS: See description in Unit 75A additional comments.

Core Photo



312-1256D-187R-1 (Section top:1324.3 mbsf)

Volcanic Rock

UNIT: 75a

ROCK NAME: Aphyric microcrystalline to fine-grained basal

SUMMARY DESCRIPTION: Aphyric microcryastalline to fine-grained basalt dike with crypto-crystalline margin

PIECES: 1-12, 1–16, parts of 13 and parts of 17–21

CONTACTS:
Upper: cryptocrystalline margin in Piece 1, Section 186R-1
Lower: possible lower dike margin in Pieces 13 and 17–20

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline to fine grained
Texture: variolitic to intergranular

VESICLES: None

ALTERATION: Moderately altered dark gray basalt with several dark green patches, some with several mm scale quartz crystals. More highly altered along margin with Unit 76.

VEINS: Common quartz-chlorite and chlorite veins. Piece 6 has a 0.5 mm laumontite + anhydrite + carbonate vein. 1 mm chlorite veins are evident along dike margins. Vein halo along chilled margin in Piece 20 has abundant carbonate (cm size).

STRUCTURE: Veins and fractures throughout the section, including mostly green (chlorite) veins with irregular Y-shapes and splay morphologies. Fractures are mostly subhorizontal, whereas veins are steeply dipping. Alteration patches in Piece 12 have irregular shapes and are spatially related to younger veins. An igneous contact (probably the boundary between Units 75 and 76) is first present in Piece 13. The contact is sharp and has a light green halo, ~4 mm in width, with a wavy morphology.

ADDITIONAL COMMENTS: Acicular plagioclase is present and more prominent in the fine-grained pieces. The base of the unit is defined by the dike margin in Pieces 13 and 17–20. We infer that Unit 75 is the host rock for the intrusion of a younger dike in these pieces, and we assign the cryptocrystalline material to Unit 76. This preferred interpretation is based on subtle textural changes between the pieces above and below the dike margin. Pieces above the margin (e.g., Piece 3) appear to have slightly better developed acicular plagioclase than those found below the margin (Piece 22). However, it should be noted that alternative interpretations are also consistent with the observed variation in texture and the possible presence of the edge of a chilled margin, or alteration associated with a margin, at the top of Piece 22. Since the large pieces containing the margin are not oriented, these observations may be consistent with a situation where Unit 76 is the host rock for the intrusion of Unit 75. A third possibility is that the fine-grained rocks of Units 75 and 76 are parts of the same intrusion and that they are intruded by a dike that is only sampled in the edges of Pieces 13 and 17–21.

UNIT: 76

ROCK NAME: Aphyric cryptocrystalline to microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to microcrystalline basalt dike

PIECES: Parts of 13 and 17–21, all of 22–25

CONTACTS:
Upper: Possible upper dike margin in Pieces 13 and 17–20
Lower: Not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to microcrystalline
Texture: variolitic to intergranular

VESICLES: None

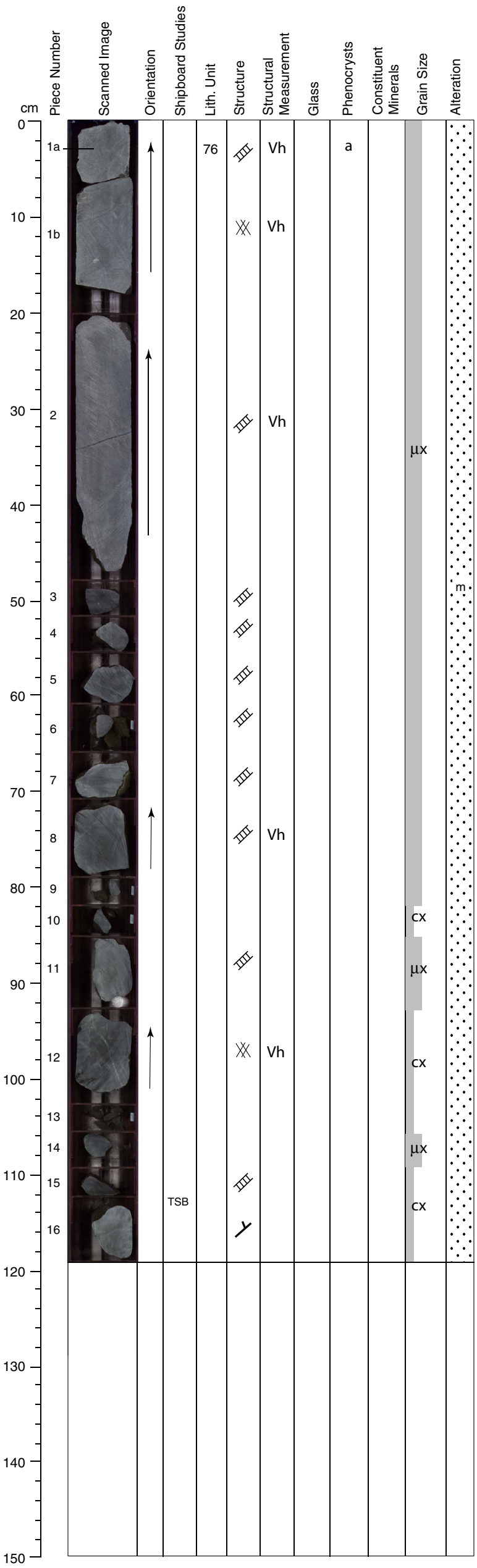
ALTERATION: Dominantly dark gray alteration with diffuse dark green halos along thin cryptic veins

VEINS: Several quartz-chlorite 0.5 mm veins. Piece 24a has a 1 mm chlorite + laumontite vein.

STRUCTURE: The contact between Units 75 and 76 in Piece 13 is described for Unit 75. Igneous contacts in Pieces 18, 19, and 20 are similar to the contact in Piece 13. Veins are present in all of the pieces in Unit 76, steeply dipping about 60 degrees. A shear vein in Piece 24 has an irregular morphology, tool marks defining striae, and (younger) white minerals (carbonate + laumontite). There is a weak indication of dextral slip from the striae.

ADDITIONAL COMMENTS: See Unit 75 additional comments for discussion of the definition of the boundary between Units 75 and 76.

Core Photo



312-1256D-187R-2 (Section top:1325.67 mbsf)

Volcanic Rock

UNIT: 76

ROCK NAME: Aphyric cryptocrystalline to microcrystalline basalt

PIECES: 1–16

CONTACTS:
Upper: Possible upper dike margin in Pieces 13 and 17–20, Section 187R-1
Lower: Not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to microcrystalline
Texture: variolitic to intergranular

VESICLES: None

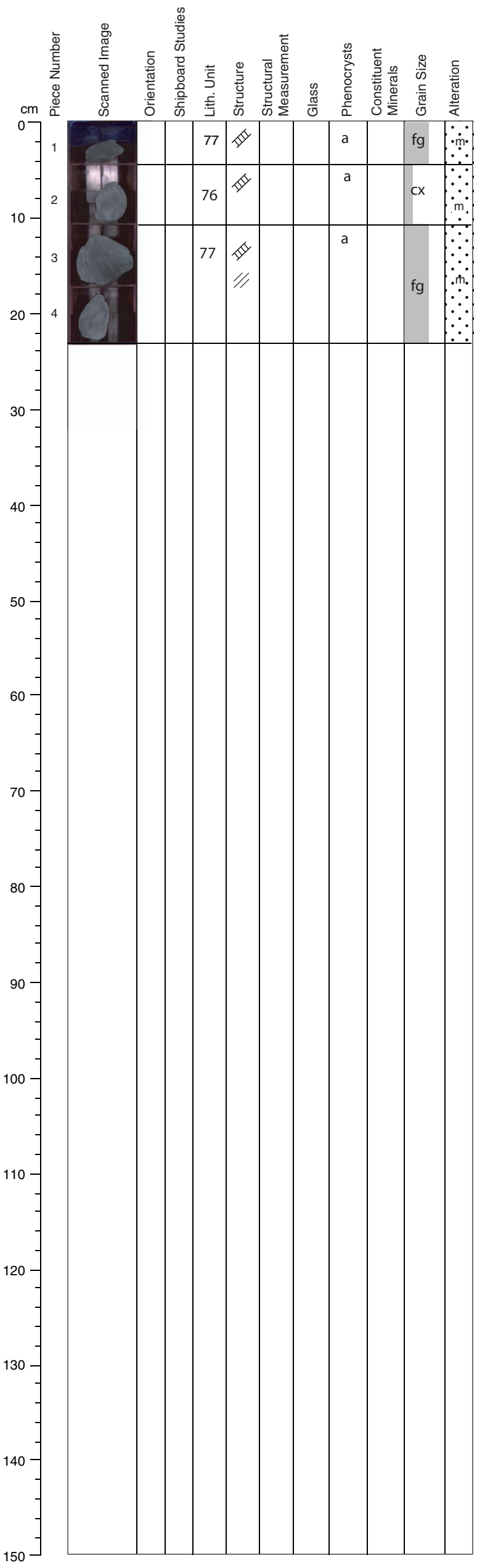
ALTERATION: Moderately altered with light greenish gray halos developed around veins

VEINS: Common chlorite-actinolite veins, some with light gray alteration halos. Diffuse chlorite-actinolite veins are cross-cut by more robust chlorite + quartz + pyrite veins. Piece 16 includes an orthogonal network of 1 mm acicular actinolite veins with 2 mm light gray halos.

STRUCTURE: There are steeply dipping veins throughout the section which are cut by subhorizontal veins. All have planar or irregular morphologies with dark and/or light green associated halos (for example, Piece 2). Alteration patches in Piece 7 are elongate and ~1.2 cm x 0.6 cm on the cut face, with light and dark green colors, enriched in chlorite and actinolite. Unoriented Piece 16 has an intrusion of coarse-grained material with no chilled margins and a light-green halo. The host rock adjacent to the intrusion is brecciated.

ADDITIONAL COMMENTS: See Section 187R-1, Unit 75 additional comments for discussion of the definition of the boundary between Units 75 and 76. After sawing, Pieces 1B and 2 appeared to show vertical features subparallel to the core margins. These pale bands, ~10 mm in width, were picked out by the saw marks, but do not appear to have been caused by the saw. However, on polishing of Piece 1B these bands disappeared, and their origin is not yet clear.

Core Photo



312-1256D-188R-1 (Section top:1329.10 mbsf)

Volcanic Rock

UNIT: 76

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to microcrystalline basalt

PIECES: Piece 2

CONTACTS:
Upper: possible upper dike margin in Pieces 13 and 17–20, Section 187R-1
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline
Texture: intergranular to variolitic.

VESICLES: None

ALTERATION: Moderately altered

VEINS: Diffuse chlorite-actinolite vein

STRUCTURE: A light green (chlorite-actinolite), pyrite-bearing vein with a diffusive and irregular morphology.

ADDITIONAL COMMENTS: See Section 187R-1, Unit 75 additional comments for discussion of the definition of the boundary between Units 75 and 76. This single piece is similar in grain size to the cryptocrystalline pieces at the bottom of Section 187R-2, so it is classified as Unit 76. However, halo present parallel to the margins of the piece may indicate that this piece is out of sequence, and is potentially part of the overlying lava sequence that has been introduced into the core.

UNIT: 77

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric fine-grained basalt

PIECES: Pieces 1, 3, and 4

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular

VESICLES: None

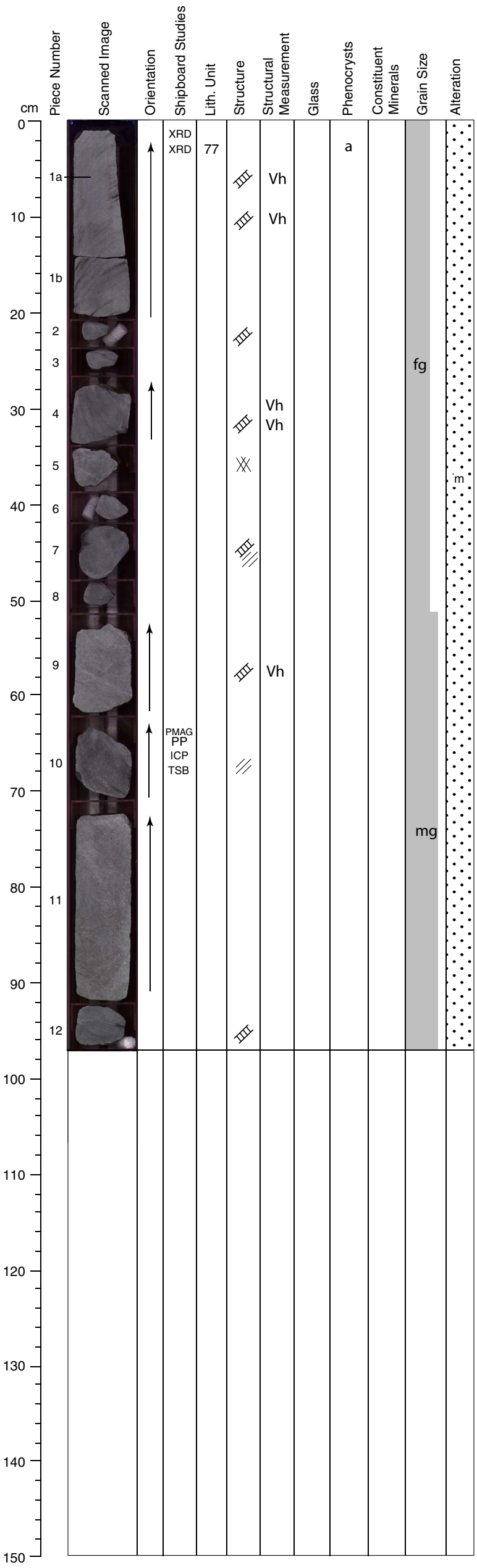
ALTERATION: Moderately altered dark gray basalt.

VEINS: Several 0.2 mm chlorite and chlorite-actinolite veins.

STRUCTURE: Light and dark green veins (proportion of chlorite to actinolite) with diffusive and irregular morphologies. Piece 3 has 1 mm wide halos. There are no specific structures near the unit boundary (Piece 2).

ADDITIONAL COMMENTS: Pieces 1, 3, and 4 are fine grained, while Piece 2 is cryptocrystalline, similar to the bottom two pieces of Section 187R-2 in Unit 76. The recovery is poor, and the pieces may have been jumbled out of sequence. We define a new unit here on the basis of the presence of cryptocrystalline samples at the base of Section 187R-2 and the observation that the grain size in Pieces 1, 3, and 4 is larger than that observed in any samples of Unit 76.

Core Photo



312-1256D-189R-1 (Section top: 1333.90 mbsf)

Volcanic Rock

UNIT: 77

ROCK NAME: Aphyric fine-grained to medium-grained basalt

SUMMARY DESCRIPTION: Aphyric fine-grained to medium-grained basalt

PIECES: 1–12

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained to medium grained
Texture: intergranular to subophitic

VESICLES: None

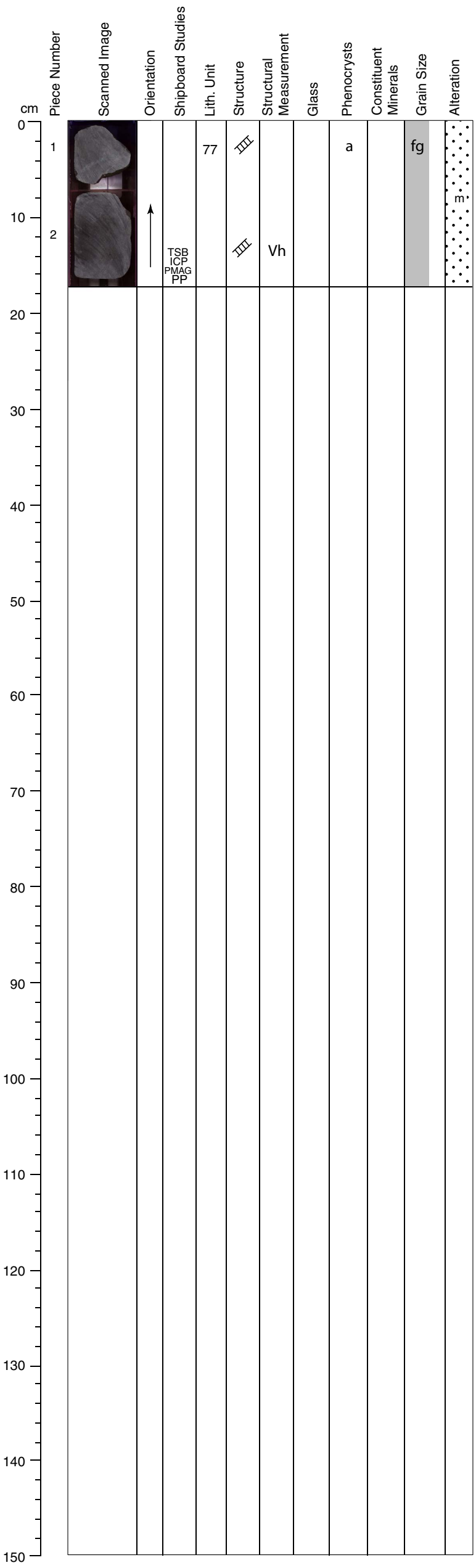
ALTERATION: Moderately altered dark gray basalt with greenish-gray (5BG 4/1) areas of more intense alteration. In fine-grained Pieces 7–12, groundmass clinopyroxene appear altered to actinolite.

VEINS: Several irregular 0.5 mm chlorite-actinolite veins

STRUCTURE: Fracture intensity is low. In oriented Piece 1, subvertical vein (dipping 88 degrees) filled with pyrite, chlorite, and actinolite, cuts moderately dipping (46 degrees) vein with chlorite-actinolite fillings. Oriented Piece 9 has moderately dipping (around 45 degrees) parallel veins with chlorite-actinolite filings. In Piece 11, a diffusive alteration patch (10 cm x 1 cm) is elongated subvertically.

ADDITIONAL COMMENTS: In this section, Unit 77 shows an increase in grain size from top to bottom, with Pieces 9–12 being defined as medium grained (>1 mm). The largest grain size is found in Piece 11, and the grain size starts to drop from Piece 12 (and into the next core). This distribution of grain sizes may indicate that Pieces 9–11 come from close to the center of the intrusion. Acicular plagioclase is present in all of the samples, but is most prominent in the medium-grained pieces, where its long axis attains lengths of up to 3 mm. Parts of Piece 12 appear to have a subophitic texture.

Core Photo



312-1256D-190R-1 (Section top: 1338.70 mbsf)

Volcanic Rock

UNIT: 77

ROCK NAME: Aphyric fine-grained to medium-grained basalt

SUMMARY DESCRIPTION: Aphyric fine-grained to medium-grained basalt

PIECES: 1–2

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine-grained
Texture: intergranular

VESICLES: None

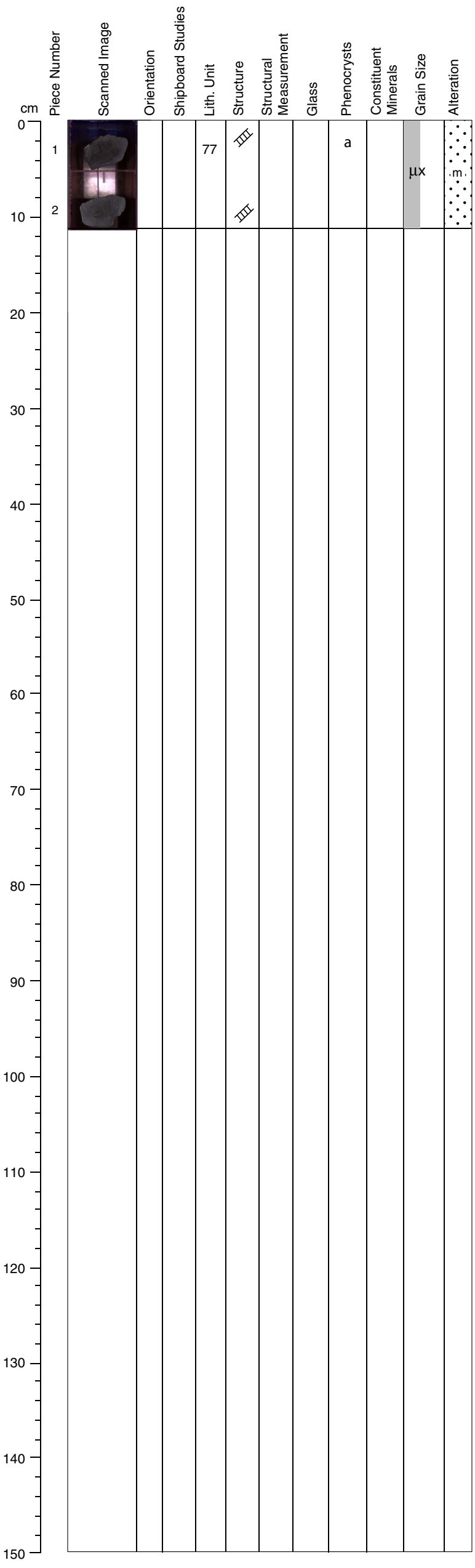
ALTERATION: Moderately altered dark gray basalt

VEINS: Piece 1 has a 0.8 mm chlorite-actinolite-quartz-pyrite-chalcopyrite vein with a composite halo (2 mm light green inner zone and 2 mm dark gray outer zone).

STRUCTURE: Piece 1 has a 0.8 mm thick subhorizontal vein filled with chlorite, actinolite, quartz, and pyrite. Oriented Piece 2 has three thin veins filled with chlorite and dipping moderately about 50 degrees.

ADDITIONAL COMMENTS: These two fine-grained pieces are assigned to Unit 77, and may represent a continuation of a decrease in grain size observed in the last two pieces of Section 189R-1. This decrease in grain size possibly reflects increasing proximity to the margin of this unit.

Core Photo



312-1256D-191R-1 (Section top:1343.50 mbsf)

Volcanic Rock

UNIT: 77

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1–2

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

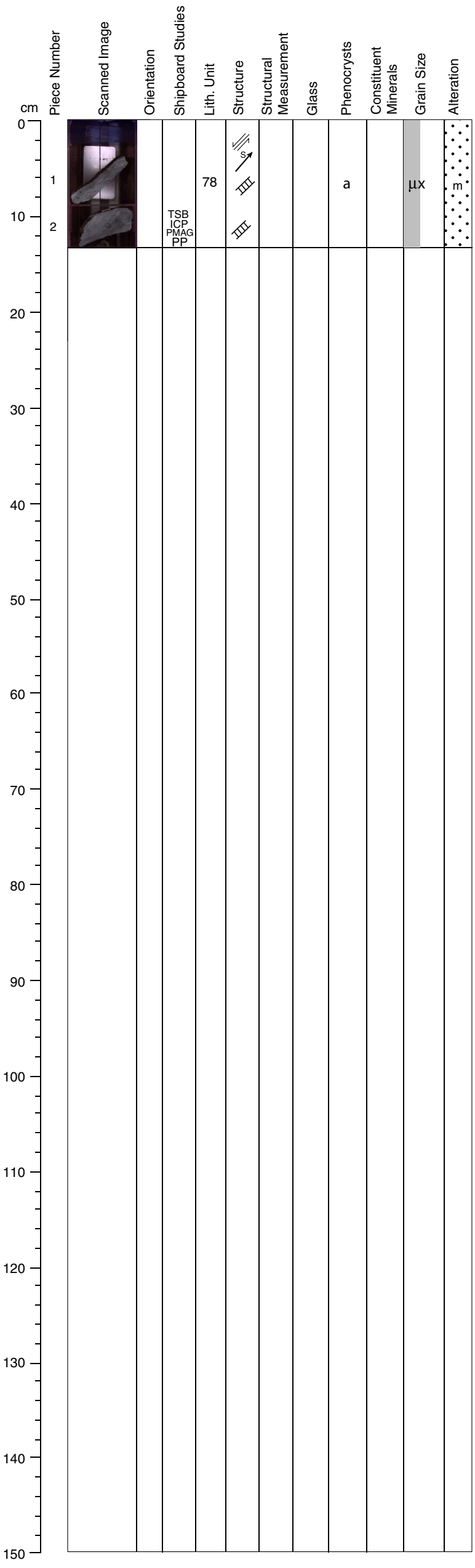
ALTERATION: Dark gray moderately altered basalt

VEINS: Several 0.1–1 mm chlorite + actinolite veins with 1–2 mm discrete dark green to light gray composite halos. Piece 1 contains a subvertical 0.1 mm zeolite + chlorite vein. Piece 2 contains a 1 mm vertical quartz + pyrite + chlorite vein.

STRUCTURE: Irregular, anastomosing, 0.1–0.8 mm wide veins with chlorite + actinolite 1–2 mm wide halos.

ADDITIONAL COMMENTS: These two fine-grained pieces are assigned to Unit 77, and may represent a continuation of a decrease in grain size observed from last two pieces of core from 189R-1 onward. This decrease in grain size possibly reflects increasing proximity to the margin of this unit.

Core Photo



312-1256D-192R-1 (Section top: 1348.30 mbsf)

Volcanic Rock

UNIT: 78

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt rubble

PIECES: 1–2

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

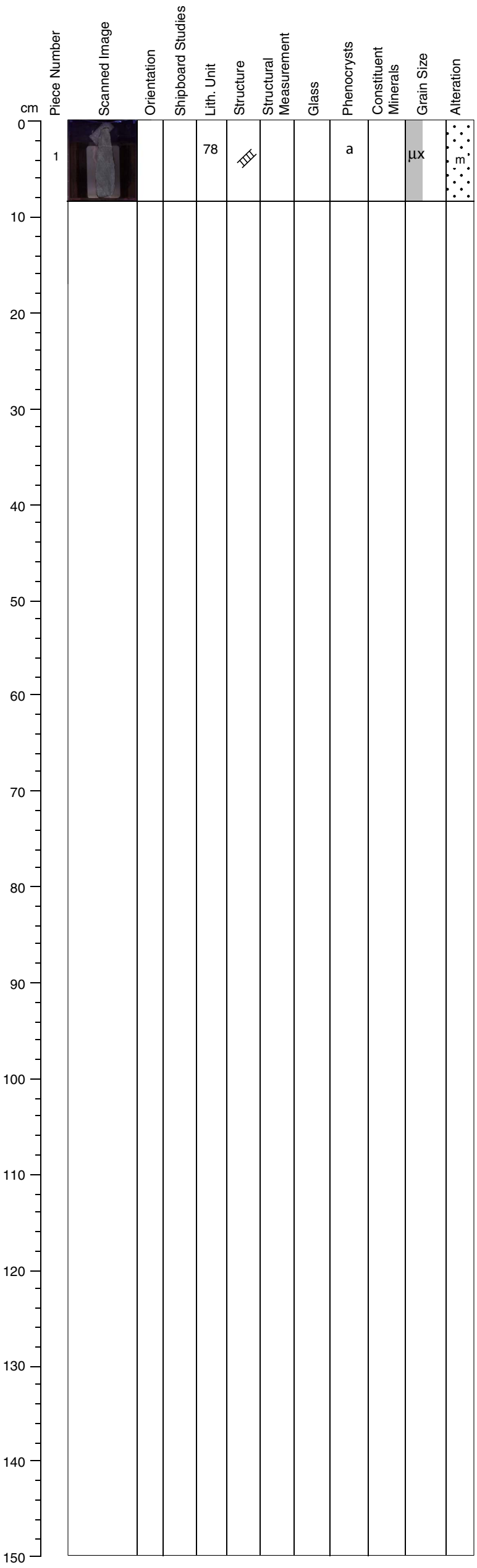
ALTERATION: Moderately altered dark gray to dark green basalt

VEINS: Several 0.1–0.5 mm actinolite veins with <5 mm light gray halos

STRUCTURE: Dark (chlorite) and light (actinolite) green veins, ~0.5 mm wide with thick, gray halos (~1.5 mm wide). Slickenlines on the surface of unoriented Piece 1 have steps indicating shear.

ADDITIONAL COMMENTS: Low recovery. Although there is no significant change in texture between the rocks below and above these pieces, these two microcrystalline pieces are assigned to Unit 78 because the lack of recovery between Sections 190R-1 and 191R-1 is significant.

Core Photo



312-1256D-193R-1 (Section top: 1353.10 mbsf)

Volcanic Rock

UNIT: 78

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

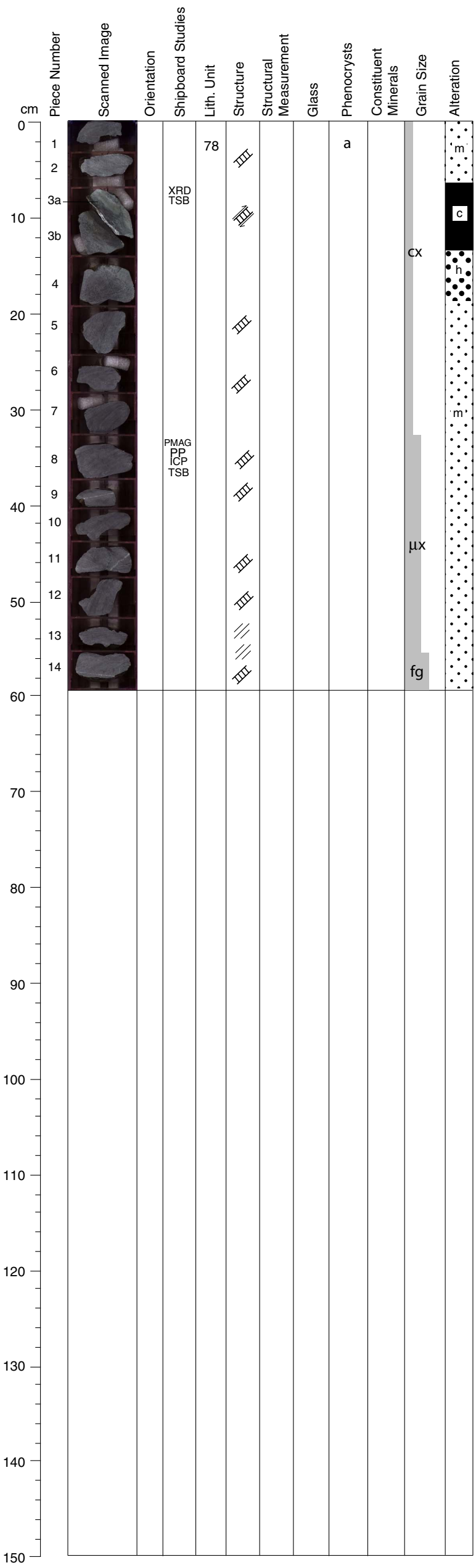
ALTERATION: Moderately altered dark gray to dark green basalt

VEINS: Several 0.1–0.5 mm actinolite veins with <5 mm light gray halos

STRUCTURE: Irregular, dark-green veins (actinolite) with light green halos.

ADDITIONAL COMMENTS: Poor recovery. We assign this piece to Unit 78, along with the two pieces in the previous core, due to the similar grain size and texture, and the similar shape of this piece to Piece 1 from Section 192R-1. Note that this piece is labeled as oriented, although elongate shape suggests that only way-up direction is known.

Core Photo



312-1256D-194R-1 (Section top: 1357.90 mbsf)

Volcanic Rock

UNIT: 78

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–14

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: intergranular

VESICLES: None

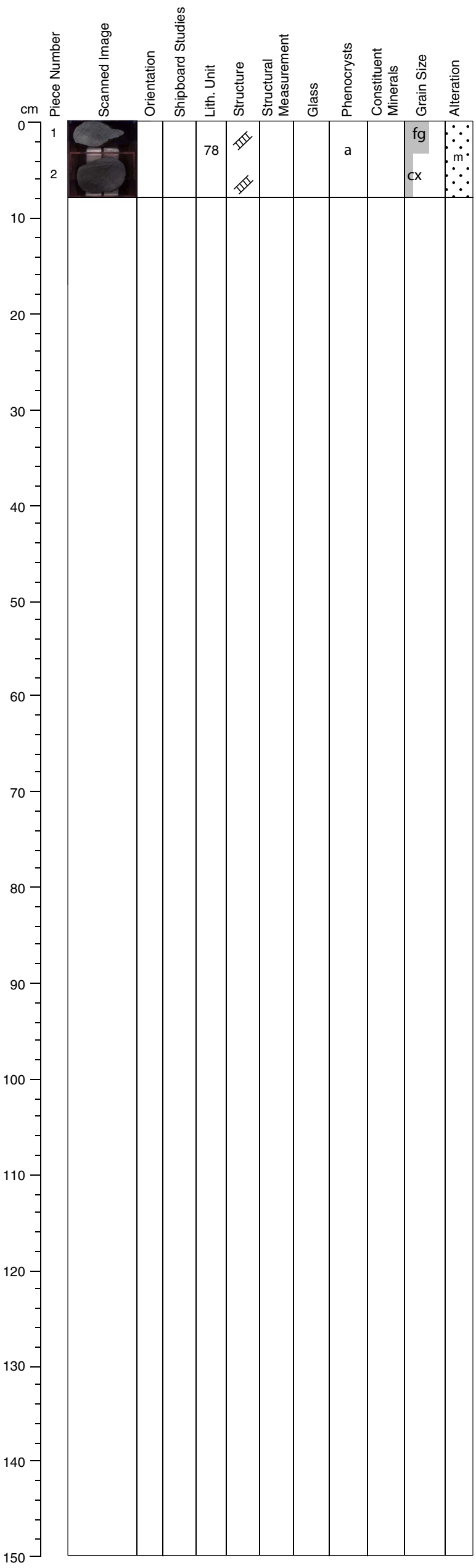
ALTERATION: Moderately to highly altered dark greenish gray basalt. Piece 3 is completely altered and deformed along a shear band with abundant chlorite and actinolite (shear band along 5 mm dikelet).

VEINS: 3 mm shear vein (quartz + carbonate + zeolite ± anhydrite + pyrite + chalcopyrite + sphalerite?) with a composite halo (5 mm dark green inner zone and an outer 1 mm light gray zone) in Piece 3. Several 1–2 mm quartz + pyrite veins (Pieces 5, 9, 11, and 14). Common 0.2–1 mm chlorite + pyrite veins, some with composite halos (2 mm inner dark green zone and an outer 1 mm light gray zone).

STRUCTURE: There are no oriented pieces. Veins throughout are dark and light green to light gray, with stepped, planar, irregular, and anastomosing morphologies. Toward the base of the section most of the veins are white or light gray. In some pieces (e.g., Piece 4) there are crosscutting relationships between veins, although there is no correlation between composition (color) and relative age. Piece 3 is part of a chilled margin complex intensely overprinted by alteration: (1) sharp contacts between domains of contrasting primary grain size (e.g., a lens of microcrystalline within cryptocrystalline basalt), (2) alteration patches with cm-scale dark spherical morphologies adjacent to the sharp contacts, (3) flow-structures adjacent to the sharp contacts. A white shear vein cutting across the chilled margin has an irregular shape. Internally the vein-filling mineral texture indicates simple opening.

ADDITIONAL COMMENTS: We assign these pieces to Unit 78 because there is no unambiguous change in grain size and texture between the lower pieces in this section and the pieces from the previous two sections. At the top of this section there is a cryptocrystalline interval that has been extensively altered, and this interval may represent an approach to the margins of Unit 78. The grain size then increases from cryptocrystalline through microcrystalline to fine grained by the base of the section, indicating increasing distance from the cooling margin.

Core Photo



312-1256D-195R-1 (Section top: 1362.7 mbsf)

Volcanic Rock

UNIT: 78

ROCK NAME: Aphyric cryptocrystalline to fine grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine grained basalt

PIECES: 1–2

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: intergranular

VESICLES: None

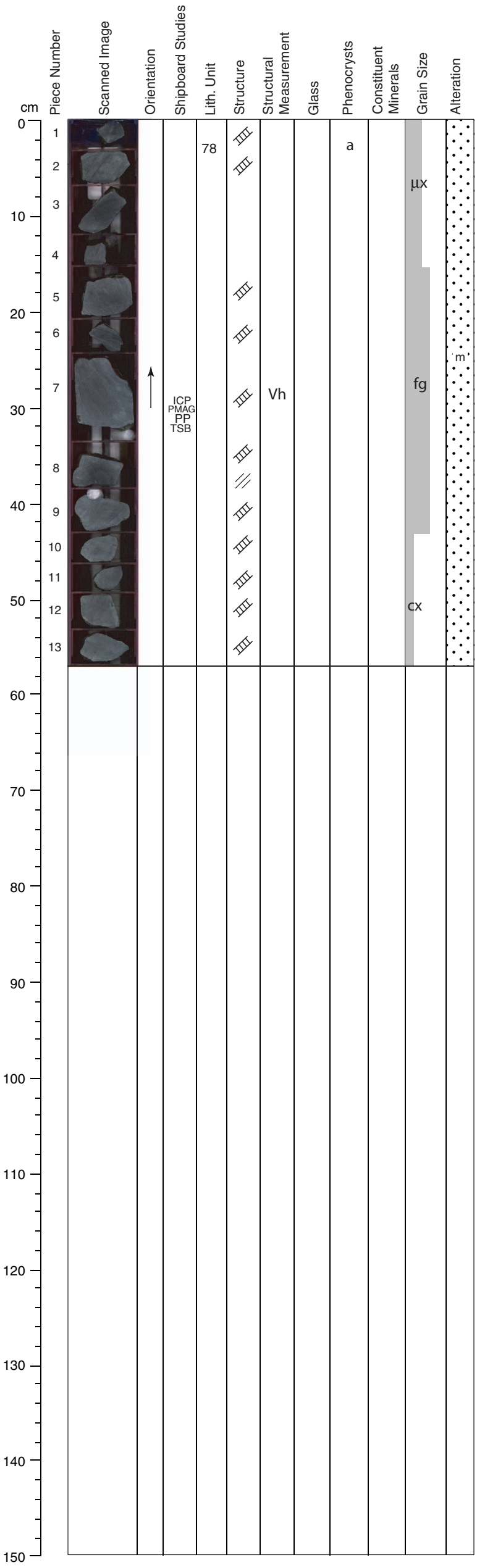
ALTERATION: Moderately altered dark gray to dark greenish gray basalt. Piece 1 contains a 1 cm dark greenish gray actinolite-rich patch.

VEINS: One 0.5 mm actinolite vein in Piece 1. Several 0.1 mm cracks filled with a white mineral.

STRUCTURE: Three veins in the two unoriented pieces. Veins are curved, planar, and irregular, 0.1 mm wide, and light green in color (actinolite).

ADDITIONAL COMMENTS: Low recovery. We assign these pieces to Unit 78, due to the similarity of the grain size and texture of Piece 1 and the lower pieces of the last section. Piece 2 is cryptocrystalline, and may have been sampled a significant distance from Piece 1.

Core Photo



312-1256D-196R-1 (Section top: 1363.7 mbsf)

Volcanic Rock

UNIT: 78

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–13

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: intergranular

VESICLES: None

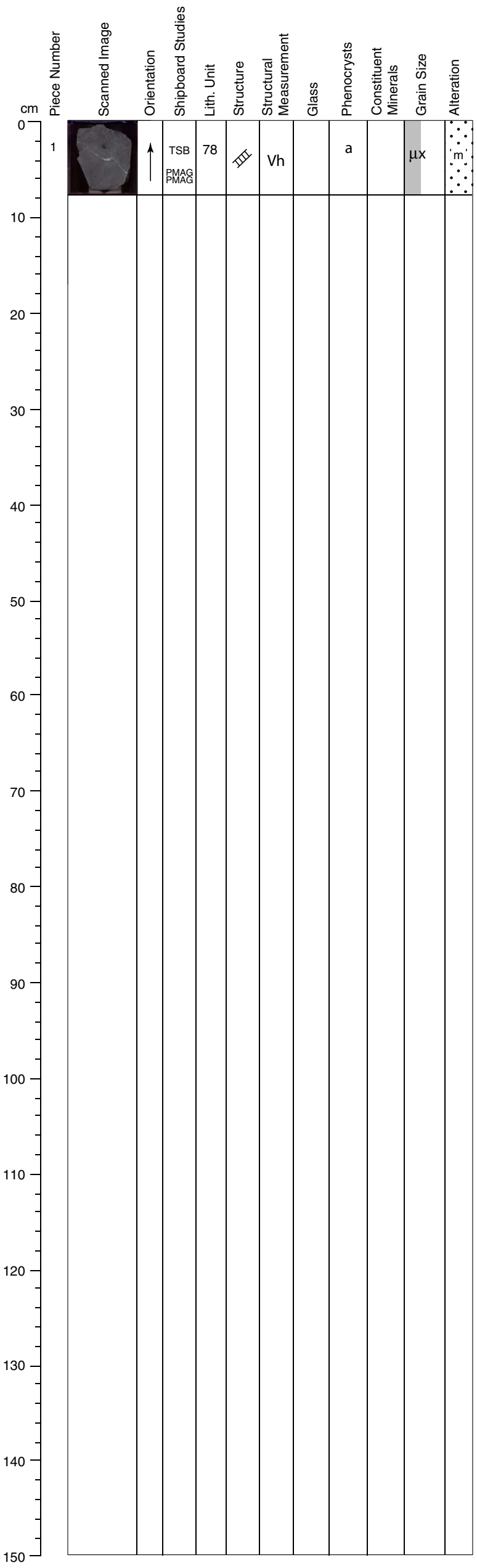
ALTERATION: Moderately altered dark gray basalt. Several 1 cm greenish alteration patches.

VEINS: Several 1 mm quartz + chlorite veins with 2 mm light gray halos, which cut across 0.2 mm actinolite veins with 1 mm light gray halos.

STRUCTURE: Veins throughout the section are submillimeter wide with planar, irregular, curved, and diffusive morphologies. Alteration patches are also present (e.g., Piece 2). An area of micro- to cryptocrystalline basalt adjacent to a vein in Piece 12 may be part of an igneous contact.

ADDITIONAL COMMENTS: These pieces are assigned to Unit 78 due to the similarity in grain size and texture between the first piece of the last section (195R-1) and the first nine pieces of this section. The second piece in Section 195R-1 may be out of sequence, or it may have been sampled from near the edge of the intrusion. The grain size varies slightly from microcrystalline to fine grained in the first nine pieces, and then drops off significantly in the last four pieces, perhaps indicating another approach to the dike margin.

Core Photo



312-1256D-197R-1 (Section top: 1367.5 mbsf)

Volcanic Rock

UNIT: 78

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

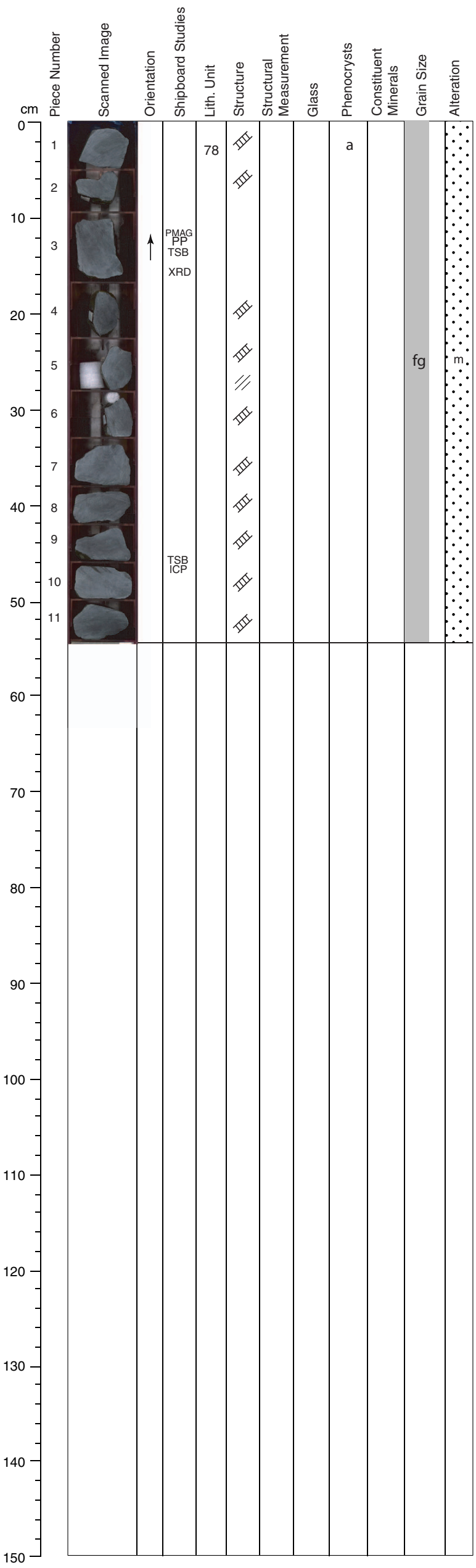
ALTERATION: Moderately altered dark gray to greenish gray basalt. Several 5 mm light gray patches with abundant chlorite.

VEINS: Cross-cut by a 0.2 mm chlorite + actinolite + pyrite vein and a prominent 1 mm quartz + actinolite + chlorite vein with a 10 mm light gray halo.

STRUCTURE: Pyrite-bearing irregular, discontinuous veins intersect creating a dilational jog. The intersection contains fragments of host rock in a matrix of quartz + actinolite + chlorite.

ADDITIONAL COMMENTS: Piece 1 shows the same texture as the previous core. Unit 78 is continuous with same lithology and varying grain size. Note that this observation is based on one piece of this core due to the low recovery (7%).

Core Photo



312-1256D-198R-1 (Section top: 1369.0 mbsf)

Volcanic Rock

UNIT: 78

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric fine-grained basalt

PIECES: 1–11

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular

VESICLES: None

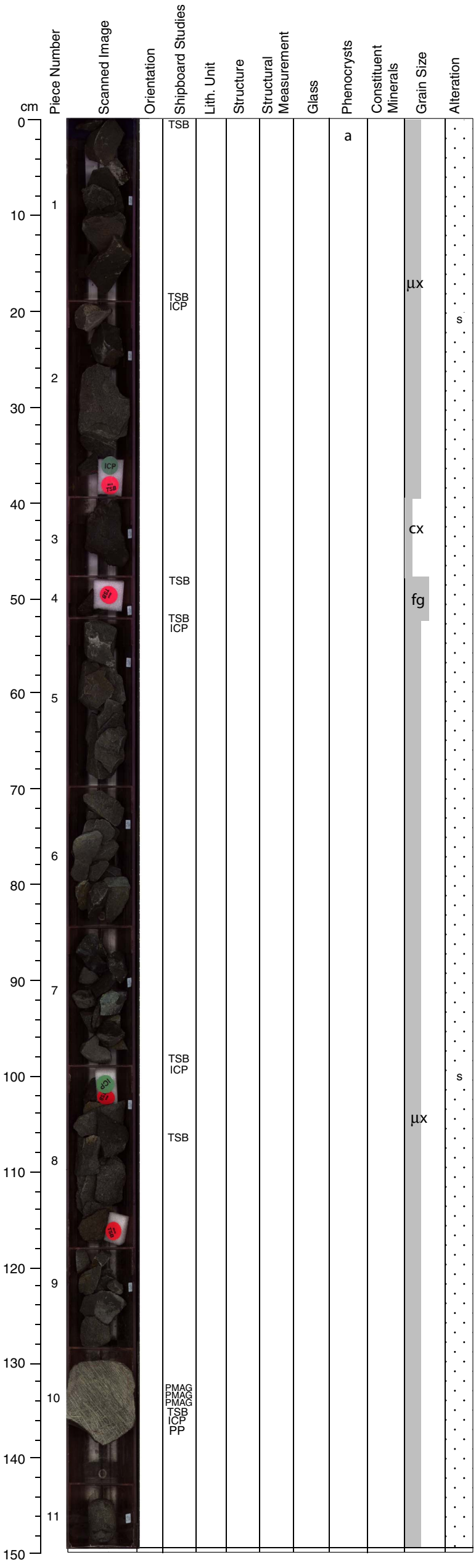
ALTERATION: Moderately altered dark gray to greenish-gray basalt with disseminated pyrite.

VEINS: Several 0.2 mm actinolite veins, some with 1–3 mm light gray halos. Several 0.2 mm pyrite-chlorite veins with 1mm light gray halos

STRUCTURE: Pyrite-chlorite veins throughout the section are irregular, stepped, planar, and anastomosing with splayed and Y-shaped intersections and local crosscutting relationships.

ADDITIONAL COMMENTS: Unit 78 continues with the same lithology and varying grain size. Note that this observation is based on a small amount of core. As has been the case throughout sections with low recovery, it is difficult to ascertain whether all of Unit 78 truly belongs to one intrusion, or whether several dike boundaries have been crossed but not sampled.

Core Photo



312-1256D-201G-1 (ghost core)

Volcanic Rock

UNIT: None

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–11

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: mixed

VESICLES: None

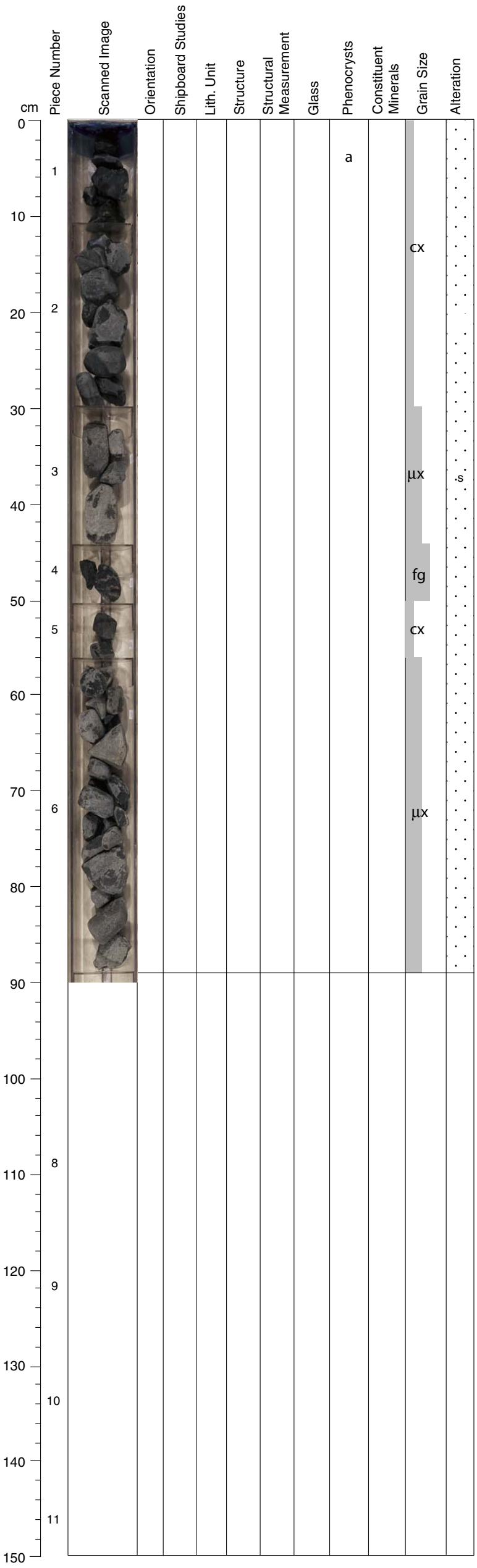
ALTERATION: Most of the pieces are slightly altered and contain clay and pyrite, and Piece 11 has a brown halo, suggesting that the material was from higher in the hole.

VEINS: None

STRUCTURE: No structure logged

ADDITIONAL COMMENTS: Material collected from junk basket. Most of the material catalogued in this section is tabular, fractured fragments of basalt. Piece 11 is rounded into a sausage shape and has a fresh olivine phenocryst at one end. Piece 10 is crescent shaped with scratch marks on its inner surface. This piece is derived from wall of the hole.

Core Photo



312-1256D-201G-2 (ghost core)

Volcanic Rock

UNIT: None

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–6

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: mixed

VESICLES: None

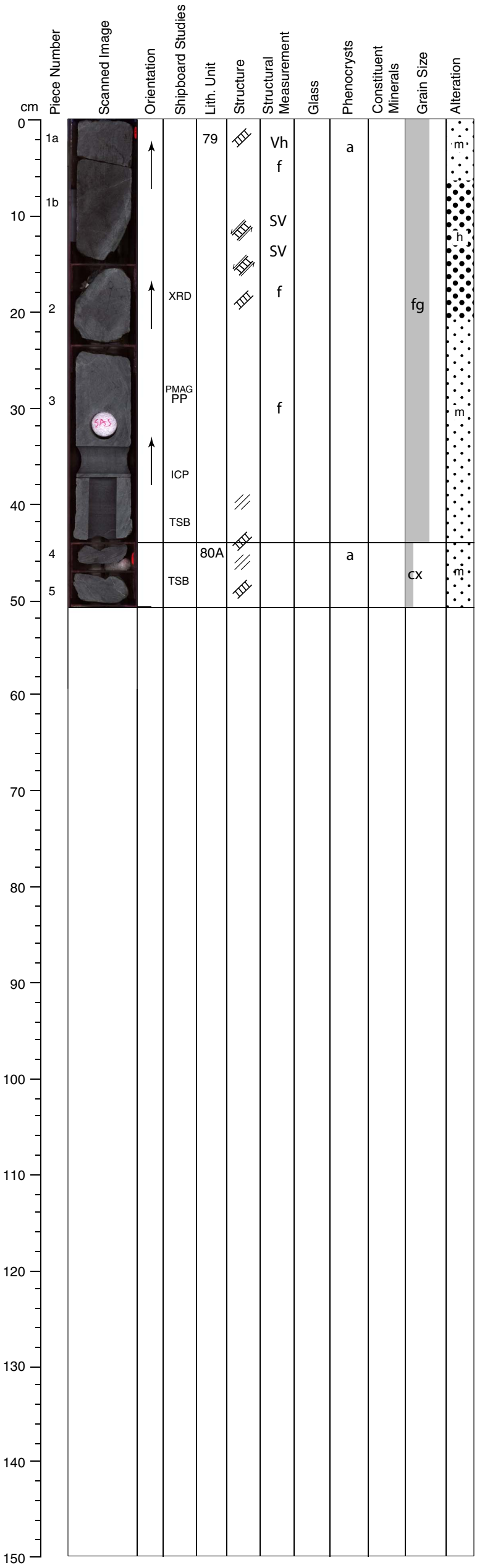
ALTERATION: Slightly altered, with saponite in most pieces. Some pieces contain fresh and altered glass.

VEINS: None

STRUCTURE: No structure logged

ADDITIONAL COMMENTS: Material collected from junk basket. Most of the material catalogued in this section has been rounded during drilling or recovery.

Core Photo



312-1256D-202R-1 (Section top: 1372.8 mbsf)

Volcanic Rock

UNIT: 79

ROCK NAME: Aphyric fine-grained basalt

SUMMARY DESCRIPTION: Aphyric fine-grained basalt

PIECES: 1–3

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular

VESICLES: None

ALTERATION: Moderately to highly altered dark greenish gray basalt, with disseminated pyrite. There is a prominent 1 cm dark green to light gray halo around a moderately dipping vein in Pieces 1 and 2.

VEINS: Several 0.1–0.5 mm quartz ± laumontite veins, with a prominent 1–3 mm moderately dipping vein (quartz + chlorite + laumontite) that crosses from Piece 1 to Piece 2. This vein has a prominent dark green to light gray actinolitic halo, with disseminated pyrite.

STRUCTURE: A shear vein dips moderately to the east (left on the archive half) and intersects Pieces 1 and 2. The vein has quartz + laumontite fibers that plunge down the dip of the vein, and weak sense of shear indicators in the adjacent slickenside indicate normal sense displacement. The shear vein on Piece 2 has a subsidiary fault plane with obliquely plunging slickenfibers. Throughout the section there are light and dark green veins (chlorite and actinolite) with irregular, diffusive, and curved morphologies, including veins with Y-shaped intersections. Several of the veins have light green halos. Fractures, probably drilling induced, are present in all of the pieces except for Piece 4.

ADDITIONAL COMMENTS: This fine-grained material bears many similarities to the last pieces from Unit 78, and may well be from the same dike. However, in view of the hiatus in recovery between Section 198R-1 and this core, a new unit is defined.

UNIT: 80A

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrysatalline basalt

PIECES: 4–5

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline
Texture: variolitic/intergranular

VESICLES: None

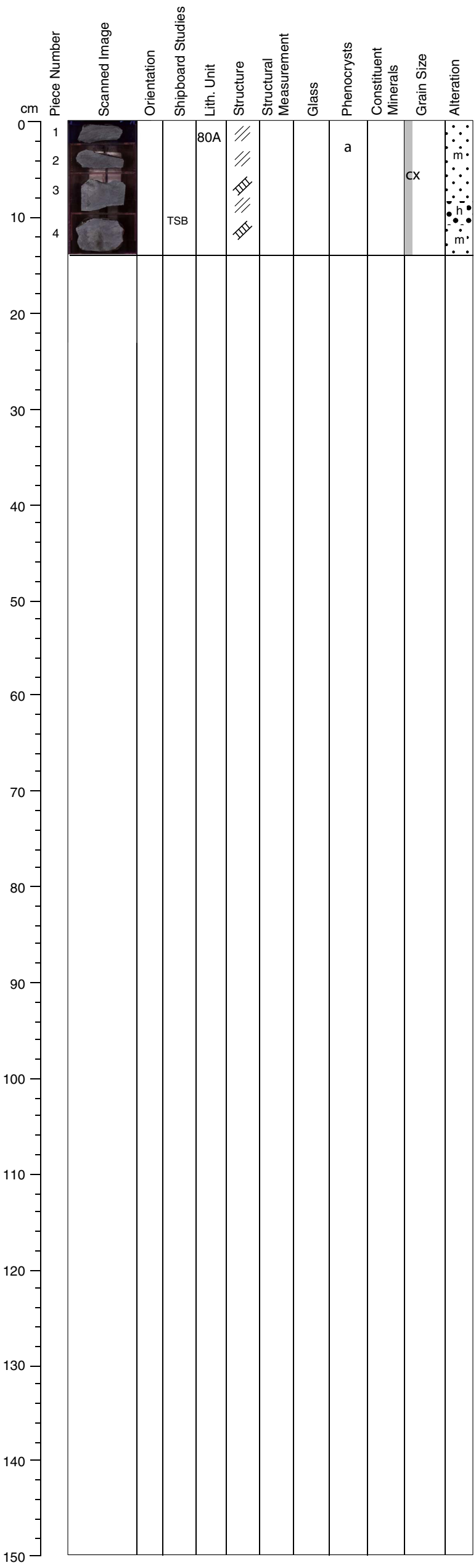
ALTERATION: Moderately to highly altered dark gray basalt

VEINS: Piece 5 has two 0.5–1.5 mm quartz + actinolite veins with light gray actinolitic halos.

STRUCTURE: Several subhorizontal fractures with irregular shapes are present (e.g., Piece 4). These may be drilling induced.

ADDITIONAL COMMENTS: There is a sharp change in grain size in the recovered material so a new Unit 80 is defined. This unit may be from the same dike as Unit 79, in which case it is derived from close to the cooled margin of this dike. Alternatively, these samples may be from the margins of a separate intrusion.

Core Photo



312-1256D-203R-1 (Section top: 1374.8 mbsf)

Volcanic Rock

UNIT:

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline basalt

PIECES: 1–4

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline
Texture: variolitic/intergranular

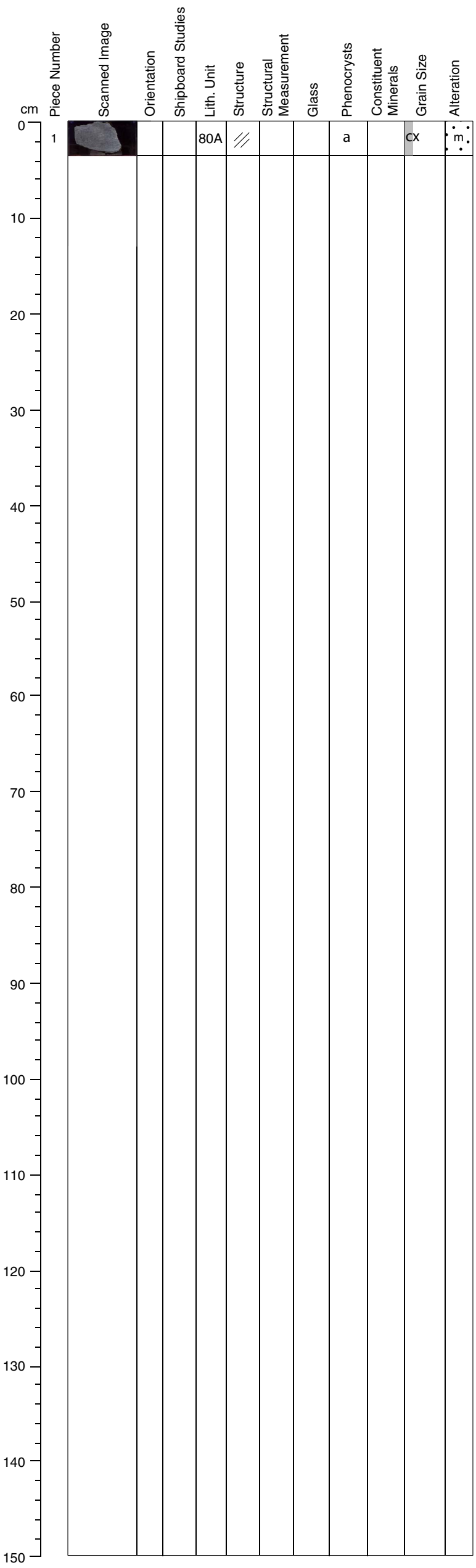
VESICLES: None

ALTERATION: Moderately to highly altered dark greenish gray basalt, with several 5–10 mm dark green actinolitic patches surrounded by <5 mm light gray actinolitic halos.

VEINS: Several 0.2 mm quartz + chlorite + pyrite veins

STRUCTURE: Fractures in Pieces 1 and 2 curve and taper inward from the edges of the pieces; they are possibly drilling induced. Pieces 3 and 4 have 0.1 mm wide veins exhibiting crosscutting relationships between lighter and darker colored veins, some with sulfides. Veins throughout the section are irregular, curved, anastomosing, and planar. Pieces 3 and 4 have irregularly shaped alteration patches with sulfides and halos.

Core Photo



312-1256D-204R-1 (Section top: 1377.3 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline basalt

PIECES: 1

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline
Texture: variolitic/intergranular

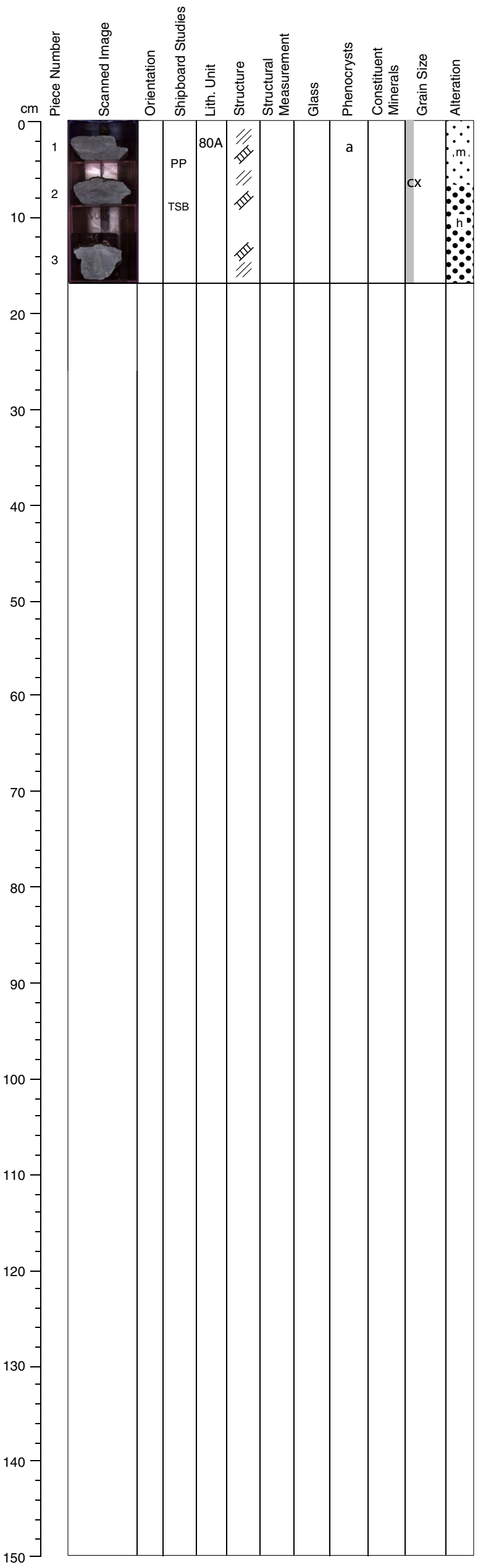
VESICLES: None

ALTERATION: Moderately altered dark gray basalt

VEINS: None

STRUCTURE: White fractures curve and taper from the sides of the piece inward; possibly drilling induced

Core Photo



312-1256D-205R-1 (Section top: 1382.1 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline basalt

PIECES: 1–3

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline
Texture: variolitic/intergranular

VESICLES: None

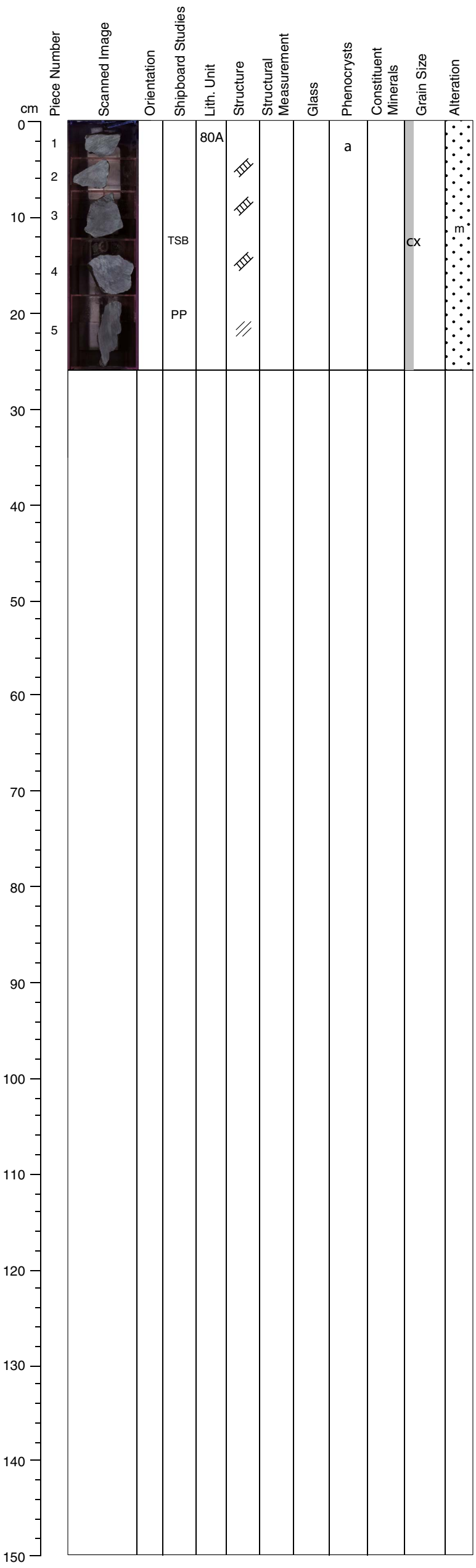
ALTERATION: Moderately to highly altered dark greenish gray basalt

VEINS: Piece 3 has a 3 mm actinolite + pyrite vein with a prominent 5 mm dark green to light green actinolitic halo and several 0.2 mm quartz veins with 2 mm dark green halos.

STRUCTURE: Throughout the section there are light and dark green veins (actinolite and chlorite). In Pieces 1 and 2, the veins are 0.1 mm wide, curved, planar, and anastomosing. In Piece 3 there are four alteration patches roughly 10–12 mm in diameter with distinctive halos. There are four veins in Piece 3, including a curved dark brown vein (amphibole) with a 10 mm wide halo that is offset by a 0.1 mm wide light green vein (actinolite), and a 3–4 mm wide green vein with a dark halo. Fractures, potentially drilling induced, also are present throughout the section.

ADDITIONAL COMMENTS: A vein cutting Piece 3 is straight and has incorporated angular elongate fragments of the host rock. The vein is darker than many of the previous veins. It is gray in color, similar to the host. The grain size in the vein is coarser than that of the host rock. It is possible that this vein is of igneous origin, or that it is a hydrothermal vein that has been overprinted by later heating.

Core Photo



312-1256D-206R-1 (Section top: 1386.9 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline basalt

PIECES: 1–5

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline
Texture: variolitic/intergranular

VESICLES: None

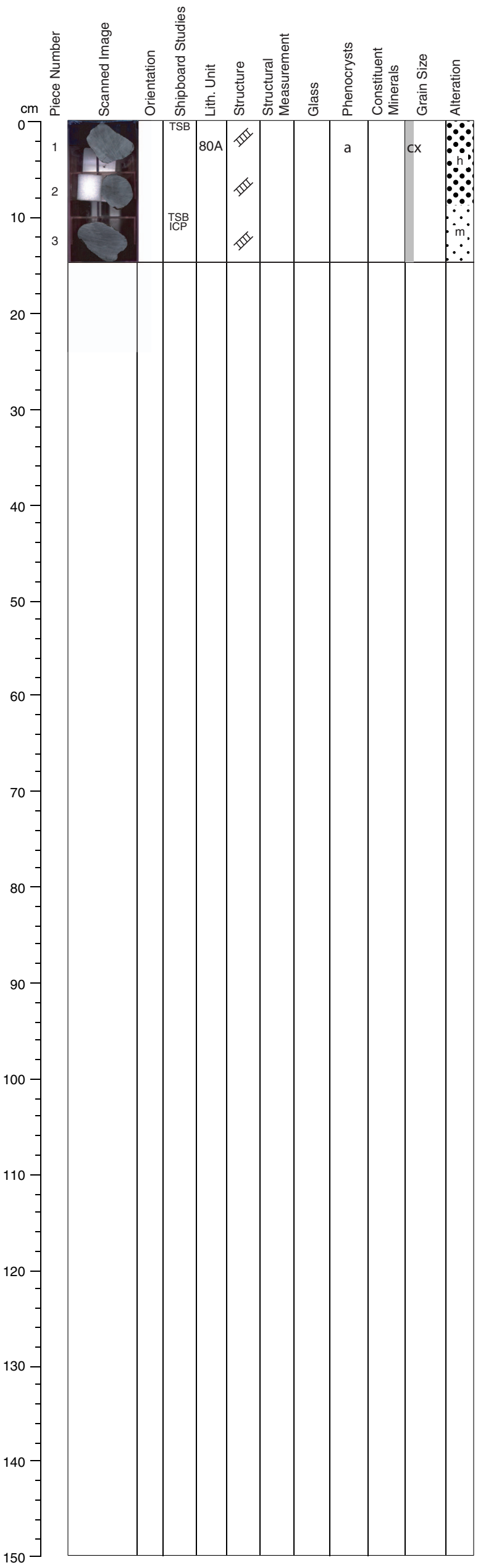
ALTERATION: Moderately to highly altered dark gray basalt with 5 mm actinolitic alteration patches with some disseminated pyrite

VEINS: Several 0.1 mm actinolite veins, some with actinolite +/- pyrite, and some with <1 mm halos. There is a prominent 1.5 mm actinolite + pyrite vein with a 3 mm light gray halo in Piece 4.

STRUCTURE: Irregular, 0.1 mm wide, and possibly drilling-induced (given Y-shaped morphologies and tapers toward the center of the pieces) fractures are present throughout the section. Dark green veins (chlorite) (with a halo in Piece 2) have irregular, diffusive, and planar morphologies.

ADDITIONAL COMMENTS: These samples have been logged as cryptocrystalline, but it is likely that the apparent grain size has been influenced by alteration at this depth. Grain size appears larger in halos around veins and altered patches.

Core Photo



312-1256D-207R-1 (Section top: 1390.7 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline basalt

PIECES: 1–3

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline
Texture: variolitic/intergranular

VESICLES: None

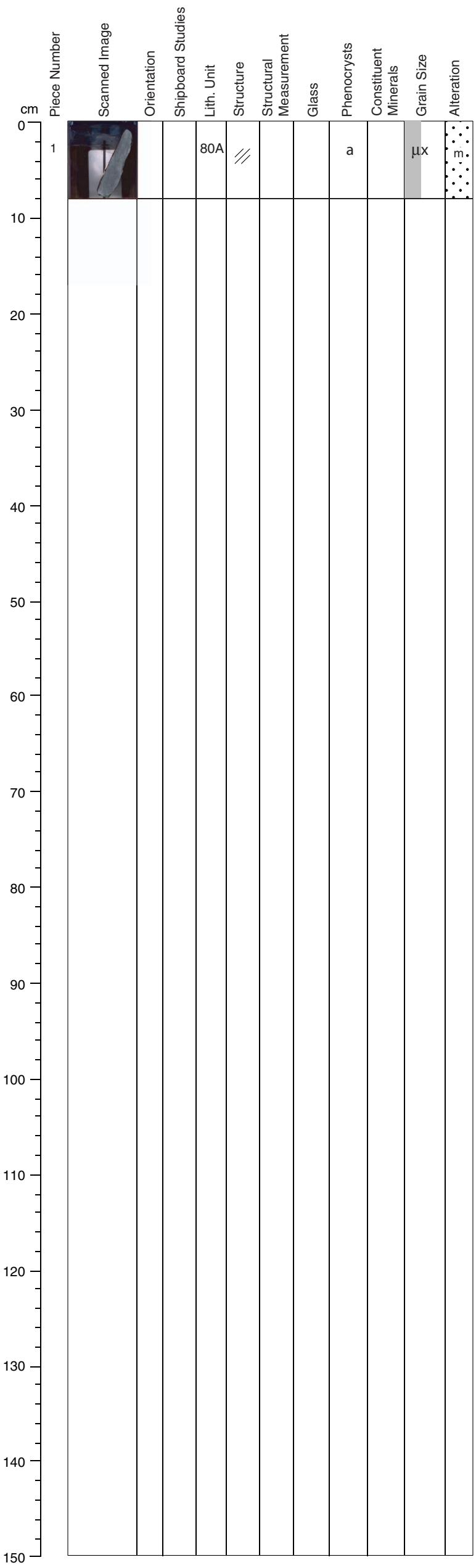
ALTERATION: Moderately to highly altered dark gray to dark greenish-gray basalt with disseminated pyrite

VEINS: Several 0.2 mm actinolite + chlorite + pyrite veins, some with 1 mm light gray halos. In Piece 1, a prominent 0.8 mm chlorite-actinolite-pyrite vein cuts across a network of 0.1–0.2 mm actinolite veins.

STRUCTURE: Veins in all three unoriented pieces are <1 mm wide with the exception of a 1 mm wide vein in Piece 1. The veins are splayed, planar, and have slightly diffuse boundaries. Three of the veins in Piece 1 have halos, whereas the other veins in the section do not. The veins are dark green and in places sulfide bearing. In Piece 1 a dark green (actinolite and chlorite) vein crosscuts the other six veins in the piece.

ADDITIONAL COMMENTS: These cryptocrystalline samples with patchy alteration and veins may have been from close to a dike margin.

Core Photo



312-1256D-208R-1 (Section top: 1392.7 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

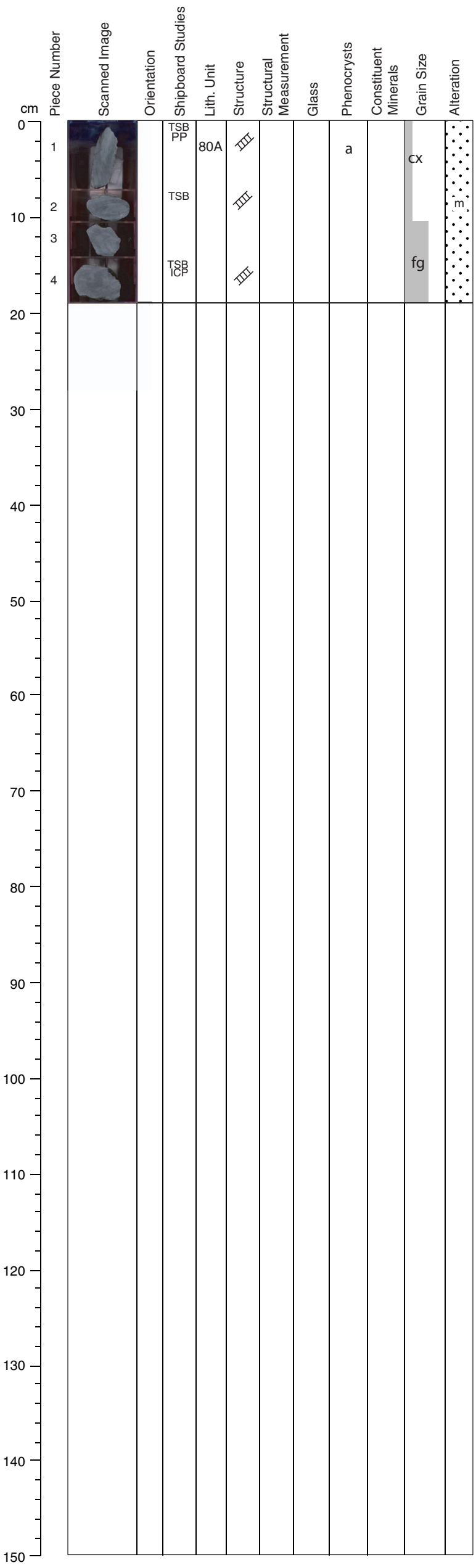
ALTERATION: Moderately altered dark gray basalt with disseminated pyrite

VEINS: 0.2 mm actinolite vein with a 1 mm dark green halo along the edge of the piece

STRUCTURE: A single unoriented piece with a possible shear surface, although there is no evidence of faulting on the cut face. A small (1.2 x 0.2 mm) alteration feature on the edge of the piece.

ADDITIONAL COMMENTS: This sample is clearly coarser than those from the previous two cores, and may have been derived from closer to the centre of a dike than the shallower samples from Unit 80A. Again, the primary grain size may have been slightly influences by alteration.

Core Photo



312-1256D-209R-1 (Section top: 1396.5 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric cryptocrystalline to fine-grained basalt

SUMMARY DESCRIPTION: Aphyric cryptocrystalline to fine-grained basalt

PIECES: 1–4

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: intergranular–subophitic

VESICLES: None

ALTERATION: Moderately to highly altered dark gray basalt

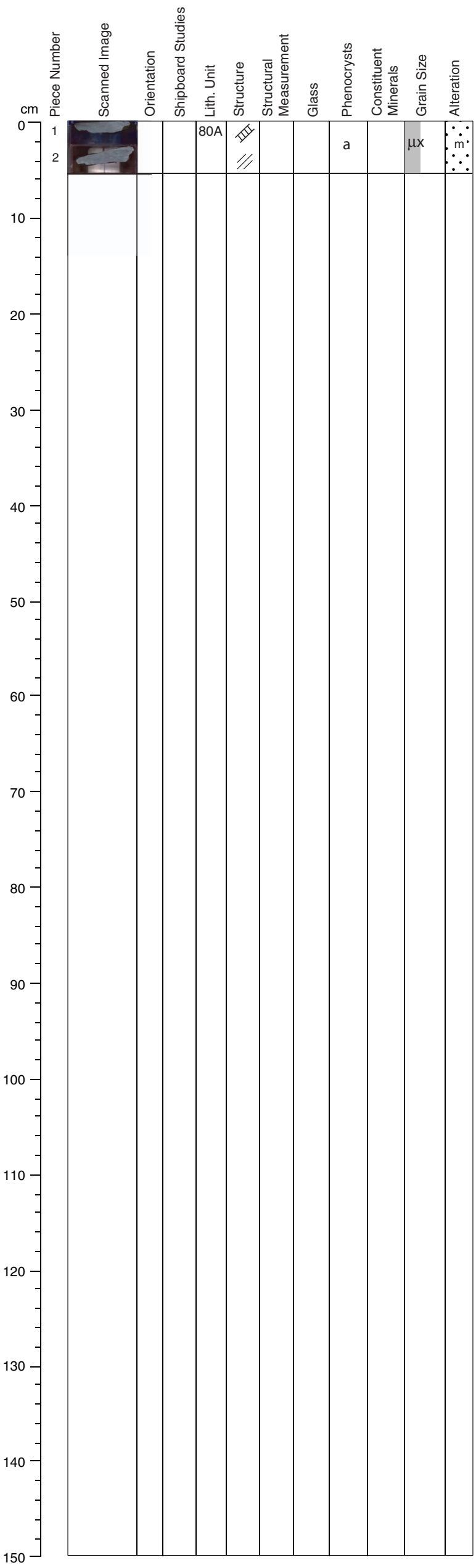
VEINS: Several 0.1 mm actinolite ± chlorite veins, some with disseminated pyrite halos. One is flanked by a prominent 2 mm light gray halo in Piece 1.

STRUCTURE: All of the pieces except for Piece 3 contain veins that are 0.1 mm wide, dark green, light green, white, and metallic (varying amounts of actinolite, chlorite, quartz, and sulfides). In Piece 1 the vein has a 0.3 mm halo. Piece 3 has an elongate alteration patch.

ADDITIONAL COMMENTS: Although Pieces 1 and 2 are definitely cryptocrystalline, Pieces 3 and 4 are coarser than above two pieces and similar to Piece 1 in Section 208R-1.

1256D-210R No recovery

Core Photo



312-1256D-211R-1 (Section top: 1401.3 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 2

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

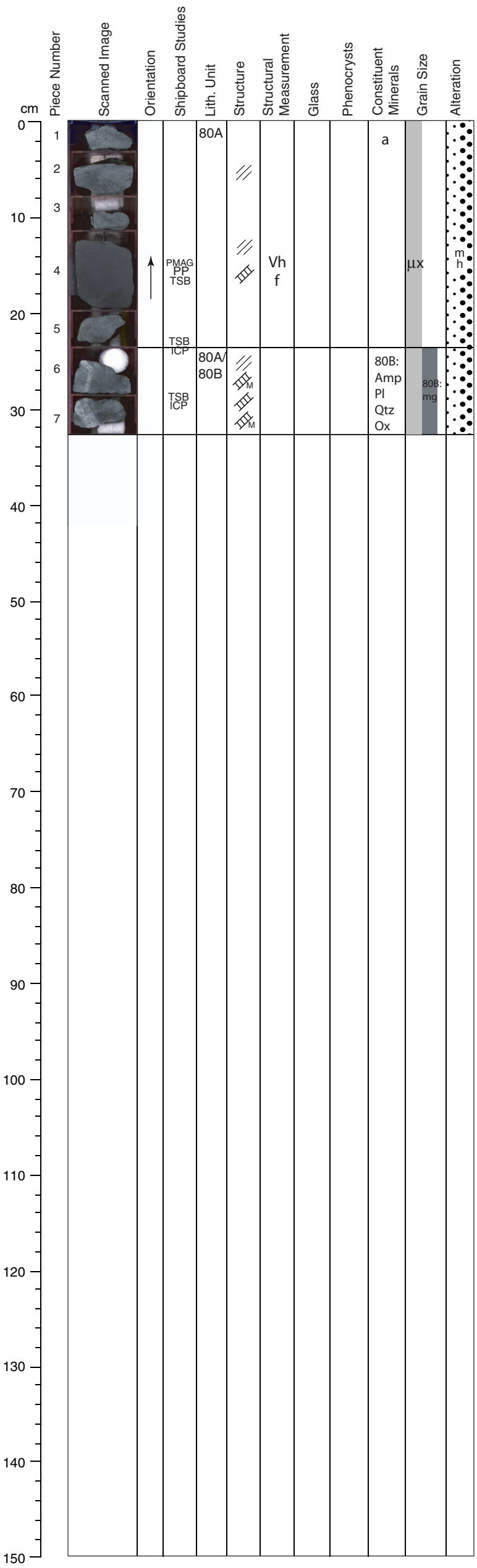
ALTERATION: Moderately to highly altered dark gray basalt, with disseminated pyrite. There is a 5 mm actinolite + pyrite patch in Piece 1, adjacent to a vein.

VEINS: There is a 0.2 mm chlorite + actinolite vein in Piece 1.

STRUCTURE: Veins in Piece 1 are 0.1 mm wide with 0.2 mm wide halos, light green (chlorite and actinolite), and planar. Fractures in Piece 2 are parallel to one another, 0.1 mm wide, and irregular.

ADDITIONAL COMMENTS: Very similar to the last two pieces in Section 209R-1. The igneous textures in these rocks are being obscured by metamorphic overprint, but it is likely that the original texture was intergranular.

Core Photo



312-1256D-212R-1 (Section top: 1404.1 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline basalt

PIECES: 1–5, parts of 6–7

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular

VESICLES: None

ALTERATION: Moderately to highly altered dark gray basalt with sparse disseminated pyrite

VEINS: Several 0.3 mm chlorite + pyrite ± actinolite veins. In Piece 5 there is a 3 mm actinolite + magnetite vein, with a 7 mm dark green actinolitic halo.

STRUCTURE: Section is noteworthy for Pieces 6 and 7 that contain a dikelet of medium-grained quartz-diorite. Pieces 2, 4, 6, and 7 have dark green and light green (chlorite and actinolite) veins that are curved, irregular, splayed and Y-shaped. The veins are 0.1–0.2 mm wide and, with the exception of Piece 4, do not have pronounced halos. Fractures throughout the section are 0.1 mm wide and irregular.

ADDITIONAL COMMENTS: Very similar to Section 211R-1. The igneous textures are obscured by metamorphic overprint, but it is likely that the original texture was intergranular.

Plutonic Rock

UNIT: 80B

ROCK NAME: Medium-grained trondjhemite

SUMMARY DESCRIPTION: Medium-grained trondjhemite

PIECES: Parts of 6 and 7

COLOR: Gray (N5)

CONTACTS:
Upper: intrusive margins in Pieces 6 and 7
Lower: intrusive margins in Pieces 6 and 7

PRIMARY MINERALS:	**% Mode**	**Grain Size (mm): Max**	**Min**	**Avg.**	**Shape/Habit**
Plagioclase:	40	1.5	0.5	1.2	Subhedral
Quartz:	50	1.0	0.3	0.5	Anhedral
Amphibole:	10	3.0	0.1	1.0	Subhedral-anhedral
Oxides:	5	0.3	<0.1	0.1	Subhedral-anhedral

Modal estimate based on Piece 7

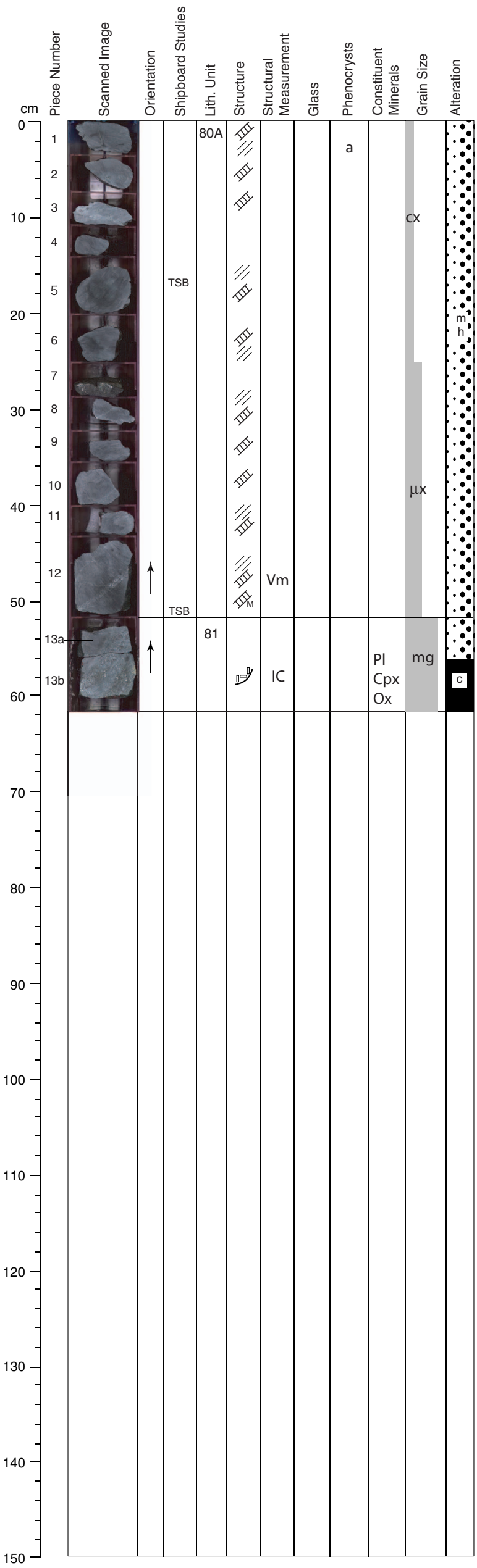
ALTERATION: Highly altered to an assemblage of plagioclase + actinolite + quartz + epidote

VEINS: None

STRUCTURE: The 5 mm (Piece 6) and 1.4 cm (Piece 7) quartz-diorite dikelet has sharp contacts with the wall rock. The dikelet is surrounded by a ~5 mm halo defined by enrichment in amphibole, and possibly a contact aureole. There is no obvious magmatic fabric in the quartz-diorite.

ADDITIONAL COMMENTS: This subunit is a 5–20 mm wide dikelet within unit 80A. It is generally parallel sided and the contacts are sharp. There is no chilled margin or reduction in grain size toward the margins, perhaps indicating that the intrusion entered relatively hot host rock. The texture is equigranular, although the oxide phases are smaller than the other crystal types. The plagioclase and quartz are equant, and some of the amphiboles are prismatic.

Core Photo



312-1256D-213R-1 (Section top: 1406.1 mbsf)

Volcanic Rock

UNIT: 80A

ROCK NAME: Aphyric microcrystalline to cryptocrystalline basalt

SUMMARY DESCRIPTION: Aphyric microcrystalline to cryptocrystalline basalt

PIECES: 1–11, parts of 12–13

CONTACTS:
Upper: not recovered
Lower: apparent igneous contact in Piece 13

COLOR: Dark bluish gray (5B 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline to cryptocrystalline
Texture: intergranular

VESICLES: None

ALTERATION: Moderately to highly altered dark gray basalt (?) with disseminated pyrite. Common <3 cm dark green alteration patches comprise 40% of the rock.

VEINS: Several 0.5–1 mm hornblende + magnetite veins, some with 5 mm light gray halos

STRUCTURE: The section is noteworthy for the intrusive contact between gabbros and dikes in Piece 13. Above this contact (Pieces 1–12), all of the pieces except for Piece 7 have veins and fractures. Veins are in most places 0.1 mm wide but there are wider veins with complex >1 mm wide halos in Piece 1, 6, and 9. The veins are either light or dark green (chlorite and actinolite), sulfide bearing in places, with splays, curved, planar, anastomosing, and irregular morphologies. One brown vein is present in Piece 1. Fractures are 0.1 mm wide throughout and either irregular or planar. Alteration patches in Pieces 2–4 and 5 are light green and sulfide bearing in places. The patches have elongate and amoeboid morphologies.

ADDITIONAL COMMENTS: Very similar to Section 212R-1. The igneous textures are obscured by metamorphic overprint, but it is likely that the original texture was intergranular. Piece 12 is cut by a 5 mm wide medium-grained oxide gabbro dike that has no chilled margin. This dike is likely to be related to the gabbros of Unit 81 below. Piece 13 contains an igneous contact between altered dike rocks above and gabbro below.

Plutonic Rock

UNIT: 81

ROCK NAME: Medium-grained oxide gabbro

SUMMARY DESCRIPTION: Medium-grained oxide gabbro

TEXTURE: Equigranular

PIECES: Parts of 12 and 13

COLOR: Dark bluish grey (5B 4/1)

CONTACTS:
Upper: intrusive margins in Piece 13
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	60	1.5	0.5	1.0	Euhedral–subhedral
Clinopyroxene	30	2.0	0.2	1.0	Subhedral
Oxides:	10	2.0	<0.1	1.0	Interstitial

Modal estimate based on Piece 13b.

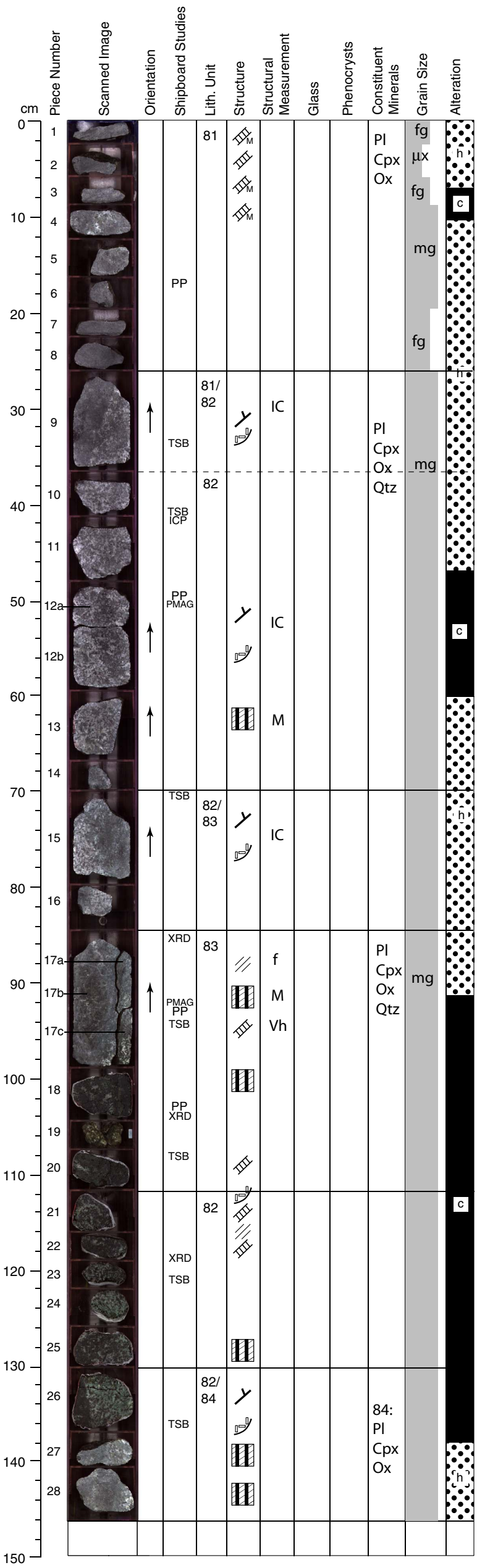
ALTERATION: Highly to completely altered gabbro. Clinopyroxene is replaced by green amphibole and plagioclase by albite ± zeolite. Abundant mm-scale epidote clots. There are two (mm-sized) inclusions of highly altered basalt within the gabbro.

VEINS: 0.5 mm magnetite vein along the margin of the intrusion, with a 2 mm greenish actinolite-rich halo within the host basalt

STRUCTURE: Pieces 12 and 13 contain intrusions of medium-grained gabbro with a porphyroclastic texture. The gabbroic domains are locally cut by dark and light green (chlorite and actinolite) 0.1–0.2 mm wide veins with halos. The main contact in Piece 13 is not necessarily cut by veins, but is altered effectively with veins located at the contact. An alteration halo surrounds part of the intrusion.

ADDITIONAL COMMENTS: This unit is composed of mixed gabbro and altered dike material. The gabbro occurs in two dikes, 5 mm thick in Piece 12 and 40 mm thick in Piece 13. This gabbro has an intrusive contact with the altered basalt host. There is a 0.5 mm wide band of oxides on the margin of the intrusion, but little change in grain size in the gabbro toward the margin. The gabbro appears to have a broadly equigranular texture with equant crystal shapes but has been subject to later alteration.

Core Photo



312-1256D-214R-1 (Section top: 1410.9 mbsf)

Plutonic Rock

UNIT: 81
ROCK NAME: Medium-grained oxide gabbro
SUMMARY DESCRIPTION: Medium-grained oxide gabbro
TEXTURE: Inequigranular-seriate
PIECES: 1–8 and part of 9
COLOR: Dark bluish grey (5B 4/1)
CONTACTS: Upper: intrusive margins in Piece 13 of Core 213R-1; Lower: intrusive margin in Piece 9 of Core 214R-1

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	2.0	0.2	1.2	Euhedral-subhedral
Clinopyroxene	43	2.0	0.2	1.5	Subhedral-anhedral
Oxides:	2	2.0	0.2	0.5	Interstitial

Modal estimate based on dark part of Piece 9 of Section 214R-1.
ALTERATION: Highly to completely altered gabbro, with inclusions of dolerite? Clinopyroxene is replaced by green amphioble; plagioclase by albite + epidote ± chlorite ± amphibole ± zeolite.
VEINS: Rare 0.1 mm white (plagioclase?) veins
STRUCTURE: Diffuse, thin, gabbroic dikes/magmatic veins intrude other gabbroic rocks throughout the section, locally with leucocratic domains (Unit 81) intruding melanocratic domains (Unit 82), but this relationship is not clear everywhere. In Pieces 1, 2, 9, and 27, there is a very weak mineral lineation. Patchy alteration and light green and white veins are present in Pieces 2, 17, 18, and 20.
ADDITIONAL COMMENTS: This unit is composed of mixed gabbro and altered dike material, spanning the boundary between gabbro and basalt. There is a variation from microcrystalline in Piece 2 to medium grained in Piece 9. The lower contact occurs in Piece 9, where an intrusive margin with Unit 82 occurs.

UNIT: 82
ROCK NAME: Medium-grained quartz-rich oxide diorite
SUMMARY DESCRIPTION: Medium-grained quartz-rich oxide diorite
TEXTURE: Inequigranular-seriate
PIECES: Part of 9, all of 10–14, parts of 15 and 16, all of 21–25, parts of 26–28
COLOR: Grey (N6)
CONTACTS: Upper: intrusive margins in Piece 9 of Core 213R-1; Lower: intrusive margin with Unit 84 in Piece 26 of Core 214R-1

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	30	3.0	0.5	1.8	Euhedral-subhedral
Clinopyroxene	40	3.0	0.5	1.5	Subhedral-anhedral
Oxides:	5	2.0	0.2	0.5	Interstitial
Quartz	25	0.5	0.1	0.2	Interstitial

Modal estimate based on pale part of Piece 9 of Section 214R-1.
ALTERATION: Moderately to completely altered oxide dolerite. Plagioclase is replaced by albite + epidote + chlorite? + zeolite?; in Pieces 21–26 the plagioclase is now white and crumbly and is replaced by zeolite + quartz? Clinopyroxene is moderately to highly replaced by greenish amphibole.
VEINS: Common 0.1 mm white cracks, with 0.2 mm white halos in plagioclase that are absent in clinopyroxene. Diffuse epidote-rich areas appear to follow irregular 0.1 mm veins.
STRUCTURE: The contact between Unit 82 and Unit 81 is well defined in Pieces 12 and 15, and very sharp in Piece 12. Unit 81 has a weak mineral lineation in Pieces 1, 2, 9, and 27.
ADDITIONAL COMMENTS: This gabbro has an inequigranular seriate texture. It is distinguished from the surrounding Units 81, 83, and 84 principally on the basis of color, with the plagioclase in this unit being noticeably more pale on cut surfaces than the plagioclase in Units 81, 83, and 84. The clinopyroxenes are occasionally euhedral and elongate, and may have been replaced by amphibole in places. The order of intrusion of these units is difficult to determine from the exposed contacts. Some parts of this unit are much coarser than the average given above, with grain sizes as large as 10 mm in Piece 27.

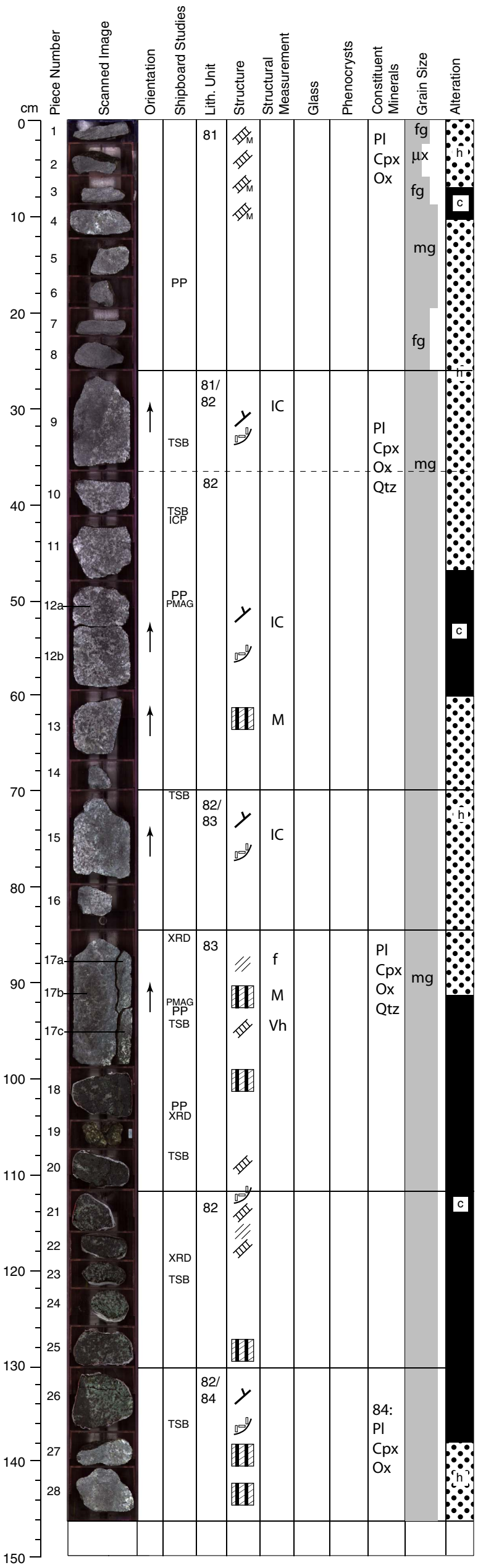
UNIT: 83
ROCK NAME: Medium-grained disseminated oxide gabbro
SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro
TEXTURE: Inequigranular-seriate
PIECES: Parts of 15 and 16, all of 17–20
COLOR: Dark Grey (N4)
CONTACTS: Upper: intrusive margin with Unit 82 in Piece 15; Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	66	3.0	0.2	2.0	Euhedral-subhedral
Clinopyroxene	31	3.0	0.2	1.5	Subhedral
Oxides:	2	2.0	0.1	1.0	Interstitial
Quartz	<1	0.5	0.1	0.2	Interstitial

Modal estimate based on pale part of Piece 19b of Section 214R-1.
ALTERATION: Moderately to completely altered gabbro. Clinopyroxene is partially altered to greenish amphibole. Plagioclase is replaced by albite + epidote + zeolite + greenish chlorite. Pieces 17 and 20 are very dark gray, completely altered, and crumbly.
VEINS: Several 0.2 mm laumontite? subvertical veins. Piece 18 has a 0.5 mm epidote vein with abundant epidote in a dark chlorite? + amphibole? halo.
STRUCTURE: Patchy alteration and light green and white veins are present in Pieces 17, 18, and 20.
ADDITIONAL COMMENTS: This gabbro has an inequigranular seriate texture. It is distinguished from Unit 82 principally on the basis of color, with the plagioclase in this unit being darker on cut surfaces than the plagioclase in Unit 82. The upper contact is diffuse over a 1–2 mm width, but this unit appears to have a smaller grain size than Unit 82 near the contact. The clinopyroxenes are occasionally euhedral and elongate, and may have been replaced by amphibole in places. The order of intrusion of these units is difficult to determine from the exposed contacts.

(Continued on next page)

Core Photo



312-1256D-214R-1 (Section top: 1410.9 mbsf)

Continued:

Plutonic Rock

UNIT: 84
ROCK NAME: Medium-grained disseminated oxide gabbro
SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro
TEXTURE: Inequigranular-seriate
PIECES: Parts of 26–28
COLOR: Bluish gray (5B 5/1)
CONTACTS: Upper: intrusive margin with Unit 82 in Piece 26; Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	65	2.0	0.1	1.2	Euhedral-subhedral
Clinopyroxene:	34	3.0	0.1	1.5	Subhedral (sometimes poikolitic)
Oxides:	1	3.0	0.1	1.0	Interstitial

Modal estimate based on pale part of Piece 4a of Section 214R-2

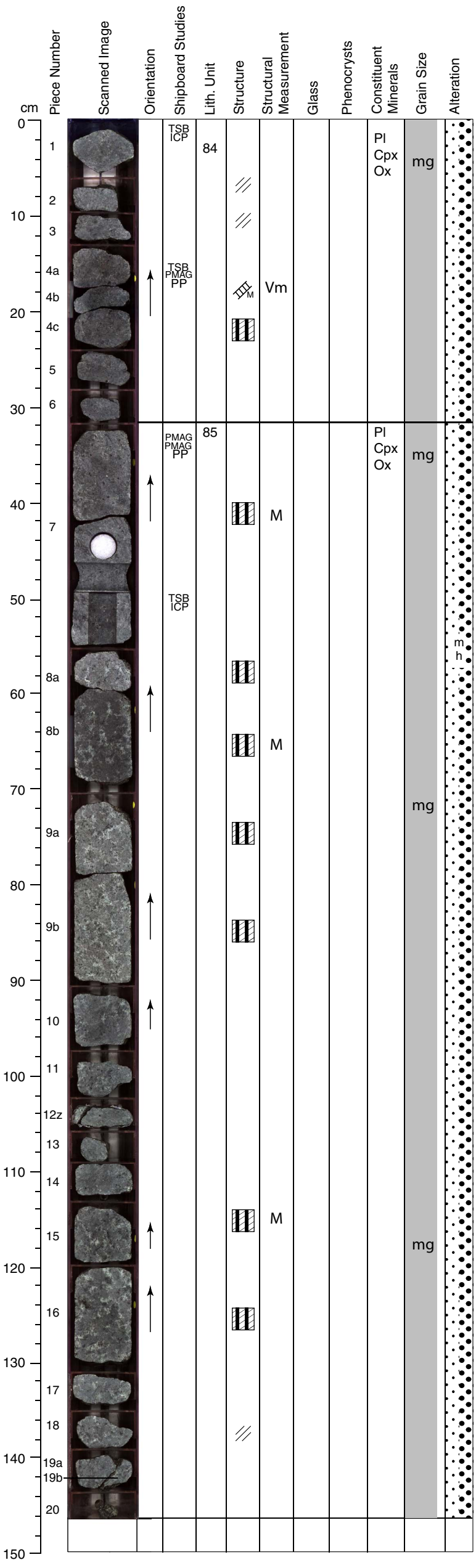
ALTERATION: Highly to completely altered dark gray gabbro. Plagioclase is altered to albite + prehnite + chlortite + quartz? Clinopyroxene is replaced by amphibole?

VEINS: No veins

STRUCTURE: None of note. Intrusive relationship with Unit 82 is sharp.

ADDITIONAL COMMENTS: Unit 84 is very similar to Unit 83, and may indeed be part of the same magmatic body. Both are intruded by Unit 82 because they are not contiguous in the core they are defined as seperate units. Piece 27 has been altered a green color, and contains epidote. A quartz-plagioclase intergrowth texture can also be observed in this piece.

Core Photo



312-1256D-214R-2 (Section top: 1412.35 mbsf)

Plutonic Rock

UNIT: 84

ROCK NAME: Medium-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro

TEXTURE: Seriate

PIECES: 1–6

COLOR: Bluish grey (5B 5/1)

CONTACTS:
Upper: intruded by Unit 82 in Piece 26 of Section 214R-1
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	65	2.0	0.1	1.2	Euhedral-subhedral
Clinopyroxene	34	3.0	0.1	1.5	Subhedral (sometimes poikolitic)
Oxides:	1	3.0	0.1	1.0	Interstitial

Modal estimate based on pale part of Piece 4a of Section 214R-2.

ALTERATION: Moderately to highly altered dark gray/green gabbro, with disseminated pyrite. Olivine/orthopyroxene? is altered to ~2 mm red spots (hematite?). Plagioclase is moderately altered to white secondary plagioclase. Clinopyroxene is partially replaced by green amphibole.

VEINS: No veins

STRUCTURE: Unit 84 in this section contains a magmatic (leucocratic) vein (Piece 4), fractures, and leucocratic patches. In Piece 4, there is also a band of leucocratic material (as opposed to a vein).

ADDITIONAL COMMENTS: This gabbro has an inequigranular seriate texture. It is distinguished from Unit 82 principally on the basis of color, with the plagioclase in this unit being darker on cut surfaces than the plagioclase in these other units. The upper contact is diffuse over a scale of millimeters (see Piece 27), but this unit appears to have a smaller grain size than Unit 82 near the contact. The clinopyroxenes are occasionally euhedral and elongate, and may have been replaced by amphibole in places. The order of intrusion of these units is difficult to determine from the exposed contacts.

Plutonic Rock

UNIT: 85

ROCK NAME: Medium-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro

TEXTURE: Seriate

PIECES: 7–20

COLOR: Bluish grey (5B 6/1)

CONTACTS:
Upper: not recovered
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	65	3.0	0.1	1.5	Euhedral
Clinopyroxene	33	2.0	0.1	1.0	Subhedral-anhedral
Oxides:	2	2.0	0.1	1.2	Interstitial

Modal estimate based on Piece 8b of Section 214R-2.

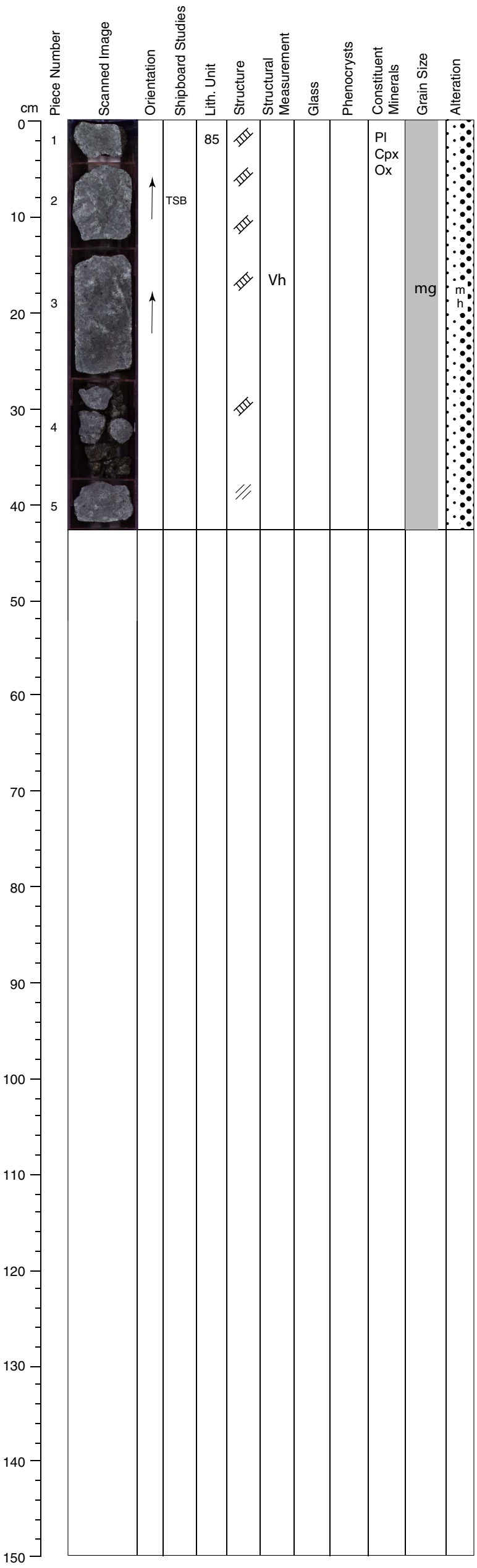
ALTERATION: Moderately to completely altered variegated dark gray to light gray blotchy gabbro, with disseminated pyrite. Irregular felsic zones altered to white secondary feldspar and with greenish margins (prehnite? actinolite) with minor epidote. Clinopyroxene partially altered to amphibole and chlorite. Olivine/orthopyroxene? is altered to ~2 mm red spots (hematite?). Rare 5 mm fibrous actinolite patches.

VEINS: Several 0.1 mm white cracks flanked by 2 mm zones of increased plagioclase alteration, with chlorite

STRUCTURE: Unit 85 in this section is typified by diffuse leucocratic patches. In Pieces 7 and 15, the two patches are elongate and parallel to one another. Irregular fractures are in Pieces 10 and 19.

ADDITIONAL COMMENTS: This gabbro has an inequigranular seriate texture. It is distinguished from Unit 84 by the development of a patchy texture, where 1 cm diameter roughly spherical dark patches are separated by 1–5 mm wide zones of leucocratic material. The dark patches are finer grained and may contain more pyroxene than the coarser grained plagioclase rich zones. The clinopyroxene is replaced by amphibole in places. The order of intrusion of these units is difficult to determine from the exposed contacts.

Core Photo



312-1256D-214R-3 (Section top: 1413.81 mbsf)

Plutonic Rock

UNIT: 85

ROCK NAME: Medium-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro

TEXTURE: Seriate

PIECES: 1–5

COLOR: Bluish grey (5B 6/1)

CONTACTS:
Upper: not recovered
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	65	3.0	0.1	1.5	Euhedral
Clinopyroxene:	33	2.0	0.1	1.0	Subhedral-anhedral
Oxides:	2	2.0	0.1	1.2	Interstitial

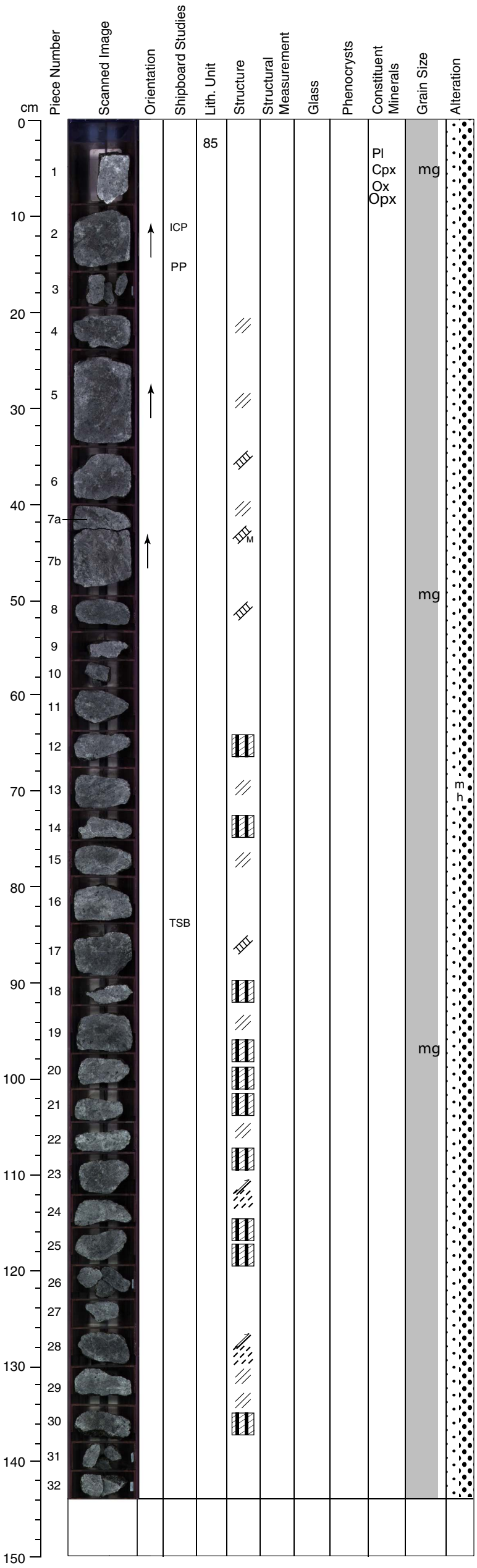
Modal estimate based on Piece 8b of Section 214R-2.

ALTERATION: Moderately to highly altered dark gray to light gray blotchy gabbro, with disseminated pyrite. Feldspars are altered to secondary plagioclase + actinolite. Hematite + chlorite replaces orthopyroxene. Clinopyroxene is ~50% altered to amphibole.

VEINS: Several 1 mm actinolite + epidote + quartz + pyrite + prehnite? veins, and several 0.5 mm actinolite + pyrite veins

STRUCTURE: All pieces except for Piece 5 have dark green (actinolite rich), sulfide-bearing, and/or white veins (quartz rich) that are 0.1 mm wide, curved, anastomosing, planar, and/or diffuse morphologies. Fractures in Piece 5 are irregular and 0.1 mm wide.

Core Photo



312-1256D-215R-1 (Section top: 1415.70 mbsf)

Plutonic Rock

UNIT: 85

ROCK NAME: Medium-grained orthopyroxene-bearing disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing disseminated oxide gabbro

TEXTURE: Seriate

PIECES: 1–32

COLOR: Bluish gray (5B 6/1)

CONTACTS:
Upper: not recovered
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	63	2.5	0.1	1.5	Euhedral
Clinopyroxene:	33	2.0	0.1	1.2	Subhedral
Oxides:	2	2.5	0.1	1.8	Interstitial
Orthopyroxene	2	1.0	0.1	0.5	Anhedral

Modal estimate based on Piece 5b of Section 215R-1.

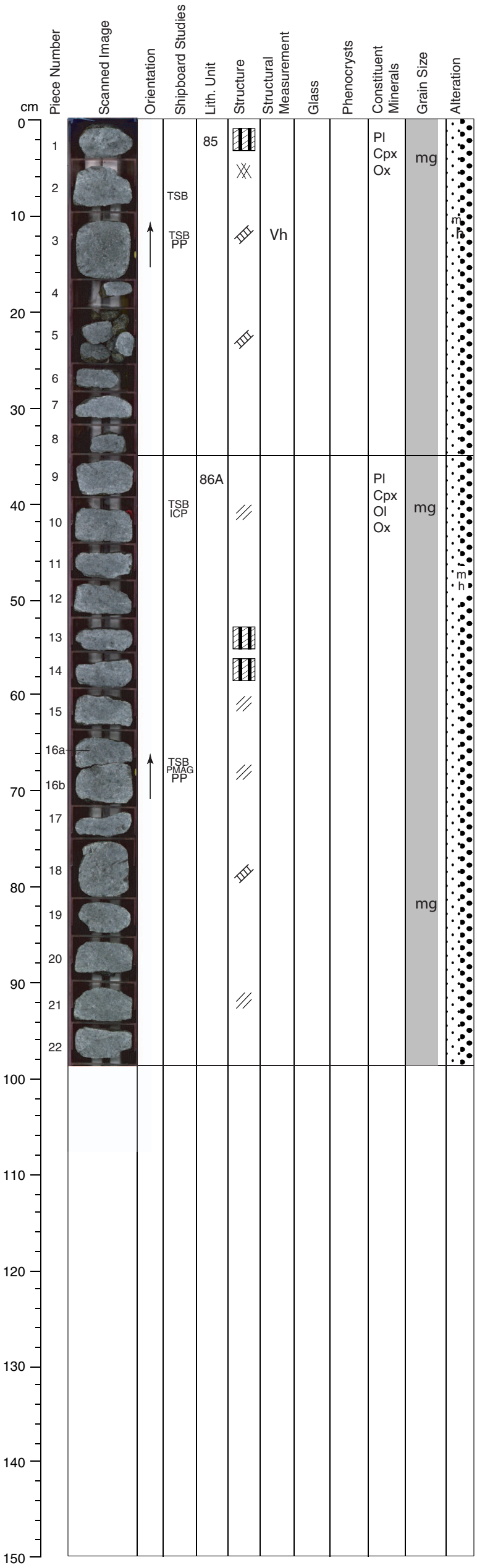
ALTERATION: Moderately to highly altered dark gray to light gray blotchy gabbro, with disseminated pyrite. Feldspars are altered to secondary plagioclase + actinolite. Hematite + chlorite replaces orthopyroxene. Clinopyroxene is ~50% altered to amphibole.

VEINS: No veins

STRUCTURE: Fractures interspersed throughout the section, and abundant in Piece 5. Most fractures are probably drilling induced. "Hydrothermal" veins in Pieces 6 and 8 are light green (plagioclase-rich) and contain sulfide minerals. A vein in Piece 17 is dark green (actinolite-rich) and sulfide bearing. Very poorly defined magmatic fabrics—interpreted as supra-solidus shear zones—are present in Pieces 24 and 28. The felsic portions of these shear zones may be partly cataclastized. Leucocratic patches are distributed mostly in the lower part of the section in Pieces 12, 14, 19–25, and 30. Some of the patches are slightly elongate and all have diffuse boundaries.

ADDITIONAL COMMENTS: Continuation of Unit 85. The patchy texture is gradually changing in this section, with well-developed centimeter-sized dark patches in the upper few pieces, with less well-developed individual patches, and coarser-grained ophitic clinopyroxene in the dark areas toward the base of the section (Piece 29). The reddish mineral may be altered orthopyroxene.

Core Photo



312-1256D-215R-2 (Section top: 1417.13 mbsf)

Plutonic Rock

UNIT: 85

ROCK NAME: Medium-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro

TEXTURE: Seriate

PIECES: 1–8

COLOR: Bluish grey (5B 6/1)

CONTACTS:
Upper: not recovered
Lower: arbitrary lower boundary based on textural change

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	65	2.5	0.1	1.5	Euhedral
Clinopyroxene:	33	2.0	0.1	1.2	Subhedral
Oxides:	2	2.5	0.1	1.8	Interstitial

Modal estimate based on Piece 5b of Section 215R-1.

ALTERATION: Moderately to highly altered dark gray gabbro, with disseminated pyrite. Feldspars are altered to secondary plagioclase + actinolite. Hematite + chlorite replaces orthopyroxene. Clinopyroxene is ~50% altered to amphibole.

VEINS: Piece 3 has several 0.5–1 mm actinolite veins.

STRUCTURE: Dark amphibole veins, 1 mm wide, form networks (Piece 2) and parallel sets (Piece 3), with irregular, anastomosing, and discontinuous traces. Veins in Pieces 5 and 7 are dark and light green (plagioclase-rich and actinolite-rich, respectively), planar, and 0.5 mm wide. A leucocratic patch with an amoeboid shape and irregular boundaries is located in Piece 1.

ADDITIONAL COMMENTS: Continuation of Unit 85. Toward the base of the section, a number of large elongate clinoproxene crystals are present, with axes as long as 25 mm. Once more, the patchy texture gradually disappears in this section, evolving toward a more uniform equigranular texture. Only the top couple of pieces show patches, but the evolution in texture is gradual, so these rocks remain part of Unit 85. Unit 86 below is likely to be part of the same cooling unit, but a new unit is defined (below) in order to highlight this change in texture from patchy to nonpatchy.

UNIT: 86A

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro

TEXTURE: Equigranular–hypidiomorphic

PIECES: 9–22

COLOR: Bluish grey (5B 6/1)

CONTACTS:
Upper: Arbitrary upper boundary based on textural change
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	63	2.0	0.2	1.0	Euhedral-subhedral
Clinopyroxene:	35	2.5	0.1	1.0	Subhedral-interstitial
Olivine:	<1	1.5	0.1	1.0	Subhedral
Oxides:	1	1.8	0.1	1.0	Interstitial

Modal estimate based on Piece 3 of Section 216R-1.

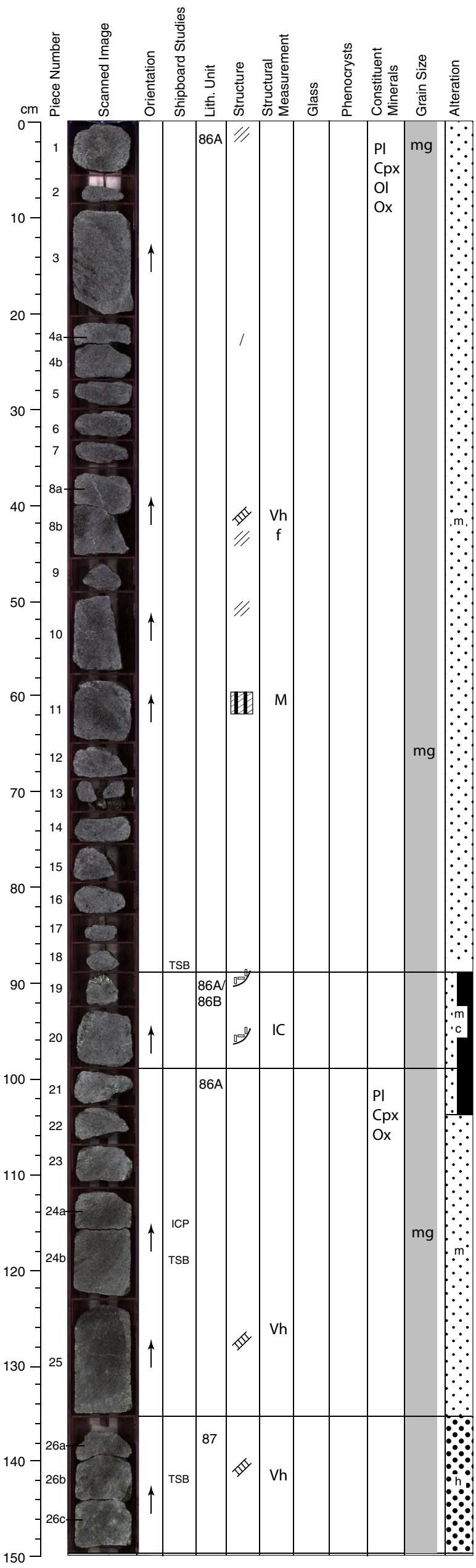
ALTERATION: Moderately to highly altered dark gray gabbro, with disseminated pyrite. Feldspars are altered to secondary plagioclase. Clinopyroxene is highly altered to amphibole.

VEINS: No veins

STRUCTURE: One dark green (actinolite-rich), irregular vein in Piece 18 is 3 mm wide. Leucocratic patches in Pieces 14 and 21 have irregular shapes and diffuse boundaries. Otherwise, Unit 86A in this section is typified by fractures that are probably drilling induced.

ADDITIONAL COMMENTS: This unit is part of the same intrusion as Unit 85 and is defined on the basis of a gradual textural change from patchy in Unit 85 to more equigranular with ophitic pyroxenes in Unit 86. Toward the base of the section, a number of large, elongate, clinoproxene crystals are present, with long axes as long as 25 mm. The unexpected presence of quartz and olivine in the same rock will have to be verified by thin section inspection.

Core Photo



312-1256D-216R-1 (Section top: 1417.90 mbsf)

Plutonic Rock

UNIT: 86A
ROCK NAME: Medium-grained gabbro
SUMMARY DESCRIPTION: Medium-grained gabbro
TEXTURE: Subhedral–equigranular
PIECES: 1–18, parts of 19 and 20, all of 21–25
COLOR: Dark bluish gray (5B 4/1)
CONTACTS: Upper: arbitrary upper boundary based on textural change;
Lower: lower boundary based on further textural change

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	63	2.0	0.2	1.0	Euhedral-subhedral
Clinopyroxene:	35	2.5	0.1	1.0	Subhedral-interstitial
Olivine:	<1	1.5	0.1	1.0	Subhedral
Oxides:	1	1.8	0.1	1.0	Interstitial

Modal estimate based on Piece 3 of Section 216R-1.

ALTERATION: Moderately altered greenish gray gabbro, with disseminated pyrite. Olivine is altered to chlorite and rarely hematite. Clinopyroxene is partially altered to amphibole, commonly in millimeter-scale patches.
VEINS: Several 1 mm plagioclase + actinolite veins? Several 1 mm actinolite veins.
STRUCTURE: Hydrothermal veins in Pieces 8 and 25 have light green and white (plagioclase-rich) (Piece 8) and dark green (actinolite-rich) (Piece 25) fillings and are irregular, anastomosing, and planar. Fractures in Pieces 8 and 10 nucleate on veins. In Pieces 19 and 20 there is a sharp igneous contact with the leucocratic subunit. The mafic grains have their long axes at a high angle to the contact. Other leucocratic patches with diffuse boundaries are present in Pieces 21 and 23.
ADDITIONAL COMMENTS: This unit is part of the same intrusion as Unit 85 and is defined on the basis of a gradual textural change from patchy in Unit 85 to more equigranular with ophitic pyroxenes in Unit 86. The lower boundary is marked by a change in the size of the largest ophitic pyroxenes, with Unit 86 containing pyroxene oikocrysts <5 mm in size, and Unit 87 containing pyroxene oikocrysts >10 mm in size.

UNIT: 86B
ROCK NAME: Medium-grained oxide gabbro
SUMMARY DESCRIPTION: Medium-grained oxide gabbro
TEXTURE: Inequigranular
PIECES: Parts of 19 and 20
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: magmatic contact in Piece 19;
Lower: magmatic contact in Piece 20

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	45	2.5	0.5	1.5	Euhedral-subhedral
Clinopyroxene:	45	3.0	0.5	1.8	Euhedral-subhedral
Oxides:	10	2.5	0.1	1.5	Interstitial

Modal estimate based on Piece 20 of Section 216R-1.

ALTERATION: Completely altered “pegmatitic” gabbro vein with coarse-grained mafic and felsic minerals and abundant oxides, which has an irregular contact with the equigranular gabbro. Plagioclase is completely altered to secondary feldspar; clinopyroxene is completely altered to amphibole. Along the outside edge of the core there is an amphibole + epidote vein. The more intense alteration of the coarser-grained gabbro may result from its larger grain size or may be a halo along the amphibole + epidote vein. This alteration halo may extend 5 mm into the equigranular host gabbro.
VEINS: Along the outside edge of the core there is an amphibole + epidote vein.
STRUCTURE: See “Additional Comments.”
ADDITIONAL COMMENTS: This subunit is defined on the basis of a rapid change in grain size and plagioclase color on the edges of Pieces 19 and 20. The margin is diffuse over 1 mm. Unit 86B is coarser than Unit 86A. The paleness of the plagioclase may be related to alteration: the edge of Piece 20 appears to be finer grained and altered. The contact is magmatic and there may be some alignment of the long axes of elongate crystals perpendicular to the margin. Some small interstitial plagioclase crystals are present between larger pyroxenes. Millimeter-sized oxide patches in Unit 86B are surrounded by tiny felsic crystals.

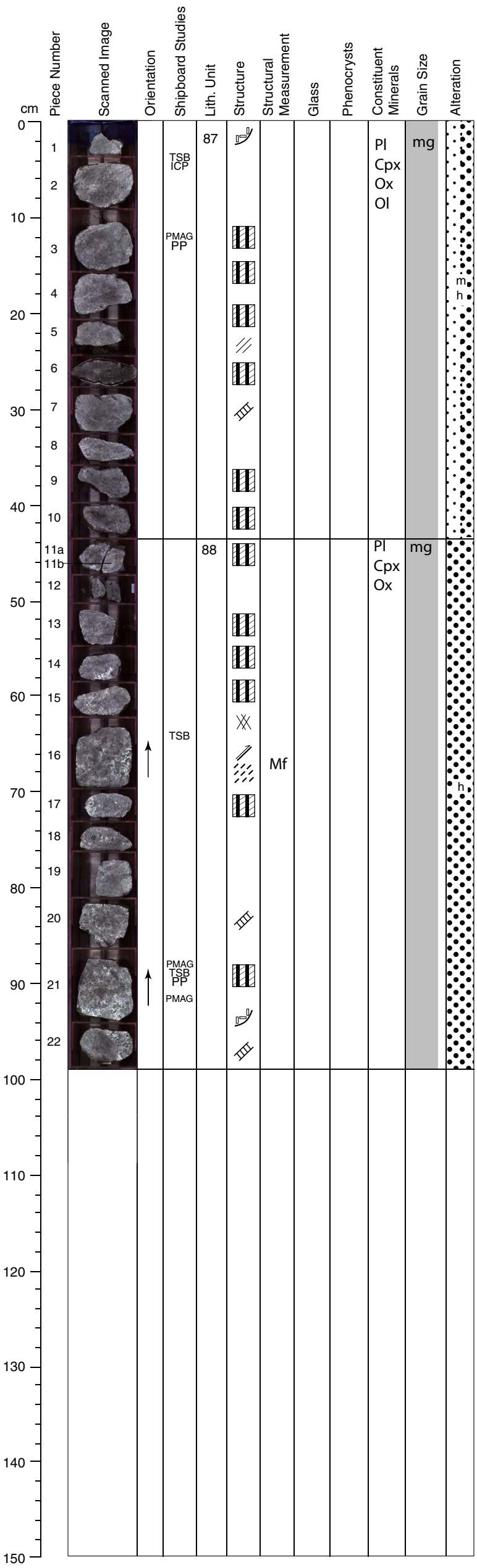
UNIT: 87
ROCK NAME: Medium-grained disseminated oxide gabbro
SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro
TEXTURE: Inequigranular-poikilitic
PIECES: 26
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: based on textural change between Pieces 25 and 26;
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	69	2.2	0.1	1.2	Euhedral
Clinopyroxenea:	30	25.0	0.1	1.0	Interstitial as oikocryst
Oxides:	1	2.2	0.1	1.5	Interstitial
Olivine:	< 1	1.2	0.1	0.5	Subhedral

Modal estimate based on Piece 2 of Section 217R-1.

ALTERATION: Highly-altered, dark greenish gray gabbro. Plagioclase is highly to completely altered to secondary feldspar. Clinopyroxene is altered to green amphibole that has highly reflective cleavage surfaces.
VEINS: There is a 0.5 mm amphibole + epidote? vein, that is re-inflated by a later white mineral in Piece 26. The patchiness of the piece is somewhat parallel to the veins.
STRUCTURE: Two hydrothermal veins with white, dark and light green (varying amounts of plagioclase and amphibole), and sulfide-bearing fillings. The veins are irregular, with diffuse alteration (light green).
ADDITIONAL COMMENTS: While Unit 87 may be part of the same igneous body as Unit 86, there is a marked change in the size of the clinopyroxene oikocrysts, with Unit 87 containing oikocrysts as large as 30 mm.

Core Photo



312-1256D-217R-1 (Section top: 1421.60 mbsf)

Plutonic Rock

UNIT: 87

ROCK NAME: Medium-grained disseminated oxide gabbro
SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro
TEXTURE: Inequigranular–poikilitic
PIECES: 1–10

COLOR: Dark bluish gray (5G 4/1)

CONTACTS: Upper: based on textural change between Pieces 25 and 26 of Section 216R-1; Lower: Presence of coarse-grained and pale plagioclase patches from Piece 11 onward

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	69	2.2	0.1	1.2	Euhedral
Clinopyroxene:	30	25.0	0.1	1.0	Interstitial as oikocryst
Oxides:	1	2.2	0.1	1.5	Interstitial
Olivine:	< 1	1.2	0.1	0.5	Subhedral

Modal estimate based on Piece 2 of Section 217R-1.

ALTERATION: Moderately to highly altered dark gray green gabbro, with disseminated pyrite. Oikocrystic clinopyroxene is fresher (differently altered?) than prismatic clinopyroxene, which is completely altered to amphibole + magnetite. Olivine is completely replaced by hematite + chlorite ± pyrite. Plagioclase is moderately altered to secondary plagioclase.

VEINS: Several 0.5 mm actinolite + pyrite veins

STRUCTURE: Several leucocratic patches in Pieces 3, 7, 9, and 10. Patches are irregular and spherical. A weak foliation/banding in Piece 4 is defined by the intermixed leucocratic and melanocratic domains. In Piece 7 there is a planar and sharp, dark green (amphibole-rich) vein.

ADDITIONAL COMMENTS: While Unit 87 may be part of the same igneous body as Unit 86, there is a marked change in the size of the clinopyroxene oikocrysts, with Unit 87 containing oikocrysts as large as 30 mm. This unit is devoid of the large coarse-grained patches with pale plagioclase which are found in Unit 88.

UNIT: 88

ROCK NAME: Medium-grained disseminated oxide gabbro
SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro with mixed coarser and finer portions.
TEXTURE: Inequigranular–poikilitic (fine-grained parts), seriate (coarse-grained parts)
PIECES: 11–22

COLOR: Dark bluish gray (5G 4/1)

CONTACTS: Upper: appearance of coarse-grained and pale plagioclase patches from Piece 11 onward; Lower: not recovered

PRIMARY MINERALS:

Coarser portion:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	6.0	0.1	3.0	Euhedral
Clinopyroxene:	42	6.0	0.1	3.0	Euhedral-subhedral
Oxides:	3	3.0	0.1	1.5	Interstitial

Modal estimate based on coarse portion of Piece 21 of Section 217R-1.

Finer portions:					
Plagioclase:	60	2.0	0.1	1.2	Euhedral-subhedral
Clinopyroxene	39	20.0	0.1	10.0	Interstital as oikocryst
Oxides:	1	1.5	0.1	1.0	Interstitial

Modal estimate of finer portion based on Piece 10a of Section 218R-1.

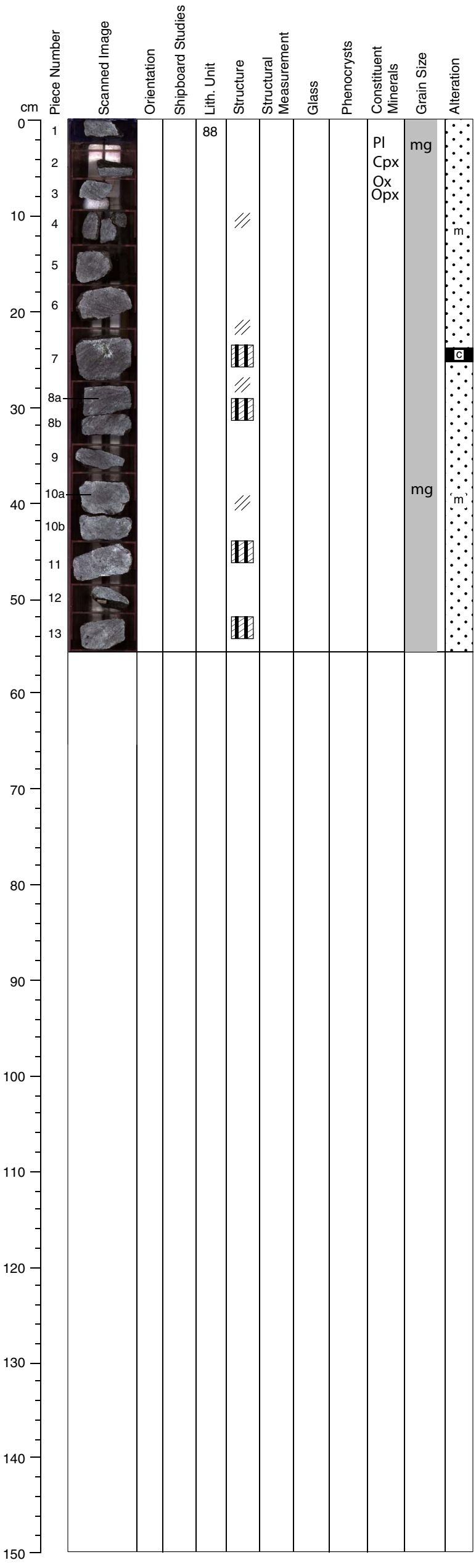
ALTERATION: Highly altered, variegated dark gray to white gabbro. Oikocrystic clinopyrene is fresher than the prismatic clinopyroxene in the coarser-grained patches, and is moderately altered to amphibole. In the coarser patches clinopyroxene is completely replaced by amphibole, and plagioclase is white to teal and predominantly altered to secondary feldspar with minor actinolite and trace epidote.

VEINS: Rare 0.2 mm amphibole + laumontite veins

STRUCTURE: Leucocratic patches in all of the pieces, with one patch in Piece 22 classified as an igneous contact based on its sharp boundary and strong contrast in lithology (leucocratic against melanocratic). Pieces 20 and 22 have dark and light green minerals filling irregular, anastomosing, and splayed veins with dark and light green (amphibole-rich and daumortite-rich, respectively) minerals fillings.

ADDITIONAL COMMENTS: Unit 88 may be part of the same igneous body as Unit 87, and is defined by the downhole appearance of diffuse zones with coarser grain size, (altered) pale plagioclase and a higher modal content of oxide minerals. The background finer grained gabbro is very similar to Unit 87, still containing large clinopyroxene oikocrysts. The variation in grain size between the coarser and finer parts appears to be igneous in origin, but the paler plagioclase in the coarser parts may indicate that alteration of these portions occurred more readily. Coarser regions do not contain clinopyroxene with poikilitic texture (in contrast to the finer regions). The boundaries between the coarser and finer regions vary in nature, sometimes being very diffuse (e.g., Piece 16) and in other cases, fairly sharp (Piece 22), occurring over a couple of millimeters or less. The modal mineralogies of the coarse and fine regions are similar.

Core Photo



312-1256D-218R-1 (Section top: 1425.30 mbsf)

Plutonic Rock

UNIT: 88

ROCK NAME: Medium-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro with mixed coarser and finer portions

TEXTURE: Inequigranular–poikilitic (fine-grained parts); seriate (coarse-grained parts)

PIECES: 1–13

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:

Upper: appearance of coarse-grained and pale plagioclase patches from Piece 11 onward
Lower: not recovered

PRIMARY MINERALS:

Coarser portions:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	6.0	0.1	3.0	Euhedral
Clinopyroxene:	42	6.0	0.1	3.0	Euhedral–subhedral
Oxides:	3	3.0	0.1	1.5	Interstitial
Orthopyroxene:	3	2.2	0.1	1.2	Euhedral–subhedral

Modal estimate based on coarse portion of Piece 21 of Section 217R-1.

Finer portions:					
Plagioclase:	60	2.0	0.1	1.2	Euhedral– subhedral
Clinopyroxene:	38	20.0	0.1	10.0	Interstital as oikocryst
Oxides:	1	1.5	0.1	1.0	Interstitial
Orthopyroxene:	1	2.0	0.1	1.0	Subhedral

Modal estimate of finer portion based on Piece 10a of Section 218R-1.

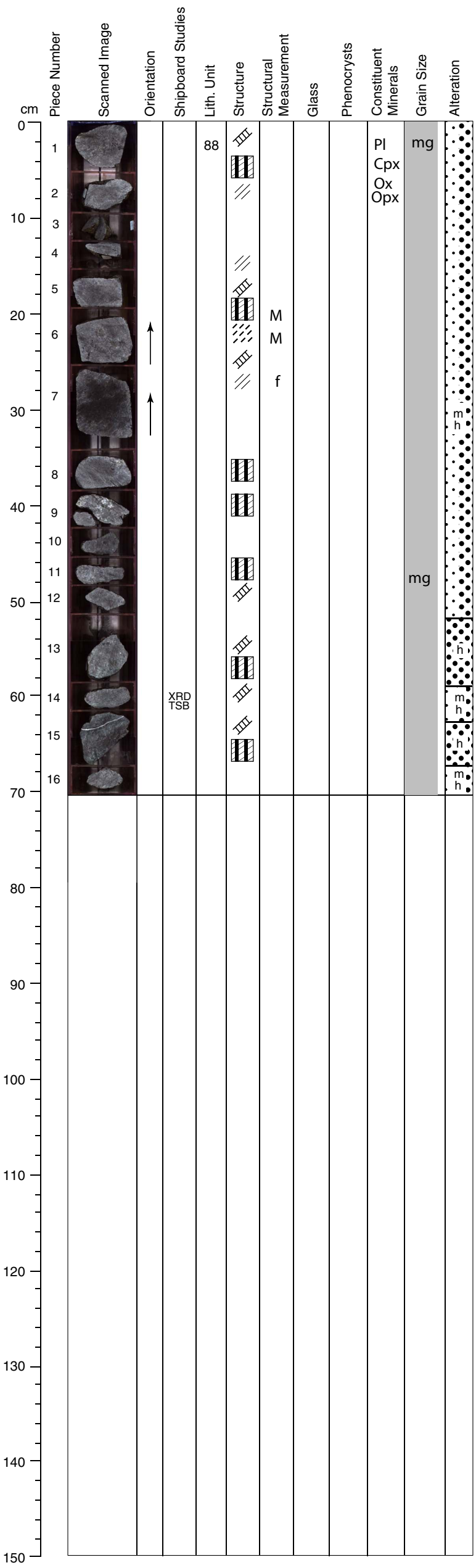
ALTERATION: Moderately altered gabbro. Clinopyroxene moderately altered, predominantly to green amphibole. Plagioclase partially altered to secondary feldspar. There is an irregular 2 cm alteration patch where plagioclase is completely altered to secondary plagioclase + quartz? and clinopyroxene is replaced by matted acicular amphibole, in Piece 7.

VEINS: Several 0.2 mm dark green amphibole veins

STRUCTURE: Patches in Pieces 7–8, 11, and 13 are leucocratic, irregular, and in Piece 7 very altered. Fractures are interpreted as drilling induced.

ADDITIONAL COMMENTS: The modal proportion of oxides in the finer-grained part in this section is slightly lower than in Section 217R-1.

Core Photo



312-1256D-219R-1 (Section top: 1430.00 mbsf)

Plutonic Rock

UNIT: 88

ROCK NAME: Medium-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro with mixed coarser and finer portions

TEXTURE: Inequigranular–poikilitic (fine-grained parts); seriate (coarse-grained parts)

PIECES: 1–16

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:

Upper: appearance of coarse-grained and pale plagioclase patches from Piece 11 onward
Lower: not recovered

PRIMARY MINERALS:

Coarser portion:	**% Mode**	**Grain Size (mm): Max**	**Min**	**Avg.**	**Shape/Habit**
Plagioclase:	55	6.0	0.1	3.0	Euhedral
Clinopyroxene:	42	6.0	0.1	3.0	Euhedral-subhedral
Oxides:	3	3.0	0.1	1.5	Interstitial

Modal estimate based on coarse portion of Piece 21 of Section 217R-1.

Finer portions:					
Plagioclase:	60	2.0	0.1	1.2	Euhedral-subhedral
Clinopyroxene:	38	20.0	0.1	10.0	Interstital as oikocryst
Oxides:	1	1.5	0.1	1.0	Interstitial
Orthopyroxene:	1	2.0	0.1	1.0	Subhedral

Modal estimate of finer portion based on Piece 10a of Section 218R-1.

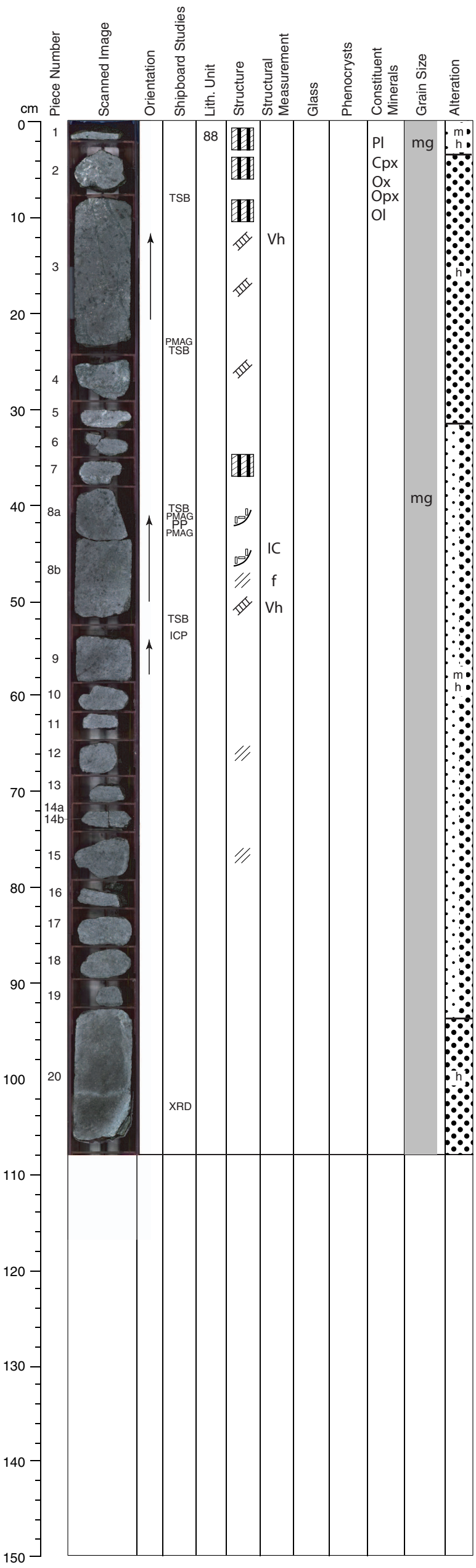
ALTERATION: Moderately altered gabbro. Clinopyroxene moderately altered, predominantly to green amphibole. Plagioclase partially altered to secondary feldspar. Irregular ~2 cm alteration patches, where plagioclase is completely altered to secondary plagioclase + quartz? and clinopyroxene is replaced by matted acicular amphibole in Pieces 1, 6, 8, 9, and 11. Trace disseminated pyrite. Orthopyroxene? is altered to black chlorite.

VEINS: Several 0.5 mm amphibole veins, some with <10 mm dark green to light gray alteration halos. A well-developed halo is present in Piece 15, and is cross-cut by a late-stage 1.5 mm quartz vein. In the halos, clinopyroxene is completely altered to very dark green amphibole, and plagioclase is completely altered to teal secondary plagioclase + actinolite. Piece 13 has a 0.2 mm epidote vein.

STRUCTURE: Several hydrothermal veins in Pieces 1, 5–6, and 12–15. The veins are dark and light green and white (amphibole, chlorite, and plagioclase-rich, respectively), with mostly diffuse but locally planar and irregular morphologies. Fractures in Pieces 2 and 7 are interpreted as drilling induced. Patches of leucocratic material are in Pieces 2, 6, 8–9, 11, 13, and 15. In Piece 6 there is a weak lineation of felsic minerals and a diffuse textural band of melonocratic, fine-grained material. The patch in Piece 8 is particularly altered. The white (hydrothermal) vein in Piece 15 is noteworthy for its distinctive alteration halo.

ADDITIONAL COMMENTS: Again, the modal proportion of oxides in the finer-grained part of this section is slightly lower than in Section 217R-1, but similar to Section 218R-1. Piece 8 contains a large (30 mm) clinopyroxene oikocryst with small plagioclase chadacrysts.

Core Photo



312-1256D-220R-1 (Section top: 1435.0 mbsf)

Plutonic Rock

UNIT: 88

ROCK NAME: Medium-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Medium-grained disseminated oxide gabbro with mixed coarser and finer portions.

TEXTURE: Inequigranular–poikilitic (fine-grained parts); seriate (coarse-grained parts)

PIECES: 1–20

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:

Upper: appearance of coarse-grained and pale plagioclase patches from Piece 11 onward
Lower: not recovered

PRIMARY MINERALS:

Coarse portion:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	6.0	0.1	3.0	Euhedral
Clinopyroxene:	42	6.0	0.1	3.0	Euhedral-subhedral
Oxides:	3	3.0	0.1	1.5	Interstitial

Modal estimate based on coarse portion of Piece 21 of Section 217R-1. Fine portion is similar to Unit 87.

Fine portion:

Plagioclase:	55	3.5	0.1	2.0	Euhedral
Clinopyroxene:	41	30.0	0.1	20.0	Interstitial as oikocryst
Orthopyroxene:	2	3.0	0.1	2.0	Subhedral
Oxides:	1	3.0	0.1	1.5	Interstitial
Olivine	<1	1.5	0.1	1.0	Subhedral

Modal estimate for finer portion based on Piece 8b of Section 220R-1.

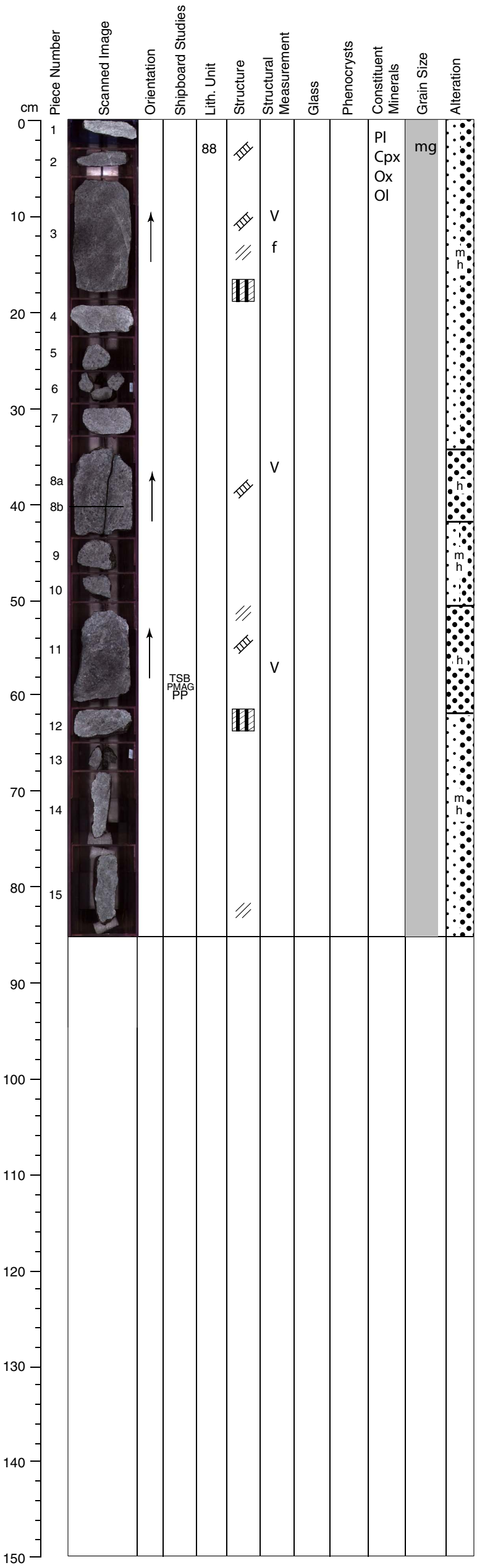
ALTERATION: Moderately to highly altered gabbro. Clinopyroxene moderately altered, predominantly to green amphibole. Plagioclase partially altered to secondary feldspar. Irregular ~2 cm alteration patches, where plagioclase is completely altered to secondary plagioclase + quartz? and clinopyroxene is replaced by matted acicular amphibole, in Pieces 2, 3, 4, 5, and 7. Trace disseminated pyrite. Orthopyroxene? is altered to black chlorite + trace hematite and pyrite.

VEINS: Common subvertical 0.5 mm dark green amphibole veins with 2 mm dark green to light gray halos. Where these veins cut across the irregular patches, plagioclase and clinopyroxene are completely altered to secondary feldspar and amphibole. Piece 20 has a 1 cm quartz + epidote + amphibole vein with an intense 1 cm dark green inner and 5 cm light gray outer halo.

STRUCTURE: Pieces 3–4 and 8 have hydrothermal veins with dark green and white (amphibole- and quartz-rich, respcetively) filling, with complex morphologies. Some of the veins have ~1–3 mm wide dark green halos. There are leucocratic patches in Pieces 2, 3 and 8 and a textural band in Piece 7. In Piece 8 there is a very subtle and diffuse igneous contact.

ADDITIONAL COMMENTS: In some of the coarser portions, the grain size is becoming truly coarse (>5 mm for plutonic rocks), as shown in Piece 2. The texture in this piece reinforces the idea that the coarser portions of this unit do not have well-developed poikilitic textures, in contrast to the finer portions. This contrast indicates that the textural differences are magmatic in origin. However, the differences in mode between the coarser and finer portions are very small, showing that the variation is predominantly in texture.

Core Photo



312-1256D-221R-1 (Section top: 1439.6 mbsf)

Plutonic Rock

UNIT: 88

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro with mixed coarser and finer portions.

TEXTURE: Inequigranular–poikilitic (fine-grained parts); seriate (coarse-grained parts)

PIECES: 1–15

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:

Upper: appearance of coarse-grained and pale plagioclase patches from Piece 11 in Section 217R-1 onward
Lower: not recovered

PRIMARY MINERALS:

Coarse portion:	**%**	**Grain Size (mm):**			
	Mode	**Max**	**Min**	**Avg.**	**Shape/Habit**
Plagioclase:	55	6.0	0.1	3.0	Euhedral
Clinopyroxene:	42	6.0	0.1	3.0	Euhedral-subhedral
Oxides:	3	3.0	0.1	1.5	Interstitial

Modal estimate based on coarse portion of Piece 21 of Section 217R-1. Fine portion is similar to Unit 87.

Fine portion:

Plagioclase:	65	3.0	0.1	1.5	Euhedral
Clinopyroxene:	33	5.0	0.1	2.0	Subhedral-interstitial as oikocryst
Oxides:	<1	2.5	0.1	1.5	Interstitial
Olivine:	<1	1.5	0.1	0.8	Subhedral

Modal estimate for finer portion based on Piece 3 of Section 221R-1.

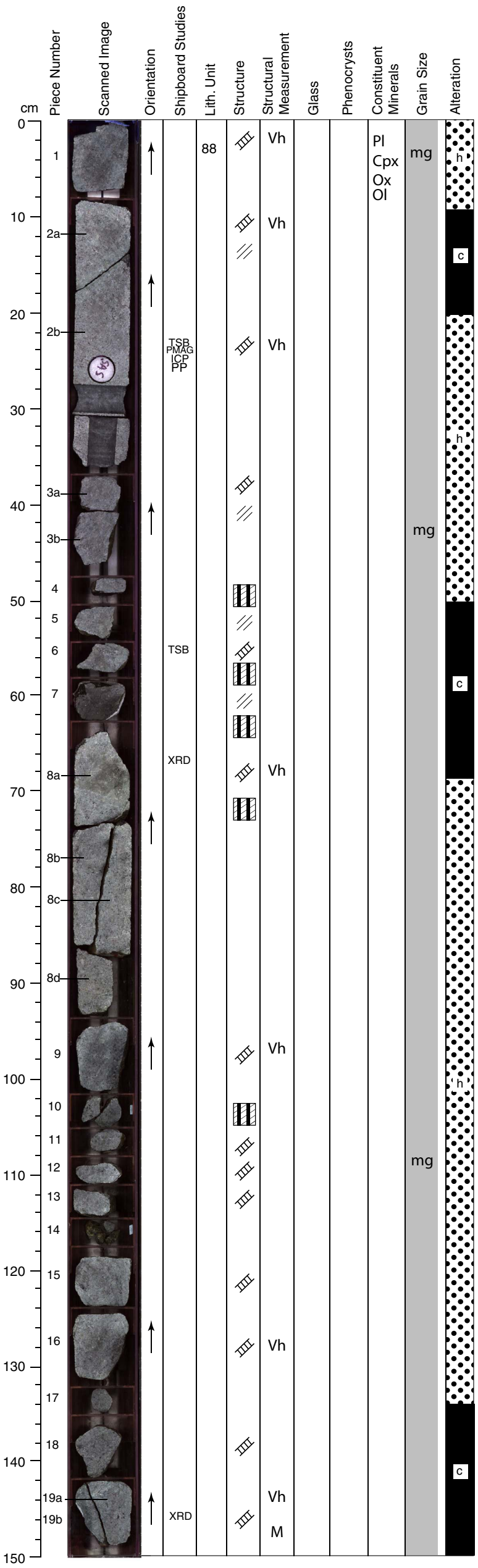
ALTERATION: Moderately to highly altered gabbro. Clinopyroxene moderately altered, predominantly to green amphibole. Plagioclase partially altered to secondary feldspar. Irregular ~2 cm alteration patches, where plagioclase is completely altered to secondary plagioclase and clinopyroxene is replaced by amphibole in Piece 11. Orthopyroxene(?) is altered to black chlorite + trace hematite.

VEINS: Several 0.5 mm dark green amphibole veins with intensely altered 5 mm dark green halos, flanked by ~15 mm diffuse halos with 2 mm dark green patches. 1 mm subvertical felsic vein in Piece 3

STRUCTURE: Hydrothermal veins in Pieces 2, 3, 8, 11, with dark and light green (anphibole- and chorite-rich, respectively) and white fillings. The veins are irregular in morphology. In Piece 8, the vein has a 4 mm dark green halo. Fractures in Pieces 3, 11, and 15 are mostly drilling induced. Some poorly defined patches are present in Pieces 11 and 12.

ADDITIONAL COMMENTS: There appears to be a gradual decrease in the content of oxide in this unit, so that by Piece 3 of this section the rock is a gabbro rather than oxide gabbro. The size of the poikilitic clinopyroxenes appears to be dropping, and the coarse patches are less prominent, with less difference in grain size between the coarser and finer portions.

Core Photo



312-1256D-222R-1 (Section top: 1444.60 mbsf)

Plutonic Rock

UNIT: 88

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro with mixed coarser and finer portions.

TEXTURE: Inequigranular–poikilitic (fine-grained parts); seriate (coarse-grained parts)

PIECES: 1–19

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:

Upper: Appearance of coarse-grained and pale plagioclase patches from Piece 11 217R-1 onward
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	60	3.0	0.1	1.5	Euhedral-subhedral
Clinopyroxene:	38	4.0	0.1	1.5	Interstitial as oikocryst
Oxides:	<1	2.0	0.1	1.0	Interstitial
Olivine	<1	1.0	0.1	0.5	Subhedral

Modal estimate for finer portion based on Piece 16 of Section 222R-1.

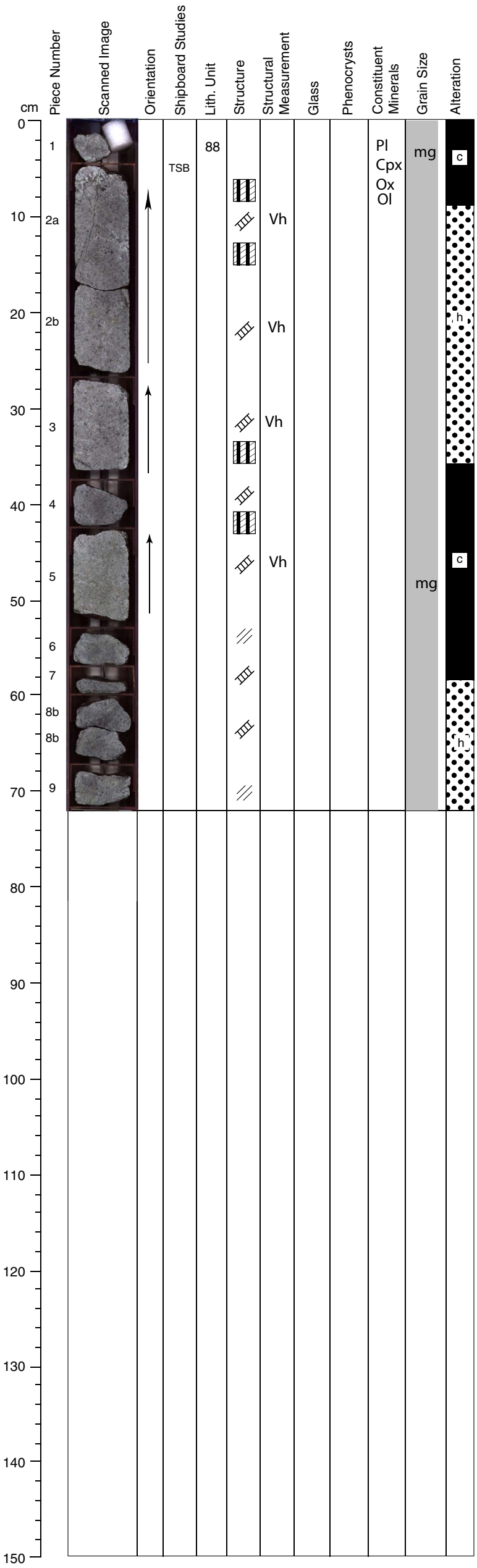
ALTERATION: Highly to completely altered gabbro. Plagioclase is replaced by secondary plagioclase, clinopyroxene by amphibole. Relatively abundant (~5%) chlorite replaces euhedral crystals, rarely with trace hematite.

VEINS: Pieces 1, 2, 6, and 8 contain abundant 0.5–1 mm hornblende veins with 2 mm green halos and 10–15 mm light gray halos. Black euhedral altered grains are more common within 15 mm of amphibole veins. Several 0.5 mm black chlorite ± amphibole veins in Pieces 9, 16, 18 and 19, with 10 mm dark chloritic halos. Piece 19 has a 2 mm quartz + chlorite ± amphibole vein, with a 10 mm dark chloritic halo.

STRUCTURE: Pieces 1, 2, 3, 8, 9, 10, and 19 are oriented. Leucocratic patches are present in Pieces 5, 6, 7, 10, and 16. Veins with diffuse morphologies are present in most pieces. They dip moderately to steeply. Piece 8a has green patches around a subhorizontal vein. A dark alteration patch was observed in Piece 19 accompanied by a hydrothermal vein.

ADDITIONAL COMMENTS: The grain size of the clinopyroxene oikocrysts is slightly larger than in the last section, reversing the downward trend observed in the previous section. Therefore, these gabbros are kept in the same unit as the last section. There is a small drop in grain size from Pieces 9 to 19. There are no coarse pale patches in this section.

Core Photo



312-1256D-222R-2 (Section top: 1446.10 mbsf)

Plutonic Rock

UNIT: 88

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro with mixed coarser and finer portions.

TEXTURE: Inequigranular–poikilitic (fine-grained parts), seriate (coarse-grained parts)

PIECES: 1–9

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:

Upper: Appearance of coarse grained and pale plagioclase patches from Piece 11 of Section 217R-1 onward
Lower: not recovered

PRIMARY MINERALS:

Coarse portion:	**% Mode**	**Grain Size (mm): Max**	**Min**	**Avg.**	**Shape/Habit**
Plagioclase:	55	6.0	0.1	3.0	Euhedral
Clinopyroxene:	42	6.0	0.1	3.0	Euhedral–subhedral
Oxides:	3	3.0	0.1	1.5	Interstitial

Modal estimate based on coarse portion of Piece 21 of Section 217R-1. Fine portion is similar to Unit 87.

Fine portion:

Plagioclase:	60	3.0	0.1	1.5	Euhedral–subhedral
Clinopyroxene:	38	4.0	0.1	1.5	Interstitial as oikocryst
Oxides:	<1	2.0	0.1	1.0	Interstitial
Olivine:	<1	1.0	0.1	0.5	Subhedral

Modal estimate for finer portion based on Piece 16 of Section 222R-1.

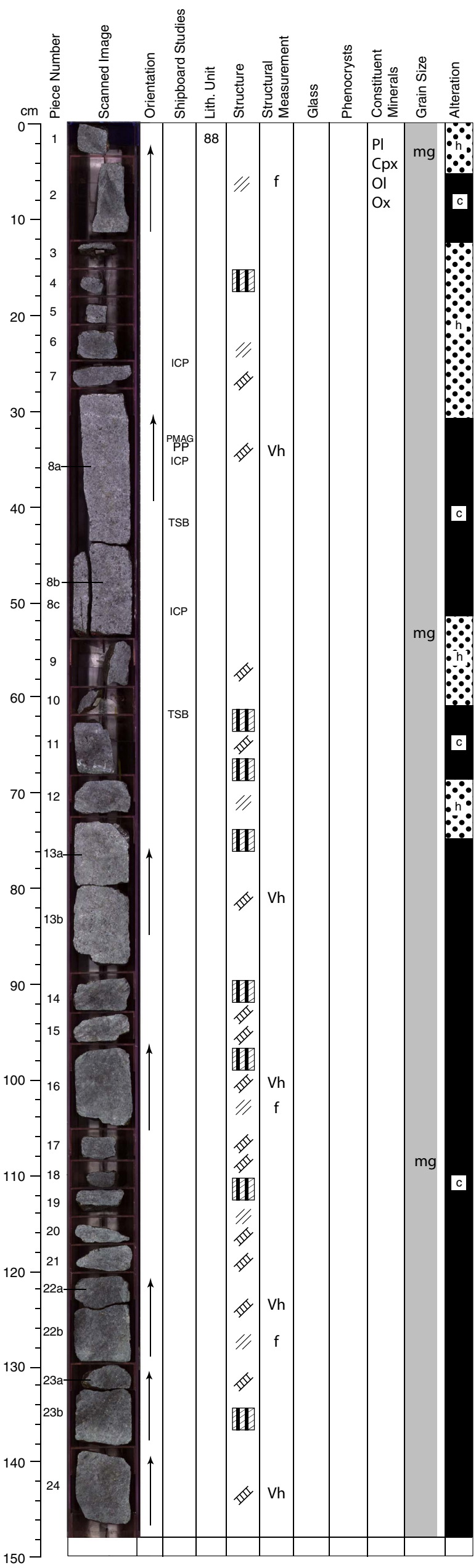
ALTERATION: Highly to completely altered gabbro. Plagioclase is replaced by secondary plagioclase, clinopyroxene by amphibole. Relatively abundant (~5%) chlorite replaces euhedral crystals, rarely with trace hematite. More intense alteration, with complete replacement of plagioclase in irregular coarser-grained cm-scale patches in Pieces 1 and 2.

VEINS: Pieces 2 and 5 contain abundant 0.5–1 mm hornblende veins with 2 mm green halos and 10–15 mm light gray halos. Black euhedral altered grains are more common within 15 mm of amphibole veins. Piece 3 has a 0.5 mm black chlorite? vein with common olivine replaced by hematite along its margins, and a 5 mm dark chloritic halo.

STRUCTURE: Pieces 2, 3, and 5 are oriented. Leucocratic patches in Pieces 1 and 2 closely connected to subvertical and subhorizontal veins with green mineral (amphibole) fillings. Piece 5 has subvertical, parallel set of diffuse veins that accompany light green alteration.

ADDITIONAL COMMENTS: In this section the grain size increases from the base of the last section. The texture is variable: in Piece 5 the large clinoproxene does not appear to grow in a poikilitic texture, while in Pieces 8 and 9 the poikilitic texture returns. Diffuse coarse pale patches are found in Piece 1.

Core Photo



312-1256D-223R-1 (Section top: 1449.30 mbsf)

Plutonic Rock

UNIT: 88

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro with mixed coarser and finer portions.

TEXTURE: Inequigranular–poikilitic (fine-grained parts); seriate (coarse–grained parts)

PIECES: 1–24

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:

Upper: appearance of coarse grained and pale plagioclase patches from Piece 11 of Section 217R-1 onward
Lower: not recovered

PRIMARY MINERALS:

Coarse portion:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	6.0	0.1	3.0	Euhedral
Clinopyroxene:	42	6.0	0.1	3.0	Euhedral–subhedral
Oxides:	3	3.0	0.1	1.5	Interstitial

Modal estimate based on coarse portion of Piece 21 of Section 217R-1. Fine portion is similar to Unit 87.

Fine portion:

Plagioclase:	60	2.0	0.1	1.2	Euhedral–subhedral
Clinopyroxene	38	7.0	0.1	3.0	Subhedral–interstitial as oikocryst
Oxides:	<1	2.0	0.1	1.0	Interstitial
Olivine:	<1	1.0	0.1	0.5	Subhedral

Modal estimate for finer portion based on Piece 8b of Section 223R-1.

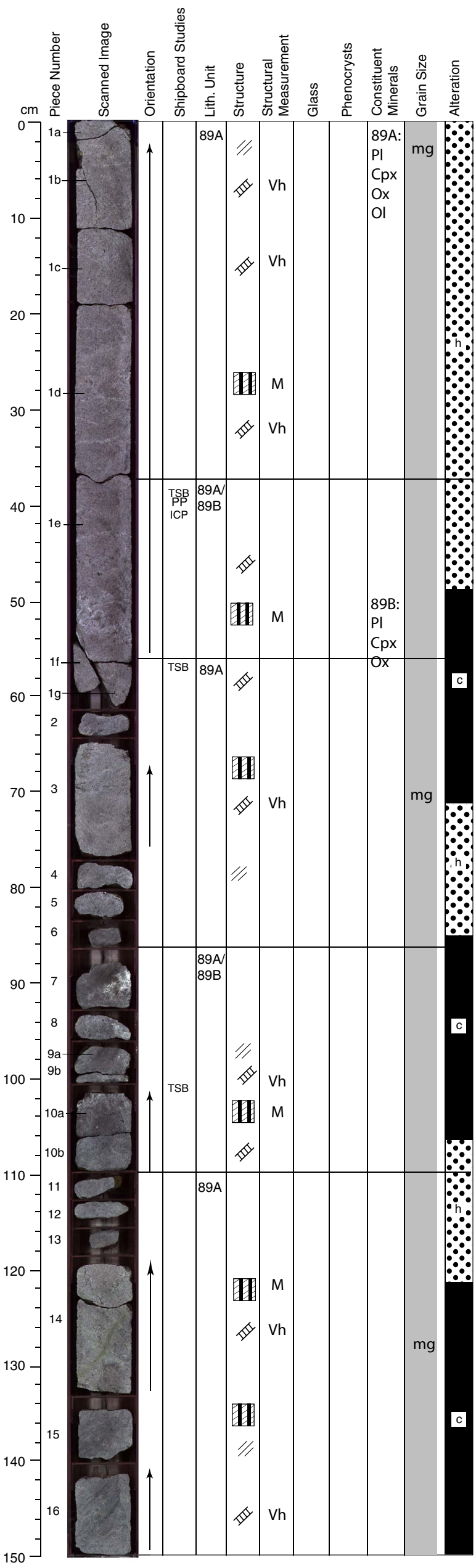
ALTERATION: Highly to completely altered gabbro. Plagioclase is replaced by secondary plagioclase, clinopyroxene by amphibole. Relatively abundant (~5%) chlorite replaces euhedral crystals, rarely with trace hematite. More intense alteration, with complete replacement of plagioclase in an irregular coarser grained cm-scale patch in Piece 11. Trace disseminated pyrite in Piece 24.

VEINS: Common chlorite + actinolite veins, some with 1 mm dark green and 15 mm light gray halos.

STRUCTURE: Pieces 2, 8, 13, 16, 22, 23, and 24 are orientated. Leucocratic gabbros are recognized as layers that transect from core end to core end (Piece 11). Elongate (Pieces 4, 13, and 14) or spherical mineral patches (Piece 12) consist mainly of melanocratic materials. White (chlorite-rich) subhorizontal vein (Piece 8a) and dark (actinolite-rich) subvertical veins (Pieces 13, 16, and 23) are also present.

ADDITIONAL COMMENTS: A diffuse altered coarse patch is found in Piece 11. In Piece 8a, it appears that the cores of the larger clinopyroxenes do not contain abundant plagioclase chadacrysts, while the rims are growing in more pronounced poikilitic texture.

Core Photo



312-1256D-223R-2 (Section top: 1450.78 mbsf)

Plutonic Rock

UNIT: 89A

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro

TEXTURE: Inequigranular, seriate, with occasional poikilitic portions

PIECES: 1a–1d, 1f, 1g, 2–6, 11–16, and parts of 1e and 7–10

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: significant and rapid drop in grain size at beginning of Section 223R-2
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	60	1.5	0.1	1.0	Euhedral
Clinopyroxene	38	1.8	0.1	1.0	Subhedral–interstitial
Olivine	<1	1.0	0.1	0.5	Subhedral
Oxides:	<1	1.0	0.1	0.7	Interstitial

Modal estimate based on Piece 1b of Section 223R-2.

ALTERATION: Highly to completely altered gabbro. Plagioclase is replaced by secondary plagioclase, clinopyroxene by amphibole. Relatively abundant (~5%) chlorite replaces euhedral crystals. Disseminated pyrite is more abundant near veins.

VEINS: Common amphibole + chlorite? veins, some with 15 mm chlorite + pyrite-rich halos, others with dark green to gray halos. Piece 1d has a 1.2 mm quartz + chlorite vein, with abundant euhedral olivine(?) replaced by dark green chlorite + pyrite in a 15 mm diffuse halo adjacent to the vein.

STRUCTURE: Pieces 1, 3, 10, 14, and 16 are orientated. Leucocratic, pegmatitic gabbros are recognized as subhorizontal layers (Pieces 1d, 1e, and 10) or patches (Pieces 2, 5, 7, 8, and 9) in otherwise fine- to medium-grained melanocratic gabbros. Alteration patches are present in Pieces 3 and 16. Subvertical veins accompany dark green (amphibole) mineral fillings and diffuse contacts (Pieces 1b, 1c, 10, 14, and 16), whereas subhorizontal veins have light green and white mineral fillings (Pieces 1d, 1e, 3, and 16).

ADDITIONAL COMMENTS: This unit is defined on the basis of a large drop in average grain size from Piece 24 of Section 223R-1 to Piece 1 of Section 223R-2, from an average of 3 mm to ~1 mm. Parts of this unit are fine grained (Piece 1d) but the grain size appears to increase toward the base of this section (Piece 14b). This unit is cut by a couple of coarse grained dikes, but since these are discrete (rather than diffuse) we define these dikes as a subunit.

UNIT: 89B

ROCK NAME: Coarse-grained disseminated oxide gabbro

SUMMARY DESCRIPTION: Coarse-grained disseminated oxide gabbro

TEXTURE: Inequigranular seriate

PIECES: Parts of 1e and 7–10

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: intrusive margins in Pieces 1e and 7
Lower: intrusive margins in Pieces 1e and 10

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	7.0	0.2	5.0	Euhedral–subhedral
Clinopyroxene	43	8.0	0.2	5.0	Euhedral–anhedral
Oxides:	2	2.5	0.2	2.0	Euhedral–anhedral

Modal estimate based on Piece 1e of Section 223R-2.

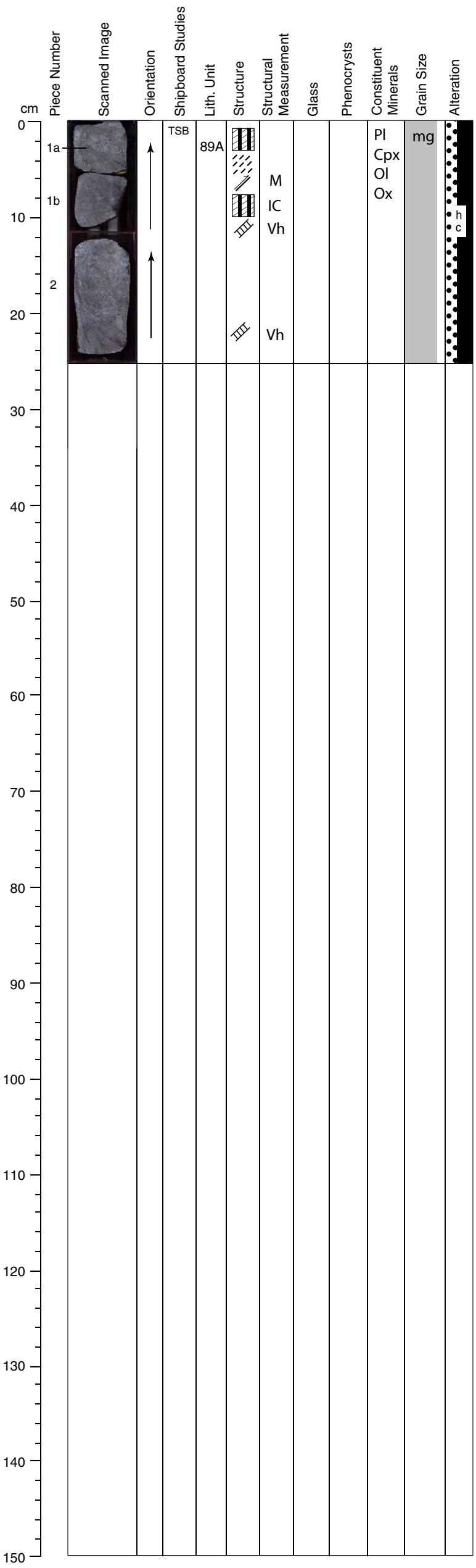
ALTERATION: Coarse grained, completely altered gabbro. Plagioclase replaced by white feldspar ± chlorite ± prehnite ± quartz. Clinopyroxene is replaced by hornblende. The host rock along the edge of the coarse patch is slightly more altered with common black chloritic patches.

VEINS: The finer grained host rock and coarse patch are crosscut by 0.5 mm amphibole veins in Piece 10.

STRUCTURE: No structure specific to the oxide gabbro is noted.

ADDITIONAL COMMENTS: This subunit occurs as a pair of thin dikes (one 2 cm thick, the other close to 5 cm) which cut Unit 89. The margins are less diffuse and straighter than those in the patches in Unit 88, and the dike margins are almost parallel sided. We therefore define these two intrusive bodies as a separate subunit.

Core Photo



312-1256D-223R-3 (Section top: 1452.28 mbsf)

Plutonic Rock

UNIT: 89A

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro

TEXTURE: Inequigranular, seriate, with occasional poikilitic portions

PIECES: 1–2

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: significant and rapid drop in grain size at beginning of Section 223R-2
Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	60	1.5	0.1	1.0	Euhedral
Clinopyroxene:	38	1.8	0.1	1.0	Subhedral–interstitial
Olivine:	<1	1.0	0.1	0.5	Subhedral
Oxides:	<1	1.0	0.1	0.7	Interstitial

Modal estimate based on Piece 1b of Section 223R-2.

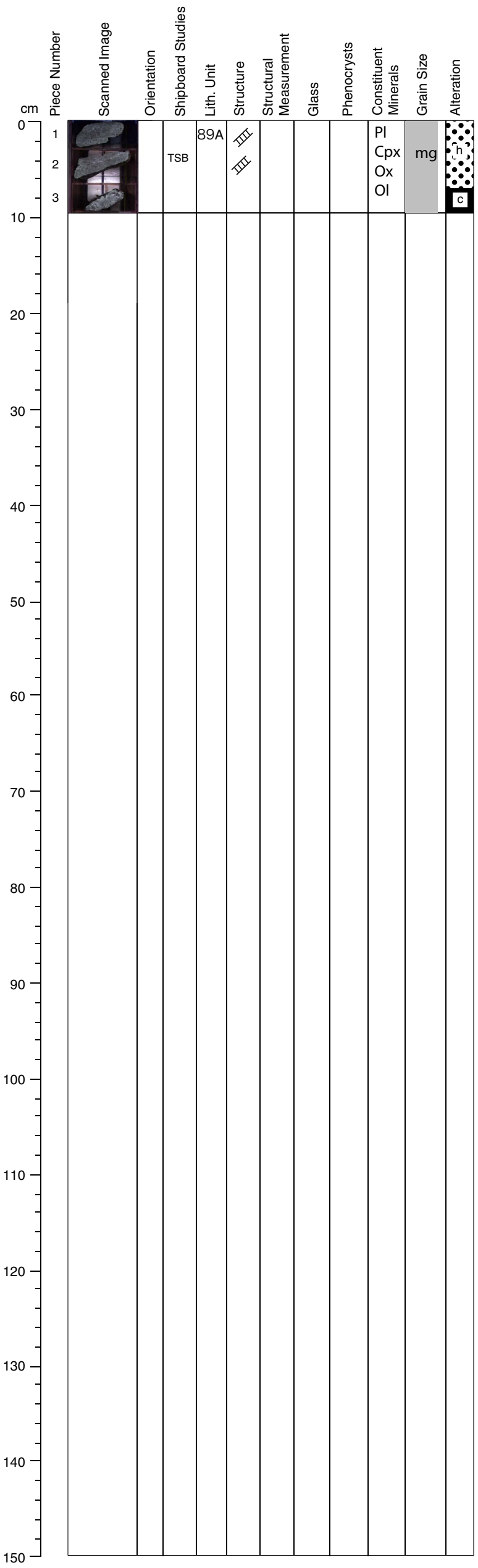
ALTERATION: Highly to completely altered gabbro, with abundant disseminated pyrite. In Piece 1 (5–6 cm) there is a large cm-scale clot of chalcopyrite + pyrhotite + magnetite?. Plagioclase is replaced by secondary plagioclase, clinopyroxene by amphibole. Minor chlorite replaces euhedral crystals. Alteration is most intense around a 5 mm recrystallized clinopyroxene, which is replaced by amphibole and surrounded by 1–5 mm of white secondary feldspar + oxides in Piece 2 (18–20 cm).

VEINS: Several chlorite + actinolite veins with pyrite ± chalcopyrite., with a 5 mm light gray halo

STRUCTURE: Oriented Piece 1a exhibits several structural features of magmatic and deformation origins. Horizontal textural banding of magmatic origin (defined by alternation of coarse- and medium-grained layer) shows reverse sense shear by later high temperature deformation. Flow foliation also seems to develop. Textural banding and a vein with dark alteration halo are in Piece 1b. Oriented Piece 2 has a subhorizontal vein with white fillings and a subvertical vein with green mineral fillings. Leucocratic patches are distributed along the green vein.

ADDITIONAL COMMENTS: In this section, a couple of diffuse coarse patches are present. It also appears that a poikilitic texture with small and closely spaced plagioclase chadacrysts is developed in Piece 2.

Core Photo



312-1256D-224R-1 (Section top: 1454.30 mbsf)

Plutonic Rock

UNIT: 89A

ROCK NAME: Medium-grained gabbro

SUMMARY DESCRIPTION: Medium-grained gabbro

TEXTURE: Inequigranular, seriate, with occasional poikilitic portions

PIECES: 1–3

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: significant and rapid drop in grain-size at beginning of Section 223R-2
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	60	1.5	0.1	1.0	Euhedral
Clinopyroxene:	38	1.8	0.1	1.0	Subhedral–interstitial
Olivine:	<1	1.0	0.1	0.5	Subhedral
Oxides:	<1	1.0	0.1	0.7	Interstitial

Modal estimate based on Piece 1b of Section 223R-2.

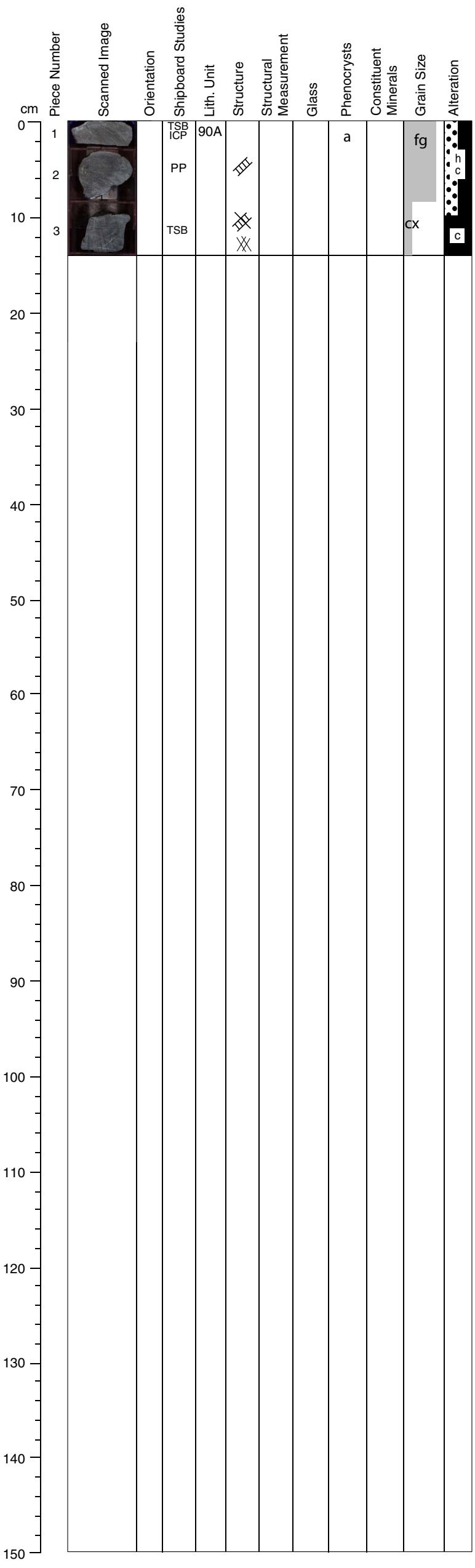
ALTERATION: Highly to completely altered gabbro. Plagioclase is replaced by secondary plagioclase, clinopyroxene by amphibole. Piece 3 is coarse-grained gabbro, in which plagioclase is completely altered to white secondary feldspar and clinopyroxene is replaced by green amphibole, with abundant 3–4 mm oxide grains.

VEINS: Several 0.5 mm quartz + chlorite veins

STRUCTURE: Piece 1 has parallel veins with green (chlorite-rich) and white (quartz-rich) mineral fillings. There is a thin irregular vein in Piece 2.

ADDITIONAL COMMENTS: Continuation of Unit 89A. The recovery is poor in this core, bringing back three small tabular fragments of variable texture and grain size, which may have come from the same gabbro body as the rest of Unit 89A.

Core Photo



312-1256D-225R-1 (Section top: 1458.90 mbsf)

Volcanic Rock

UNIT: 90A

ROCK NAME: Fine-grained to cryptocrystalline aphyric basalt

SUMMARY DESCRIPTION: Fine-grained to cryptocrystalline aphyric basalt dike

PIECES: 1–3

CONTACTS:
Upper: drop in grain size in Piece 1 of Section 225R-1
Lower: not recovered

COLOR: Dark bluish gray (5G 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular, overprinted by metamorphism

VESICLES: None

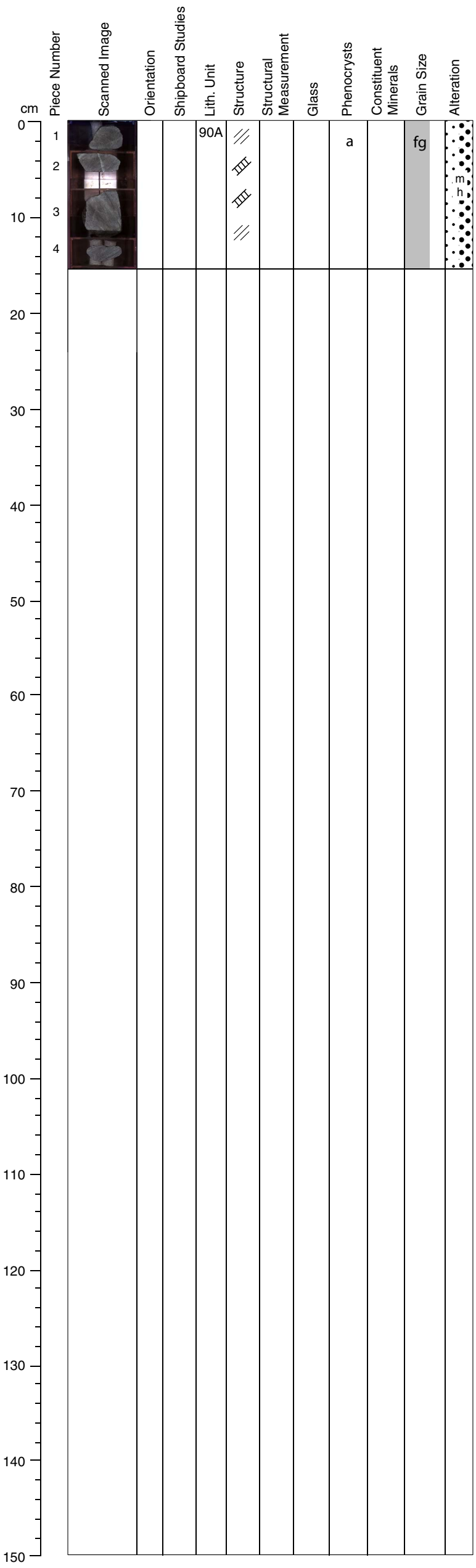
ALTERATION: Dark gray, highly to completely altered. Mottled, speckled appearance suggesting granoblastic recrystallization although an igneous texture is still apparent in places. 1–4 mm sulfide grains in Piece 2.

VEINS: There is a 2 mm quartz + chlorite vein, with a 3 mm dark green chloritic halo on the edge of Piece 2. Piece 3 has abundant 0.1–0.5 mm veins of a number of generations. Early light-colored actinolite? veins with 0.5 mm halos are (mostly) crosscut by 0.5 mm chlorite veins with 0.5 mm halos that occur in two dominant orientations, in a 'trellis.' Later actinolite? veins with 2 mm light gray actinolitic halos crosscut the chlorite veins. 1.5 mm quartz + chlorite + pyrite veins cut across both the light gray halos and chlorite veins.

STRUCTURE: A leucocratic patch in Piece 1. Piece 2 has fracture with dark green (actinolite) film on surface and patchy alteration halo. Piece 3 has three conjugate vein networks, one with white (quartz) mineral fillings and cut the others. The second has gray mineral filling. The oldest set of vein networks has dark green (amphibole) mineral filling. A folded magmatic foliation was observed.

ADDITIONAL COMMENTS: Pieces 1 and 2 are fine-grained rocks, with textures that look similar to the basalt dikes from Unit 80A and shallower. This original intergranular texture has been overprinted by later metamorphic heating. Piece 3 is cryptocrystalline, containing a number of conjugate pairs of shear bands and veins. This piece bears many similarities to samples from close to dike margins from the sheeted dikes above. These three pieces may correspond to parts of a dike that has cut the gabbros, and has then undergone later contact metamorphism. The low recovery in this section (and the previous section) may be related to a return to the altered fine-grained basalt.

Core Photo



312-1256D-226R-1 (Section top: 1463.9 mbsf)

Volcanic Rock

UNIT: 90A

ROCK NAME: Fine-grained aphyric basalt

SUMMARY DESCRIPTION: Fine-grained aphyric basalt dike

PIECES: 1–4

CONTACTS:
Upper: drop in grain size in Piece 1 of Section 225R-1
Lower: not recovered

COLOR: Dark bluish gray (5G 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular, overprinted by metamorphism

VESICLES: None

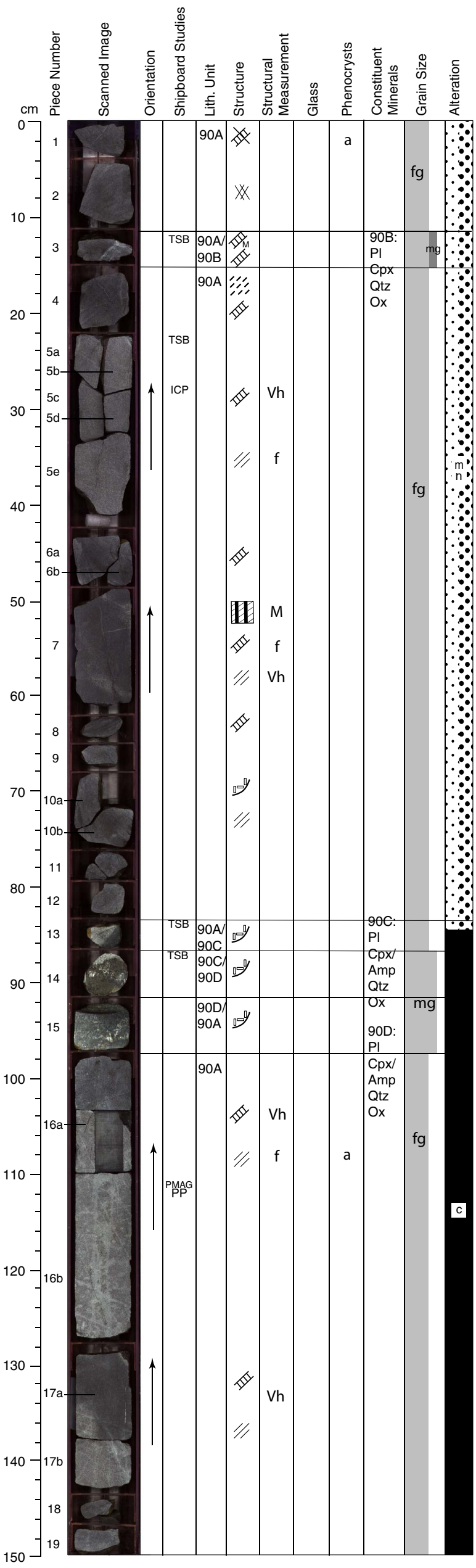
ALTERATION: Moderately to highly recrystallized? dark gray basalt. Disseminated pyrite.

VEINS: Diffuse 1–2 mm wide pale veins in Pieces 2 and 3. These features have no discrete vein filling (they have the appearance of veinless halos), and are probably composed of secondary feldspar + hornblende. Piece 3 has a 0.1 mm actinolite vein.

STRUCTURE: Irregular and splayed veins with diffuse boundaries are in two (Pieces 2 and 4) of the four unoriented pieces.

ADDITIONAL COMMENTS: The grain size and texture of these pieces is similar to Pieces 1 and 2 of Section 225R-1. The original igneous texture appears to have been strongly overprinted by thermal metamorphism, giving the rock a pale granular appearance.

Core Photo



312-1256D-227R-1 (Section top: 1468.5 mbsf)

Volcanic Rock (?)
UNIT: 90A
ROCK NAME: Fine-grained aphyric basalt
SUMMARY DESCRIPTION: Fine-grained aphyric basalt dike
PIECES: 1, 2, 4–12, parts of 3, 13, and 15, all of 16–19
CONTACTS: Upper: drop in grain size in Piece 1 of Section 225R-1; Lower: none recovered
COLOR: Dark bluish gray (5G 4/1)
PHENOCRYSTS: Aphyric
GROUNDMASS: Grain size: fine grained; Texture: intergranular, overprinted by metamorphism
VESICLES: None
ALTERATION: Moderately to highly altered recrystallized (?) dark gray basalt with disseminated pyrite.
VEINS: Common 0.1 mm diffuse actinolite veins that may have been annealed with 1–5mm light gray halos. These veins are crosscut by 0.1–0.5 mm quartz + chlorite veins in Pieces 4, 5, and 7.
STRUCTURE: White, light green, and dark (quartz, chlorite, and actinolite-rich, respectively) conjugate veins, vein networks, and individual veins are present in Pieces 1–7 and 16–19. The veins have planar and irregular but very diffuse morphology and light green alteration halos (Pieces 4, 6, 16, and 19). A melanocratic band in Piece 10 and Pieces 2 and 4 define an irregular magmatic foliation. Elongate and spherical igneous patches are present in Piece 7.
ADDITIONAL COMMENTS: A slight increase in grain size from the top to bottom of this section is noted. The unit is cut by a number of thin intrusions.

Plutonic Rock
UNIT: 90B
ROCK NAME: Medium-grained quartz diorite
SUMMARY DESCRIPTION: Medium-grained quartz diorite dikelet
TEXTURE: Inequigranular–seriate
PIECES: Parts of 3
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: igneous contact in Piece 3; Lower: igneous contact in Piece 3

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	49	5.0	0.1	3.0	Euhedral–subhedral
Clinopyroxene:	35	3.0	0.1	2.0	Euhedral–anhedral
Quartz:	15	1.0	0.1	0.5	Interstitial
Oxides:	1	1.2	0.1	1.0	Interstitial

Modal estimate for finer portion based on Piece 3 of Section 227R-1.
ALTERATION: Highly altered with secondary plagioclase replacing plagioclase and clinopyroxene replaced by amphibole. This coarse grained dike is completely altered along one margin in a 2 mm band.
VEINS: No viens
STRUCTURE: A green, 1.2 cm-wide magmatic vein is present in Piece 3 with an irregular morphology.
ADDITIONAL COMMENTS: 15 mm thick dike cutting Unit 90A with no clear chilled margin. Grain size is larger in the dike than in the host. The margin is diffuse.

UNIT: 90C
ROCK NAME: Fine-grained tonalite
SUMMARY DESCRIPTION: Fine-grained tonalite dikelet
TEXTURE: Equigranular
PIECES: Parts of 13 and 14
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: igneous contact with Unit 90A in Piece 13; Lower: igneous contact with Unit 90D in Piece 14

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	64	1.2	0.1	0.5	Euhedral
Clinopyroxene/Amphibole:	15	0.5	0.1	0.3	Interstitial
Quartz:	30	0.5	0.1	0.3	Interstitial
Oxides:	1	0.3	0.1	0.2	Anhedral

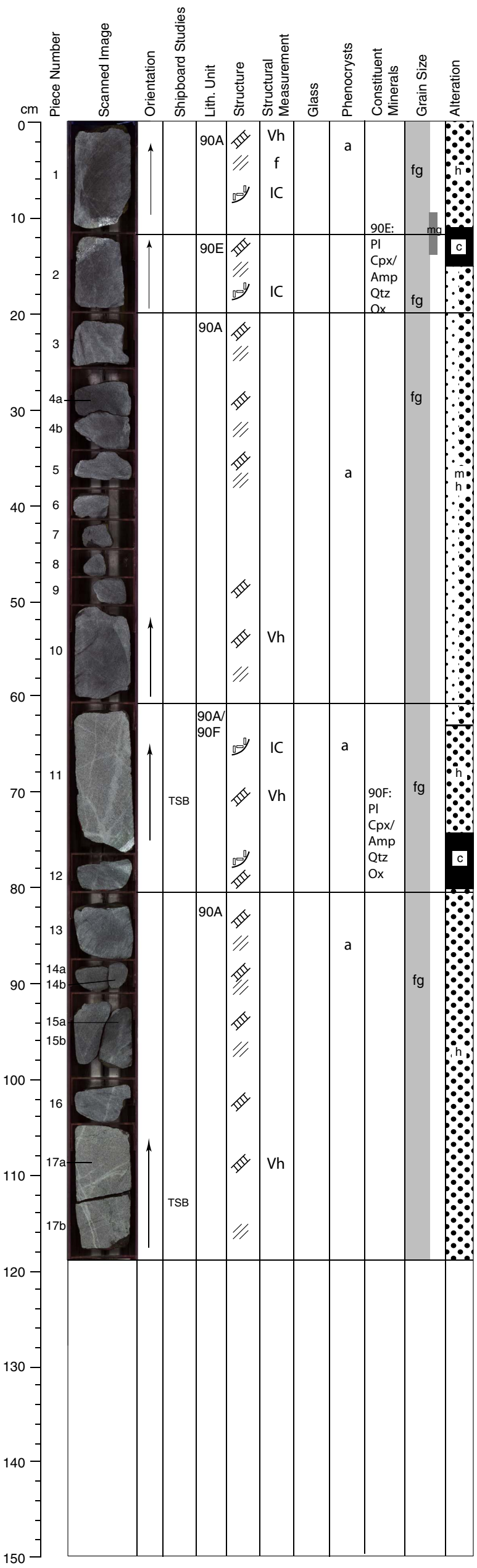
Modal estimate for finer portion based on Piece 13 of Section 227R-1.
ALTERATION: Highly to completely altered to an assemblage of quartz, chlorite, epidote, amphibole, and prehnite. Pale greenish gray in colour.
VEINS: No veins
STRUCTURE: Pieces 13 and 14 have diffuse and irregular igneous contacts between metabasalt and fine-grained tonalite.
ADDITIONAL COMMENTS: Thin dike cutting Unit 90A, slightly coarser than host and with no chilled margin. The margin is fairly straight, but diffuse over 1 mm and related to an alteration halo in the host rock. In the working half there is a small vein of Unit 90C that appears to enter Unit 90D, implying that Unit 90C cuts Unit 90D.

UNIT: 90D
ROCK NAME: Medium-grained gabbro
SUMMARY DESCRIPTION: Medium-grained gabbro dikelet
TEXTURE: Inequigranular seriate
PIECES: Parts of 14 and 15
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: igneous contact with Unit 90D in Piece 14; Lower: igneous contact with Unit 90A in Piece 15

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	50	7.0	0.1	1.5	Euhedral–subhedral
Clinopyroxene/Amphibole:	40	3.0	0.1	1.5	Interstitial–subhedral
Quartz:	8	0.8	0.1	0.5	Interstitial
Oxides:	2	1.5	0.1	0.5	Subhedral–anhedral

Modal estimate for finer portion based on Piece 15 of Section 227R-1.
ALTERATION: Completely altered to an assemblage of epidote, chlorite, quartz + prehnite (?) and magnetite. Trace disseminated pyrite. Variegated white/green/gray in colour.
VEINS: No veins
STRUCTURE: Igneous contacts were recorded in Pieces 14 and 15, respectively, as irregular medium-grained leuco-gabbro fragments and 1.3 cm wide dikelet.
ADDITIONAL COMMENTS: Thin dike cuts Unit 90A and possibly Unit 90C. It is coarser grained than both of these units with diffuse and irregular margins. The grain size is variable in this dike.

Core Photo



312-1256D-227R-2 (Section top: 1470.00 mbsf)

Volcanic Rock (?)

UNIT: 90A
ROCK NAME: Fine-grained aphyric basalt
SUMMARY DESCRIPTION: Fine-grained aphyric basalt dike
PIECES: 1, 3–10, 13–17 and parts of 2, 11, and 12
CONTACTS: Upper: drop in grain size in Piece 1 of Section 225R-1; Lower: not recovered
COLOR: Dark bluish gray (5G 4/1)
PHENOCRYSTS: Aphyric
GROUNDMASS: Grain size: fine grained; Texture: intergranular, overprinted by metamorphism.
ALTERATION: Moderately to highly altered dark gray (recrystallised?) basalt with abundant disseminated pyrite. Diffuse 1–5 mm light gray halos may be annealed veins?
VEINS: Common 0.1 mm cross-cutting actinolite (+ feldspar?) veins, annealed?, some with 1–5mm light gray halos (well developed in Pieces 1 and 17). A 0.5 mm amphibole + chlorite vein with a 2 mm light gray halo (Pieces 1–3) that cuts across the coarse gabbro dike (Unit 90E) in Pieces 1 and 2. Late stage 0.1 mm white veins crosscut the actinolite veins in Piece 10.
STRUCTURE: Pieces 1, 2, 10, 11, and 17 are oriented. Hydrothermal veins in all the pieces (except Pieces 6, 7, 8, and 14), have irregular, planar, splayed, and curved morphologies and dark green, light green, and white (amphibole, chlorite, and quartz-rich, respecively) mineral fillings. Many veins are very diffuse (e.g., Pieces 3, 11, and 17) and visible by the presence of dark green and light green alteration halos. Several irregular fractures widespread in all the pieces. In Pieces 10 and 12, fractures and veins show subparallel orientation, whereas in Pieces 1, 3, 11, and 13, they form several crosscutting relationships. Pieces 1, 2, 11, and 12 present sharp igneous contacts (Units 90E and 90F).
ADDITIONAL COMMENTS: After the slight increase in grain size observed in the last section (227R-1), there appears to be a slight and gradual decrease in grain size from the top to the bottom of this section.

Plutonic Rock

UNIT: 90E
ROCK NAME: Medium-grained gabbro
SUMMARY DESCRIPTION: Medium-grained gabbro dikelet
TEXTURE: Inequigranular–seriate
PIECES: 2
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: igneous contact in Piece 2; Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	45	5.0	0.1	1.5	subhedral
Clinopyroxene/amphibole:	48	5.0	0.1	2.0	euhedral–anhedral
Quartz:	5	1.0	0.1	0.5	interstitial
Oxides:	2	1.5	0.1	0.8	interstitial

Modal estimate for finer portion based on Piece 2 of Section 227R-2.

ALTERATION: Completely altered variegated white to green gabbro dike with plagioclase replaced by secondary feldspar plus actinolite (?) and clinopyroxene replaced by actinolite + chlorite?. There is a 2 mm dark green alteration halo in the host basalt along the margins of the dike.
VEINS: A 0.5 mm amphibole + chlorite vein with a 2 mm light gray halo (Pieces 1–3) that cuts across the coarse gabbro dike (Unit 90E) in Pieces 1 and 2.
STRUCTURE: Piece 2 shows a sharp and planar contact between the host rock and medium-grained leuco-gabbro, more altered (green secondary minerals) in the inner part. The contact between the two units is highlighted by 1 mm wide mafic minerals band.
ADDITIONAL COMMENTS: This thin dike cuts Unit 90A. It is coarser than the host rock, and the margin is diffuse over 2–3 mm, with apparent baking of the host rock shown by a darkening over a 2 mm wide zone.

UNIT: 90F
ROCK NAME: Fine-grained tonalite
SUMMARY DESCRIPTION: Fine-grained tonalite dikelet
TEXTURE: Equigranular
PIECES: Parts of 11 and 12
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: igneous contact with Unit 90A in Piece 11; Lower: igneous contact with Unit 90A in Piece 12

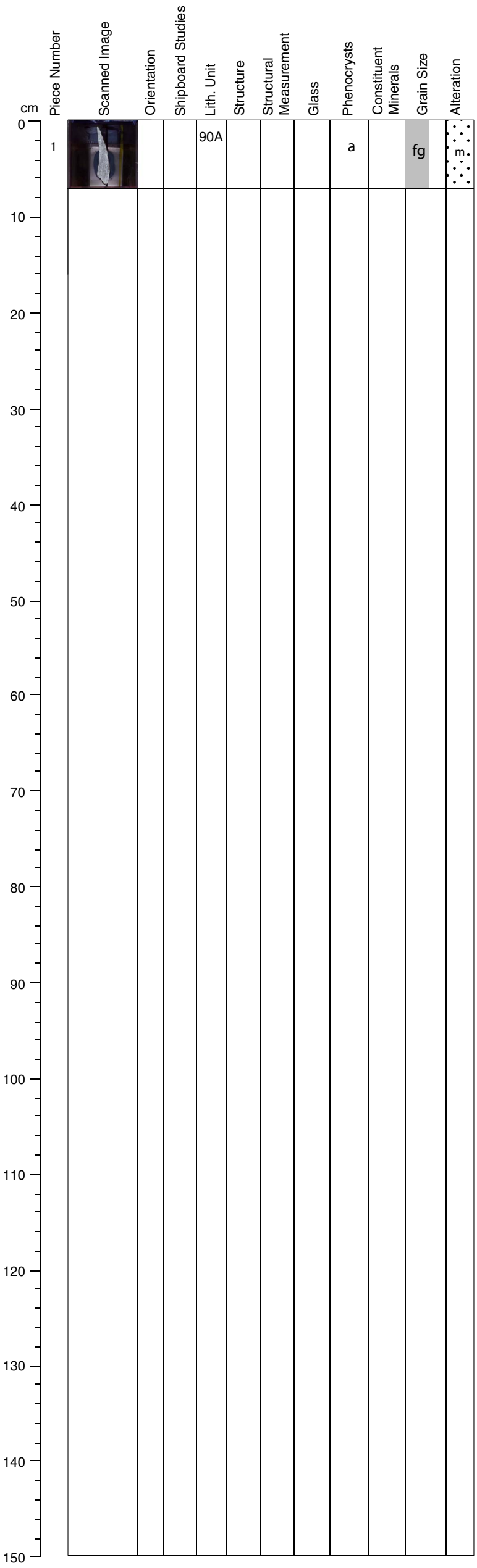
PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	64	1.2	0.1	0.5	euhedral
Clinopyroxene/Amphibole:	15	0.5	0.1	0.3	interstitial
Quartz:	30	0.5	0.1	0.3	interstitial
Oxides:	1	0.3	0.1	0.2	anhedral

Modal estimate for finer portion based on Piece 13 of Section 227R-1 (Unit 90C).

ALTERATION: Highly to completely altered to quartz, chlorite, secondary plagioclase, amphibole, epidote + prehnite?. Disseminated pyrite. 2 mm epidote patches are best developed adjacent to 0.1 mm amphibole vein. There is a 1 mm dark green halo in the host rock along the margin of this dike.
VEINS: 0.1 mm amphibole vein
STRUCTURE: Pieces 11 and 12 show two sharp igneous contacts. In Piece 11, the tonalite dikelet is in contact with a finer-grained portion of the host rock. In Piece 12, the contact is 0.8 cm wide and cut by a hydrothermal dark green (amphibole-rich) vein.
ADDITIONAL COMMENTS: This thin dike cuts Unit 90A. The mineralogy and texture is very similar to that found in Unit 90C. The grain size is slightly higher in the dike than in the host rock, and there is no chilled margin. The margin is quite straight in Piece 11 and diffuse over 1 mm width. In Piece 12, the geometry of the margin is more complex, showing a pinched bulbous tip about 5 mm wide where the margin is more diffuse. This apparent increase in the width of the diffuse zone may show that the cut surface is subparallel to the margin.

1256D-228R No recovery

Core Photo



12-1256D-229R-1 (Section top: 1478.0 mbsf)

Volcanic Rock (?)

UNIT: 90A

ROCK NAME: Fine-grained aphyric basalt

SUMMARY DESCRIPTION: Fine-grained aphyric basalt dike

PIECES: 1

CONTACTS:
Upper: drop in grain size in Piece 1 of Section 225R-1
Lower: none recovered

COLOR: Dark bluish grey (5G 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular, overprinted by metamorphism

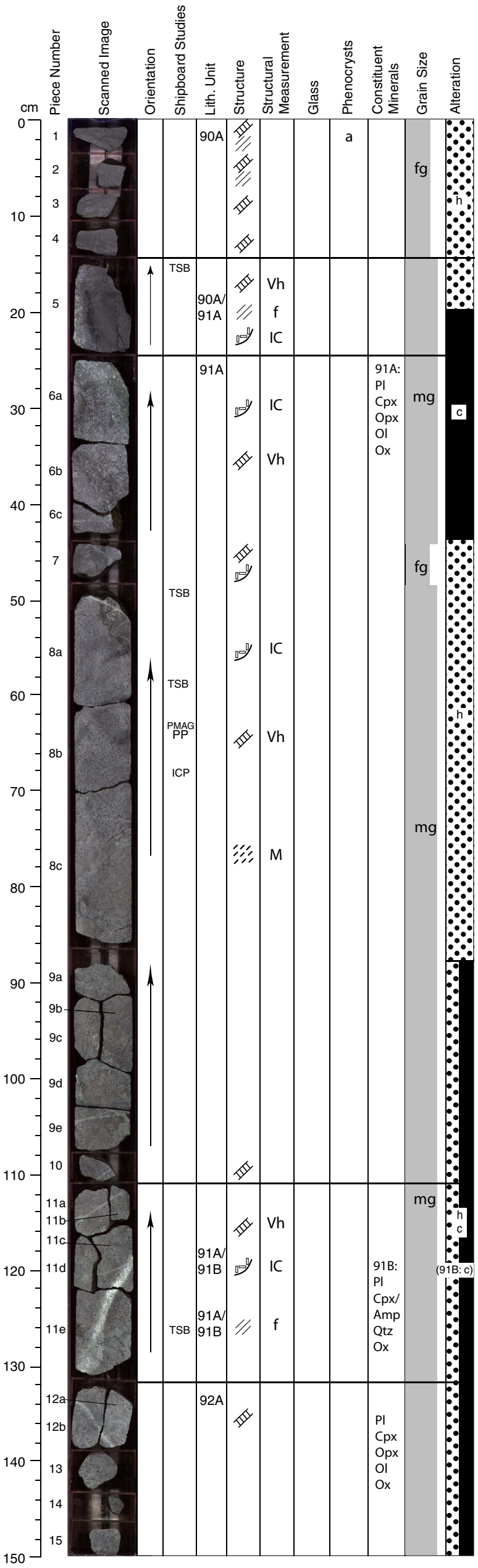
ALTERATION: Moderately altered dark gray basalt.

VEINS: No veins

STRUCTURE: No structures.

ADDITIONAL COMMENTS: This single, tabular, fractured piece comes after a core with no recovery. The texture and grain size are similar to some of the pieces in Section 227R-2, so we assign this piece to Unit 90A.

Core Photo



312-1256D-230R-1 (Section top: 1483.0 mbsf)

Volcanic Rock (?)
UNIT: 90A
ROCK NAME: Fine-grained aphyric basalt
SUMMARY DESCRIPTION: Fine-grained aphyric basalt dike
PIECES: 1–4, part of 5
CONTACTS: Upper: drop in grain size in Piece 1 of Section 225R-1; Lower: sharp increase in grain-size from Piece 5 of Section 230R-1
COLOR: Dark bluish gray (5G 4/1)
PHENOCRYSTS: Aphyric
GROUNDMASS: Grain size: fine grained; Texture: intergranular, overprinted by metamorphism
ALTERATION: Highly altered recrystallised? dark gray basalt
VEINS: Several 0.1 mm actinolite + chlorite veins
STRUCTURE: Piece 5 is oriented. Several hydrothermal veins in all the pieces filled by white and dark green (chlorite and actinolite, respectively) minerals, showing irregular, planar, and splayed morphologies. Irregular fractures are drilling induced.
ADDITIONAL COMMENTS: Continuation of Unit 90A. Similar granular texture.

Plutonic Rock
UNIT: 91A
ROCK NAME: Medium-grained oxide gabbro
SUMMARY DESCRIPTION: Mixed medium-grained gabbro and basalt fragments in marginal unit
TEXTURE: Hetereogeneous. Equigranular in medium-grained gabbro, possible granular in fine-grained basalt fragments, inequigranular seriate in coarse portion.
PIECES: Part of 5, all of 6–11
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: significant increase in grain size in Piece 5 of Section 230R-1; Lower: end of occurrence of basaltic fragments in Piece 12
PRIMARY MINERALS:
Medium-grained gabbro portion:

	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	40	1.5	0.1	0.8	Euhedral–subhedral
Clinopyroxene:	36	1.5	0.1	0.8	Euhedral–subhedral
Orthpyroxene:	3	1.5	0.1	0.8	Euhedral–subhedral
Olivine:	<1	1	0.1	0.5	Subhedral
Oxides:	20	1.5	0.1	0.7	Interstitial

Modal estimate based on Piece 8b of Section 230R-1.

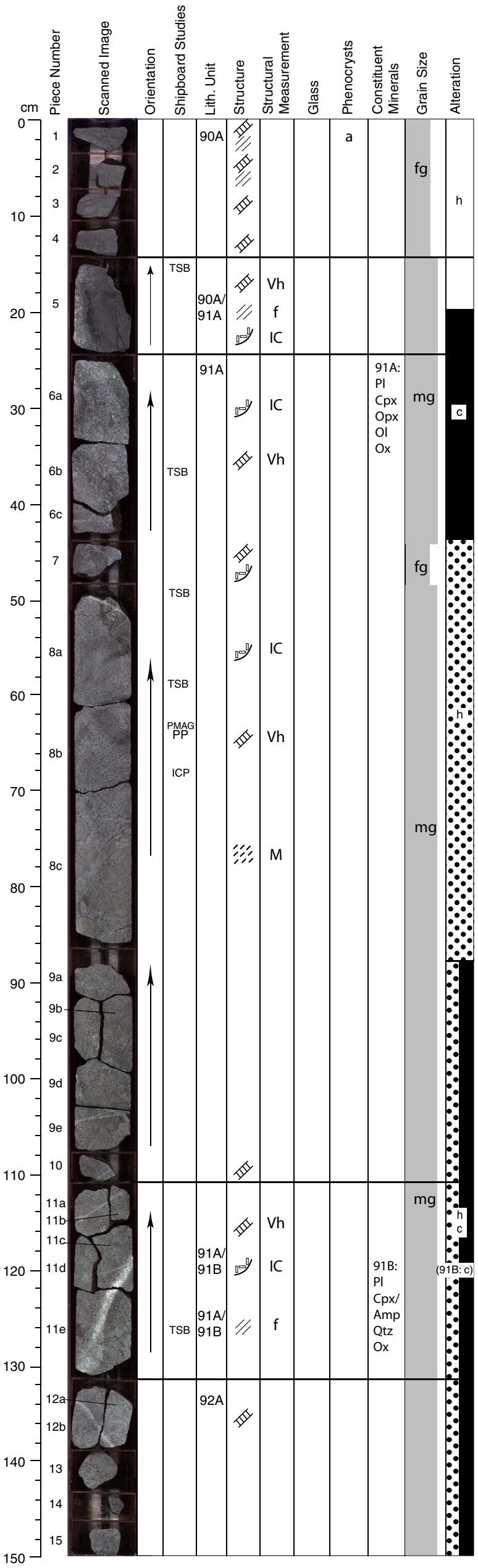
Coarse-grained gabbro portion:

Plagioclase:	55	3.0	0.1	2.0	Subhedral
Clinopyroxene:	42.5	3.0	0.1	2.0	Subhedral–interstitial
Oxides:	1.5	2.0	0.1	1.5	Interstitial
Quartz:	1	1.0	0.1	0.5	Interstitial

Modal estimate based on Piece 6b of Section 230R-1.
ALTERATION: Highly to completely altered heterogeneous dark gray to dark greenish gray gabbro, with abundant disseminated magnetite. The upper edge of the gabbro intrusion in Pieces 5 and 6 is completely altered to secondary feldspar + epidote + amphibole + chlorite. The basalt dike is baked and has a 5 mm very dark gray alteration halo along the vertical margin with the gabbro intrusion; alteration is less intense in the host dike adjacent to the 1 cm wide subhorizontal gabbro apophysis at the top of Piece 5. There is a completely altered and comminuted 40 mm chloritic band through the highly altered gabbro in Piece 6a. The alteration appears more intense within the gabbroic matrix than basaltic clasts.
VEINS: There are several 0.1-0.5 mm actinolite +/- chlorite veins. There are two 0.5 mm quartz and actinolite and plagioclase veins.
STRUCTURE: One igneous contact was recorded in Piece 5; the contact is highlighted by a 1 cm thick irregular gabbroic vein. One irregular zone intrusion and a fine-grained, amphibole-rich zone are present in Pieces 6 and 7 (weakly foliated). Several irregular and diffuse contacts with fine-grained xenoliths were recorded in Pieces 8, 9, and 11. Hydrothermal veins are present in all the pieces, with dark green, white, and light green (amphibole, quartz, and chlorite, respectively) mineral fillings and mainly irregular and splayed morphologies. Some of these veins have 0.1–1 mm alteration halos. Planar, irregular, and splayed fractures in Pieces 5, 9, and 11. One igneous contact (Unit 91B) in Piece 11.
ADDITIONAL COMMENTS: This complex marginal unit contains medium-grained gabbro, fine-grained basaltic fragments, and a coarser gabbro (often altered) in Pieces 5, 6, and 8, adjacent to the margin. In Piece 5, this coarse gabbro cuts a large basaltic fragment, which is likely part of Unit 90A. The intrusion of gabbro into the finer-grained dike material is confirmed by the crosscutting relationships. Fine-grained basaltic fragments of varying size and shape are found within this unit, and the end of the unit is defined by their disappearance. In Pieces 7 and 8, a zone of dark, fine-grained material is present. Basaltic fragments are slightly pink, implying the presence of orthopyroxene in the groundmass (c.f. dike rocks in Unit 90A). The interval 49–69 cm contains abundant 1–2 mm magnetite grains, and has extremely high magnetic susceptibility.

(Continued on next page.)

Core Photo



312-1256D-230R-1 (Section top: 1483.0 mbsf)

Continued:

Plutonic Rock

UNIT: 91B
ROCK NAME: Medium-grained leuco-gabbro
SUMMARY DESCRIPTION: Medium-grained leuco-gabbro
TEXTURE: Equigranular
PIECES: 11c and 11e
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: igneous contacts in Pieces 11c and 11e; Lower: igneous contacts in Pieces 11c and 11e

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	75	3.0	0.1	1.5	Euhedral-subhedral
Clinopyroxene/amphibole:	22	2.0	0.1	1.5	Subhedral
Oxides:	2	1.2	0.1	1.0	Interstitial
Quartz:	1	1.0	0.1	0.5	Interstitial

Modal estimate based on Piece 11c of Section 230R-1.
ALTERATION: Highly altered to amphibole and white secondary feldspar. The dike margin has a 5 mm dark green chlorite rich halo in the host gabbro.
VEINS: A 1.5 mm quartz + chlortite vein with a 1 mm dark green halo cuts across Units 91B and 92. A 5 mm altered magmatic dikelet in Piece 12A may also be part of Unit 91B.
STRUCTURE: Piece 11 shows a steeply dipping intrusion of 0.6 cm thick. The boundaries have finer-grained margins and irregular and diffuse morphologies. The intrusion is cut by one 0.2 mm thick light green (quartz and chlorite) hydrothermal vein.
ADDITIONAL COMMENTS: 10 mm wide dike that cuts Unit 91A at a high angle. There is no chilled margin, and a sutured contact is observed.

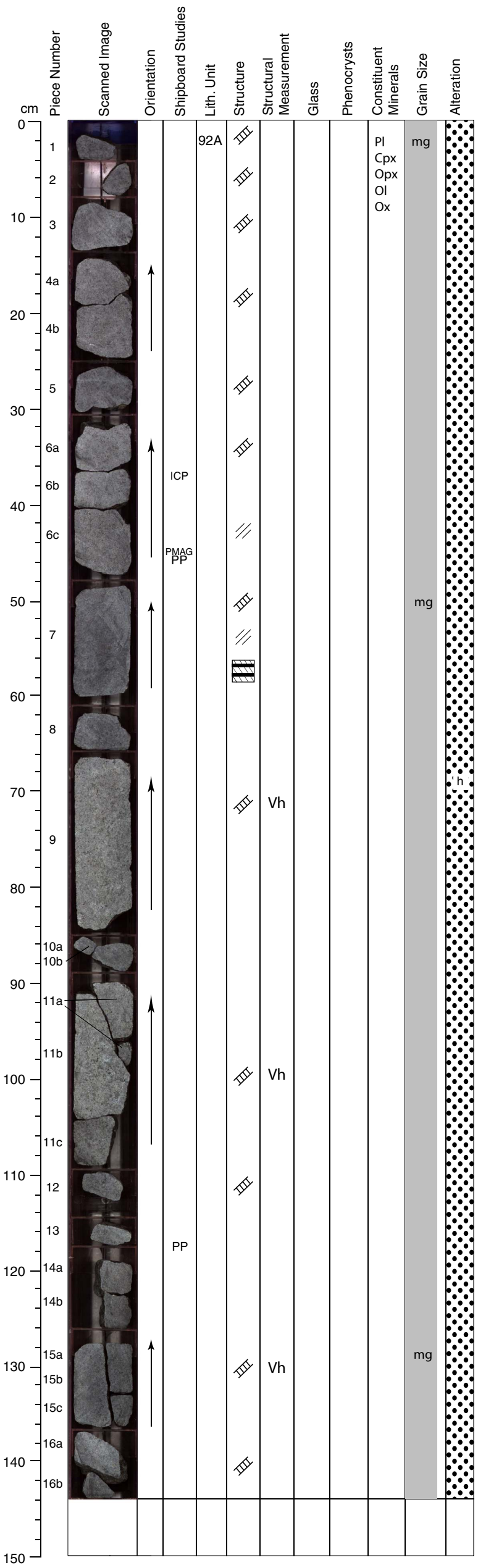
UNIT: 92A
ROCK NAME: Medium-grained orthopyroxene-bearing gabbro
SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro
TEXTURE: Inequigranular seriate
PIECES: 12–15
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1; Lower: not recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	2.0	0.1	1.5	Euhedral
Clinopyroxene:	40	2.0	0.1	1.5	Subhedral-interstitial
Orthopyroxene:	3	3.0	0.1	2.0	Subhedral-interstitial
Olivine:	1	1.0	0.1	0.8	Subhedral
Oxides:	1	3.0	0.1	1.0	Interstitial

Modal estimate based on Piece 7 of Section 230R-2.

ALTERATION: Highly to completely altered with common 2–5 mm dark green chlortitic patches and disseminated pyrite.
VEINS: Piece 12 is cut by a 5 mm magmatic dikelet (Unit 91B?) that has a diffuse 1 mm light gray halo.
STRUCTURE: Two hydrothermal veins were recorded in Piece 12, with dark green, light green, and white mineral fillings, one of which has 0.1 mm light green halo. These veins have irregular and curved morphologies. Pieces 13–15 have no structures.
ADDITIONAL COMMENTS: The beginning of this unit is defined by the disappearance of fine-grained basaltic xenoliths from the gabbro, away from the margin. The pieces of Unit 92 in this section appear to be altered, with blackened olivine and orthopyroxene.

Core Photo



312-1256D-230R-2 (Section top: 1484.50 mbsf)

Plutonic Rock

UNIT: 92A

ROCK NAME: Medium-grained orthopyroxene-bearing gabbro

SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro

TEXTURE: Inequigranular seriate

PIECES: 1–16

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	2.0	0.1	1.5	Euhedral
Clinopyroxene:	40	2.0	0.1	1.5	Subhedral–interstitial
Orthopyroxene:	3	3.0	0.1	2.0	Subhedral–interstitial
Olivine:	1	1.0	0.1	0.8	Subhedral
Oxides:	1	3.0	0.1	1.0	Interstitial

Modal estimate based on Piece 7 of Section 230R-2.

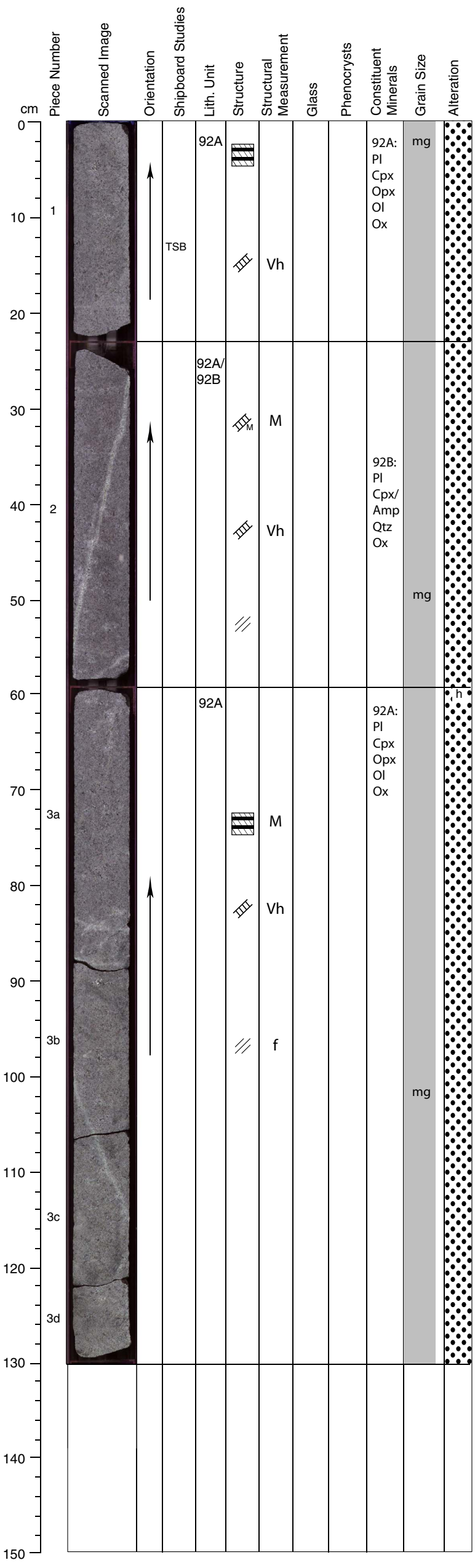
ALTERATION: Highly altered dark greenish gray to dark gray gabbro.

VEINS: Several 0.5 mm actinolite veins. Piece 11 is crosscut by a network of subvertical and subhorizontal amphibole veins. Pieces 11–16 have several 0.5 mm subvertical chlorite ± actinolite veins.

STRUCTURE: Pieces 4, 6, 7, 9, 11, and 15 are oriented. Several hydrothermal veins in all the pieces, have irregular, planar, curved and splayed morphologies, and dark green, iight green and metallic (amphibole, quartz, chlorite, and sulfides) mineral fillings. Crosscutting relationships in Piece 11. Piece 16 has a probable shear vein with a stepped morphology. One rounded, diffuse, and very altered mineral patch in Piece 7.

ADDITIONAL COMMENTS: There may be a very subtle increase in grain size from the top to bottom of this section, but not by more than 0.5 mm.

Core Photo



312-1256D-231R-1 (Section top: 1487.90 mbsf)

Plutonic Rock

UNIT: 92A

ROCK NAME: Medium-grained orthopyroxene-bearing gabbro

SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro

TEXTURE: Inequigranular seriate

PIECES: 1 and 3, parts of 2

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	2.5	0.1	1.0	Euhedral-subhedral
Clinopyroxene:	40	2.0	0.1	1.0	Subhedral-interstitial
Orthopyroxene:	3	1.0	0.1	0.5	Subhedral
Olivine:	<1	1.2	0.1	0.5	Subhedral
Oxides:	1	1.0	0.1	0.5	Interstitial

Modal estimate based on Piece 3d of Section 231R-1.

ALTERATION: Highly altered, dark greenish gray to dark gray gabbro. Disseminated pyrite is most abundant adjacent to a leuco-gabbro dikelet (Unit 92B) in Piece 2.

VEINS: Rare 0.1–0.5 mm chlorite + pyrite ± amphibole? veins with 1 mm dark green halos cut across the leuco-gabbro dikelet (Unit 92B).

STRUCTURE: Pieces 1–3 are oriented. Hydrothermal veins in all the pieces, have light green, dark green, and white (chlorite and amphibole-rich) mineral fillings. These veins are very diffuse and have irregular, planar, and splayed morphologies. Several mineral patches with different shapes are present in Piece 3. The irregular fractures of Piece 3 are probably drilling induced. One igneous contact is present in Piece 2 (Unit 92B). Piece 3c shows a 4 cm thick coarse-grained textural band, with diffuse boundaries.

ADDITIONAL COMMENTS: Continuation of gabbro of Unit 92. There is no clear systematic change in grain size or texture within this section or between this section and the last. Some pieces (e.g., Piece 3b) contain a number of ~1 cm diameter diffuse patches with slightly increased grain size. The unit is also cut by several small veins, and we pick out Unit 92B as a thin dike.

Plutonic Rock

UNIT: 92B

ROCK NAME: Medium-grained leuco-gabbro

SUMMARY DESCRIPTION: Medium-grained leuco-gabbro

TEXTURE: Inequigranular seriate

PIECES: Parts of 2

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: igneous contact in Piece 2
Lower: igneous contact in Piece 2

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	70	2.0	0.1	1.0	Subhedral
Clinopyroxene/Amphibole:	26	2.0	0.1	1.0	Subhedral
Quartz:	3	0.5	0.1	0.3	Interstitial
Oxides:	1	1.5	0.1	1.0	Interstitial

Modal estimate based on Piece 2 of Section 231R-1.

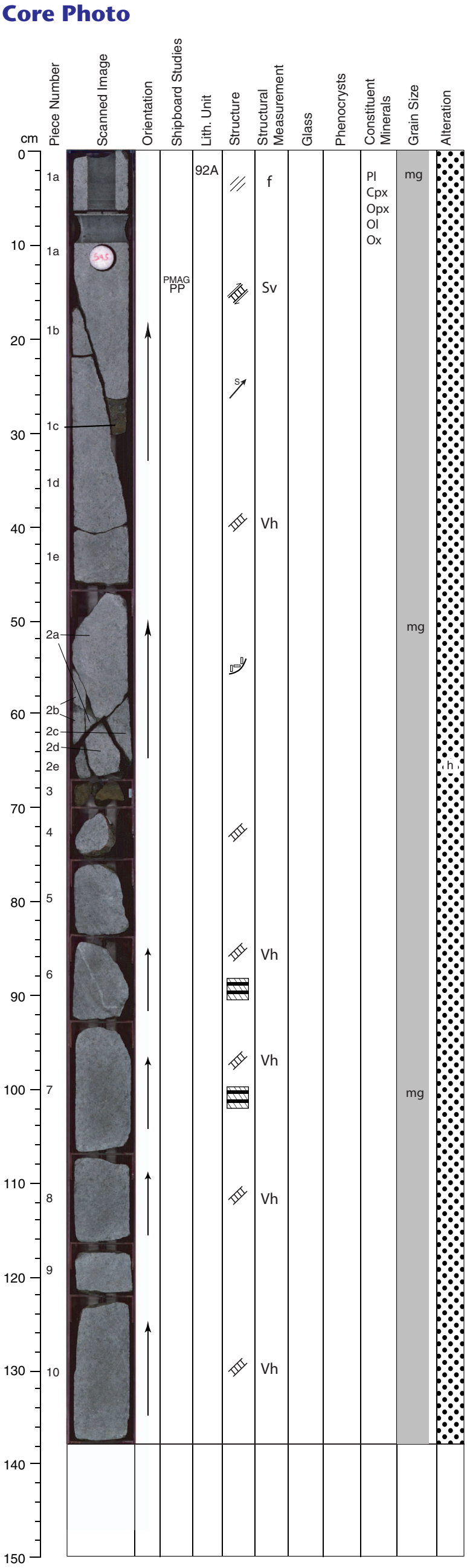
ALTERATION: Completely altered to secondary plagioclase + amphibole + pyrite. There is a 5 mm dark green halo in the host gabbro along the margins of the leuco-gabbro dikelet.

VEINS: Rare 0.1–0.5 mm chlorite + pyrite ± amphibole? veins with 1 mm dark green halos cut across the leuco-gabbro dikelet (Unit 92B)

STRUCTURE: One steeply dipping igneous intrusion of 3–5 mm thick in Piece 3a has irregular and diffuse boundaries.

ADDITIONAL COMMENTS: 7 mm wide dike that cuts at a high angle through Unit 92A. There is no chilled margin, and the margins are fairly sharp, although some fine veins branch out of the dike. The dike is altered, and may have provided a pathway for hydrothermal fluids.

Core Photo



312-1256D-231R-2 (Section top: 1489.19 mbsf)

Plutonic Rock

UNIT: 92A

ROCK NAME: Medium-grained orthopyroxene-bearing gabbro

SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro

TEXTURE: Inequigranular seriate and poikilitic to equigranular

PIECES: 1–10

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	2.0	0.1	1.0	Euhedral
Clinopyroxene:	40	2.0	0.1	1.0	Interstitial-subhedral
Orthopyroxene:	2	1.5	0.1	1.0	Subhedral
Olivine:	2	2.0	0.1	1.0	Euhedral-subhedral
Oxides:	1	1.0	0.1	0.8	Interstitial

Modal estimate based on Piece 5 of Section 231R-2.

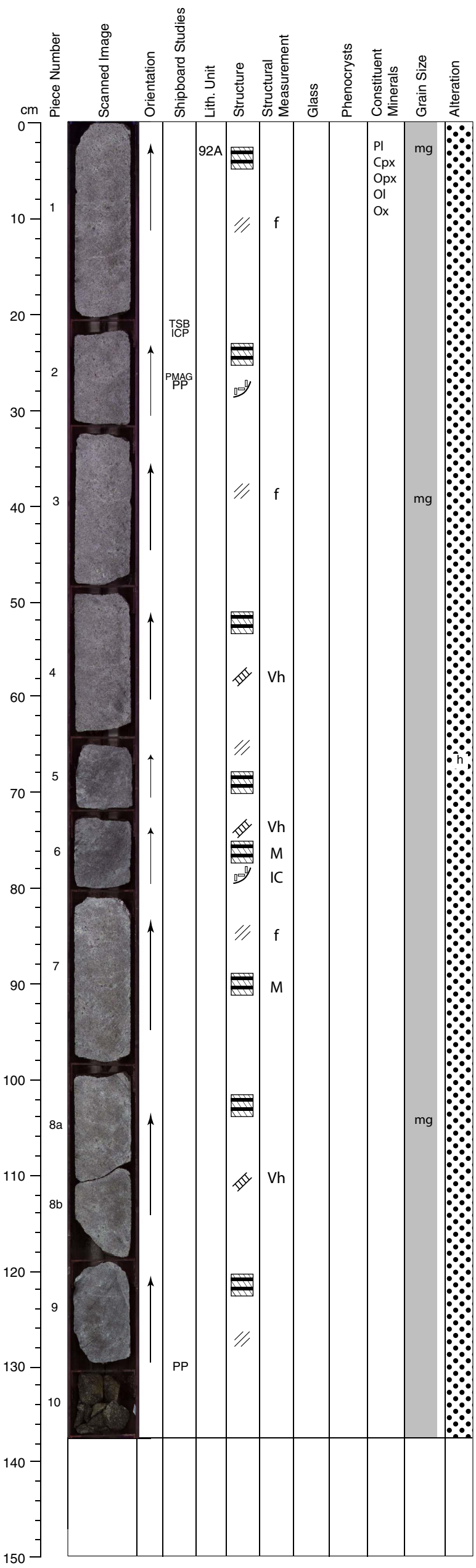
ALTERATION: Highly altered dark greenish gray to dark gray gabbro, with disseminated pyrite. Piece 6a has a 3 mm leuco-gabbro dikelet altered to feldspar + amphibole.

VEINS: Several 0.1–0.5 mm chlorite veins with 1 mm dark green halos. Chlorite veins in Piece 1 appears to have subhorizontal slickenlines.

STRUCTURE: All the Pieces except 4, 5, and 9 are oriented. Hydrothermal veins in Pieces 1, 4, 6, 7, 8, and 10 have dark green, light green, and white mineral fillings. The veins are irregular, planar, curved, and splayed in morphology and can be diffuse and discontinuous. There are several crosscutting relationships in Pieces 4 and 6; whereas veins in Piece 10 have subparallel orientation. One shear vein was recorded in Piece 1; slickenlines indicate a dextral apparent sense of shear. Two fine-grained igneous contacts between Unit 92A and fine-grained xenolith were recorded in Piece 2, with diffuse 1 mm dark green halos at the boundaries. Several diffuse, elongated, and rounded mineral patches in Pieces 6 and 7.

ADDITIONAL COMMENTS: From Piece 5 onward, there appears to be a change in texture, with the gabbros becoming more equigranular and larger clinopyroxene oikocrysts developing to give the rock a slightly patchy texture.

Core Photo



312-1256D-231R-3 (Section top: 1490.56 mbsf)

Plutonic Rock

UNIT: 92A

ROCK NAME: Medium-grained orthopyroxene-bearing gabbro

SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro

TEXTURE: Inequigranular seriate, poikilitic

PIECES: 1–10

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	2.0	0.1	1.2	Euhedral
Clinopyroxene:	42	6.0	0.1	2.0	Subhedral–interstitial (as oikocrysts)
Orthopyroxene:	1	1.0	0.1	0.5	Subhedral
Olivine:	<1	1.0	0.1	0.5	Subhedral
Oxides:	1	3.0	0.1	1.5	Interstitial

Modal estimate based on Piece 2 of Section 231R-3.

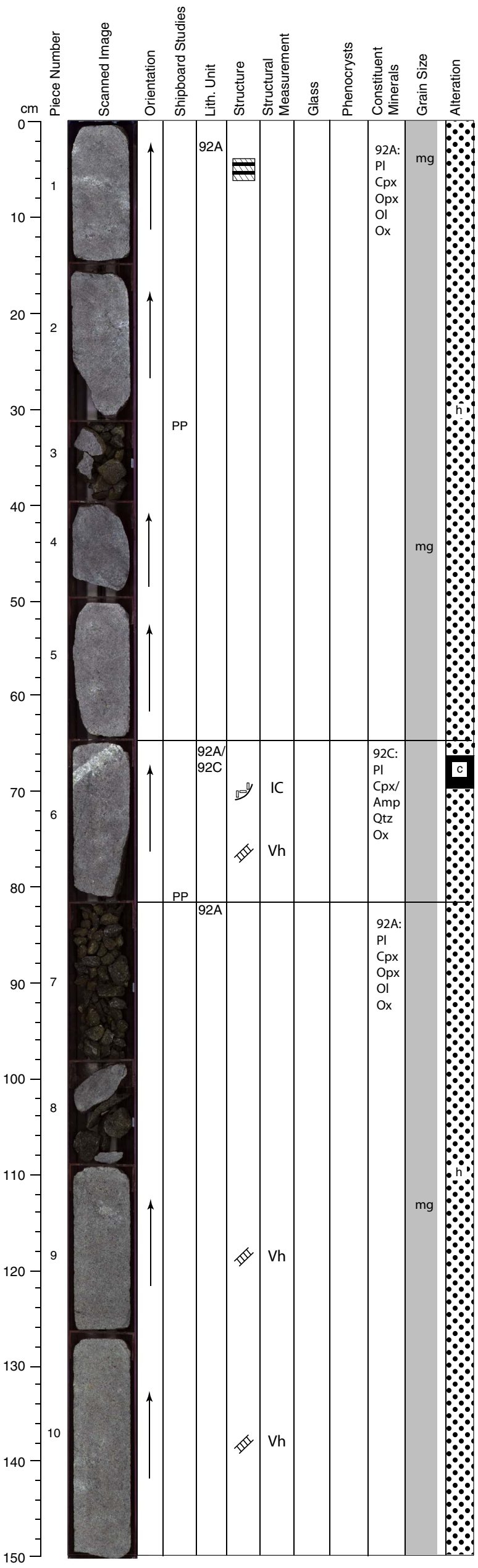
ALTERATION: Highly altered dark greenish gray to dark gray gabbro, with disseminated pyrite.

VEINS: Rare 0.1–0.5 mm chlorite veins with 1 mm dark green halos. Piece 6a has a 0.5–1.5 mm actinolite vein with a 5 mm light gray halo with abundant secondary white feldspar + pyrite. Piece 8 has a diffuse 0.1 mm actinolite? vein with 1 mm light gray halo.

STRUCTURE: All the pieces except 10 are oriented. Hydrothermal veins in Pieces 4, 6, and 8, have dark green and white (chlorite, actinolite, and plagioclase-rich, respectively) fillings and planar and irregular morphologies. Several mineral patches in all the pieces except 3 and 10, with both rounded and elongated morphologies and diffuse boundaries. Irregular fractures, some of which drilling induced, are present mainly in Pieces 5, 7, and 9. In Piece 6, a 5 cm wide leucocratic and altered dikelet is recorded, with planar but diffuse boundaries.

ADDITIONAL COMMENTS: Continuation of gabbro of Unit 92. The poikilitic texture that was noted in the last section continues and persists to the base of this section. The apparent grain size increases downward. The texture is reminiscent of the first gabbros found in this hole, where finer oikocrystic domains are separated by paler and coarser zones with prominent plagioclase. It is interesting that this texture has developed gradually with distance from the margin, and may perhaps reflect differences in the cooling and crystallization history in different parts of the gabbro.

Core Photo



312-1256D-231R-4 (Section top: 1491.93 mbsf)

Plutonic Rock

UNIT: 92A

ROCK NAME: Medium-grained orthopyroxene-bearing gabbro

SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro

TEXTURE: Inequigranular seriate, poikilitic

PIECES: 1–5, parts of 6, 7–10

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	2.0	0.1	1.2	euhedral
Clinopyroxene:	42	6.0	0.1	2.0	subhedral–interstitial (as oikocrysts)
Orthopyroxene:	1	1.0	0.1	0.5	subhedral
Olivine:	<1	1.0	0.1	0.5	subhedral
Oxides:	1	3.0	0.1	1.5	interstitial

Modal estimate based on Piece 2 of Section 231R-3.

ALTERATION: Highly altered dark greenish gray to dark gray gabbro, with abundant disseminated pyrite + pyrrhotite. There are irregular cm-scale coarser-grained patches that are more intensely altered to green actinolite and white secondary feldspar (Pieces 1 and 2).

VEINS: Piece 6 is crosscut by a 10 mm leuco-gabbro dikelet (Unit 92C). 0.2–0.5 mm subvertical chlorite veins crosscut Units 92A and 92C.

STRUCTURE: Pieces 1, 2, 4, 5, 6, 9, and 10 are oriented. Hydrothermal veins in Pieces 6, 9, and 10, with planar, anastomosing, curved morphology and filled by dark green (chlorite-rich) minerals. All of them have 0.1–0.5 mm dark green halos. In Piece 10, there are veins with subparallel orientation. Several alteration and mineral patches are present in Pieces 1, 2, 4, 5, 6, 9, and 10, with irregular, elongated, and amoeboidal morphology and diffuse boundaries. One igneous contact is present in Piece 6 (Unit 92C).

ADDITIONAL COMMENTS: There is no significant variation of grain size in this unit and the presence of a texture with finer ophitic and coarser plagioclase portions persists. A large sulphide is present in Piece 10.

UNIT: 92C

ROCK NAME: Medium-grained quartz diorite

SUMMARY DESCRIPTION: Medium-grained quartz diorite

TEXTURE: Inequigranular seriate

PIECES: Parts of 6

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: igneous contact in Piece 6
Lower: igneous contact in Piece 6

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	70	5.0	0.1	2.5	euhedral–subhedral
Clinopyroxene/Amphibole:	19	2.0	0.1	1.8	subhedral–interstitial
Quartz:	10	0.8	0.1	0.5	interstitial
Oxides:	1	1.0	0.1	0.5	interstitial

Modal estimate based on Piece 6 of Section 231R-4.

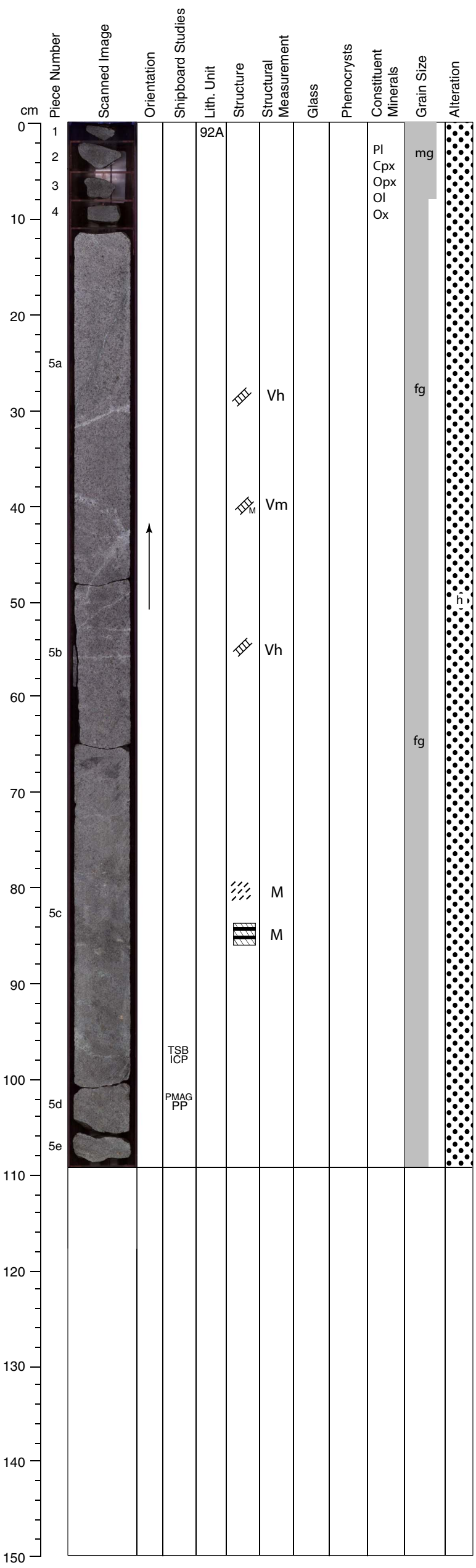
ALTERATION: Completely altered to secondary feldspar + amphibole. Margins are diffuse, but are crosscut by a 0.5 mm chlorite vein.

VEINS: 0.5 mm chlorite vein.

STRUCTURE: Igneous contact in Piece 6 represents a 1 cm dikelet intrusion. Lobulate but sharp boundaries with the host rock. Felsic minerals show higher alteration.

ADDITIONAL COMMENTS: 1 cm wide dike cutting 92A with no chilled margin. Margins are mostly sharp and sutured, but in one portion are partly diffuse.

Core Photo



312-1256D-232R-1 (Section top: 1492.90 mbsf)

Plutonic Rock

UNIT: 92A

ROCK NAME: Medium-grained orthopyroxene-bearing gabbro

SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro

TEXTURE: Inequigranular seriate, poikilitic

PIECES: 1–5

COLOR: Dark bluish gray (5G 4/1)

CONTACTS:
Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1
Lower: none recovered

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	1.5	0.1	0.8	Euhedral
Clinopyroxene:	42	2.0	0.1	1.0	Subhedral–interstitial (as oikocrysts)
Orthopyroxene:	1	1.0	0.1	0.8	Subhedral–interstitial
Olivine:	<1	1.5	0.1	0.8	Subhedral
Oxides:	1	1.0	0.1	0.8	Interstitial

Modal estimate based on Piece 5d of Section 232R-1.

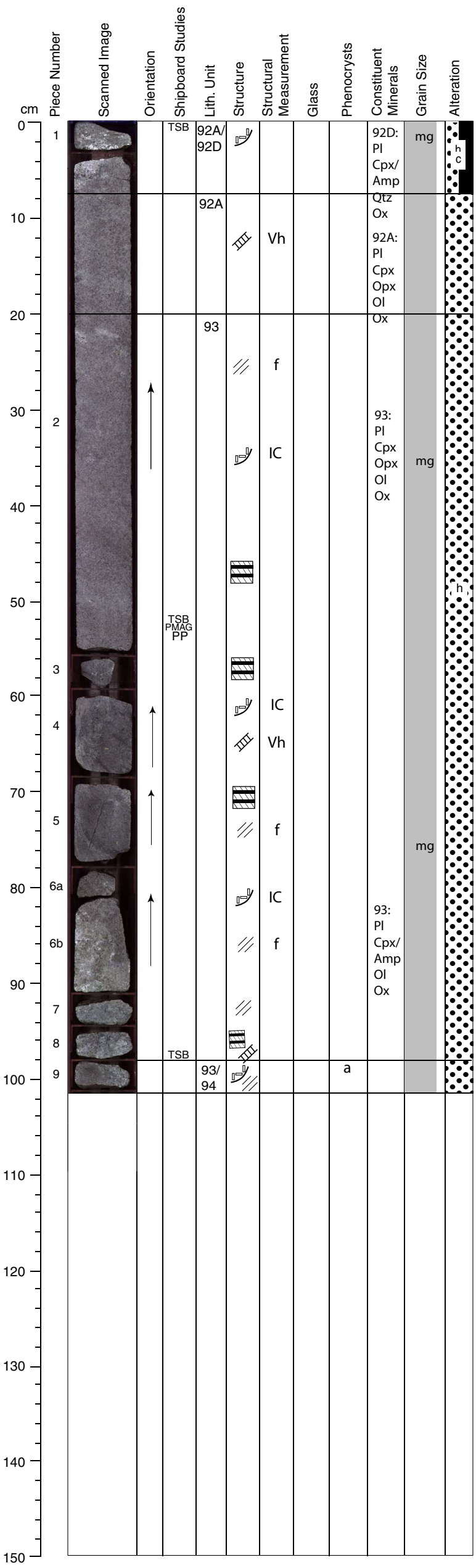
ALTERATION: Highly altered dark greenish gray to dark gray gabbro, with abundant disseminated pyrrhotite (grains as large as 5 mm). Crosscut by common irregular/diffuse coarser gabbro dikelets.

VEINS: Several diffuse 1 mm light green actinolite + secondary feldspar veins. Piece 5 has a 1 mm quartz + chlorite vein with a 2 mm dark green halo flanked by a 15 mm band in which there is common chlorite replacement of mafic minerals.

STRUCTURE: Piece 5 is oriented. Several hydrothermal veins in Pieces 5a and 5b with white, light green, dark green (plagioclase, quartz-chlorite, and actinolite, respectively) mineral fillings. These veins are diffuse and have irregular, anastomosing and splayed morphologies. In Pieces 5a and 5b, there is a coarse-grained leucocratic and irregular dikelet with diffuse contacts. Piece 5c shows several fine-grained textural bandings of both leucocratic and melanocratic minerals. Two mineral foliations associated with flow bandings were recorded in Piece 5c, which show a subparallel orientation with the textural bandings.

ADDITIONAL COMMENTS: Continuation of gabbro of Unit 92. While the overall grain size appears to remain the same, the strength of the poikilitic texture seems to drop toward the bottom of this section, perhaps related to a decrease in the size of the ophitic clinopyroxenes. Piece 5 contains a number of large sulphide blobs. In some cases, the diffuse coarse patches attain a size of >1 cm, and are associated with small veins or dikes of coarse material, as in Piece 5a.

Core Photo



312-1256D-232R-2 (Section top: 1493.98 mbsf)

Plutonic Rock

UNIT: 92A
ROCK NAME: Medium-grained orthopyroxene-bearing gabbro
SUMMARY DESCRIPTION: Medium-grained orthopyroxene-bearing gabbro
TEXTURE: Inequigranular seriate, poikilitic
PIECES: Parts of 1 and 2
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: disappearance of basaltic xenoliths in gabbro from Piece 12 of Section 230R-1; Lower: reappearance of basaltic fragments in gabbro at Piece 2 of Section 232R-2

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	1.5	0.1	0.8	euhedral
Clinopyroxene:	42	2.0	0.1	1.0	subhedral–interstitial (as oikocrysts)
Orthopyroxene:	1	1.0	0.1	0.8	subhedral–interstitial
Olivine:	<1	1.5	0.1	0.8	subhedral
Oxides:	1	1.0	0.1	0.8	interstitial

Modal estimate based on Piece 5d of Section 232R-1.
ALTERATION: Highly altered dark green gray gabbro.
VEINS: No veins
STRUCTURE: See comments
ADDITIONAL COMMENTS: The poikilitic texture is still present in Piece 2, and there is no clear decrease in grain size as the base of the Unit and the associated intrusion is approached.

UNIT: 92D
ROCK NAME: Medium-grained oxide bearing quartz diorite
SUMMARY DESCRIPTION: Medium-grained oxide bearing quartz diorite
TEXTURE: Inequigranular seriate
PIECES: Parts of 1 and 2
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: not recovered; Lower: igneous contact in Piece 2

PRIMARY MINERALS:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	45	11.0	0.1	2.5	euhedral
Clinopyroxene/Amphibole:	48	6.0	0.1	2.5	euhedral–subhedral
Quartz:	5	0.5	0.1	0.2	interstitial
Oxides:	1	2.0	0.1	1.5	interstitial

Modal estimate based on Piece 1 of Section 232R-2.
ALTERATION: Highly to completely altered coarse grained diorite with abundant secondary feldspar and amphibole replacing pyroxene. Disseminated pyrrhotite.
VEINS: No veins
STRUCTURE: Two igneous contacts were recorded in Pieces 1 and 2. The contact in Piece 1 has a sharp boundary, whereas in Piece 2 it is diffuse. Increase in grain size of the felsic minerals from the central portion to the edge of the intrusion in Piece 2.
ADDITIONAL COMMENTS: Thin dike with diffuse contact.

UNIT: 93
ROCK NAME: Medium-grained gabbro
SUMMARY DESCRIPTION: Mixed medium-grained gabbro and basalt fragments in marginal unit
TEXTURE: Hetereogeneous. equigranular in medium-grained gabbro, possible granular in fine-grained basalt fragments, inequigranular seriate in coarse portion
PIECES: 2–8, parts of 9
COLOR: Dark bluish gray (5G 4/1)
CONTACTS: Upper: appearance of basaltic xenolith fragment in Piece 2; Lower: contact with coarse gabbro in Piece 9
PRIMARY MINERALS:

Medium-grained portion:	% Mode	Grain Size (mm): Max	Min	Avg.	Shape/Habit
Plagioclase:	55	1.5	0.1	0.8	Euhedral
Clinopyroxene:	42	2.0	0.1	1.0	Subhedral–interstitial (as oikocrysts)
Orthopyroxene:	1	1.0	0.1	0.8	Subhedral–interstitial
Olivine:	<1	1.5	0.1	0.8	Subhedral
Oxides:	1	1.0	0.1	0.8	Interstitial

Modal estimate based on Piece 5d of Section 232R-1.

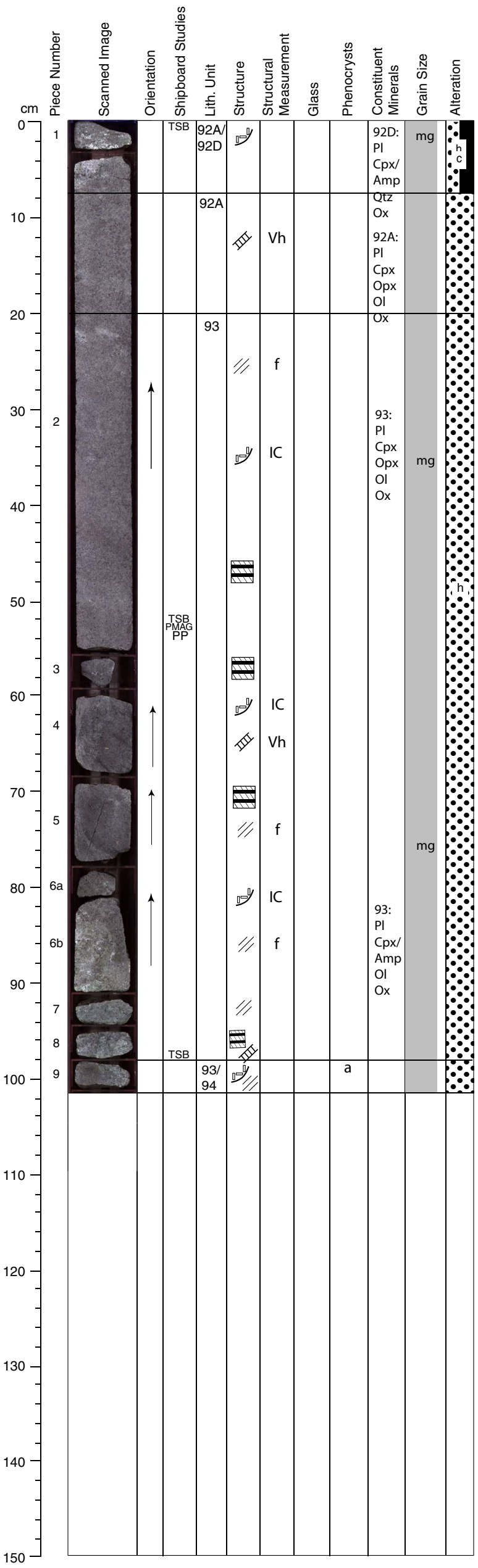
Coarse grained gabbro portion:					
Plagioclase:	35	4.0	0.5	1.5	Subhedral
Clinopyroxene/Amphibole:	62	4.0	0.5	2.0	Euhedral–subhedral
Orthopyroxene:	1	3.0	0.1	1.5	Subhedral
Oxides:	<1	2.0	0.1	1.0	Interstitial
Olivine:	<1	2.0	0.1	1.0	Subhedral

Modal estimate based on Piece 6b of Section 232R-1.

ALTERATION: Highly altered dark greenish gray gabbro with several cm-scale moderately to highly? altered dark gray basalt clasts. Abundant disseminated pyrrhotite. The pegmatitic base of this Unit is highly to completely altered to secondary feldspar + amphibole.
VEINS: Several 0.5 mm chlorite veins.
STRUCTURE: Pieces 2, 4, 5, and 6 are oriented. Several hydrothermal veins were recorded in Pieces 2, 4, and 6, showing dark green, light green, and white mineral fillings and irregular and planar morphologies. Some of these veins (e.g. Piece 2) are very diffuse and visible by the light green alteration halos (0.1–2 mm). Some irregular fractures are in Pieces 2, 5, 6, 7, and 9. Mostly rounded and altered mineral patches in Pieces 2 and 3; Piece 5 has several leucocratic patches with different shape and diffuse boundaries. Piece 2 contains a basaltic xenolith fragment.
ADDITIONAL COMMENTS: This marginal unit is very similar to the Unit 91 described at the upper contact of this gabbro, containing medium-grained gabbro (similar to Unit 92), fine-grained basaltic fragments, and a coarser, possibly pegmatitic gabbro in Pieces 3, 4, and 6–9, adjacent to the margin. The lower contact in Piece 9a is fairly sharp and sutured, and shows no decrease in the gabbro grain size toward the contact.

(Continued on next page.)

Core Photo



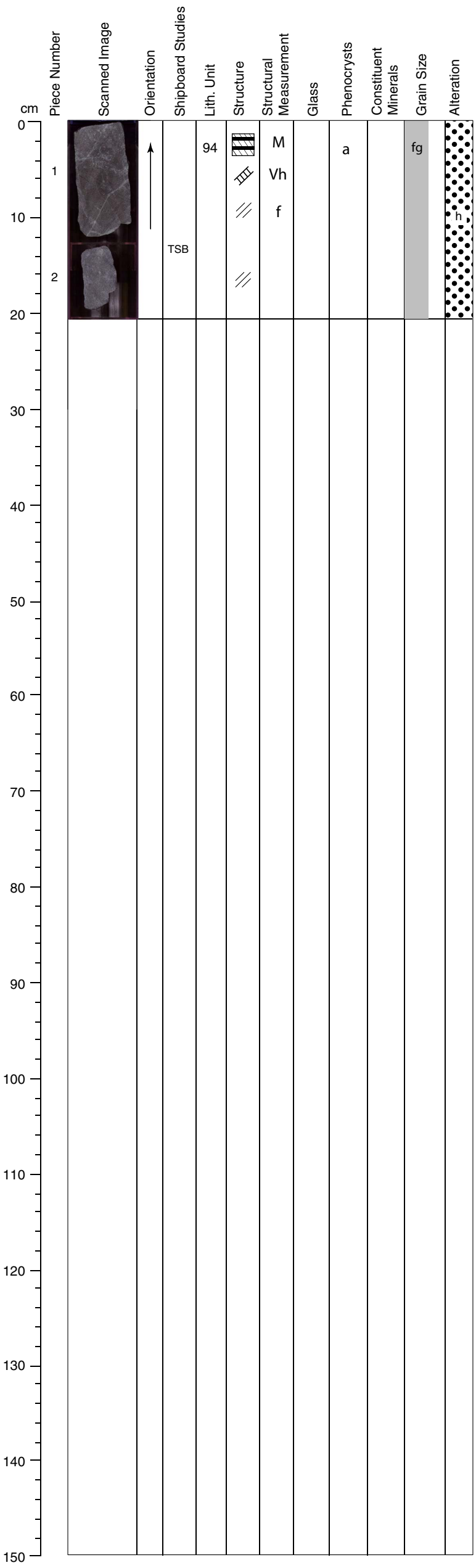
312-1256D-232R-2 (Section top: 1493.98 mbsf)

Continued:

Volcanic Rock (?)

UNIT: 94
ROCK NAME: Fine-grained aphyric basalt
SUMMARY DESCRIPTION: Fine-grained aphyric basalt dike
PIECES: Piece 9
CONTACTS: Upper: cut by gabbro in piece 9; Lower: not recovered
COLOR: Dark bluish gray (5G 4/1)
PHENOCRYSTS: Aphyric
GROUNDMASS: Grain size: fine grained; Texture: intergranular, overprinted by metamorphism
VESICLES: None
ALTERATION: Moderately to highly altered dark gray basalt
VEINS: No veins
STRUCTURE: An igneous contact with diffuse boundaries was recorded in Piece 9; it is cut by three irregular fractures.
ADDITIONAL COMMENTS: Similar texture and relationship to gabbro intrusion as Unit 90A. It is not certain whether this fine-grained portion of Piece 9 is a basaltic xenolith in the gabbro or is truly the margin, but we log it as part of Unit 94, which continues in the next two sections.

Core Photo



312-1256D-233R-1 (Section top: 1497.50 mbsf)

Volcanic Rock (?)

UNIT: 94

ROCK NAME: Fine-grained aphyric basalt

SUMMARY DESCRIPTION: Fine-grained aphyric basalt dike

PIECES: 1-2

CONTACTS:
Upper: cut by gabbro in Piece 9 of Section 232R-2
Lower: not recovered

COLOR: Dark bluish gray (5G 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: fine grained
Texture: intergranular, overprinted by metamorphism

VESICLES: None

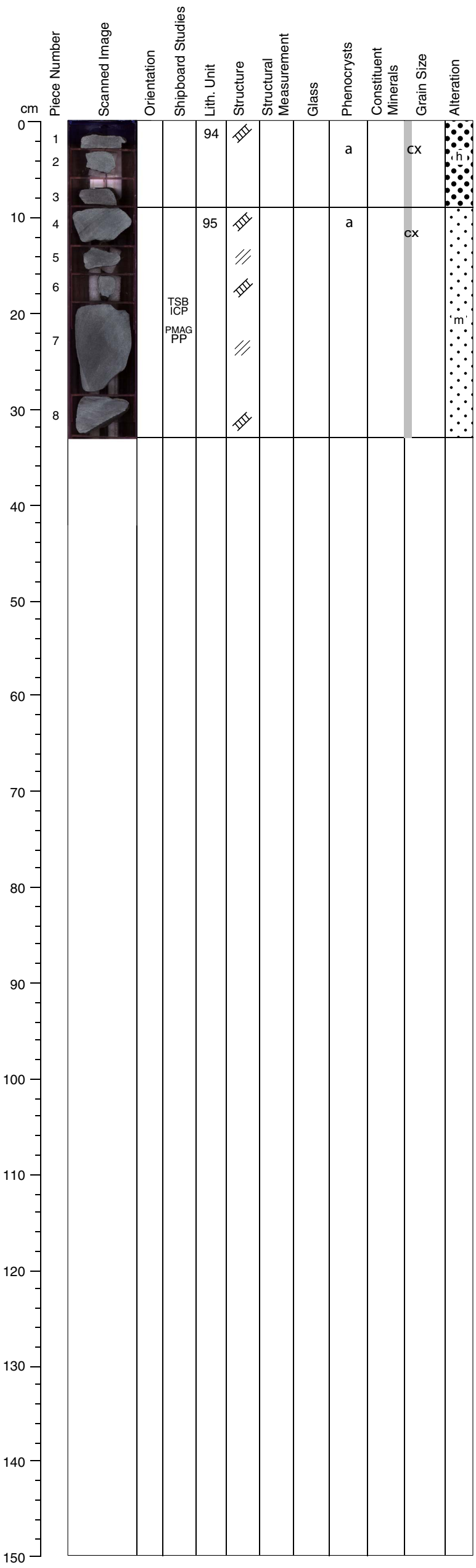
ALTERATION: Highly altered and probably recrystallized basalt, crosscut by 1–5 mm gabbroic dikelets with 5 mm dark green halos around diffuse margins. Abundant pyrrhotite.

VEINS: 0.5 mm actinolite vein with a 1 mm diffuse dark green halo that crosscuts the gabbro dikelets and host basalt in Piece 1, which is in turn cut by 0.1 mm chlorite veins.

STRUCTURE: Piece 1 is oriented, and has several hydrothermal veins with light green and dark green (chlorite- and actinolite-rich, respectively) mineral fillings. Some veins are planar, others irregular, and some of them are diffuse and discontinuous. One irregular coarse-grained leucocratic mineral patch is in Piece 1. Piece 2 shows one irregular fracture, probably drilling induced.

ADDITIONAL COMMENTS: Similar texture and relationship to gabbro intrusion as Unit 90A. Piece 1 is cut by an oxide-rich diffuse vein, which may have emanated from the cooling gabbro.

Core Photo



312-1256D-234R-1 (Section top: 1502.50 mbsf)

Volcanic Rock (?)

UNIT: 94

ROCK NAME: Fine-grained aphyric cryptocrystalline basalt

SUMMARY DESCRIPTION: Fine-grained aphyric cryptocrystalline basalt dike

PIECES: 1–3

CONTACTS:
Upper: cut by gabbro in Piece 9, Section 232R-2
Lower: not recovered

COLOR: Dark bluish gray (5G 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: cryptocrystalline to fine grained
Texture: intergranular and variolitic, overprinted by metamorphism.

ALTERATION: Highly altered recrystallized? dark gray basalt. Disseminated pyrrhotite.

VEINS: Several 1 mm quartz + chlorite veins in Piece 1

STRUCTURE: One hydrothermal vein filled by dark green (chlorite-rich) minerals, with planar and sharp boundaries in Piece 1.

ADDITIONAL COMMENTS: This section shows a gradual drop in grain size from the overlying section, becoming cryptocrystalline.

UNIT: 95

ROCK NAME: Aphyric microcrystalline basalt

SUMMARY DESCRIPTION: Fine-grained aphyric cryptocrystalline basalt dike

PIECES: 4–8

CONTACTS:
Upper: not recovered
Lower: not recovered

COLOR: Dark bluish gray (5G 4/1)

PHENOCRYSTS: Aphyric

GROUNDMASS:
Grain size: microcrystalline
Texture: intergranular and variolitic

ALTERATION: Moderately altered dark green basalt

VEINS: Several 1 mm quartz + chlorite veins in Pieces 4 and 8

STRUCTURE: Several hydrothermal veins filled by dark green and white (chlorite, and quartz-rich, respectively) minerals in Pieces 4, 6, 7, and 8, with very sharp and planar boundaries. In Piece 7, some pyrite crystals show a preferred orientation.

ADDITIONAL COMMENTS: Very pale basalt, with unusually smooth drilled surface. Thin section shows that the nature of alteration is very different to that of Unit 94.

TS #1: 312-1256D-173R-1, 39-42 cm, Piece No: 8 | **Unit: 66** | **OBSERVER: J cm,TY, JK / CL, SM, DT / NH**

ROCK NAME: Sparsely plagioclase-clinopyroxene-olivine phyric fine-grained basalt

WHERE SAMPLED: Dike interior?

GRAIN SIZE: Fine grained

TEXTURE: Hypocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	0.85	0.93					
Clinopyroxene	0.72	0.72	1	2.5	1.8	Subhedral	Also occurs in glomerocrysts, some show sector zoning
Plagioclase	0.13	0.13	1.8	2	1.9	Bladed	
Olivine		0.08	1	2	1.5	Subhedral	Altered to chlorite. Contains altered melt inclusion?
MICROPHENOCRYSTS							
GROUNDMASS	83						
Plagioclase	50					Subhedral, acicular-skeletal	
Clinopyroxene	30	47				Subhedral	Dusty cpx/act
Fe-Ti oxides	3					Subhedral	Probably titanomagnetite
Mesostasis							Altered to brown material.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	5				olivine, plagioclase, interstitial	
albite	10				plagioclase	
prehnite	0.5				plagioclase	locally
dusty cpx/act	17				replacing clinopyroxene	
actinolite	0.5				interstitial	very thin needles protruding from cpx in chlorite
titanite	1.5				disseminated	rarely well crystallized
quartz	0.01				interstitial	associated with chlorite
magnetite	0.3				olivine	associated with chlorite
pyrite	1				disseminated, olivine	

STRUCTURE : No flow or deformational texture, alteration patches are apparently not structurally controlled (not localized by phenocrysts). Good example of fracture in thin section.

COMMENTS : Modal proportions of phenocrysts estimated using high precision scanning method. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Some material classified as mesostasis may be altered plagioclase or clinopyroxene. / Several 0.1-0.2 mm thick veins, mostly plucked out but one vein includes chlorite+pyrite+titanite. No clear associated alteration halo. We define here for the first time dusty cpx/act as the pale brown (PPL = plane polarized light) with dusty replacement product representing an intermediate stage of alteration of clinopyroxene to actinolite.

TS #2: 312-1256D-173R-1, 124-127 cm cm, Piece No: 23 | **Unit: 66** | **OBSERVER: BS,TY, JK, JM / CL, SM / NH**

ROCK NAME: aphyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: fine-grained
TEXTURE: hypocrystalline intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	0.8						
MICROPHENOCRYSTS	0.4	0.59					
Clinopyroxene	0.4	0.4				Subhedral-anhedral	Forms glomerocrysts
Olivine		0.19				Subhedral	Completely altered to chlorite + magnetite
GROUNDMASS	89						
Plagioclase	51					Subhedral-anhedral, Skeletal laths	
Clinopyroxene	30	40				Subhedral-anhedral	Partly occurs in glomerocrysts. Partly altererd
Glass/mesostasis	5						Altered to brown microcrystalline masses
Fe-Ti Oxides	3					Euhedral-subhedral	probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	4				interstitial, plagioclase, olivine	up to 35% in between the chlorite veins
dusty cpx/act	20				replacing clinopyroxene	partial replacement
albite	15				plagioclase	
titanite	1				interstitial	mostly associated with chlorite
prehnite	1				plagioclase	
epidote	0.2				plagioclase	
magnetite	0.2				olivine	associated with chlorite
pyrite	1				disseminated	
chalcopyrite	0.1				disseminated	

STRUCTURE : Alteration patches are phenocryst-controlled. In the center of the section there is a fairly equant vein (almost a vug), filled with quartz crytals with a blocky morphology and chlorite rims. The center of the chlorite-rich veins in the network (on the lower part of the thin section) has ribbons of quartz in their centers. The center of the vein in the upper part of the thin section has chlorite and quartz, but is dominated by vuggy (perhaps anhydrite). Veins do not show a simple opening texture. Instead, fine-grained domains, irregular extinction, and curviplanar structures are evidence for some minor shear strain accommodated by the vein.

COMMENTS : Modal proportions of phenocrysts estimated using high precision scanning method. Modal proportions of groundmass estimated by comparison with standard visual estimation chart. Three 0.1 mm chlorite-quartz-pyrite-prehnite-(epidote) veins anastomosing as a 1.5 mm vein composed of the same minerals + anhydrite at center. Another 0.1-2 mm chlorite-quartz-pyrite vein ends against the other veins. The region located between the anastomosing veins is chlorite rich.

TS #3: 312-1256D-173R-2, 6-10 cm, Piece No: 1C **Unit: 66** **OBSERVER: SY,TY, JK / CL, SM /**

ROCK NAME: Sparsely olivine-plagioclase-clinopyroxene phyric medium- to fine-grained basalt

WHERE SAMPLED: Dike interior

GRAIN SIZE: Fine-grained to medium-grained

TEXTURE: Holocrystalline, intersertal to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	1.3	1.62					
Plagioclase	0.3	0.35	0.7	1.5	1	Euhedral	Contain melt inclusions (only one grain)
Clinopyroxene	1	1.27	0.2	1.5	0.4	Subhedral-anhedral	Often glomerocrysts, often subophitic texture, some show sector zoning
MICROPHENOCRYSTS							
GROUNDMASS	98.5						
Plagioclase	44.5		0.2	1.5	0.8	Euhedral-subhedral laths and anhedral interstial plagioclase	Some interstial plagioclase show micrographic texture, zoning
Clinopyroxene	39		0.1	0.5	0.3	Euhedral-subhedral	strongly altered to dusty brownish cryptocrystalline masses
Fe-Ti Oxide	5		0.01	0.2	0.1	subhedral	probably titanomagnetite
Glass/mesostasis	10						Completeley altered to brown and green phyllosilicates

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	7				olivine, plagioclase, interstitial	locally abundant, associated with quartz and actinolite as mm patches
dusty cpx/act	18				replacing clinopyroxene	partial replacement
actinolite	1				interstitial, clinopyroxene	associated with chlorite in mm patches
albite	10				plagioclase	
titanite	0.8				interstitial	more abundant in chlorite-actinolite mm patches
quartz	1				interstitial	associated with chlorite-actinolite in mm patches
pyrite	0.5				disseminated	
chalcopyrite	0.01				disseminated	

STRUCTURE : Alteration patches surround some phenocryst. Cpx glomerocrysts strongly localize intense fracturing, almost cataclastic textures, but surrounding texture is unfractured. Some tiny veins are discontinuous, parallel, splayed and filled with chlorite and quartz. Local alteration of phenocrysts.

COMMENTS : Modal proportions of phenocrysts estimated using high precision scanning method. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Several parallel 0.03 mm veins composed of chlorite alternating with quartz. No associated alteration halos.

TS #4: 312-1256D-174R-1, 70-73 cm, Piece No: 7, 14						**Unit: 68**	**OBSERVER: JK / SM, CL, DT / NH**
ROCK NAME:	Aphyric fine-grained basalt						
WHERE SAMPLED:	Dike interior						
GRAIN SIZE:	fine grained						
TEXTURE:	hypocrystalline intersertal to variolitic						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS							
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	45					subhedral laths	moderaltely altered
Clinopyroxene	35					Subhedral-anhedral prismatic	altered to tiny needles of actionolite and brownish dusty material
Glass/mesostasis		15					comleteley altered to chlorite and cryptocrystalline masses
Fe-Ti Oxides	5					Euhedral-subhedral granular	probably titanomagnetite

SECONDARY		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
chlorite	5				plagioclase, interstitial	predominant in patches
quartz	0.5				interstitial	in patches only, associated with chlorite
pyrite	1				disseminated	often associated with chlorite in patches
dusty cpx/act	5				clinopyroxene	partly altered cpx
actinolite	25				clinopyroxene	
epidote	0.5				interstitial	
prehnite	0.5				plagioclase	
calcite	0.5				plagioclase?	in patches and groundmass around patches
albite	20				plagioclase	dominant secondary mineral in background

STRUCTURE : Alteration patch in center of thin section makes an elongate band dipping to the east. < 0.5 mm irregularly shaped patches of dominantly chlorite. The patches do not contain obvious relict phenocrysts.

COMMENTS : No glomerocrysts and alteration is relatively interstitial.

TS #5: 312-1256D-174R-1 92-97 cm, Piece No: 18 | **Unit: 68** | **OBSERVER: JK / CL, SM / NH**

ROCK NAME: Aphyric fine-grained basalt with completely altered zones
WHERE SAMPLED: probably dike interior
GRAIN SIZE: fine grained
TEXTURE: holocrystalline intergranular (for the primary rock)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS	< 0.5						
olivine		<0.5	0.5	2		subhedral prismatic	completely altered to chlorite and magnetite
clinopyroxene	<0.5		0.2	0.5		euhedral prismatic	partly altered to chlorite
GROUNDMASS							
Plagioclase	50					subhedral laths	strongly altered (chlorite, epidote?, brownish cryptocrystalline masses)
Clinopyroxene	45					subhedral, primatic	strongly altered to chlorite and green- brownish actinolite
Glass/mesostasis							
Fe-Ti Oxide	5					Euhedral-subhedral, skeletal	probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	2				interstitial	
actinolite	25				clinopyroxene	
dusty cpx/act	5				clinopyroxene	
titanite	3				disseminated	
laumontite? albite?	45				plagioclase	
pyrite	1				disseminated	
chalcopyrite	0.2				disseminated	

STRUCTURE : Grains in quartz aggregate exhibit weak undulatory extinction. Fractures distributed through section, and one cuts across alteration patch.

COMMENTS : Very heterogeneous rock due to zones of alteration with different intensity. Modal proportions of the primary rock estimated by comparison with standard visual estimation chart. The whole thin section is part of an alteration patch where the basalt is moderately to highly replaced by different mineral assemblages in subconcentric, cm-scale zones. The core of this altered region is made of quartz-laumontite-prehnite±epidote surrounded by chlorite, then epidote-quartz-actinolite and an external light gray zone of zeolite (laumontite?) and actinolite. Large pyrite grains occur along the diffuse boundary between the light gray and dark gray moderately altered basalt The proportions of secondary minerals given above concern the least altered part of the thin section. See Initial Report for more details and sketch. Magnetite needles within alteration patches.

TS #6: 312-1256D-174R-1, 130-134 cm, Piece No: 23						**Unit: 68**	**OBSERVER: BS, JK / CL, SM / AV**
ROCK NAME:	Aphyric fine-grained basalt						
WHERE SAMPLED:	sheeted dike complex						
GRAIN SIZE:	fine grained						
TEXTURE:	hypohyalin intergranular to intersertal						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS							
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	50					acicular, skeletal laths	in part dentritic, often clusters of acicular crystals radiating from a nucleus
Clinopyroxene	35					subhedral-anhedral	
Glass/mesostasis	5						Altered to chlorite and brownish microcrystalline masses
Fe-Ti Oxides	10					euhedral to subhedral	probably titanomagnetite; clusters of very tiny oxides in the mesostasis

SECONDARY		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
chlorite	4				interstitial, plagioclase	
dusty cpx/act	15				clinopyroxene	partial replacement
actinolite	0.2				interstitial	protruding from cpx
albite	0.5				plagioclase	
quartz	0.2				interstitial	associated with chlorite
pyrite	1				disseminated	
chalcopyrite	0.05				disseminated	

STRUCTURE : No flow-related or plastic deformation structures appear in the thin-section. Some fractures are present in glomerocrysts and larger phenocrysts.

COMMENTS : Modal proportions of primary rock (minerals) estimated by comparison with standard visual estimation chart. No veins. Magnetite skeletons can be commonly observed, with, usually, (pseudo)cubic habit and in sizes up to 100 microns.

TS #7: 312-1256D-175R-1, 43-46 cm, Piece No: 11 | **Unit: 68, 69** | **OBSERVER: J cm,JK / CL /AV**

ROCK NAME:
WHERE SAMPLED: Dike margin
GRAIN SIZE: Fine grained, cryptocrystalline (see comment)
TEXTURE: Intergranular, Spherulitic to variolitic (see comment)
HOST ROCK: UNIT 68

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	Aphyric						
GROUNDMASS	100						Strongly altered - estimate groundmass from alt. minerals
Plagioclase	50					subhedral acicular	strongly altered; filled with chlorite and cryptocrystalline masses
Clinopyroxene	40					subhedral prismatic	strongly altered to greenish-brownish actinolite
Fe-Ti oxides	5					subhedral to anhedral	often a mixture of two different oxide phases; mostly probabl titanomagnetite
Mesostasis	5						

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	2					60% in alteration halo
actinolite	40				clinopyroxene	0% in alteration halo
titanite	5					10% in alteration halo
albite	20				plagioclase	5% in alteration halo
magnetite	0					5-90% in alteration halo
pyrite	1				disseminated	0% in alteration halo

LATER INTRUSION:
UNIT 69

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	0.5	0.8					
Plagioclase	0.3	0.34	0.5	1	0.8	Euhedral laths	
Clinopyroxene	0.2	0.46	0.5	1	0.8	Euhedral	Mostly fresh some parts altered to chlorite
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	45						
Fe-Ti oxides	7					anhedral skeletal	probably titanomagnetite
Mesostasis	48						

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	0.1				clinopyroxene, plagioclase	
actinolite	0.05				clinopyroxene	
prehnite	0.05				plagioclase	
albite	0.05				plagioclase	
pyrite	0.05				disseminated	

STRUCTURE : Two domains: Domain 1 (Unit 68) is fine grained and Domain 2 (Unit 69) is cryptocrystalline. Domain 1 has no preferential alignment of the long axes of plagioclase crystals. In the lower-left corner of domain 1 a diffuse vein with an irregular morphology contains opaque anhedral crystals (secondary titanomagnetite) and accompanies a 1.5 mm chloritic halo. This vein is cut by the chilled margin. The chilled margin has an undulose morphology. In some parts near the chilled margin in the domain 1 there is some chloritic alteration. Plagioclase phenocryst, located within 1.5 mm of the chilled margin boundary, have a preferred orientation with long axes parallel to the chilled margin boundary. A diffuse vein with sigmoidal shape is 2-2.3 mm from the chilled margin, and contains abundant titanomagnetite (secondary) that forms a slight halo. The sigmoidal shape of this vein suggest oblique opening/shear strain. At about 1.5 cm from the chilled margin another vein is subparallel and contains large (subhedral) titanomagnetite that have exsolution lamellae. Another conjugate vein, at about 2 cm from the chilled margin, also contains titanomagnetite crystals. In this vein plagioclase crystals have long axes subparallel to the chilled margin, at an angle of about 10-20 degrees suggesting oblique (dextral) opening. Other veins of about 0.1 to 0.3 mm wide are oriented at an angle of about 40-50 degrees with respect to the titanomagnetite-rich veins. These contain abundant quartz and prehnite with radial and blocky habits. Quartz-prehnite veins cut, but do not displace, titanomagnetite-rich veins. howver, this relation is somehow uncertain siince pumpellyte-rich veins stop a few milimiters after passing the titanomagetite-rich veins. Pumpellyte-rich veins have irregular to planar morphologies and the wider one present also a Y-shape morphology. Near the upper left corner of the thin-section, a ca. 3 mm long and 0.2 mm wide sigmoidal vein containing quartz indicates a clear dextral sense of shear. At this point. plagioclase crystals in the ground mass do not show any preferential orientation. Quartz in this latter vein exhibits undulose extintion. Also in the upper left corner of the thin section, another vein of about 0.3 mm wide has quartz, in the center, and chlorite, in the border, as mineral filling. The vein has a splayed morphology, with subsidiary veins containing mostly chlorite. Some titanomagnetite, subhedral, crystals are also present in the main vein. These crystals exhibit at least two compositional (?) phases. Some unusually large pyroxene and plagioclase crystals are located next to this latter vein.

TS #7: 312-1256D-175R-1, 43-46 cm, Piece No: 11	Unit: 68, 69	OBSERVER: J cm,JK / CL /AV
ROCK NAME:		
WHERE SAMPLED:	Dike margin	
GRAIN SIZE:	Fine grained, cryptocrystalline (see comment)	
TEXTURE:	Intergranular, Spherulitic to variolitic (see comment)	
HOST ROCK: UNIT 68		
COMMENTS :	This thin section slide contains parts of 68 and 69 as well as the intrusive contact. Observations from Unit 68 are given first, followed by the observations from Unit 69 after the comma. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Some material classified as mesostasis may be altered plagioclase or clinopyroxene. Unit 68 has been strongly altered. Unit 69 varies in groundmass grainsize and texture with distance with its cooling contact. In a 1 mm wide zone at the margin, the grain size is truly cryptocrystalline and a spherulitic texture is developed. With increasing grain size away from the contact the texture develops from intersertal (at a distance of 10 mm) to variolitic (at 40 mm). In one patch, on the left hand side of the slide, about 30 mm away from the contact, a trachytic texture is developed, with plagioclase long axes aligned parallel to the dike margin. This may reflect flow alignment. Phenocrysts directly at the chilled margin are aligned parallel to the margin suggesting magmatic flow parallel to the dike margin. At one point, the flow appears to diverge around a small phenocryst. There are a number of euhedral, 1-2 mm clinopyroxene phenocrysts in Unit 69, which are not commonly reported from MORB. / In later intrusion (unit 69), several veins occur: (A) one 0.5 mm vein of (1) chlorite, (2) prehnite, (3) quartz, and (1, 2, or 3) pyrite; (B) One 0.2 mm calcite vein crosses and merges into vein (A); (C) several 0.03 mm parallel prehnite veins; (D) several 0.1-0.15 mm veins of euhedral quartz + later laumontite; (E) several 0.2 mm chlorite + quartz + pyrite veins. The crosscuting relationships are to be determined... In host rock (Unit 68), one vein composed of chlorite and numerous magnetite grains, with diffuse boundaries, sub-perpendicular to the dike contact. 1.5-2 mm alteration halo associated with this vein. One vein composed of chlorite + large pyrite crystals (+ small magnetite ?) along the dike margin - host rock contact, with a chlorite rich alteration halo.	

TS #8: 312-1256D-175R-1, 58-62 cm, Piece No: 13 **Unit: 69** **OBSERVER: BS, / CL, SM / AV, RA**

ROCK NAME: aphyric cryptocrystalline basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: cryptocrystalline
TEXTURE: hypocrystalline intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS	< 1	0.49					
Clinopyroxene	< 1	0.11	0.3	0.4	0.35	Euhedral	
Plagioclase	< 1	0.38	0.6	0.7	0.65	Euhedral	often altered to chlorite
GROUNDMASS	100						
Plagioclase	47					Skeletal laths, acicular	Some swallow-tail structures
Clinopyroxene	40					Subhedral-anhedral	strongly altered to brownish cryptocrystalline masses
Glass/mesostasis	10						unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	3					subhedral to anhedral granular	some are skeletal, probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	1				plagioclase, interstitial	
dusty cpx/act	40				replacing clinopyroxene	
albite	0.1				plagioclase microphenocrysts	
titanite	0.3				disseminated	
pyrite	1				disseminated, plagioclase	

STRUCTURE : Vein developed along the length of the thin section is composed of chlorite and quartz. Chlorite aggregates are mostly distributed in the center of the vein together with elongated pyrite, and fine-grained quartz grains in the border zones. Quartz exhibits weak undulatory extinction. No significant shape preferred orientation that indicates magmatic flow was observed. Plagioclase phenocrysts are intensely fractured and altered.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Modal proportions of phenocrysts in percent estimated using high precision scanning technique. One 0.05-2 mm vein of chlorite-quartz-pyrite-minor titanite. No associated alteration halo.

TS #9: 312-1256D-175R-1, 113-117 cm, Piece No: 22						**Unit: 69**	**OBSERVER: BS,JK / CL, SM / NH**
ROCK NAME:	Aphyric fine-grained basalt						
WHERE SAMPLED:	sheeted dike complex						
GRAIN SIZE:	fine grained						
TEXTURE:	intergranular to intersertal						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS							
MICROPHENOCRYSTS		0.54					
Plagioclase	< 0.5	0.15	0.4	1	2	subhedral tabular	forms glomerocrysts with clinopyroxene
Clinopyroxene	< 0.5	0.39				subhedral prismatic	forms glomerocrysts with plagioclase
GROUNDMASS	100						
Plagioclase	50					Skeletal laths, acicular	often clusters of acicular crystals radiating from a nucleus
Clinopyroxene	41					Subhedral-anhedral	
Glass/mesostasis	5						completely altered to chlorite and brownish microcrystalline masses
Fe-Ti Oxides	4					subhedral	

SECONDARY		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
chorite	5				interstitial, plagioclase	form patch when abundant
quartz	0.1				interstitial	associated with chlorite
titanite	0.5				disseminated	more abundant in chlorire patches
dusty cpx/act	15				replacing clinopyroxene	
actinolite	0.5					protruding from cpx
albite	2				plagioclase	
prehnite	0.1				plagioclase	
pyrite	1				disseminated	

STRUCTURE :	No structures of note.
COMMENTS :	Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Modal proportions of phenocrysts in percent estimated using high precision scanning technique. No veins.

TS #10: 312-1256D-176R-1, 8-12 cm, Piece No: 3a | **Unit: 69** | **OBSERVER: TY / CL, SM / AV, LG**

ROCK NAME: aphyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: fine grained
TEXTURE: holocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	55		0.1	1	0.5	Subhedral-anhedral, Skeletal laths	often clusters of acicular crystals radiating from a nucleus, often filled with patches of chlorite
Clinopyroxene	38		0.05	0.5	0.2	Subhedral-anhedral	Some are dendritic, often altered to cryptocrystalline dusty brownish masses
Fe-Ti Oxides	2		0.05	0.2	0.1	Subhedral-anhedral	probably titanomagnetite
Glass	5						completely altered to brown microcrystalline masses.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	3				interstitial, plagioclase, olivine, clinopyroxene	up to 50% in dark patch
dusty cpx/act	20				replacing clinopyroxene	up to 8% in dark patch (completely replacing cpx)
actinolite	0				clinopyroxene	up to 30% in dark patch (completely replacing cpx)
titanite	0				replaces titanomagnetite in pat	3% in dark patch (replaces titanomagnetite)
albite	1.5				plagioclase	35% in dark patch
prehnite	0				interstitial, plagioclase	1% in dark patch
magnetite	0.05				olivine	associated with chlorite
quartz	0				center of alteration patch	up to 20 % in patch
pyrite	1				disseminated	
sphalerite	0.01				center of alteration patch	0.1 % in patch

STRUCTURE : Thin section consists of relatively fresh basaltic part with elongate plagioclase and cpx crystals and altered patches with chlorite-actinolite and quartz growth. Vein network of mainly irregular veins exhibits several crosscutting relationships: quartz-rich veins cut the others. Quartz-rich veins show planar morphology and sharp boundaries with the host rock, whereas chlorite-rich veins are more diffuse. Alteration is controlled by development of diffuse chlorite veins. Quartz in the quartz-chlorite-actinolite alteration patch exhibits weak to moderate undulatory extinction. In contrast, quartz grains in the veins do not show undulatory extinction. No clear shape preferred orientation in basaltic part. Late stage calcite in many veins shows evidence for dilation.

COMMENTS : Modal proportions of primary gm? estimated by comparison with standard visual estimation chart. Fan-like aggregates of plagioclase and dendritic clinopyroxene are observed in places. / Several veins occur: (A) 0.5 mm thick, composed of abundant prehnite (giving the milky appearance of this vein on hand specimen) chlorite and pyrite; (B) laumontite alternating with calcite; (C) abundant quartz, minor chlorite at center and rim, reopened on its edge by a laumontite vein; (D) laumontite alone; (E) minor euhedral quartz at the edge, abundant laumontite at center (F) minor quartz at the edge, prehnite at center; (G) prehnite alone; (H) chlorite + titanite. Crosscuting relationships to be determined... Half of the area of the thin section is alteration patches, that are composed of 80-100 % secondary minerals. These patches consist of subconcentric regions made of, from center to outer regions, quartz ± prehnite ± sphalerite, chlorite + prehnite + titanite, and actinolite + chlorite.

TS #11: 312-1256D-176R-1, 92-94 cm, Piece No: 23 | **Unit: 72** | **OBSERVER: BS, JK/ CL, SM / NH, LG**

ROCK NAME: aphyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: fine grained
TEXTURE: hypocrystalline intersertal to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS	< 1	0.37					
Clinopyroxene		0.33	0.4	0.6	0.5	Euhedral prismatic	forms glomerocrysts
Plagioclase		0.04					
GROUNDMASS	100						
Plagioclase	50					Skeletal laths, acicular	often skeletal, often altered to chlorite
Clinopyroxene	40					Subhedral-anhedral prismatic	mostly altered to brownish masses (probably actinolite involved)
Glass/mesostasis	7						altered to brownish cryptocrystalline masses; unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	3					subhedral to anhedral	probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
chlorite	4				plagioclase, interstitial	
dusty cpx/act	30				clinopyroxene	
actinolite	2				clinopyroxene and dusty cpx/act	
albite	5				plagioclase	
titanite	1.5				disseminated	
pyrite	1				disseminated	

STRUCTURE : Three main veins with blocky quartz defining the median walls, surrounded by fibrous chlorite and disseminated sulfides. Some other very thin, discontinuous veins are present. Most of the veins show simple opening (assuming chlorite-fibers track opening directions), but there is a stepover (offset) in one vein that shows very weak indications of shear displacements (a quartz ribbon, chlorite enrichment in the pull-apart). In one place a quartz-vein crosscuts a chlorite vein, but in another place chlorite cuts quartz. Very sharp boundaries of the veins with the host rock.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Most clinopyroxene crystals have a dusty apperance probably due to a beginning of replacement by actinolite. Two 0.2-0.4 mm veins composed of (1) chlorite + very minor actinolite, (2) pyrite + quartz (fluid inclusions) + titanite. 0.2 mm thick discrete alteration halo where clinopyroxene is partly replaced by actinolite.

TS #12: 312-1256D-176R-1, 133-136 cm: Piece No: 31 | **Unit: 70** | **OBSERVER: BS, JK / SM, CL / NH, LG**

ROCK NAME: aphyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: fine grained
TEXTURE: hypocrystalline intersertal to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	45					Acicular laths, skeletal	Often clusters of radiating acicular crystals
Clinopyroxene	40					Subhedral-anhedral, prismatic, to acicular, some are dentritic	Mostly altered to brownish cryptocrystalline masses
Glass/mesostasis	10						Altered to brown brownish cryptocrystalline masses; unclear how much glass was initially present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	5					Subhedral, partly skeltal	Probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Chlorite	5				Plagioclase, interstitial	Often found as veinlets
Albite	30				Plagioclase	Albitisation varies in intensity through the sample
Dusty cpx/act	20				Clinopyroxene	Partial alteration of clinopyroxene.
Magnetite	2				Clinopyroxene	Seen as blebs in partly altered clinopyroxene.
Pyrite	1				Disseminated	

STRUCTURE : Chlorite-rich veins with discontinuous domains of quartz, local actinolite and sulfides. Apparently reduced grain sizes are possible evidence for non-coaxial shear strain. A blocky quartz vein cuts a chlorite-rich vein.

COMMENTS : Modal proportions of primary rock(?)estimated by comparison with standard visual estimation chart. Quartz(fluid inclusions)-chlorite vein with associated pyrite varying in composition along its length from almost 100% quartz to almost 100% chlorite. Pyrite makes up approx 5% of this vein. The other vein in this section is 70% Chlorite, 25 % Quartz, 5 % Pyrite.

TS #13: 312-1256D-176R-2, 0-2 cm, Piece No: 1 | **Unit: 71** | **OBSERVER: SV, JK / CL, SM / AV**

ROCK NAME: Aphyric cryptocrystalline basalt (for zone 1, see below)

WHERE SAMPLED: Chilled margin; dike boundary

GRAIN SIZE: Cryptocrystalline

TEXTURE: Variolitic for zone 1; spherulitic at the chilled margin (zone 2) (see comment)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS		0.11					
Plagioclase	0.1	0.11	0.2	0.4	0.2	Euhedral tabular	often altered to chlorite
GROUNDMASS	99.9						
Plagioclase						subhedral, fine needle-like micolites	
Glass/mesostasis							altered to brownish cryptocrystalline masses
Fe-Ti Oxide						subhedral to anhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
albite	0.5				plagioclase	
actinolite	5				clinopyroxene	in the light coarser parts of the thin section

STRUCTURE : Vein network arrangment of several types of veins with different mineral infillings together with a highly altered chilled margin. Oldest (magmatic) vein, located in the right side of the thin section, contains what it seems to be pyroxene highly altered to brownish amphiboles and actinolite. This vein is cut by an network arrangment of veins containing mostly chlorite and albite (?). Chlorite is commonly observed in the borders of the vein, while other minerals are mostly located in the center. However, in smaller veins is only possible to observe chlorite as the infillng material. In the rightmost side of the slide, this alteration becomes pervasive. The network arrangment stops at the chilled margin, and only the youngest veins (containing mostly chlorite) cut the chilled margin. These veins are of about 0.1 mm wide in the massive (left side) part while their thickness increases up to 0.5 mm wide in the deformed domain. Thinnest veins present steps and sigmoidal shapes, perhaps indicating an oblique opening of the vein. The right side of the chilled margin presents several structures, such as folds and thrust movements (relative to the thin section plane). Youngest veins are not affected by these structures. This suggests that the deformed domain experienced a significant semi-plastic shearing of, perhaps, upward direction (relative to the thin section plane and orientation). A ca. 0.1 mm wide vein located in the rightmost side of the chilled margin, interface with the non-deformed domain, presents prehnite. Some veins present small, subhedral crystals with high birefringence colors (prehnite-pumpelliyte?). In the non-deformmed domain, several elongated (and coarser in grain size) mineral patches form a discontinious foliation parallel to the chilled margin. These become expanded and with irregular shapes near to and in the contact with a chlorite vein in the upper-left corner of the thin-section.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Heterogeneously brecciated and hydrothermally altered dike boundary. Section consists of 3 texturally distinct zones: (1) aphyric cryptocrystalline basalt; (2) chilled margin of the same zone; (3) brecciated hydrothermally altered cryptocrystalline basalt adjacent to the chilled margin. Several 0.02-0.25 mm veins of (A) chlorite + laumontite (replacing euhedral quartz) + titanite; (B) chalcopyrite + laumontite + minor epidote + minor prehnite; (C) prehnite + magnetite + minor chlorite; (D) chlorite + minor quartz + prehnite + laumontite (?) including ± thin actinolite needles. One of the chlorite-rich vein has an adjacent halo. Both grade to an alteration patch made of 50 % chlorite, 8 % magnetite, 42 % zeolite or albite or quartz (?). Prehnite-rich alteration halo adjacent to parallel prehnite veinlet.

TS #14: 312-1256D-176R-2, 3-9 cm, Piece No: 2 | **Unit: 71** | **OBSERVER: SP, TY, JK / CL /**

ROCK NAME: Aphyric cryptocrystalline basalt
WHERE SAMPLED: Dike margin
GRAIN SIZE: Cryptocrystalline
TEXTURE: Variolitic to intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS	<1	0.17					
Plagioclase	<1	0.05	0.02	1	0.5	Euhedral prismatic	
Clinopyroxene	<1	0.13	0.01	0.5	0.3	Euhedral	totally altered to chlorite
GROUNDMASS	100						
Plagioclase	20					subhedral acicular	
mesostasis	75						glass competely altered to brownish cryptocrystalline masses
Fe-Ti Oxide	5						

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolite	10				clinopyroxene phenocryst	clinopyroxene of the groundmass
albite	0.5				plagioclase phenocryst	partially

STRUCTURE : A composite magmatic-hydrothermal breccia. One chilled margin (cm1), oriented parallel to the edge of the thin section, intersects another chilled margin (cm2) at a high angle; the intersection of the two has no clear crosscutting relationship and flow fabrics are folded around the intersection. The relative age of the chilled margins is uncertain. A domain of vein-rich micro-breccia is oriented parallel to the cm1. Surrounding the domain of micro-breccia the entire area is best described as a jigsaw breccia that affects both chilled margins. However, (network-forming) veins cementing the jigsaw breccia do not trace continuously across cm2.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Description of the primary textures are based on areas with lower grade of alteration. Complex network of veins. The main vein (=cement of the breccia) is made of (from edge to center) (1) (locally abundant) chlorite, (2) minor euhedral quartz (replaced by prehnite), (3) actinolite (up to 1 mm long, sometimes euhedral slabs), (4) epidote, (5) later prehnite + titanite, (6) later anhydrite + minor calcite + zeolite (or quartz?) including thin actinolite needles. Part of the clinopyroxene of the cryptocrystalline groundmass is possibly replaced by actinolite.

TS #15: 312-1256D-176R-2, 22-25 cm, Piece No: 4B **Unit: 72** **OBSERVER: BS, SY,JK / SM , CL / RA, AV**

ROCK NAME: ahyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: fine grained
TEXTURE: hypocrystalline intersertal to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS		1.83					
Plagioclase	<1	1.45	0.4	1.2	0.7	Euhedral tabular	forms glomerocrysts with clinopyroxene
Clinopyroxene	<1	0.37	0.1	0.6	0.3	Anhedral prismatic	forms glomerocrysts with plagioclase, in part subophitic with acicular plagioclase chadacrysts
GROUNDMASS	100						
Plagioclase	45					subhedral skeletal acicular	often branching fibers, intergrowth with clinopyroxene, some show cylindric hollows
Clinopyroxene	40					Subhedral-anhedral acicular	intergrown with plagioclase, strongly altered to brownish cryptocrystalline material; mostly microlites
Glass/mesostasis	10						unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	5					subhedral granular, some skeletal	probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Chlorite	5				Plagioclase, interstitial	Dominantly plagioclase replacement
Albite	15				Plagioclase	Partial albitisation of original plagioclase
Dusty Cpx/Act	30				Clinopyroxene	Partially altered clinopyroxene
Pyrite	0.5				Disseminated	
Magnetite	1				Clinopyroxene	Associated with alteration of clinopyroxene. Found as blebs.

STRUCTURE : Primary patches (crystal aggregates) are composed of plagioclase and clinopyroxene crystals. Plagioclase crystals are sorrounded by pyroxene crystals within ophitic texture.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Skeletal magnetite crystals together with pyrite crystals were observed in the matrix of the thin-section. Opaque crystals are about 100 microns size with (pseudo) cubic habit. Alteration patches (approx 5mm) are areas of coarser grained material with albitised plagioclase (40%) and dusty cpx/act (15%). Some chlorite (2%) is evident along fractures in plagioclase laths. These alteration patches make up approx. 5% of the thin section.

TS #16: 312-1256D-176R-2, 83-86 cm, Piece No: 8						**Unit: 69**	**OBSERVER: BS,JK / SM, CL /RA**
ROCK NAME:	aphyric fine-grained basalt						
WHERE SAMPLED:	sheeted dike complex						
GRAIN SIZE:	fine grained						
TEXTURE:	hypocristalline intersertal to variolitic						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS							
MICROPHENOCRYSTS		0.22					
Plagioclase		0.22				euhedral tabular	contains patches and veins of chlorite
GROUNDMASS	100						
Plagioclase	50					subhedral skeletal acicular	often branching fibers, intergrowth with clinopyroxene, some show cylindric hollows
Clinopyroxene	40					Subhedral-anhedral acicular	intergrown with plagioclase, strongly altered to brownish cryptocrystalline material; mostly microlites
Glass/mesostasis	6						unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	4					subhedral granular, some skeletal	probably titanomagnetite
SECONDARY			**SIZE (mm)**				
MINERALOGY	**PERCENT**		**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
Dusty cpx/act	18					Clinopyroxene	Partial replacement of clinopyroxene
Actinolite	7					Clinopyroxene	
Chlorite	2					Clinopyroxene, actinolite, plagioclase	
Albite	30					Plagioclase	
Pyrite	2					Disseminated	

STRUCTURE : Euhedral plagioclase crystals, perhaps section of skeletal laths, are seen in intersertal material. Dendritic growths of clinopyroxene accompany plagioclase laths. Cpx crystals are partly replaced by chlorite and actinolite. Elongated, often skeletal, magnetite grains up to 400 micron are observed. Sulfide minerals are commonly seen.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. / Slightly darker patches are compositionally comparable to the background.

TS #17: 312-1256D-178R-1, 31-34 cm, Piece No: 9						Unit: 73	OBSERVER: BS,JK / SM, CL / NH, LG
ROCK NAME:	aphyric fine-grained basalt						
WHERE SAMPLED:	sheeted dike complex						
GRAIN SIZE:	fine grained						
TEXTURE:	holocrystalline intergranular						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS							
MICROPHENOCRYSTS		0.12					
Plagioclase	< 1	0.12	0.8	1.5	1	euhedral tabular	
GROUNDMASS	100						
Plagioclase	50					subhedral, skeletal laths	often clusters of radiating acicular crystals, many show cylindric hollows
Clinopyroxene	40					Subhedral-anhedral prismatic	strongly altered (actinolite, chlorite, brownish cryptocrystalline masses)
Glass/mesostasis	5						unclear whether glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	5					subhedral granular, some skeletal	probably titanomagnetite

SECONDARY		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
Dusty Cpx/Act	20				Clinopyroxene	Partial alteration of clinopyroxene
Actinolite	8				Clinopyroxene	Partial alteration of clinopyroxene
Albite	30				Plagioclase	
Chlorite	10				Plagioclase, interstitial	Varies through the thin section
Pyrite	0.5				Disseminated	

STRUCTURE : One irregular and splayed fracture from the edge to the center of the thin section.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. No veins

TS #18: 312-1256D-179R-1, 5-9 cm, Piece No: 2 | **Unit: 73** | **OBSERVER: J cm, JK / CL / NH**

ROCK NAME: Aphyric cryptocrystalline basalt
WHERE SAMPLED: Dike margin
GRAIN SIZE: Cryptocrystalline
TEXTURE: hypocrystalline, intersertal to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	0.2	0.43					
Plagioclase	0.05	0.3	0.5	2	1	Euhedral-subhedral bladed-tabular	often filled with alteration patches
Clinopyroxene		0.13	1	2	1.5	Euhedral-subhedral	Altered to chlorite and actinolite?
MICROPHENOCRYSTS							
GROUNDMASS							Percentages given for coarsest part of groundmass
Plagioclase	52						
Mesostasis	45						glass completely altered into brownish cryptocrystalline masses
Fe-Ti oxides	3						

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	0.08				Clinopyroxene phenocryst	
Chlorite	0.02				Clinopyroxene phenocryst, plagioclase	30% in the coarser grained part of the thin section
Albite	0.02				Plagioclase phenocryst	

STRUCTURE : Magmatic-hydrothermal breccia, chilled margins, and veins. From host-rock down (on the upper part of the thin section), a chilled margin is altered by a (prehnite+actinolite+chlorite?) vein oriented parallel to the contact; the chilled margin is replaced by opaques (+?) against the contact. Veins oriented normal to the contact splay and secondary minerals also surround a local breccia domain. A second chilled margin cuts(!) the breccia. One vein is offset dextrally in the lower chilled margin, and sinistrally in the middle of the upper chilled margin. Some weak flow textures are present around grains of plagioclase, but no aligned plagioclases are present.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. The grainsize and groundmass texture vary with distance from the margins. The finest cryptocrystalline material is found at the margin. This material shows a patchiness that may be related to alteration or possibly incipient spherulite formation. Outside of this 1mm wide zone a 3-4 mm wide cryptocrystalline zone with magmatic flow-banding is found. Then, with increasing distance from the margin and increasing grain size, an intersertal texture is developed. At a distance of about 25 mm from the contact a variolitic groundmass texture is observed. These variations record the effect of cooling rate on grain size and texture. The greatest abundance of phenocrysts are found in the finest grained material at the margin, with one 5 mm diameter ol-plag glomerocryst found. The largest phenocrysts are also found at the margin. The margin is sharp, but it is not regular, as parts of the host rock have been ripped off by the intruding dike, and (in 2D at least), 2 mm long fragments of host-rock are incorporated in the dike. Some 1mm size pockets of oxide-rich material are also found near the margin. These may be parts of oxide-rich alteration veins that are found in the host-rock, and have been ripped up and incorporated into the new intrusion. / One 0.1 mm vein of actinolite + quartz + prehnite, with a 5 mm magnetite-rich adjacent alteration halo. Several 0.2 mm quarz + anhydrite + minor prehnite veins and 0.2 mm actinolite veins. One of the actinolite veins is offset by several parallel microfractures.

TS #19: 312-1256D-180R-1, 0-4 cm, Piece No: 7,1						**Unit: 73**	**OBSERVER: SP, JK / CL, SM / LG**
ROCK NAME:	Aphyric cryptocrystalline basalt						
WHERE SAMPLED:	dike interior?						
GRAIN SIZE:	Cryptocrystalline						
TEXTURE:	hypocrystalline variolitic						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS							
MICROPHENOCRYSTS		0.51					
Plagioclase	0.1	0.51	0.1	1	0.3	euhedral tabular	forms glomerocrysts
GROUNDMASS	100						
Plagioclase	45					subhedral tiny fibers	often branching fibers, intergrowth with clinopyroxene
Clinopyroxene	45					subhedral acicular, dentrical	intergrown with plagioclase, strongly altered to actinolite and brownish cryptocrystalline material
Glass/mesostasis	8						unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	2					subhedral granular	tiny grains, disseminated

SECONDARY		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
actinolite	0				clinopyroxene	38 % in alteration halo adjacent to vein A
titanite	0				disseminated	10 % in alteration halo adjacent to vein A
albite	0				plagioclase	50 % in alteration halo adjacent to vein A
pyrite	0.5				disseminated	
chalcopyrite	0.2				disseminated	

STRUCTURE : Several chlorite+actinolite+quartz veins show mainly planar morphology and crosscutting relationships, without any evidence for shear strain. One 0.02 mm vein with irregular to splayed morphology and dark green minerals filling cuts vein A (see comments). Vein network of mainly actinolite veins has very diffuse boundaries with the host rock.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. One 0.01-0.02 mm vein (= vein A) made of actinolite + quartz + minor prehnite, with 1 mm thick associated light gray alteration halo that is 98 % recrystallized (only some titanomagnetite left). Several 0.02 mm actinolite ± minor pyrite ± very minor epidote and prehnite veins, with diffuse boundaries, and with or without discrete 0.2 mm light alteration halo.

TS #20: 312-1256D-181R-1, 27-30 cm, Piece No: 8 **Unit: 73** **OBSERVER: J cm / CL, SM / LG**

ROCK NAME: Aphyric fine-grained basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: Fine grained
TEXTURE: Intergranular/ Variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS	< 1	0.11					
Plagioclase	< 1	0.11	0.8	0.8	0.8	Subhedral tabular equant	
GROUNDMASS	100						
Plagioclase	45					subhedral laths, acicular	often clusters of radiating acicular crystals; some show cylindric hollows, some show graphopyric intergrowth with clinopyroxene
Clinopyroxene	40					Subhedral prismatic, some are skeletal	strongly altered to actinolite and brownish dusty masses
Glass/mesostasis	10						unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	5					subhedral granular, some skeletal	probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolite	15				clinopyroxene	
dusty cpx/act	20				clinopyroxene and dusty cpx/act	
chlorite	1				plagioclase	
albite	1				plagioclase	
pyrite	0.1				disseminated	
chalcopyrite	0.5				disseminated	

STRUCTURE : One planar vein made by quartz+actinolite+sulfides. Quartz crystals are finer grained at the edge and blocky at the center. A thinner planar quartz+calcite vein merges with the previous one.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Modal proportions of groundmass estimated by comparison with standard viusal inspection charts. (A) 0.5 mm vein of (1) chlorite + actinolite at edge or at center, (2) quartz + pyrite in center This vein locally grades to a late magmatic? vein. No real alteration halo, but actinolite replacing clinopyroxene in the host rock is more green when in contact with the vein. (B) 0.2 mm vein of quartz + later calcite perpendicular to A and getting stuck against vein A.

TS #21: 312-1256D-181R-1, 43-47 cm, Piece No: 12 | **Unit: 73** | **OBSERVER: J cm,JK / SM, CL / LG**

ROCK NAME: Aphyric fine grained basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: Fine grained
TEXTURE: Intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS	< 1	0.38					
Plagioclase	< 1	0.38	0.4	0.5	0.4	Euhedral tabular	
GROUNDMASS	100						
Plagioclase	52					subhedral laths, often dentritic	often clusters of acicular crystals radiating from a nucleus; some are hollow along the long side; some show granophyhric(?) intergrowth with clinopyroxene
Clinopyroxene	30					Subhedral prismatic	mostly altered to brownish cryptocrystalline masses;
Glass/mesostasis	15						altered to brown brownish cryptocrystalline masses; unclear how much glass was initially present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	3					subhedral, partly skeltal	probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	18				Clinopyroxene	Partially altered cpx
Actinolite	7				Clinopyroxene and dusty cpx/act	
Albite	5				Plagioclase	Albitisation of plagioclase
Pyrite	0.2				Disseminated	

STRUCTURE : Some plagioclase phenocrysts show undulatory extinction.

COMMENTS : Modal proportions of phenocrysts in percent estimated using from high precision scanning technique. Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. While the groundmass texture is dominantly intergranular, some small patches are variolitic. No veins.

TS #22: 312-1256D-182R-1, 25-28 cm, Piece No: 7 **Unit: 73** **OBSERVER: BS, JK /SM, CL / LG**

ROCK NAME: aphyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: microcrystalline
TEXTURE: hypocrystalline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	0.5	0.57					
Plagioclase	0.5	0.57	0.7	1.3	1	euhedral tabular	
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	42					Subhedral acicular to fibrous	often branching fibers, intergrowth with clinopyroxene; both strongly altered to brownisch cryptocrystalline material
Clinopyroxene	35					Subhedral-anhedral	intergrown with plagioclase, both strongly altered to brownish cryptocrystalline material; mostly microlites
Glass/mesostasis	20						Altered to brownish cryptocrystalline masses; modal proportion very uncertain
Fe-Ti Oxides	3					subhedral to anhedral granular	probably titanomagnetite

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	22				Clinopyroxene	Partial alteration of clinopyroxene
Actinolite	5				Clinopyroxene	
Albite	30				Plagioclase	Albitisation
Chlorite	15				Plagioclase, interstitial	
Pyrite	0.5				Disseminated	

STRUCTURE : Several irregular and subparallel fractures develop from the edge to the center of the thin section, one of which cuts plagioclase phenocrysts. One 0.2 mm vein of chlorite+actinolite with very diffuse boundaries.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Occasional phenocrysts (0.5%) of plagiocalse exhibit albitisation and some chlorite can be observed along twin planes. Occasional veinlets (~0.1mm width) of albite and chlorite (approx. 50:50) plus very minor epidote and titanite are evident making up 0.5% of the section.

TS #23: 312-1256D-184R-1, 10-12 cm, Piece No: 1 | **Unit: 74** | **OBSERVER: SY, JK /SM, CL /RA**

ROCK NAME: Aphyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: Fine grained
TEXTURE: Holocrystalline intersertal to intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS	<1	0.17					
Plagioclase	<1	0.15	0.4	1	0.7	Euhedral tabular	
Clinopyroxene	<1	0.02	0.4	0.8	0.6	Euhedral prismatic	completely altered to actinolite, oxide and brownish dusty masses
GROUNDMASS	100						
Plagioclase	50		0.2	0.8	0.4	Subhedral acicular laths	often skeletal, some show cylindrical hollows, often clusters of radiating acicular crystals
Clinopyroxene	40		0.05	0.3	0.15	Subhedral-anhedral prismatic to acicular	stronly altered to actinolite; and tiny dusty oxide
Mesostasis	5						unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	5		0.01	0.2	0.05	Suhedral to subhedral, partly skeletal	1) primary oxides in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty Cpx/Act	25				Clinopyroxene	0 % in alteration halo
Actinolite	10				Clinopyroxene	35 % in vein-related halo.
Albite	0				Plagiocalse	8 % in alteration halo
Pyrite	0.5				Disseminated	
Magnetite	0.5				Clinopyroxene	Seen as blebs in dusty cpx/act in both halo and host rock

STRUCTURE : Subhedral plagioclase grains with subhedral cpx inclusions are observed in intersertal materials. Clinopyroxenes are observed as subhedral grains as well as dendritic crystals with radially distributed plagioclase laths. Magnetite (often skeletal and up to 200 microns) is the dominant opaque phase with minor amount of sulfides. No shape preferred orientation was observed. In the center of subhorizontal vein in the lower part of the thin section, clots of larger actinolite crystals are fringed by plagioclase grains. Border zones are composed of finer-grained actinolite (+ minor chlorite) and fringed by ribbons of a transparent mineral with high relief (probably epidote or prehnite). Shear bands were observed in the middle of the vein implying left-lateral shear. A thinner, irregular vein with actinolite (+ chlorite) fillings is observed in the upper part of thin section. These two veins have orthogonal directions.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. There are 2 veins which make up approx. 5% of the thin section. They are both dominantly actinolite (90%) with some albite (9.5%) and minor magnetite (0.5%). Composite alteration halo (0.8-1 mm inner light gray, outer dark gray) adjacent to the 0.6 mm actinolite vein, particularly actinolite rich.

TS #24: 312-1256D-184R-1, 100-104 cm, Piece No: 19 | **Unit: 74** | **OBSERVER: SY, JK / CL, SM / RA**

ROCK NAME: Aphyric fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: Fine grained
TEXTURE: hypocrystalline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS	<1	0.34					
Plagioclase	< 1	0.34	0.3	1	0.6	Euhedral tabular	Strongly altered
GROUNDMASS	100						
Plagioclase	52					Acicular subhedral laths, often strongly dentritic	crystals often show swallow tails; some are hollow along the long side;
Clinopyroxene	20					anhedral prismatic	completely altered to tiny needls of actinolite and /or dusty brownish masses
Mesostasis	25						completely altered
Oxides	3					anhedral granular to acicular	elongated crystals often form clusters in the mesostasis,

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolite	25				clinopyroxene	possibly part of fresh cpx in plumose is left
albite	15				plagioclase	replaces 85% of plagioclase microphenocrysts
chlorite	2				plagioclase, interstitial	
prehnite	0.2				plagioclase	
titanite	6				disseminated	
pyrite	0.1				disseminated	

STRUCTURE : Large elongated (up to 1.4 mm long) plagioclase laths are observed in the intersertal materials. Clinopyroxenes are observed as subhedral to anhedral crystals as well as dendritic crystals that accompany radially distributed plagioclase laths. No shape preferred orientation was observed. Opaque phase consists of only small magnetite crystals of less than 30 micron across.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. One 0.02 vein of chlorite + quartz, with some actinolite protruding from host-rock clinopyroxene, and without associated alteration halo. One 0.2 mm actinolite vein.

TS #25: 312-1256D, 186R-1, 48-53 cm, Piece No: 10 **Unit: 75B** **OBSERVER: JK/CL/RA**

ROCK NAME: aphyric fine-grainded basalt (host) / sparsely plagioclase-phyric cryptocrystalline basalt (magmatic vein)

WHERE SAMPLED: Probably dike interior or dike margin

GRAIN SIZE: Fine grained (host) / cryptocrystalline (magmatic vein)

TEXTURE: holocrystalline Intergranular (host) / hypohyaline (micro)spherulitic, partlly banded (magmatic vein)

HOST BASALT

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	Aphyric						
GROUNDMASS							
Plagioclase	50					subhedral acicular to bladed, some are dentritic	often clusters of acicular crystals radiating from a nucleus; partly filled with chlorite
Clinopyroxene	17	30				subhedral prismatic	strongly altered to actinolite and brownish cryptocrystalline masses
Fe-Ti oxides	3					subhedral to anhedral; partly skeletal	probably titanomagnetite
Mesostasis	17						If glass was present it is now overgrown together with cpx to actinolite and dusty brownish cryptocrystalline masses

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	REPLACING / FILLING	COMMENTS
actinolite	50				clinopyroxene, plagioclase	complete replacement of clinopyroxene (locally up to 70%)
albite	5				plagioclase	
titanite	3				disseminated	
magnetite	2				clinopyroxene	small crystals associated with actinolite

CRYPTOCRYSTALLINE VEIN

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	1	1					
Plagioclase	0.9	0.9	0.05	1.2	0.5	Euhedral tabular	contain alteration patches of chlorite
Clinopyroxene	0.1	0.1	0.1	0.4	0.4	Euhedral prismatic	Probably completely altered to actinolite
MICROPHENOCRYSTS							
GROUNDMASS							
Plagioclase							
Fe-Ti oxides						tiny anhedral grains	
Mesostasis						cryptocrystalline	

STRUCTURE : Kinked magmatic vein in the lower part of the thin section includes euhedral plagioclase and clinopyroxene crystals that apparently different from those of host basalts in shapes. The long axes of plagioclase crystals are often aligned into parallelism to the contact. The magmatic vein also contains clasts of host rocks of around 5 mm long. This magmatic vein has well defined chilled margins that accompany oxide minerallization in the host rock-side in both side; around the kinked part, the margins become diffused suggesting early high temperature deformation. The diffused contact usually accompanies actinolite+ quartz mineralization along the border, which in turn intruded into the magmatic vein as perhaps, back-veins. Early cooling joints that accompany glassy halo fringed by small oxide crystals developed in the magmatic vein, cut and offset by later veins with actinolite (+ oxide) mineralization. Other veins in the slide contain actinolite+oxide mineralization. Dark-green patches surrounded by light green materials are observed on the rock slab. Under microscope, the dark parts consist of plagioclase and clinopyroxene crystals whereas light green part has the same mineral assemblage but contains patches of tiny actinolite crystals. Dendritic clinopyroxene growth is rarely seen. Subhedral plagioclase and clinopyroxene grains have no preferred orientation. Oxide grains are up to 300 micron long in the host rock.

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. The thin section shows a fine grained basalt cut by a 5 mm wide kinked magmatic vein (cryptocrystalline basalt) . Magmatic Vein: Plagioclases are aligned parallel to the margin suggesting transport by flow parallel to the margin. Magmatic flow parallel to the vein margin is also indicated by bands of tiny oxide grains. In some parts these bands are oriented parallel to the vein margin, in other parts, especially located within the kink of the vein, bands are irregulary curved probably due to flow turbulences. The vein includes mm-sized xenoliths of the host rock. Several 0.1-0.3 mm veins of actinolite (dominant) + magnetite + very minor quartz or albite.

TS #26: 312-1256D-187R-1, 17-18 cm, Piece No: 3 | **Unit: 75a** | **OBSERVER: BS, JK / CL, SM / LG**

ROCK NAME: Aphyric microcrystalline to fine-grained basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: microcrystalline to fine grained
TEXTURE: holocrystalline intergranular to intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS		0.22					
plagioclase		0.22					
GROUNDMASS	100						
Plagioclase	50					Subhedral-anhedral laths	often skeletal; clusters of radiating acicular crystals, fans of diverging crystals;
Clinopyroxene	40					Subhedral-anhedral prismatic to acicular	mostly replaced by actinolite and dusty brownish masses; often filled with tiny oxides
Glass/mesostasis	5						unclear how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	5					subhedral granular, some skeletal	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	30				clinopyroxene, plagioclase	clinopyroxene is completely altered
Dusty cpx/act	5				clinopyroxene	
Magnetite	5				clinopyroxene	
Pyrite	1.3				disseminated	
Chalcoyrite	0.2				disseminated	

STRUCTURE : No structures of note.

COMMENTS : Modal proportions of phenocrysts in percent estimated using from high precision scanning technique. One 0.02 mm actinolite vein. No alteration halos.

TS #27: 312-1256D-187R-1, 75-77 cm, Piece No: 18 | **Unit: 76** | **OBSERVER: SY, JK / CL /AV**

ROCK NAME: Aphyric fine-grained basalt (zone 1), aphyric cryptocystrallien basalt (zone 2)

WHERE SAMPLED: Sheeted dike complex, contact to dike markgin

GRAIN SIZE: Fine grained (zone 1), cryptocrystalline (zone 2, chilled margin)

TEXTURE: Holocrystalline intergranular to intersertal (zone 1), hypohyaline (crypto)spherulitic (zone 2)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Zone 1 - fine-grained basalt							
GROUNDMASS	100						
Plagioclase	40					Subhedral laths, anhedral interstitial	often skeletal, fans of diverging crystals, some show cylindrical hollows
Clinopyroxene	50					Subhedral-anhedral prismatic to acicular	strongly altered to actinolite and tiny dusty oxides
Fe-Ti Oxides	10					subhedral to anhedral, some are skeletal	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene
Zone 2 : Chilled margin							
Microphenocryst		0.1					
Plagioclase	<1	0.1				acicular	completely altered
Groundmass	100						
glass/mesostasis							completely altered to Fe-Ti oxide and cryptocrystalline masses.
Fe-Ti oxide						subhedral granular	(1) diffuse grainy dust; (2) tiny grains are arranged in form of irregular patches or lines or sub-spherical rings around cryptocrystalline spherules (3) tiny grains form irregular lines parallel to the margin
Zone 3 :Alteration zone (vein?)							
Fe-Ti oxide							
Sulfide							

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolite	40				clinopyroxene	
titanite	3				disseminated	
magnetite	1				clinopyroxene	
prehnite	2				plagioclase	
albite	7				plagioclase	
pyrite	0.02				disseminated	
chalcopyrite	0.01				along chilled margin	along chilled margin in vein with magnetite and pyrite

STRUCTURE : Zone 1: no visible structures. Zone 2 (Chilled margin): Chilled margin with wavy morphology. Glass is highly replaced by chlorite and titanomagnetite, giving it a dirty aspect. Some cpx and plag crystals are present near the boundary of the chilled magin with the host rock. Plag crystals slightly orient their long axes parallel to the chilled margin as well as magnetite crystals that seem to display sigmoidal shapes. However, no sense of shear could be recognized. At about 1 mm from the chilled margin, glass display a spherulitic texture, with the long axes of the ellipses parallel to the chilled margin. This suggests that flow ocurred at high temperature. At more than 1 mm away from the chilled margin, glass spherulites are basically rounded. In this area, the margin is intruded by a subparallel arrange of veins of about 0.05 mm wide. Quartz with undulose extinction and blocky habit fill these veins. An obscure object, most probably glass, forms a sigmoidal object indicating a sinistral sense of shear (relative to the thin section plane). No others shear sense indictors have been observed. Zone 3 (Alteration zone, vein?): Corresponds to a well ca. 0.3 mm wide well defined and planar vein filled with quartz, in the margins, and pumpellyte (?) in the center. This veins stops, and become diffuse, at about 1 mm from the chilled margin where it seems to fuse with a later magamtic (?) vein subparallel to the margin. No cross-cutting relations were observe between the netwrok veining and the zone 3.

COMMENTS : Modal proportions of primary rock estimated by comparison with standard visual estimation chart. This thin section consists 3 zones. Zone 1 is the host dike interior part (aphyric fine-grained basalt). Zone 2 is the chilled margin of the later intrusive. Zone 3 is the completely altered area of zone 1, the host rock. Zone 2 show (crypto)spherulitic texture, this texture vary remarkable toward contact with zone 3. / (A) 1-2.5 mm vein along the chilled margin/fine-grained basalt contact. This vein is made of chlorite, magnetite, prehnite, minor actinolite, and pieces of highly recystallized basalt; (B) vein of magnetite (edge), quartz or zeolite?, and magnetite + actinolite. T-shape intersection between A and B (C) magnetite + actinolite vein grading to host-rock.

TS #28: 312-1256D-187R-1, 89-90 cm, Piece No: 22 | **Unit: 76** | **OBSERVER: BS, JK / CL SM / LG**

ROCK NAME: aphyric cryptocrystalline to microcrystalline basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: microcrystalline
TEXTURE: holocrystalline intergranular to intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	47					Subhedral acicular	often skeletal, often clusters of radiating acicular crystals, some show graphopyric intergrowth with clinopyroxene, some show cylindric hollows
Clinopyroxene	45					Subhedral-anhedral prismatic	strongly altered to actinolite and tiny dusty oxides
Glass/mesostasis	5						unclear whether/how much glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	3					subhedral to euhedral, some are skeletal	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	41				clinopyroxene, plagioclase	
Albite	4				plagioclase	
Chlorite	1				interstitial	
Titanite	4				disseminated, plagioclase	locally euhedral
Magnetite	4				clinopyroxene	

STRUCTURE : A very diffuse vein composed of secondary actinolite fibers that are locally subparallel to the vein walls. The vein is highly irregular and its width is somehow constant and about 0.2 mm. Minerals contained in the vein have a fibrous habit but they do not display a simple growing pattern, either perpendiular or parallel to the vein walls.

COMMENTS : One 0.1 mm actinolite + minor chlorite and titanite vein.

TS #29: 312-1256D-187R-2, 112-118 cm, Piece No: 16 | **Unit: 76** | **OBSERVER: BS,JK / CL SM / LG**

ROCK NAME: aphyric cryptocrystalline to microcrystalline basalt
WHERE SAMPLED: sheeted dike complex
GRAIN SIZE: microcrystalline
TEXTURE: holocrystalline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS	< 1	0.13					
Plagioclase	< 1	0.1	0.3	0.8	0.5	subhedral tabular	strongly altered (products: chlorite and dusty brownish masses)
Clinopyroxene	< 1	0.03	0.2	0.8	0.5	subhedral primatic	completely altered to actinolite and brownish dusty masses
GROUNDMASS	100						
Plagioclase	46					Subhedral acicular, skeletal	often branching fibers, intergrowth with clinopyroxene
Clinopyroxene	51					Subhedral-anhedral	intergrown with plagioclase, both strongly altered to actinolite and brownish cryptocrystalline material
Glass/mesostasis							unclear whether glass was present due to intense alteration of the interstices between plagioclase
Fe-Ti Oxides	3					subhedral to anhedral	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	15				clinopyroxene	0% in alteration halo
Actinolite	20				clinopyroxene, minor plagioclase	50% in alteration halo
Chlorite	0.5				plagioclase	1% in alteration halo
Titanite	0.2				plagioclase	5% in alteration halo
Albite	2				plagioclase	40 % in alteration halo

STRUCTURE : Vein network due to several crosscutting actinolite and secondary plagioclase veins with mostly planar morphology. Secondary minerals don't show particular orientation in veins. Although independent veins that form the network have different widths, they are between 0.5 to 2 mm accross. In some places, the veins of the network become as narrow as 0.1mm wide yet the filling material is the same as that present in the wider veins.

COMMENTS : Modal proportions of phenocrysts in percent estimated using high precision scanning technique. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. / Several 0.1-2 mm crosscutting and bifurcating veins of well crystallized actinolite (88%), secondary plagioclase (10%) of unknown composition (albite?), magnetite (0.5 %) (some is ilmenite), titanite (0.5%) and chlorite (1%). These veins progressively grade to adjacent 0.3-0.6 mm alteration halos. Fe-ti oxides inside and outside the vein network present different chracteristics. Fe-Ti oxides inside veins are larger in size and they commonly have borders of titanite and patchy exolution of ilmenite and, perhaps, hemetite(?). On the contrary, Fe-Ti oxides in the groundmass are much smaller, about 0.05 mm diameter, and they present titanite-rich borders but no exsolution of ilmenite or any other opaque phase.

TS #30: 312-1256D-189R-1, 68-69 cm, Piece No: 10 | **Unit: 77** | **OBSERVER: SY,TY, JK / CL SM /AV**

ROCK NAME: Aphyric medium-grained basalt
WHERE SAMPLED: Sheeted dike complex
GRAIN SIZE: Medium-grained
TEXTURE: Holocrystalline subophitic to intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS	100						
Plagioclase	55			4.5	2	Subhedral-euhedral laths, anhedral interstital	Often with swallow tail, some show cylindric hollows; often altered to diffuse brownish, cryptocrystalline masses; often veined perpendicular to the elongation
Clinopyroxene	40					Anhedral prismatic	highly altered (actinolite, brownish dusty masses, tiny oxide grains); some show subophitic features
Fe-Ti Oxides	5					Subhedral, partly skeletal	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	5				clinopyroxene	
actinolite	35				clinopyroxene, plagioclase	plagioclase are only very partly altered
magnetite	4				clinopyroxene	associated with actinolite
titanite	1				disseminated	
pyrite	0.01				disseminated	
chalcopyrite	0.05				disseminated	

STRUCTURE : No visible structures.

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. No veins.

TS #31: 312-1256D-190R-1, 14-16 cm, Piece No: 2						**Unit: 77**	**OBSERVER: J cm, JK / CL, SM / NH**
ROCK NAME:	Aphyric microcrystalline basalt						
WHERE SAMPLED:	Dike interior						
GRAIN SIZE:	microcrystalline						
TEXTURE:	Holocrystalline intergranular, occasional variolitic patches (primary magmatic texture)						
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
GROUNDMASS	100	100					
Plagioclase	40	50		0.6	0.1	Subhedral-euhedral laths, anhedral interstital	Some show cylindric hollows; sometimes altered to diffuse brownish, cryptocrystalline masses.
Clinopyroxene	0	47				Anhedral prismatic	highly altered (actinolite, brownish dusty masses, tiny oxide grains).
Fe-Ti Oxides	3	3		0.1		Subhedral, partly skeletal	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
actinolite	45				clinopyroxene	
magnetite	5				clinopyroxene	associated with actinolite
epidote	0.1				plagioclase	
chlorite	0.5				plagioclase	
titanite	1				disseminated, plagioclase	

STRUCTURE : There is one vein on the eastern margin of the thin section. The vein is almost entirely actinolite with very local, minor chlorite. The vein has a Y-shaped morphology/intersection and in most places the vein has sharp vein-walls. The actinolite cleavage planes do not track the vein opening.

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. Magmatic texture seems to be overprinted by a metamorphic texture; not clear whether plagioclase has original composition or is albitic; unclear whether glass was present due to intense alteration of the groundmass. One 0.2 mm vein of actinolite (90.5%, locally bluish green), chlorite (3%), titanite (2%), prehnite (0.5%), quartz (or albite or zeolite) (3%), magnetite (1%). In reflected light, oxides appear to be secondary.

TS #32: 312-1256D-192R-1, 11-13 cm, Piece No: 2 | **Unit: 78** | **OBSERVER: J cm, SY, JK / CL SM / NH**

ROCK NAME: Aphyric microcrystalline basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: microcrystalline
TEXTURE: Holocrystalline intergranular (obscured by alteration)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS	100	100					
Plagioclase	40	50		0.8	0.1	Subhedral-euhedral laths, anhedral interstital	often clusters of radiating acicular crystals; may be significant secondary growth of feldspar.
Clinopyroxene	0	47				Anhedral prismatic	highly altered (actinolite, brownish dusty masses, tiny oxide grains).
Fe-Ti Oxides	3	3		0.1		Subhedral	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	5				clinopyroxene	
actinolite	35				clinopyroxene, plagioclase	
hornblende-rich amphibole	1				interstitial, clinopyroxene	Slabs or acicular aggregates. Pleochroic from greenish brown to light brownish green. Slightly zoned, pale brownish at center, pale green at rim. Does not include magnetite. Surrounded by acicular actinolite rich amphibloe.
magnetite	8				clinopyroxene, disseminated	associated with actinolite and dusty cpx/act
secondary plagioclase	5				plagioclase	
quartz	0.5				interstitial	includes acicular actinolite
ilmenite	0.5					
pyrite	0.05				disseminated, local fillings of plagioclase microfractures	anhedral, rarely euhedral

STRUCTURE : A very weak magmatic fabric is present in portions of the igneous texture with aligned plagioclase laths. There is a vein rich in well-developed actinolite in most places with the cleavage planes parallel to the vein margins. Other veins are present forming a network, but most did not retain their filling through preparation .

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. Sometimes small patches of tiny secondary magnetite sit in actinolite at center of radiating feldspars. Magmatic texture seems to be overprinted by a metamorphic texture; not clear whether plagioclase has original composition or is more albitic. One 0.1 mm vein of actinolite (78%), brownish hornblendic amphibole (2%), quartz (18%), and titanite (2%).

TS #33: 312-1256D-194R-1, 8-13 cm, Piece No: 3A | **Unit: 78** | **OBSERVER: JK / CL, SM / NH**

ROCK NAME: Aphyric cryptocrystalline basalt

WHERE SAMPLED: probably outer dike including chilled margin

GRAIN SIZE: cryptocrystalline

TEXTURE: hypocrystalline variolitic (primary magmatic texture, now obscured by alteration)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
Plagioclase	< 1		0.2	1	0.6	euhedral laths	strongly altered (chorite patches, calcite, eventually albite)
GROUNDMASS							
Plagioclase	48					Subhedral laths to acicular	Obviously significant secondary growth of feldspar; intimately intergrown with actinolite
Clinopyroxene	0	50				Anhedral prismatic	completely altered to fibrous actinolite; intimately intergrown with plagioclase
Fe-Ti Oxides	2					anhedral graunlar	disseminated

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolite	50				clinopyroxene	
chlorite	1				plagioclase	up to 90% in zone F and G
calcite	0.1				plagioclase	
epidote	0.05				plagioclase	
secondary plagioclase	0.2				plagioclase	
magnetite	7				disseminated	
titanite	1				disseminated	up to 12 % in zone F and G
pyrite	0.2				disseminated	rare large (0.8 x 0.3 mm) anhedral crystals

STRUCTURE : A quartz vein is roughly parallel to a pervasively altered chilled margin. Evidence of the chilled margin comes in the form of parallel plagioclase laths within cryptocrystalline (altered) basalt that coarsens outward (westward on the thin section). In the coarser grained (microcrystalline) basalt away from the chilled margin there is a quartz vein with chlorite (plus trace epidote) rims. The vein has a milimeter wide halo and has a curving, irregular trace through the thin section. Within the altered basalt are several spherical, 0.6 mm-wide, white alteration patches. The patches are cut by the magnetite+actinolite+chlorite+quartz+epidote alteration around the vein that is central to the chilled margin. Clasts of host rock in hand sample are completely altered to actinolite+chlorite in thin section, and the clast boundaries are barely recognizable. The vein is dominantly blocky quartz. Several of the larger grains exhibit strain either via undulose extinction (subgrain boundaries), apparent stretch, and local zones of cataclasis (possibly creep). Although the vein has many qualities of a shear vein, strain is low, and shear sense indicators subtle or absent.

COMMENTS : The host rock is an aphyric cryptocrystalline basalt showing zones of complete alteration displaying also deformation and metamorphic veins. The description of the primary mineralogy is based on the least altered host rock. Plagioclase phenocrysts show a subparallel alignment parallel to the alteration zones implying that this piece represents a metamorphic overprinted chilled margin, since similar features were observed in fresh chilled margins (e.g., thin sections13,25) and interpreted as flow structures parallel to a dike margin. Magmatic texture seems to be overprinted by a metamorphic texture; not clear whether plagioclase has original composition or is albitic. One 2-5 mm thick complex vein zone on the long edge of the slide. From the edge, to the center, one observes: (A) calcite + sphalerite, (B) quartz + pyrite + magnetite + minor chalcopyrite + minor epidote, (C) chlorite + minor actinolite, (D) euhedral and suhedral quartz with overgrowth of quartz containing solid inclusions + local epidote neeedles, (E) epidote + chlorite + actinolite, (F) chlorite + magnetite (large subhedral crystals partly replaced and surrounded by titanite), (G) chlorite + actinolite + quartz, (H) same as G. In E to H, the large magmatic plagioclase laths are still observed, even if highly altered. Two 0.01 mm calcite veins, one crosscuting a 0.01 mm quartz vein. One 0.2 mm vein of, from edge to center, chlorite + titanite, quarz + cacite + minor prehnite and titanite, with 1 mm thick dark green chlorite- and actinolite-rich alteration halo. There is also a strand of small dark patches (~1mm each) which are richer in chlorite (up to 90%). This strand runs parallel to the vein complex. A similar strand of pale alteration patches exist. These have a composition of chlorite (80%), titanite (15%) and minor actinolite (5%).

TS #34: 312-1256D-196R-1, 32-33 cm, Piece No: 3A | **Unit: 78** | **OBSERVER: JK / CL, SM / NH**

ROCK NAME: Aphyric cryptocrystalline basalt
WHERE SAMPLED: probably outer dike including chilled margin
GRAIN SIZE: cryptocrystalline
TEXTURE: hypocrystalline variolitic (primary magmatic texture, now obscured by alteration)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
Plagioclase	< 1		0.2	1	0.6	euhedral laths	stronlgy altered (chorite patches, calcite, eventually albite)
Clinopyroxene	< 1				0.4	euhedral prismatic	completely altered (actinolite, magnetite, brownish cryptocrystalline masses)
GROUNDMASS	50						
Plagioclase	48					Subhedral laths to acicular	Obviously significant secondary growth of feldspar; intimately intergrown with actinolite
Clinopyroxene	0	50				Anhedral prismatic	completely altered to fibrous actinolite; intimately intergrown with plagioclase
Fe-Ti Oxides	2					anhedral granunlar	disseminated

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	0.01				part of clinopyroxene phenocryst	
actinolite	50				clinopyroxene	
chlorite	1				plagioclase	
calcite	0.1				plagioclase	
epidote	0.05				plagioclase	
secondary plagioclase	0.2				plagioclase	
magnetite	7				disseminated, clinopyroxene phenocryst	
titanite	1				disseminated	
pyrite	4				disseminated	large (0.8 x 0.3 mm) anhedral crystals

STRUCTURE : Patchy alteration and a diffusive 0.2 mm chlorite-rich vein typify the altered microcrystalline basalt. The boundary between micro and cryptocrystalline basalt of the chilled margin is irregular and in places sharp. Spherical, 0.1mm-diameter white alteration patches are present near and within the chilled margin. A band of alteration parallel to the chilled margin defines the east side of the thin section with no evidence of shear strain. The band is cut by the thin chlorite-vein.

COMMENTS : The host rock is an aphyric cryptocrystalline basalt showing zones of complete alteration displaying also deformation and metamorphich veins. The description of the primary mineralogy is based on the least altered host rock. Magmatic texture seems to be overprinted by a metamorphic texture; not clear whether plagioclase has original composition or is albitic. Along the longest edge of the slide, one 2.5-4 mm coarse grained band composed of large euhedral probably magmatic (titano?)magnetite, abundant well crystallized actinolite and less hornblendic amphibole, titanite, chlorite, minor epidote and prehnite. This band could be a highly recrystallized and boudinaged xenolith, but only primary titanomagnetite and MAYBE the shape of a large (0.8 mm) primary plagioclase are left. Adjacent to this possible xenolith, zones of fine grained highly recrystallized (actinolite and locally calcite) fine grained rock. Several 0.1 mm actinolite + titanite (up to 5%) veins.

TS #35: 312-1256D-194R-1, 36-37 cm, Piece No: 8 | **Unit: 78** | **OBSERVER: J cm,JK / CL SM / NH**

ROCK NAME: Aphyric microcrystalline basalt

WHERE SAMPLED: Dike interior

GRAIN SIZE: Microcrystalline

TEXTURE: Holocrystalline intergranular (possibly obscured by alteration).

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	0.56	0.56					
Plagioclase	0.56	0.56	0.5	3	2	Subhedral laths to tabular	The plagioclase crystals form one glomerocryst all occur in a single 4 mm long clot. They show conspicuously concentric compositional zoning, The largest phenocrysts contains inclusions and a elongate hollow containing alteration minerals.
GROUNDMASS	100	100					
Plagioclase	40	50		1.2	0.2	Subhedral-euhedral laths, anhedral interstital	May be significant secondary growth of feldspar, including longest grains and radiating/vermicular patches.
Clinopyroxene	0	47				1) subhedral prismatic to anhedral, 2) anhedral microgranular	1) prismatic crystals highly altered to actinolite, brownish dusty masses, and tiny oxide grains; in part, seems to develop to hornblende; 2) also clusters of tiny grains (microgranulr) eventually in a paragenesis with opx, probably caused by higher graded metamorphism
Fe-Ti Oxides	3	3		0.1		Subhedral	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene
Orthopyroxene ??	<1					Subhedral prismatic to anhedral granular	Only some grains; show pleochroism from light green to reddish colour

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	5				clinopyroxene	
actinolite	35				clinopyroxene, plagioclase	
hornblende-rich amphibole	3				interstitial, clinopyroxene	Slabs or acicular aggregates. Pleochroic from greenish brown to light brownish green. Slightly zoned, pale brownish at center, pale green at rim. Does not include magnetite. Surrounded by acicular actinolite rich amphibloe.
magnetite	8				clinopyroxene	associated with actinolite and dusty cpx/act
quartz	0.5				interstitial	large (0.3 mm) subhedral crystals, associated with actinolite
Ca-plagioclase	1				plagioclase	Inclusion (0.005 0.0005 mm)-rich areas, more often at the plagioclase rim. More frequent at the vicinity of pyroxene granulitic areas
pyrite	1.2				disseminated, local fillings of plagioclase microfractures	anhedral, rarely euhedral
chalcopyrite	0.1				disseminated	

STRUCTURE : No structure of note.

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. Sometimes small patches of tiny secondary magnetite sit in actinolite at centre of radiating feldspars in vermicular texture. Magmatic texture seems to be overprited by a metamorphic texture; not clear whether plagioclase has original composition. Several patches made of aggregates of small (0.01-0.05mm) equigranular pyroxene (clino + minor ortho) and plagioclase crystal. The clinopyroxene in these patches is in places slightly altered into actinolite.

TS #36: 312-1256D-196R-1, 32-33 cm, Piece No: 7 | **Unit: 78** | **OBSERVER: SY, JK / CL, SM / NH**

ROCK NAME: Aphyric medium- to fine-grained basalt
WHERE SAMPLED: Sheeted dike complex
GRAIN SIZE: Medium to fine grained
TEXTURE: Holocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Groundmass	100						
Plagioclase	55					Subhedral laths, anhedral interstital	often clusters of radiating crystals; some show cylindric hollows
Clinopyroxene	40					1) subhedral prismatic to anhedral, 2) anhedral microgranular	1) prismatic grains between the plagioclase framework, hardly altered (actinolite, sometimes hornblende, tiny oxide grains); 2) microgranular domains, grainsize <0.03mm, probably caused by higher graded metamorphism
Fe-Ti Oxides	5					Subhedral, partly skeletal	1) primary oxides (probably titanomagnetite) in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene
Orthopyroxene	<1			0.1		Subhedral to anhedral prismatic	only a few grains; some show pleochroism from light green to reddish colour; probably interstitial formation between plagioclase laths; eventually mircogranular opx also present, forming a paragenesis with microgranular cpx

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	17				clinopyroxene	
Actinolite	15				clinopyroxene, plagioclase	
Hornblende-rich amphibole	5				interstitial, clinopyroxene	Slabs or acicular aggregates. Pleochroic from greenish brown to light brownish green. Slightly zoned, brownish at center, green at rim. Does not include magnetite. Surrounded by acicular actinolite rich amphibloe.
Secondary plagioclase	1?				plagioclase	Inclusion-rich areas, often elongated parallel to (cleavage Ca-rich?)
Magnetite	8				clinopyroxene	associated with dusty cpx/act and actinoilite
Pyrite	1				disseminated	
Chalcopyrite	0.1				disseminated	

STRUCTURE : No structures of note

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. Rare appearance of orthopyroxene. Magmatic texture seems to be overprinted by a metamorphic texture. Some small (0.01mm) isometric granular clinopyroxene crystal either evenly distributed or forming aggregates. No veins.

TS #37: 312-1256D-197R-1, 3-6 cm, Piece No: 1 | **Unit: 78** | **OBSERVER: JM / CL, SM / NH**

ROCK NAME: Aphyric microcrystalline basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: Microcrystalline
TEXTURE: Holocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Groundmass	100	100					
Plagioclase	50	50	0.1	1.2	0.2	Subhedral laths, anhedral interstital	Still lath like, but more blocky than in in preceding thin section slides. Texture may have been overprinted by metamorphic regrowth. Some more acicular, longer plag are also present, perhaps from original igneous texure
Clinopyroxene	0	47				1) euhedral to subhedral prismatic, 2) anhedral micro-granular	1) prismatic crystals hardly alterd to actinolitic horn-blende (sometimes brown) and tiny oxides 2) some mi-crogranular domains probably caused by higher graded metamorphism
Fe-Ti Oxides	3	3	0.01	0.1	0.6	Subhedral	Primary oxides in interstices, along with possible growth of a range of sizes of alteration related oxides.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	5				clinopyroxene	
actinolite	37				clinopyroxene	
magnetite	8				clinopyroxene	
Ca-plagioclase	1				plagioclase	Up to 10% when adjacent to vein A. Contains numer-ous tiny inclusions.
epidote	0.1				plagioclase	
chlorite	0.1				plagioclase	
prehnite	0.1				plagioclase	
quartz	0.1				small patches	large crystals

STRUCTURE : A vein network with an intersection in a wide area of secondary alteration. The veins are quartz-dominated, with acicular actinolite and patches of amphibole throughout. The intersection of the veins has acicular actinolite surrounding amphiboles with well-developed faces; this area in the center of the thin section may have been a vug or inclusion. The vein walls are somewhat diffusive with actinolite + amphibole alteration grading from the wall rock into the vein.

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. Magmatic texture seems to be overprinted by a metamorphic texture. Some small (0.01mm) isometric rounded clinopyroxene crystals either evenly distributed in local areas, not related to veins. (A) Two 0.8-1.5 mm veins of euhedral hornblendic amphibole + euhedral quartz (fluid inclusions), + plagioclase + titanite, + later actinolite + minor chalcopyrite at edge, locally. These two veins merge, forming two large (3x6mm) patches; (B) Several 0.05-0.1 mm veins of hornblende + minor plagioclase ± minor quartz ± minor titanite, that are sinuous and grade to host-rock. Primary plagioclase adjacent to vein A are highly altered into Ca-plagioclase.

TS #38: 312-1256D-198R-1, 13-15 cm, Piece No: 3 **Unit: 78** **OBSERVER: JM, JK / CL, SM / NH**

ROCK NAME: Aphyric fine grained basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: Fine grained
TEXTURE: Holocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Groundmass	100	100					
Plagioclase	50	50	0.4	0.8	0.6	Subhedral laths, anhedral interstital	Often occur in radiating intergrowths with altered cpx. This primary magmatic texture appears to have been affected by recrystallization, so that the intergrowths now have a slightly vermicular appearance.
Clinopyroxene	0	47				Anhedral	Heavily altered to actinolite (probably acitnolitic hornblende). Relics of clinopyroxenes are flilled with tiny oxides.
Fe-Ti Oxides	3	3	0.01	0.1	0.6	Subhedral	Primary oxides in interstices, along with possible growth of a range of sizes of alteration related oxieds. Tiny grains disseminated in relics of clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	5				clinopyroxene	associated with magnetite
actinolite	28				clinopyroxene, plagioclase	associated with magnetite as cpx replacement
hornblendic amphibole	4				clinopyroxene	
magnetite	10				clinopyroxene	associated with dusty cpx/act and actinolite
epidote	0.5				plagioclase	
Ca-plagioclase	0.5				plagioclase	
pyrite	0.8				disseminated	
chalcopyrite	0.05				disseminated	

STRUCTURE : No structures of note.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Magmatic texture seems to be overprinted by a metamorphic texture. No veins. Disseminated rounded tiny clinopyroxene (granulite facies?). (NH: Wonderful amphibolite textures with textural equilibrium between amphibole and plagioclase).

TS #39: 312-1256D-198R-1, 45-49 cm, Piece No: 10 | **Unit: 78** | **OBSERVER: JK, SY / CL / NH**

ROCK NAME: Aphyric fine-grained basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: Fine grained
TEXTURE: Holocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
Plagioclase	< 1		0.2	1	0.8	subhedral tabular to bladed	stronlgy zoned; show fissures filled with tiny crystals (former fluid inclusions?)
Groundmass	103						
Plagioclase	50		0.05	0.3	0.8	Subhedral laths, anhedral interstital	Often occur in radiating intergrowths with altered cpx. This primary magmatic texture appears to have been affected by recrystallization, so that the intergrowths now have a slightly vermicular appearance.
Clinopyroxene	3	40				1) subhedral prismatic to anhedral, 2) anhedral micro-granular	1) primary prismatic hardly alterd to actinolitic hornblende (sometimes brown) and tiny oxides 2) some microgranular domains probably caused by higher graded metamorphism
Fe-Ti Oxides	10		<0.05	0.2	0.05		Disseminated; seems that primary oxides together with tiny oxides grians from clinopyroxene alteration were recrystallized to larger crystals; still tiny grains exist in relics of clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	8				clinopyroxene	
actinolite	25				clinopyroxene, plagioclase	as large needles in plagioclase
hornblende amphibole	2				clinopyroxene	
magnetite	7				clinopyroxene, disseminated	
Ca-plagioclase	5				plagioclase	
pyrite	1				disseminated	
chalcopyrite	0.1				disseminated	
ilmenite	tr					

STRUCTURE : No deformational structures of note.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Magmatic texture seems to be overprinted by a metamorphic texture. Numerous disseminated rounded tiny (mostly unaltered) clinopyroxene locally very abundant and associated with tiny (same size as clinopyroxene) isometric plagioclase. (NH: again, clear upper amphibolite facies textures, and a better example of possible granulite facies recrystallized pyroxene than thin section #38)

TS #40: 312-1256D-201G-1, 19-40 cm, Piece No: 2 | **JUNK #1- NO UNIT SPECIFIED** | **OBSERVER: BS, SY, JK / CL / LG**

ROCK NAME: Aphyric fine-grained dolerite
WHERE SAMPLED: Junk #1
GRAIN SIZE: Fine grained
TEXTURE: Holocrystalline intergranular, in places subophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
Groundmass	100						
Plagioclase	50					subhedral laths	some show cylindric hollows, now filled with actinolite
Clinopyroxene	42					1) subhedral to anhedral prismatic, 2) anhedral microgranular	1) primary prismatic hardly altered to actinolitic hornblende and tiny oxides 2) some microgranular domains probably caused by metamorphism
Fe-Ti-Oxides	8					subhedral to anhedral, often skeletal, often agglomerates	1) primary oxides in the interstices; 2) tiny oxide grains as alteration products in clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolite	28				clinopyroxene, plagioclase microfractures	
hornblende	8				clinopyroxene	
C-plagioclase	3				plagioclase	
magnetite	10				clinopyroxene	1) tiny crystals associated with actinolite as cpx replacement; 2) disseminated large crystals
pyrite	1.5				disseminated	subhedral crystals and very anhedral crystals
chalcopyrite	0.2				disseminated	

STRUCTURE : There is an irregular vein of mainly actinolitic horneblende+quartz+plagioclase+magnetite with diffused boundaries with the host rock. Actinolitic hornblende crystals don't show preferential orientation. Some plagioclase and quartz crystals both in the vein and in the host rock have undulose extinction.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Texture of this thin section is similar to TS#39 (appearace of brown hornblende and microgranular clinopyroxene). / One 0.6-0.8 mm vein of actinolite or actinolitic hornblende at the edge, quartz + minor plagioclase + actinolitic hornblende + magnetite at center. The edge of this vein locally contains tiny equant clinopyroxene (partly replaced by actinolite) and plagioclase crystals. Some (clinopyroxene or clinopyroxene + plagioclase) microgranular domains grading to regular texture.

TS #41: 312-1256D-201G-1, 48-52 cm, Piece No: 4 | **JUNK #1- NO UNIT SPECIFIED** | **OBSERVER: BS, SY, JK / CL / LG**

ROCK NAME: Aphyric fine-grained basalt
WHERE SAMPLED: Junk #1
GRAIN SIZE: Fine grained, seriate
TEXTURE: Hypocystalline interseriatal to subophitic, microcrystalline variolitic domains

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
Plagioclase	<1		0.5	1	0.75	subhedral tabular	only 2 grains
Groundmass	100						
Plagioclase	50					euhedral to suhedral laths and needles, anhedral interstitials	needle-like lath, very high aspect ratio; often with cylindric hollows filled with tiny clinpyroxene and oxide (often this oxide appear as numerous tiny oxides)
Clinopyroxene	40					anhedral, often prismatic	often fan-like anrangement associated with plagioclase assemblages (based on variolitic domains); sometimes replaced by cryptocrystalline dusty brownish masses
Fe-Ti-Oxides	3					euhedral to subhedral granular, some skeletal	crystallized in interstices
Mesostaisis / glass	7						altered to clay minerals; some show tiny cypto-crystals with dendritic structure, crystals probably grown during quenching
Sulfide	< 1						poililitic aggregates in interstices

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
saponite	6				in small vesicles, interstitial, glass	olive green
celadonite/saponite	1				in small vesicles, interstitial, glass	
pyrite	0.8				clinopyroxene and plagioclase	very irregular blebs

STRUCTURE : No structures of note.

COMMENTS : This piece from the junk basket probably derives from a much higher crustal level obviously fallen down into the bottom of the hole. Modal proportions of primary minerals estimated by comparison with standard visual estimation chart Low temperature alteration. Plagioclase and clinopyroxene are fresh.

TS #42: 312-1256D-201G-1, 99-107 cm, Piece No: 8 **OBSERVER: BS, SY / CL / LG**

ROCK NAME: Aphyric fine-grained basalt
WHERE SAMPLED: junk #1
GRAIN SIZE: fine grained
TEXTURE: holocrystalline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
clinopyroxene	<1		1	1.5	1.2	euhedral prismatic	only one grain
Plagioclase	1		0.1	0.75	0.4	euhedral tabular, often forming glomerocrysts	often altered
Groundmass							
Plagioclase	40					needle-like, euhedral to subhedral laths	often with swallow tails
Clinopyroxene	55					euhedral	fan-like assemblages are completely altered, euhedral interstitials hardly altered.
Fe-Ti-Oxides	5					euhedral, often skeletal	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolite	20				clinopyroxene, interstitial	
dusty cpx/act	25				clinopyroxene	
chlorite	0.5				plagioclase	
albite	4				plagioclase	
pyrite	0.8				disseminated	
chalcopyrite	0.1				disseminated	

STRUCTURE : A 0.05 mm irregular vein is composed by quartz at the center and actinolite (+ chlorite?) at the rim; in some places actinolite is oriented perpendicular to the vein boundaries. It is cut by an irregular quartz+chlorite+calcite+ minor actinolite vein. Plagioclase phenocrysts show brittle failure rather than undulose extinction (crystal-plastic strain).

COMMENTS : This piece from the junk basket probably derives from a higher crustal level obviously fallen down into the bottom of the hole. Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. / One 0.06 mm vein of actinolite + titanite. One 0.05 mm vein of actinolite + quartz + magnetite + titanite.

TS #43: 312-1256D-201G-1, 107-117 cm, Piece No: 8 **OBSERVER: BS, SY, JK / CL / LG**

ROCK NAME: Aphyric fine grained basalt
WHERE SAMPLED: Junk #1
GRAIN SIZE: Fine grained
TEXTURE: Hypocrystalline intersertal to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Groundmass	100						
Plagioclase	55					subhedral laths	often laths with cylindrical hollow filled clinopyroxene and oxide
Clinopyroxene	35					anhedral to subhedral prismatic	1) prismatic clinopyroxene between the plagioclase framework 2) acicular to fibrous branching crystals with slender plagioclase lath (fan-like assembrage in variolitic domains)
Fe-Ti-Oxides	3					euhedral to subhedral, skeletal	
mesostaisis	5						altered to brownish dusty masses
sulfide	2					anhedral poikilitic	spheric penetration (or concentration?) oxide assemblage with plagioclase laths and clinopyroxene as chadocrysts.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
saponite	4				interstitial	olive brown
pyrite	1				pyroxene, plagioclase	large (1.5 mm) irregular blebs

STRUCTURE : No structures of note

COMMENTS : This piece from the junk basket probably derives from a much higher crustal level obviously fallen down into the bottom of the hole. Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. / Low temperature reducing alteration.

TS #44: 312-1256D-201G-1, 0-1 cm, Piece No: none — **OBSERVER: SY, JK / CL / LG**

ROCK NAME: grain mount of different small pieces of felsic material handpicked from the junk basket

WHERE SAMPLED: Junk #1

GRAIN SIZE: Microcrystalline to fine grained

TEXTURE: Primary texture: holocrystalline subheddral equigranular; cataclastic; some mounts show foliated textures caused by extreme cataclasis

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
The largest piece located upper left in the grain mount (shape is like C)							
GRAIN SIZE:	microcrystalline						
TEXTURE:	holocrystalline equigranular, cataclastic						
Plagioclase						subhedral tabular	some large grains show undulatory extinction probably caused by shear, strong cataclastic overprint
amphibole						subhedral prismatic	probably hornblende; eventually altered to actinolite; filled with anhedral oxide grains
Quarz						anhedral granular	extreme undulatory extinction; extremely disrupted
Fe-Ti oxide						anhedral granular	associated with or included in amphibole; two populations of grain sizes

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
amphibole						see above

STRUCTURE : Undulatory extinction of some plagioclase crystals.

COMMENTS : All pieces show a very strong cataclastic imprint; some pieces show s-shaped plagioclases probably formed by shear; most pieces show a marked cataclastic foliation with aligned disrupted oxide grains; the primary magmatic texture - holocrystalline equigranular - is best preserved in the large mount located upper left on which the description above is based.

TS #45: 312-1256D-201G-1, 52-69 cm, Piece No: 5 — **OBSERVER: SY,JK / CL / LG**

ROCK NAME: Sparsely clinopyroxene-plagioclase phyric fine-grained basalt
WHERE SAMPLED: Junk
GRAIN SIZE: Fine grained
TEXTURE: Hypocrystalline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	2.0						
Plagioclase	1.5	1.5	0.5	1.4	1	euhedral tabular	often show glomerocryst; some are altered (chlorite, eventually albite); one grain shows typical sieve structre suggesting an early partial melting event
Clinopyroxene	0.5	0.5	0.25	1.3	0.75	subhedral prismatic	glomerocrysts; subophitic including plagioclase laths; rims filled with melt inclusions, not converted to cryptocrystalline matter
Groundmass	98						
Plagioclase	40					euhedral to subhedral lath	often laths with swallow tails and cylindric hollows
Clinopyroxene	33					anhedral interstitials, subhedral prismatic	1) prismatic clinopyroxene between the plagioclase framework 2) tiny acicular to fibrous branching crystals h (fan-like assemblage in variolitic domains)
Fe-Ti-Oxides	2					euhedral to subhedral, often skeletal	probably interstitial titanomagnetite
Chromite?	< 1					euhedral granular	2 crystals; slighly transparent with reddish color (~0.2mm); both are associated with plag phenocrysts implying that this phase is an early crtstallization product
Mesostaisis	23						with desseminated tiny oxides

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	8				clinopyroxene plumoses	
albite	10				plagioclase	
chlorite	3				plagioclase, interstitial	
prehnite	0.5				plagioclase	
pyrite	0.5				disseminated	

STRUCTURE : Plagioclase phenocrysts show mainly brittle structure with intracrystalline fractures filled by secondary minerals (chlorite).

COMMENTS : This piece from the junk basket probably derived from a much higher crustal level obviously fallen down into the bottom of the hole. Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. / No veins.

TS #46: 312-1256D-201G-1, 135-138 cm, Piece No: 10 | **JUNK -NO UNIT SPECIFIED** | **OBSERVER: TY / CL / LG**

ROCK NAME: Aphyric fine-grained to microcrystalline basalt
WHERE SAMPLED: Junk
GRAIN SIZE: Fine grained to microcrystalline
TEXTURE: Hypocrystalline intersertal

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS							
GROUNDMASS	100						
Plagioclase	30	30	<0.1	0.9	0.3	euhedral to subhedral acicular lath	Euhedral microphenocrystic grains with dusty core are also observed.
Clinopyroxene	3	5	<0.1	0.2	0.1	anhedral	
Olivine	0	<1	<0.1	0.2	0.1	euhedral to subhedral	Completely altered to greenishbrown clay mineral.
Glass/mesostasis	0	65					Altered to dusty minerals.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Fe-oxyhydroxides	2.5				vesicles, interstitial, staining magmatic minerals	In brown alteration halo
Celadonite	2.5				interstitial, vesicles	In brown alteration halo
Saponite	3				interstitial	

STRUCTURE : No structures of note.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. / Most of the thin section represents a typical low temperature brown alteration halo. This sample from the upper volcanics. The proportions of Fe-oxyhydroxides and celadonite are averages on the whole halo. /

TS #47: 312-1256D-202R-2, 48-50 cm, Piece No: 5						**Unit: 80**	**OBSERVER: BS, JK / CL / LG**
ROCK NAME:	Aphyric fine-gained basalt (metabasalt)						
WHERE SAMPLED:	Sheeted dikes						
GRAIN SIZE:	Fine grained						
TEXTURE:	Holocrystalline intergranular (primary magmatic texture, obscured by metamorphic overprint)						
PRIMARY MINERALOGY	**PERCENT PRESENT**	**PERCENT ORIGINAL**	**SIZE (mm) min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
PHENOCRYSTS							
MICROPHENOCRYSTS							
GROUNDMASS							
plagioclase	45					subhedral laths	probably recrystallized
clinopyroxene		45				1) subhedral prismatic to anhedral (pseudomorphs) 2) anhedral microgranular	1) Primary prismatic crystals strongly alterd to actinolitic hornblende (sometimes brownish) and tiny oxides 2) recrystallized microgranular domains
Fe-Ti oxide	10					subhedral to anhedral	two populations: 1) larger grains (probably recrystallized) and 2) tiny oxide grains as alteration products in the magmatic clinopyroxene

SECONDARY MINERALOGY	**PERCENT**	**SIZE (mm) min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
Hornblende	3				clinopyroxene	
Actinolitic hornblende	30				clinopyroxene, plagioclase fractures	
Dusty cpx/act	8				clinopyroxene	
Magnetite	8				clinopyroxene	
Ca-plagioclase	25				plagioclase	more abundant close to vein

STRUCTURE : Several crosscutting relationships: one irregular 0.4 mm vein of hornblende+quartz+ minor plagioclase cuts and displaces (?) one 0.1 mm vein with the same mineral filling; the sense of shear is not shown by any particular mineral orientation or deformation. Irregular veins of quartz+ horneblende/ actinolitic hornblende always cut several 0.05 mm hornblende/ actinolitic hornblende veins with diffuse boundaries with the host rock. A y-shaped vein of quartz+hornblende merges with a quartz vein. The 0.4 mm vein shows quartz+hornblende at the rim and hornblende+ minor plagioclase at the center (just in a small portion of the vein). In all the other veins the opening history is not known. This vein has both quartz and plagioclase with undulose extinction; plagioclase can also show subgrain boundaries.

COMMENTS : This primary magmatic texture appears to have been affected by recrystallisation, resulting in places in microgranular granoblastic textures. Modal proportions of the primary minerals estimated by comparison with standard visual estimation chart. / Several crosscuting 0.2-0.8 mm veins of hornblende + quartz + magnetite + minor plagioclase, with adjacent 0.4-1.5 mm dark halo where actinolite and tiny magnetite are more abundant. Minor late-stage calcite with furry actinolite needles. Several 0.3 mm veins of actinolitic hornblende grading to the host-rock.

TS #48: 312-1256D-203R-1, 10-14 cm, Piece No: 4						Unit: 80	OBSERVER: SY,JK / CL /
ROCK NAME:	Aphyric microcrystalline basalt (meta basalt)						
WHERE SAMPLED:	Probalbly near to dike margin						
GRAIN SIZE:	Fine grained, microcrystalline and cryptocrystalline						
TEXTURE:	Holocrystalline microgranular, holocrystalline						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
ROCK NAME:	Aphyric microcrystalline to cryptocrystalline basalt						
Texture	Holocrystalline intergranular / intersertal (primary magmatic texture, obscured by metamorphic overprint)						
Grain Size	cryptocrystalline to microcrystallne						
GROUNDMASS							
plagioclase		55				subhedral lath, anhedral interstitials	often with cylindric hollows filled clinopyroxne and oxide,
clinopyroxene		42				1) subhedral prismatic to anhedral (pseudomorphs) 2) anhedral microgranular 3) subhedral prismatic, poikiloblastic	1) Primary prismatic crystals strongly alterd to actinolitic hornblende (sometimes brownish) and tiny oxides 2) recrystallized microgranular domains 3) pikiloblastic with inclusion of tiny oxide and dusty spots
Fe-Ti oxide		3				anhedral to subhedral	mostly disseminated within the recrystallized different texture domains
Metamorphic texture							
Microgranular Part (separate 3 sub-part)							
Microgranular Part 1 : cryptocrystalline part (upper left side of thin section)							
Plagioclase					<0.03	anhedral microgranular	1) microgranular plagioclase (<0.03mm), often with tiny microgranular inclusions (clinopyroxene & oxide), 2) some more coarse grains (<0.1mm) between microgranular minerals, tiny clinopyroxene inclusion with rim
Clinopyroxene					<0.03	anhedral microgranular	grain size <0.3mm, often with tiny Fe-Ti oxide inclusions,
Orthopyroxene					<0.03	anhedral microgranular	often opx appears in place of cpx, show obscure vein-like distribution (or patch?)
Fe-Ti Oxides					<0.05	subhedral to anhedral	
Amphibole						interstitial	
Microgranular part 2 : microcrystalline part (most part of lower rigth side of thin section)							
Plagioclase						subhedral lath and anhedral interstitals	
Clinopyroxene						anhedral and anhedral microgranular	1) anhedral clinopyroxene, altered to actinolite and desseminated tiny oxide
Fe-Ti Oxides							
Amphibole							
Microgranular Part 3 : opx cluster part (right side of thin section)							
Olthopyroxene						subhedral	weak pleochroism from colorless to reddish
Plagioclase						subhedral lath	opx cluster is surrounding by plagioclase laths, this plagioclase show zoning with corroded core
Fine grained part (actinolite and clinopyroxene predominant part)							
Clinopyroxene						anhedral polikiloblastic	with oxide inclusion
Plagiolase						euhedral and anhedral interstitals	between prismatic actinolite, some show euhedral between actinolite.
Fe-Ti oxide						anhedral to subhedral	between prismatic actinolite
Hornblende						anhedral	some within poikiloblastic clinopyroxene (replacement)
Actinolite						subhedral prismatic	
Epidote						anhedral interstital	interstital between actinolite.
Calcite						anhedral interstital	very high index mineral, interstital between clinopyroxene and actinolite

TS #48: 312-1256D-203R-1, 10-14 cm, Piece No: 4					**Unit: 80**	**OBSERVER: SY,JK / CL /**
ROCK NAME:	Aphyric microcrystalline basalt (meta basalt)					
WHERE SAMPLED:	Probalbly near to dike margin					
GRAIN SIZE:	Fine grained, microcrystalline and cryptocrystalline					
TEXTURE:	Holocrystalline microgranular, holocrystalline					
Opx rich vein part						
Orthopyroxene			0.17		subhedral	
Plagioclase					subhedral, anhedral	core with numerous tiny inclusions
Amphibole					anhedral interstitials, fibrous	green to blown amphibole, fibrous amphibole (altered clinopyroxene) relate with appearance of orthopyroxene
Fe-TI oxide						

SECONDARY		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
Brown hornblende	1				core of large cpx	91% in the amphibole rich zone
Actinolitic hornblende	0				clinopyroxene	up to 40% close to veins
Ca-plagioclase	50				plagioclase	
Pyrite	0.1				disseminated	
Magnetite	7				disseminated	

STRUCTURE : Irregular-shaped, defused amoeboidal-shaped opx-rich veins. The opx vein stop at quartz-actinolite vein that turns its longitudinal direction to about 45 degree. Cpx vein continues straight upward from the turn, but cut by the quartz vein and hornblende rich alteration patch. The quartz crystals in the vein have a blocky texture and the individual grains have diffuse boundaries, that rarely show a weak undulose extintion. The quartz-rich vein partly penetrates, but does not continue beyond the hornblende alteration patch. The alteration patch includes altered clasts of neighbouring finer graind rock with equigranular texture in the left of the alteration patch. No shape preferred orientation, no plastic deformation was observed in both host rocks.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Magmatic texture is overprinted by a metamorphic texture. Description of primary texture based on weakly altered part. This thin section can be divide into 3 parts based on grain size and texture. This sample can be interpreted as an outer dike margin (microcrystalline part and cryptocrystalline part, see above) because of grain size variation (from cryptocrystalline to microcrystallne toward lower right side of thin section). This thin section show considerable amounts of orthopyroxene concentrated in veins, as microgranular patch and as clusters. Plagioclase in this section can be divided into two types, one type shows inclusions in the rim, the other in the core of the crystal. Fine grained part (actinolite and poikiloblastic cpx predominant part) shows calcite as interstital minerals. / The whole thin section is heterogeneous in terms of grain size, extent and type of alteration/metamorphism. Amphibole-rich zone made of large crystals of actinolitic hornblende (91%), pyrite (2%), chalcopyite (1.5%), later prehnite (1%), titanite (1%), calcite (1.5%), plagioclase (1%), quartz (1%). This amphibole-rich zone is in contact with a clinopyroxene rich zone. Severals veins : (A) quartz + plagioclase + hornblende; (B) opx + pl ± qz; (C) tiny clinopyroxene (± replaced by actinolite)+ quartz; (D) quartz + plagioclase + hornblende; (E) minor actinolite + quarz + later prehnite; (F) epidote + actinolite; (G) chlorite + titanite; (H) hornblende + magnetite. Dark Fe-rich oxides (magnetite?) alteration halos adjacent to cpx or opx bearing veins.

TS #49: 312-1256D-205R-1, 10-14 cm, Piece No: 3 **Unit: 80** **OBSERVER: JK / CL / LG**

ROCK NAME: Aphyric microcrystalline basalt (metabasalt)
WHERE SAMPLED: not known, dike rock
GRAIN SIZE: Cryptocrystalline
TEXTURE: Holocrystalline, equigranular, banded
General comment: Primary basaltic texture seems nearly completely metamorphic overprinted except that the occurence of phenocrysts is still preserved. Bands of different lithologies are present: endmembers are 1) equigranular slightly foliated plagioclase-amphibole-oxide fels, and 2) equigranular mosaic plagioclase-clinopyroxene-oxide felspar continously grading in each other. In the following this two lithologies are described.

(PRIMARY) present MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
Plagioclase	< 1		0.2	0.6	0.4	subhedral tabular	strongly altered, overgrown by groundmass, glomerocrysts
Clinopyroxene	< 2		0.2	0.7	0.5	subhedral prismatic	glomerocrysts; different alteration behavior: 1) in lithology 1 completely altered into fibrous actinolitc amphibole; 2) in lithology 2 obviously recrystallized to metamorphic clinopyroxene
Lithology 1)							
Plagioclase					<0.05	subhedral laths	many with tiny inclusions (former cylindrical hollow fillings?)
Amphibole					<0.05	subhedral prismatic, show internal fibrous structure	greenish sometimes slightly brownish (probably actinolitic hornblende)
Fe-Ti oxide					<0.05	subhedral granular	disseminated; no tiny oxides;
Lithology 2)							
Plagioclase					<0.05	subhedral laths	many with tiny inclusions (former cylindrical hollow fillings?)
Clinopyroxene					<0.05	anhedral granular	completely colorless; microgranular; many show inclusions of tiny oxides (suggests that these cpx derives from former altered primary cpx?
Amphibole					<0.05	subhedral prismatic	greenish sometimes slightly brownish (probably actinolitic hornblende)
Fe-Ti oxide					<0.05	subhedral to anhedral granular	1) disseminated within the matrix rock; 2)very tiny grains as inclusions in granular clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
clinopyroxene	0.2				clinopyroxene phenocryst	
dusty cpx/act	0				clinopyroxene	0% in light gray halo, 20 % in dark gray outer halo adjacent to vein (A)
actinolite	0				clinopyroxene	50% in light gray halo, 25% in dark gray outer halo adjacent to vein (A)
Ca-plagioclase	?				plagioclase	more intense replacement in alteration halo related to vein (A)
Magnetite	9				disseminated	

STRUCTURE : Vein A (see alteration description) has an irregular morphology and sharp boundaries with the host rock. The vein opening history is roughly marked by zoning of minerals: actinolitic hornblende, plagioclase and magnetite. Plagioclase and actinolite laths track the opening history which appears to be coaxial. Actinolite vein crosscuts hornblende-bearing vein and is in turn crosscut by another actinolite vein, both crosscutting relationships include some displacement (see comments). Vein halos combine to create an alteration zone.

COMMENTS : Modal proportions of phenocrysts estimated by comparison with standard visual estimation chart. Possible (personal, JK) interpretation: Amphibolit-facies metamorphic overprint of a former cryptocrystalline, highly altered basalt. Due to varying activity of H2O in different rock zones during the overprint, banded textures were produced resulting in more cpx-rich (now probably diopside) and more amphibole-rich (actinolitic hornblende) bands. Possible reasons for varying aH2O: different source compositions (evtl. zones of different alteration), different precursor microtextures, varying fluid chemistry (a dilution of the fluid phase by CO2, F Cl causes a decrease in aH2O favoring the stability of cpx). This interpretation conforms with the observed behavior of cpx alteration which is different within in the different lithologies. / (A) main vein (3-5 mm thick) made of actinolitic hornblende, magnetite, plagioclase, and probable large crystals of quartz replaced by zeolite (?). Both edges of this vein are lined by a discontinuous inner magnetite-rich halo, with a 1-3 mm light green central alteration halo and a dark gray outer alteration halo. (B) One 0.2 mm vein of hornblende + quartz + plagioclase, crosscut by (C), that is a 0.2 mm vein of actinolite flanked by a light gray alteration halo. (D) several 0.005-0.05 mm veins of actinolite with discrete light green adjacent halo. (E) one 0.3 mm vein of actinolic hornblende, magnetite, minor quartz and plagioclase. The proportions of secondary minerals given in the table above concern the freshest part of the thin section, i.e. its lower side.

TS #50: 312-1256D-202R-1, 42-43 cm, Piece No: 3 **Unit: 80** **OBSERVER: SY,JK / CL / LG**

ROCK NAME: Aphyric fine grained basalt
WHERE SAMPLED: Probably dike interior
GRAIN SIZE: Fine-grained
TEXTURE: Holocrystalline intergranular (primary magmatic texture, obscured by metamorphic overprint)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase		55				subhedral lath, anhedral interstitials	often with cylindric hollow filled clinopyroxene and oxide, often show fan-like texture with clinopyroxene
Clinopyroxene		38				subhedral prismatic,anhedral	altered to fibrous amphibole and tiny oxide
Fe-Ti oxide		7				anhedral to subhedral	two populations: 1) larger grains (probably recrystallized) and 2) tiny oxide grains as alteration products in the magmatic clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	8				clinopyroxene	Greenish brown to green
Actinolitic hornblende	28				clinopyroxene	
Magnetite	9				clinopyroxene	Associated with both hornblende and actinolitic hornblende
Ca-plagioclase	5?				plagioclase	
Pyrite	0.5				disseminated	
Chalcopyrite	0.05				disseminated	

STRUCTURE : Several plagioclase crystals show either intracrystalline strain manifest as undulose extinction and subgrain boundaries or intracrystalline subparallel fractures. In addition, one diffuse and irregular chlorite-actinolite vein crosscut the section. This vein is about 0.2 mm wide.

COMMENTS : Modal proportions of phenocrysts estimated by comparison with standard visual estimation chart. This primary magmatic texture is strongly overprinted by high-grade alteration or metamorphism. / One 0.05-0.5 mm vein of large actinolite crystals grading to the host dolerite. No clearly defined alteration halos. Plagioclase are very fractured.

TS #51: 312-1256D-206R-1, 12-16 cm, Piece No: 4 | **Unit: 80A** | **OBSERVER: / CL / LG**

ROCK NAME: Aphyric cryptocrystalline basalt
WHERE SAMPLED: Sheeted dikes
GRAIN SIZE: Cryptocrystalline
TEXTURE: Holocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
MICROPHENOCRYSTS							
plagioclase			0.2	0.4	0.3	euhedral	
GROUNDMASS							
plagioclase	45						needle-like
clinopyroxene	45						
Ti-Fe oxides	10						

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	1				small granular clinopyroxene and clinopyroxene phenocryst	55% in light gray alteration halo. Locally dusty brown.
Magnetite	8				disseminated	
Clinopyroxene	0.1				clinopyroxene phenocryst	
Ca-plagioclase	1				plagioclase	
Pyrite	0.1					2% in light alteration halo

STRUCTURE : Occurrence of 1.2 mm wide planar vein made of, from the edge to the center, altered plagioclase, hornblende, chlorite+prehnite and quartz??. The distribution of these minerals is symmetrical for the whole vein and their crystalization history is not evident. For example, quartz is only present in one side of the vein, as two isolated ribbons with blocky texture and a slight undulose extintion. This may indicate a complex and perhaps multi-phase opening history for the vein. However, this relations are not clear and they seem to be widely overprinted by a later alteration. Magnetite is widespread both in the vein and in the host rock, but finer grained magnetite, together with minor pyrite and chalcopyrite, forms two bands associated to the vein halo. The orientation of these minerals in the vein doesn't show any particular orientation. A 0.001 mm wide vein with very diffused boundary with the host rock is parallel to the largest vein and shows irregular morphology. Occurrence of several irregular and Y-shaped fractures spreading from the edge to the center of the thin section.

COMMENTS : The rock is composed of more or less actinolite- (and reversely less and more clinopyroxene-) rich elongated areas roughly vein related. One 1.2 mm vein of hornblende (70%) + magnetite + pyrite + chlorite + plagioclase (almost completely replaced by another plagioclase + prehnite) + epidote, with associated alteration halo, made of (1) 0.2-0.5 mm inner dark halo, containing 30-60% tiny magnetite crystals and 3-7 mm light gray halo composed of actinolitic hornblende, plagioclase, pyrite and magnetite. Several sinuous 0.005-0.01 mm veins of actinolite.

TS #52: 312-1256D-207R-1, 0-3 cm, Piece No: 1 **Unit: 80** **OBSERVER: JM / SM / AV**

ROCK NAME: Altered aphyric cryptocrystalline basalt
WHERE SAMPLED: Possibly close to dike margin
GRAIN SIZE: Cryptocrystalline
TEXTURE: Variolitic (heavily overprinted)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS	0.38	0.38					
Plagiolcase	0.38	0.38	1	2	1.3	Laths	Often partly replaced by alteration minerals, show clear zoning close to rim that may be related to re-growth during alteration.
MICROPHENOCRYSTS							
GROUNDMASS							
Plagioclase		50	0.2	0.01	0.1	Laths, sometimes slightly vemicular	Plagioclase has been recrystallised during alteration
Clinopyroxene		47					Entirely replaced by alteration phases (poikiloblastic actinolite in places)
Fe-Ti oxides		3				Equant, subhedral	Recrystallised during alteration.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	10				small granular clinopyroxene	
Ca-plagioclase	3				plagioclase	
Dusty cpx/act	0				clinopyroxene and Plagioclase	Up to 10% in dark patches.
Magnetite	9				disseminated	
Pyrite	1				disseminated	5% in dark patches
Chalcopyrite	0.01				disseminated	

STRUCTURE : Oxide (+ actinolite) vein extends transverse direction and cuts subvertical actinolite-cpx vein. The actinolite-cpx vein stops at and offsets dusty-cpx-act-oxide vein of transverse direction. Thin actinolite vein (extends from top-right to left-middle of the thin section) cut the cpx beraing veins. Network of veins of fibrous actinolite also cuts the cpx-bearing vein. No evidence for plastic deformation and shape preferred orientation was observed.

COMMENTS : Phenocrysts of plagioclase are fluid inclusion rich and appear to have been overprinted by finer grained clinopyroxene and amphibole crystals giving the phencrysts apparently rough edges. Veins: A. Actinolitic hornblende and magnetite vein with a light gray halo which is more plagioclase-rich than the background. B. Actinolitic hornblende with magnetite vein with light gray alteration halo that grades into the dark gray alteration halo of vein C, the light gray halo has little if any dusty cpx/act. C. Actinolitic hornblende and magnetite vein with dark gray alteration halo containing dusty cpx/act as well as actinolite. D. Magnetite-actinolitic hornblende with minor hornblende vein. The halo is light gray with actinolite and less magnetite than background. E. Network of actinolitic hornblende with dusty cpx/act and magnetite veins with a dark gray halo with dusty cpx/act and actinolite. F. Actinolitic hornblende with hornblende and magnetite with large crystals of secondary clinopyroxene (diopside) in the centre of the vein in places. G. Actinolitic hornblende with minor magnetite vein with a dark gray alteration halo with some dusty cpx/act and actinolitic hornblende. Veins A-E and G all appear to post-date vein F, as indicated by cross-cutting relationships.

TS #53: 312-1256D-209R-1, 0-6 cm, Piece No: 1 | **Unit: 80A** | **OBSERVER: SY / CL / LG**

ROCK NAME: Aphyric microcrystalline basalt (meta-basalt)
WHERE SAMPLED: Dike interior
GRAIN SIZE: Microcrystalline
TEXTURE: Holocrystalline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS							
Plagioclase		53				Subhedral lath, euhedral interstitials	often with cylindric hollows filled clinpyroxene and tiny oxide
Clinopyroxene		40				Subhedral prismatic, anhedral acicular	Hardly altered to actinolite and tiny oxide, fan-like texture with small plagioclase laths
Fe-Ti oxide		7				euhedral to subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	0				clinopyroxene	0% in light green halo, 5% in dark gray halo
Actinolite	5				clinopyroxene, plagioclase	65% in light green halo,
Magnetite	9				clinopyroxene	3% in light green halo,
Ca-plagioclase	10?				plagioclase	
Pyrite	1				disseminated	Mostly euhedral or subhedral. Both in halo and adjacent rock
Chalcopyrite	0.1				disseminated	

STRUCTURE : Some plagioclase crystals show undulouse extinction and lobate boundaries. Occurrence of three0.01 mm thick, subparallel and irregular fractures spreading from the edge to the center of the thin section. A very diffuse vein, that crosscuts all the section, of mostly prehnite and secondary plagioclase (?) is present. The vein is about 0.2 mm wide with an irregular shape. The vein is highly recrystallized, making virtually impossible to distinguish the veins walls in contact with the host rock.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. / Two anastomosing 0.1 mm veins of actinolitic hornblende, with adjacent composite alteration halo: 0.4 mm inner light green actinolite-rich halo, 1.5-2 mm outer dark gray halo.

TS #54: 312-1256D-209R-1, 8-10 cm, Piece No: 2 | **Unit: 80A** | **OBSERVER: SY / CL / LG**

ROCK NAME: Aphyric microcrystalline basalt (meta-basalt)
WHERE SAMPLED: Dike interior
GRAIN SIZE: microcrystalline
TEXTURE: Holocrystralline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
Clinopyroxene		<1	0.7	0.7	0.7		only one grain, altered to tiny oxide and brownish cryptocrystalline minerals
GROUNDMASS							
Plagioclase		60				Subhedral laths, anhedral interstitials	small plagioclase lath show fan-like structure with clinopyroxene, often with cylindrical hollow filled crynopyroxene and oxide.
Clinopyroxene		35				Subhedral laths, anhedral interstitials	some prismatic clinopyroxene between plagioclase framework, hardly altered to actinolite and tiny oxide.
Fe-Ti oxide		5				Euhedral to subhedral	often with anhedral sulfide

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	5				Clinopyroxene	
Actinolitic hornblende	15				Clinopyroxene	
Magnetite	8				Clinopyroxene	
Ca-plagioclase	6				Plagioclase	
Clinopyroxene?	0.5				Clinopyroxene phenocryst	Associated with minor amphibole
Pyrite	1				Disseminated	Anhedral or subhedral. More abundant at the vicinity of veins
Chalcopyrite	0.1				Disseminated	

STRUCTURE : Both vein A (irregular shape) and C (curved shape), (see comments below), have diffused boundaries, grading into the host rock or alteration halo. No preferential orientation of the minerals in veins. Undulatory extinction observed in several plagioclase crystals.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. / Three cross-cutting veins: (A) 0.02 mm actinolitic hornblende, grading to host rock, becoming more brown in the upper right side of the thin section; (B) 1 mm vein composed of large (up to 0.8 mm) poikilitic brown green hornblende crystals (with inlusions of granular plagioclase and possibly clinopyroxene) + anhedral magnetite and pyrite + actinolite; (C) 0.4-0.7 mm vein of tiny granular (clinopyroxene? and) orthopyroxene + magnetite + minor plagioclase. The host rock is recrystallized in this assemblage, but the igneous texture is still recognizable. The entire vein + adjacent recystallized halo is 1.5 mm thick. Vein (C) is clearly cross-cut by vein (A). (B) ends against (C) but their timing relationships are not clear. (B) may postdate, overlap, replace a cpx + opx + plag + magnetite granular vein.

TS #55: 312-1256D-207R-1, 10-15 cm, Piece No: 3 | **Unit: 80A** | **OBSERVER: JM / CL / LG**

ROCK NAME: Aphyric microcrystalline basalt (meta-basalt)
WHERE SAMPLED: Dike interior
GRAIN SIZE: microcrystallne
TEXTURE: Holocrystralline variolitic/intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS		0.27					
Plagioclase		0.27	0.4	0.6	0.5	Laths	Most appear as aggregates, perhaps altered glomerocryst
GROUNDMASS							
Plagioclase		55	0.1	0.5	0.2	Subhedral laths, anhedral interstitials	Larger plagioclase occurs in radiating arrangements in regions that appear to have been most influenced by texture change upon alteration
Clinopyroxene		40					Altered to actinolite in groundmass
Fe-Ti oxide		5	0.05	0.1	0.08	Euhedral to subhedral	Texture and grain size changed upon alteration

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	5				Clinopyroxene	
Actinolitic hornblende	40				Clinopyroxene, orthopyroxene phenocryst	
Magnetite	10				Disseminated, orthopyroxene phenocryst	
Ca-plagioclase	20				Plagioclase	Locally as overgrowths on igneous plagioclase?
Pyrite	1				Disseminated	

STRUCTURE : Occurrence of two planar veins with very diffused boundaries with the host rock in which a few orthopyroxene and plagioclase crystals show undulous extinction. Plagioclase phenocrysts in the host rock in places exhibit undulouse extinction and subgrain development. Occurrence of one 0.01 mm fracture spreading from the edge to the center of the thin section.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Groundmass recrystallization upon alteration has reinforced any variolitic texture, resulting in radiating patterns of plagioclase. In one part, a mafic phenocryst may have been altered and replaced by an aggregate of what has been referred to as orthopyroxene in previous thin sections (pinkish coloured, high relief, moderate/low birefringence, cleavage). This material does not show extinction parallel to its crystal edges in this section, but may show extinction parallel with its cleavage. Phenocryst proportions esimated using high precision photo-shop method. / (A) 0.1-0.2 mm vein made of large euhedral orthopyroxene + large subhedral pyrite and chalcopyrite + plagioclase (+ minor quartz?) + magnetite + hornblende + tiny granular clino and orthopyroxene. Sulfides are commonly associated with green hornblende. This vein grades to a hornblende vein towards the bottom right of the thin section. (A) could be reopened by a (B) type vein; (B) 0.2 mm actinolitic hornblende vein, with very diffuse boundaries, sub parallel to vein (A); (C) 0.1-0.2 mm vein of actinolitic hornlende, without sharp boundaries. Around the orthopyroxene glomerocrysts, the small granular ortho- and clinopyroxene are abundant. They also partly replace the plagioclase glomerocyst associated with the orthopyroxene glomerocrysts.

TS #56: 312-1256D-212R-1, 17-20 cm, Piece No: 4 | **Unit: 80A** | **OBSERVER: BS / SM / AV**

ROCK NAME: Aphyric microcrystalline basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: microcrystalline
TEXTURE: Holocrystalline intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
Plagioclase			0.5	2	2	euhedral to needle-like	euhedral and needle-like phenocrysts are close together
Clinopyroxe			0.4	0.7	0.5	euhedral to subhedral	cpx replaced by actinolite
GROUNDMASS							
clinopyroxene	40					subhedral	replaced by actinolite
Plagioclase	50					needle-like	needle-like feldspar in the groundmass are partly > 0.2 mm
Ti-Fe-oxides	10						

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic Hornblende	15				clinopyroxene	
Clinopyroxene	5				clinopyroxene and amphibole (?)	
Secondary plagioclase	25				plagioclase	Fluid inclusions
Magnetite	7				disseminated, often associated with cpx and act hornblende	Occasionally seen randomly dispersed within cpx crystals
Pyrite	0.01				disseminated	

STRUCTURE : No preferent orientation visible in the groundmass. Prehnite-rich vein in the upper-right corner of the section. The vein is cut by later fracture, which is most probably not drilling induced. The fracture cuts several phenocrysts of feldspar. Some displacement can be observed in the intersection of vein and fracture. The relative sense of shear is sinestral with respect to the thin section plane; or reverse according to the IODP reference frame.

COMMENTS : / There is one vein of actinolitic hornblende (0.2mm) with a dark gray alteration halo (1mm) which is slightly richer in magnetite than the background (9%) and also has minor amounts of dusty cpx/act (2%). / Note: after a close examination of the vein it seems not to contain hornblende, but prehnite-actinolite with plumose habit. The enrichment in opaque minerals, most of them titanomagnetite, does not seem to be more than in the groundmass.

TS #57: 312-1256D-212R-1, 24-27 cm, Piece No: 6 | **Unit: 80A (host) / 80B (vein)** | **OBSERVER: JK, SY / CL / AV**

ROCK NAME: Aphyric microcrystalline basalt with magmatic vein (trondhjemite)

WHERE SAMPLED: Probably Dike interior

GRAIN SIZE: Microcrystalline (host) / fine grained (vein)

TEXTURE: Holocrystalline intergranular with variolitic domain , granoblastic overprinted (host) / anhedral equigranlar (vein)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
HOST							
MICROPHENOCRYSTS							
Plagioclase	< 1				1	subhedral tabular to bladed	altered, overgrown by groundmass
GROUNDMASS							
	100						
Plagioclase	55				0.3	Subhedral laths	recrystallized, probably rich in Ab
Clinopyroxene		40			0.3	1) subhedral prismatic to anhedral, 2) anhedral microgranular	1) primary prismatic hardly altered to brownish dusty masses and actinolitic hornblende (sometimes brownish, sometimes poikiloblastic) and tiny oxides 2) some microgranular domains caused by granoblastic overprint
Fe-Ti Oxides	5				0.1	subhedral to anhedral granular	
VEIN							
Plagioclase	40				0.5	subhedral, tabular	heavily altered
Hornblende?	10				0.3	subhedral, prismatic	completely altered to actinolite; some rare basal sections show the typical amphibole cleavage;
Quartz	45				0.5	anhedral, prismatic	some microgranophric intergrowths with plag
Oxide	5				0.2	anhhedral, granular	interstitial

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
dusty cpx/act	0				clinopyroxene	8% in dark halo
actinolitic hornblende	40				clinopyroxene	32% in dark halo
magnetite	10				clinopyroxene, titanomagnetite	
Ca-plagioclase	10				plagioclase	30% in dark halo
pyrite	0.5				disseminated	

STRUCTURE : In the groundmass there are no visible structures. The magmatic vein (gabbroic) contains plagioclase crystals that usually show undulose extintion, but other feldspar with no twin planes do not show the undulose extintion. Grain size of feldspar crystals seem to decrease downwards of the section (after the change in direcion of the magmatic vein). Crystals in this vein do not present any preferent orientation. A secondary, hornblende-rich vein merges with the down-side of the magmatic vein and follows it until the latter changes direction (about 30 degrees). However, in the upper-side of the magmatic vein, the hornblende-rich veins stops before reaching the magmatic vein.

COMMENTS : Modal proportions of primary groundmass estimated by comparison with standard visual estimation chart. Magmatic texture is affected by granoblastic overprint. Emplaced, contact between host and vein is continuous, regular. / (A) 0.2 mm vein of orthopyroxene (partly replaced by actinolite), in later chlorite + actinolite, crosscut and reopened by a (B) 0.2 mm vein of actinolitic hornblende (edges), quartz + plagioclase (center). (C) 0.2 mm vein of quartz + hornblende + plagioclase, probably cross cut by (B). 4-8 mm dark alteration halo adjacent to the quartz-plagioclase-hornblende vein described as VEIN in the igneous section.

TS #58: 312-1256D-213R-1, 17-19 cm, Piece No: 5 | **Unit: 80A** | **OBSERVER: BS, SY / CL / NH**

ROCK NAME: Aphyric microcrystalline to cryptocrystalline basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: Microcrystalline
TEXTURE: Holocrystralline intergranular to variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	max.	av.	MORPHOLOGY	COMMENTS
MICROPHENOCRYSTS							
GROUNDMASS							
clinopyroxene	45					subhedral interstitial to prismatic	replaced by actinolite and disseminated tiny oxide,
Plagioclase	50					subhedral lath, anhedral interstital	needle-like, some show cylindrical hollow filled clinopyroxene and oxide,
Ti-Fe-oxides	5						
Olthopyroxene						subhedral to euhedral granular	show pleochroism from reddish to colorless

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	REPLACING / FILLING	COMMENTS
Hornblende	5					
Actinolitic hornblende	30				Clino and orthopyroxene	
Magnetite	8				Clinopyroxene	
Secondary plagioclase	15?				Plagioclase	
Quartz	0					abundant in the alteration patch
Pyrite	1				disseminated	see comment
Chalcopyrite	0.05					

STRUCTURE : Intergranular texture contains abundant actinolite and minor hornblende with no related structure (e.g. static alteration). Patches have diffusive boundaries and heterogeneously distributed quartz, fine-grained actinolite, and trace hornblende and prehnite. A chlorite-actinolite vein is present in the uppermost right side of the section. The vein is about 0.1 mm side, diffuse and with an irregular shape and is cut by a later splayed fracture that also crosscuts one of the patches. There is no movement associated with the crosscutting relationships.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. This thin section show granoblastic texutre (secondary granular cpx&opx)./ Several irregular 5-10 mm patches made of quartz (dominant), plagioclase replaced by secondary plagioclase, both corroded and fractured, equant actinolitic hornblende (possibly replacing equant pyroxene)

TS #59: 312-1256D-213R-1, 51-54 cm, Piece No: 13A | **Unit: 80A and 81** | **OBSERVER: J cm, SY / CL / AV**

ROCK NAME: Microcrystalline aphyric basalt and medium-grained oxide gabbro
WHERE SAMPLED: Dike-gabbro contact
UPPER PART: **MICROCRYSTALLINE BASALT (ALTERED DIKE)**
GRAIN SIZE: Microcrystalline
TEXTURE: Intergranular/variolitic overprinted by metamorphic texture

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS							
Plagioclase	45	50	0.05	0.6	0.2	subhedral laths in radiating variolitic patches.	Texture overprinted by alteration
Clinopyroxene	0	47					Completely altered
Fe-Ti oxides	3	3	0.01	0.2	0.1	subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	20				Clinopyroxene	More abundant close to veins
Magnetite	8				Clinopyroxene, titanomagnetite	
Secondary plagioclase	3				Plagioclase	More abundant close to veins
Chlorite	0.5					
Calcite	0				Plagioclase	1.5% in halo next to contact

LOWER PART: **MEDIUM-GRAINED OXIDE GABBRO**
GRAIN SIZE: medium-grained
TEXTURE: inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	50	55	0.4	3	1.3	Large subhedral laths, smaller more equant.	Partly altered
Clinopyroxene	0	30	0.4	2	1	Interstitial-subhedral	Completely altered
Fe-Ti Oxide	15	15	0.4	3.5	1.2	Interstitial-subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Orthoamphibole?	0.5				Primary	
Actinolitic hornblende	30				Clinopyroxene, plagioclase	
Actinolite	2				Interstitial	Needle-like, in quartz
Magnetite	3				Clinopyroxene, titanomagnetite	
Albite	15				Plagioclase	
Chlorite	7				Plagioclase, actinolite	
Titanite	2				Titanomagnetite	
Epidote	5				Plagioclase	
Calcite	1				Plagioclase	
Prehnite	5				Plagioclase	
Quartz	3				Plagioclase	

STRUCTURE : No visible structures in the groundmass of the basaltic unit. The contact with the gabbro unit is diffuse and somehow gradual. Phenocrysts became larger as move away from the contact within the gabbro, specially opaque minerals. Ti-Fe oxides seem to be secondary, on both units. It is possible to see exsolution of titanomagnetite into, perhaps, magnetite and/or ilmenite (?). There is one chlorite vein, of about 0.05mm wide, that has an angle of s. 30 degrees with respect to the gabbro-dike boundary. The chlorite vein cuts the contact and enters into the gabbro about 0.5 cm until it stops (this may indicate an insuficient amount of fluids?). Another vein with diffuse boundaries, in the upper part of the section and within the basaltic dike, contains hornblende, and it is parallel to a smaller irregular vein with the same mineral content. No crosscutting relationship between this latter vein and the chlorite or with the contact were observed.

COMMENTS : The igneous texture of the microcrystalline basalt has been strongly overprinted by alteration. There is a 3-4 mm wide region of increased alteration in the area adjacent to the gabbro, involving more dusty alteration of the plagioclase and a chloritic vein also runs sub-parallel to the contact. The line of the contact is marked by a trail of oxides, as is observed in many of the igneous contacts within the dikes. The modal estimates in the gabbro are made by comparison with visual estimation charts, and are based on the coarsest part of the gabbro close to the contact. More than 1 cm from the contact the gabbro is highly altered, and the grainsize of this altered material is significantly smaller than that of the gabbro at the contact. The size and proportion of oxides increases from the contact up to 1 cm away from the contact, and then drops markedly in the highly altered zone. Comparison with the core shows that the change in grain size is most likely caused by alteration rather than reflecting an original igneous texture. / In the microcrystalline basalt part, several 0.02-0.4 mm actinolitic hornblende vein, with very diffuse boundaries. One 0.1-0.2 mm vein of chlorite (dominant) + titanite + local prehnite + pyrite. This vein bifurcates; one arm lines the dike/gabbro transition and the other arm crosscuts this transition and rapidly vanishes into the gabbro. The lower part of the slide is highly (about 90%) altered, with abundant quartz.

TS #60: 312-1256D-214R-1, 41-47 cm, Piece No: 11 **Unit: 82** **OBSERVER: JK / CL / NH**

ROCK NAME: Quartz-rich oxide diorite
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Subhedral inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	45		0.5	5	3	euhedral to subhedral tabular	strong zoning; partly altered; dusty inclusion
Hornblende	25		0.2	8	2	subhedral acicular; anhedral poikilitc	mostly altered to fibrous actinolite; some relics shows nice cleavage and green-brown colors
Fe-Ti Oxide	7		<0.05	5	0.5	1) anhedral, interstitial, 2) anhedral granular	1) primary oxides, interstitial, partly poikilitic; 2) tiny oxide grains as alteration product
Quartz	23		0.2	3	1	anhedral granular	interstitial, partly graphic intergrowth with plagioclase

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	20				Pyroxene (clino or ortho?)	only minor amounts of magmatic pyroxene is left
Actinolite	8				Hornblende	
Chlorite	5				Actinolite, plagioclase	
Secondary plagioclase	20				Plagioclase	along cleavages and microfractures
Epidote	2				Plagioclase	pistachite and less zoisite
Prehnite	1				Plagioclase	
Quartz	0.1				Interstitial	Drusy, associated with epidote and chlorite
Magnetite	2				Pyroxene	Tiny crystals associated with hornblende and actinolite
Titanite	2				subhedral, small disseminated crystals, or large crystals in or adjacent to large Fe-Ti oxides	

STRUCTURE : In Feldspars: Intense intragranular fracture and even some cataclastic textures. Grain boundaries are unclear and extinction patchy. Interpreted to be upper amphibolite-grade deformation with a component of recovery.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Section contains two areas with different grain sizes and also different modal proportions, therefore the estimation of the modal proportions is weak / No veins /

TS #61: 312-1256D-214R-1, 108-111 cm, Piece No: 20 **83** **OBSERVER: JK / CL / AV**

ROCK NAME: Quartz-bearing disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular seriate (primary magmatic texture, obscured by strong alteration overprint)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase			0.4	8	4	Subhedral tabular	completeley altered to dusty brownish masses
Clinopyroxene / Hornblende?				6	3	Anhedral poikilitic	only pseudomorphs present; completely altered to fibrous actinolite plus tiny oxide
Fe-Ti Oxide			<0.05	3	1	1) anhedral, interstitial, 2) anhedral granular	1) primary oxides, interstitial, partly poikilitic; 2) tiny oxide grains as alteration product
Quartz						Anhedral interstitial	probably primary in small amount; much of secondary quartz

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
orthamphibole?	0.5					
Actinolitic hornblende	28				Clinopyroxene / Hornblende?	
Prehnite	10				Plagioclase	
Chlorite	10				Plagioclase	
Epidote	15				Plagioclase	
Titanite	5				Titanomanetite	Into or in contact with magnetite
Zeolite	12				Plagioclase	
Quartz	10					
Magnetite	10				Clinopyroxene	Large primary and tiny secondary

STRUCTURE : There are no visible structures besides a couple of veins within the melanocratic portion (upper part of the thin section). The quartz vein is discontinuous and it is about 0.7mm wide. The quartz vein is cut by a later epidote vein. The epidote vein is very diffuse and easily becomes undistinguishable from the alteration that affects the host rock. The leucocratic part (portion) has larger phenocryst size when compared with the crystals in the melanocratic part (right side of the thin section). The melanocratic part represents a strong grain size reduction, probably as a result of the alteration. Secondary minerals are apparently more common in the melanocratic portion, although most of the grains in the leucocratic part seem to be secondary as well. Several fractures are also present in the section. Fractures protrude from the edges of the section towards the interior, and they are clearly the youngest structures present in the section. Fractures crosscut veins and alteration patches, yet no shear was recognized. The fractures have different morphologies, but in general they are curved and highly irregular and rarely splayed. There is a big chance that fractures are either drilling induced or generated during the preparation of the section.

COMMENTS : Primary magmatic features are strongly overprinted by strong alteration, therefore related descriptions are poorly constrained; it is not possible to estimate the primary mode; not clear whether primary mafic phase was cpx or hornblende. / Epidote, quartz, prehnite rich alteration patches grading to - and/or crosscut by - epidote vein. Epidote vein crosscut by quartz vein. The proportions of secondary minerals given above are averages on the whole surface of the section.

TS #62: 312-1256D-214R-1, 121-124 cm, Piece No: 24 **Unit: 82** **OBSERVER: BS,JK / SM, CL / NH**

ROCK NAME: Quartz-rich oxide diorite
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Subhedral inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	5	65	0.5	1.2	1	anhedral to subhedral	nearly completely altered
Clinopyroxene/Hornblende	0 (as primary)	15	0.4	0.9	0.6	anhedral	strongly altered to actinolite; not clear whether the primary mafic phase was hbl or cpx
Fe-Ti Oxide	5	5	0.1	1	0.1	subhedral to euhedral	
Quartz	15	15				anhedral granular	interstitial, partly graphic intergrowth with plagioclase
Apatite	<1	<1	0.1	0.4	0.2	euhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	30				clinopyroxene and/or hornblende	Better developed where replacing clinopyroxene, dusty looking where replacing plagioclase (less well developed)
Zeolite	15				plagioclase	Colorless or pale brown because dusty appearance, two cleavages
Plagioclase	5				plagioclase	Along cracks and an irregular rim
Epidote	5				interstitial and replacing plag-	
Chlorite	1				plagioclase	
Prehnite	0.5				plagioclase	
Magnetite	8				pyroxene	Seen as blebs in actinolite crystals
Titanite	1					Associated with magnetite

STRUCTURE : Grain fracture in feldspars is slight, but granophyric domains are present. In places the granophyric domains are cataclastic and contain actinolite needles and prehnite. Alteration patches of microcrystalline amphibole protrude into and fracture feldspar.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Primary magmatic features are strongly overprinted by strong alteration, therefore related descriptions are poorly constrained; it is not possible to estimate the primary mode; not clear whether primary mafic phase was cpx or hornblende. / No veins. /

TS #63: 312-1256D-214R-2, 0-6 cm, Piece No: 1 **Unit: 84** **OBSERVER: JK,TY, SY / SM / AV**

ROCK NAME: Hornblend oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Fine grained

TEXTURE: Subhedral inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	50	55	0.1	3	2	subhedral bladed to tabular	some are strongly zoned; partly altered; dusty inclusion; chadachrist laths are smaller than plag of the rock outside
Clinopyroxene	20	25	0.5	4	3	anhedral poikilitic	chadacrysts are plagioclase laths; strongly altered to actinolite
Hornblende/CPX?		15	0.5	5	2	subhedral prismatic	strongly altered to actinolite; not clear whether the primary mafic phase was hbl or cpx
Orthopyroxene	0	<1	0.2	1	0.8	subhedral to interstitial	Completely altered
Olivine	0	2	0.2	1.7	1	Subhedral to anhedral?	Completely altered
Fe-Ti Oxide	3	3	<0.05	2	1	1) anhedral, interstitial, 2) anhedral granular	1) primary oxides, interstitial, partly poikilitic; 2) tiny oxide grains as alteration product

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	10				clinopyroxene	
Actinolitic hornblende	20				clinopyroxene	Locally relict cpx crystals are evident
Secondary plagioclase	10				plagioclase	
Magnetite	6				clinopyroxene, interstitial	blebs in actinolitic hornblende and actinolite

STRUCTURE : No visible structures or veins. Only moderate to strong fracturing of feldspar crystals, probably as a result of the alteration and/or change in volume due to the growth of secondary minerals.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Due to strong alteration of the mafic phases to actinolite, the primary relations between cpx and hornblende are unclear, also the initial modal proportions. Section can also be interpreted as to consist of two lithologies: one related to the cpx-oikocrysts (oxide-free, small plag lath, evtl. doleritic patches); and the other correspond to a much coarser grained (in terms of plag laths) oxide-rich hornblende gabbro: this could be interpreted as the mixing/ percolation of two or magmas. / There are no veins in this thin section. It is possible to observe different opaque mineral phases, including titanomagnetite, ilmenite, chalcopyrite and, perhaps, pyrite.

TS #64: 312-1256D-214R-2, 50-51 cm, Piece No: 7B | **Unit: 85** | **OBSERVER: JK,TY/ SM, DT /NH**

ROCK NAME: Hornblende-bearing disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular, subhedral granular, partly poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	45	47	0.1	3	1	subhedral bladed to tabular	some are strongly zoned but chadacryst are unzoned; partly altered; dusty inclusion
Clinopyroxene	20	40	0.2	5	3	anhedral poikilitic	chadacrysts are plagioclase laths; sometimes show symplectitic structures at the rim; strongly altered to actinolite
Hornblende		5			1	subhedral prismatic	strongly altered to actinolite
Fe-Ti Oxide	4	4	<0.05	1	0.5	1) anhedral, interstitial, 2) anhedral granular	1) primary oxides, interstitial, partly poikilitic; 2) tiny oxide grains as alteration product
Olivin	0	3	0.3	2	1.2	subhedral	Completely altered, originarry surrounded by orthopyroxene?
Sulfide	< 1	<1					

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	5				clinopyroxene, plagioclase	plagioclase altered along cracks and cleavage traces
Actinolitic hornblende	20				clinopyroxene	
Unidentified amphibole	0.1				clinopyroxene	colorless to very mildly pleochroic in shades of green. Moderately high relief with a ribbed appearance, found in association with other amphiboles.
Secondary plagioclase	10					
Epidote	3				plagioclase or interstitial	
Titanite	0.1				interstitial	with epidote, euhedral
Chlorite	1				olivine	
Magnetite					Disseminated and pyroxene, olivine	most commonly as bleb networks in actinolite and actinolitic hornblende
Dark green phyllosilicate	0.2				olivine	
Chalcopyrite					disseminated	associated with secondary minerals (epidote, chlorite + minor actinolite)

STRUCTURE : Intense grain fractures in plagioclase spatially related to amphibole alteration. Very local cataclastic textures on the edges of alteration patches.

COMMENTS : Due to strong alteration of the mafic phases to actinolite, the primary relations between cpx and hornblende and the initial modal proportions are unclear. Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. The symplectitic rims of the clinopyroxene reflects a reaction with a late-stage hornblende-saturated hydrous magma producing amphibole. Epidote-rich patch (~2 mm) with needles of actinolite, chalcopyrite, quartz? laumontite and euhedral titanite. No veins.

TS #65: 312-1256D-214R-1, 34-35 cm, Piece No: 9 | **Unit: 81/82 contact** | **OBSERVER: SY, TY / CL /AV**

ROCK NAME: Medium-grained oxide gabbro (Unit 81) and medium-grained quartz-rich oxide diorite (Unit 82)

WHERE SAMPLED:

GRAIN SIZE: Medium-grained

TEXTURE: Subhedral inequigranular seriate (both part)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Oxide diorite (Unit 82)							
Plagioclase	10	53	0.5	6	3	subhedral bladed to tabular	some are strongly zoned; partly altered
Quartz	20	20	1	6	3	anhedral, interstitial	micrographic texture with completely altered plagioclase
Clinopyroxene or hornblende	0	20	0.2	8	3	subhedral prismatic	completely altered to fibrous actinolite and disseminated tiny oxide
Fe-Ti Oxide	7	7	<0.05	2	1	anhedral, interstitial, 2) anhedral granular	primary oxides, interstitial, partly poikilitic
Gabbro (Unit 81)							
Plagioclase	40	55	0.1	2	1	subhedral bladed to tabular	some are strongly zoned; partly altered; dusty inclusion; chadacrysts laths are smaller than plag of other portions
Clinopyroxene	15	37	1	7	3	anhedral poikilitic,	chadacrysts are plagioclase laths; strongly altered to actinolite and desseminated tiny oxide
Olivine	0	5	0.2	1.8	1	subhedral	completely altered, originally surrounded by orthopyroxene?
Fe-Ti Oxide	3	3	<0.05	1.5	0.75	1) anhedral, interstitial, 2) anhedral granular	1) primary oxides, interstitial, partly poikilitic; 2) tiny oxide grains as alteration product

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	25				Clinopyroxene, minor plagioclase	replaces all cpx in tonalite, partial cpx in dolerite
Magnetite	1.5				Clinopyroxene	associated with actinolitic hornblende
Titanite	2				Plagioclase	euhedral
Albite	25				Plagioclase	only 1% in dolerite
Prehnite	3				Plagioclase	colorless or pale brown
Chlorite	2				Plagioclase	
Epidote	1.5				Plagioclase	
Quartz	0.5				In laumontite, interstitial between two plagioclase	euhedral, dusty apperance because replaced (by laumontite ?)
Laumontite	0.8				Plagioclase	

STRUCTURE : In unit 81 strong alteration of phenocrysts, give dusty appearance. Moderate brecciatization of plagioclase crystals, due to fracturing (probably due to volume increment). This fracturing seems to be stronger in unit 82. No other visible structures.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Section consists of two lithologies: one related to the cpx-oikocrysts (oxide-free, small plag laths), and the other coarser grained with quartz and appearance of oxide diorite.

TS #66: 312-1256D-214R-1, 70-73 cm, Piece No:15 | **Unit: 82 / 83 contact** | **OBSERVER: SY, TY / CL /AV**

ROCK NAME: Medium-grained oxide gabbro and mg quartz-rich oxide diorite

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Subhedral inequigranular seriate (Unit 82), inequigranular ophitic to seriate (Unit 83)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Medium grained qtz-rich oxide diorite part (Unit 82)							
Plagioclase	45		0.2	4.5	3	subhedral bladed to tabular, anhedral interstitial	Rarely altered to albite
Quartz	25		0.1	3.5	1.75	anhedral, interstitial	micrographic texture with completely altered plagioclase
Clinopyroxene	20		0.2	9	3	subhedral prismatic, anhedral interstitial	completely altered to fibrous actinolite and disseminated tiny oxide, some show curved shape
Fe-Ti Oxide	10		<0.05	2	1	anhedral, interstitial	interstitial, some with plagioclase and quartz inclusions.
Medium-grained quartz bearing oxide gabbro part (between Unit 82 and 83)							
Plagioclase	50		0.5	5.5	3	subhedral bladed to tabular	highly altered to albite, chrolite and oxide.
Clinopyroxene	40		0.2	6	3	subhedral prismatic	completely altered to fibrous actinolite and disseminated tiny oxide, some with small brown amphibole
Fe-Ti Oxide	7		<0.05	2.5	1.25	anhedral, interstitial	interstitial, some with plagioclase and quartz inclusion.
Quartz	3		0.3	0.5	0.4	anhedral, interstitial	some show micrographic texture with plagioclase (completely altered)
Medium grained oxide gabbro part (Unit 83)							
Clinopyroxene	60		2	7	4.5	anhedral poikilitic	chadacrysts are plagioclase laths; strongly altered to actinolite and oxide
Plagioclase	35		0.1	3	1.5	subhedral bladed to tabular lath	strongly altered, chadacript laths in poikilitic clinopyroxene
Fe-Ti Oxide	5		<0.05	0.5	0.25	anhedral, interstitial	interstitial, some with plagioclase and quartz inclusion.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	2				Primary?	rim replaced by chlorite
Actinolitic hornblende	28				Clinopyroxene, minor plagioclase	
Magnetite	3				Clinopyroxene	
Titanite	7				Titanomagnetite	In or around titanomagnetite, well developed when in contact with the vein
Albite	30				Plagioclase	often dusty, main replacement product of plagioclase
Prehnite	8				Plagioclase	
Chlorite	10				Actinolitic hornblende, minor plagioclase.	Frequently as thin rim of amphibole replacing clinopyroxene
Epidote	5				Plagioclase	
Laumontite	2				Plagioclase	
Calcite	1				Plagioclase	one large - and several large parts in the center of - plagioclase crystal

STRUCTURE : Small (0.05mm wide) and very diffuse chlorite vein. There is no clear crosscutting relationship\ between this vein and the crystals in the groundmass of unit 82. Unit 82 is strongly recrystallized, quartz and feldspar crystals usually show lobate margins, although no subgrains or undulose extintion of the crystals were observed. This indicates rearrangment of the crystalline structure is only due to temperature (no strain). One actinolite-horneblende vein develops from the edge to the center of the thin section and shows planar morphology and it is cut by a very diffuse chlorite-rich vein.

COMMENTS : Modal proportions of primary mineral estimated by comparison with standard visual estimation chart. Section can also be interpreted as consisting of three lithologies: 1) coarser grained oxide, 2) doleritic part related to the cpx-oikocrysts (with small plag lath), 3) tonalitic part. These contacts are not clear (diffused). / One 0.4 mm chlorite-epidote-quartz vein grading to an alteration patch. One chlorite-laumonite vein. The proportions given above are averages of the whole thin section / Some titanomagnetite crystals have exolution lamellae of ilmenite, and they are commonly accompanied by titanite.

TS #67: 312-1256D-214R-1, 94-95 cm, Piece No: 17a&b **Unit: 83** **OBSERVER: SY, TY / CL / AV**

ROCK NAME: Medium-grained quartz bearing oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Subhedral inequigranular ophitic to seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	15	57	0.1	4.2	2	subhedral bladed to tabular, anhedral interstitial	some are strongly zoned; partly altered
Clinopyroxene	35	34	0.4	5	2.5	subhedral prismatic, anhedral interstitial to poikilitic	some altered to fibrous actinolite and disseminated tiny oxide, some altered to brownish amphibole, poikilitic clinopyroxene include plagioclase laths as chadocrysts.
Hornblende?						interstitial	suggested by relics of brown patches in the cores of actinolitic patterns, and by some crystals showing basal sections with typical amphibole cleavage; nearly completely altered to clinopyroxene
Olivine	0	1	0.2	1.2	1	Subhedral	Originally surrounded by orthopyroxene?
Fe-Ti Oxide	5	5	<0.05	2.5	1	1) anhedral, interstitial, 2) anhedral granular	1) primary oxides, interstitial, often with inclusions (quartz, plagioclase and clinpyroxene) ; 2) tiny oxide grains as alteration products
Quartz	3	3	0.3	4.5	2.5	anhedral interstitial to poikilitic	micrographic texture with completely altered plagioclase, some poikilitic quartz include plagioclase laths as chadocrysts.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Orthoamphibole?	0.5		1.6		overprint on plagioclase	4 crystals, colorless, parallel extinction
Brown amphibole	0.5				Primary?	
Actinolitic hornblende	25				Clinopyroxene	1-2% magmatic cpx relicts
Magnetite	4				Clinopyroxene	
Chlorite	7				Plagioclase, minor actinolitic hornblende	
Titanite	3					
Albite	8				Plagioclase	
Prehnite	5				Plagioclase	
Epidote	3				Plagioclase	
Laumontite	7				Plagioclase	Strong replacement in the lower part of the slide

STRUCTURE : Small and very diffuse chlorite veins of ca. 0.02mm, discontinuous and irregular. They crosscut several feldspar crystals in the groundmass, but with no apparent shear within the crystals. Chlorite veins are ubiquitous in the thin section. They are very diffuse and they seem to use interstitial crystalline spaces to propagate. Very few crosscutting relationships could be observed between the chlorite veins and the groundmass. Also one very narrow, ca. 0.002mm wide, quartz vein that crosscut both titanomagnetite and hornblende crystals (strongly altered with actinolite) and the reaction rim of the hornblende. The quartz in this vein shows undulose extinction but no strain indicators. A few strongly altered feldpars crystals show generation of subgrains of rounded shapes of sizes of about 0.005mm. Subgrains show undulose extintion but no plastic (strain) deformation, indicating that temperature is the main factor for their generation. Plagioclase crystals in the groundmass show strong fracturing, that in general is subperpendicular or in high angle with respect to the length of the crystals. Intensely fractured domains ocassionally result in micro-cataclastic areas.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. There are some completeley altered obscured objects which eventually could represent former olivines and/or orthopyroxene. Curious mineral assemblage of this rock suggests that the relatively coarse grained, quartz-bearing portion and quartz-free, olivine-bearing portion are derived from different origin. / Several titanomagnetite crystals, especially larger ones, show exsolution of ilmenite and, perhaps, hematite (?) /

TS #68: 312-1256D-214R-1, 136-139 cm, Piece No: 27 **Unit: 82/84** **OBSERVER: JM,TY/ CL / AV**

ROCK NAME: Contact between unit 82 (quartz-rich oxide diorite) and 84 (oxide gabbro)

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular seriate (quartz-rich oxide diorite), inequgranular seriate/poikilitic (oxide gabbro)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
DIORITE							
plagioclase	20	40	0.4	4	3	subhedral laths	Often highly altered
quartz	20	20	0.8	4	2	granophyric intergrowths	
amphibole/clinopyroxene	5	30	0.6	6	2	Subhedral elongate, sometimes diamond shaped sections with cleavages at 56 degrees	Often altered to actinolite, but some of these mafic phases may have been primary amphibole. In two cases the amphibole has a diamond cross-section with well developed cleavage and green-brown pleochroism.
fe-ti oxides	10	10	0.5	2	1	subhedral	
OLIVINE-BEARING OXIDE GABBRO							
Plagioclase	30	58	0.4	2	1	elongate subhedral laths as chadacrysts, more equant crystals in coarser regions	Plagioclase texture is once more controlled by whether it appears as a chadacryst or not
Clinopyroxene/amphibole	10	34	0.4	4	2	fresh clinopyroxene as oikocrysts, altered as interstitial	Some primary clinopyroxene is preserved in the oikocrysts but much material in the region with coarser plagioclase has been altered
Olivine	0	5	0.3	1	0.7	subhedral to anhedral	originally surrounded by orthopyroxene?
fe-ti oxides	3	3	0.5	1	0.8	interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Orthoamphibole?	1					colorless, parallel extinction, one in epidote
Brown hornblende	0.5				Core of actinolitic hornblende replacing cpx	
Actinolitic hornblende	25				Clinopyroxene, minor olivine	2% magmatic cpx is preserved, at the top of the slide
Magnetite	2				Clinopyroxene, olivine	associated with actinolitic hornblende
Chlorite	2				Actinolitic hornblende, plagioclase. Olivine?	
Titanite	3					
Albite	2				Plagioclase	
Prehnite	3				Plagioclase	
Epidote	1				Plagioclase	
Laumontite	8				Plagioclase	

STRUCTURE : Alteration produces granophyric texture of the feldspars which are strongly fractured, especially in the tonalite (unit 82). The contact between both units is diffuse and difficult to distinguish. Plagioclase crystals in the gabbro portion (unit 84) seem to be less fractured than those in the tonalite (unit 82). Plagioclase crystals in the gabbro can show undulose extinction. There is no evidence for strong recrystallization. No alignment of the crystals was observed, neither in the gabbro nor the tonalite nor in the contact between them.

COMMENTS : The strong alteration of this section makes it difficult to ascertain the exact relative proportions of primary amphibole and clinopyroxene. The tonalite, in particular, has been extensively altered. The contact is interlocking and neither unit shows appreciable decreases in grain size towards its margin. However, the gabbro appears to show a 2-3 mm wide halo of strongly coloured green-blue/green pleochroic amphiboles, perhaps indicating that the tonalite (unit 82) intruded the gabbro (unit 84). The gabbro shows the typical texture for this unit of fresh clinopyroxene oikocrysts with elongate plagioclase chadacrysts and coarser feldspar patches with interstital clinopyroxene and FeTi oxides. / This slide displays the most and least altered portions observed in these rocks more and less altered part. Alteration patch on the left side, rich in subhedral actinolitic hormbende + later laumontite. / The pleoroic hornblende alteration halo is accompanied by titanomagnetite with dusty appearance (reflected light). These titanomagnetite display exsolution lamellae of ilmenite in addition to clusters of titanite.

TS #69: 312-1256D-214R-2, 15-17 cm, Piece No: 4A **Unit: 84** **OBSERVER: BS, TY / CL, SM / NH**

ROCK NAME: Medium-grained disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Subhedral granular, poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
plagioclase	55	55	0.1	2	1	euhedral to subhedral	commonly strong zoning
clinopyroxene	20	43	0.2	4	2	anhedral, ophitic	oikocrystic
olivine	0	1	0.2	1.5?	1	subhedral	completely altered
orthopyroxene	0	<1			1.2	anhedral	
Fe-Ti-oxide	1	1	0.1	1.3	0.5	subhedral to euhedral	primary oxides with sulfide inclusions

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	5				clinopyroxene	
Actinolitic hornblende	15				clinopyroxene	
Chlorite	10				clinopyroxene, actinolitic hornblende, minor plagioclase	
Magnetite	3				clinopyroxene	associated with actinolitic hornblende
Pyrite	0.5				disseminated	locally seen adjacent to magnetite
Chalcopyrite	0.5				disseminated	

STRUCTURE : Grain fracture is moderate, and no cataclastic or granophyric textures are apparent. A large amount of plagioclase crystals, usually the smaller ones, display a slight undulose extinction and lobate borders. No generation of subgrains were observed. Alteration appears to have been static. An irregular, discontinious and partly splayed fracture crosscuts all the section. The fracture crosscut several crystals of the host rock but no displacement was observed in this. It is highly possible that this fracture is drilling induced.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Some clinopyroxenes are dusty but comparatively fresh with respect to some sections higher up. / No veins.

TS #70: 312-1256D-215R-1, 10-14 cm, Piece No: 2 | **Unit: 85** | **OBSERVER: BS, JK, TY, SY / SM / AV**

ROCK NAME: Medium-grained olivine bearing oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Subhedral granular, poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
plagioclase	45	55	0.1	2.5	2	subhedral to euhedral	highly altered
clinopyroxene	20	39	0.2	7	10	anhedral to subhedral	poikilitic, symplektitic structures (mainly at the rim), replaced by actinolite
olivine	0	3	0.2	1.2	0.8	anhedral, interstitial	strongly altered
Fe-Ti-oxide	3	3	0.2	2.2	2.5	subhedral to anhedral, interstitial	it appears like many of the larger grains are products of alteration

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	25				clinopyroxene	Some of these are not very well developed give a dusty appearance.
Secondary plagioclase	25				plagioclase	
Epidote	1				interstitial plagioclase	
Prehnite	0.5				inerstitial	
Magnetite	6				clinopyroxene + disseminated	Blebs in actinolitic hornblende
Haematite	2.5				Disseminated	
Pyrite	1				Disseminated	

STRUCTURE : No structures are visible under the microscope, but several leucocratic patches are present. The patches seems to contain a larger amount of feldspar, especially plagioclase, and to a lesser degree actinolite-hornblende alteration. Throughout the section, feldspar crystals are moderately fractured, usually in a direction perpendicular to the twinning of the crystals. Large feldspar crystals also display weak undulose extinction. No generation of subgrains or lobate borders are present. Plagioclase chadacrysts, included within cpx oikocrysts, have usually well defined borders and do not present undulose extinction.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. A few completely altered fragments could represent former olivine or orthopyroxene graines / No veins in this thin section. / Titanomagnetite crystals commonly display exsolution of ilmenite and rarely of pyrrhotite (?).

TS #71: 312-1256D-215R-1, 84-88 cm, Piece No: 17 | **Unit: 85** | **OBSERVER: JK, TY / RC / AV**

ROCK NAME: Olivine (or orthopyroxene)-bearing oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Subhedral granular, partly poikilitic, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	50	50	0.1	3	2	subhedral bladed to tabular	chadacryst laths are smaller than plag of the host rock
Clinopyroxene	40	40	0.1	1	0.6	anhedral poikilitic	sometimes shows symplectitic structures at the rim, sometimes hbl involved; mantled by hornblende; altered to actinolite
Olivine	3	3		1	0.6	subhedral to euhedral	strongly altered, partly to talc; initially probably prismatic, (not poikilitic), some are possibly orthopyroxene
Hornblende	3	3?	0.1	5	2	anhedral interstitial	forms coronas around cpx, fills interstices, forms isolated crystals; often showscpx relics inside; strongly altered to actinolite plus oxide
Fe-Ti Oxide	4	4	0.1	2	0.5	anhedral, interstitial	primary oxides, interstitial, partly poikilitic

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	2				clinopyroxene, olivine	non-poikilitic clinopyroxene is more intensely altered, poikilitic clinopyroxene is commonly altered along grain margins and cracks
Actinolitic hornblende	13				clinopyroxene, vein	
Hornblende	5				clinopyroxene, actinolite, vein	coronas around clinopyroxene, especially where clinopyroxene is cut by the vein
Epidote	0.5				plagioclase, interstitial	
Prehnite	0.5				plagioclase, interstitial	
Titanite	0.1				interstitial	euhedral, with epidote
Secondary plagioclase	20				plagioclase	plagioclase is most intensely altered in plagioclase-rich areas and along the late-magmatic vein
Dark brown-green phyllosilicate	1				olivine	
Secondary clinopyroxene	0.5				clinopyroxene	stripey; altered exsolution lamellae?
Magnetite	1				clinopyroxene, disseminated, olivine	disseminated blebs in fibrous amphibole after clinopyroxene
Pyrite	0.1				disseminated	

STRUCTURE : The magmatic(?) vein in the middle of the section is completely recrystallized mostly to secondary plagioclase. Only parts of what seem to be the relict of the alteration halo can be distinguished, mostly because of the relative abundance of titanomagnetite, and rarely chalcopyrite. Some of what seem to be primary plagioclase cut by the vein show recrystallization in the affected zone, sometimes displaying a weak undulose extinction and/or including oikocrysts of titanomagnetite. In some parts of this vein(?) is still possible to follow its trace, as a weak and highly fractured diffuse and discontinuous plane. Other crystals in the groundmass seem to be only moderately fractured, althought not in a prefered orientation. This maybe due to an increase in volume.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Due to strong alteration of the mafic phases to actinolite, the initial modal proportions of cpx,opx and hbl are unclear. Section contains some kind of vein (from upper right to left down) bounded by large oxide grains (plus quartz), representing traces of a late melt or a zone of stronger alteration. The plagioclase in this vein is replaced by secondary plagioclase, epidote, prehnite, quartz and titanite.

TS #72: 312-1256D-215R-2, 12-14 cm, Piece No: 3 **Unit: 85** **OBSERVER: J cm / SM / NH**

ROCK NAME: Medium-grained disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular seriate, parts have poikilitic texture

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	60	65	0.1	2.5	1.2	Large euhedral laths, smaller equant.	Large plagioclases are present throughout the section. Those included in clinopyroxene oikocrysts are not strongly zoned. Those present away from oikocrysts tend to be strongly zoned. Small equant plagioclase only occurs outside oikocrysts
Clinopyroxene/Amphibole	5	32	0.5	50	3	Interstitial, poikilitic	Highly altered. Large clinopyroxene oikocrysts occupy patches of the section. In the rest, the pyroxene forms smaller interstitial crystals. The large oikocrysts are most likely to be primary pyroxene, but it is not yet clear whether the other interstitial crystals were primary pyroxene or amphibole.
Fe-Ti oxides	3	3	0.5	2	1	Interstitial	Only found outside clinopyroxene oikocrysts, in regions with coarser plagioclase

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	20				clinopyroxene	Cpx is variably altered throughout this section.
Hornblende	3				clinopyroxene	Locally seen as patches within less altered cpx
Secondary plagioclase	5				plagioclase	
Chlorite	tr				clinopyroxene and interstitial	
Magnetite	5				clinopyroxene and interstitial	

STRUCTURE : Fracture intensity of plagioclase scales with alteration. Fractures are randomly oriented with respect to the crystals boundaries, althought they seem to nucleate in the center of them. In places, small-size plagioclase crystals are not fractured but instead they present rounded corners and a marked undulose extintion. These grains are most probably secondary plagioclases.

COMMENTS : Modal proportions estimated by comparison with visual chart. / One 0.6 mm veinlet, composed of super-fine grained actinolitic hornblende with minor magnetite. / Very well-defined reaction rims between amphibole and plagioclase/ brown areas of large hornblende grains are ?/ Titanomagnetite crystals present exolution of ilmenite, as lamellas, and titanite, as lamellas and patches in the crystal borders.

TS #73: 312-1256D-215R-1, 40-44 cm, Piece No: 10 **Unit: 86** **OBSERVER: J cm / SM /NH**

ROCK NAME: Medium-grained disseminated oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	50	55	0.2	4	1.8	Large euhedral-subhedral laths, small subhedral interstitial	Large laths are strongly zoned.
Clinopyroxene/Amphibole	20	43	0.8	2	1.2	Interstitial	Mostly altered to amphiboles, but primary pyroxene is preserved in the cores of some crystals. Primary amphibole may also have been present.
Fe-Ti oxides	2	2	0.2	0.8	0.6	Interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Amphibole	20				clinopyroxene	Clinopyroxene exhibits varying degrees of alteration in this slide
Secondary plagioclase	5				plagioclase	
Magnetite	4				clinopyroxene and disseminated	Large blebs in amphibole crystals related to the alteration of cpx.
Pyrite	0.5				disseminated	

STRUCTURE : Intense fracture of plagioclase where amphibole impinges on grain boundaries. Locally approaches cataclastic textures. Subgrains of plagioclases develop in areas of recrystallization but without intracrystalline strain. Recrystallization areas sometimes form glomerocrysts composed mostly of plagioclase crytals. Undulatory extinction present in some plagioclase crystals.

COMMENTS : Modal proportions estimated by comparison with visual chart. No orthopyroxene was observed in thin section. / No veins. / Noteworthy that there are two amphiboles - well-crystallized green (hint of brown?) hornblende and actinolite. / Completely replaced CPX by actinolite may have minor prehnite (NH)

TS #74: 312-1256D-215R-2, 67-71 cm, Piece No: 16B **Unit: 86** **OBSERVER: J cm /SM /NH**

ROCK NAME: Medium-grained disseminated oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	55	60	0.2	2	1.3	Large euhedral-subhedral laths, smaller subhedral	Large laths show concentric zoning.
Clinopyroxene/amphibole	15	38	0.4	4	1.8	Interstitial	Sub-ophitic texture partly enclosing large plagioclase laths in places. Primary clinopyroxene is certainly present, and in some places is overgrown by a high temperature hornblende, which may be late magmatic or related to high temperature fluid-flow.
Fe-Ti oxides	3	2	0.4	3	1	Interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	3				clinopyroxene/amphibole	
Actinolitic hornblende	19				clinopyroxene/amphibole	
Secondary plagioclase	5				plagioclase	
Epidote	0.1				plagioclase/interstitial	
Actinolite?	0.1				interstitial	Euhedral interstitial areas of very fine-grained brown/green translucent mineral; actinolite?
Pyrite	0.1				disseminated	

STRUCTURE : Grain fracture is modest and there are no cataclastic zones present. Subgrains of secondary plagioclase have no associate intracrystalline strain (Static alteration). Plagioclase crystals can show undulatory extinction.

COMMENTS : Modal proportion estimated by comparison with visual charts./ Hornblende is texturally earlier than actinolite. Hornblende has a variety of brown and blue-tinted portions in the otherwise dominant green variety. (NH)

TS #75: 312-1256D-216R-1, 88-91 cm, Piece No: 19 | **Unit: 86A (fine)/86B(coarse)** | **OBSERVER: TY/SM / AV**

ROCK NAME: Medium-grained disseminated oxide gabbro / medium-grained oxide gabbro

WHERE SAMPLED: Magmatic contact between two lithologies

GRAIN SIZE: Medium grained

TEXTURE: Subhedral granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Main rock, fine-grained							
Plagioclase	35	58	0.3	2	1	subhedral bladed to tabular	Strongly altered (products: dusty brownish masses)
Clinopyroxene	7	30	0.1	5	2	anhedral to subhedral	Interstitial; mantled by hornblende; strongly altered to actinolite
Hornblende	10	10?	0.1	2	1	anhedral interstitial	Forms coronas around cpx,but probably also isolated crystals; show often cpx relicts inside; strongly altered to actinolite plus oxide
Fe-Ti Oxide	2	2	0.1	2	1	anhedral, interstitial	Primary oxides, interstitial, partly poikilitic
Rim (upper right), coarse-grained							
Plagioclase				5		subhedral bladed to tabular	Strongly altered (products: dusty brownish masses)
Clinopyroxene?				5			Was probalby the major primary mafic phase; strongly altered to actinolite
Hornblende ?							Presence unclear due to strong alteration; intensely altered to actinolite plus oxide
Fe-Ti Oxide				5		anhedral, interstitial	Interstitial, partly poikilitic; forming a large aggregate

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolitic hornblende	20				clinopyroxene / amphibole	
secondary plagioclase	40				plagioclase	
magnetite	5				clinopyroxene and interstitial	Dominantly associated with alteration of clinopyroxene
epidote	0.01				plagioclase	
pyrite	0.01				disseminated	Disseminated

STRUCTURE : No visible structures or veins. Coarser grain unit seems to be have more fractured crystals than the other unit, perhaps due to a volume increase as a result of the strong alteration.

COMMENTS : Magmatic contact between two lithologies showing similar mineralogy, but different grain sizes. Comb texture at the contact in the coarser grained rock suggests that the coarser rock type intrudes the finer one. The coarser grained rock is stronger altered. Due to strong alteration of the mafic phases to actinolite, the primary relations between cpx and hornblende are unclear, also the initial modal proportions. Modal proportions of primary minerals estimated by comparison with standard visual estimation chart (not from the coarser grained rim due to the pervasive alteration and limited amount); / No veins in this thin section. The section has a generally mucky appearance, at higher magnification it is evident that this is because of tiny relicts of the original mineralogy. / Titanomagnetite is common and presents exolution of ilmenite. Rarely accompanied by pyrite and chalcopyrite.

TS #76: 312-1256D-216R-1, 119-122 cm, Piece No: 24 **Unit: 86A** **OBSERVER: J cm / RMC /NH**

ROCK NAME: Medium-grained gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	50	55	0.2	2	1.2	Euhedral-subhedral laths (larger)/ subhedral equant (smaller).	Larger laths have marked concentric zoning, and sometimes enter into a subophitic texture with clinopyroxene. The smaller grains grow in interstitial regions.
Clinopyroxene	0	44	0.4	4	1.5	Subhedral	Interstitial, sometimes forming sub-ophitic texture that partially encloses large plagioclase laths. Altered.
Fe-Ti oxides	1	1	0.2	1	0.8	Interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	39				clinoproxene, plagioclase	Actinolite replaces plagioclase along micro cracks and cleavage surfaces
Actinolitic hornblende	4				clinopyroxene	Interlocking <1 mm subhedral prismatic crystals replace larger clinopyroxene grains
Secondary plagioclase	4				plagioclase	
Magnetite	2				clinopyroxene	Small blebs within fibrous actinolite

STRUCTURE : Intense grain fracture of plagioclase with only very local zones of cataclastic texture adjacent to alteration patches. An educated guess is that the grain fracture is associated with the actinolite alteration and not the hornblende.

COMMENTS : Proportions of primary minerals were estimated by comparison with standard chart. No quartz or olivine were found in this thin section, although they were reported in the visual core description. This section is devoid of strong ophitic texture or development of portion with fine-grained plagioclase chadacrysts in clinpyroxene oikocrysts./ No veins / Actinolite is texturally later than hornblende. The hornblende locally exhibits pleochroism from green to clear and even a touch of brown. Local brown, clear hornblende in triple junctions of plagioclase - magmatic or uralite? (NH).

TS #77: 312-1256D-216R-1, 142-147 cm, Piece No: 24 **Unit: 86A** **OBSERVER: J cm / SM / AV**

ROCK NAME: Medium-grained oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular seriate with poikilitic patches

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	55	60	0.2	4	1.2	Euhedral-subhedral laths (larger)/ subhedral equant (smaller).	Large, elongate, unzoned laths are present as chadacrysts in clinopyroxene. Away from oikocrysts, laths are more equant and zoned, and show a seriate texture. Interestingly, this boundary in textures also relates to a change from mildly altered clinopyroxene oikocrysts to interstitial amphibole.
Clinopyroxene	12	15	3	6	4	Interstitial (oikocrysts)	Largely fresh clinopyroxene sitting in oikocrysts, sometimes showing reaction textures with amphibole at edge of oikocrysts, resulting in vermicular intergrowths.
Amphibole (altered cpx?)	22	22	1	5	2	Interstitial	Some amphibole is likely to have been generated by hydrothermal alteration of clinopyroxene. However, some of the amphibole may well have been primary, for reasons described in the comments below.
Fe-Ti oxides	3	3	1	5	2	Interstitial	Only found outside of areas containing clinopyroxene oikocrysts

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	22				clinopyroxene	Less altered relicts of clinopyroxen are evident in places
Actinolite	3				clinopyroxene	Usually seen as discrete needles.
Secondary plagioclase	5				plagioclase	
Chlorite	2				interstitial and plagioclase	
Magnetite	3				clinopyroxene	Blebs

STRUCTURE : Actinolite veins in the lower part of the section form a subparallel network with several small connecting veins, although the main trend is defined by the principal veins. The main subparallel veins are anostomosed, and irregular, and in some parts they merge. These networked veins cut primary crystals of plagioclase and pyroxene (replaced by hornblende?). However, some of the larger hornblende crystals seem to nucleate in or around these veins. There is no visible displacement along the vein network. The width of the veins is about 0.4mm but it is highly variable along the veins, especially when the network becomes more developed. / The vein containing radial prehnite+chlorite+epidote is about 1.2 mm wide, although it becones thinner in certain domains, especially in the center of the section. This vein is irregular and diffuse and it can be recognized, in some part, solely by the presence of a strong green (hornblende+chlorite) halo of about 1 mm wide. Few crosscutting relationships between this vein and the groundmass could be observed. When present, they cut primary crytals of plagioclase mostly. The vein is partially erased (recrystallization) by hornblende crystals. / Small chlorite vein is about 0.3 mm wide, irregular and diffuse.

COMMENTS : Proportions of primary minerals were estimated by comparison with standard chart. Due to alteration , initial proportions of cpx and hbl are unclear. Parts of this thin section have been strongly influenced by alteration, particulalry in the region around the obvious veins. However, there is a fair amount of moderately fresh clinopyroxene preserved. There is a range of observations that can be made in this thin section which can be synthesised as follows. Large clinopyroxene oikocrysts generally contain isolated, unzoned, large, elongate plagioclase, and do not include any oxide phases. Areas with interstitial amphibole contain more equant, zoned plagioclase with a seriate texture that commonly touch and form aggregates of crystals. The regions with interstitial amphibole also contain the Fe-Ti oxides. The boundaries of these regions are often marked by unusual vermicular textures in clinopyroxene where the clinoyroxene is touching the amphiboles. The change in plagioclase texture between the ophitic clinopyroxene and the interstitial amphibole indicates that the amphibole may have been primary, in which case the vermicular texture is part of a corona texture. The alternative is that alteration has simply picked out regions with more equant, touching plagioclase because fluid was able to flow more easily in these parts. However, in this case, the flow has very carefully picked out regions that correspond to variation in the primary igneous texture. / There are 4 veins in this section. A & B are two sub-parallel veins composed of very fine grained actinolite with very minor amounts of magnetite. C vein composed of Chlorite + Actinolite + Zeolite or Prehnite (radiating finely acicular crystals exhibiting first order orange birefringence, brown in ppl, (perhaps mildy pleochroic?)) with very minor amounts of epidote. There are some finer networking veins which appear to be associated with this vein that are dominantly composed of chlorite. This vein has a variable halo which is rich in chlorite (0-2mm). D is a very fine chlorite vein. / Titanomagnetite crystals present weak exolution of ilmenite, and strong replacement by pyrrhotite. Some lamellaes of ilmenite are accompanied by haematite(?).

TS #78: 312-1256D-217R-1, 4-9 cm, Piece No: 2 **Unit: 87** **OBSERVER: BS, TY / SM /NH**

ROCK NAME: Medium-grained disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Subhedral granular, ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	58	60	0.2	4	2	subhedral to euhedral	Strongly zoned
Olinopyroxene	20	38	0.1	4	2	subhedral to interstitial	Replaced by actinolite
Ol/Opx?	0	<1	0.2	0.5	0.3	subhedral?	Strongly altered
Fe-Ti-oxide	1	1	0.5	1	0.8	subhedral to anhedrall	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	20				clinopyroxene	
Actinolitic	3				clinopyroxene	
Secondary plagioclase	10				plagioclase	
Magnetite	4				clinopyroxene	
Pyrite	0.01				disseminated	
Chalcopyrite	0.05				disseminated	Seems to be associated with actinolitic hornblende

STRUCTURE : Grain fracture is not very intense except proximal to alteration patches.

COMMENTS : Large grain size variation. / No veins. / Some fresh (albeit dusty) CPX,

TS #79: 312-1256D-217R-1, 64-69 cm, Piece No: 16 | **Unit: 88** | **OBSERVER: SY / CL /AV**

ROCK NAME: Coarse to medium grained quartz bearing oxide gabbro, medium-grained ol-opx bearing disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium to coarse grained, medium grained

TEXTURE: Subhedral inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Coarse-to medium-grained part : oxide diorite (lower part of thin section)							
Plagioclase	58		0.3	11	5	subhedral tabular	some show zoning, commonly clinopyroxene inclusions
Clinopyroxene	30		0.5	8.5	4	subhedral prismatic	hardly altered to fibrious amphibole and disseminated tiny oxide, some with symplectitic texture, some with small brown amphibole patch
Fe-Ti oxide	7		0.1	4	2	subhedral to anhedral interstitial	
Quartz	5		0.2	2.5	1.3	anhedral interstitial	often show micrographic texture with altered plagioclase, some include plagioclase lath
Medium-grained part : ol-opx bearing disseminated oxide gabbro (upper part of thin section)							
Plagioclase	65		0.1	3	1.5	subhedral tabular to acicular, anhedral interstitial	some with small plagioclase inclusion, some show multiple zoning,
Clinopyroxene	30		0.3	6	3	anhedral, interstitial to poikilitic	some show symplectite texture (probabry with ill-menite) between flesh part and altered part, some with plagioclase as chadocryst
Orthopyroxene	3		0.6	3.5	2	anhedral, interstitial to poikilitic	
Olivine	1		1.2	5	3	anhedral, interstitial	hardly altered, corona texture between olivine and plagioclase
Fe-Ti oxide	1					anhedral, interstitial	between plagioclase framework,

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Orthoamphibole	0.1					
Dusty cpx/act	5				clinopyroxene	
Actinolite	20				clinopyroxene	
Chlorite	0.5				plagioclase, actinolite	very light green when as reaction rim between pleocroiticand olivine
Albite	6				plagioclase	
Epidote	0.5				plagioclase	
Prehnite	1				plagioclase, quartz	
Green+brown phyllosilicate	0.05				olivine	Associated with magnetite.
Dark green phyllosilicate	0.5				olivine	Dark green, not or slightly pleocroitic, very low birefrengence. No fresh olivine.
Pumpellyite?	1				plagioclase	
Magnetite	2				clinopyroxene	associated with actinolite
Titanite	3				titanomagnetite	

STRUCTURE : Grain size increases towards up (of the section), especially the plagioclase crystals. In the coarser part of the section, quartz crystals usually have lobate borders and they develop subgrains of about 0.04 to 0.02mm. These zones resemble microcataclasites, however it seems that generation of subgrains is solely due to temperature changes and no to strain. In the finer grain part of the section, crystals, especially those of plagioclase and other feldspars, have a cleaner aspect compared with those of the coarser grain portion. In the finer grain part, quartz crystals have lobate borders but no evidence of subgrain generation was observed. This may imply that the finer grain portion represents a later melt, at a slightly lower temperature compared with the coarser grain portion. The coraser grain portion seems to be one of the leucocratic patchs recognized in the visual core descriptions.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. / No veins. Frequent plagioclase included in olivine. Chlorite-rich reaction rim between plagioclase and unidentified dark green mineral

TS #80: 312-1256D-217R-1, 89-91 cm, Piece No: 21 **Unit: 88** **OBSERVER: BS, TY, SY / RMC /NH**

ROCK NAME: Medium-grained oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Subhedral granular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	45	50	0.2	4.5	2	subhedral to euhedral	Some are strongly zoned
Olinopyroxene	3	40	0.1	4	2	anhedral to subhedral	Replaced by actinolite
Fe-Ti-oxide	8	8	0.2	3	2	subhedral to interstitial	
Quartz	2	2	0.2	2.1	1	anhedral, interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	50				clinopyroxene	
Hornblende	2				clinopyroxene	
Secondary plagioclase	18				plagioclase	
Epidote					interstitial, plagioclase	
Prehnite	0.1				plagioclase	Spherulitic patch within quartz
Calcite	0.5				plagioclase, clinopyroxene, interstitial	In more intensely altered patches, with quartz
Titanite	0.1				plagioclase	Euhedral grains, associated with quartz and epidote
Chlorite	0.1				plagioclase	Spherulitic patches
Quartz	2				plagioclase, clinopyroxene	
Pyrite	<0.1				disseminated	
Magnetite	0.5				clinopyroxene	<<0.1 mm round to euhedral inclusions within fibrous amphibole

STRUCTURE : In areas of the section there are fairly well-developed fracture networks, and areas of local cataclastic texture. The alteration effectively anneals the cataclastic textures. (Note: the cataclastic textures are NOT shear strain related).

COMMENTS : No veins. Plagioclase rich area is highly altered to quartz + calcite + epidote + prehnite

TS #81: 312-1256D-219R-1, 61-62 cm, Piece No: 15 **Unit: 88** **OBSERVER: JK, TY / SM /**

ROCK NAME: Medium grained orthopyroxene-bearing disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Subhedral granular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	15	50	0.2	4	3	Subhedral to anhedral	Altered
Clinopyroxene	15	45	0.2	4	2	Anhedral, interstitial to subhedral	Replaced partly by actinolite
Hornblende	4	4?				Interstitial	
Fe-Ti Oxide	1	1	0.1	2	0.5	Anhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	15				clinopyroxene	
Secondary plagioclase	10				plagioclase	
Chlorite	15				plagioclase and actinolitic hornblende	Often found in close association with actinolitic hornblende
Prehnite	5				plagioclase	Pale brown, very finely crystallised
Magnetite	6				clinopyroxene	
Pyrite	0.1				disseminated	

STRUCTURE : The chlorite-quartz vein has clearly defined by diffuse boundaries of chlorite enrichment. The quartz in the vein is blocky and does not track opening direction. Plagioclase has intense grain-scale brittle deformation associated with secondary plagioclase and actinolite-chlorite alteration.

COMMENTS : / There is one vein in this section. It is composed of quartz with minor chlorite (5%), with a chlorite rich halo which also contains prehnite, titanite and minor epidote. /

TS #82: 312-1256D-220R-1, 8-10 cm, Piece No: 3 | **Unit: 88** | **OBSERVER: TY / SM /NH**

ROCK NAME: Disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Subhedral inequigranular, seriate (coarse patches), ophitic (finer patches)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
COARSE PORTIONS	65						
Plagioclase	45	60	1	11	5	Subhedral laths and equant morphologies.	Zoning
Clinopyroxene/Amphibole	5	38	1	10	-	Interstitial	Mafic phases extensively altered to actinolite
Fe-Ti oxide	2	2	1	5	3	Subhedral-interstitial	
OPHITIC PORTIONS	35						
Plagioclase	45	60	0.1	2	0.6	Chadacrysts: Elongate laths	Zoning
Clinopyroxene	24	39	0.5	2	1	Oikocrysts	Partly altered, often with vermicular intergrowth
Fe-Ti oxides	1	1	0.4	0.1	0.2	subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	17				clinopyroxene	
Actinolite	3				clinopyroxene	
Secondary plagioclase	15				plagioclase	
Magnetite	4				clinopyroxene	Blebs in actinolite and actinolitic hornblende
Chlorite	2				plagioclase	Seen along fracures in plagioclase laths

STRUCTURE : The contact between finer and coarser grained gabbro is gradational but cut by/obscured by the chlorite-rich vein. Grain fracture in the plagioclase is only intense on certain grain boundaries.

COMMENTS : This sample was selected for thin section due to the macroscopic diffuse portion of coarse-grained plagioclase observed in hand-specimen. The mineralogy and textures of this coarse-grained and the fine-grained (ophitic) portions are therefore listed separately above. The proportions of primary minerals were estimated by visual inspection and comparison with standard chart. The patchy texture developed in this section is similar to many described from the gabbros where any patchiness has been observed. / There is one vein (0.2 mm) in this section which is chlorite-lined with a fine grained prehnite centre. There are a few other tiny chlorite veins. /

TS #83: 312-1256D-220R-1, 24-29 cm, Piece No: 4 | **Unit: 88** | **OBSERVER: J cm, SY /RMC / AV**

ROCK NAME: medium-grained oxide gabbro, medium-grained disseminated oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: medium grained

TEXTURE: subhedral inequigranular, seriate (coarse patches), ophitic (finer patches)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
COARSE PORTIONS	65						
Plagioclase	45	55	1	7	5	Subhedral laths and equant morphologies.	Often show normal zoning
Clinopyroxene/Amphibole	0	38	0.8	4	2	Interstitial	Mafic phases extensively altered to actinolite
Fe-Ti oxide	7	7	1	5	3	Subhedral-interstitial	Sometimes seem to form as alteration product
OPHITIC PORTIONS	35						
Plagioclase	45	55	0.4	0.8	0.6	Chadacrysts: Elongate laths	Not strongly zoned, occasional slight zonation
Clinopyroxene	15	44	0.5	2	1	Oikocrysts	Partly altered, often with vermicular intergrowth
Fe-Ti oxides	1	1	0.4	0.1	0.2	subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
COARSE PORTIONS	65				clinopyroxene	
Actinolite	13				clinopyroxene	
Dusty clinopyroxene	2				clinopyroxene	
Actinolitic hornblende	2				clinopyroxene	
Magnetite	1				clinopyroxene	Very fine, intergrown with actinolite
Chlorite	23				clinopyroxene, plagioclase, interstitial	Most abundant adjacent to the chlorite vein network
Quartz	0.5				plagioclase	
Epidote	0.1				interstitial	
Secondary plagioclase	6				plagioclase	
OPHITIC PORTIONS	35					
Actinolite	8				clinopyroxene	
Magnetite	0.5				clinopyroxene	Very fine, intergrown with actinolite
Pyrite	0.1				disseminated	
Dusty clinopyroxene	12				clinopyroxene	Very fine colourless/brown replacement of clinopyroxene
Chlorite	10				clinopyroxene, plagioclase, interstitial	Very fine-grained, occurs along cracks/as patches in plagioclase and as rims around clinopyroxene, overgrowing amphibole? Most abundant adjacent to the chlorite vein network
Secondary plagioclase	5				plagioclase	

STRUCTURE : The chlorite-rich vein is actually formed by several small, less than 0.004mm wide, veins in a subparallel and network arrangement. The vein netwok cuts mainly primary crystals but also uses the intracrystalline spaces to propagate. Some crosscutting relationships between this network and other small chlorite veins, that are oriented about 80 degrees with respect to the network, can be observed. Some crosscutting relations present dextral movements (with respect to the thin section plane). However, the temporality between both sets of veins could not be established, and they seem to be somehow contemporaneous. Plagioclase crystals, in the coarser part, present intense fracturing. Such fracturing usually helps to develop subgrains. Some few other plagioclase crystals present lobate borders and some small (less than 0.002 mm diameter) subgrains. However, the subgrain generation may be due to temperature or to the strong alteration of the sample.

COMMENTS : This sample was selected for thin section due to the macroscopic diffuse portion of coarse grained plagioclase observed in hand-specimen. The minerlogy and textures of this coarse-grained and the fine-grained portions are therefore listed separately above. The proportions of primary minerals were estimated by visual inspection and comparison with standard chart. The patchy texture developed in this section is similar to many textures described from the gabbros where any patchiness has been observed. Many sections have this split into coarser portions with equant zoned plagioclase and finer portions with ophitic clinopyroxene. The patchiness is macroscopically visible in this case both because the crystals in the coarser part are unusually coarse but possibly also because this sample is quite highly altered. / Vein networks cut-across both the coarser- and finer-grained areas, brecciating the primary minerals. They are comprised of anastomosing irregular chlorite veins, with minor prehnite, secondary plagioclase and quartz, and trace epidote. Primary minerals are variably replaced to chlorite along the vein margins. Primary minerals are also intensely altered to chlorite (overgrowing amphibole after clinopyroxene?) adjacent to irregular branching 0.5-1.5 mm quartz veins, with trace epidote + prehnite. / titanomagnetite oikocryst are common included into hornblende (pyroxene?) crystals. These opaque phase does not present exolution of ilmenite, commonly seen in other gabboic samples. Titanomagnetite crystals are, however, accompanied by titanite usually developed in the borders.

TS #84: 312-1256D-220R-1, 40-43 cm, Piece No: 8A | **Unit: 88** | **OBSERVER: TY, SY / SM, CL / NH**

ROCK NAME: Medium-grained disseminated oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Subhedral inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	45	54	0.1	3	1.2	Euhedral to subhedral, elongate laths	Strongly zoned
Clinopyroxene	15	42	0.1	4	1	Subhedral to interstitial	Partly altered
Orthopyroxene	0.2	2	0.4	1.5	1	Subhedral to interstitial	Mostly altered
Olivine	0.2	1	0.5	1	0.7	Subhedral	Mostly altered, originally surrounded by orthopyroxene
Fe-Ti oxides	1	1	0.4	0.1	0.2	Subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
actinolitic hornblende	15				clinopyroxene	
actinolite	5				clinopyroxene, olivine, mionor plagioclase	Usually very fine grained in association with chlorite
hornblende	5				clinopyroxene	
dark green unidentified	0.001				olivine	In between fresh olivine and magnetite reaction rim
secondary plagioclase	5				plagioclase	
chlorite	10				plagioclase, olivine and clinopyroxene	Often found in aggregates with actinolite
magnetite	3				clinopyroxene	
chalcopyrite	0.01				disseminated	
pyrite	0.5				disseminated	

STRUCTURE : Slight to moderate grain fracture of plagioclase, but plagioclase has abundant recrystallization textures and uneven extinction.

COMMENTS : Although this sample shows significant grain-size variation, clear boundaries are observed. Ophitic texture is unclear in this section. Coarse to medium grained plagioclase show strong zoning, and small plagioclase is less zoned. Small subhedral olivine with altered magnetite rim are surrounded by chlorite + actinolite, suggesting primary existence of orthopyroxene around the olivine. / Possible fluid inclusions in plagioclase (could be subgrains?).; (NH)

TS #85: 312-1256D-220R-1, 52-58 cm, Piece No: 9A | **Unit: 88** | **OBSERVER: JK / SM /NH**

ROCK NAME: Medium-grained olivine-beraing orthopyroxene bearing oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Subhedral inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	45				2	Subhedral bladed to tabular	
Clinopyroxene	35				3	Anhedral	Strongly altered to actinolite
Orthopyroxene	2				3	Prismatic	Strongly altered
Hornblende	10				4	Anhedral, coronal	Strongly altered to actinolite plus oxide
Olivine	3				1.5	Only disrupted patches preserved	Strongly altered, only disrupted cores are preserved, only some relics preserved, all show dark probably oxide-rich alteration halos
Fe-Ti oxide	5				2		Many large grains, some of them obviously secondary

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Iddingsite	1				olivine	seen as a halo around fresh olivine
Hornblende	3				clinopyroxene	
Actinolitic hornblende	10				clinopyroxene	
Actinolite	8				clinopyroxene	
Chlorite	10				clinopyroxene and plagioclase	often seen in a fine-grained aggregate with actinolite
Secondary plagio	5				plagioclase	
Magnetite	3				clinopyroxene and olivine	seen as blebs in actinolitic hornblende and in olivine alteration halos
Pyrite	0.5				disseminated	

STRUCTURE : Plagioclase grain fracture is slight, and recrystallization textures (subgrains, irregular extinction) are abundant.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Due to strong alteration of the mafic phases to actinolite, the primary relations between ol, opx, cpx and hornblende are unclear, also the initial modal proportions. / No veins. /

TS #86: 312-1256D-221R-1, 58-60 cm, Piece No: 11 **Unit: 88** **OBSERVER: SY,TY / SM / NH**

ROCK NAME: Gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Subhedral inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	40	50	0.2	6	3	Subhedral tabular to subequant	Some strongly zoned
Clinopyroxene	5	49	0.4	2.5	1.5	Anhedral, interstitial	Often with brownish amphibole patches
Fe-Ti Oxide	<1	<1	0.1	2	1	Anhedral, interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	10				clinopyroxene	
Hornblende	1				clinopyroxene	seen as tiny patches within other amphibole alteration phases.
Actinolite	10				clinopyroxene	usually forming fine grained aggregates, sometimes with chlorite
Secondary plagioclase	5				plagioclase	
Chlorite	10				clinopyroxene and plagioclase	locally seen along fractures and twin boundaries in plagioclase
Magnetite	3				clinopyroxene	seen as blebs in actinolite and chlorite, related to the alteration of clinpoyroxene
Pyrite	0.01				disseminated	

STRUCTURE : Discontinuous chlorite vein on thin section edge has diffuse boundaries. Grain fracture of plagioclase is locally intense and cuts across grains (is not just on grain boundaries) - no evidence of shear strain, all alteration related. Secondary plagioclases and irregular extinction abound.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. / There appears to be a chlorite rich vein along one of the long sides of this section. However its boundaries are ill-defined. /

TS #87: 312-1256D-222R-1, 23-25 cm, Piece No: 2B **Unit: 89** **OBSERVER: BS, TY / SM / NH**

ROCK NAME: Medium grained olivine and orthopyroxene-bearing gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	43	45	0.1	2	1.5	Subhedral to euhedral	Strongly zoned
Clinopyroxene	30	49	2	4	2	Anhedral	Replaced partly by actinolite
Olivine	1	3	0.5	2	1	Subhedral to anhedral, interstitial	Generally altered
Orthopyroxene	1	3	0.5?	3	1	Anhedral, interstitial	Strongly alterd
Fe-Ti Oxide	<1	<1	0.2	0.6	0.5	Anhedral, interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	15				clinopyroxene	seen as aggregates of very fine needles.
Brown unidentified	0.5				olivine	just a staining?
Hornblende	1				clinopyroxene	seen as inclusions in other secondary amphibole phases.
Chlorite	10				plagioclase and clinopyroxene	
Secondary plagioclase	2				plagioclase	
Magnetite	4				olivine, clinopyroxene	seen as blebs within alteration amphiboles when associated with cpx and seen as a reaction rim when involved with the alteration of magnetite.
Pyrite	0.1				disseminated	

STRUCTURE : Little to no grain fracture of plagioclase, plagioclase has relatively even extinction except in local recrystallized areas.

COMMENTS : / No veins. / inclusions in olivine? (NH)

TS #88: 312-1256D-222R-1, 55-57 cm, Piece No: 6 **Unit: 88** **OBSERVER: BS, TY/ SM / AV**

ROCK NAME: Medium-grained gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular, poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	30	48	0.2	3	2	Subhedral to euhedral	Some are strongly zoned
Clinopyroxene	1	50	1	6	2	Subhedral	Replaced by actinolite
Olivine/Orthopyroxene	0	1?	0.2?	2	1	Subhedral to interstitial?	Completely altered
Fe-Ti Oxide	<1	<1	0.01	1	0.6	Anhedral to subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	20				clinopyroxene	
Actinolitic hornblende	5				clinopyroxene	
Hornblende	10				clinopyroxene	some seen as inclusions in other secondary amphibole crystals.
Secondary plagioclase	5				plagioclase	
Chlorite	15				plagioclase and clinopyroxene	along fractures and twin planes in plagiocalse
Magnetite	6				clinopyroxene	dominantly seen as blebs in secondary amphibole phases.

STRUCTURE : Chlorite vein has a irregular morpholgy, in its uppermost end (with respect to the thinsection orientation) is splayed at least in 2 additional branches. Here, the vein cuts some phenocrysts from the groundmass. The width of the vein is variable between 0.04 and 0.02 mm. The other chlorite-actinolite vein is strongly variable in width, between 0.08 and 0.02 mm. Also, is very diffuse and becomes less defined when enters in cotact with strongly altered phenocrysts. A third vein, in the lowermost part of the section, also composed by chlorite-actinolite, is present. This vein is very diffuse and its width is less than 0.02mm. The size of the plagioclase crystals is strongly reduced in some parts of the section, especially in the central part, giving the aspect of a cataclasite. This is not related to the veins. Here, feldspars crystals present a weak undolose extintion, but no generation of subgrains. This indicates that this is the result of solely temperature and no strain.

COMMENTS : Large grain size variation / Veins: A. (100% chlorite vein with a diffuse light green-gray halo of chlorite and actinolite. B.) chlorite plus actinolite vein (~50:50), less well defined where it cuts across clinopyroxene veins which have been altered to a similar composition. / Titanomagnetite crystals have a slight (when compared to previous thin sections) exolution of ilmenite.

TS #89: 312-1256D-222R-2, 5-10 cm, Piece No: 2A **Unit: 88** **OBSERVER: TY / CL / AV**

ROCK NAME: Medium-grained olivine gabbronorite/ coarse-grained oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grain (olivine gabbronorite)/coarse grain (oxide gabbro)

TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Olivine gabbronorite							
Plagioclase	60	60	0.2	1.8	1	Subhedral	Sometimes strongly zoned
Clinopyroxene	12	20	0.3	4	1	Anhedral, interstitial	Sometimes twinning
Orthopyroxene	5	10	0.3	5	0.8	Anhedral, interstitial	Often around a olivine
Olivine	3	8	0.5?	3.3	1	Subhedral	Surrounded by magnetite rim
Fe-Ti Oxide	2	2	0.2	2.5	0.8	Anhedral, interstitial	
Oxide gabbro							
Plagioclase	40	50	0.8	6.5	4	Subhedral-euhedral	Commonly zoned
Clinopyroxene	30	40	0.5	6.5	4	Interstitial	
Fe-Ti Oxide	10	10	0.2	6	3	Interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	12				clinopyroxene	
Actinolitic hornblende	10				clinopyroxene, orthopyroxene, olivine	
Actinolite						
Brown-green phylosilicate	1				olivine	in magnetite rim or in between fresh olivine and magnetite rim
Secondary plagioclase	2				plagioclase	in microfractures
Chlorite	1				plagioclase, olivine	
Epidote	0.5				plagioclase	
Talc rich phyllosilicate	0.5				olivine	
Magnetite	2				olivine	

STRUCTURE : The border between the the olivine gabbronorite and the oxide gabbro is diffuse, but traceable. The finer grain portion usually enters into the coarse grain portion, using what it seem to be recrystallized microfractures. In the gabbronoritic portion, plagioclase crystals commonly have lobate borders, although no generation of subgrain was observed. This may indicate a strong recrystallization of the gabbronorite due to solely temperature. This characteristic is not present in the oxide gabbro. This indicates that the gabbro norite intruded at a higher temperature with respect to the oxide gabbro.

COMMENTS : Large olivine and orthopyroxene occur at boundaries between olivine gabbronorite and oxide gabbro. Those large crystals are counted as constituent minerals of olivine gabbronorite. / No veins. Clinopyroxene exhibit all the degrees of replacement by actinolite /

TS #90: 312-1256D-223R-1, 42-45 cm, Piece No: 8A **Unit: 89** **OBSERVER: BS, TY / CL /NH**

ROCK NAME: Medium-grained olivine and orthopyroxene-bearing gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular, poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	48	50	0.4	2	1	Subhedral to euhedral	Some crystals are strongly zoned
Clinopyroxene	25	39	0.4	2.5	1.5	Anhedral	Replaced by actinolite
Orthopyroxene	3	5	1.5?	3	1.2	Anhedral, interstitial	
Olivine	2	5	1.0?	4	1.5	Subhedral to anhedral	High birefringence
Fe-Ti oxide	<1	<1	0.2	1.2	0.8	Subhedral to euhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	20				clinopyroxene	
Hornblende	10				clinopyroxene, interstitial	brown, grading to green amphibole
Actinolitic hornblende	10				clinopyroxene, minor plagioclase	
Chlorite	3				olivine, orthopyroxene, minor plagioclase, interstitial	
Magnetite	2				olivine	as tiny grains forming a rim between fresh olivine and actinolite + actinolite replacing olivine
Green + brown phyllosilicate	0.01				olivine	between fresh olivine and magnetite-rich reaction rim
Talc-rich phyllosilicate	0.2				olivine	associated with magnetite rim
Pyrite	0.5				olivine, disseminated	

STRUCTURE : Grain fracture is slim-to-none (olivine-bearing sections have almost no plag, grain fracture, coincidence?). Secondary plagioclase is abundant with irregular extinction and forms interesting reaction textures with cpx.

COMMENTS : Large grain size variation. Orthopyroxenes show weak pleochroism from X′ = pale reddish-brown to Z′ = pale greenish-brown.

TS #91: 312-1256D-223R-1, 62-67 cm, Piece No: 11 **Unit: 88** **OBSERVER: BS, TY / SM /AV**

ROCK NAME: Medium-coarse-grained olivine and orthopyroxene-bearing oxide gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	50	55	0.1	6	2	Subhedral to euhedral	Some crystals are strongly zoned
Clinopyroxene	25	35	0.2	5	3	Anhedral, interstitial	Replaced by actinolite
Orthopyroxene	1.5	3	0.5?	2.5	1.5	Anhedral, interstitial	
Olivine	0.5	2	0.2?	3	1.5	Subhedral	
Fe-Ti Oxide	5	5	0.2	4	2	Anhedral to euhedral	Large mm-scale subhedral to euhedral oxides associated with sulphides

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	8				clinopyroxene, olivine	15% in patch, replacing clinopyroxene
Hornblende	2				clinopyroxene	
Actinolitic hornblende	1				clinopyroxene	
Dark green phyllosillicate	1				olivine	
Secondary plagioclase	2				plagioclase	2% in patch, replacing primary plagioclase.
Chlorite	5				clinopyroxene, olivine, plagioclase	30% in patch, replacing plagiocalse and clinopyroxene
Magnetite	2				clinopyroxene, olivine	2% in patch, associated with actinolite (blebs)
Prehnite	0					4% in patch replacing plagioclase
Epidote	0					1% in patch replacing plagioclase, associated with prehnite
Pyrite	0.5				disseminated	
Chalcopyrite	0.01				disseminated	

STRUCTURE : The large grain size variation of the plagioclase is due to the generation of subgrains. Plagioclase crystals commonly develop lobate borders that result in subgrains. These subgrains have sizes between 0.02 and 0.005mm. They commonly have undolose extition, while coarser plagioclase grain show a weak undolose extintion, usually by zones or patches in the crystal. However, a larger portion of the subgrains show the typical plagioclase twining, indicating that some recrystallization occurred. These are secondary plagioclases, and they are mostly located in the intracrystalline spaces between other phenocrysts, such as olivine, cpx and opx. In the patch of intense alteration, upper left corner of the section, there are no subgrains and plagioclase phenocryst have straight borders.

COMMENTS : Large grain size variation of plagioclase. / The top left hand corner of the slide is a chlorite-rich alteration patch (see comments column above for mineralogical description). This patch is bounded by an area that is slightly more rich in coarse magnetite. Olivine alteration is variable but characterised by the development of magnetite rims with outer halos of chlorite-actinolite. The more highly altered crystals have a phyllosilicate core. / Titanomagnetite usually present exolution of ilmenite, in one or two different directions. However, the section seems to be poorly polished, giving a dusty aspect to the titanomagnetite crystals.

TS #92: 312-1256D-223R-2, 39-41 cm, Piece No: 1E **Unit: 89** **OBSERVER: JM, JK, TY, SY / SM / NH**

ROCK NAME: Meidum-grained olivine gabbronorite
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	45	50	0.2	1.6	1.1	Large subhedral laths and smaller equant grains	Heterogeneous textures, with plagioclase sometimes occurring as chadacrysts in mafic oikocrysts, and at other times as aggregates of small, zoned, equant crystals
Clinopyroxene	5	25	0.4	5	2	Oikocrysts	Occurs rarely, may have formed much of now-altered mafic material.
Orthopyroxene	5	8	2	3	1.5	Interstitial	Also now partly altered
Olivine	5	15	0.8	1.5	1	Subhedral	Partly broken down with oxide rims. Contains melt inclusions, fluid inclusions and possible exsolution lamellae of titanium oxides.
Fe-Ti Oxide	1	1	0.1	0.5	0.3	Subhedral-interstitial	
Pargasite	<1	<1	0.2	0.2	0.2	Subhedral	One dark brown pleochroic amphibole with good cleavages in irregular octagonal section. These have been overprinted by actinolite to a large extent.

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	20				clinopyroxene, olivine	
Hornblende	5				clinopyroxene	
Secondary plagioclase	2				plagioclase	It is very difficult to confidently assess the alteration of plagioclase
Chlorite	8				clinopyroxene, plagioclase, olivine	Commonly associated with actinolite in fine-grained alteration aggregates.
Talc	0.5				olivine	Seen between olivine and magnetite reaction rims
Magnetite	3				clinopyroxene, olivine	Seen as rims around olivine and along fractures within olivine. Blebs in secondary amphibole phases.
Pyrite	0.5				disseminated	Often associated with chalcopyrite
Chalcopyrite	0.1				disseminated	Associated with pyrite

STRUCTURE : Very little grain fracture of plagioclase. Extensive recrystallization of plagioclase with equant grains of plag with irregular extinction.

COMMENTS : / There are no veins! Olivine replacement is characterised by the development of a composite halo around the olivine crystal. The inner halo is magnetite and the outer halo is a chlorite-actinolite combo. Locally talc can be observed between the magnetite and the olivine. /

TS #93: 312-1256D-223R-2, 57-60 cm, Piece No: 1A | **Unit: 89A** | **OBSERVER: BS, TY / RMC / AV**

ROCK NAME: Medium grained olivine orthopyroxene bearing gabbro

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	43	45	0.5	2	1	subhedral to euhedral	Some crystals are strongly zoned
Clinopyroxene	10	52	1	5	4	anhedral, interstitial	Replaced by actinolite
Orthopyroxene	0.5	1	0.4?	2	1.0?	anhedral, interstitial	
Olivine	0.2	1	0.4	1.2	1.0?	subhedral	
Fe-Ti Oxide	1	1	0.2	2	0.4	anhedral to subhedral	Large mm-scale oxides (subhedral)

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Calcite	<0.1				interstitial	Patches within acicular/fibrous amphibole patches
Talc	0.5				olivine	Some olivine grains are completely replaced by fine talc, with the original euhedral olivine grain edges delineated by fine magnetite + trace pyrite grains; other olivine grains are partially altered to talc + magnetite along cracks and around their rims.
Magnetite	3				clinopyroxene, olivine	<0.1 mm magnetite grains occur as regular lines through talc after olivine, and are disseminated in the altered clinopyroxenes
Pyrite	0.1				disseminated, olivine	
Hornblende	3				clinopyroxene, olivine?	Brown -green pale pleochroic mineral intergrown with magnetite around relict fresh olivine core.
Actinolitic hornblende	30				clinopyroxene, orthopyroxene?	
Secondary clinopyroxene?	1					The cores of some clinopyroxenes appear to be recrystallized to secondary clinopyroxene, which is intergrown with amphibole.
Secondary plagioclase	2				plagioclase	
Dusty clinopyroxene	5				clinopyroxene	

STRUCTURE : The Actinolite-chlorite vein is very diffuse and does not cross the entire section. It is about 0.02mm wide, although it becomes thinner towards the center of the section where it eventually disappears. Minerals in this vein seem to have grow perpendicular to the walls, most probably due to direction of movement of the vein. Generation of plagioclase subgrains is well developed but the majority of these are completely recrystallized. Still, larger individual grains retain the lobate borders and the weak, but clear, undulose extinction. This indicates crystal annealing due solely to temperature changes in the absence of strain.

COMMENTS : Clinopyroxene is completely replaced by actinolite in a 2 mm wide halo adjacent to a 0.5 mm irregular actinolite vein. / Similar to other sections from the gabbro unit, this section presents titanomagnetite crystals with exsolution of ilmenite and very rare hematite.

TS #94: 312-1256D-223R-2, 101-105 cm, Piece No: 10 **Unit: 89A/89B** **OBSERVER: TY / CL /**

ROCK NAME: Medium-grained orthopyroxene-bearing olivine gabbro (89a) / Coarse-grained oxide gabbro (89b)

WHERE SAMPLED:

GRAIN SIZE: Medium grained (89a) / Coarse grained (89b)

TEXTURE: Inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Medium-grainbed orthopyroxene-bearing olivine gabbro (89a)							
Plagioclase	40	45	0.1	1.5	0.8	Subhedral	Commonly zoned
Clinopyroxene	30	35	0.1	4.5	1	Interstitial to subhedral	Large oikocryst
Orthopyroxene	2	4	0.2	1	0.8	Subhedral to interstitial	
Olivine	7	15	0.2	1.2	0.8	Subhedral to anhedral	Partly replaced by orthopyroxene in later magmatic stage.
Fe-Ti Oxide	1	1	0.1	1	0.5	Anhedral, interstitial	
Coarse-grained oxide gabbro (89b)							
Plagioclase	50	65	0.2	10.5	6	Subhedral to euhedral	Highly altered, clinopyroxene and oxides inclusions
Clinopyroxene	15	31	0.2	4	2.5	Subhedral	Oxides and plagioclase inclusions
Oxide	4	4	0.2	5	3	Subhedral to anhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	4				Olivine	Pale blue-green. May be associated with a phyllosilicate
Brown and green phyllosilicate	1.5				Olivine	Very pleochroic. Replaces the core and/or the total area of olivine
Magnetite	5				Olivine	
Actinolitic hornblende	4				Plagioclase, clinopyroxene	15% in coarse-grained gabbro
Chlorite	4				Plagioclase, olivine	0% in coarse-grained gabbro
Secondary plagioclase	0				Plagioclase	3% in coarse-grained gabbro

STRUCTURE :

COMMENTS : Thin section shows contact between medium-grained orthopyroxene-bearing olivine gabbro (Unit 89a) and coarse-grained oxide gabbro (Unit 89b). The contact is characterized by perpendicular growth of clinopyroxene and plagioclase to lithologic boundary and high modal proportion of clinopyroxene. The medium-grained orthopyroxene-bearing gabbro contains fine-grained troctolite xenolith or patch (~6.0 mm in long axis) which shows granular texture with strongly zoned plagioclase. / 0.5 mm vein of actinolite + minor intergrown chlorite cross-cutting both types of gabbro.

TS #95: 312-1256D-223R-3, 1-6 cm, Piece No: 1 **Unit: 89A** **OBSERVER: J cm, SY /CL / AV**

ROCK NAME: Medium-grained olivine bearing disseminated oxide gabbronorite, coarse grained in places (gabbronorite)

WHERE SAMPLED:

GRAIN SIZE: Medium grained, coarse grained

TEXTURE: Inequigranular seriate, poikilitic in patches, granular in other portions

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
COARSE VEIN							
Plagioclase	55	60	0.4	4	2	Tabular euhedral laths enclosed in pyroxenes, tabular subhedral laths outside oikocrysts	
Clinopyroxene	4	8	0.4	2	1	Interstitial and as oikocrysts	
Orthopyroxene	20	30	2	5	4	Subhedral, interstitial as oikocrysts.	Often enclosing large plagioclase in poikilitic texture, sometimes including small clinopyroxenes
Fe-Ti Oxide	1	1	1	3	2	Interstitial	
BACKGROUND							
Plagioclase	50	60	0.05	4	0.4	Heterogeneous: elongate euhedral, tabular euhedra-subhedral, equant granular	
Clinopyroxene	7	18	0.1	0.4	0.6	Subhedral (large), interstitial and granular (small)	Granular clinopyroxenes often contain many small oxides, giving them a dusty appearance.
Orthopyroxene	10	15	0.1	4	2	Large as oikocrysts, small as subhedral equant grains	Large oikocrysts include plagioclase, olivine and clinopyroxene chadacrysts.
Olivine	4	5	0.1	0.8	0.2	Largest subhedral, smaller are granular and subhedral-interstitial	Occurs in 3 or 4 isolated patches, altered to oxides at margins. Contain exsolution structures, possibly of Ti-oxides. Smaller olivines in granular texture are overgrown by orthopyroxene and clinopyroxene.
Pargasite	1	1	2	0.4	0.3		Dark brown-green pleochroic amphiboles. Possibly primary, or may be related to high temperature alteration
Fe-Ti oxides	2	2	0.1	3	0.2	interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	2					
Actinolitic hornblende	15				orthopyroxene, clinopyroxene, minor plagioclase	
Actinolite?	0.5				olivine	Blue-green, associated with minor chlorite around olivine
Chlorite	2				plagioclase, olivine	Minor when associated with actinolite around olivine
Talc-rich pyllosilicate	0.1				olivine	
Magnetite	2				olivine	Along cracks and as a rim around olivine
Dark brown green phyllosilicate	0.5				olivine	Dark green when as complete replacement of olivine, associated with magnetite
Pyrite	1				disseminated	
Chalcopyrite	0.5				disseminated	
Other opaques	0.5				disseminated	
Titanite	1				disseminated	

STRUCTURE : The mentioned linear feature corresponds to a highly recrystallized high temperature shear zone. No ductile kinematic indicators could be seen in this feature, but the anhedral nature of the plagioclase crystals indicates that important grain size reduction ocurred in this zone. This may be the result of a early, and later recrystallized, cataclastic zone. Plagioclase laths in this zone display a moderate undulose extintion, evidence of high temperature. The so-called coarser grain patches seem to be elongated objects due to the shear. The longest axes of these patches are parallel to the main trend of the shear zone. Although the long axes of the plagioclase laths in the coarser patches are not strictly parallel to the shear zone, they are rarely perpendicular to it. These axes are, in general oriented in acute angles with respect to the shear zone, perhaps indicating a dextral sense of shear. However, this is not completely clear. The shear zone is not restricted to an area just between the patches, but to almost half of the section in where strong reduction of the plagioclase laths can be observed. Clearly, alteration post-dates the deformation, since secondary minerals such as actinolite are located in the intracrystalline spaces and in the coraser crystals in the patches.

TS #95: 312-1256D-223R-3, 1-6 cm, Piece No: 1	Unit: 89A	OBSERVER: J cm, SY /CL / AV
ROCK NAME:	Medium-grained olivine bearing disseminated oxide gabbronorite, coarse grained in places (gabbronorite)	
WHERE SAMPLED:		
GRAIN SIZE:	Medium grained, coarse grained	
TEXTURE:	Inequigranular seriate, poikilitic in patches, granular in other portions	
COMMENTS :	This section is complicated, and merits further detailed inspection. Several features indicate that this section represents an extreme continuation of the textural development in the thermally altered basaltic dikes from higher up the hole. Key pieces of evidence include the presence of a relict variolitic texture in some portions of the slide (mid-bottom of the left side, for example). Here, radiating plagioclase fans out in an arrangement very similar to the textures observed in the lowermost basaltic dikes. Also, the intergranular clinopyroxenes in these areas contain many small oxides, and have the dusty appearance so commonly found in the altered basaltic dikes. These patches are often then overgrown and partly contained within orthopyroxene oikocrysts. This suggests that the rock is a partially remelted basaltic dike, that has recooled slowly enough, or in sufficiently wet conditions, to grow large oikocrysts containing some of the original igneous texture. Total disaggregation of the rock cannot have occurred, or the original igneous texture would have been destroyed. These large orthopyroxene oikocrysts possibly grew concurrently with the large orthopyroxene crystals found in the coarse vein portion of this section. On the right-hand side of the section, between the two coarse patches, a linear feature cuts from top middle towards bottom right. This feature is about 1mm wide. The plagioclase in this feature is smaller and more equant than the plagioclase in the surrounding areas. Granular orthopyroxene and fibrous actintolite are also present in this feature. Critically, some of the orthopyroxene that appears in this feature is part of optically continous oikocrysts that are also present in the coarser backgroun area. Is it possible that this feature was once a hydrothermal vein present in the basalt, which has subsequently been overprinted by the event that caused orthopyroxene crystallisation. The order of events here seems to have been 1) solidification of fine-grained basaltic dike with development of variolitic/intergranular texture 2) hydrothermal veins and relatively low temperature alteration 3) partial melting and recrystallisation in thermal aureole of adjacent gabbroic intrusion (Unit 88). / All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray apperance. One 0.1-0.3 mm hornblende and actinolitic hornblende vein (top left), with very diffuse boundaries. The elongated coarse grained pach displays the same secondary minerals as the rest of the slide./ Note: Titanomagnetite is commonly developed in this section, and it present very rare exolution of ilmenite (increasing in temperature with respect to previous, upper, rocks?). Chalcopyrite grows in the borders or in within titanomagnetite crystals, as slightly elongated crystals. The longest axes of these chalcopyrite crystals seem to have growth parallel to the shear zone.	

TS #96: 312-1256D-224R-1, 4-5 cm, Piece No: 2 **Unit: 89** **OBSERVER: TY, BS, SY / SM, DT / AV**

ROCK NAME: Medium-grained olivine bearing gabbronorite
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	44	45	0.5	5	2	subhedral to euhedral	Partially altered to albite along fractures
Clinopyroxene	10	30	2	5	3	subhedral	Replaced by actinolitic hornblende
Orthopyroxene	15	23	0.2	2	1	subhedral to interstitial	
Olivine	0	1	0.2?	0.2?	0.2?	subhedral?	Completely altered
Fe-Ti Oxide		<1				anhedral	1. 0.5 to 1.5 mm oxides between plagioclase lath, 2. 50 um to 150 um dissemimated Fe-Ti-oxides

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic Hornblende	2				clinopyroxene	Replacing interstitial clinopyroxene and rimming
Actinolite	15				clinopyroxene, orthopyroxene (and olivine)	Seen as rims around altered olivine
Chlorite	5				clinopyroxene, orthopyroxene (and olivine)	Seen as rims around olivine with actinolite
Dusty cpx/act	10				clinopyroxene	
Dark green-brown phyllosilicate (unidentified	0.5				olivine	Seen as halos around fresh olivine
Magnetite	6				clinopyroxene	Seen as halos around and cracks within olivine
Pyrite	0.5				disseminated	

STRUCTURE : An actinolitic vein of about 0.4 mm wide crosscuts at the thin section. The morphology of this vein is irregular, displaying jogs in some parts. However these jogs are not related to other veins or shear and therefore they do not imply movement but just propagation of the vein opening. The vein crosscut several strongly altered hornblende (Cpx?) crystals, indicating that it may have been generated as one the latest alteration events. Variolitic texture of plagioclse (radiated cumulates) can be seen in several places in the section. At these places, it is common to observe recrystalization of plagioclase (secondary plagioclase) with strongly lobated and round borders. This indicates that recrystallization most probably ocurred during the heating phase of the rock. No other structures, such as strain indicators, could be seen in the section.

COMMENTS : Plagioclase appears reasonably fresh only partially altered to secondary plagioclase (albite?) along fractures. Interstitial clinopyroxene partially altered to actinolitic hornblende. Actinolitic hornblende vein cut by halo in which clinopyroxene is completely replaced by actinolitic hornblende. / Titanomagnetite crystals have weak exolution of ilmenite, and they are also rarely accompanied by hematite (?) and chalcopyrite. / There is one vein in this section. It is composed of actinolite and appears to pre-date later crystal growth. Olivine is variably altered in this section with some fresh cores of olivine still evident.

TS #97: 312-1256D-225R-1, 0-3 cm, Piece No: 1 **Unit: 90** **OBSERVER: TY / DT /RA**

ROCK NAME: Fine-grained aphyric basalt

WHERE SAMPLED:

GRAIN SIZE: Fine grained

TEXTURE: Intergranular partially recrystallized to granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	52	52	0.1	3	0.8	Euhedral-subhedral	Mostly fresh and strongly zoned, partially replaced by albite, actinolite
Clinopyroxene	44	44	-	-	-	Anhedral, interstitial (ophitic)	Dusty cpx, actinolite + magnetite, then orthopyroxene
Fe-Ti Oxide	4	4	0.1	1	0.5	Anhedral, interstitial	Recrystallized to large rounded blebs

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx	10				clinopyroxene	
Actinolite	20				clinopyroxene and veins	
Secondary Plagioclase	5				plagioclase	Soft grain boundaries, grains are euhedral but sub-rounded

STRUCTURE : No visible shape preferred orientation.

COMMENTS : Partially recrystallized to granular assemblage with smooth annealed grain boundaries./ Igneous texture is maintained by plagioclase but both clinopyroxene and Ti-oxide phases partially to completely recrystallized to rounded grains. Orthopyroxene appears (to DT?) to replace actinolite + magnetite hydrothermal replacement of primary clinopyroxene. Plagioclase appears mostly fresh although grain edges are smooth and rounded. Alteration is patchy with zones of common granular orthopyroxene but other regions dominated by actinolite or dusty clinopyroxene. Rare wispy 0.1 mm actinolite (?) veins.

TS #98: 312-1256D-225R-1, 9-12 cm, Piece No: 3						Unit: 90A	OBSERVER: BS, TY / DT / RA
ROCK NAME:	Fine-grained to cryptocrystaliine aphyric basalt						
WHERE SAMPLED:	Dike interior						
GRAIN SIZE:	Microcrystalline						
TEXTURE:	Holocrystalline intergranular (obscured by alteration)						
PRIMARY	**PERCENT**	**PERCENT**	**SIZE (mm)**				
MINERALOGY	**PRESENT**	**ORIGINAL**	**min.**	**max.**	**av.**	**MORPHOLOGY**	**COMMENTS**
GROUNDMASS	100	100					
Plagioclase	44	45	0.2	0.4	0.3	Subhedral-euhedral laths, anhedral interstital	Minor secondary plagioclase, actinolite.
Clinopyroxene	5	45	0.2	1	0.5	Anhedral prismatic	Highly altered (actinolite, brownish dusty masses, tiny oxide grains).
Fe-Ti Oxides	11	10	0.2	0.3	0.2	Subhedral	1) primary oxides 2) disseminated tiny oxide grains

SECONDARY		**SIZE (mm)**				
MINERALOGY	**PERCENT**	**min.**	**max.**	**av.**	**REPLACING / FILLING**	**COMMENTS**
Dusty cpx/act	15				clinopyroxene	Clinopyroxene
Actinolite	30				clinopyroxene, veins	Veins, after clinopyroxene. Abundance in vein halos
Magnetite	2				clinopyroxene	With actinolite
Secondary plagioclase	5				plagioclase	With actinolite after plagioclase
Pyrite	1					Disseminated

STRUCTURE : Cross cutting relationship indicates the following order of vein development: actinolite monomineralic vein (with flaky crystals --> fiborous one) --> conjugate set of chlorite vein --> quartz (+ chlorite) vein. These three sets of veins are developed in orthogonal directions and parallel to each other. Fibrous actinolite veins have dendritic branches that grow nearly perpendicular to main orientation. Chlorite and actinolite crystals grow almost normal to the contact plane of veins.

COMMENTS : Partially recrystallized to granoblastic assemblage. Clinopyroxene replaced by dusty clinopyroxene or actinolite + magnetite. Opaques subangular rather than sub-rounded in higher granoblastic dikes. / Numerous vein generations and associated halos. Early diffuse actinolite veins cut across by later actinolite veins. Both generations have 2 mm recrystallized clean actinolite-rich halos. These veins cut across by thin chlorite + actinolite veins. All veins cross-cut by 0.5 to 2 mm braided quartz veins that include slivers of actinolite+chlorite+secondary plagioclase altered wall rock. Thick ~ 1mm quartz-chlorite vein, cross-cut and offset by pure quartz vein. Quartz veins can exploit trace of earlier actinolite veins.

TS #99: 312-1256D-227R-1, 12-14 cm, Piece No: 3 | **Unit: 90A/90B** | **OBSERVER: J cm, SY / CL / AV**

ROCK NAME: Fine-grained aphyric basalt / medium grained quartz-rich oxide diorite

WHERE SAMPLED:

GRAIN SIZE: Fine grained/Medium grained

TEXTURE: Intergranluar overprinted to granular / Inequigranluar seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
FINE-GRAINED BASALT (UNIT 90A)							
Plagioclase	51	55	0.2	0.8	0.4	Subhedral tabular to equant	Original igneous texture (intergranular) has been overpinted by later heating, with the development of some smaller equant plagioclase in a granular texture.
Clinopyroxene	20	34	0.1	0.6	0.3	Interstitial-subhedral granular	
Orthopyroxene	5	7	0.1	0.4	0.3	Subhedral	Growing in granular texture
Fe-Ti oxides	4	4	0.1	0.4	0.2	Interstitial-subhedral	
MEDIUM GRAINED DIORITE (UNIT 90B)							
Plagioclase	30	40	0.4	5.5	2	Subhedral tabular to equant	
Clinopyroxene/Amphibole	30	30	0.3	3	2	Subhedral-interstitial	Present as amphibole, but may have originally been clinopyroxene
Quartz	25	25	0.4	0.8	0.6	Granophyric intergrowths	
Fe-Ti oxides	5	5	0.1	0.8	0.3	Intestitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
FINE-GRAINED BASALT (UNIT 90A)						
Actinolitic hornblende	4				clinopyroxene	
Actinolite	2				orthopyroxene, clinopyroxene	Associated with chlorite as a rim around rounded opx
Chlorite	3				orthopyroxene	
Magnetite	2				clinopyroxene	
Pyrite	0.5				clinopyroxene disseminated	
MEDIUM GRAINED DIORITE (UNIT 90B)						
	30				Clinopyroxene, plagioclase	
Magnetite	2				Clinopyroxene	
Chlorite	1.5				plagioclase, actinolite	
Pyrite	0.5				disseminated	
Chalcopyrite	0.05				disseminated	
Titanite	1				disseminated	

STRUCTURE : The contact between units 90A and 90B is sharp and linear, although slightly diffuse. Plagioclase crystals, in unit 90B, often display myrmekitic texture, which seems to result in a blocky break-down of the crystals. In unit 90B, plagioclase crystals commonly show a weak undulose extinction, with their borders rounded and/or lobate. In contrast, the small plagioclase crystals in unit 90A do not present myrmekitic texture, althought their borders are commonly lobate and the crystals display a weak undulose extinction. In the border between the two units there is a larger concentration of quartz with blocky texture and lobate borders. No subgrains were recognized either in unit 90a or 90B. / No veins.

COMMENTS : Unit 90B is a 2 cm wide gabbroic dike cutting the metamorphosed basalt of Unit 90A. There is no chilled margin, and the contact zone is marked by enhanced alteration of the host dike in a 2-3 mm wide halo, indicating either that the gabbro was the source of the fluid for alteration, or that the gabbro has subsequently acted as a preferential conduit for hydrothermal fluids. / In both basalt and gabbro, all plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray appearance . The rim of plagioclase is frequently inclusions-free.

TS #100: 312-1256D-227R-1, 23-28 cm, Piece No: 5A | **Unit: 90A** | **OBSERVER: TY / CL / AV**

ROCK NAME: Fine-grained aphyric basalt

WHERE SAMPLED: Dike interior

GRAIN SIZE: Fine grained

TEXTURE: Holocrystalline intergranular (obscured by alteration)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS	100	100					
Plagioclase	49	50	0.2	1	0.4	Subhedral	Some crystals are zoned
Clinopyroxene	15	42	0.2	1	0.4	Subhedral to interstitial	Primary features are obscured by metamorphism
Fe-Ti Oxides	8	8	0.2	0.5	0.3	Anhedral	Primary features are obscured by metamorphism

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	23				clinopyroxene	
Actinolite	7				orthopyroxene	
Chlorite	5				orthopyroxene, plagioclase	
Magnetite	4				clinopyroxene	
Titanite	1				disseminated	Anhedral
Pyrite	1				disseminated	

STRUCTURE : One very diffuse chlorite-rich vein, discontinuous, about 0.05 mm, wide is present in the section. This vein seems to be strongly recrystallized, since several quartz, plagioclase and horblende crystals crosscut the vein in several places. This indicates that the vein corresponds to one of the early alteration stage events. No preferered orientation of the minerals or strain indicators are present in the section.

COMMENTS : Primary igneous features are unclear because of strong metamorphism. / One 0.3-0.5 mm vein of actinolite + titanite + quartz, with (about 3 mm thick) adjacent alteration halo slowly grading to less altered rock. All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray apperance . The rim of plagioclase is frequently inclusions-free.

TS #101: 312-1256D-227R-1, 84-86 cm, Piece No: 13 | **Unit: 90A/90D** | **OBSERVER: BS, TY/ RC, CL / AV**

ROCK NAME: Fine-grained aphyric basalt/fine-grained trondhjemite
WHERE SAMPLED: Dike interior
GRAIN SIZE: Fine grained
TEXTURE: inequigranular, seriate (tonalite) / uncertain (basalt)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Fine-grained basalt							
GROUNDMASS							
Plagioclase	<1	30?				Subhedral?	Too altered, see comments.
Clinopyroxene	0	68?				Subhedral to interstitial?	Too altered, see comments.
Oxides	2	2				Subhedral	
Fine-grained trondhjemite							
Plagioclase	0	80	0.1	1.2	1	subhedral	Highly altered
Clinopyroxene/Amphibole	0	10	0.1	0.8	0.6	anhedral, interstitial?	Highly altered
Quartz	8	8	0.1	0.3	0.2	Interstitial	
Fe-Ti Oxides	2	2	0.1	0.9	0.3	anhedral to subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Fine-grained basalt						
GROUNDMASS						
Chlorite	80				Plagioclase, clinopyroxene	Fine grained aggregates replace most of the primary minerals, some spherultic patches
Secondary plagioclase	1				Plagioclase	
Magnetite	1				Clinopyroxene	Fine inclusions within chlorite
Titanite	5				Interstitial	Occurs as euhedral grains, within epidote or quartz, and as fine disseminated grains intergrown with chlorite giving it a dirty/speckled appearance (replacing magnetite?)
Prehnite	0.5				Plagioclase	Intergrown with chlorite
Quartz	12				Plagioclase	
Epidote	1				Plagioclase?	Most abundant along diffuse margin between the basalt and the trondhjemite
Fine-grained trondhjemite						
Quartz	2				Plagioclase, quartz, interstitial	Interstitial quartz areas contain fewer inclusions and appear clearer; some contain euhedral epidote grains and spherules of chlorite.
Epidote	3				Plagioclase, interstitial	Euhedral equant grains in the cores of altered plagioclase crystals; in intersitial patches as prismatic grains, that surround magnetite grains and contain euhedral titanite.
Titanite	2				Plagioclase, interstitial	
Magnetite	0.5				Mafic	Inclusions in chlorite; replaced by titanite?
Chlorite	10				Plagioclase, primary mafic phase, interstitial	Commonly with a spherultic texture.

STRUCTURE : The uppermost part of the section is strongly altered and its contact with the least altered lowermost part of the section is very diffuse and difficult to follow, albeit linear. However, they is an increase in the grain size in the least altered zone. The alteration decreases gradually but quickly towards the lowermost part of the section. No preference orientation of the crystals is observed in any of the two zones. the rare epidote in the least altered zone, occupies the intracrystalline spaces. Plagioclase crystals have very weak lobated borders and very weak undulose extintion.

COMMENTS : This piece shows a contact between highly altered fine-grained aphyric basalt and highly altered fine-grained trondhjemite. No chilled margins are visible. Because of strong alteration, primary igneous features of the basalt is unclear. Abnormaly high modal proportion of mafic minerals in the basalt is unlikely for primary modal proportion, interms of igneous petrological point of view./ The basalt is completely altered, predominantly to chlorite (with fine grains of titanite after magnetite?) and quartz, obscuring the primary modal mineralogy. Epidote and prehnite are most abundant near the margin of the trondhjemite, which is almost completely altered to secondary plagioclase + chlorite. In the fine grained trondhjemite, plagioclase is very rich in inclusions, giving the plagioclase a dirty appearance, difficult to determine if primary or secondary.

TS #102: 312-1256D-227R-1, 87-91 cm, Piece No: 14 | **Unit: 90C/90D** | **OBSERVER: TY / CL /**

ROCK NAME: Fine-grained trondhjemite (90C) / Medium-grained oxide diorite? (90D)

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequgranluar seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Fine-grained trondhjemite (Unit 90C)							
Plagioclase	0	87	0.3	1.5	0.6	Subhedral to euhedral tabular	Completely altered
Quartz	10	10	0.1	0.6	0.3	Anhedral, interstitial	
Clinopyroxene	0	1	0.1	0.4	0.3	Subhedral	Completely altered
Fe-Ti oxides	2	2	0.1	0.4	0.2	Interstitial-subhedral	Secondary ?
Medium-grained oxide diorite ?							
Too altered, see comments.							

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Ortho-amphibole??	1				Associated with quartz	Colorless, high relief, cleavage perpendicular to elongation, 1st order colors, parallel extinction
Epidote	40				Plagioclase	
Quartz	10					Subhedral, associated with epidote
Chlorite	8				Plagioclase	
Titanite	4				Disseminated	
Secondary plagioclase	5				Plagioclase	Possibly more. The replacement product of plagioclase is questionable
Laumontite	5				Plagioclase	Possibly more. The replacement product of plagioclase is questionable

STRUCTURE : No preference mineral orientation can be seen in this section. Quartz crystals display cumulates with blocky texture and slightly lobated borders and undulose extintion. Larger quartz crystals also display extinction by zones, indicating that recrystallization at high temperature has been an important process.

COMMENTS : This thin section contains fine-grained trondhjemite (90C) and medium-grained oxide diorite ? (90D). Boundary between both lithologies is diffuse and unclear under the microscope. Since medium-grained oxide diorite is extremely altered, estimation of primary igneous mineralogy was impossible. General texture, modal propotion of mafic/felsic minerals and rarely preserved pseudomorph suggest that the rock have been composed of Cpx+Amp+Pl+Qtz+Oxide, dioritic assemblage. / The proportions of the various secondary minerals are variable from one part of the slide to another one. Average proportions are given above.

TS #103: 312-1256D-227R-2, 71-75 cm, Piece No: 11 | **Unit: 90A/90F** | **OBSERVER: J cm / RC /AV**

ROCK NAME: Fine-grained basalt / fine-grained trondhjemite

WHERE SAMPLED:

GRAIN SIZE: Fine grained/Medium grained

TEXTURE: Intergranular partly overprinted by granular / Equigranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
FINE-GRAINED BASALT (UNIT 90A)							
Plagioclase	45	55	0.1	0.4	0.2	Subhedral tabular to subequant	
Clinopyroxene	10	38	0.2	0.4	0.3	Subhedral interstitial	Variably altered, often with many oxide inclusions to give a dusty appearance
Orthopyroxene	2	4	0.2	0.2	0.3	Subhedral, interstitial, granular	Only occur in limited patches, sometimes overprinted by later alteration
Fe-Ti oxides	3	3	0.1	0.4	0.2	Interstitial	
FINE-GRAINED TRONDHJEMITE (UNIT 90F)							
Plagioclase	30	75	0.4	1.2	0.7	Subhedral tabular	Dusty alteration
Quartz	15	20	0.1	0.4	0.2	Anhedral interstitial	
Amphibole/clinopyroxene	0	3	0.1	0.2	0.1	Interstitial	Altered to epidote, calcite?
Fe-Ti oxides	2	2	0.1	0.2	0.1	Interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
FINE-GRAINED BASALT (UNIT 90A)						
Actinolite	15				Clinopyroxene, plagioclase	Along cleavage planes around rims of plagioclase
Secondary plagioclase	8				Plagioclase	Plagioclase has tiny inclusions that give it a dusty appearance
Magnetite	2				Clinopyroxene	Inclusions within actinolite (that replaces after clinopyroxene) giving the clinopyroxene a very dusty appearance
Dusty clinopyroxene	10				Clinopyroxene	
Titanite	5				Clinopyroxene, plagioclase	Intergrown with actinolite replacing clinopyroxene, and along plagioclase cleavage planes
Pyrite	0.1				Disseminated	trace
Chlorite	1				Clinopyroxene, plagioclase, interstitial	Most abundant in a 15 mm halo along adjacent to the trondhjemite dike, where it comprises ~50% of the rock and overgrows actinolite
FINE-GRAINED TRONDHJEMITE (UNIT 90F)						
Chlorite	5				Plagioclase, clinopyroxene?	There are spherultic patches of chlorite within some quartz grains
Quartz	5				Quartz	Recrystallized quartz?
Epidote	2				Intersitial, plagioclase	Disseminated euhedral crystals and anhedral interstitial grains, most abundant adjacent to a very fine chlorite + quartz vein that parallels the unit margin
Titanite	3				Interstitial, magnetite, plagioclase	Euhedral grains associated with/included within epidote; rims on magnetite grains
Calcite	0.5				Interstitial	
Prehnite	0.5				Interstitial	Associated with epidote and titanite
Secondary plagioclase	68				Plagioclase	Plagioclase completely recrystallised, and full of tiny inclusions giving it a very dirty appearance.

STRUCTURE : There are three visible veins in this section. One, running from top to bottom of the section, is about 0.8 mm wide and composed of plagioclase (probably secodary) and cpx. This vein is partially affected by the strong alteration of the host rock (unit 90A). There is no crosscutting relation between unit 90A and this vein in the section. The other 2 veins are very diffuse, irregular and discontinuous. They are composed mostly of actinolite. The actinolite vein cuts and displaces, left-laterally with respect to the thin section plane and normal with respect to the IODP reference frame, the plagioclase+cpx vein. This indicates that the actinolite vein post-dates the other. This supports the moderate alteration observed in the plagioclase+cpx vein. The contact between units 90A and 90B is linear. A clear grain size change can be observed between the two units. no mineral prefered orientation is present in the contact.

COMMENTS : Modal proportions estimated by comparison with standard visual inspection chart. The tronhjemite is highly altered, and appears to have been a source of hydrothermal fluids for alteration of the host basalt, with the degree of alteration generally decreasing with distance from the contact. There is no obvious drop in grain size from the trondhjemite towards the contact with the basalt. / There are several cross-cutting 0.2 mm veins within the basaltic part of this section, including a granular pale green clinopyroxene (diopside; partialy replaced by chlorite and actinolite) + plagioclase vein, and an actinolite vein. Where these two veins cross the actinolite extends 2 mm up to the clinopyroxene + plagioclase vein, indicating that the actinolite vein is the later of the two. However, the actinolite vein may be a completely replaced by clinopyroxene vein. These veins have 1-3 mm diffuse actinolitic halos, and were described as 'annealed' in the macroscopic core descriptions. The basalt has a 15 mm chlorite rich halo (50% chlorite) along the margin of the trondhjemite.

TS #104: 312-1256D,212R-1, 29-32 cm, Piece No: 7 | **Unit: 80A/80B** | **OBSERVER: SY,TY / RC, CL / RA**

ROCK NAME: Aphyric microcrystalline basalt, fine-grained trondhjemite

WHERE SAMPLED:

GRAIN SIZE: microcrystalline / fine grained

TEXTURE: Hypocrysalline intergranular to variolitic / inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Aphyric microcrystalline basalt (Unit 80A)							
Plagioclase	40	50				subhedral laths, anhedral interstitial	With numerous tiny oxide inclusions , some plagioclase include granular clinopyroxene
Clinopyroxene	0	35				subhedral prismatic, anhedral interstitial	Hardly altered to fibrous actinolite and desseminated tiny oxide
Fe-Ti oxide	10	15				subhedral to anhedral	
Fine grained quartz-rich oxide diorite (Unit 80B)							
Quartz		55	0.1	1.2	0.6	interstitial	Sutured boundary with other quartz, often include euhedral columnar mineral (epidote?) and acicular apatite. Some show micrographic texture with plagioclase
Plagioclase		25	0.05	1	0.5	euhedral to subhedral	Some plagioclase show oscillatory zoning with corroded zone in rim, often plagioclase surrounded with quartz show rounded shape.
Clinopyroxene/Amphibole		15	0.15	2	0.7	subhedral prismatic to anhedral interstitial	Hardly altered to fibrous amphibole and tiny oxide, often with brownish hornblende patch
Fe-Ti Oxide		5	<0.05	0.8	0.3	subhedral to anhedral interstital	Often show interstitial between quartz framework
Zircon		<0.1		<0.1		Euhedral	Included by quartz

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Aphyric microcrystalline basalt (Unit 80A)						
Actinolite	37				Clinopyroxene, plagioclase	Completely pseudomorphs clinopyroxene (with tiny magnetite inclusions)and occurs along cleavage fractures of plagioclase.
Magnetite	1				Clinopyroxene	Tiny inclusions within amphibole, after clinopyroxene
Titantite	6				Plagioclase, magnetite	Some tiny euhedral and anhedral grains in plagioclase and around the margins of magnetite. Rare larger euhedral crystals replace the cores of some magnetite grains
Secondary plagioclase	6				Plagioclase	
Fine grained quartz-rich oxide diorite (Unit 80B)						
Actinolite	6					Some actinolite needles within quartz and plagioclase
Actinolitic hornblende	10				Primary mafic	Some of this may be primary amphibole?
Titanite	5				Plagioclase, magnetite, interstitial	Predominantly around the margins of magnetite, intergrown with epidote + amphibole. Rare larger euhedral crystals replace the cores of some magnetite grains. Dusty 'spots' within amphibole may be magnetite replaced by titanite
Magnetite	1				Primary mafic	Tiny inclusions give the amphibole a dusty appearance; partially replaced by titanite.
Quartz	5?				Quartz? Plagioclase	Difficult to estimate how much of the quartz is primary.
Secondary plagioclase	15				Plagioclase	Many inclusions give the plagioclase a very dusty appearance.
Epidote	1				Interstitial	Euhedral columnar crystals (generally colourless) and anhedral interstitial crystals

STRUCTURE : Contact between fine-grained dolerite and quartz diorite. Actinolite vein developed in dolerite cut by quartz diorite intrusion. Two clasts of dolerite are included in diorite. No shape preferred orientation (if any, very weak one around the diorite-side of contact). No plastic deformation. Amphiboles concentrated near the contact in diorite. Relic of dendritic growth of plagioclase and cpx are seen in dolerite in otherwise granoblastic texture.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Thin section separates two parts by sharp contact ; one is aphyric microcrystalline basalt (host), another is fine-grained quartz-rich oxide diorite (dike). The host basalt often show secondary microgranular clinopyroxene as inclusion in plagioclase, but these metamorphic textures are not clear by alteration. Quartz-rich oxide diorite dike include xenolith from host basalt. Mineral proportion of tonalite dike vary from dike margin (plagioclase rich) to dike interior (quartz-rich). / A 1.5 mm actinolite (65%) + plagioclase (30%) + magnetite (5%) vein is cut by the quartz-rich diorite. This vein has a recrystallized texture and diffuse margins, indicating that it may have been annealed.

TS #105: 312-1256D-227R-2, 113-117 cm, Piece No: 17 **Unit: 90A** **OBSERVER: SY / CL /**

ROCK NAME: Fine-grained quartz bearing oxide gabbronorite
WHERE SAMPLED:
GRAIN SIZE: Fine grained
TEXTURE: Inequgranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	60	65	0.1	1.6	0.7	Subhedral tabular to subequant	With numeous tiny inclusions, often with microgranular clinopyroxene, orthopyroxene and oxide as inclusion
Clinopyroxene	3	20	0.05	1.5	0.5	Subhedral tabular to subequant	Altered to fibrous green amphibole and tiny oxide
Orthopyroxene	5	7	0.05	0.4	0.15	Euhedral to subhedral	Some with bleb-like inclusions, show pleochroism from colorless to reddish, some with rounded oxide inclusion
Fe-TI oxide	7	7	<0.05	0.5	0.15	Anhedral to subhedral	
Quartz	1	1	0.05	0.6	0.15	Subhedral interstitial	Interstital, some include acicular mineral,

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	5				Clinopyroxene	10% when adjacent to vein
Magnetite	2				Clinopyroxene	
Sulfide	1				Disseminated	

STRUCTURE : Several small recrystallized veins are present in this section. Most of them are irregular, diffuse and difficult to follow. The most prominent vein, visible to the naked eye in the section, corresponds to a very diffuse zone of partly rich dusty plagioclase, epidote and prehnite. The vein is about 1.5 mm wide in average, although its width highly varies. This vein is highly recrystallized with secondary plagioclase, from the host rock, often mixing with the dusty plagioclase crystals in the interior. In the uppermost part of the section there is another vein of about 0.005mm wide composed of chlorite(?). This vein is irregular but not as diffuse as the others present in the section. This vein cuts another prehnite-actinolite-rich vein with no displacement across. The actinolite-prehnite-rich vein is well defined, planar and of about 0.3 mm. In the lower part of the section, another vein composed by prehnite-epidote and of about 0.02 mm is present. This vein is irregular, diffuse and splayed. No preferred mineral orientation was observed in the host rock or in the veins. In the host rock, plagioclase crystal usually present lobated borders and a moderate undulose extinction.

COMMENTS : Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. / One 1.5 mm vein, with very diffuse boundaries, made of actinolitic hornblende, euhedral titanite, quartz, thin actinolite needles, minor chlorite, minor epidote. One 0.2 mm vein (with sharp boundaries) made of actinolite hornblende. All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray appearance . The rim of plagioclase is frequently inclusion-free.

TS #106: 312-1256D-230R-1, 15-18 cm, Piece No: 5 | **Unit: 90A/91A** | **OBSERVER: J cm/ CL / AV**

ROCK NAME: Fine-grained aphyric basalt (Unit 90A) to medium grained oxide gabbro (Unit 91A)

WHERE SAMPLED:

GRAIN SIZE: Fine grained / Medium grained

TEXTURE: Granular overprint of intergranular flow-aligned texture / Inequigranular seriate gabbros

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
FINE GRAINED BASALT							
Plagioclase	50	55	0.05	0.4	0.2	Subhedral tabular to equant	Tabular plagioclases appear to show some weak flow alignment.
Clinopyroxene		0-22.5 see comments	0.1	0.2	0.15	Subhedral interstitial equant granular	At the top end of the section, about half of the pyroxene is clinopyroxene and the rest is orthopyroxene. Next to the contact with the gabbro all of the pyroxene is orthopyroxene. There is a gradual increase in orthopyroxene content towards the contact.
Orthopyroxene		22.5-45 see comments	0.1	0.3	0.2	Subhedral equant granular	See above
Fe-Ti oxides	5	5	0.1	0.2	0.1	Interstitial	
MEDIUM GRAINED GABBRO							
Plagioclase	50	55	0.4	3	2	Subhedral tabular laths	
Clinopyroxene	25	40	0.4	1.5	1.2	Interstitial	Contain many inclusions of oxide
Quartz	3	3	0.4	0.8	0.6	Granophyric intergrowth	
Fe-Ti Oxides	2	2	0.1	0.4	0.2	Interstitial	
Orthopyroxene							See comments below
MEDIUM GRAINED OXIDE GABBRO							
Plagioclase	45	50	0.4	5	3	Subhedral tabular	
Clinopyroxene	10	30	0.4	2.5	2	Interstitial	
Quartz		<1	0.2	0.3	0.2	Interstitial	
Fe-Ti Oxides	20	20	0.2	2	1.8	Interstitial	
Orthopyroxene							See comments below

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
FINE GRAINED BASALT						
Actinolite	5				Clinopyroxene	
Magnetite	2				Clinopyroxene	
Sulfide	0.1				Disseminated	
GABBRO						
Hornblende	1				clinopyroxene	Surrounded by actinolitic hornblende
Chlorite	4				plagioclase, clinopyroxene	In microfractures of plagioclase when cross-cut by main vein, associated with actinolitic hormblende when replacing clinopyroxene
Actinolitic hornblende	5				clinopyroxene	
Epidote	1				plagioclase	Some large slabs
Magnetite	3				clinopyroxene	

STRUCTURE : In the finer grained part, on both sides of the vertical intrusion (with respect to the thin section plane), small plagioclase crystals are weakly alinged parallel to the contact with the lower and coarser less oxide gabbro. This may indicate that the less oxide gabbro was hot enough to produce a realignment of these crystals in the host rock. This tendency is even weaker in the vertical intrusion of oxide gabbro. In the finer grained part, a very weak preferred orientation of the plagioclase crystals can be seen. This orientation is oriented about 30 degeres with respect to the contact with the "vertical" oxide gabbro intrusion. The contact between the host rock (fine grain) and the oxide gabbro is sharp and well defined. Titanomagnetite seems to be specially abundant in, or very near, to this contact within the oxide gabbro. The contact between the host rock and the less oxide gabbro is also sharp and well defined. In contrast, the contact between the two gabbros is diffuse and difficult to follow, although a slight grain size variation can be observed, with the (low oxide) gabbro been coarser. No prefered mineral orientation was observed in any of the two gabbros.

COMMENTS : This slide is made of three or four disinct zones. First, a fine-grained basaltic dike. This has been cut by the oxide gabbro as a 1 cm thick dike. This dike has then been cut by the (low oxide) gabbro. In both the basalt and the gabbro, the proportion of orthopyroxene present increases with proximity to the margin, perhaps indicating both thermal and chemcial exchange between the host rock and the intrusion. In a 5 mm wide band at the intrusion, up to 2 mm subhedral subequant orthopyroxene crystals are present, sometimes enclosing clinopyroxene and plagioclase. The increase in orthopyroxene content of the basalt towards the margin indicates that the orthopyroxene is of metamorphic, rather than primary igneous, origin./ All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray apperance . The rim of plagioclase is frequently inclusions-free. One 0.3 mm hornblende-actinolitic vein cross-cutting both basalt and gabbro. The basalt/gabbro contact is extensively altered, with abundant actinolitic-hornblende (up to 100% in some places). / Titanomagnetite crystals display different characteristics between the three rock types present in the section. On both oxide and less oxide gabbro, titanomagnetite crystals present exolutions of ilmenite, while in the fine grain (host rock) portion, they do not. Also, in the less oxide gabbro it seems that ilmenite has exolution of hematite in portion where the ilmenite pockets, inside the titanomagnetite, became large enough.

TS #107: 312-1256D-230R-1, 49-54 cm, Piece No: 8A **Unit: 90A** **OBSERVER: TY / CL /**

ROCK NAME: Fine-grained aphyric basalt/medium-grained gabbro/fine-grained gabbro?

WHERE SAMPLED:

GRAIN SIZE: Fine grained (basalt) / medium grained and fine grained (gabbro)

TEXTURE: Holocrystalline, intergranular (basalt) / inequigranular, seriate (gabbros)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Fine-grained basalt							
GROUNDMASS	100						
Plagioclase	45	50	0.2	1	0.5	Subhedral	Rarely strong zoning
Clinopyroxene	20	43	0.2	0.7	0.5	Subhedral to anhedral	
Fe-Ti Oxides	7	7	0.1	0.5	0.3	Subhedral to anhedral	
Secondary metamorphism							
Plagioclase		50					
Clinopyroxene		23					
Orthopyroxene		20	0.1	0.5	0.3	anhedral to subhedral	Commonly granular
Fe-Ti oxides		7					
Medium-grained gabbro							
Plagioclase	45	48	0.2?	0.7	0.6	Subhedral	Numerous tiny inclusions. Commonly zoned.
Clinopyroxene	30	49	0.3	1.1	0.7	Subhedral to anhedral	Oxides and orthopyroxene inclusions.
Oxides	3	3	0.1	0.5	0.3	Euhedral to anhedral	
Fine-grained gabbro?							
Plagioclase	55	64	0.1	0.7	0.4	Euhedral to subhedral	Inclusions of corroded clinopyroxene
Clinopyroxene	25	35	0.1	0.7	0.5	Interstitial to subhedral	Rarely corroded plagioclase inclusions.
Oxides	1	1	<0.1	0.3	0.2	Anhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Smectite rich phyllosilicate ?	20				rounded granular orthopyroxene and clinopyroxene	Pleocroic dark to middle olive green, parallel extinction
Actinolitic hornblende	3				rounded granular orthopyroxene and clinopyroxene	Mainly where adjacent to the actinolitic hornblende rich vein
Magnetite	1				clinopyroxene	
Sulfide	1				disseminated	

STRUCTURE : The coarsest gabbro has the highest intensity of grain-scale deformation with grain fracture and some intracrystalline strain (no bulk shear strain on the sample). A wide(4 mm) vein traces out of the gabbro, cutting across the opx rich domain, with relatively well-defined vein walls and quartz+amphibole (actinolite + amphibole replacing Pyroxenes) mineralization and plagioclase recrystallization. A dark brown vein in the center of the opx=rich domain has no vein walls or greenschist condition minerals, and appears to have well-crystallized oikocrysts of opx in its center. Adjacent to the opx-bearing domain is a crystallographically clean and compositionally simple basaltic (?) domain. The boundaries between these different domains (xenoliths, intrusions ...) are relatively sharp but with no well-defined chill, strain, or alteration.

COMMENTS : This thin section consists of three defferent portions. The dominant portion is fine-grained metabasalt. This basalt is overprinted by high-temperature metamorphism, and change of the mineral assemblage to two-pyroxene+plagioclase assemblages. The texture is also possibly changed by metamorphism. Two gabbroic portions contain xenocrystic orthopyroxene crystals, suggesting later intrusion to meta basalts. fine-grained gabbro shows relatively similar texture to a kind of metabasalts, however, very minor amount of oxides in this rock suggest the possibility of accumulation of plagioclase+clinopyroxene from the melt. / All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray apperance . The rim of plagioclase is frequently inclusions-free. The slide displays a dark halo, one of which is clearly related to a vein of 'granular' orthopyroxene+clinopyroxene both partly replaced at rim by actinolite. One sinuous 0.2-0.4 mm vein and several linear veins of 'granular' orthopyroxene+clinopyroxene both partly replaced at rim by actinolite. One linear 1 mm vein of quartz + plagioclase + clinopyroxene + hornblende + actinolitic hornblende, cross-cutting the dark alteration halos. One 0.05 mm vein of chlorite + actinolite lining one edge of the slide.

TS #108: 312-1256D-230R-1, 59-63 cm, Piece No: 8B | **Unit: 91A** | **OBSERVER: BS, SY / RC, CL / RA**

ROCK NAME: Fine-grained orthopyroxene bearing oxide gabbro with meta-basaltic fragment (oxide gabbronorite)

WHERE SAMPLED:

GRAIN SIZE: Fine grained (contact gabbro/basalt)

TEXTURE: Equigranular seriate (gabbro) / equigranular, seriate (metabasalt; see comments)

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Medium-grained oxide gabbro							
Plagioclase	50	55	0.1	2	0.7	Subhedral to euhedral	Medium grained plagioclase partly occur in clusters
Clinopyroxene	25	39	0.5	2	0.7	Anhedral to subhedral	
Orthopyroxene	1	2	0.2	2	1	Subhedral	
Fe-Ti Oxide	4	4	0.1	2	1.2	Anhedral to subhedral	Fe-Ti oxides are heterogenous contributed, see comments
Fine-grained metabasalt							
Plagioclase	43	45	0.1	0.7	0.4	Subhedral to euhedral	Small pyroxene inclusions
Clinopyroxene	23	25	0.1	0.4	0.3	Subhedral to anhedral	Granular
Orthopyroxene	23	25	0.1	0.3	0.2	Subhedral to euhedral	Commonly granular
Oxides	5	5	0.1	0.3	0.2	Anhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
FINE basalt clast:						
Secondary plagioclase	2				plagioclase	
Magnetite	0.1				clinopyroxene	
Pyrite	0.1				disseminated	
Chalcopyrite	0.1				disseminated	Intergrown with pyrite
Actinolite	1				clinopyroxene	Rims on clinopyroxene grains
MEDIUM: host gabbro						
Secondary plagioclase	5				plagioclase	
Actinolite	5				clinopyroxene and orthopyroxene (?)	
Dusty clinopyroxene	5				clinopyroxene	
Chlorite	1				clinopyroxene, interstitial	
Titanite	2				clinopyroxene and orthopyroxene (?)	Very fine grains intergrown with actinolite in 0.5 to 1.5 mm patches, and along cracks between optically continuous relict orthopyroxene fragments?
Chalcopyrite	<0.1				intergrown with disseminated pyrite	
Pyrite	0.1				disseminated	
Magnetite	1				clinopyroxene	

STRUCTURE : Contact between fine-grained dolerite xenolith and medium-grained gabbro. Weak shape preferred orientation of plagioclase crystals along the contact. No evidence for plastic deformation. Fine-grained dolerite is abundant in opx and has granoblastic texture and opx vein that stops at the contact plane. Plagioclase + magnetite growth along dolerite-side of the contact. Medium-grained gabbro has large (up to 1 mm across) magnetite crystals and less opx. Cpx are altered to actinolite. Plagioclase crystals from both dolerite and gabbros have dusty (with numerous tiny inclusion) core and clean rims. The clean rims are more pronounced in gabbro.

COMMENTS : Since the basaltic rocks have been strongly metamorphosed and recrystallized, present high-temperature metamorphic assemblages are described as primary mineralogy. Two orthopyroxene/plagioclase zones are visible in the thin sections. One is cutting the fine grained basalt and one occurs at the transition between fine grained gabbro and medium grained basalt. Furthermore the transition gabbro/basalt is characterized by a zone of plagioclase and oxides without pyroxene between the orthopyroxene/plagioclase zones and the fine grained gabbro. On the basis of the metamorphic texture of the orthopyroxene/plagioclase zone and the "vein", which is cutting the fine grained basalt, they may represent a metamorphic reaction zone, triggered by percolating fluids (?). / In both basalt and gabbro, all plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray apperance. The rim of plagioclasse is frequently inclusions-free

TS #109: 312-1256D-230R-1, 126-130 cm, Piece No: 11 | **Unit: 91A/91B** | **OBSERVER: TY,SY/ CL / AV**

ROCK NAME: Fine-grained disseminated oxide gabbronorite or metabasalt (91A) / Coarse-grained disseminated gabbro (91B)

WHERE SAMPLED: Dike interior, contact between Unit 91A and 91B

GRAIN SIZE: Fine grain (91A) / coarse grain (91B)

TEXTURE: Inequigranular, seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Fine-grained gabbronorite (91A)							
Plagioclase	53	55	0.2	1.2	0.7	Subhedral to euhedral	Commonly zoned
Clinopyroxene	10	22	0.2	2	0.8	Anhedral, interstitial	
Orthopyroxene	17	21	0.1	5	2	Anhedral, interstitial	Poikilitic texture
Oxides	2	2	0.2	1.5	0.7	Anhedral	
Coarse-grained gabbro (91B)							
Plagioclase	20	60	0.3	4	2.5	Euhedral to subhedral	Commonly zoned, thin overgrowth in rim
Clinopyroxene	5	38	0.3	4	2.5	Subhedral to anhedral	Strongly altered
Oxides	2	2	0.3	2	0.7	Anhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	3				Clinopyroxene	
Actinolitic hornblende	5				Clinopyroxene	
Magnetite	2				Clinopyroxene	
Chlorite	3				Clinopyroxene, actinolitic hornblende, plagioclase. Also in alteration patch	
Quartz	0.5				As small alteration patch	
Sulfides	1				Disseminated	

STRUCTURE : One quartz-rich vein, irregular about 1.2 mm wide, cuts the thin section from bottom to top. This vein is splayed and the branch is chlorite-rich, although it contains a significant amount of quartz. Quartz crystals, grow mostly perpendicular to the vein walls. Chlorite, when present, is mostly located in the middle portion of the vein. Such growth pattern of quartz in the border and chlorite in the center suggest that the vein is antitaxial. In addition to the perpendicular growth of quartz, a large number of them show obliquity, with repect to the vein walls, of about 40-50 degrees, suggesting a dextral opening history for the vein. However, one optically continuous and strongly altered hornblende crystal is cut by the quartz-rich vein indicating an opposite (sinestral) movement. This may be only a effect of the cutting plane of the section with respect to the vein. The vein crosscuts the contact between the gabbronorite and the coarse-grained gabbro. At this point, the vein shows a bottle-neck morphology and perhaps a slight reverse movement (with respect to the IODP frame). There is another similar vein, in the right side of the section with similar characteristics and that cuts both the gabbronorite and the coarse-grained gabbro. However, no shear could be observed here. The contact between the gabbronorite and the coarse-grained gabbro is diffuse and irregular. No prefered mineral orientation is present on either of the rocks in contact.

COMMENTS : This thin section shows contact between fine-grained gabbronorite (meta-basalt) and coarse-grained gabbro. The boundary is marked by significant grain size change. The fiine-grained gabbronorite is probably strongly metamorphosed metabasalt, however, most primary igneous features have been completely modified. Hence, high-temperature metamorphic assemblages or neary magmatic, secondary assemblages are described as primary mineralogy. / All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray appearance. The rim of plagioclase is frequently inclusions-free. One 0.4-0.8 mm vein of chlorite (edge) and quartz (center).

TS #110: 312-1256D-230R-1, 36-40 cm, Piece No: 6B **Unit: 91** **OBSERVER: SY, TY/ SM /**

ROCK NAME: Fine-grained hornblende bearing disseminated oxide gabbro-gabbronorite

WHERE SAMPLED:

GRAIN SIZE: Fine grained

TEXTURE: Inequigranular poikilitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS							
Plagioclase	58	60	0.1	2	0.8	subhedral tabular, anhedral interstital	Some show strong zoning with corroded core, with numerous tiny oxide inclusions in core, some with tiny clinopyroxene as inclusions.
Clinopyroxene	5	30	0.05	1.5	0.8	subhedral interstitial to poikilitic	Some with pale brown amphibole patches,
Olthopyroxene		5	0.2	4.2	2	anhedral poikilitic	Some poikilitic orthopyroxene with bleb intergrowth of clinpyroxene (similar to granoblastic cpx),
Hornblende	2	2	0.2	0.5	0.35	subhedral	With pleochroism from brown to colorless
Fe-Ti Oxides	3	3	<0.05	1	0.3	anhedral interstital to subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	15				clinopyroxene	
Chlorite	3				clinopyroxene and plagioclase	
Hornblende	2				clinopyroxene	
Actinolitic hornblende	5				clinopyroxene	
Secondary plagioclase	5				plagioclase	
Magnetite	3				clinopyroxene	
Pyrite	0.5				disseminated	
Chalcopyrite	0.01				disseminated	

STRUCTURE : No shape preferred orientation. No plastic deformation. Plagioclase crystals are dusty with numerous tiny inclusions. Opx has inclusions of rounded cpx crystals.

COMMENTS : Modal proportions of primary estimated by comparison with standard visual estimation chart. / No Veins.

TS #111: 312-1256D-231R-1, 13-16 cm, Piece No: 1A **Unit: 92A** **OBSERVER: BS,TY/ SM / RA**

ROCK NAME: Medium-grained gabbronorite

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular, seriate to poiklitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	48	50	0.5	2.6	2	subhedral to euhedral	Sometimes needle-like, commonly strong zoning
Clinopyroxene	15	30	1	4	2	subhedral	Partly altered to actinolite
Orthopyroxene	10	18	1	3	2	anhedral	
Olivine	0	<1				subhedral to anhedral	Completely altered
Fe-Ti Oxides	1	1	<0.1	1	0.3	subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	20				clinopyroxene (and olivine rims) and orthopyroxene	
Hornblende	3				clinopyroxene	
Chlorite	8				plagioclase, clinopyroxene (and olivine rims)	
Secondary plagioclase	2				plagioclase	
Talc	1.5				olivine	
Magnetite	4				olivine and clinopyroxene	
Pyrite	0.2				disseminated	
Chalcopyrite	0.2				disseminated	

STRUCTURE : No shape preferred orientation. No plastic deformation. Dusts in dusty plagioclase concentrate along twinning planes.

COMMENTS : / Olivine is entirely altered in this section to a talc + magnetite core with a rim of actinolite + chlorite. There are no veins in this section. /

TS #112: 312-1256D-231R-3, 21-25 cmm, Piece No: 2 | **Unit: 92A** | **OBSERVER: BS, TY, SY / SM /**

ROCK NAME: Medium-grained oxide gabbronorite

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS							
Plagioclase	48	50	0.4	2	1	Euhedral to subhedral	Partly altered, commonly zoned
Clinopyroxene	15	34	0.4	4	2	Anhedral interstitial	Partly replaced by actinolite, oikocrystic
Orthopyroxene	7	10	0.2	5	2	Anhedral interstitial	Oikocrystic
Olivine	<1	1	0.2	1.2	0.8	Subhedral to anhedral	Accompanied by orthopyroxene
Fe-Ti Oxides	5	5	<1	2		1. disseminated 2. subhedral	1. tiny oxides 2. 1-2mm Fe-Ti oxides occuring at the replaced clinopyroxene

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	20				clinopyroxene, orthopyroxene (rims of olivine)	see comments below
Chlorite	8				clinopyroxene, plagioclase (rims of olivine)	see comments below
Actinolitic hornblende	3				clinopyroxene	
Hornblende	2				clinopyroxene	
Secondary plagioclase	4				plagioclase	
Talc	1				olivine	see comments below
Green-brown phyllosilicate	0.5				olivine	see comments below
Magnetite	3				olivine and clinopyroxene	see comments below
Pyrite	0.1				disseminated	

STRUCTURE : No structures present in this section. Only a moderate undulose extintion of plagioclase crystals and weak lobate borders of these crystals are present.

COMMENTS : / There are no veins in this thin section. Olivine replacement is either partial (with fresh olivine core with brown-green pleochroic phyllosilicate and magnetite inner reaction rim and outer, actinolite-chlorite rim) or complete (with talc + magnetite core and chlorite-actinolite outer rim). / Titanomagnetite crystals present a weak exsolution of ilmenite, mostly as patches in the border and as planes in the inner portion of the crystal.

TS #113: 312-1256D-232R-1, 97-100 cm, Piece No: 5C **Unit: 92A** **OBSERVER: BS, TY, SY / SM / AV**

ROCK NAME: Medium-grained disseminated gabbronorite with granoblastic xenolith

WHERE SAMPLED:

GRAIN SIZE: Medium grained

TEXTURE: Equigranular poikilitic to seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	49	50	0.2	2	1	subhedral to euhedral	Tiny inclusions, zoned
Clinopyroxene	5	35	0.2	1.5	0.8	anhedral, interstitial	Altered
Orthopyroxene	9	12	0.2	1.5	0.8	anhedral, interstitial	
Olivine	0	1	0.3	0.8	0.5	anhedral	Completely altered, accompaied by orthopyroxene
Fe-Ti Oxides	2	2	0.2	1	0.4	anhedral, interstitial to subhedral	Occurs in interstices of plagioclase lath

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	22				clinopyroxene, orthopyroxene (?), olivine (?)	Commonly seen as fine grained aggregates
Hornblende	1				clinopyroxene	
Chlorite	4				clinopyroxene, plagioclase (olivine?)	Often associated with actinolite . Seen in rims around olivine with actinolite
Talc	0.5				olivine	Seen in the cores of altered olivine with magnetite.
Magnetite	4				clinopyroxene, olivine	Tiny blebs in altered cpx and larger crystals when associated with olivine alteration
Pyrite	0.5				disseminated	Often associated with chalcopyrite
Chalcopyrite	0.1				disseminated	Often associated with pyrite

STRUCTURE : Plagioclase crystals, independent of their size, commonly present undulose extinction. Larger crystals, show strongly lobate borders. This indicates recrystallization of the secondary plagioclase at high temperature.

COMMENTS : No veins. The plagioclase in this section commonly has millions of tiny, tiny inclusions, giving an almost gray appearance in plane polarized light. The inclusions are commonly observed in strands parallel to twin planes. There is no contact in this section. The plagioclase with poikilitic texture have mostly a larger grain size (>1mm) than the plagioclase with seriate texture / Titanomagnetite crystals are unusually broken in this section. They do not seem to be strongly associated with titanite. In some places, they seem to coexist with pyrite or unusual large crystals of ilmenite. Larger titanomagnetite crystals display a very weak lamila exolution of ilmenite.

TS #114: 312-1256D-232R-2, 0-3 cm, Piece No: 1 **Unit: 92A** **OBSERVER: SY / CL / RA**

ROCK NAME: Medium-grained oxide quartz-diorite / fine-grained oxide gabbronorite

WHERE SAMPLED:

GRAIN SIZE: Medium grained / Fine grained

TEXTURE: Inequigranular seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Medium grained qtz-bearing oxide diorite							
Plagioclase		30	0.1	5.5	3	Subhedral subequant to tabular, anhedral interstital	Strongly altered or heavily altered
Amphibole		15	0.2	3.2	1.5	Subhedral to euhedral prismatic	
Clinopyroxene		40	0.5	8	3	Subhedral prismatic	Replaced to greenish to pale brownish amphibole
Quartz		10	0.2	3.5	1.7	Anhedral interstitial	Micrographic texture with plagioclase
Fe-Ti Oxides		5	0.05	1.25	0.5	Anhedral interstitial	
Fine-grained amp-bearing oxide gabbronorite part							
Plagioclase		65	0.05	2.5	0.5	Subhedral tabular, anhedral interstitial	With numerous tiny tiny oxide inclusions, some with microgranular clinopyroxene inclusion, often strongly zoning
Clinopyroxene		18	0.1	0.8	0.4	Subhedral interstitial	Some replaced to pale brownish amphibole
Olthopyroxene		10	0.3	2	1.2	Subhedral poikilitic to prismatic	Some with bleb-like inclusion of clinopyroxene
Amphibole		2	0.1	0.7	0.3	Subhedral prismatic	Colorless amhibole, show cleavage
Fe-Ti Oxides		5	<0.05	0.8	0.3	Subhedral, anhedral interstitlal	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Hornblende	8				Clinopyroxene	
Actinolitic hornblende	15				Clinopyroxene	
Chlorite	1.5				Plagioclase, actinolitic hornblende	
Magnetite	3				Clinopyroxene	
Pyrite	1				Disseminated	

STRUCTURE : Boundary between medium-grained quartz diorite and fine-grained gabbro. Large and long prismatic crystals of clinopyroxenes and plagioclase developed in a direction normal to the contact, over thin layer of rounded crystals distributed along the contact. Myrmekitic texture is commonly seen in quartz diorite. Mafic minerals in fine-grained gabbros are highly altered near the contact.

COMMENTS : The former TS114 has been renamed to TS111. Modal proportions of primary minerals estimated by comparison with standard visual estimation chart. Thin section has two parts; one is medium-grained diorite part, another is fine-grained gabbronorite part. In diorite part, amphibole coexist with clinopyroxene in one grain. It is difficult to estimate mode of amphibole and clinopyroxene. / Plagioclase looks mostly fresh but contains millions of tiny tiny inclusions. Clinoproxene is pale green (secondary diopside?). /

TS #115: 312-1256D-232R-2, 52-54 cm, Piece No: 2 **Unit: 93** **OBSERVER: J cm,SY / CL, SM / RA**

ROCK NAME: Medium-grained oxide gabbronorite containing fine-grained fragments

WHERE SAMPLED:

GRAIN SIZE: Medium grained / Microcrystalline to fine grained

TEXTURE: Inequigranular seriate / Equigranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
MEDIUM GRAINED GABBRO							
Plagioclase	50	55	0.2	2	1.2	Subhedral tabular to subequant	Dusty alteration
Clinopyroxene	15	25	0.4	1.6	1	Interstitial - sub-ophitic	Partially altered to actinolite
Orthopyroxene	13	15	0.4	1.4	1	Interstitial - sub-ophitic	
Olivine	0	2	0.8	1	1	Subhedral	Entirely altered to oxides and phyllosilicates
Fe-Ti Oxides	3	3	0.2	0.4	0.3	interstitial	
MICROCRYSTALLINE PART OF FINE GRAINED FRAGMENT							
Plagioclase	55	55	0.1	0.1	0.1	Equant, granular	
Clinopyroxene	40	45	0.1	0.2	0.15	Eqaunt, granular	
Fe-Ti oxides	<1	<1	0.01	0.03	0.02	Interstitial	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
MEDIUM GRAINED GABBRO						
Hornblende	1				Clinopyroxene	
Actinolitic hornblende	5				Clinopyroxene	
Actinolite	6				Clinopyroxene, orthopyroxene	
Chlorite	2				Plagioclase	
Magnetite	3				Olivine (?), clinopyroxene	Seen as blebs associated with amphiboles and larger grains potentially associated with olivine alteration.
Chalcopyrite	trace				Disseminated	
Pyrite	1				Disseminated	Large grains
MICROCRYSTALLINE PART OF FINE GRAINED FRAGMENT						
Actinolite	5				Clinopyroxene	Alteration of the cpx is only very minor

STRUCTURE : Textural banding (patch) defined by juxtaposition of fine-grained and medium-grained gabbros (opx commonly observed). Finer part coarsening away from the contact. Plagioclase pods in the fine-grained part are elongated into parallelism to the texural banding together with elongated crystals. Medium-grained part is altered to form actinolite (+opx & magnetite) after cpx? Plagioclase crystals of both grain size have dusty cores and clean rims.

COMMENTS : Complex relationship between medium-grained and finer-grained parts of this rock. The boundaries are sometimes clear, with coarse grained forming on the medium gained side of the margin, and no clear variation in grain-size of the fine-grained portion towards the margin (see top right part of slide). Some medium-grained zones are also seen to occur within the predominantly fine-grained portion. Only the microcrystalline zones of the fine-grained portion have been described in detail above. However, four or five linear elongated lenses (1x5 mm) of granular plagioclase have fomed within the fine-grained region. These are surrounded by regions of similar thickness that contain up to 1mm diameter oikocrystic/oikoblastic orthopyroxene and clinopyroxene that enclose granular plagioclase and oxides. These pairings into dark and light zones may correspond to some sort of segregation at high temperature, perhaps related to the presence of partial melt (speculation!). / Plagioclase looks mostly fresh but contains millions of tiny tiny inclusions. Frequent inclusions-free rims. The presence of olivine in this section prior to alteration is questionable. /

TS #116: 312-1256D-232R-2, 98-100 cm, Piece No: 9 **Unit: 93/94** **OBSERVER: J cm,SY / SM / RA**

ROCK NAME: Medium-grained quartz-bearing gabbronorite / Fine-grained basalt (granular altered)

WHERE SAMPLED:

GRAIN SIZE: Medium/Fine-grained

TEXTURE: Inequigranular seriate/Granular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
COARSER MEDIUM GRAINED GABBRO (top of slide)							
Plagioclase	40	55	0.8	4	2	Subequant subhedral	Shows concentric zoning. Dusty alteration.
Clinopyroxene/Amphibole	0	30	0.4	4	1.5	Interstitial-subhedral	
Orthopyroxene	4	8	0.8	3	2	Subhedral	Often enclosing small plagioclase and clinopyroxene crystals.
Quartz	5	5	0.4	4	3	Granophyric intergrowth	
Fe-Ti oxides	2	2	0.8	4	1	Interstitial-subhedral	
FINER MEDIUM GRAINED GABBRO (bottom of slide)							
Plagioclase	40	55	0.2	2	1.4	Tabular subhedral	Some dusty alteration
Clinopyroxene	25	35	1	2	1.5	Ophitic	
Orthopyroxene	8	8	1	3	2	Ophitic and interstitial-subhedral	Near margin with finer grained basalt, contains many tiny clinopyroxenes.
Quartz	1	1	0.1	0.5	0.1	Granophyric blebs and patches?	
Fe-Ti oxides	1	1	0.5	2	0.5		
Olivine?	1	<1					Altered to oxide rim (see alteration comments below)
FINE GRAINED GRANULAR ALTERED BASALT (middle of slide)							
Plagioclase	40	55	0.2	0.8	0.4	Subhedral subequant-tabular	Granular texture, with larger crystals often being tabular, and smaller subequant.
Orthopyroxene	14	16	1	5	3	Poikilitic/Poikiliblastic	Large crystals enclosing granular plagioclase
Clinopyroxene	15	26	0.2	0.4	0.3	Subhedral granular	Altered to dusty appearance
Fe-Ti oxides	3	3	0.1	1	0.4	Interstitial	
COARSER MEDIUM GRAINED GABBRO (top of slide)							
Actinolite	25					Clinopyroxene	Often seen as halos around relatively unaltered cpx
Secondary plagioclase	5					Plagioclase	
Chlorite	12					Plagioclase, clinopyroxene	Seen along fractures and twin planes in plagioclase
Magnetite	3					Clinopyroxene	Seen as blebs in actinolite
Chalcopyrite	0.1					Disseminated	
Pyrite	0.1					Disseminated	
FINER MEDIUM GRAINED GABBRO (bottom of slide)							
Actinolite	7					Clinopyroxene	
Chlorite	8					Clinopyroxene, plagioclase	
Hornblende	1						
Secondary plagioclase	10					Plagioclase	
Phyllosilicate (unidentified)	<1					Olivine	
Magnetite	2					Olivine, clinopyroxene	
Chalcopyrite	0.5					Disseminated	
pyrite	0.5					Disseminated	

TS #116: 312-1256D-232R-2, 98-100 cm, Piece No: 9 **Unit: 93/94** **OBSERVER: J cm,SY / SM / RA**

ROCK NAME: Medium-grained quartz-bearing gabbronorite / Fine-grained basalt (granular altered)

WHERE SAMPLED:

GRAIN SIZE: Medium/Fine-grained

TEXTURE: Inequigranular seriate/granular

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	max.	av.	REPLACING / FILLING	COMMENTS
FINE GRAINED GRANULAR ALTERED BASALT (middle of slide)						
Actinolite	2				Clinopyroxene and orthopyroxene	
Dusty cpx/act	5				Clinopyroxene	
Chlorite	1				Clinopyroxene	
Secondary plagioclase	3				Plagioclase	
Magnetite	2				Clinopyroxene	
Pyrite	0.5				Disseminated	
Chalcopyrite	0.05				Disseminated	

STRUCTURE : Boundary between medium-graind diorite and fine-graind rock (gabbro-norite) is fairly distinctive and large opx crystals concentrate along the boundaries. Boundary between fine-grained gabbro-norite and medium-grained ol-gabbro (olivine replaced by talc and magnetite) is rather diffused. No evidence for shape preferred orientation nor plastic deformation was observed. Medium-grained diorite develops myrmekite texture in part. Cpx in medium-grained diorite are altered.

COMMENTS : Modal proportions estimated by comparison with visual chart. The coarsest gabbro unit seems to have entrained the fine-grained material. There is an unusual band of clinopyroxene/amphibole which is about 2 mm wide and runs sub-parallel to the contact between coarse and fine material, at a distance of about 2mm from the contact. This clinopyroxene/amphibole is packed with oxide inclusions. Most of the larger orthopyroxene crystals are also concentrated close to the margin. The contact between the coarsest gabbro and the fine-grained material is fairly distinct and sutured. However, the contact between the finer medium-grained gabbro and the fine-grained material is not always sharp and is commonly gradational. The origin of the fine-grained rock is under debate. One possibility is that it was a fine-grained bsasltic rock that was subsequently reheated to first form a granular texture, and then perhaps in a second event, the development of the orthopyroxene oikocrysts/blasts which enclose the granular texture. One argument in favour of such a mechanism comes from stufy of the texture of the fine-grained dike material from above the gabbro, as observed in thin section 99, which has a very similar plagioclase texture, and has granular rather than oikocryst/blast orthopyroxene. Another possibility is that the rock was originally intruded as a fine-greained gabbronorite, and that the orthopyroxene overgrowth textures are part of the original igneous fabric. In this case the granular nature of the clinopyroxene must also be a primary igneous feature, and is not like any of the other fine-grained intrusive rocks seen in this section that have retained their igneous texture. The fine-grained part may either be part of the adjoining fine-grained unit, or possibly a fine-grained xenolith within the gabbro./ Olivine replacement in the bottom section occurs with the formation of a magnetite rich rim and phyllosilicate core. All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray apperance. The rim of plagioclase is frequently inclusions-free. /

TS #117: 312-1256D-234R-1 19-22 cm, Piece No: 7 | **Unit: 95** | **OBSERVER: TY / DT /RA**

ROCK NAME: Fine-grained basalt
WHERE SAMPLED: Lowermost sample from Expedition 312
GRAIN SIZE: Fine grained
TEXTURE: Intergranular

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
PHENOCRYSTS							
Plagioclase	<1	<1	-	-	1.5	Rare glomerocryst with cpx	Plagioclase overgrowth around cpx glomerocryst? highly altered to secondary plagioclase + amphibole
Clinopyroxene	0	<1	-	-	2	Rare glomerocryst with plag	Highly altered to amphibole, chlorite (chlorite-smectite) and dusty cpx
GROUNDMASS	99						
Plagioclase	5	50	0.1	0.5	0.2	Subhedral	Altered to secondary plagioclase + actinolite
Clinopyroxene	5	44	0.2	0.8	0.5	Anhedral	To dusty cpx + actinolite
Fe-Ti oxides	5	5	0.1	0.3	0.5	Euhedral to anhedral	Acicular to equant sub-angular

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx	20				Clinopyroxene	
Actinolitic hornblende	14				Clinopyroxene, plagioclase	
Chlorite	5				Clinopyroxene, plagioclase	Green-brown in places - chlorite-smectite?
Secondary plagioclase	45				Plagioclase	
Quartz	3				Interstitial	

STRUCTURE : No shape preferred orientation. Nor clear evidence for plastic deformation.

COMMENTS : Modal proportions estimated by comparison with visual chart./ Highly altered fine grained basalt from beneath the lower gabbro. Its highly recrystallized but does not have a granular appearance. Alteration typical of actinolitic-hornblende-rich alteration in Cores 180R-ish. Abundant dusty, corroded clinopyroxene. No sign of granoblastic texture.

TS #118: 312-1256D-209R-1, 15-19 cm, Piece No: 4 | **Unit: 80A** | **OBSERVER: TY / SM / RA**

ROCK NAME: Aphyric fine-grained basalt
WHERE SAMPLED: Dike interior
GRAIN SIZE: Fine grained
TEXTURE: Holocrystalline variolitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
GROUNDMASS							
Plagioclase	45	50	0.1	0.6	0.3	Subhedral, tabular to acicular	Commonly zoned
Clinopyroxene	5	47	0.1	0.3?	0.3	Interstitial	Strongly altered
Fe-Ti Oxides	3	3	0.1	0.2	0.2	Subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolite	12				Clinopyroxene	
Chlorite	3				Clinopyroxene and plagioclase	
Secondary plagioclase	5				Plagioclase	Difficult to quantify
Magnetite	6				Clinopyroxene	Commonly seen as strands of blebs parallel to radiating actinolite crystals
Pyrite	0.1				Disseminated	

STRUCTURE : No flow related structures. No evidence for plastic deformation, except for weak undulose extinction of plagioclase. Dendritic growths of plagioclase and cpx (replaced by actinolite) are observed. They are highly recrystallized.

COMMENTS : Strongly overprinted by post-magmatic metamorphism. / There are no veins in this section (hurrah!). Clinopyroxene exhibits variable alteration through this section. /

TS #119: 312-1256D-215R-1, 10-15 cm, Piece No: 2 **Unit: 85** **OBSERVER: J cm / CL /**

ROCK NAME: Medium-grained disseminated oxide gabbro
WHERE SAMPLED:
GRAIN SIZE: Medium grained
TEXTURE: Inequigranular seriate ophitic

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Plagioclase	50	55	0.2	5	2	In ophitic portions: elongate, large laths. In coarse portions: subequant, subhedral grains of varying size	Plagioclase texture varies according to whether found as chadacryst in clinopyroxene, or outside the clinopyroxene. Chadacrysts tend to be elongate and unzoned, while in regions between oikocrysts the plagioclase is sub-equant and shows more pronounced concentric zoning.
Clinopyroxene/Amphibole	20	39	0.8	12	2	Interstitial/Ophitic	Clinopyroxene is present as large oikocrysts, up to 12 mm in size, and is often fresh in the cores of these oikocrysts. Between the oikocrysts, an altered interstitial mafic phase is present, which may been either primary amphibole or clinopyroxene.
Olivine	2	3	1	2	1.4	Subhedral-interstitial	Some fresh parts, show high birefringence and some exsolution of Ti oxide. Often altered to chlorite and oxides. Occurs with oikocrysts and sometimes includes plagioclase.
Fe-Ti oxides	3	3	0.1	3	1	Interstitial	Only occurs in coarse non-ophitic portions

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Actinolitic hornblende	18				Clinopyroxene, olivine, minor plagioclase	Pale blue-green when replacing olivine
Chlorite	0.5				Plagioclase	
Secondary plagioclase	1.5				Plagioclase	Locally up to 5%
Brown green phyllosilicate	0.05				Olivine	Pleochroic when in minor amounts, dark green not pleocroic when completely replacing olivine. Associated with magnetite
Talc-rich phyllosilicate	0.05				Olivine	Fresh olivine relicts occur
Magnetite	1				Olivine	
Sulfide	0.05				Disseminated	

STRUCTURE : No preferred mineral orientation, either in the groundmass or in the patches. Plagioclase crystals display a weak undulose extinction, feature that is slightly more pronounced in the patches. In the groundmass, plagioclase crystals commonly have borders moderately lobated, while in the patches they have mostly straight borders. This may indicate that the patches acted as protection pockets from the recrystallization.

COMMENTS : Modal proportions estimated by comparison with visual chart. The sample was selected for thin section due to its clear macroscopic patchiness frompale coarse regions to finer darker regions. It is clear that the darker regions correspond to the clinopyroxene oikocrysts, and the apparently coarser regions to those parts with sub-equant plagioclase that either contained more primary amphibole or have undergone preferential alteration. The texture may results from some sort of in-situ crystallization process of the gabbro body (amongst several alternatives). No fresh orthopyroxene was observed in thin section

TS #120: 312-1256D-233R-1, 13-14 cm, Piece No: 2 **Unit: 94** **OBSERVER:BS,TY / CL /RA**

ROCK NAME: Fine-grained aphyric basalt

WHERE SAMPLED:

GRAIN SIZE: Fine grained

TEXTURE: Holocrystalline seriate

PRIMARY MINERALOGY	PERCENT PRESENT	PERCENT ORIGINAL	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	MORPHOLOGY	COMMENTS
Groudmass							
plagioclase	45	50	0.2	1.5	0.5	Subhedral to euhedral	Commonly zoned
Clinopyroxene	15	38	0.2	0.8	0,5	Anhedral	Altered
Orthopyroxene	<1	10	0.1	0.3	0.2	Anhedral	Granular
Ti-Fe Oxides	2	2	0.1	0.3	0.1	Subhedral	

SECONDARY MINERALOGY	PERCENT	SIZE (mm) min.	SIZE (mm) max.	SIZE (mm) av.	REPLACING / FILLING	COMMENTS
Dusty cpx/act	5				Clinopyroxene	
Actinolitic hornblende	10				Clinopyroxene, orthopyroxene	
Magnetite	3				Clinopyroxene	
Pyrite	0.1				Disseminated	

STRUCTURE : Actinolite vein with irregular contact develops in transverse direction. No obvious shape preferred orientation. No evidence for plastic deformation. Several fractures with no shear displacement observed along the longitudinal direction.

COMMENTS : This rock is strongly metamorphosed by post-magmatic high-temperature metamorphism, and the primary igneous texture and mineralogy are unclear. Hence, secondary, metamorphic assemblages are described as primary features. No igneous contact in that section. A 5um small vein filled by actinolite/cpx brown stuff is visible. / All plagioclase crystals look fresh but contain an infinity of tiny-tiny inclusions, giving the plagioclase a general light gray appearance. The rim of plagioclase is frequently inclusion-free. Several sinuous 0.05-0.1 mm veins of actinolitic hornblende, invading the host-rock.