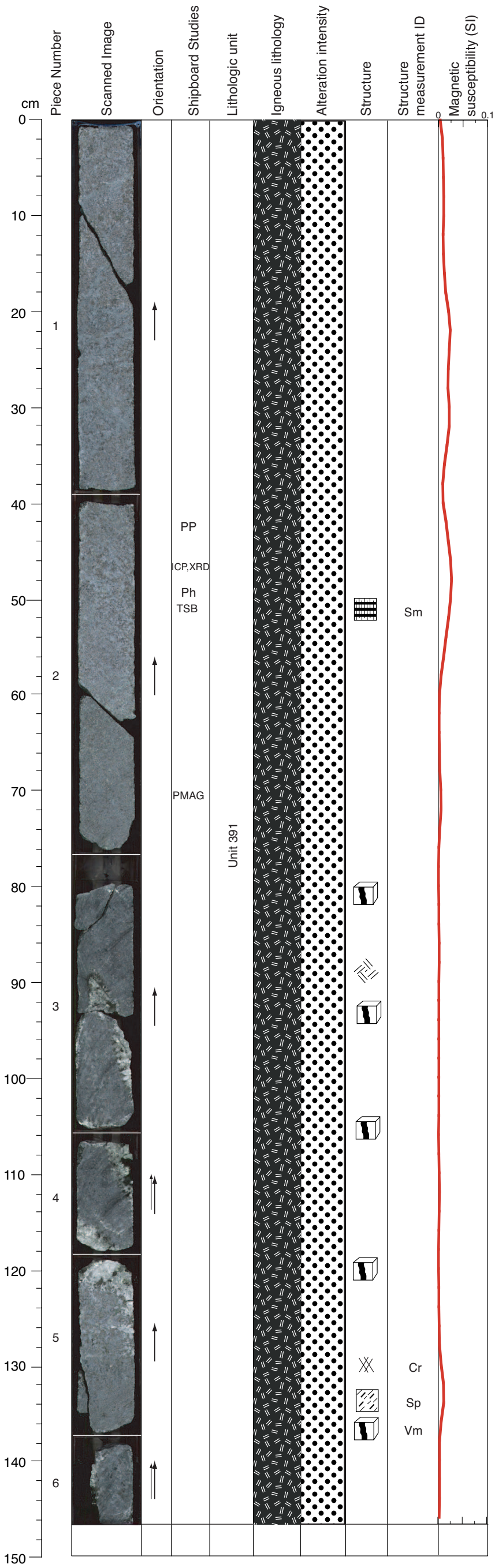
## Core Photo




**305-U1309D-144R-1 (Section top: 707.80 mbsf)**

UNIT-391: Olivine-bearing gabbro
Pieces: 1 to 6

PRIMARY MINERALOGY: Modal data from Piece 6

| | |
|---|---|
| Plagioclase | Modal 55-65%<br>Size 5 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-45%<br>Size to 50 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained olivine-bearing gabbros form the continuation of the previous core. The interval between 89 and 149 cm is crosscut by several, 20-40 mm wide leucocratic magmatic dikelets. Euhedral plagioclase crystals form a palisade texture along the walls of the veins, and are filled with a fine-grained green amphibole-bearing matrix.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Leucocratic zones (plagioclase, amphibole, sulfides) are observed at 92-100, 106, 117 and 120 cm.. Some coronas are found locally.

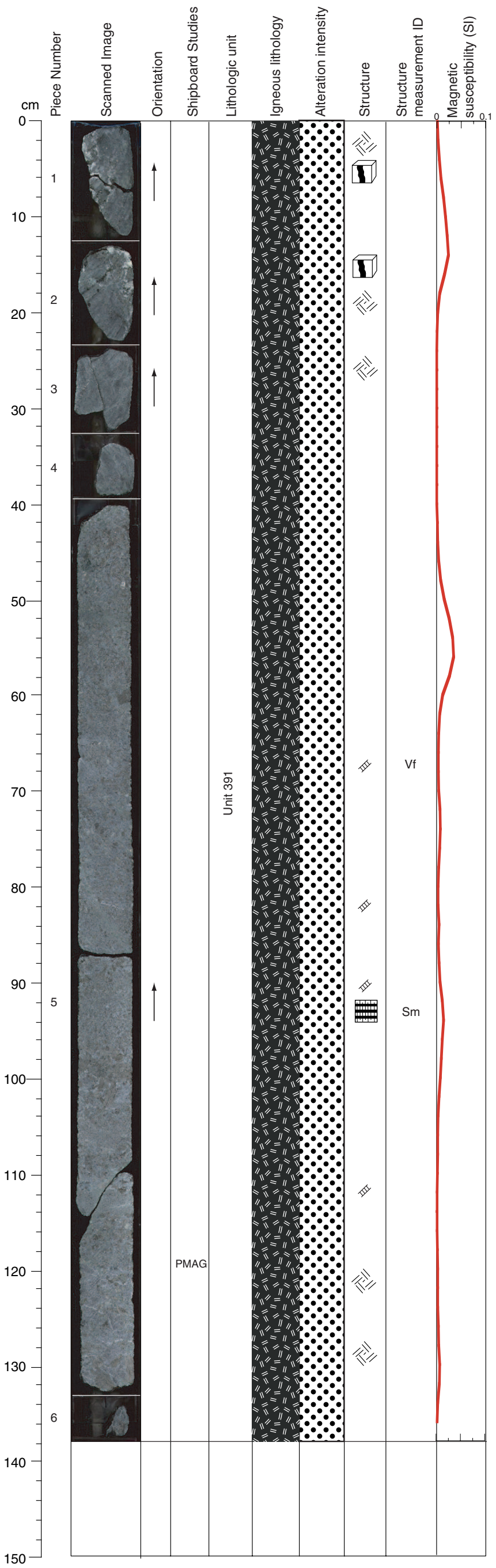
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc.

THIN SECTIONS:
**305-U1309D-144R-1, 50-52 cm (#382)**

STRUCTURE: Medium-grained gabbro with leucocratic veining, a zone of weak magmatic strain and one plastic shear zone in Piece 5, associated veins (later) crosscutting the contacts (dark green). Medium-fine grained gabbro with irregular veins and alteration zones.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-144R-1, 40-60 cm WET

## Core Photo




**305-U1309D-144R-2 (Section top: 709.27 mbsf)**

UNIT-391: Olivine-bearing gabbro
Pieces: 1 to 6

PRIMARY MINERALOGY: Modal data from Section U1309D-144R-001, Piece 6

| | |
|---|---|
| Plagioclase | Modal 55-65%<br>Size 5 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-45%<br>Size to 50 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained olivine-bearing gabbros form the continuation of the previous section. The top interval between 9 and 149 cm is crosscut by leucocratic magmatic dikelets with palisade texture of euhedral plagioclase crystals.

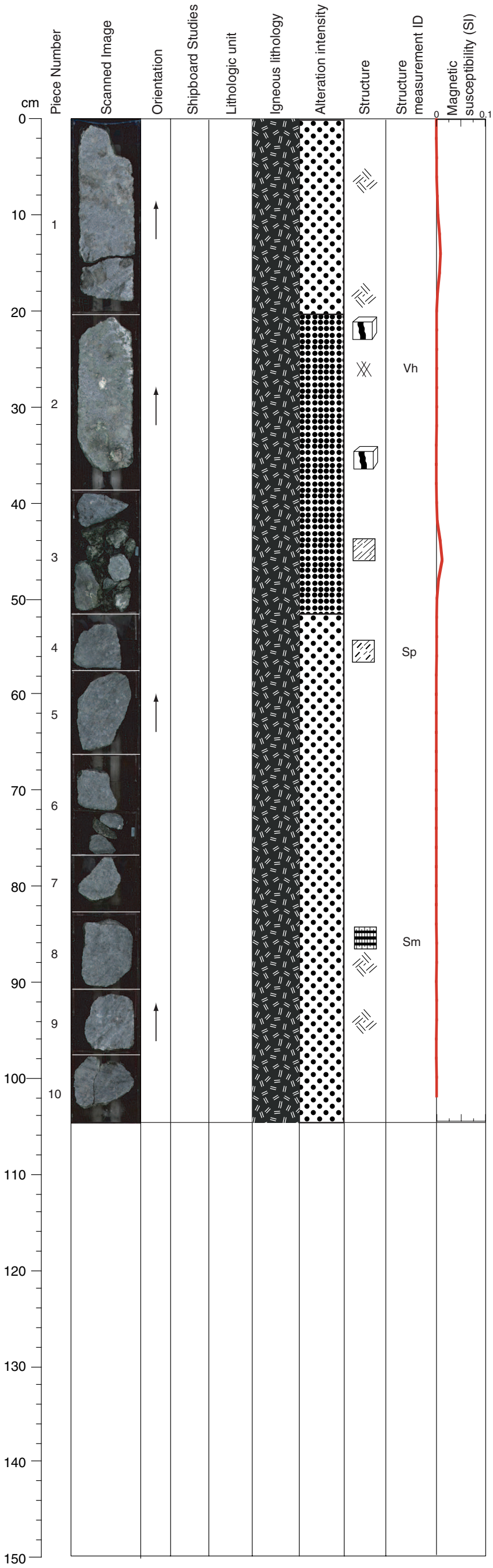
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Leucocratic zones (plagioclase, amphibole) on top of the Pieces 1 and 2. The pyroxenes close to these zones are replaced by green amphibole.

VEIN ALTERATION: Chlorite, talc.

STRUCTURE: Medium-grained gabbro with magmatic intrusions and associated veins (later) crosscutting the contacts (dark green). No clear ductile strain. Slight veining.

## Core Photo




**305-U1309D-144R-3 (Section top: 710.64 mbsf)**

UNIT-391: Olivine-bearing gabbro
Pieces: 1 to 10

PRIMARY MINERALOGY: Modal data from Section U1309D-144R-001, Piece 6

| | |
|---|---|
| Plagioclase | Modal 55-65%<br>Size 5 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-45%<br>Size o 50 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained olivine-bearing gabbros form the continuation of the previous section. Piece 2 is crosscut by a steeply dipping leucocratic magmatic dikelets.

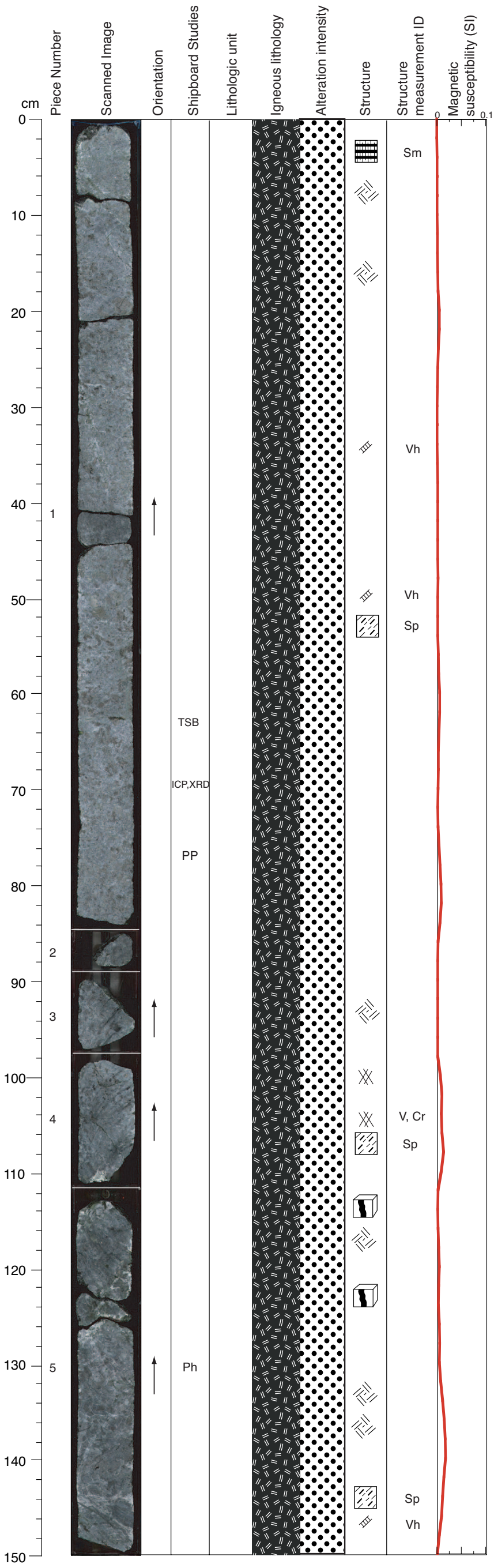
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The Piece 2 is highly altered with a significant amount of green amphibole, and plagioclase. Some coronas are observed well developed in the coarser part.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Coarse gabbro without ductile strain underlain by medium-grained gabbro with weak magmatic strain and a narrow plastic shear zone. Random fracturing and dark green veins. Cataclasized gabbro in Piece 3. Bottom of section is gabbro in pieces with little veining or deformation.

## Core Photo




**305-U1309D-145R-1 (Section top: 712.60 mbsf)**

UNIT-391: Olivine-bearing gabbro
Pieces: 1 to 5

PRIMARY MINERALOGY: Modal data from Piece 1e

| | |
|---|---|
| Plagioclase | Modal 60-70%<br>Size 7 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 30-40%<br>Size 5 mm average, to 15 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained olivine-bearing gabbros form the continuation of the previous core. Pegmatitic clinopyroxene occurs between 130 and 150 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General background alteration of the gabbro is similar to previous sections. Leucocratic zones of alteration appear scattered throughout. Fractures with white alteration of adjacent plagioclase are more common toward the bottom of the section. A few green veins with very narrow green haloes cut the section.

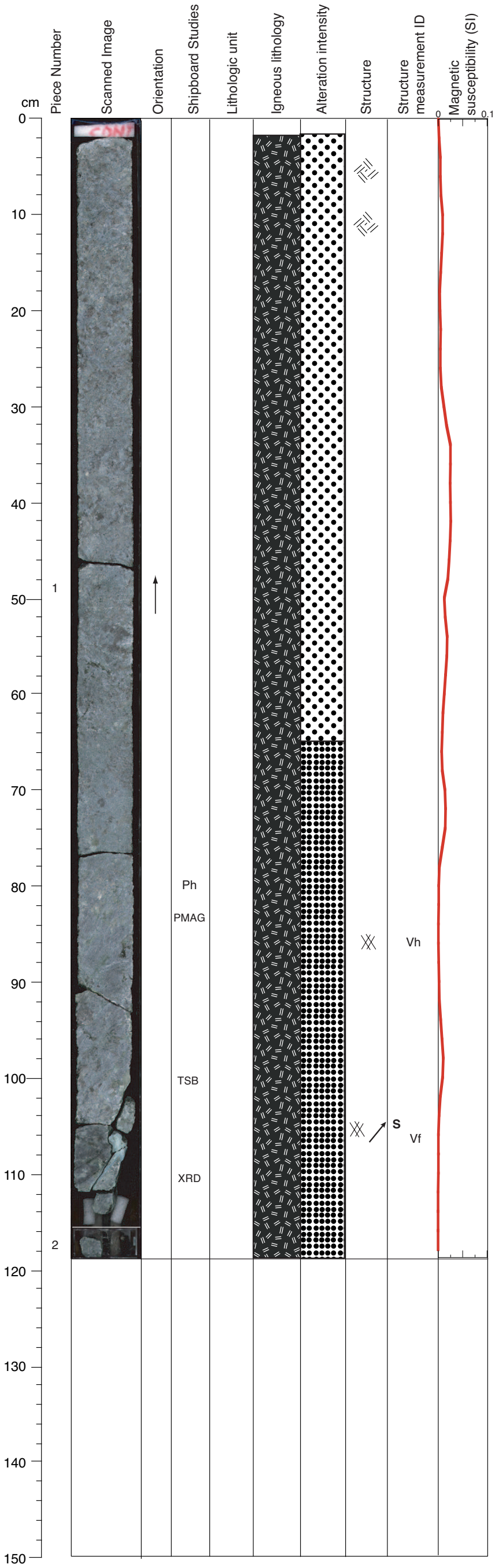
VEIN ALTERATION: Amphibole, plagioclase, chlorite.

THIN SECTIONS:
**305-U1309D-145R-1, 62-64 cm (#383)**

STRUCTURE: Medium-grained gabbro, weak magmatic foliation in upper part, local plastic shear zones throughout, one with detectable normal sense of shear. Magmatic leococratic zone in Piece 5. Later veining (dark veins) and cataclastic veins, and the latest phase of open cracks in Piece 4.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-145R-1, 54-74 cm WET
305-U1309D-145R-1, 125-148 cm WET

## Core Photo




**305-U1309D-145R-2 (Section top: 714.10 mbsf)**

UNIT-391: Olivine-bearing gabbro
Pieces: 1 to 2

PRIMARY MINERALOGY: Modal data from U1309D-145R-001, Piece 1e

| | |
|---|---|
| Plagioclase | Modal 60-70%<br>Size 7 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 30-40%<br>Size 5 mm average, to 15 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained olivine-bearing gabbros form the continuation of the previous section. Coarse orthopyroxene (less than 2 %) and trace amounts of oxide observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The overall background alteration of the gabbro is similar to the previous section. There is a fracture at 90 to 93 cm that is filled with both chlorite and carbonate. Green chlorite/talc veins cut the section in several places.

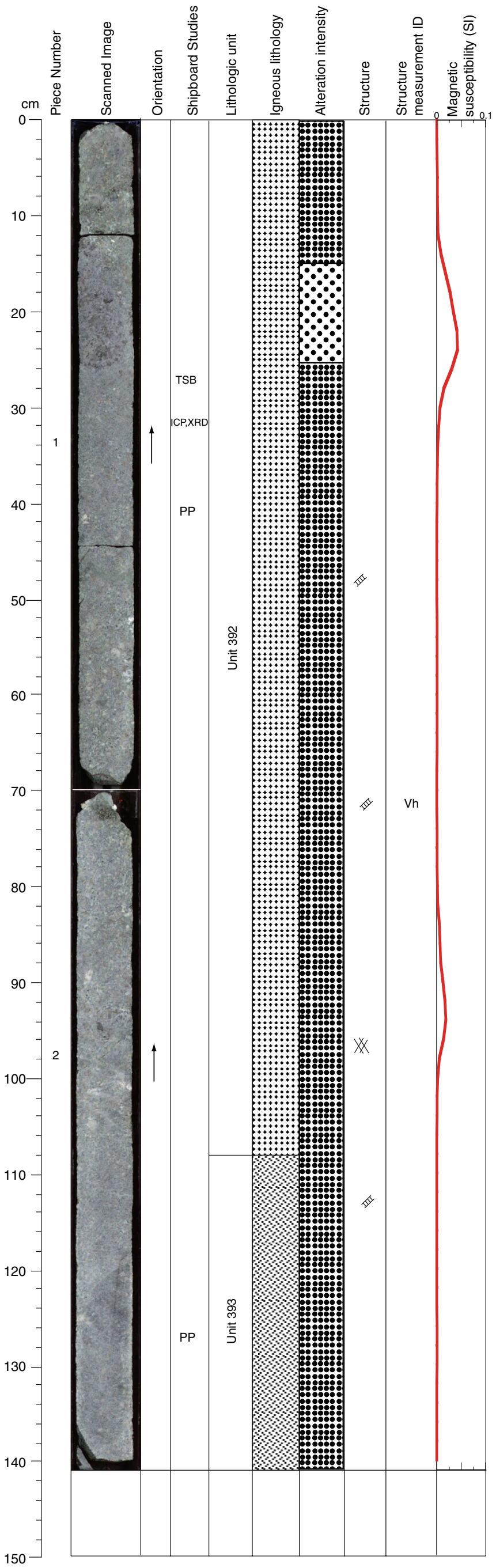
VEIN ALTERATION: Chlorite, talc carbonate.

THIN SECTIONS:
**305-U1309D-145R-2, 25-28 cm (#385)**
**305-U1309D-145R-2, 98-101 cm (#384)**

STRUCTURE: Medium-grained gabbro, no ductile strain fabric, locally coarse crystals. A set of veins at bottom with small offset.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-145R-2, 77-92 cm WET
305-U1309D-145R-2, 106-112 cm WET

## Core Photo




**305-U1309D-145R-3 (Section top: 715.29 mbsf)**

UNIT-392: Olivine gabbro
Pieces: 1 to 2

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 60-70%<br>Size 7 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 25-40%<br>Size 5 mm average, to 15 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 5-15%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: This unit consists of medium-grained olivine gabbros, with decimeter-scale modal and grain size fluctuations. A troctolitic zone occurs between 19 and 27 cm.

UNIT-393: Leucocratic gabbro
Pieces: 2

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 85%<br>Size 7 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 15%<br>Size 5 mm average, to 15 mm<br>Shape anhedral to interstitial |

COMMENTS: This unit consists of leucocratic medium-grained gabbros.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Corona texture is better developed in the upper part of the section and fades away at about 110 cm. A region of more leucocratic alteration occurs in Pieces 1a and 1b and scattered throughout the Unit 392 part of the section.

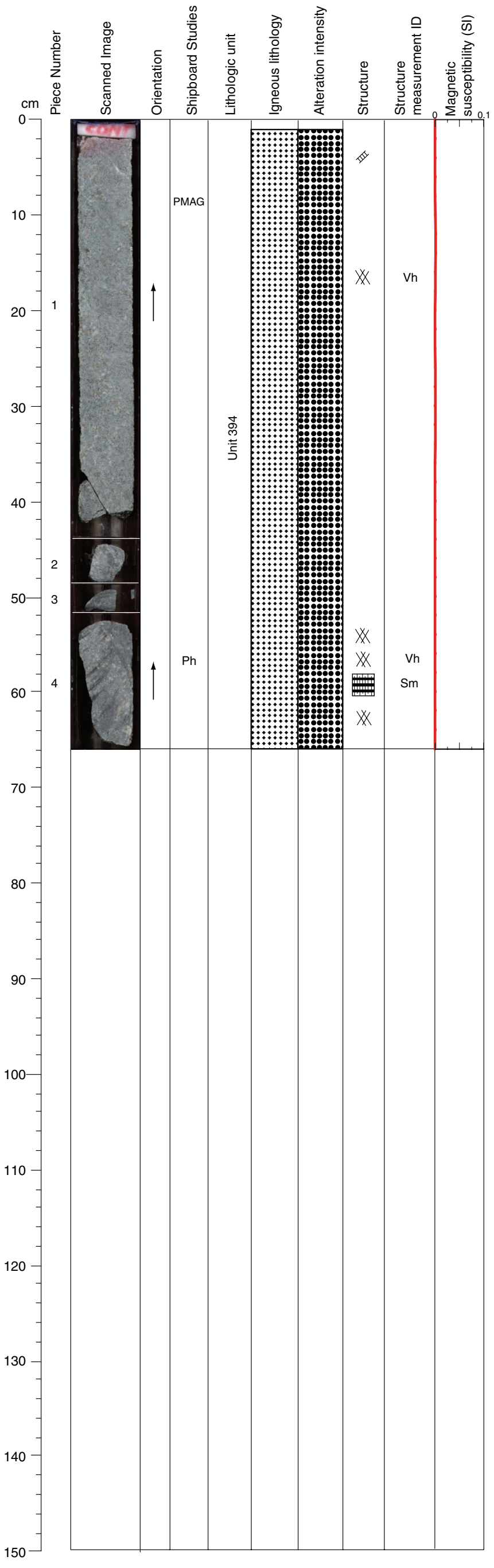
VEIN ALTERATION: Chlorite, talc, carbonate

THIN SECTIONS:

STRUCTURE: Corona alteration in medium-grained gabbro, maximum crystal size 1 cm, no ductile strain. Early irregular white veins, and alteration/hydrothermal dark veins steeply dipping.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-145R-3, 14-34 cm WET

## Core Photo




**305-U1309D-145R-4 (Section top: 716.70 mbsf)**

UNIT-394: Olivine gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 60-70%<br>Size 7 mm average, to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 25-40%<br>Size 5 mm average, to 15 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 5-15%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These medium-grained olivine gabbros are similar to Unit 392. The contact ot the gabbros of Unit 393 is near-vertical.

SECONDARY MINERALOGY: Chlorite, pale amphibole

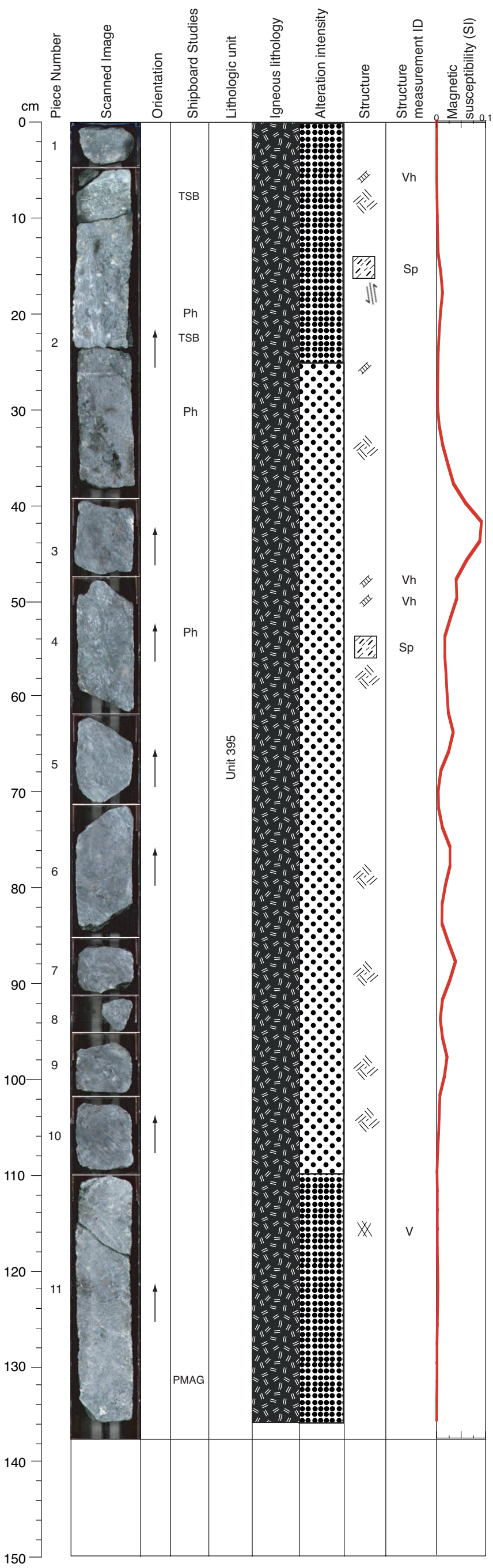
COMMENTS: Corona texture is faintly developed in the entire section. Fractures cut Piece 1 in several intervals and the adjacent rock is slightly more altered to pale green ampibole

VEIN ALTERATION: Chlorite, talc

STRUCTURE: Medium grained gabbro, corona alteration, weak magmatic mineral foliation at base of section. A high density, dark green vein set in Piece 4 - all parallel (<1 cm spacing), and with associated alteration.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-145R-4, 52-64 cm WET

## Core Photo




**305-U1309D-146R-1 (Section top: 717.40 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-11

PRIMARY MINERALOGY: Modal data from Pieces 2b and 11

| | |
|---|---|
| Plagioclase | Modal 60-75%<br>Size to 7 mm<br>Shape anhedral |
| Clinopyroxene | Modal 25-40%<br>Size 5 mm average, to 15 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These medium-grained olivine-bearing gabbros are strongly sheared and altered. Olivine is completely replaced by a corona texture. Disseminated oxides (1%) are present in the shear zone between 40-53 cm. Large orthopyroxene crystals are visible in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, sulfide

COMMENTS: On top of Piece 2, altered pale green coronas cut by green veins (amphibole?). At 10 cm, mylonites appear with a dark blue green color. At 30 cm, irregular contact between coarse-grained gabbro and mylonite. Close to this contact, the olivine grains are altered and the pyroxene grains are partially replaced to green amphibole. From 40 cm to the end of the section, the gabbro shows altered olivine and pyroxene associated with sulfides.

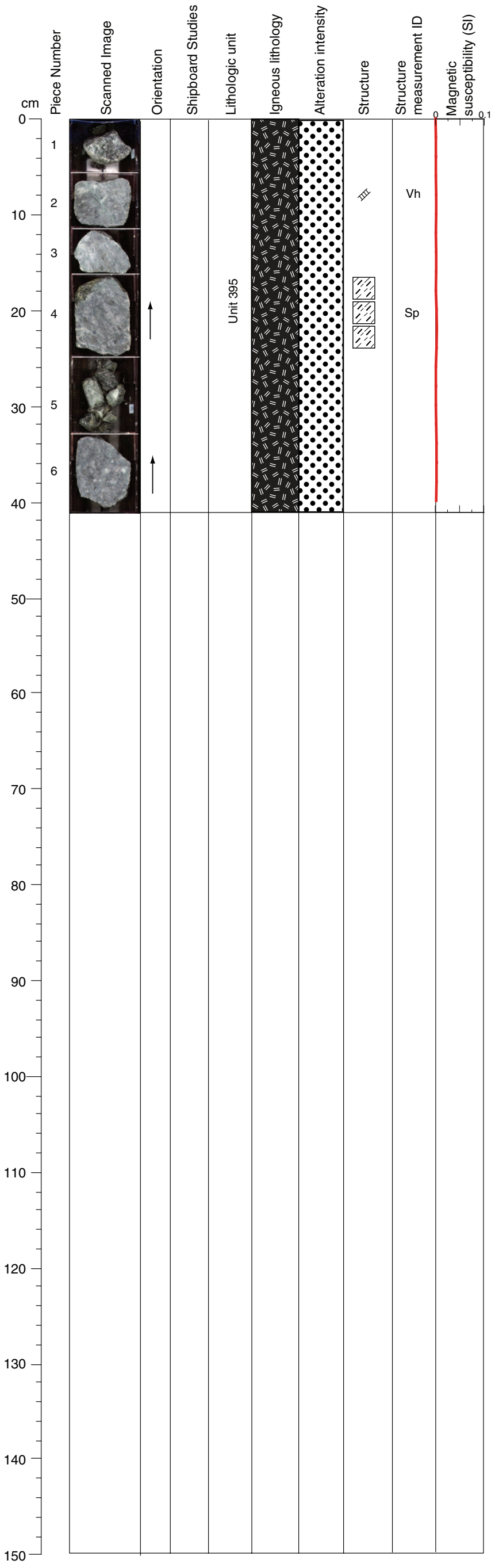
VEIN ALTERATION: Serpentine, amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-146R-1, 6-9 cm (#386)**
**305-U1309D-146R-1, 20-23 cm (#387)**

STRUCTURE: Medium-grained gabbro, no magmatic strain but plastic shear zone of steep attitude with vein (cataclastic), with distributed fracturing. Underlain by cataclastic zone – rubble, and a gabbro interval with pale green veins crosscutting it.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-146R-1, 11-24 cm WET
305-U1309D-146R-1, 11-24 cm DRY
305-U1309D-146R-1, 24-39 cm WET
305-U1309D-146R-1, 48-62 cm WET

## Core Photo




**305-U1309D-146R-2 (Section top: 718.77 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Section U1309D-146R-001, Pieces 2b and 11

| | |
|---|---|
| Plagioclase | Modal 60-75%<br>Size to 7 mm<br>Shape anhedral |
| Clinopyroxene | Modal 25-40%<br>Size 5 mm average, to 15 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: Same as previous section. Oxides are absent.

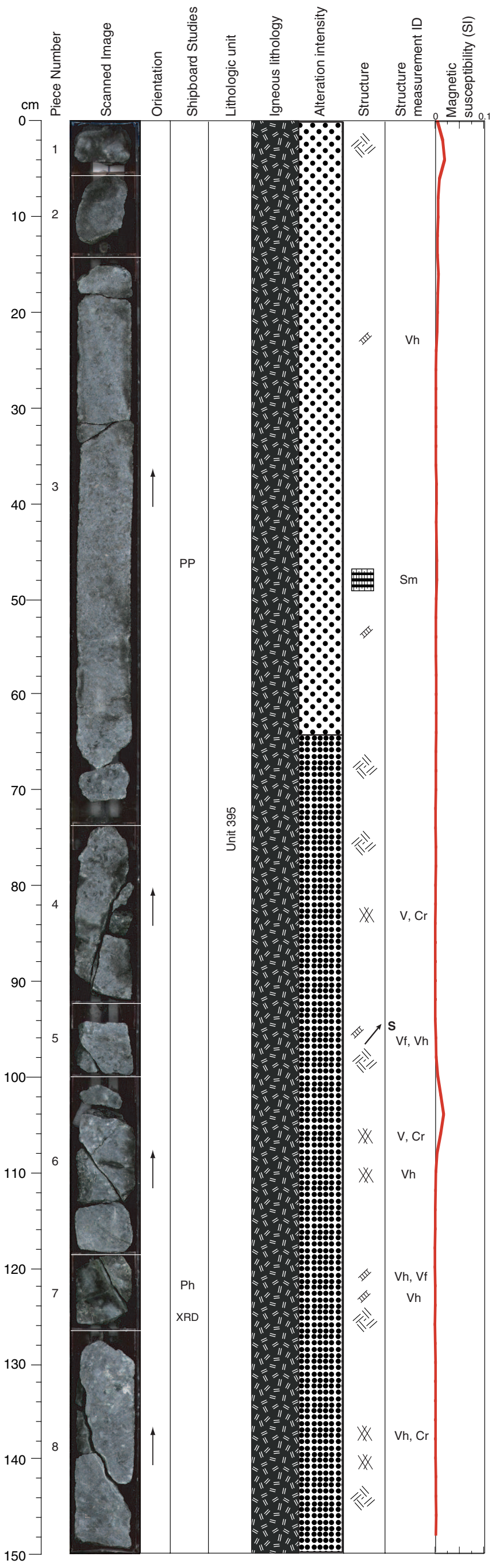
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coronas around olivines are associated with sulfides. The alteration is the same as that observed in the previous section.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium grained gabbro, no magmatic strain but plastic shear zone of steep attitude in Piece 4 with vein (cataclastic), with distributed fracturing. Possibly, cataclastic zone in Piece 5.

## Core Photo




**305-U1309D-147R-1 (Section top: 722.20 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-8

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 5 mm average, to 20 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained modally variable olivine-bearing gabbros are the continuation of the previous core.

SECONDARY MINERALOGY: Chlorite, pale amphibole

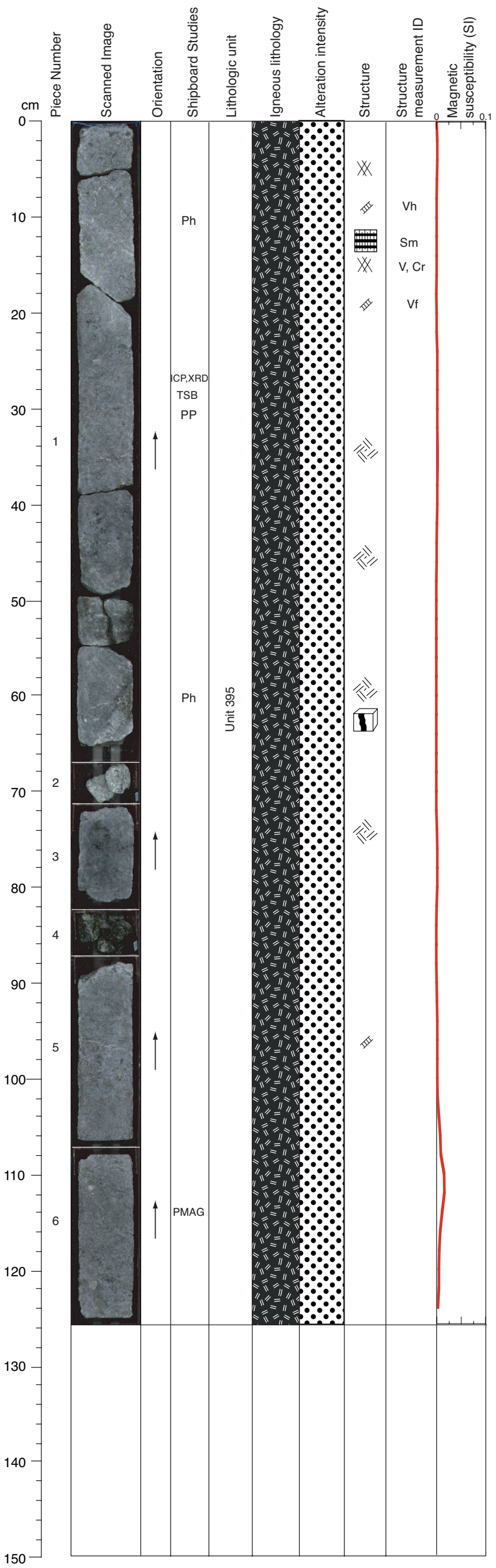
COMMENTS: Alteration similar to previous core, but green veins of ampibole cut the section in several places (e.g., Piece 3) and there are two compound veins containing carbonate.

VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate, sulfide.

STRUCTURE: Fine- to medium-grained gabbro, weak, shallowly dipping magmatic mineral fabric in upper part, no plastic strain. Scarce veining (dark green, fine with limited cataclasis associated), and alteration in Piece 1 to 3. Irregular veining and cataclasis, open fractures in Piece 4 to 8. Veins : Early hydrothermal alteration veins > brittle pale green veins with sulfide > late cracks with white material. Some veins associated with magmatic/hydrothermal alteration veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-147R-1, 119-126 cm WET

## Core Photo




**305-U1309D-147R-2 (Section top: 723.70 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Section U1309D-147R-001, Piece 3

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 5 mm average, to 20 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained and modally variable olivine-bearing gabbros are the continuation of the previous section. Up to 5% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, serpentine

COMMENTS: General background alteration lacks corona texture except very locally near veins. In Piece 2b an amphibole/chlorite vein is crosscut by a compound light-colored vein containing amphibole and white (plagioclase?) that is itself terminated by a set of branching veins that are subparallel to the amphibole chlorite vein. Another chlorite vein with a white border forms the boundary between Pieces 1b and 1c. A fine fracture network filled in partially by green amphibole/chlorite increases toward the bottom of the section and is associated in places with white altered plagioclase.

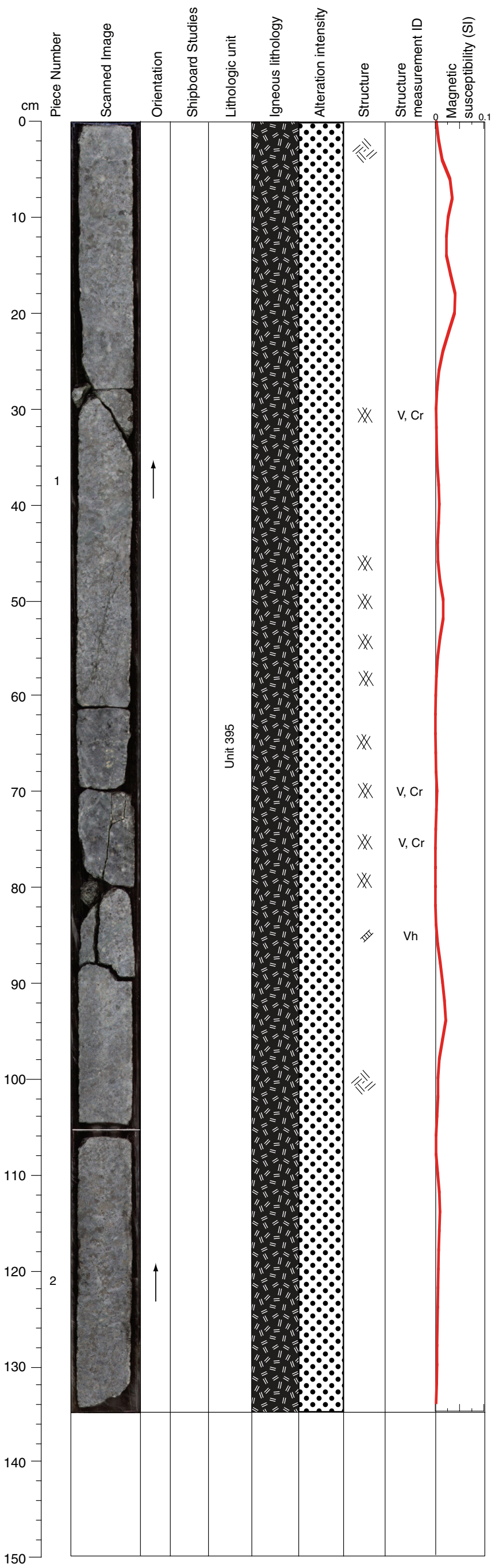
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc.

THIN SECTIONS:
**305-U1309D-147R-2, 27-29 cm (#388)**

STRUCTURE: Fine- to medium-grained gabbro, moderately dipping magmatic fabric in fine grained parts discernible, no plastic strain. Early white, subhorizontal veins (Vh), and late irregular open cracks, some with white infill, and two zones of rubble (Piece 2 and 4) that correspond to cataclastic zones.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-147R-2, 6-17 cm WET
305-U1309D-147R-2, 18-38 cm WET
305-U1309D-147R-2, 55-65 cm WET

## Core Photo




**305-U1309D-147R-3 (Section top: 724.96 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Section U309D-147R-001, Piece 3

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 5 mm average, to 20 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained modally variable olivine-bearing gabbros are the continuation of the previous section.

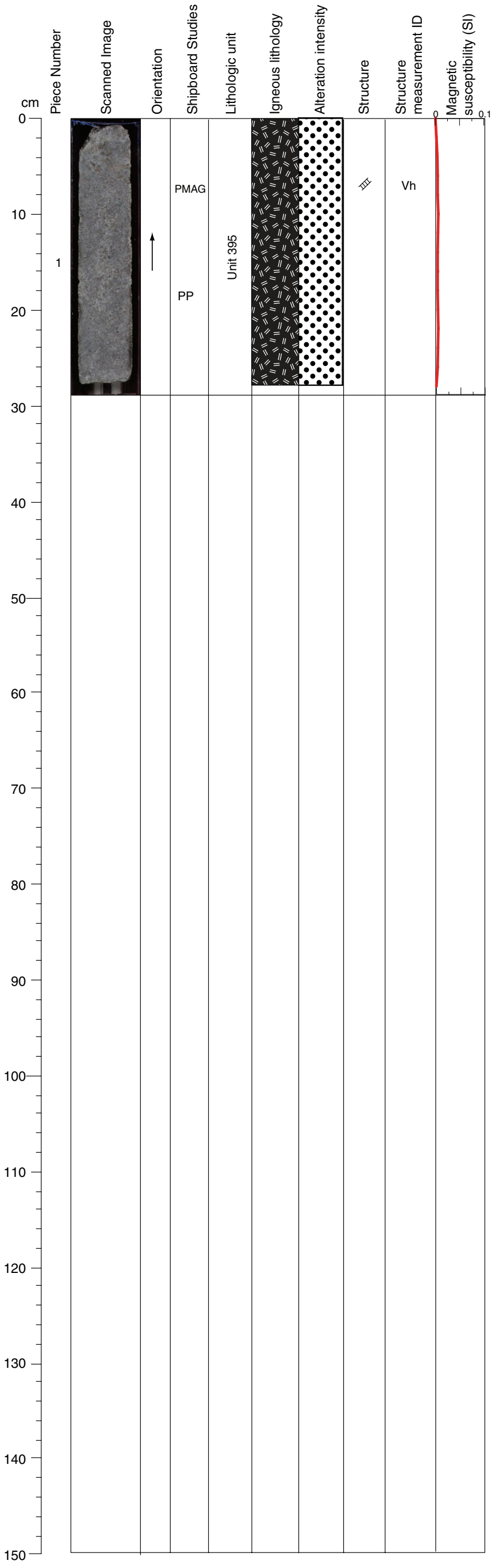
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section. A high-angle vein of green amphibole /chlorite cuts Pieces 1c, 1d through the end of Piece 1 .

VEIN ALTERATION: Amphibole, chlorite, talc.

STRUCTURE: Medium-grained gabbro, locally poikilitic clnopyroxene, no ductile fabric. Irregular early alteration veining and late brittle cracks with white infill, open cracks are irregular and contain sulfide.

## Core Photo




**305-U1309D-147R-4 (Section top: 726.31 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-2

COMMENTS: Same as previous section.

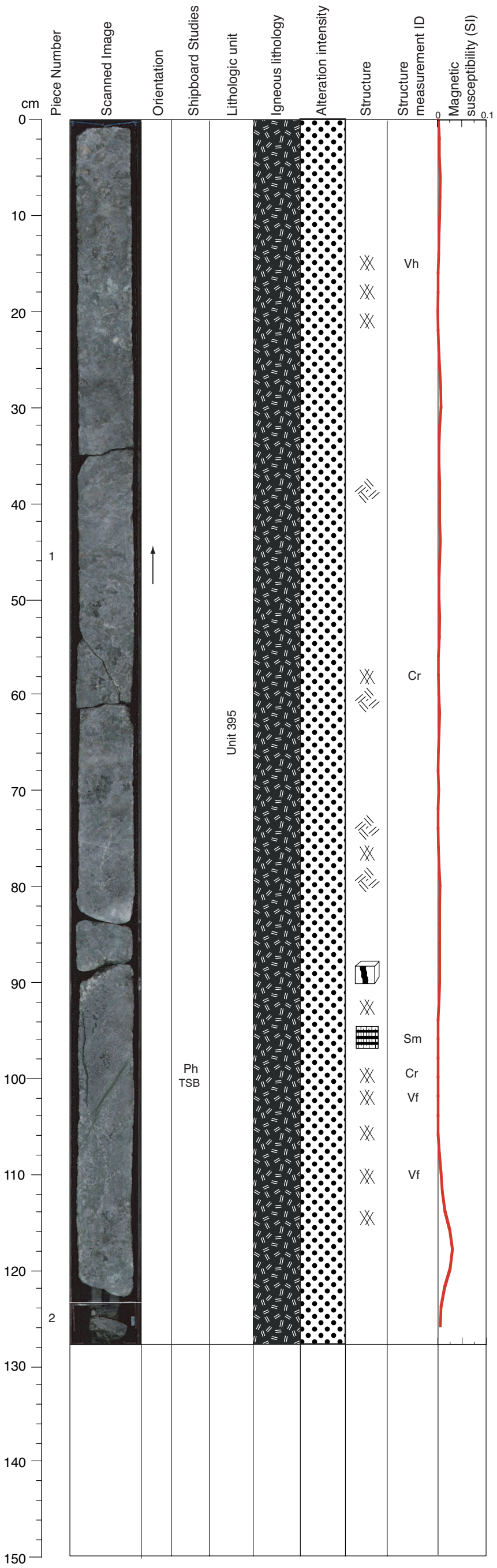
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to the previous section, but no distinct veins.

VEIN ALTERATION: n/a

STRUCTURE: Fine to medium grained gabbro, no ductile fabric. Steeply dipping dark green veins.

## Core Photo




**305-U1309D-148R-1 (Section top: 727.00 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 5 mm average, to 20 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 5 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained modally variable olivine-bearing gabbros are the continuation of the previous core. Clinopyroxene oikocrysts are abundant. Leucocratic dikelets of possible magmatic origin occur at 90 and 110 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole, serpentine

COMMENTS: General alteration of the gabbro is similar to other sections, but this section contains more altered plagioclase (white alteration). Local patches of leucocratic alteration zones with some corona texture developed near them.

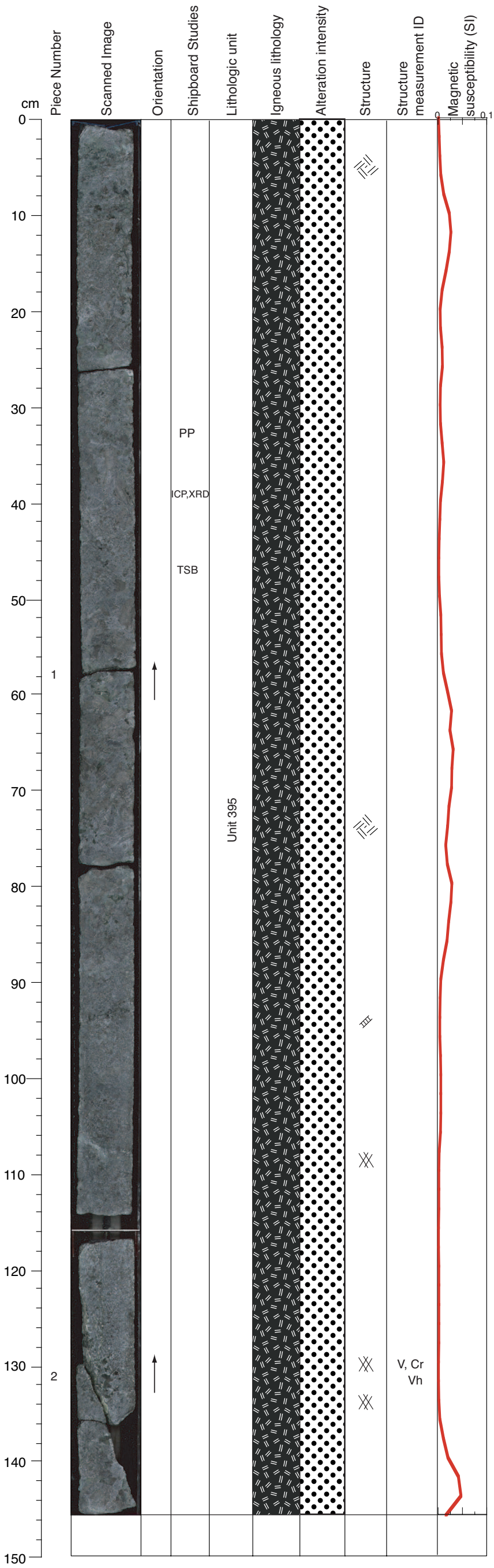
VEIN ALTERATION: Amphibole, plagioclase, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-148R-1, 109-111 cm (#389)**

STRUCTURE: Medium-grained gabbro, in lower part finer grained, and then hint of shallow-dipping magmatic fabric. Gabbro with early dark green veins, and later, irregular cracks filled with pale green and white material. Sulfides in open cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-148R-1, 96-116 cm WET

## Core Photo




**305-U1309D-148R-2 (Section top: 728.28 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-2

COMMENTS: These medium- to coarse-grained olivine-bearing gabbros are the continuation of the previous section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, serpentine

COMMENTS: Background alteration of gabbro similar to previous sections. Some corona texture developed in patches throughout the section. A vein at the base of the section (Piece 2a-c) contains carbonate. Orthopyroxene observed in thin section (1%).

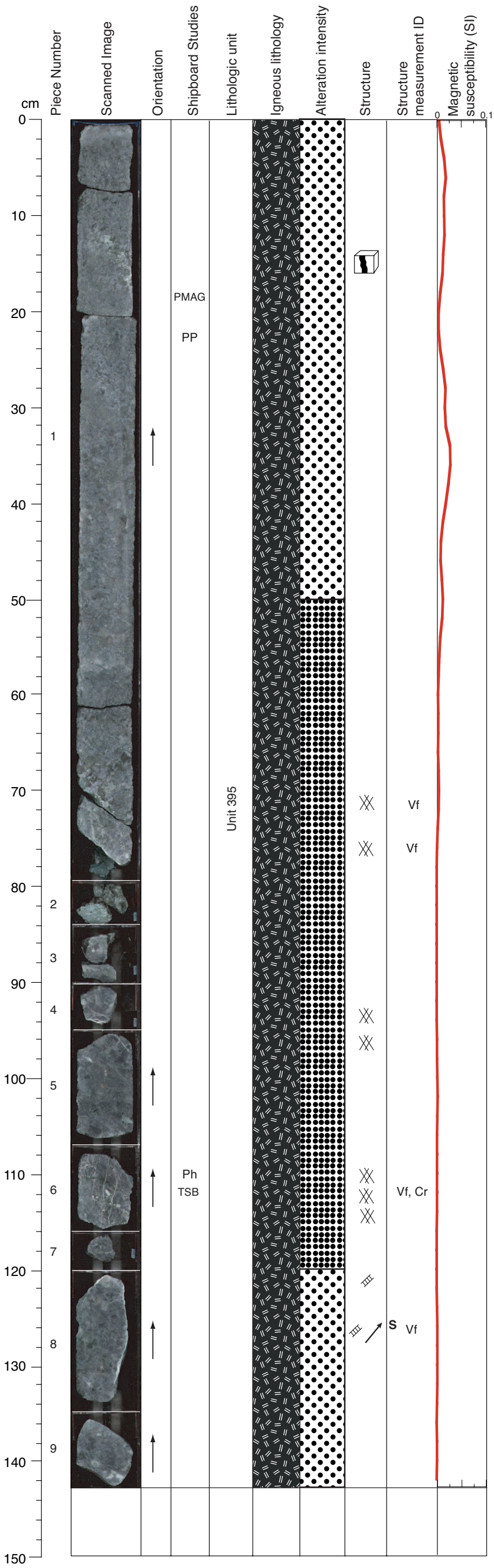
VEIN ALTERATION: Chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-148R-2, 45-47 cm (#390)**

STRUCTURE: Medium- to coarse-grained gabbro without ductile strain fabric, in patches of fine grained gabbro hint of fabric but too weak to be reliably measured. Early hydrothermal (dark green), late carbonate infill of open cracks, and hairline subhorizontal crack veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-148R-2, 30-50 cm WET

## Core Photo




**305-U1309D-148R-3 (Section top: 729.74 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-8

COMMENTS: These medium- to coarse-grained olivine-bearing gabbros are the continuation of the previous section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, dark amphibole?

COMMENTS: General alteration is similar to that of gabbro in previous sections, but this section also has patches of leucocratic alteration associated with fine green veins. In the bottom of the section, the coarser grained gabbro contains white veins of carbonate and amphibole.

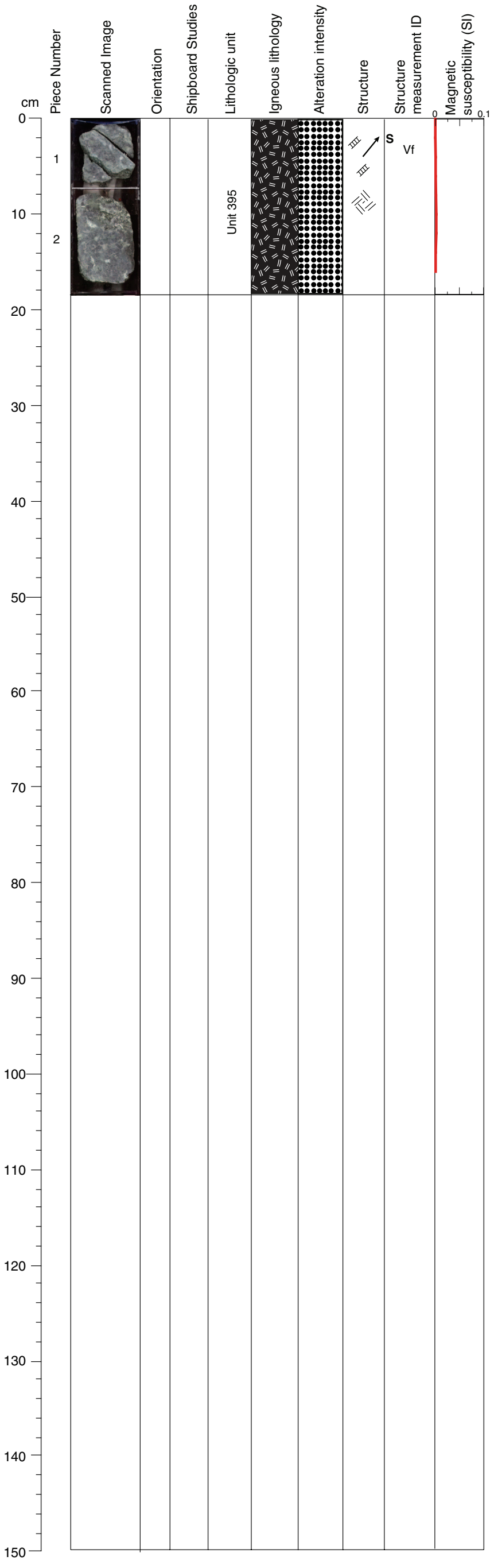
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-148R-3, 111-113 cm (#391)**

STRUCTURE: Medium- to coarse-grained fabric, local magnetite, no ductile strain fabric. Little veining and cataclasis in Piece 1 except its bottom with a level of intense fracturing and vein infill (whitish). Large subvertical fault veins in Piece 8.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-148R-3, 107-116.0 cm WET

## Core Photo




**305-U1309D-148R-4 (Section top: 731.17 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-2

COMMENTS: Same as previous section.

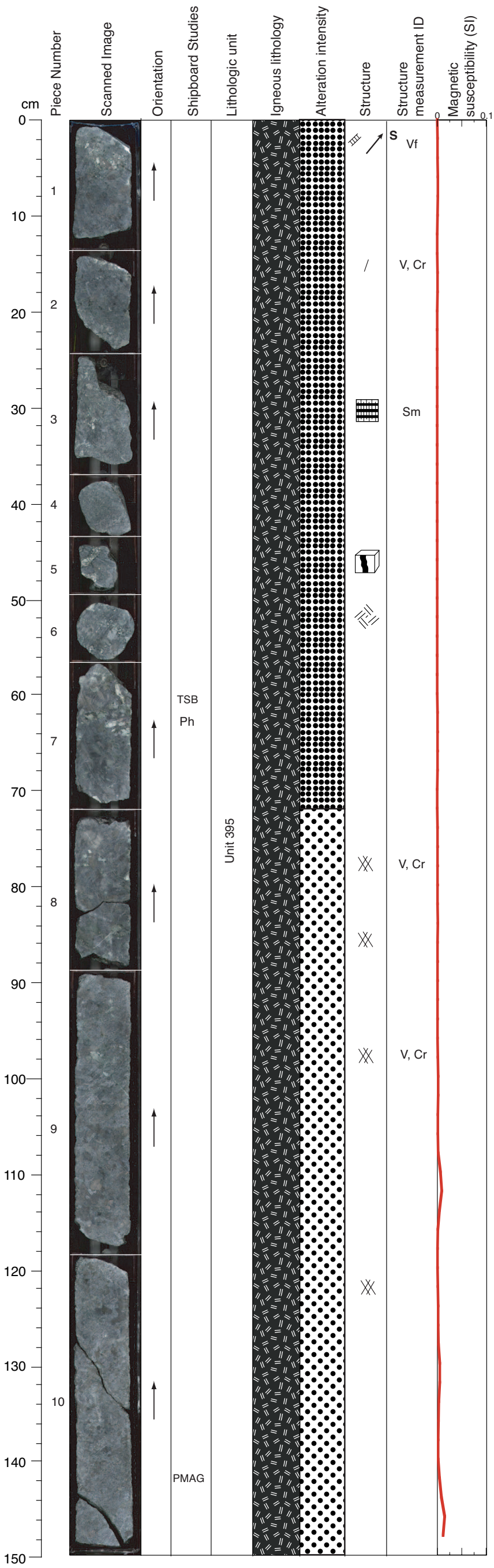
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The two pieces of this section contain green and white veins of amphibole/chlorite and white carbonate veins. The background alteration is similar to other gabbro sections in the hole.

VEIN ALTERATION: Chlorite, talc, carbonate.

STRUCTURE: Medium- to coarse-grained fabric, local magnetite, no ductile strain fabric. Cataclastic deformation and intense veining – fault vein with steeply dipping fibers.

## Core Photo




**305-U1309D-149R-1 (Section top: 731.80 mbsf)**

UNIT-395: Olivine-bearing gabbro
Pieces: 1-10

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 3 mm average, to 25 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 3 mm<br>Shape anhedral to interstitial |

COMMENTS: These dominantly medium-grained modally variable olivine-bearing gabbros are the continuation of the previous core. Leucocratic dikelet of possible magmatic origin occurs in Piece 5.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General alteration is similar to other gabbros in the hole, but this section also contains patches of leucocratic alteration of plagioclase and alreration of pyroxene to green amphibole. Corona texture in Pieces 1-8 show advanced replacement of olivine by talc and a vuggy appearance on cut surfaces. Branching white veins crosscut Piece 8 and contain carbonate.

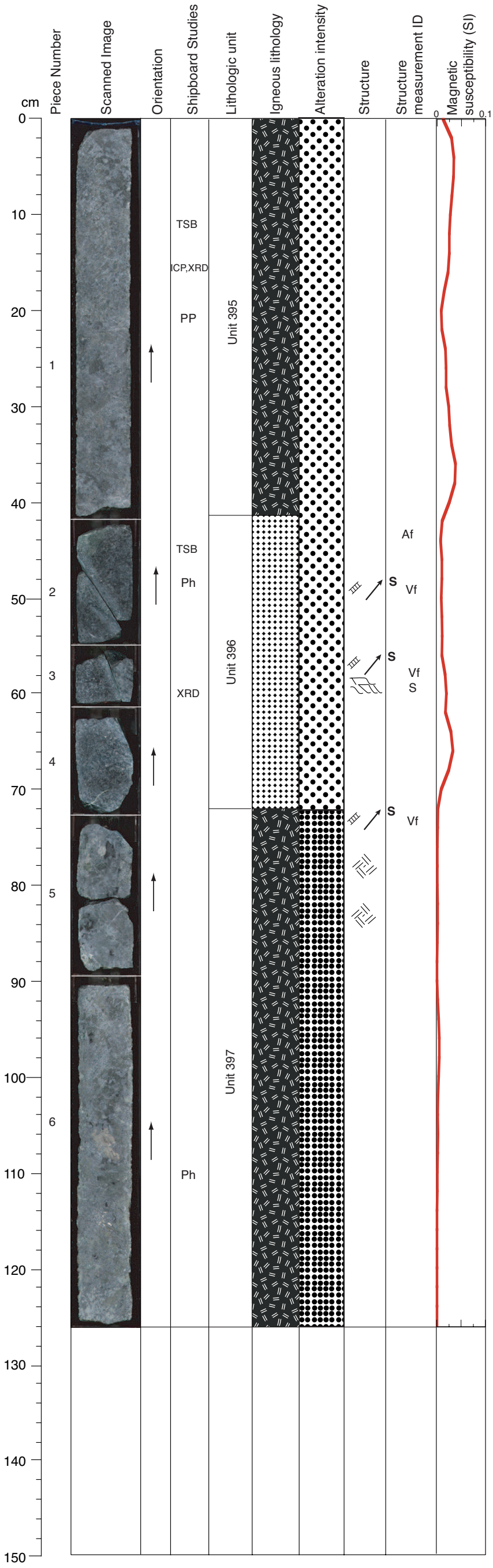
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-149R-1, 59-62 cm (#392)**

STRUCTURE: Coarse-grained gabbro without ductile strain fabric, in local fine-grained gabbro weak magmatic fabric, moderate dip. Cracking veins and fault veins (pale green/white), very irregular.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-149R-1, 57-71 cm WET

## Core Photo




**305-U1309D-149R-2 (Section top: 733.30 mbsf)**

UNITS-395 and 397: Olivine gabbro
Pieces: 1 and 5-6

PRIMARY MINERALOGY: Modal data from Section U1309D-149R-001, Piece 2

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 3 mm average, to 25 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 3 mm<br>Shape anhedral to interstitial |

COMMENTS: Same as previous section.

UNIT-396: Olivine gabbro
Pieces: 2-4

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 2 mm average, to 3 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 15%<br>Size to 3 mm<br>Shape anhedral to interstitial |

COMMENTS: This interval consists of medium-grained olivine gabbro. Olivine up to 40% observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The background alteration of the gabbro is similar to that seen in other sections of gabbro. Pieces 2a-4 have a green alteration halo around a chlorite vein and some corona texture development. White fracture formation and filling (carbonate) occurs in the bottom of the section.

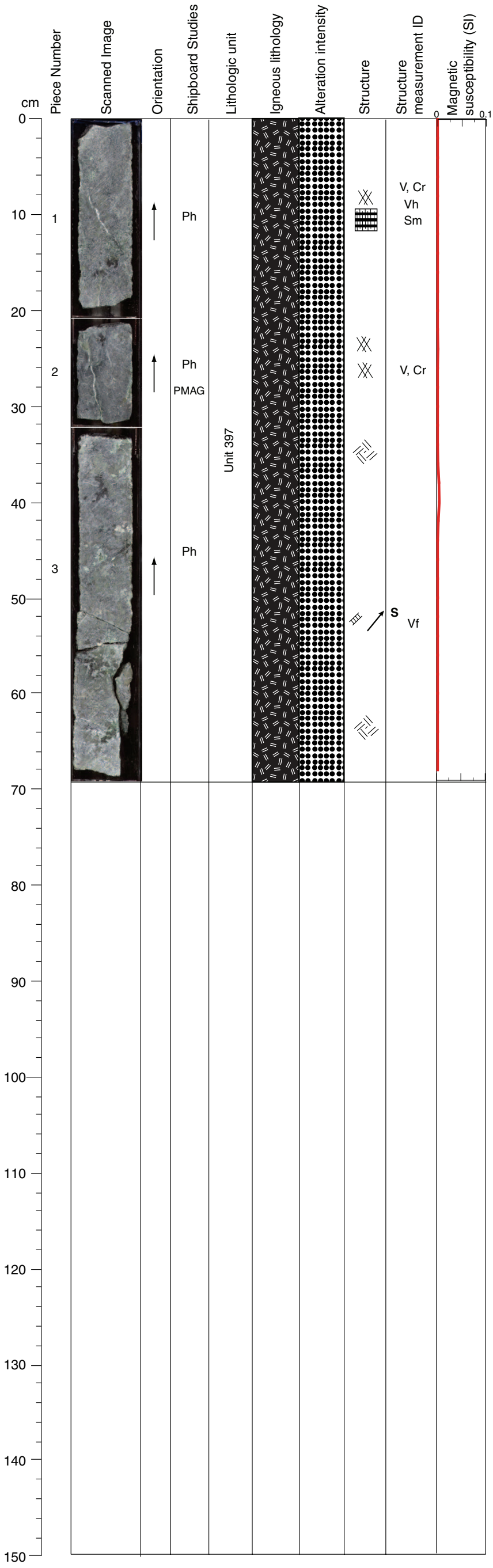
VEIN ALTERATION: Chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-149R-2, 10-12 cm (#393)**
**305-U1309D-149R-2, 44-47 cm (#394)**

STRUCTURE: Coarse-grained gabbro with fine-grained interval between 43 and 70 cm, but no fabric, no igneous contact preserved, only planar alteration front can be observed. Pale green veins with normal/reverse fibers. Local serpentinization foliation at Piece 3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-149R-2, 5-25 cm WET
305-U1309D-149R-2, 42-54 cm WET
305-U1309D-149R-2, 105-115 cm WET

## Core Photo




**305-U1309D-149R-3 (Section top: 734.56 mbsf)**

UNIT- 397: Olivine-bearing gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Section U1309D-149R-001, Piece 2

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 3 mm average, to 25 mm<br>Shape anhedral to interstitial |
| Olivine | Modal 1%<br>Size to 3 mm<br>Shape anhedral to interstitial |

COMMENTS: Same as previous section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, serpentine?

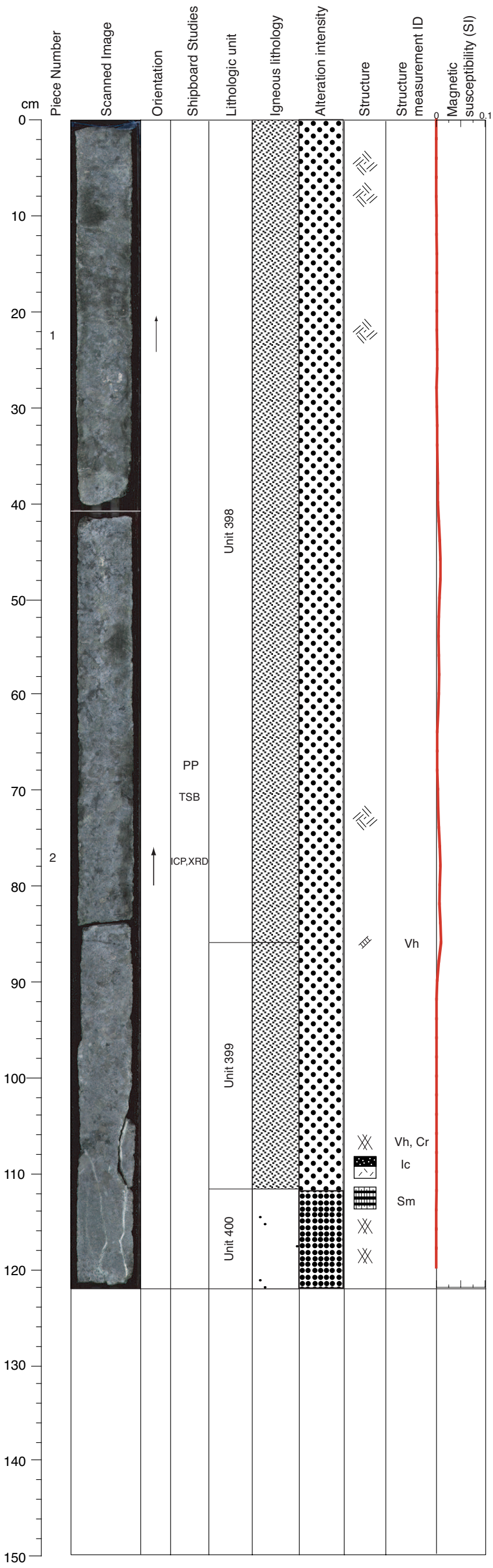
COMMENTS: General background alteration is similar to other gabbros in the hole, but this section also contains white veins of carbonate and chlorite with or without talc and patches of leucocratic alteration material with some corona texture.

VEIN ALTERATION: Chlorite, talc, carbonate.

STRUCTURE: Medium-grained gabbro, steeply dipping magmatic fabric in upper part, no plastic strain. Cracking veins and fault veins (pale green/white), very irregular.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-149R-3, 0-20 cm WET
305-U1309D-149R-3, 20-31 cm WET
305-U1309D-149R-3, 40-50 cm WET

## Core Photo




**305-U1309D-150R-1 (Section top: 736.60 mbsf)**

UNIT-398: Gabbro
Pieces: 1-2a

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal <1%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 70%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size to 50 mm<br>Shape anhedral |

COMMENTS: Unit 398 is coarse-grained gabbro. Olivine rich part at Piece 2.

UNIT-399: Gabbro
Piece 2b

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 399 is coarse-grained gabbro.

UNIT-400: Microgabbro
Piece 2b

PRIMARY MINERALOGY: Plagioclase, clinopyroxene modes not determinable

COMMENTS: Unit 400 is microgabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with coronas around olivine that are altered to serpentine and rimmed by tremolite. At 105-120 cm there is a white-green vein containing carbonate. At 103-110 cm, coarser grained part replaced at the end of the section by finer grained part.

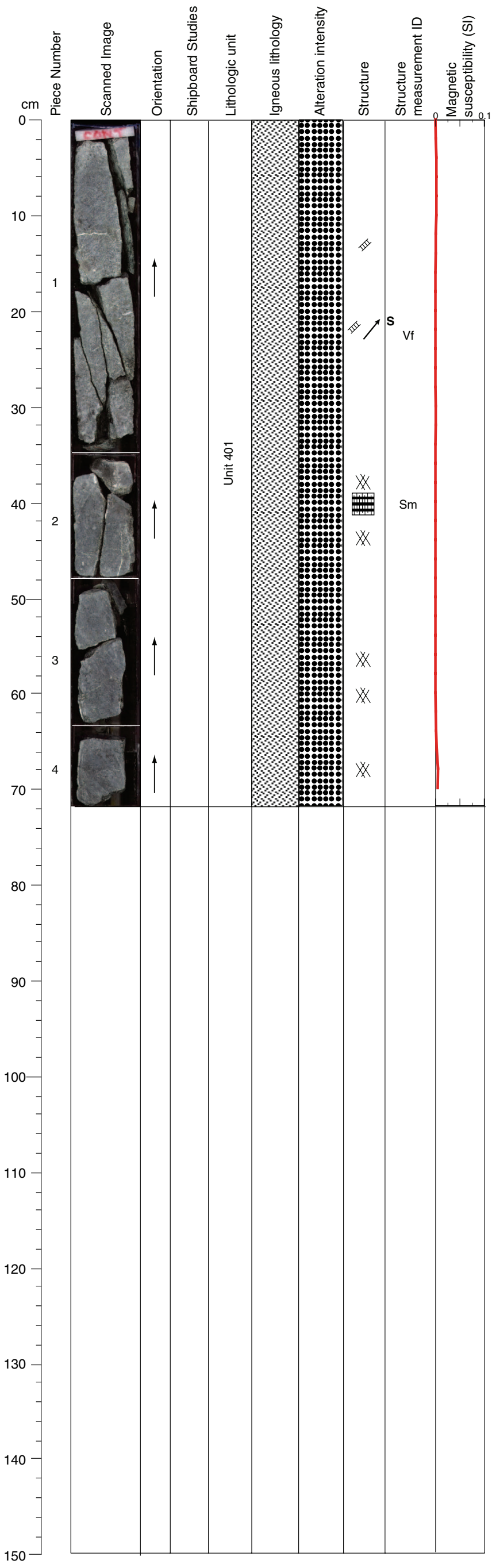
VEIN ALTERATION: Chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-150R-1, 70-72 cm (#395)**

STRUCTURE: Coarse-grained gabbro, no ductile fabric, igneous contact to magmatically foliated microgabbro. Minor fracturing, and a large subvertical, irregular vein at bottom, filled with carbonate and sulfide.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-150R-1, 60-80 cm WET

## Core Photo




**305-U1309D-150R-2 (Section top: 737.82 mbsf)**

UNIT-401: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 75%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 25%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 401 is medium-grained gabbro.

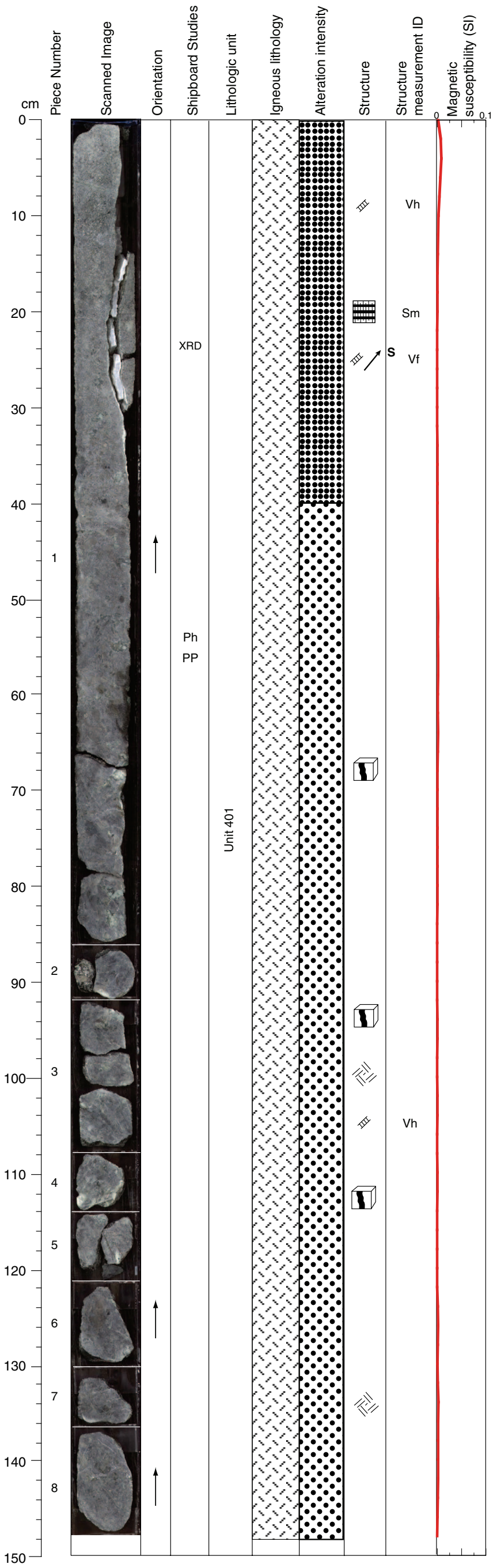
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section, white vein at 11 cm with an alteration halo 0.5 cm wide. The pieces are broken and cut by a lot of veins (calcite?). Some tiny coronas around olivine (altered to serpentine + tremolite) are observed. At 40 cm, fracture filled by white vein (calcite?) associated with a green alteration halo. Sulfides are observed associated with the calcite veins.

VEIN ALTERATION: Chlorite, talc, carbonate, sulfide.

STRUCTURE: Fine-grained gabbro with locally discernible magmatic fabric. Large subvertical and subhorizontal veins with white and sulfides infills.

## Core Photo




**305-U1309D-150R-3 (Section top: 738.53 mbsf)**

UNIT-401: Gabbro
Pieces: 1-8

PRIMARY MINERALOGY: Modal data from Piece 1c, 8

| | |
|---|---|
| Plagioclase | Modal 40-55%<br>Size 1-10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45-60%<br>Size 1-30 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 401 medium- to coarse-grained gabbro. Gradual increasing of clinopyroxene grain size to 141 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

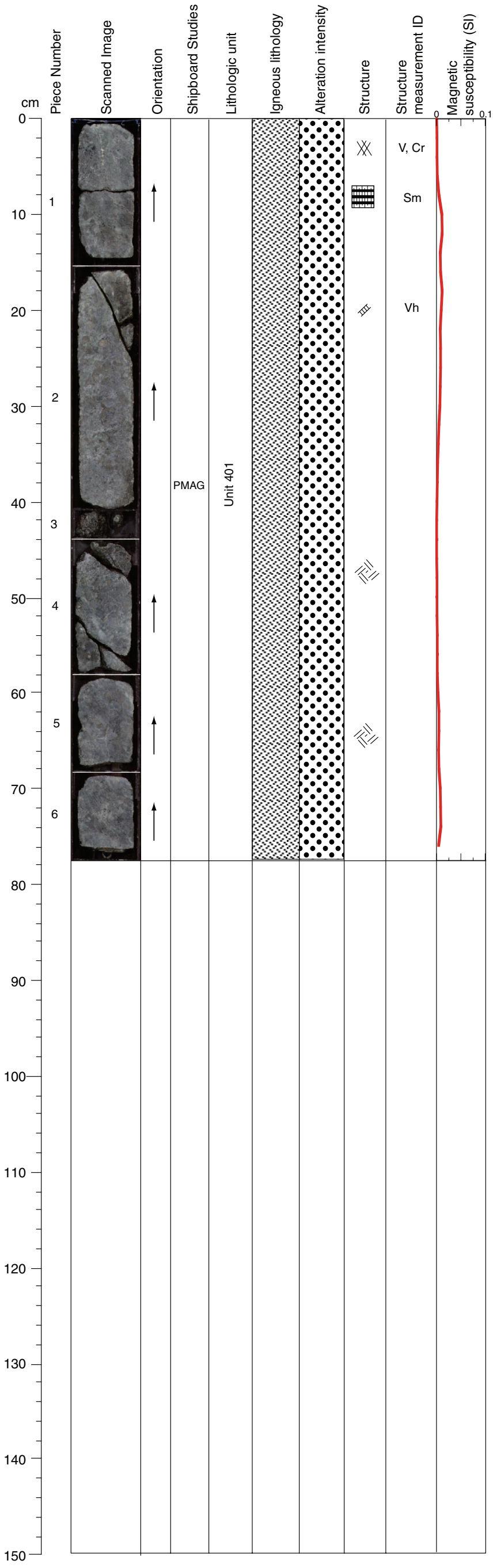
COMMENTS: The grain size of this gabbro progressively coarsens down section. At 14-30 cm there is a 1-cm-thick calcite vein (+ sulfides + pale green ampibole + ?) filling a fracture. Coronas are observed around olivine and the pyroxenes show white alteration (?) and are likely rimmed by chlorite or tremolite. Sulfides are associated with this alteration. At 136 cm, finer grained interval occurs with pale green coronas.

VEIN ALTERATION: Amphibole, chlorite, talc, carbonate, sulfide, quartz.

STRUCTURE: Microgabbro with weak magmatic foliation becoming gradually coarser, thereby losing magmatic fabric in lower half of section. Highly fractured with open fractures and veins irregular, filled with carbonate and with sulfides (subvertical set).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-150R-3, 50-60 cm WET

## Core Photo




**305-U1309D-150R-4 (Section top: 740.02 mbsf)**

UNIT-401: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 401 medium- to coarse-grained gabbro.

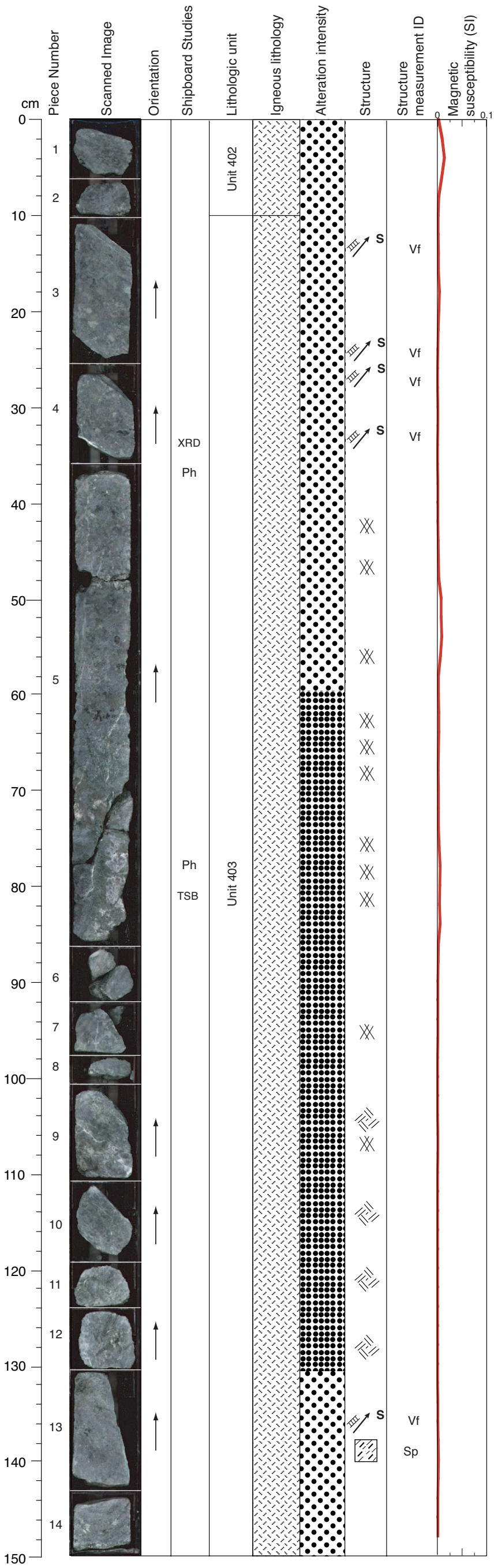
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Background alteration remains similar to gabbros elsewhere in the hole. Alteration halo related to vein at 1-10 cm. These pieces are cut by several veins and the pyroxene grains are altered to a white mineral (?) + amphibole rim. A network of fine fractures with alteration of adjacent plagioclase to a white secondary product occurs predominantly in Pieces 2-4.

VEIN ALTERATION: Amphibole, plagioclase, chlorite.

STRUCTURE: Medium-grained gabbro with weak magmatic fabric in Piece 1 coarsening down core and losing ductile strain. Highly fractured with open fractures and veins.

## Core Photo




**305-U1309D-151R-1 (Section top: 741.40 mbsf)**

UNIT-402: Gabbro rubble
Pieces: 1-2

COMMENTS: Unit 402 gabbro rubble may be in place.

UNIT-403: Gabbro
Pieces: 3-14

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 40%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 60%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 403 medium- to coarse-grained gabbro. Sulfide at 54-64 cm, sulfide scattered in altered grains. Cataclastic deformation. Some larger clinopyroxene. Locally abundant olivine and poikilitic textureis observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General alteration of the gabbro is similar to previous sections, but there is an increase in the fine network fracturing and veining of the rock toward the bottom of the section (especially in Pieces 9-12). The veins are mainly green and white ampibole, chlorite, and carbonate. At the bottom of Piece 5d there is a zone of alteration in which large plagioclase grains are partially altered (white patches).

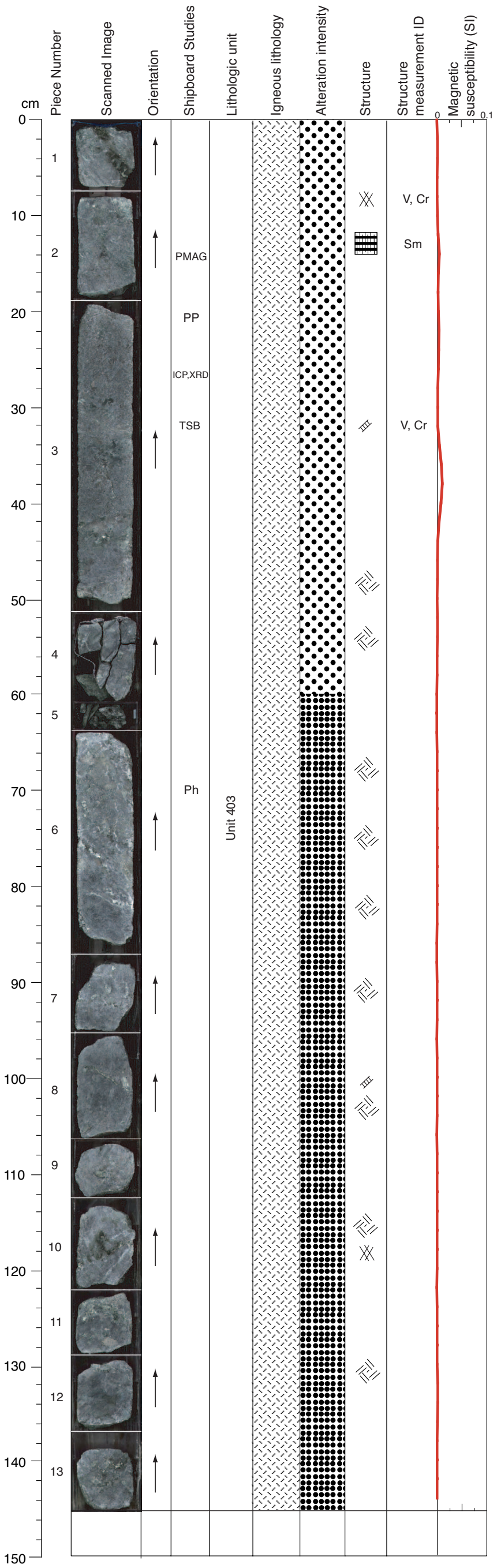
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-151R-1, 80-82 cm (#396)**

STRUCTURE: Coarse-grained gabbro with no ductile fabric, but fine-grained gabbro in Pieces 13 and 14 shows magmatic foliation. Medium-grained gabbro with a set of shallow dipping pale green veins in Piece 3 and 4. Underlain by coarse-grained gabbro with a network of white-filled irregular fractures and associated cataclasis in Piece 5 to 12. At bottom fine-grained gabbro with steep set of pale green fault veins in Piece 13 and 14.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-151R-1, 33-42 cm WET
305-U1309D-151R-1, 74-87 cm WET

## Core Photo




**305-U1309D-151R-2 (Section top: 742.90 mbsf)**

UNIT-403: Gabbro
Pieces: 1-13

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 403 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General background alteration of the gabbro continues similar to previous sections. There are some patches of poorly-developed corona texture near areas of vein concentration. Piece 6 shows some patches of greater alteration of plagioclase (white areas) near veins/fractures in the rock. Piece 8 has a compound vein with chlorite/talc and carbonate.

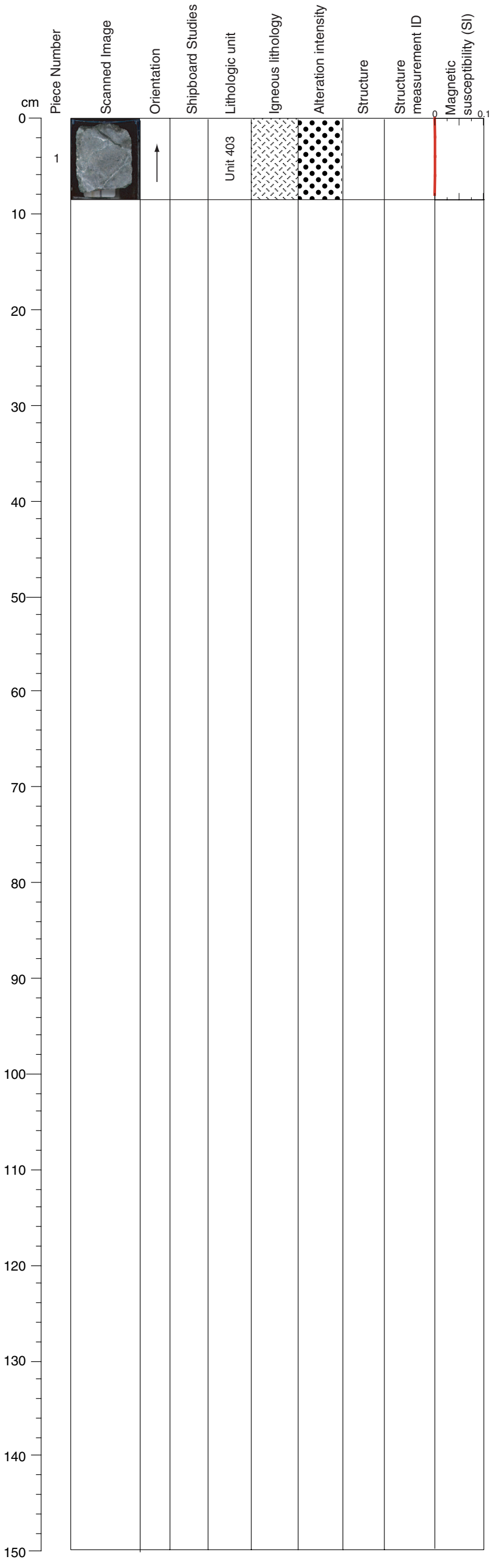
VEIN ALTERATION: Chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-151R-2, 31-33 cm (#397)**

STRUCTURE: Fine-grained gabbro with weak mineral foliation in relatively sharp contact to coarse gabbro without ductile strain. A shallow dipping network of white veins, irregular open fractures, and some cataclasis. Irregular textured gabbros with large amounts of cataclastic veins and open fractures in Piece 6 to 13.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-151R-2, 20-40 cm WET
305-U1309D-151R-2, 65-86 cm WET

## Core Photo




**305-U1309D-151R-3 (Section top: 744.36 mbsf)**

UNIT-403: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from previous section, piece 3

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 7 mm average<br>Shape anhedral |

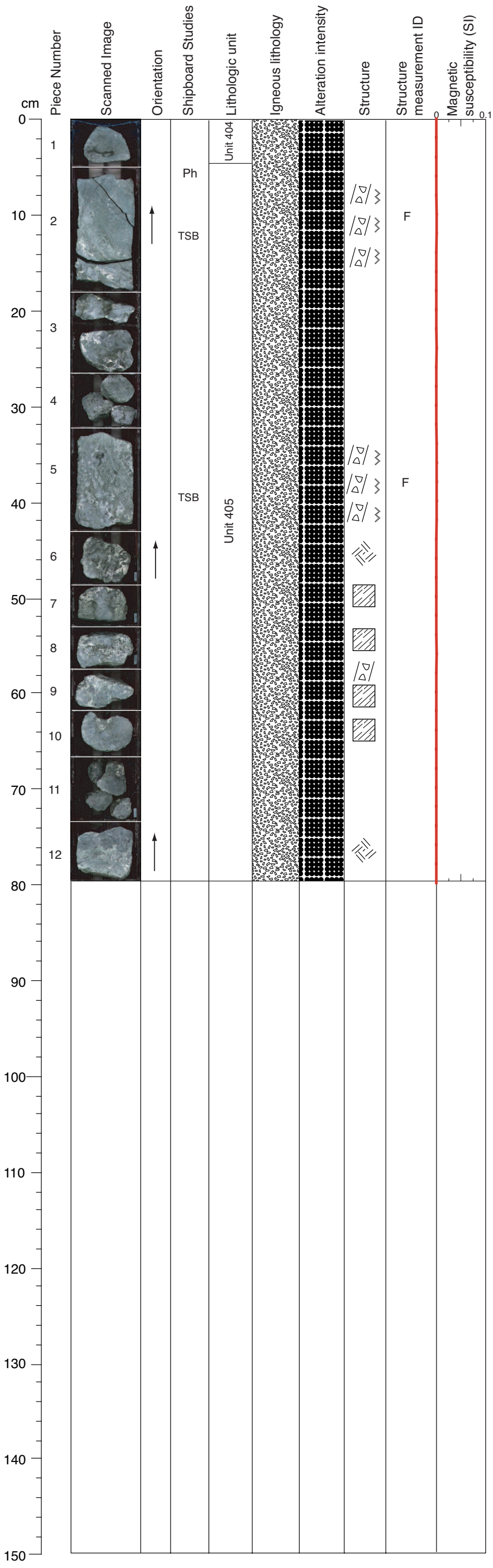
COMMENTS: Continuation of Unit 403 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section.

VEIN ALTERATION: Carbonate.

## Core Photo




**305-U1309D-152R-1 (Section top: 746.20 mbsf)**

UNIT-404: Cataclastic Gabbro Rubble
Pieces: 1

COMMENTS: Unit 404 fine- to medium-grained cataclastic gabbro rubble. Mode not determinable.

UNIT-405: Cataclastic Gabbro
Pieces: 2-12

COMMENTS: Unit 405 fine- to coarse-grained cataclastic gabbro. Mode not determinable. Sulfide at 41-50 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Brecciated gabbro (green color suggesting a significant amount of amphibole), with finer parts (5-13, 33-38, and 76-78 cm). The coarser grained gabbro has patches of leucocratic alteration with white plagioclase alteration and green amphibole.

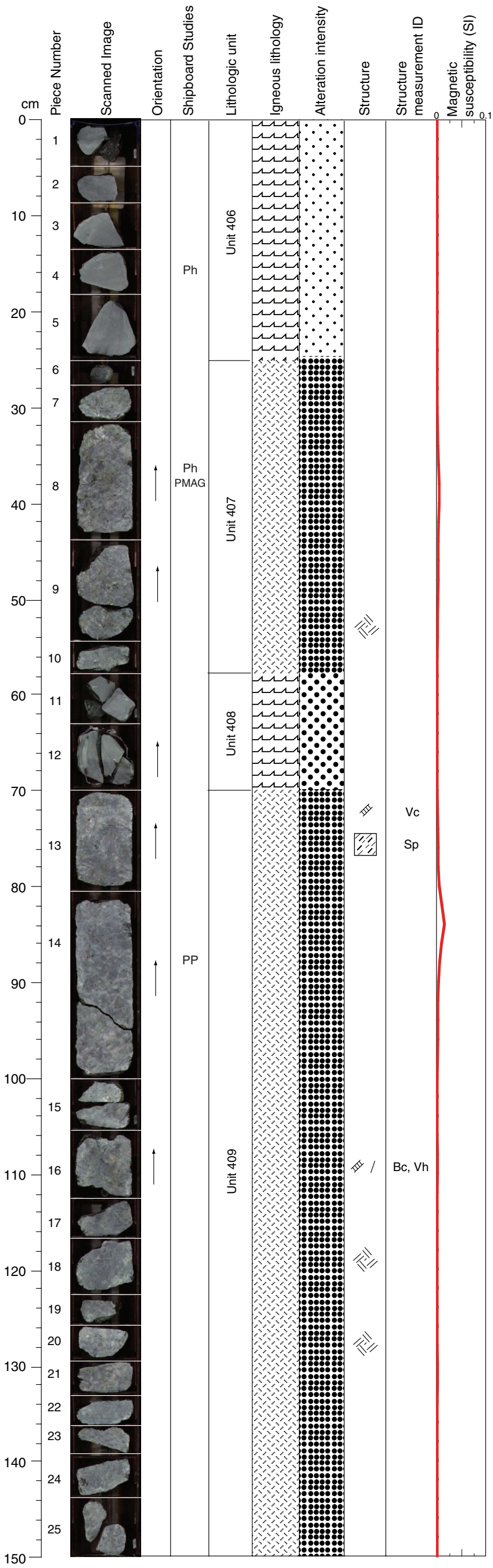
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-152R-1, 11-13 cm (#398)**
**305-U1309D-152R-1, 38-40 cm (#399)**

STRUCTURE: Fault zone with no clear evidence for early plastic strain. Foliated (locally) fault gouge with fine clasts up to several cm (loose gabbro pieces). General ~50° dip of fault zone. Fault gouge shows irregular textural development and grain grinding. Gouge is crosscut by late steeply-dipping white-filled veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-152R-1, 7-17 cm WET
305-U1309D-152R-1, 33-42 cm WET

## Core Photo




**305-U1309D-153R- 1 (Section top: 751.00 mbsf)**

UNIT-406: Diabase
Pieces: 1-5

COMMENTS: Unit 406 diabase. Mode not determinable.

UNIT-407: Gabbro
Pieces: 6-10

PRIMARY MINERALOGY: Mode based on Piece 8

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average |
| Clinopyroxene | Modal 45%<br>Size 1-12 mm |

COMMENTS: Unit 407 medium- to coarse-grained gabbro.

UNIT-408: Diabase
Pieces: 11-12

PRIMARY MINERALOGY:

COMMENTS: Unit 408 diabase. Mode not determinable.

UNIT-409: Gabbro
Pieces: 13-25

PRIMARY MINERALOGY: Mode based on Piece 14a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average |
| Clinopyroxene | Modal 45%<br>Size 1-12 mm |

COMMENTS: Unit 409 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

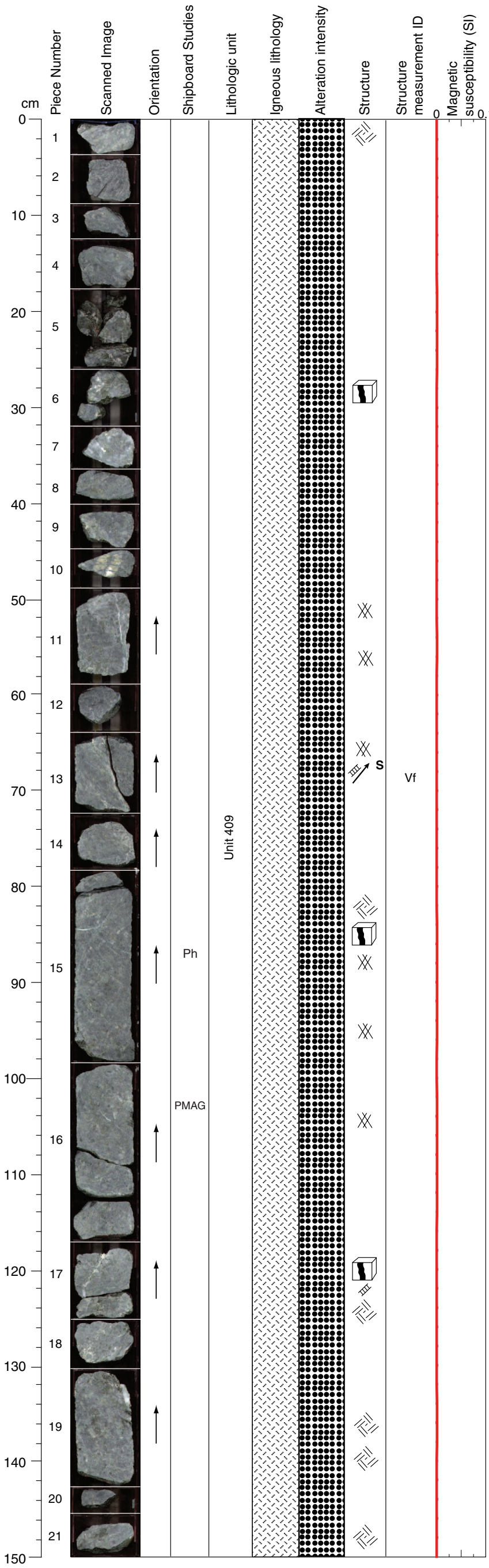
COMMENTS: The fine-grained intrusive in Pieces 1-5 shows general alteration predominated by green amphibole. Diffuse green alteration haloes surround veins in these pieces. Pieces 7-10 are altered in a manner similar to gabbro in the previous core. Pieces 11-12 are identical to Pieces 1-5 and the rest of the pieces are similar to Pieces 7-10.

VEIN ALTERATION: Serpentine, amphibole, chlorite, talc.

STRUCTURE: Diabase in unpreserved contact to coarse gabbro with interleaved further zone of diabase. Gabbro without ductile strain fabric except in contact gabbro/diabase at 72 cm. Black veins in diabase. Coarse-grained gabbro with a network of green cataclastic veins, and a later white crack vein, and general cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-153R-1, 4-24 cm WET
305-U1309D-153R-1, 28-50 cm WET
305-U1309D-153R-1, 70-93 cm WET

## Core Photo




**305-U1309D-153R-2 (Section top: 752.50 mbsf)**

UNIT-409: Gabbro
Pieces: 1-21

PRIMARY MINERALOGY: Mode based on Section U1309D-153R-001, Piece 14a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average |
| Clinopyroxene | Modal 45%<br>Size 1-12 mm |

COMMENTS: Continuation of Unit 409 medium- to coarse-grained metagabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote, serpentine?

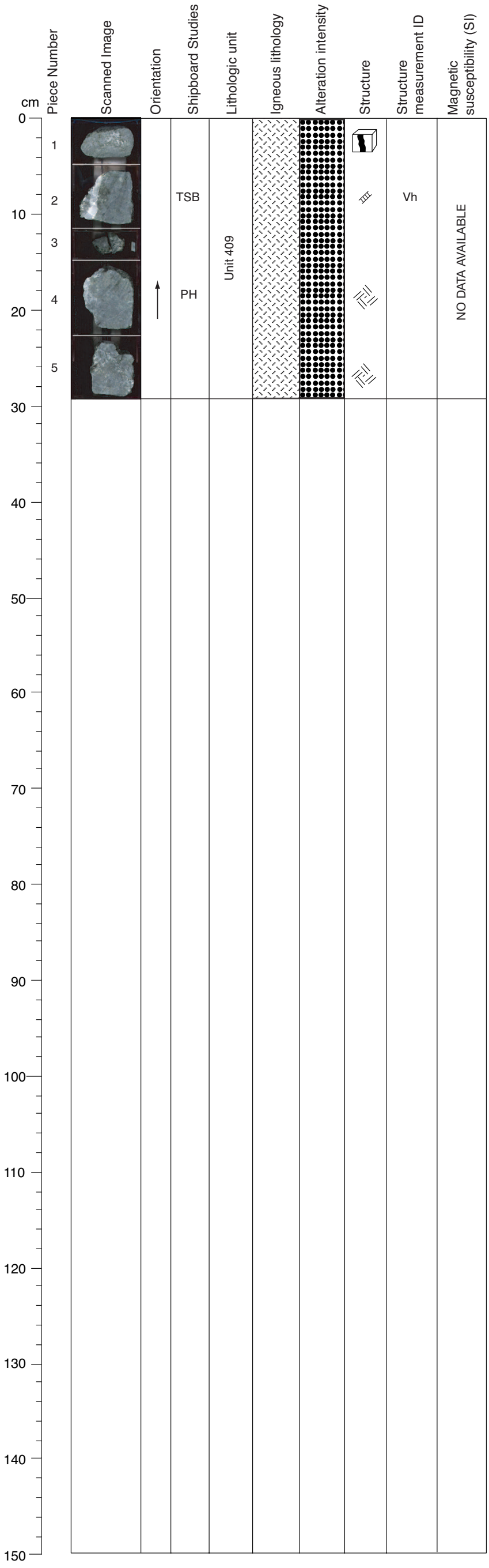
COMMENTS: Most of the pieces show the type of background alteration typical of the medium-grained gabbro recovered in the previous section, but there are lighter patches of alteration in some (plagioclase) and some compound (white/green) veins that contain carbonate in several pieces. One 5-mm-wide carbonate/amphibole(?) vein occurs in Piece 19.

VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc.

STRUCTURE: Fine- to medium-grained gabbro and leucocratic zones, with local intense cataclasite, veining, and irregular late cracking network with white infilling.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-153R-2, 78-98 cm WET

## Core Photo




**305-U1309D-153R-3 (Section top: 754.00 mbsf)**

UNIT-409: Gabbro
Pieces: 1-5

COMMENTS: Continuation of Unit 409 cataclastic metagabbro. White vein (<10 mm) in Piece 2. Mode not determinable.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration is similar to the previous section. A 1 cm-wide carbonate/amphibole(?) vein cuts Piece 2 and part of Piece 4.

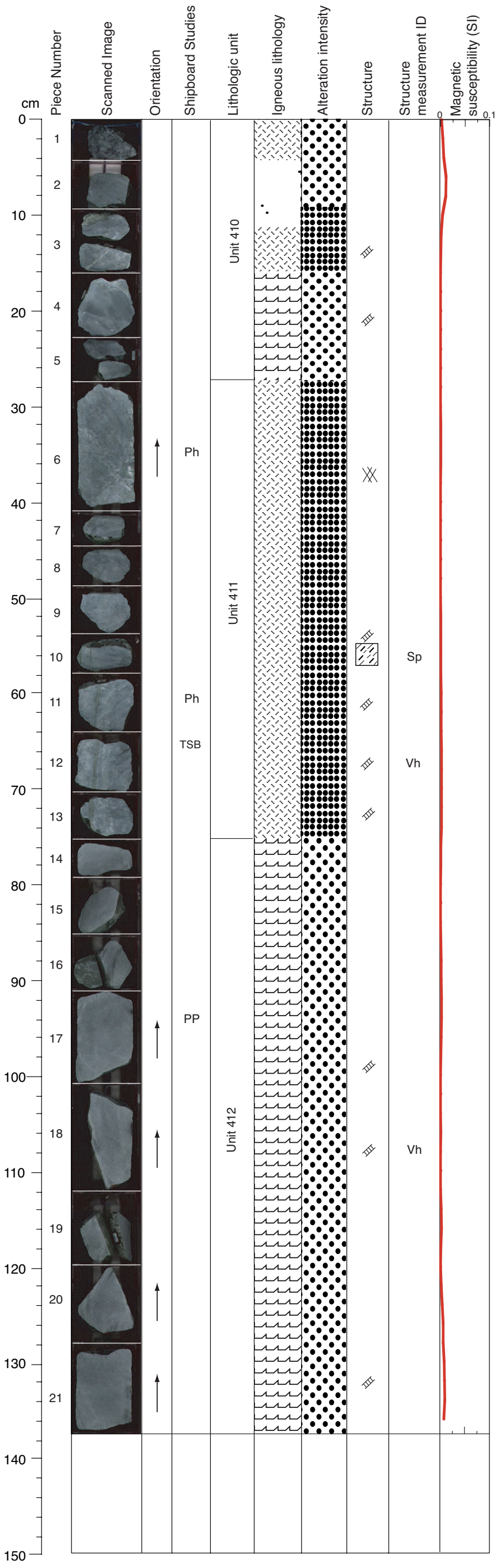
VEIN ALTERATION: Serpentine, amphibole, plagioclase, chlorite, talc carbonate.

THIN SECTIONS:
**305-U1309D-153R-3, 6-8 cm (#400)**

STRUCTURE: Fine- to medium-grained gabbro and leucocratic zones, with local intense cataclasite, veining.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-153R-3, 5-22 cm WET

## Core Photo




**305-U1309D-154R-1 (Section top: 755.80 mbsf)**

UNIT-410: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY:

COMMENTS: Unit 410 cataclastic zone with rubble of mixed gabbro and diabase. Mode not determinable.

UNIT-411: Gabbro
Pieces: 6-13

COMMENTS: Unit 411 is cataclastic gabbro. Mode not determinable.

UNIT-412: Diabase
Pieces: 14-21

COMMENTS: Unit 412 is diabase.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Pieces 1, 3 and 5 to 8 are coarse-grained gabbro with plagioclase and amphibole (replacing the preexisting olivine and pyroxene). The other parts consist of very fine-grained gabbro (microgabbro) or diabase. At 54-70 cm, the pieces are cut by a multiple-layered vein (amphibole, plagioclase and ??), forming an alteration halo 0.2 cm wide.

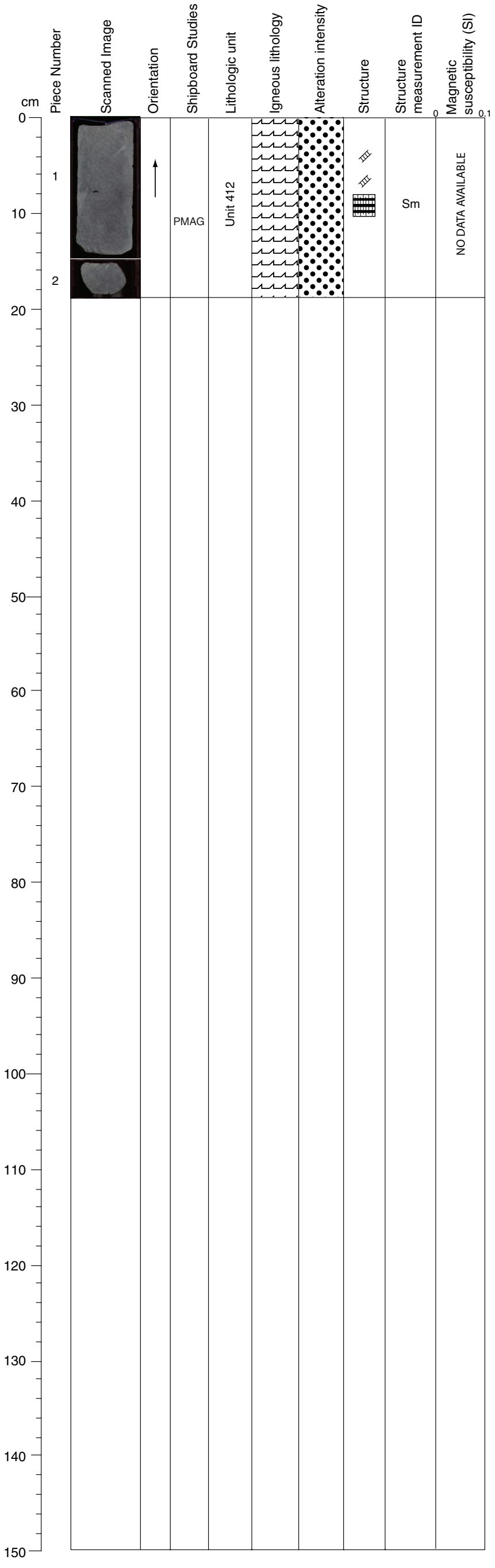
VEIN ALTERATION: Amphibole, palgioclase, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-154R-1, 64-66 cm (#401)**

STRUCTURE: Intermittent sequence of diabase/microgabbro and a cataclastic deformed gabbro with a weak early plastic strain history suspected, particularly for Piece 10. Cataclastic shear band (may be plastic) in Piece 6. Subvertical green vein with banding in Piece 10 to 13. Bottom of section in Piece 14 to 21: very fine-grained, homogeneous gabbro with faint alteration veins (very few) and no deformation.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-154R-1, 27-48 cm WET
305-U1309D-154R-1, 54-75 cm WET

## Core Photo




**305-U1309D-154R-2 (Section top: 757.18 mbsf)**

UNIT-412: Diabase
Pieces: 1-2

COMMENTS: Continuation of Unit 412 diabase.

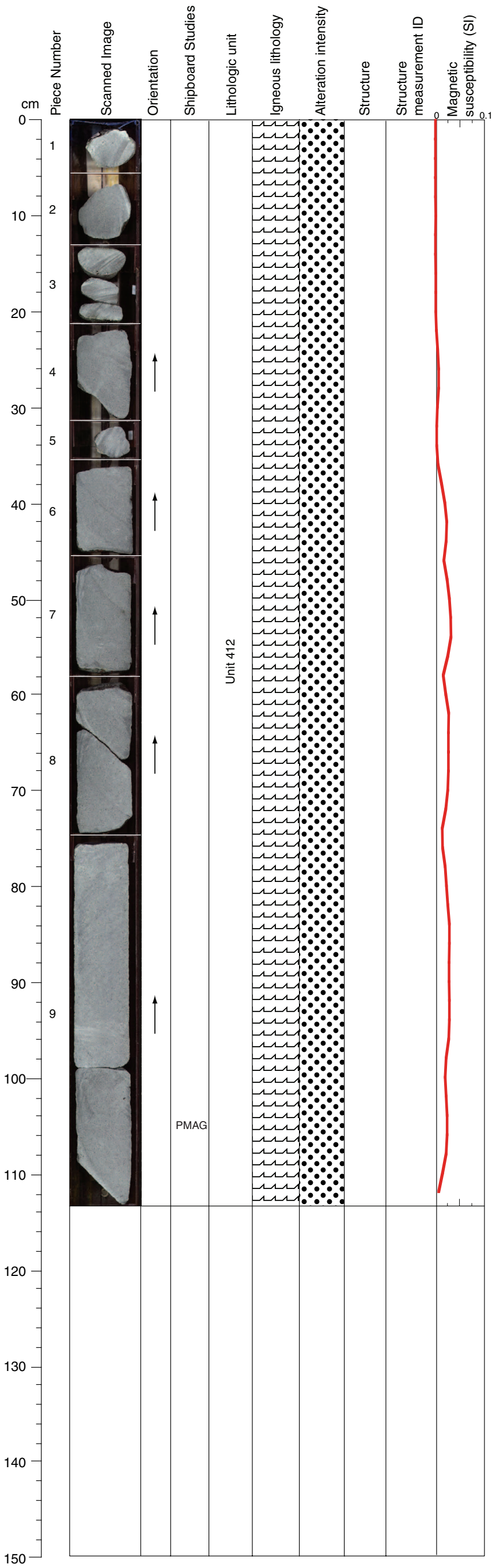
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Green diabase.

VEIN ALTERATION: Amphibole, chlorite

STRUCTURE: Potentially a weak magmatic fabric. Faint alteration veins (very few).

## Core Photo




**305-U1309D-155R-1 (Section top: 757.80 mbsf)**

UNIT-412: Diabase
Pieces: 1-9

PRIMARY MINERALOGY: Modal data estimated from Piece 6

| | |
|---|---|
| Plagioclase | Modal 75%<br>Size <1 mm average |
| Clinopyroxene | Modal 25%<br>Size <1 mm average |

COMMENTS: Continuation of Unit 412 diabase or microgabbro.

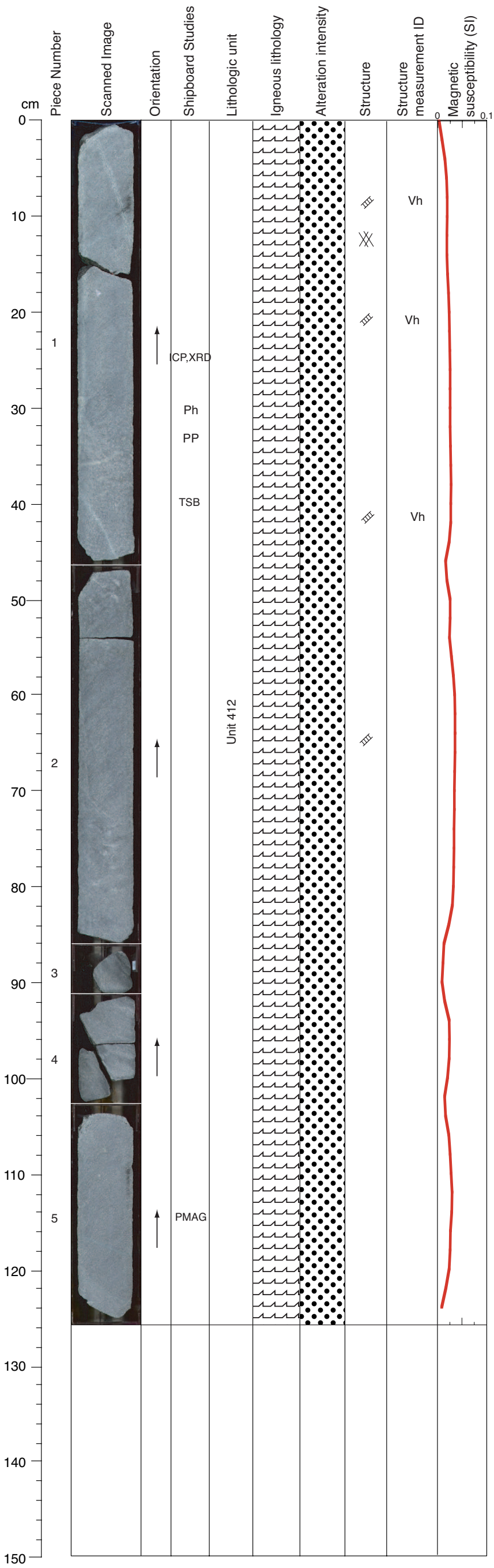
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration of the fine-grained diabase is dominated by green amphibole. There are green haloes around veins.

VEIN ALTERATION: n/a

STRUCTURE: Massive diabase, no ductile strain nor veins.

## Core Photo




**305-U1309D-155R-2 (Section top: 758.94 mbsf)**

UNIT-412: Diabase
Pieces: 1-5

PRIMARY MINERALOGY: Modal data estimated from Piece 2

| | |
|---|---|
| Plagioclase | Modal 75%<br>Size <1 mm average |
| Clinopyroxene | Modal 25%<br>Size <1 mm average |

COMMENTS: Continuation of Unit 412 diabase.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The dibase has a general greenish cast suggesting amphibole replacement of pyroxene. There are several green veins that cross cut the core and have narrow halo.

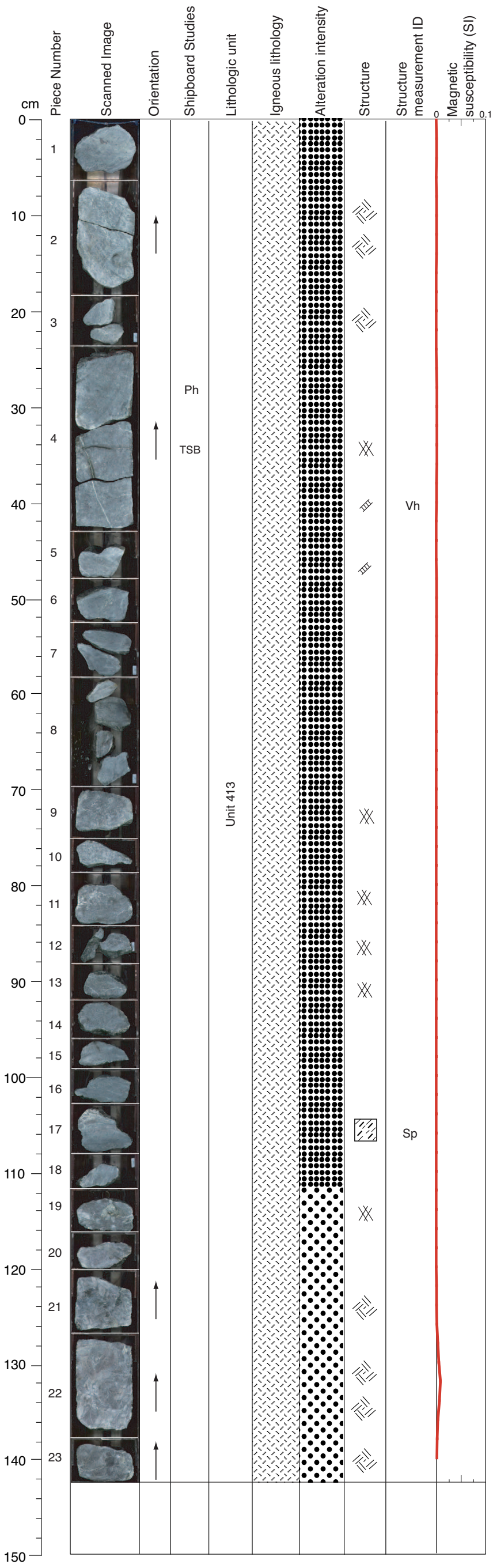
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-155R-2, 38-40 cm (#402)**

STRUCTURE: Massive diabase, slight coarsening with respect to previous section, no ductile strain. A few veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-155R-2, 26-46 cm WET

## Core Photo




**305-U1309D-156R-1 (Section top: 760.60 mbsf)**

UNIT-413: Gabbro
Pieces: 1-23

PRIMARY MINERALOGY: Modal data from Piece 22

| | |
|---|---|
| Plagioclase | Modal 35%<br>Size 7 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 65%<br>Size 13 mm average<br>Shape subhedral |

COMMENTS: Unit 413 is seriate coarse-grained gabbro. Clinopyroxene grain size increases down section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with a significant amount of amphibole (green color). some invervals are finer grained (Pieces 6-7). The pyroxenes and olivines are moderately altered without coronas. Piece 4 is cut by a white vein at 34-43 cm. Piece 9 (113 cm) has pyroxene altered and partially replaced by amphibole, and the olivine are altered to serpentine + tremollite + sulfides.

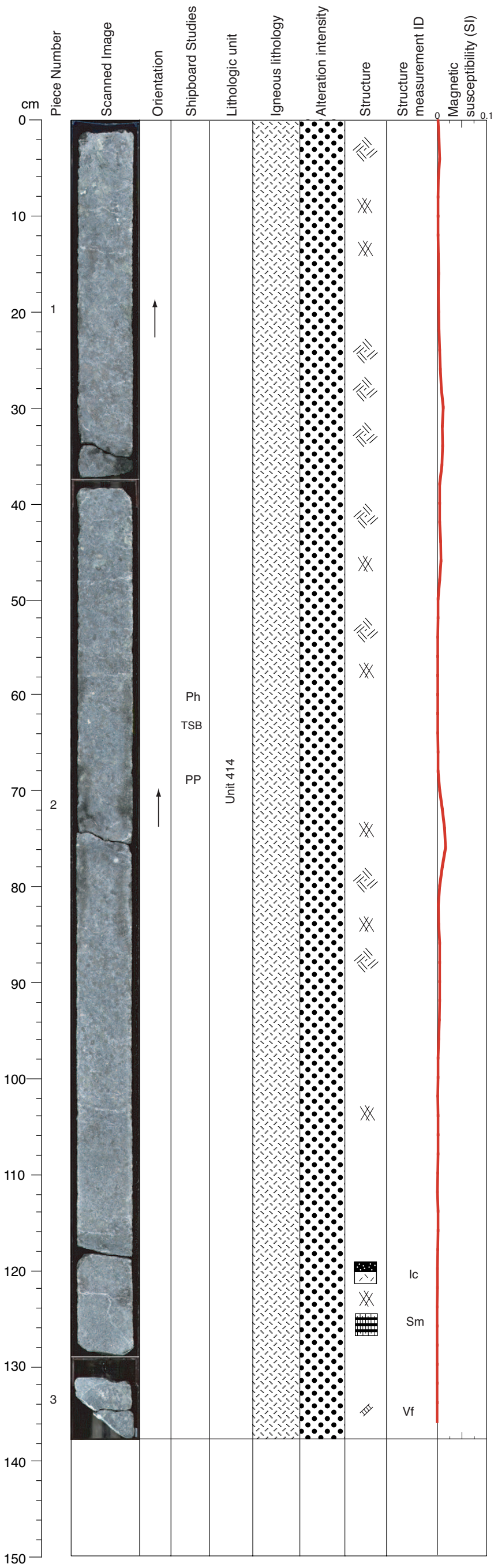
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate

THIN SECTIONS:
**305-U1309D-156R-1, 33-35 cm (#403)**

STRUCTURE: Cataclastic interval grading into mylonitic zone of same lithologies. Near base of section undetermined contact to coarse-grained gabbro, no ductile strain. Followed by variable cataclasis and late veining.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-156R-1, 23-43 cm WET

## Core Photo




**305-U1309D-156R-2 (Section top: 762.02 mbsf)**

UNIT-414: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Pieces 2b, 2c

| | |
|---|---|
| Plagioclase | Modal 55-85%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 15-45%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 414 is seriate fine- to medium-grained gabbro. Course clinopyroxene grains in Piece 1. Variable grain size along section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Some pale green coronas and some coronas around olivine (serpentine + tremolite), some shiny pyroxene that are partially replaced to green amphibole. Several veinlets cut this piece with discrete alteration halo. At 123 cm, contact with a finer grained part.

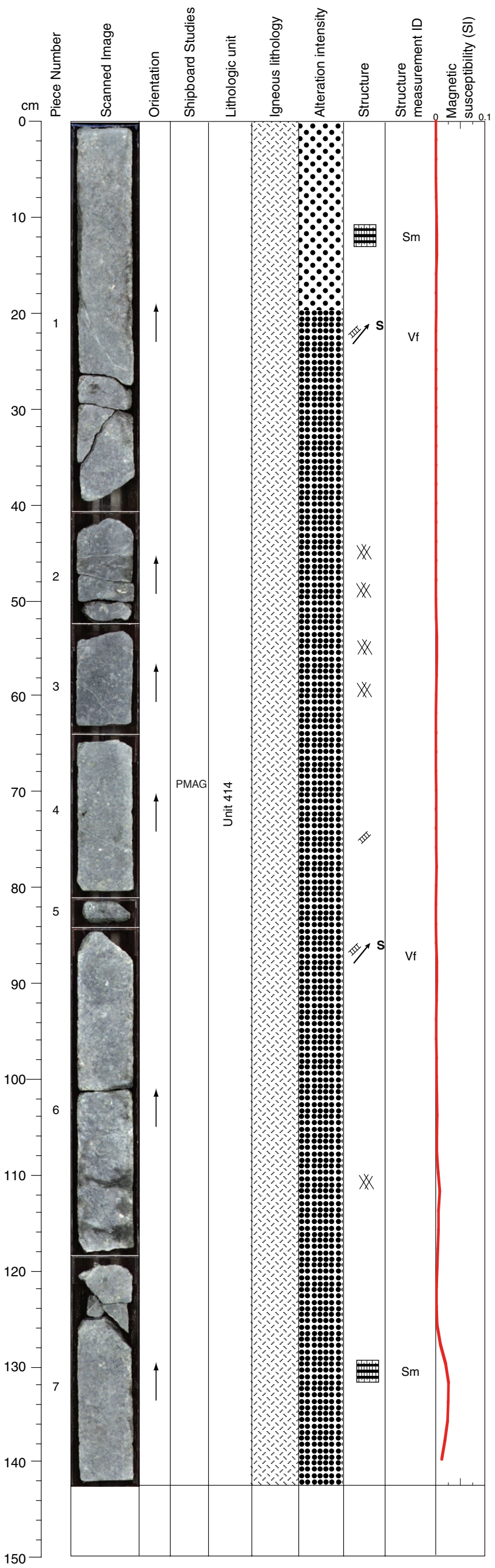
VEIN ALTERATION: Chlorite, talc, carbonate

THIN SECTIONS:
**305-U1309D-156R-2, 62-64 cm (#404)**

STRUCTURE: Coarse gabbro in igneous contact to microgabbro, no ductile strain. Minor cataclasis and veining.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-156R-2, 54-74 cm WET

## Core Photo




**305-U1309D-156R-3 (Section top: 763.39 mbsf)**

UNIT-414: Gabbro
Pieces: 1-7

PRIMARY MINERALOGY: Modal data from Section U1309D-156R-002, Piece 2c

| | |
|---|---|
| Plagioclase | Modal 85%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 15%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 414 seriate medium-grained gabbro.

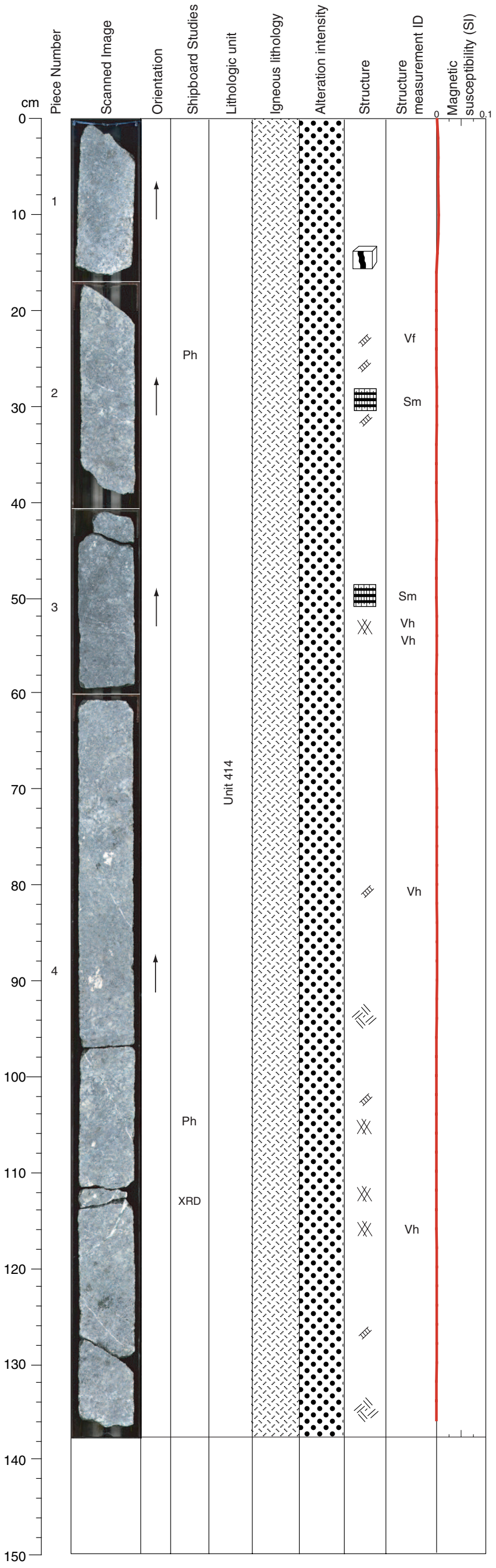
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Some coronas around olivine (serpentine + tremolite) and some pale green coronas (actinolite-tremolite-talc) are observed in this section. The shiny pyroxenes are partially altered to green amphibole.

VEIN ALTERATION: Chlorite, talc, carbonate

STRUCTURE: Fine- to medium-grained gabbro, no large crystals, no igneous contacts, intervals of weak magmatic strain. Late veining and cataclasis associated.

## Core Photo




**305-U1309D-157R-1 (Section top: 765.40 mbsf)**

UNIT-414: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 1-8 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 1-25 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 414 coarse-grained gabbro. Pyroxene oikocrysts.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section. Several light-colored veins crosscut the section. A white vein crosscuts an earlier light green vein at 106 cm and a large talc chlorite vein cuts the section at about 117 cm.

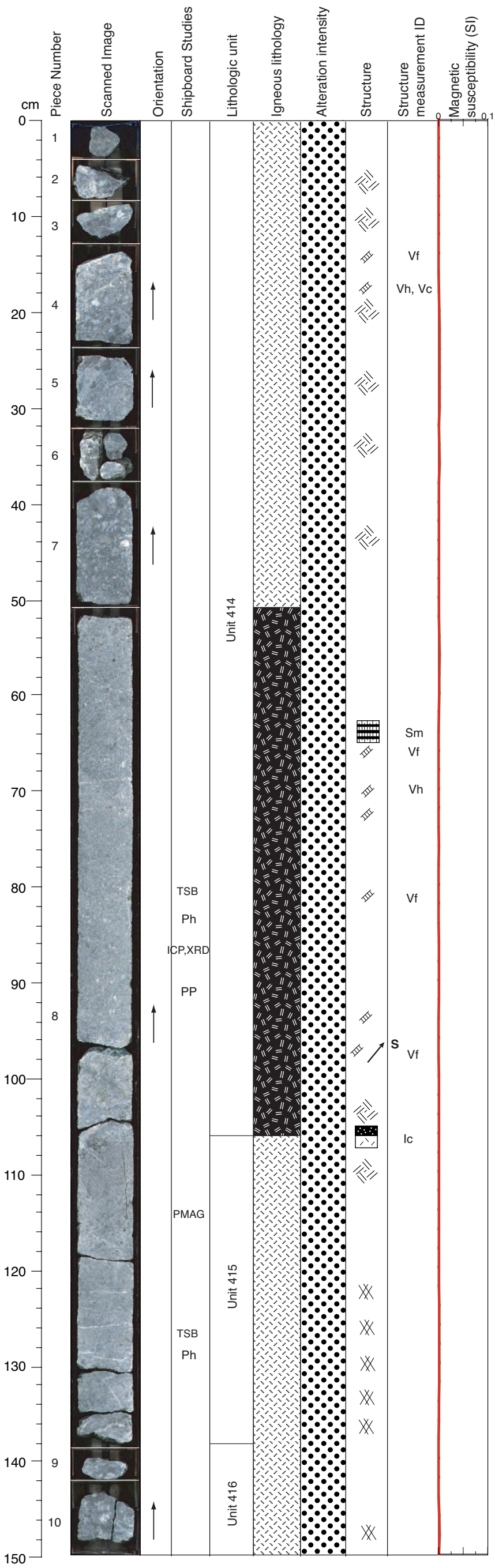
VEIN ALTERATION: Chlorite, talc, carbonate.

THIN SECTIONS:

STRUCTURE: Fine- to medium-grained gabbro with weak magmatic fabric, shallow to moderately dipping. Irregular pale green veins and white veins crosscutting them.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-157R-1, 17-38 cm WET
305-U1309D-157R-1, 97-121 cm WET

## Core Photo




**305-U1309D-157R-2 (Section top: 766.77 mbsf)**

UNIT-414-416: Gabbro
Pieces: 1-10

PRIMARY MINERALOGY: Modal data from several pieces

| | |
|---|---|
| Plagioclase | Modal 60-70%<br>Size 1-8 mm<br>Shape anhedral |
| Clinopyroxene | Modal 30-40%<br>Size 1-20 mm<br>Shape anhedral |

COMMENTS: Units 414-416 are fine- to coarse-grained gabbro. Cataclastic deformation caused highly variable grain sizes. Pyroxene oikocrysts. Interval 51-106 cm is olivine-bearing. Up to 15 % orthopyroxene observed in this section in unit 415.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section, but also contains patches of leucocratic alteration products. Several fractures below 50 cm have white alteration haloes and a light green vein with a green halo cuts the section at ~100 cm.

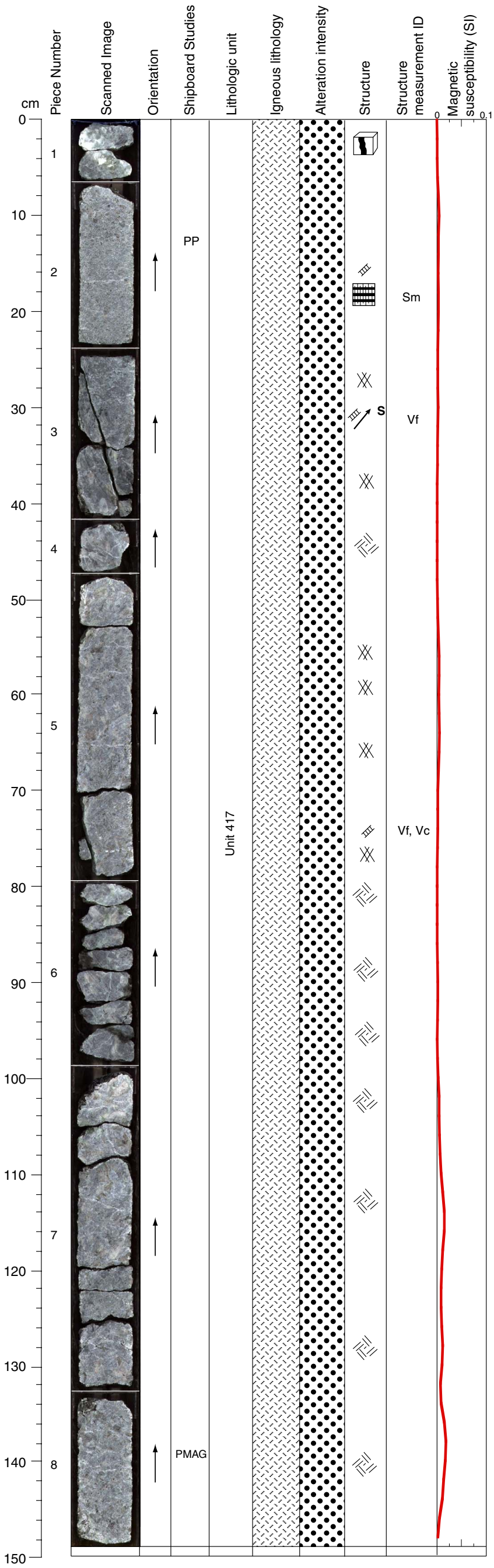
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-157R-2, 79-81 cm (#405)**
**305-U1309D-157R-2, 125-127 cm (#406)**

STRUCTURE: Coarse gabbro with some cataclasis associated with fracture veins filled. Finer grained core-down, with weak magmatic fabric. Underlain by medium- to fine-grained gabbro more massive, with white and dark green early veins, crosscut by a later network of irregular, brittle veins with white infills and slight offsets.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-157R-2, 77-97 cm WET
305-U1309D-157R-2, 120-139 cm WET

## Core Photo




**305-U1309D-157R-3 (Section top: 768.27 mbsf)**

UNIT-417: Gabbro
Pieces: 1-8

PRIMARY MINERALOGY: Modal data from Piece 5a, 8c

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 417 medium- to coarse-grained gabbro. Leucocratic dike in coarse-grained gabbro in Piece 1. Grain size variation downhole. Pegmatitic part at 79-97 cm.

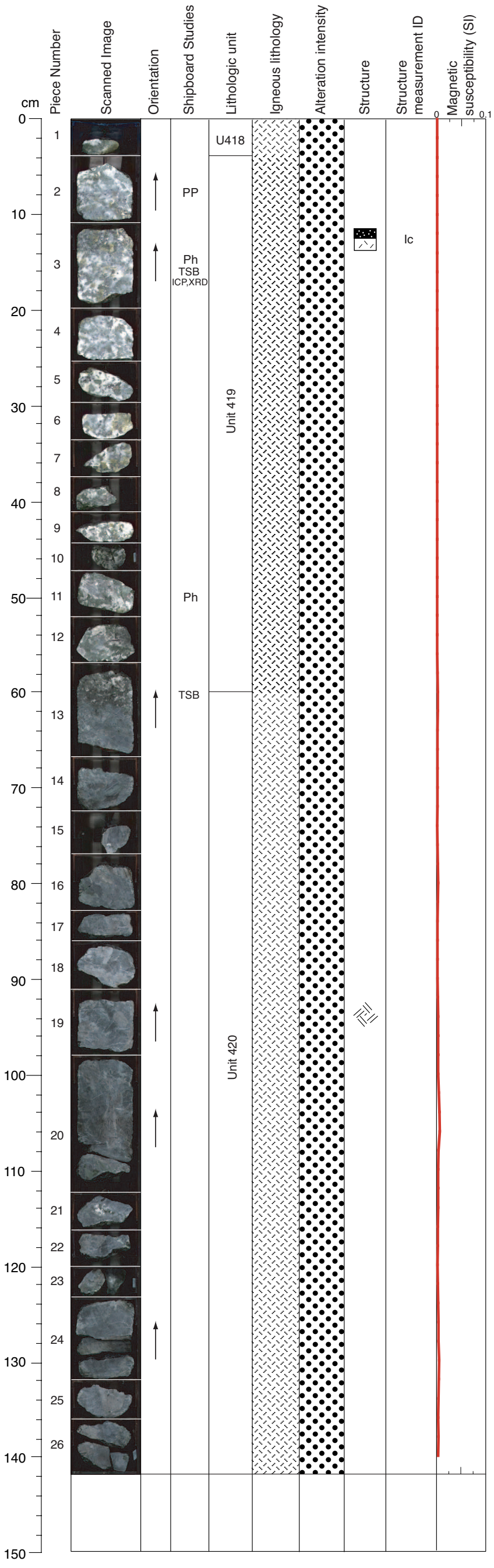
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Leucocratic alteration material occurs in the top two pieces and as scattered patches elsewhere in the section. Otherwise, similar to the previous section.

VEIN ALTERATION: Amphibole, chlorite, talc.

STRUCTURE: Short interval of fine-grained gabbro with weak magmatic fabric of shallow dip bracketed by coarse-grained gabbros showing no ductile strain. Veins (white), a zone of irregular pale green cataclasis, and some irregularly, but subhorizontally distributed veins and fault veins.

## Core Photo




**305-U1309D-158R-1 (Section top: 770.20 mbsf)**

UNIT-418: Gabbro rubble
Piece 1

COMMENTS: Unit 418 gabbro rubble.

UNIT-419: Gabbro
Pieces: 2-13

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyrxene | Modal 40%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 419 is coarse-grained leucocratic gabbro. Oxide and epidote bearing.

UNIT-420: Gabbro
Pieces: 13-26

PRIMARY MINERALOGY: Modal data from Piece 20a

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Unit 420 is coarse-grained gabbro. Sharp-looking boundary with leucocratic gabbro (above) but clinopyroxene extends across boundary.

SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote

COMMENTS: From Pieces 1 to 13 (up to 60 cm) leucocratic intrusion or alteration (?) with plagioclase, amphibole, epidote and a pink mineral (?) + titanite (??). At 60 cm there is a contact with coarse-grained gabbro with a significant amount of green amphibole and pyroxenes are replaced by a white mineral (?) and likely rimmed by green amphibole. The olivine grains are altered to serpentine + tremolite + sulfides. At 113 cm, local leucocratic alteration zone (1 cm thick).

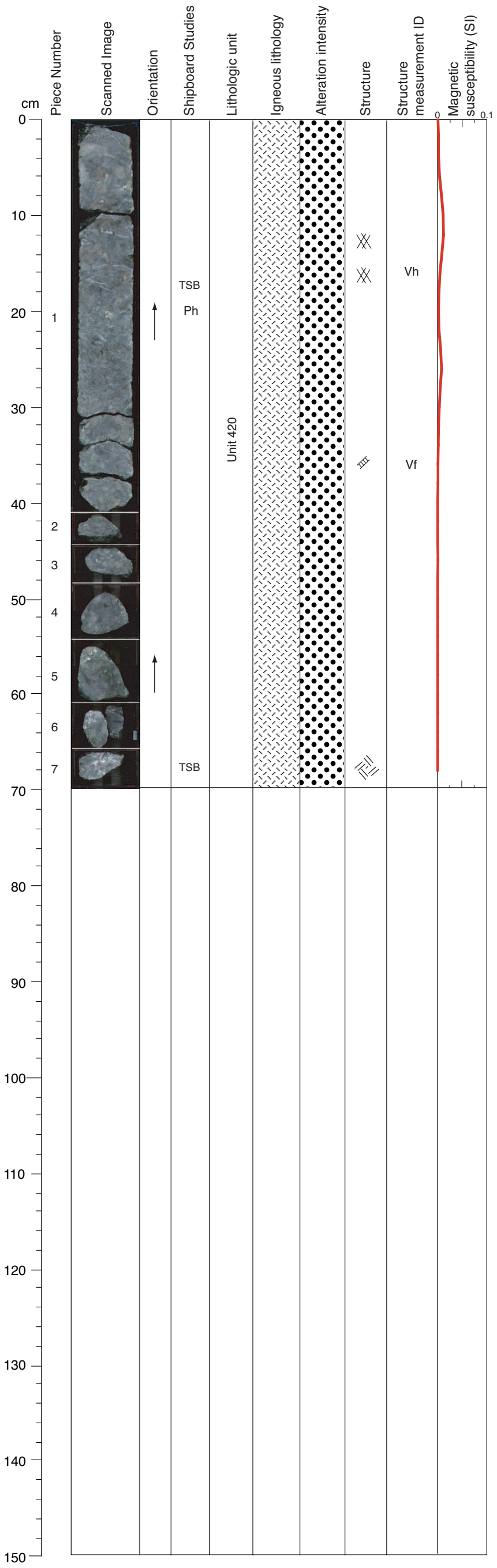
VEIN ALTERATION: Amphibole, chlorite, talc.

THIN SECTIONS:
**305-U1309D-158R-1, 15-18 cm (#407)**
**305-U1309D-158R-1, 59-62 cm (#408)**

STRUCTURE: Leucocratic, epidote and amphibole bearing gabbro in sharp contact to pegmatitic gabbro, no ductile fabric. Minor cracking with no strain.

CLSOE-UP PHOTOGRAPHS:
305-U1309D-158R-1, 5-25 cm WET
305-U1309D-158R-1, 48-72 cm WET

## Core Photo




**305-U1309D-158R-2 (Section top: 771.61 mbsf)**

UNIT-420: Gabbro
Pieces: 1-7

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 420 coarse-grained gabbro. Leucocratic zone 66-69 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with a significant amount of green amphibole. Pyroxene grains are replaced by a white mineral (?) and likely rimmed by green amphibole. The olivines are altered to serpentine + tremolite + sulfides.

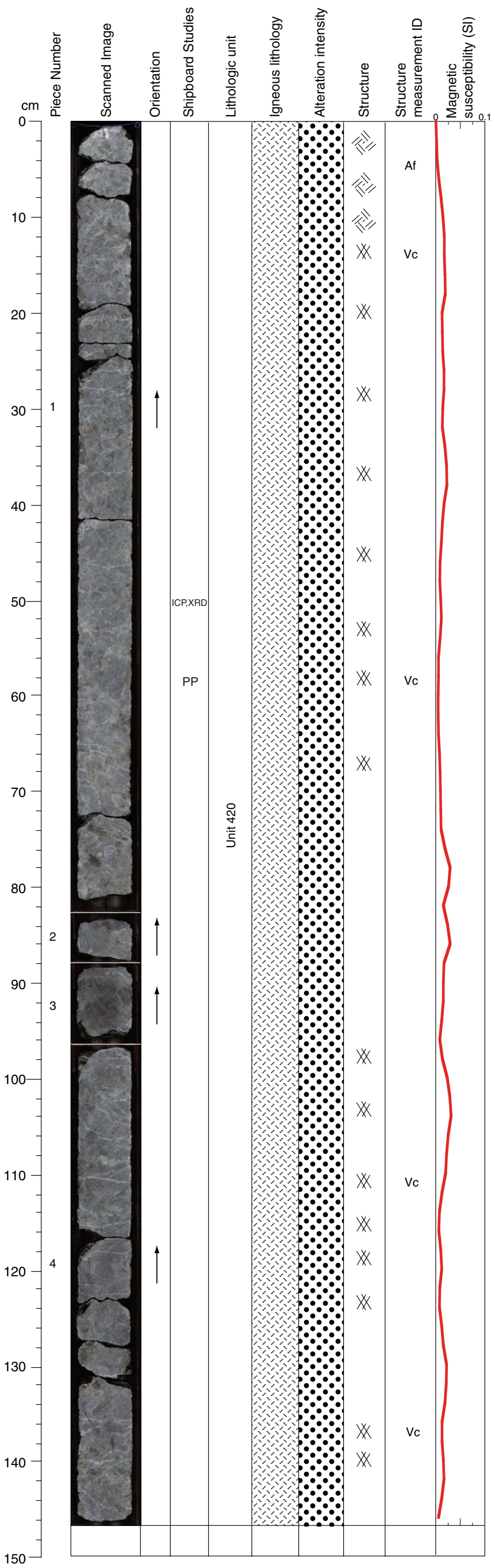
VEIN ALTERATION: Chlorite, talc.

THIN SECTIONS:
**305-U1309D-158R-2, 16-18 cm (#409)**
**305-U1309D-158R-2, 67-69 cm (#410)**

STRUCTURE: Coarse grained gabbro with no ductile strain fabric, becoming altered toward base of section. Piece 1 to 4: an early subhorizontal white vein set (short cracks < 5 cm with white halo), later open fractures some with small displacement and white-pale green infill, and cataclastic zones locally. Piece 5: small interval with more intense cataclasis associated with a fault - slickensides on a later shear zone. Piece 6 to 7: at bottom coarse gabbro with cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-158R-2, 10-31 cm WET
305-U1309D-158R-2, 49-70 cm WET

## Core Photo




**305-U1309D-158R-3 (Section top: 772.31 mbsf)**

UNIT-420: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1f

| | |
|---|---|
| Plagioclase | Modal 80%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 20%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 420 coarse-grained gabbro. Leucocratic zone 0-6 cm.

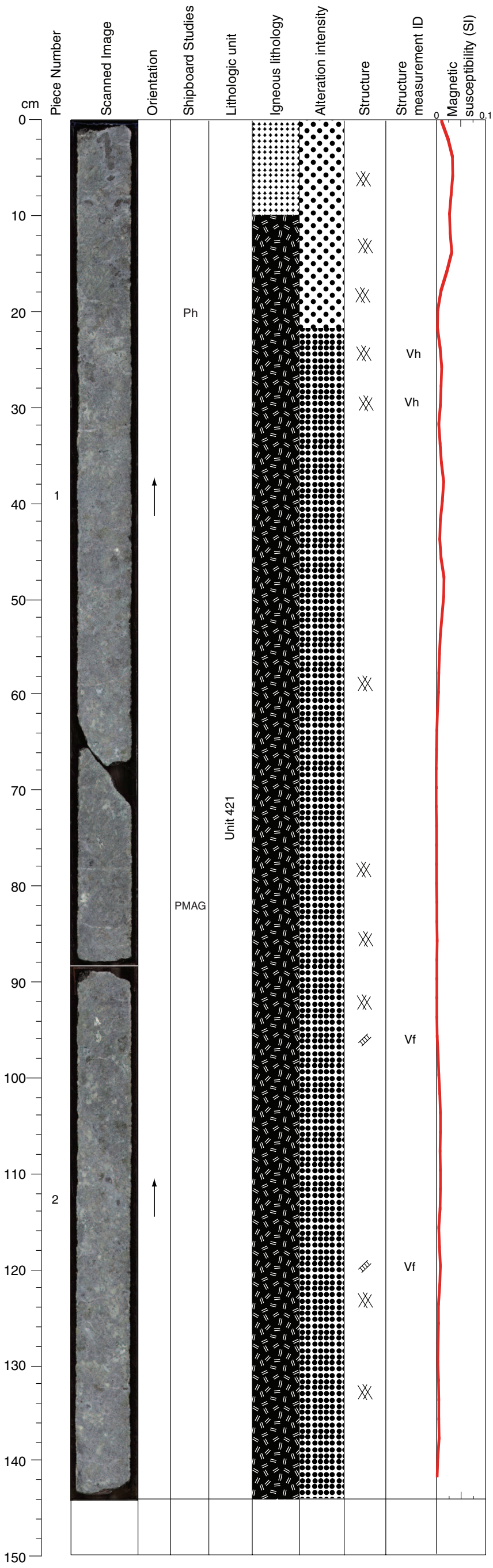
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Very coarse-grained gabbro with green alteration (amphibole) on top of Piece 1 (1 to 4 cm) associated with epidote. Significant amount of green amphibole. Pyroxene grains are replaced by a white mineral (?) and likely rimmed by green amphibole. The olivines are altered to serpentine + tremolite + sulfides. The shiny pyroxene grains are partially replaced by green amphibole.

VEIN ALTERATION: Serpentine, chlorite, talc.

STRUCTURE: Pegmatitic gabbro with no ductile strain, alteration front at top of section. Brittle deformation concentrates either at irregular, but subhorizontal fracture networks, or as distributed cracks in green alteration zone.

## Core Photo




**305-U1309D-158R-4 (Section top: 773.78 mbsf)**

UNIT-421: Olivine-bearing Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1a and 1b

| | |
|---|---|
| Olivine | Modal 2%<br>Size 7 mm average<br>Shape anhedral |
| Plagioclase | Modal 78%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 20%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 421 is medium-grained olivine-bearing gabbro. More olivine-rich zone at 0-9 cm. Pegmatitic clinopyroxene oikocryst at 9-34 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

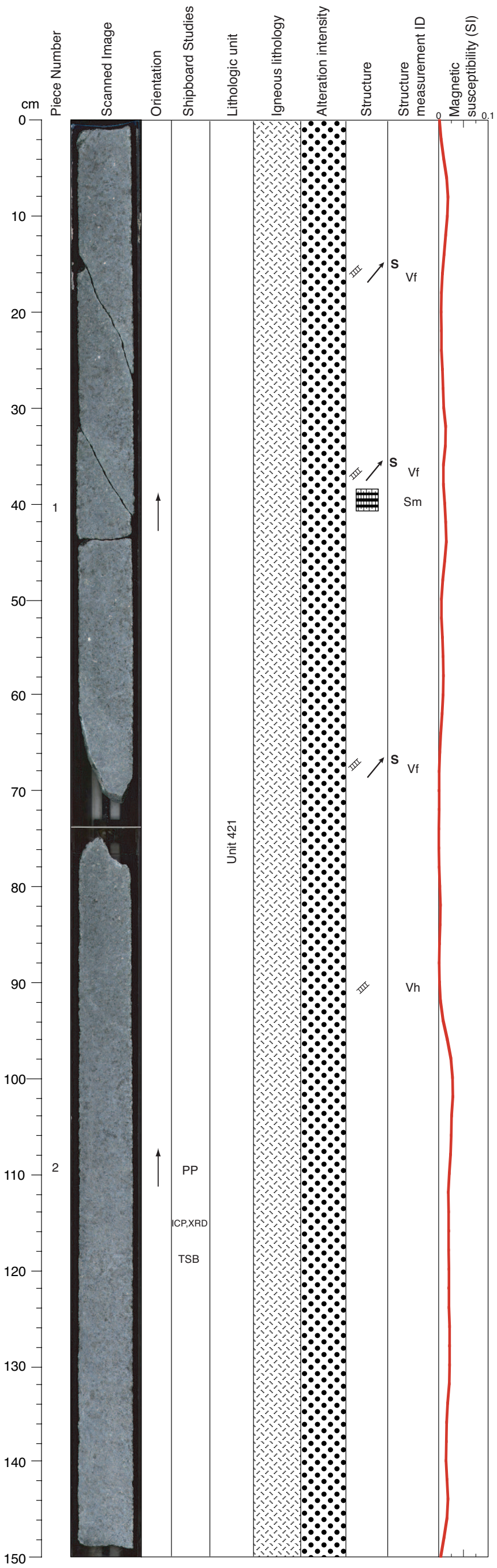
COMMENTS: Coarse-grained gabbro with both coronas around altered olivine (serpentine + tremolite + sulfides) and pale-green coronas (actinolite-tremolite-talc), which are more altered close to the fracture (64 cm). The pyroxenes are replaced by white mineral (?) and likely rimmed by green amphibole.

VEIN ALTERATION: Chlorite, talc.

STRUCTURE: Corona type alteration, medium- to coarse-grained gabbro, no ductile strain. Moderately-dipping pale green veins with alteration halo and sets of irregular, but subhorizontal, white cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-158R-4, 10-30 cm WET

## Core Photo




**305-U1309D-159R-1 (Section top: 775.00 mbsf)**

UNIT-421: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Olivine | Modal <1%<br>Size 7 mm average<br>Shape anhedral |
| Plagioclase | Modal 80%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 20%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 421 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section, but Piece 1 is cut by 3 light green veins with narrow alteration halos.

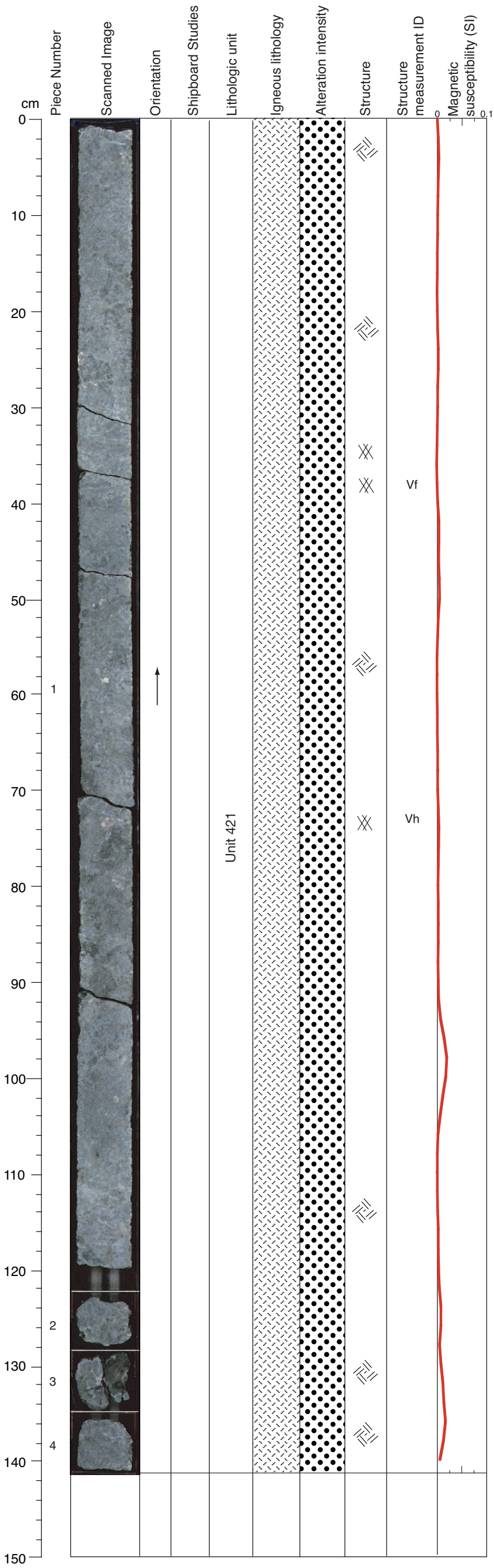
VEIN ALTERATION: Amphibole.

THIN SECTIONS:
**305-U1309D-159R-1, 117-119 cm (#411)**

STRUCTURE: Medium-grained gabbro with hint of moderately dipping magmatic fabric in upper part, no plastic strain. Pale green steep fault veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-159R-1, 110-130 cm WET

## Core Photo




**305-U1309D-159R-2 (Section top: 776.50 mbsf)**

UNIT-421: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from several pieces

| | |
|---|---|
| Olivine | Modal <1%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 35-40%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 60-65%<br>Size to 30 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 421 medium- to coarse-grained gabbro.

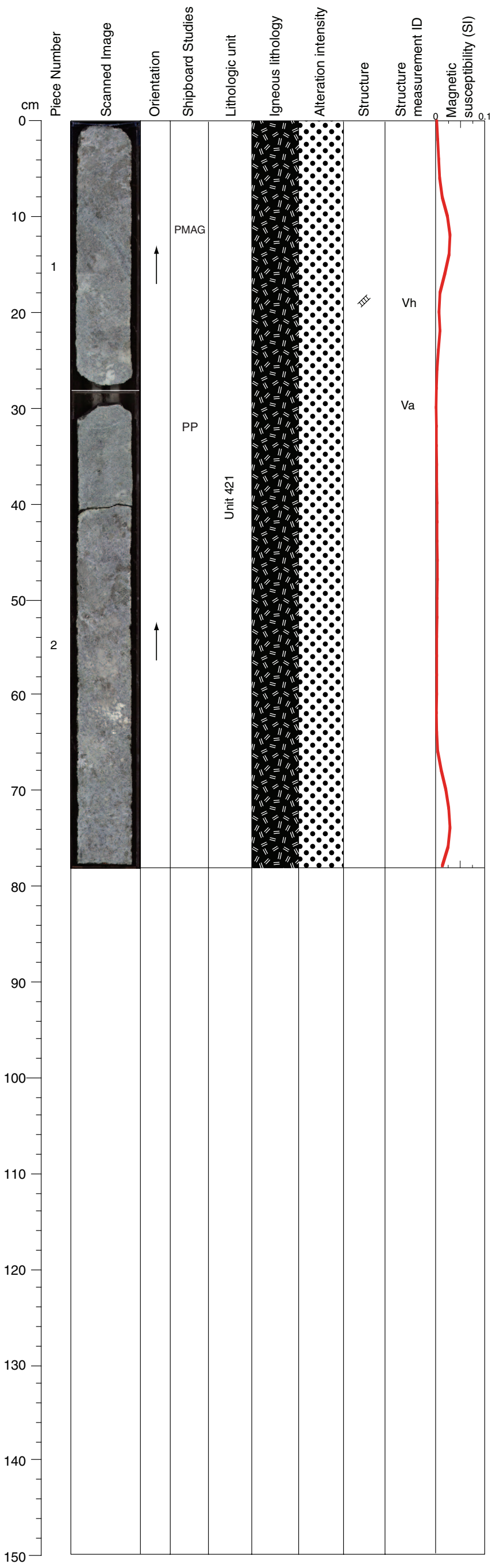
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section, but only one vein occurs in this section.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium- to coarse-grained, locally pegmatitic gabbro with no ductile strain. Some irregular subhorizontal veins.

## Core Photo




**305-U1309D-159R-3 (Section top: 777.91 mbsf)**

UNIT-421: Olivine-bearing Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 1%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 40%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 59%<br>Size to 30 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 421 medium- to coarse-grained olivine-bearing gabbro.

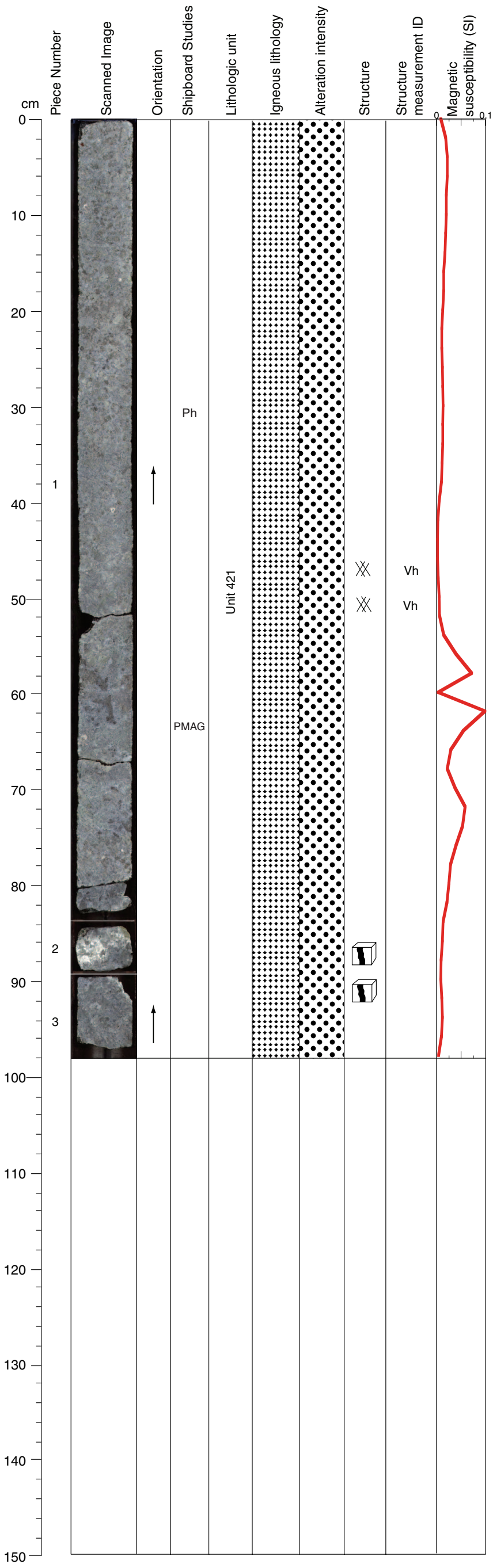
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Background alteration is similar to previous sections. Network of fine green veins from 8 to 16 cm

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium-grained gabbro with pegmatitic clinopyroxene grains up to 10 cm, no ductile fabric. earlier dark green veins and some minor white cracks.

## Core Photo




**305-U1309D-159R-4 (Section top: 778.69 mbsf)**

UNIT-421: Olivine Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1a and 1b

| | |
|---|---|
| Olivine | Modal 5-20%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 30-45%<br>Size to 110 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 421 medium- to coarse-grained olivine gabbro. Gradual increase in modal olivine down section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

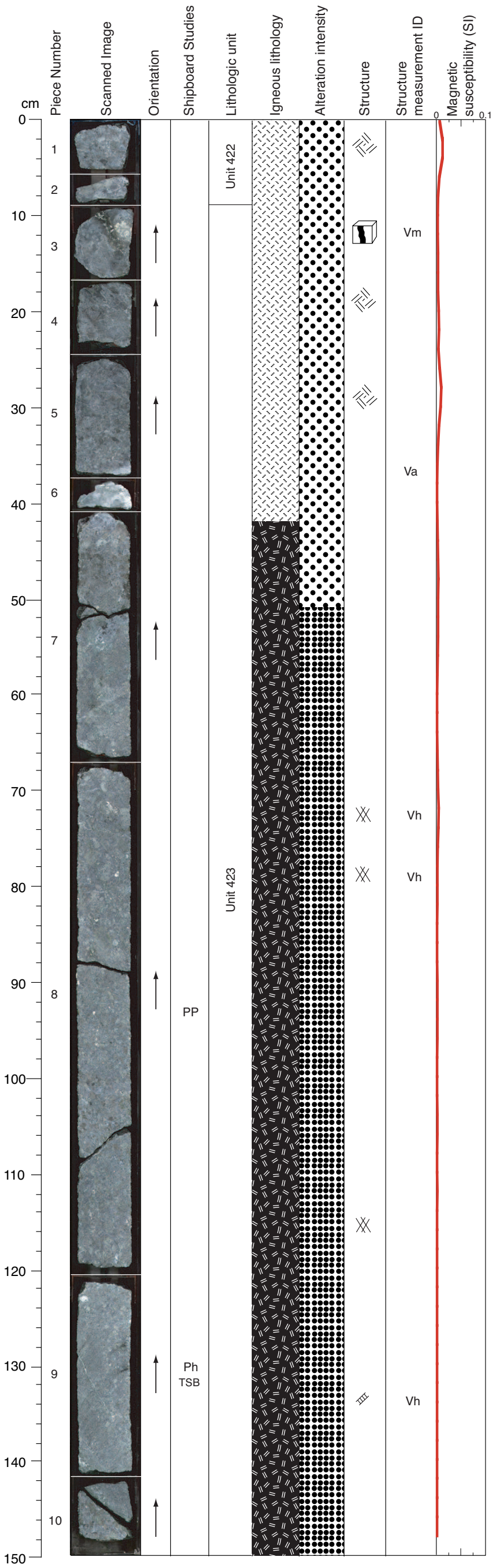
COMMENTS: Similar to previous sections. A few patches of light-colored alteration near veins.

VEIN ALTERATION: Amphibole, plagoclase, talc.

STRUCTURE: Medium-grained gabbro with pegmatitic clinopyroxene grains up to 10 cm, no ductile fabric. Little veining or cataclasis. Magmatic vein at the bottom of the section.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-159R-4, 20-40 cm WET

## Core Photo




**305-U1309D-160R-1 (Section top: 779.80 mbsf)**

UNIT-422: Gabbro Rubble
Pieces: 1-2

PRIMARY MINERALOGY:

COMMENTS: Unit 422 gabbro rubble may not be in place.

UNIT-423: Gabbro to olivine-bearing gabbro
Pieces: 3-10

PRIMARY MINERALOGY: Modal data from Piece 8

| | |
|---|---|
| Olivine | Modal <1-4%<br>Size 1-4 mm<br>Shape anhedral to interstitial |
| Plagioclase | Modal 36-65%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 35-60%<br>Size to 30 mm<br>Shape anhedral |

COMMENTS: Unit 423 medium- to coarse-grained gabbro to olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General alteration is similar to previous section to a depth of ~50 cm. Below that the gabbro is slightly more altered and shows some corona texture. Veins cut the section in several places and are accompanied by better developed corona texture and locally olivine is completely altered to white patches of talc(?) and are vuggy.

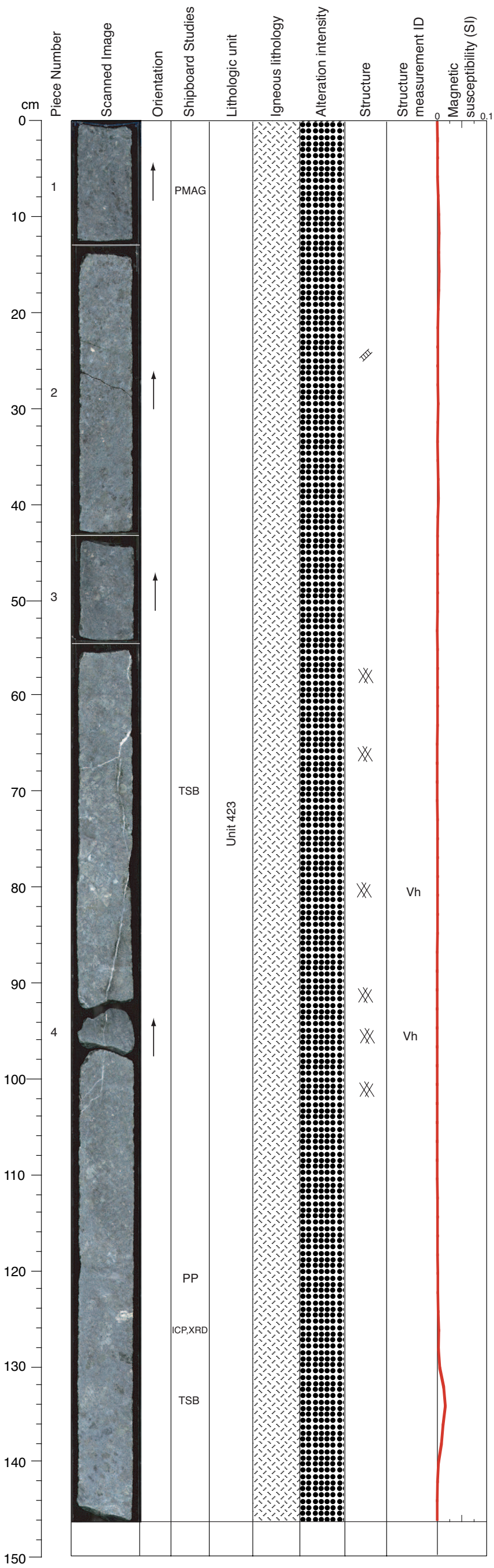
VEIN ALTERATION: Amphibole, plagioclase, chlorite

THIN SECTIONS:
**305-U1309D-160R-1, 131-133 cm (#412)**

STRUCTURE: Medium- to fine-grained gabbro with local pegmatitic grains of clinopyroxene, no ductile fabric, one magmatic vein. Minor veining or cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-160R-1, 121-141 cm WET

## Core Photo




**305-U1309D-160R-2 (Section top: 781.30 mbsf)**

UNIT-423: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 423 medium- to coarse-grained gabbro. In the 2 thin sections of this unit olivine vary between 4 and 7 %.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration similar to bottom of previous section. A vein containing carbonate and talc(?) cuts the section from 64 cm to 110 cm.

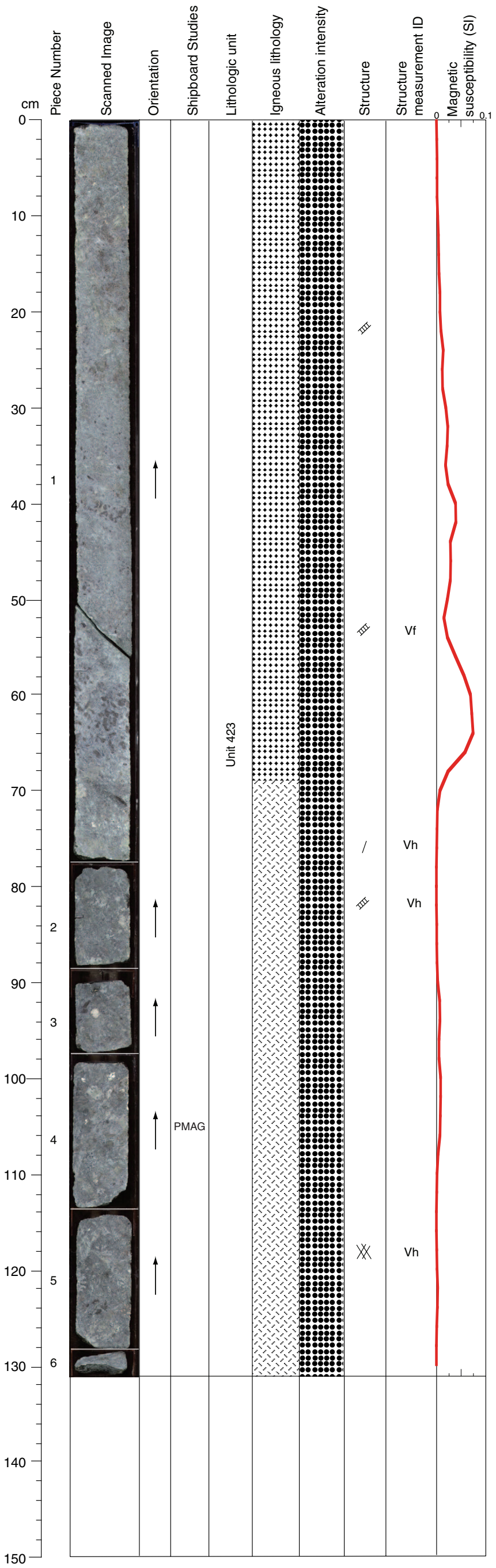
VEIN ALTERATION: Amphibole, carbonate.

THIN SECTIONS:
**305-U1309D-160R-2, 69-71 cm (#413)**
**305-U1309D-160R-2, 133-135 cm (#414)**

STRUCTURE: Medium-grained gabbro developing coarse clinopyroxene crystals, no ductile fabric. Very irregular, branching (main stem subvertical) crack veins that crosscut earlier green veins.

CLSOE-UP PHOTOGRAPHS:
305-U1309D-160R-2, 55-75 cm WET

## Core Photo




**305-U1309D-160R-3 (Section top: 782.78 mbsf)**

UNIT-423: Olivine gabbro to Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 1a, 1b

| | |
|---|---|
| Olivine | Modal 10-40%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Plagioclase | Modal 55-60%<br>Size 3 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 5-30%<br>Size to 35 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 423 medium- to coarse-grained gabbro to olivine gabbro. Pieces 1a-1b are olivine gabbro with olivines concentrated in distinct, steeply-dipping bands. Pieces 2-6 are nearly olivine-free gabbro with olivine:plagioclase:clinopyroxene = <1:50:50.

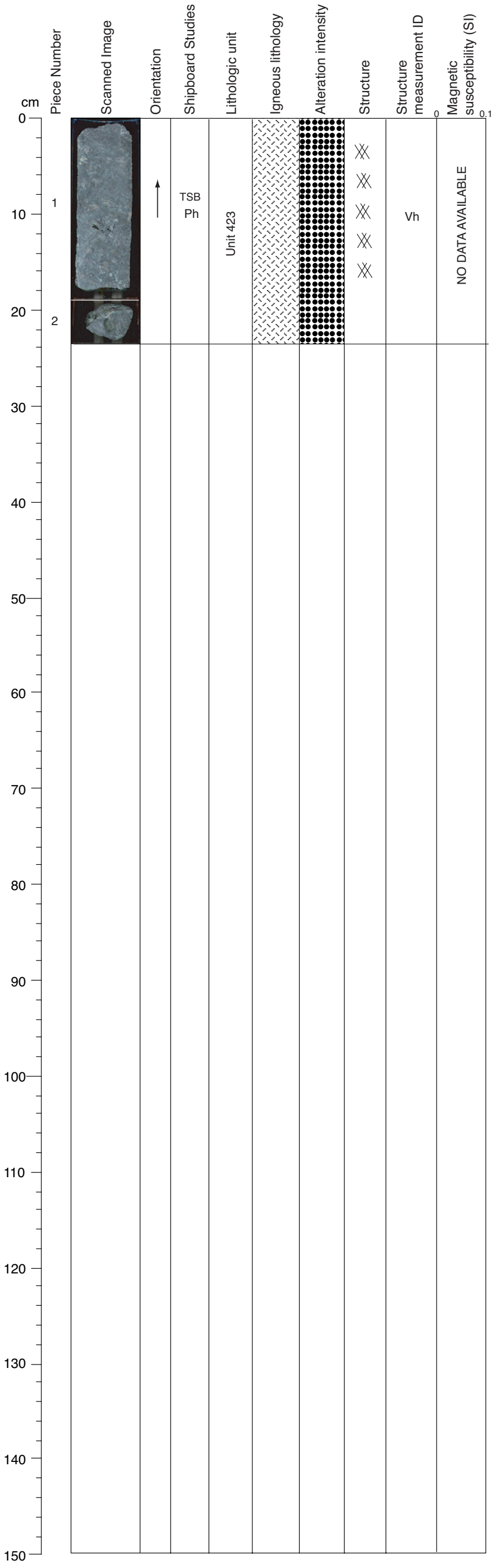
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section, but a green vein with an alteration halo about 1 cm wide cuts the section at ~50 to 56 cm. The better developed areas of corona texture are associated with single or networks of fine green veins.

VEIN ALTERATION: Amphibole, carbonate.

STRUCTURE: Medium-grained corona-altered gabbro with larger massive to oikocrystic clinopyroxene grains, no ductile fabric. Pale green fault veins associated with minor irregular cracks and irregular white veins.

## Core Photo




**305-U1309D-160R-4 (Section top: 784.09 mbsf)**

UNIT-423: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 40%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 423 medium- to coarse-grained gabbro. Olivine up to 8% observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section, but veins in this section contain only carbonate.

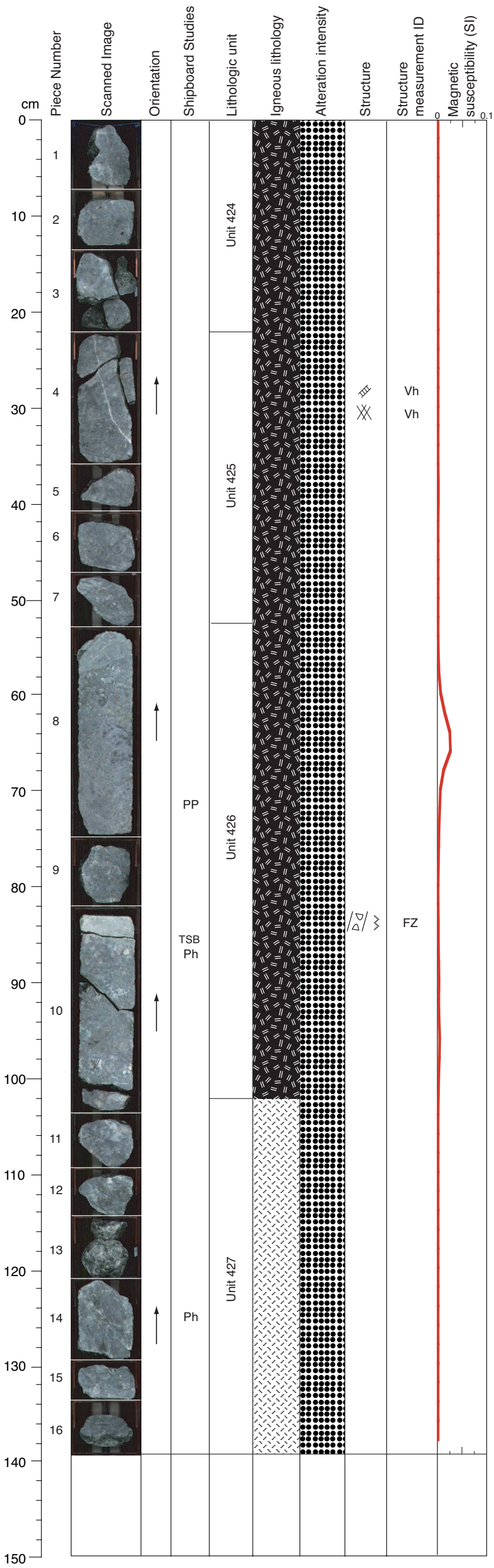
VEIN ALTERATION: Carbonate.

THIN SECTIONS:
**305-U1309D-160R-4, 6-9 cm (#415)**

STRUCTURE: Medium-grained gabbro dissected by set of high-density veins at <5 mm spaced over 20 cm interval.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-160R-4, 0-23 cm WET

## Core Photo




**305-U1309D-161R-1 (Section top: 784.60 mbsf)**

UNIT-424: Olivine-bearing gabbro rubble
Pieces: 1-3

COMMENTS: Unit 424 rubble of uncertain origin.

UNIT-425: Olivine-bearing gabbro
Pieces: 4-7

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Olivine | Modal <1%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 40%<br>Size to 35 mm<br>Shape anhedral |

COMMENTS: Unit 425 coarse-grained olivine-bearing gabbro.

UNIT-426: Olivine-bearing gabbro
Pieces: 8-10

PRIMARY MINERALOGY: Modal data from Piece 8

| | |
|---|---|
| Olivine | Modal 1%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 35%<br>Size to 35 mm<br>Shape anhedral |

COMMENTS: Unit 426 is coarse-grained olivine-bearing gabbro. Olivine-rich zone at 60-68 cm.

UNIT-427: Gabbro
Pieces: 11-16

COMMENTS: Unit 427 is coarse-grained gabbro. Too deformed to determine mode.

SECONDARY MINERALOGY: Chlorite, pale amphibole, serpentine

COMMENTS: Similar to previous section, but also contains broad networks of fine light green veins at two intervals 53 to 57 cm and 82 to 86 cm. Also white veins crosscut earlier green veins. Corona texture is best developed near veins and vein networks

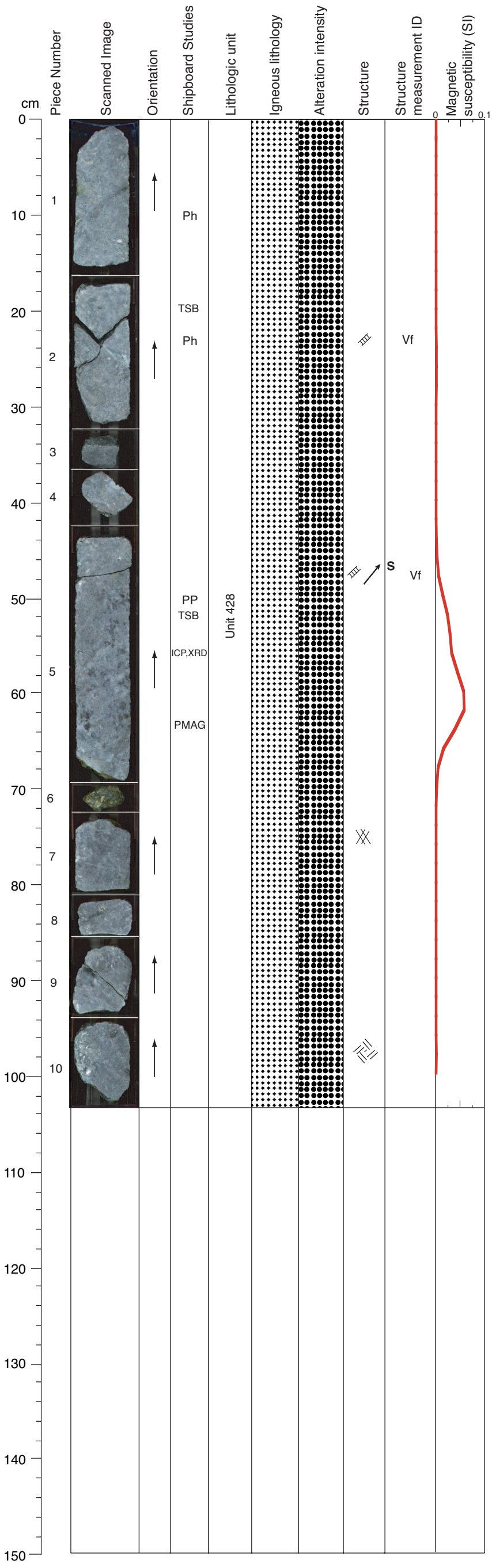
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, quartz, carbonate

THIN SECTIONS:
**305-U1309D-161R-1, 84-87 cm (#416)**

STRUCTURE: Medium-grained gabbro with abundant corona alteration, no clear ductile fabric. High-temperature foliation and intense veining (same as previous section), crosscut by white-filled cataclastic vein in Piece 1 to 7. Underlain by coarse-grained gabbro with some cataclasis and a fault zone in the top of Piece 10 (FZ) with fault gouge (>2 cm thick). The fault zone contains foliated fault gouge.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-161R-1, 76-96 cm WET
305-U1309D-161R-1, 114-136 cm WET

## Core Photo




**305-U1309D-161R-2 (Section top: 785.99 mbsf)**

UNIT-428: Olivine gabbro
Pieces: 1-10

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Olivine | Modal 25%<br>Size to 10 mm<br>Shape anhedral to interstitial |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 20%<br>Size to 15 mm<br>Shape anhedral |

COMMENTS: Unit 428 is coarse-grained olivine gabbro. Olivine-rich zone at 44-69 cm. Other portions of the section range to olivine-free gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section, but this section lacks networks of green veins. Green (talc/chlorite) veins occur throughout the section and one late vein at about 63 cm to 69 cm also contains amphibole and carbonate.

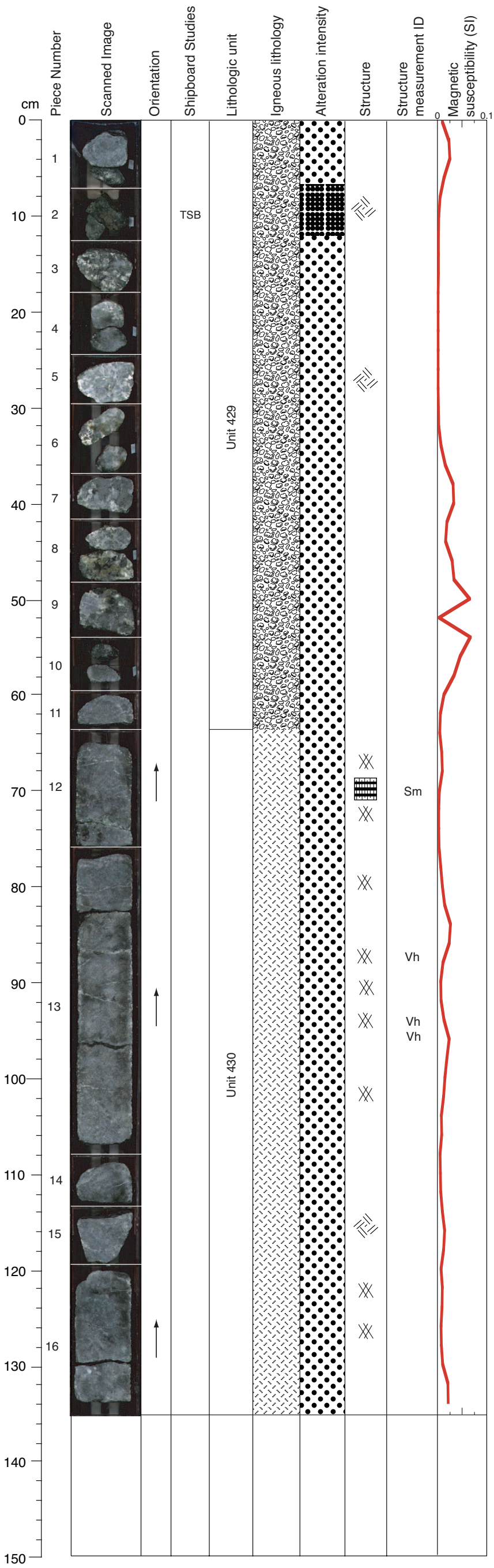
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-161R-2, 19-22 cm (#417)**
**305-U1309D-161R-2, 50-53 cm (#418)**

STRUCTURE: Medium-grained gabbro with abundant corona alteration, no clear ductile fabric. Late veins and associated minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-161R-2, 10-30 cm WET
305-U1309D-161R-2, 48-68 cm WET

## Core Photo




**305-U1309D-162R-1 (Section top: 789.40 mbsf)**

UNIT-429: Mixed gabbro rubble
Pieces: 1-11

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 6 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 40%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 429 is mixed rubble. Leucocratic zone at 13-54 cm contains trace sulfides. Oxide-rich gabbro, Piece 9 (48-54 cm).

UNIT-430: Gabbro
Pieces: 12-16

PRIMARY MINERALOGY: Modal data from Piece 13

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 4 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 30%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 430 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote

COMMENTS: The section contains rubble which is more heavily altered in Piece 2, but alteration in the rest of the pieces is generally is similar to the gabbro seen in previous sections. Leucocratic zones of alteration are associated with veins. Some epidote (?) appears in Pieces 6 through 9.

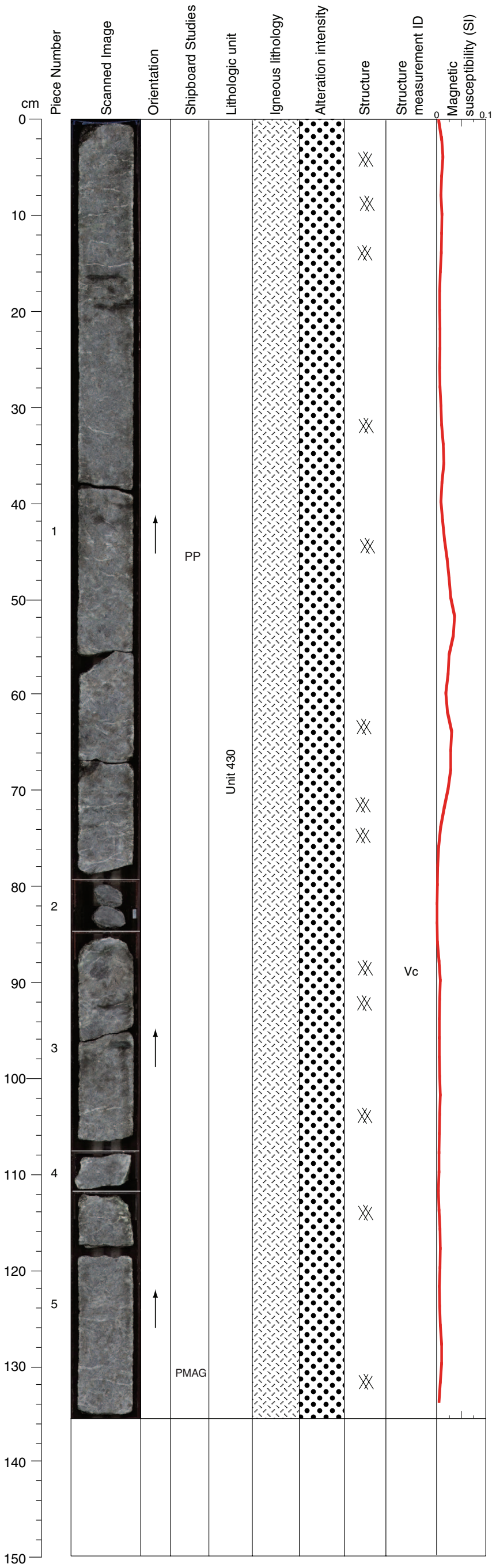
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-162R-1, 9-12 cm (#419)**

STRUCTURE: Coarse-grained gabbro except for Pieces 11 to 13, in latter weak magmatic fabric. Strong alteration in Pieces 2 to 8. Minor cracking in rubble. Under these loose rocks, medium-grained gabbro with subhorizontal irregular cracks with white halo cutting earlier dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-162R-1, 0-18 cm WET

## Core Photo




**305-U1309D-162R-2 (Section top: 790.75 mbsf)**

UNIT-430: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 6 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 30%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 430 coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

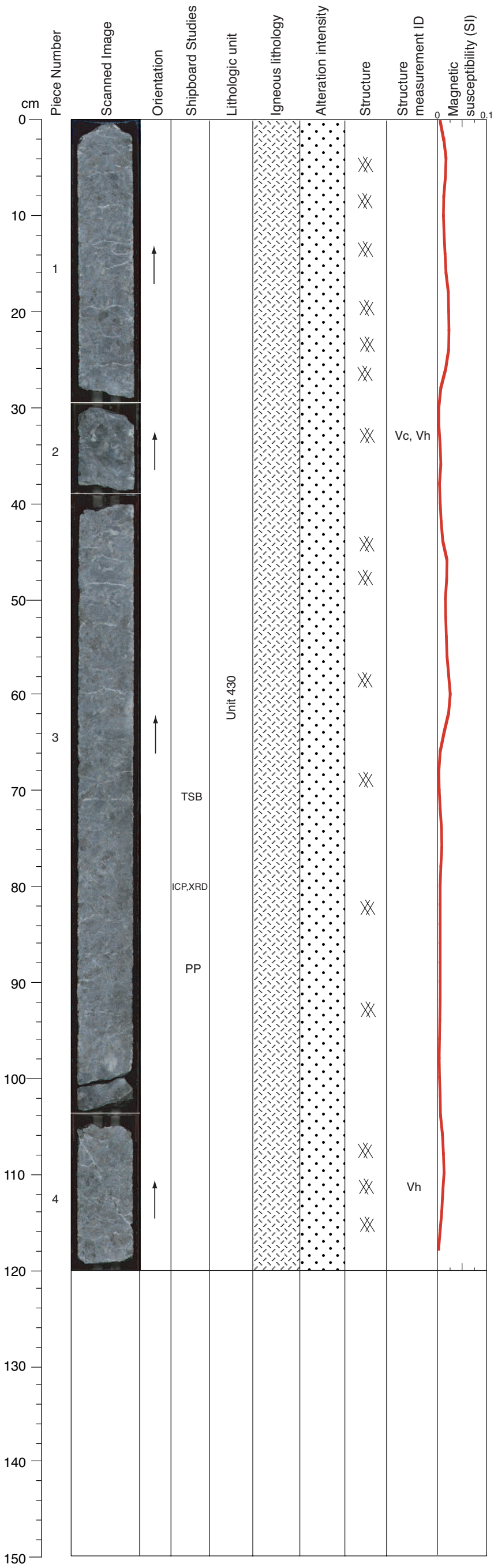
COMMENTS: Alteration is similar to that seen in the medium- to coarse-grained gabbro in earlier sections. Several light green veins cut through the section.

VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

STRUCTURE: Medium-grained gabbro with coarse to locally pegmatitic clinopyroxene, no ductile fabric in matrix, but in Piece 1 clinopyroxene has subhorizontal fabric (later growth?). Many subhorizontal white veins (<5 cm in length) and earlier pale green brittle veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-162R-2, 4-24 cm WET

## Core Photo




**305-U1309D-162R-3 (Section top: 792.10 mbsf)**

UNIT-430: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 6 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 30%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 430 coarse-grained gabbro. Orthopyroxene (<1%) observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

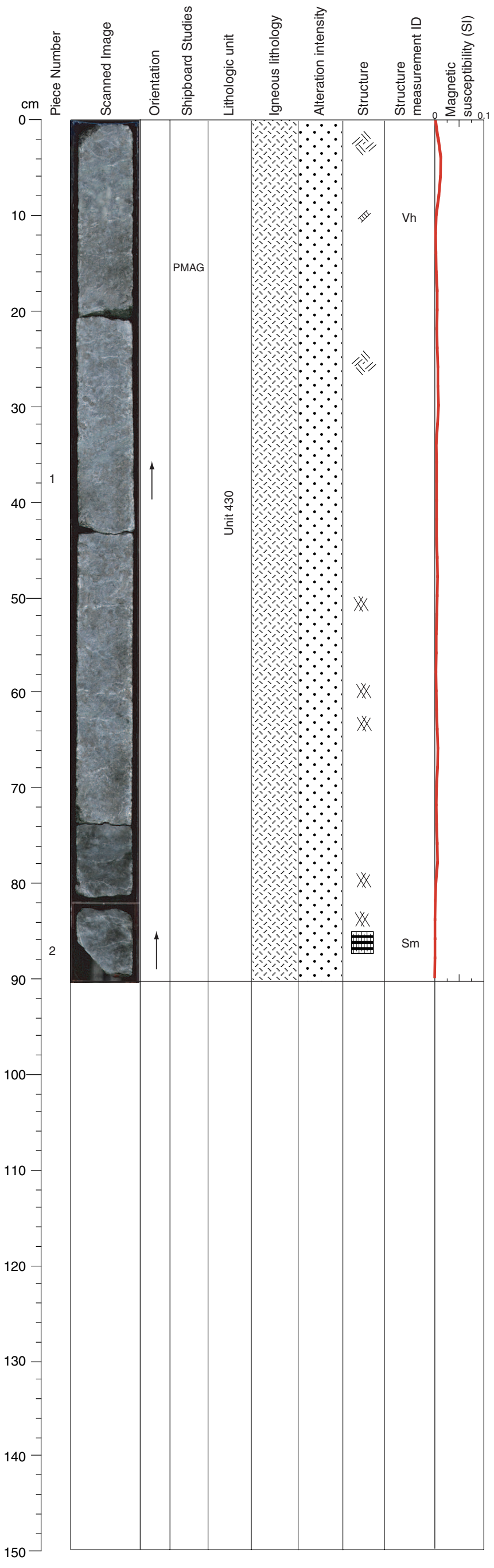
COMMENTS: Similar to the previous section. A vein crosscuts the section between 106 to 116 cm and a vein filling coats the base of the last piece in the section.

VEIN ALTERATION: Chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-162R-3, 68-71 cm (#420)**

STRUCTURE: Medium-grained gabbro with coarse to locally pegmatitic clinopyroxene, no ductile fabric. Many subhorizontal white veins (<5 cm in length) and earlier pale green brittle veins.

## Core Photo




**305-U1309D-162R-4 (Section top: 793.30 mbsf)**

UNIT-430: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1 and 2

| | |
|---|---|
| Plagioclase | Modal 70-85%<br>Size 6 mm average<br>Shape anhedral to interstitial |
| Clinopyroxene | Modal 15-30%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 430 medium- to coarse-grained gabbro. Becomes more plagioclase-rich down section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

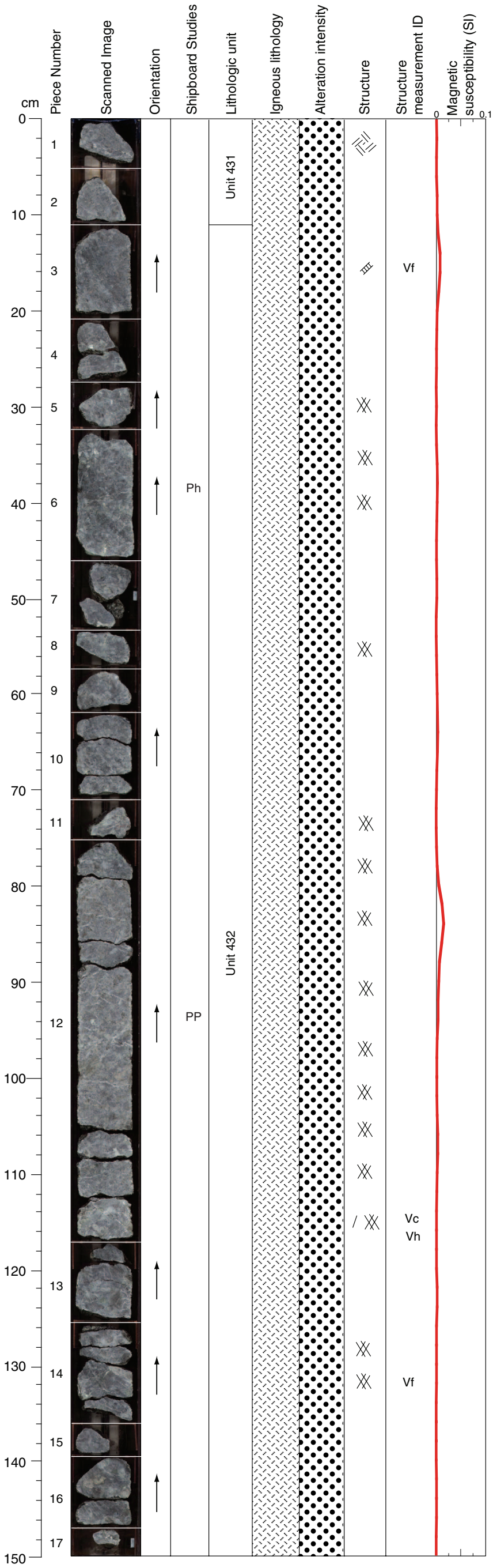
COMMENTS: The alteration is similar to the previous section. A few thin branching veins cut across the section and two subparallel veins with pale green halos about 1 cm wide cross the section between 31 and 37 cm.

VEIN ALTERATION: Chlorite, carbonate.

THIN SECTIONS:

STRUCTURE: Medium-grained gabbro with coarse to locally pegmatitic clinopyroxene, no ductile fabric. Piece 2 shows a shallowly-dipping magmatic foliation. Many subhorizontal white veins (<5 cm in length) and earlier pale green brittle veins.

## Core Photo




**305-U1309D-163R-1 (Section top: 794.20 mbsf)**

UNIT-431: Leucocratic Gabbro Rubble
Pieces: 1-2

UNIT-432: Gabbro
Pieces: 3-17

PRIMARY MINERALOGY: Modal data from Piece 12d

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 3 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 432 is coarse-grained gabbro

SECONDARY MINERALOGY: Chlorite, pale amphibole

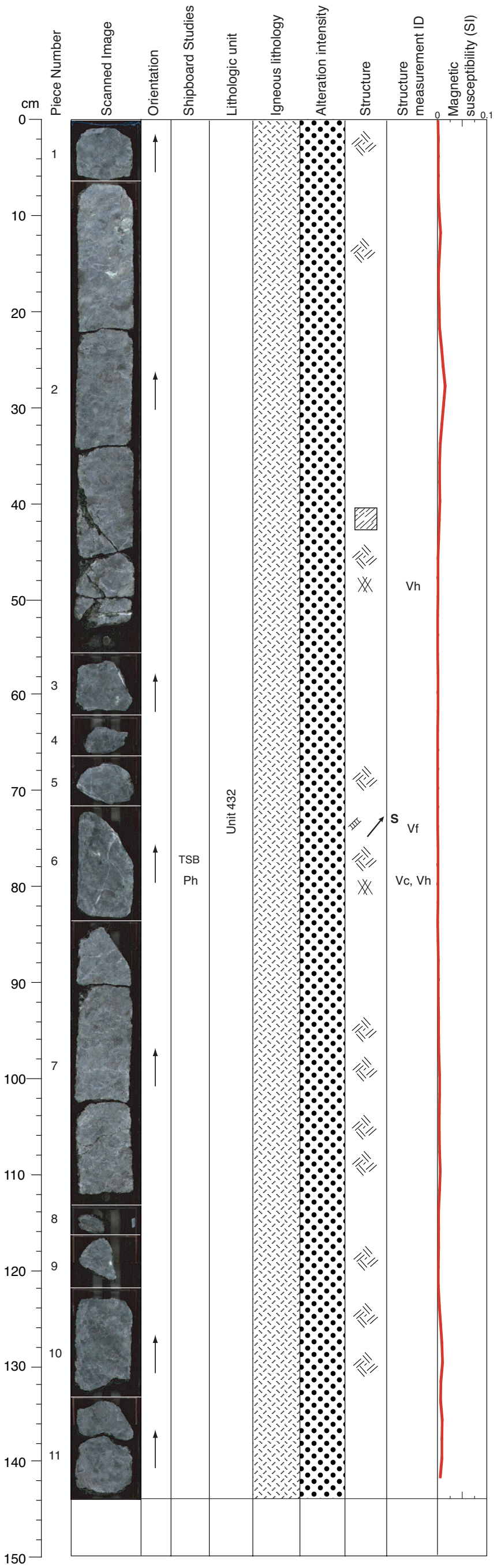
COMMENTS: Alteration is similar to the previous section. Several veins cut across the section especially in Pieces 6 and 12.

VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

STRUCTURE: Medium-grained gabbro, no ductile strain fabric. Open cracks, dark (early) and pale (later) green veins, and some cataclasis restricted to vein zones.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-163R-1, 28-50 cm WET

## Core Photo




**305-U1309D-163R-2 (Section top: 795.70 mbsf)**

UNIT-432: Gabbro
Pieces: 1-11

PRIMARY MINERALOGY: Modal data from Section U1309D-163R-001, Piece 12d

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 3 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 432 coarse-grained gabbro

SECONDARY MINERALOGY: Chlorite, pale amphibole, serpentine

COMMENTS: General alteration is similar to previous section. A white vein crosses the bottom of Piece 2 and extends to the side of Piece 3.

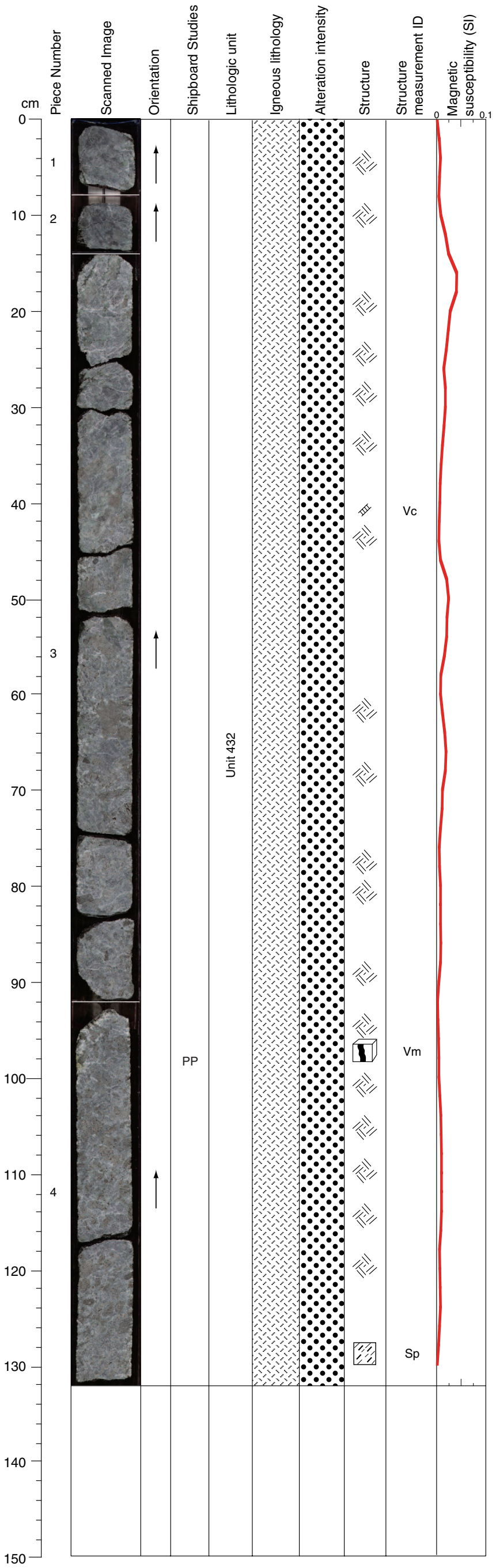
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-163R-2, 75-77 cm (#421)**

STRUCTURE: Medium-grained gabbro with coarse clinopyroxene, no ductile fabric in matrix, but in Piece 7 clinopyroxene has subhorizontal fabric (later growth?). Minor irregular cracks with white infills and pale green fault veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-163R-2, 67-90 cm WET

## Core Photo




**305-U1309D-163R- 3 (Section top: 797.14 mbsf)**

UNIT-432: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 3e

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5-15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5-30 mm<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 432 coarse-grained gabbro. Leucocratic gabbro vein at 92-100 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

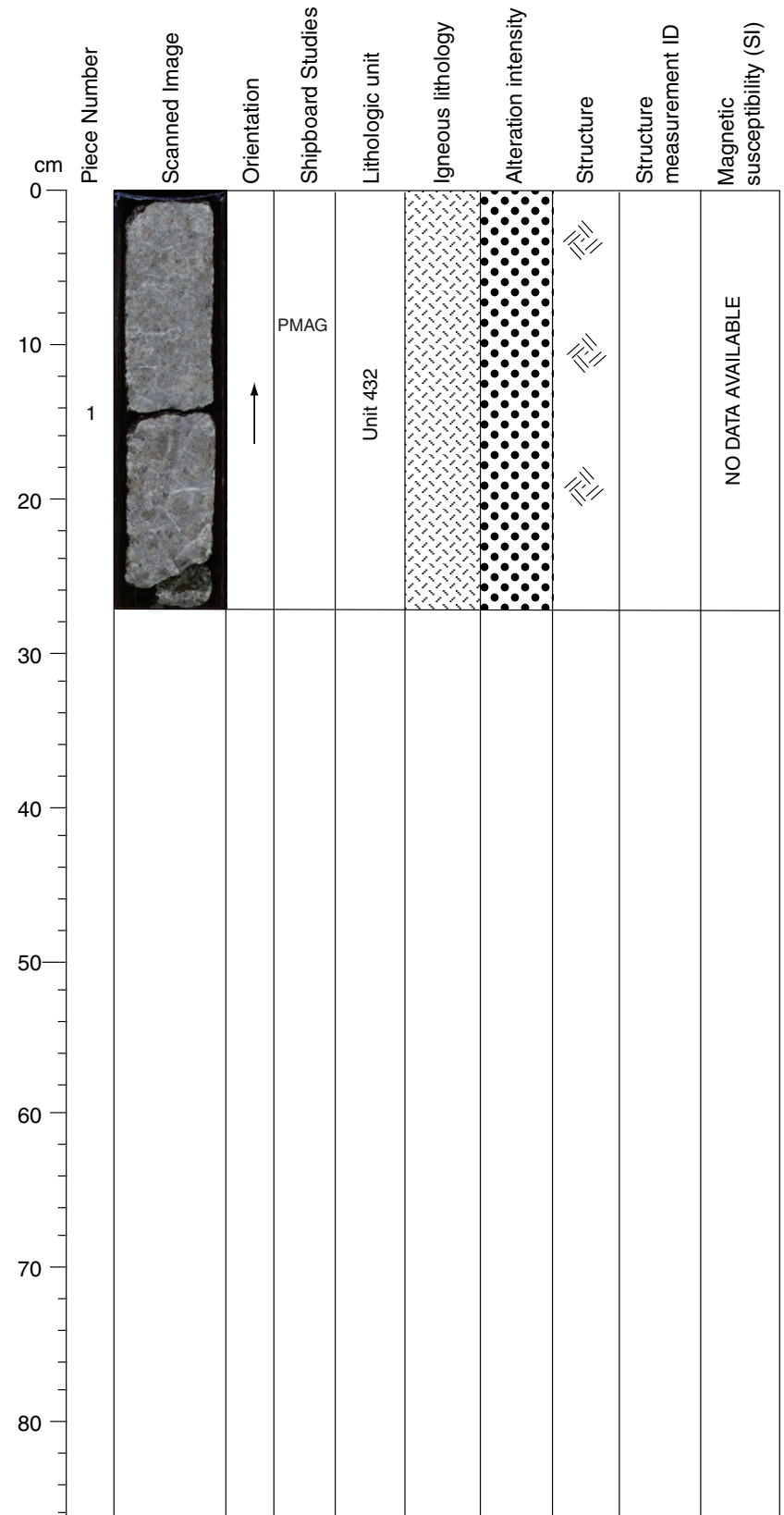
COMMENTS: Similar to previous section, but with a zone of leucocratic material at the top of Piece 4 that also contains epidote.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained gabbro with coarse clinopyroxene, no ductile fabric except in Piece 4 which is without large clinopyroxene grains. Minor irregular cracks with white infills and pale green fault veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-163R-3, 62-82 cm WET

## Core Photo




**305-U1309D-163R-4 (Section top: 798.46 mbsf)**

UNIT-432: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Section U1309D-163R-004, Piece 3e

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5-15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5-30 mm<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 432 coarse-grained gabbro.

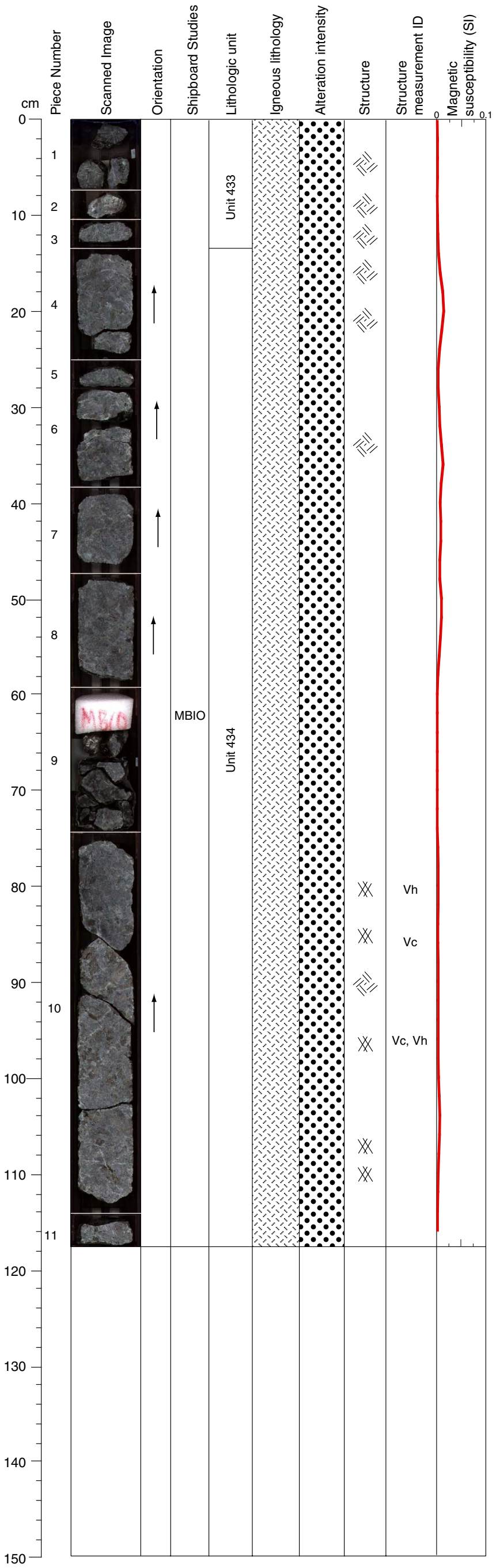
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to the previous section.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained gabbro with coarse clinopyroxene, no ductile fabric. Minor irregular cracks with white infills.

## Core Photo




**305-U1309D-164R-1 (Section top: 799.00 mbsf)**

UNIT-433: Gabbro rubble
Pieces: 1-3

COMMENTS: Unit 433 is coarse-grained gabbro rubble.

UNIT-434: Gabbro
Pieces: 4-11

PRIMARY MINERALOGY: Modal data from Piece 8

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5-15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5-30 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 434 is coarse-grained gabbro. This section is somewhat fresher than previous core.

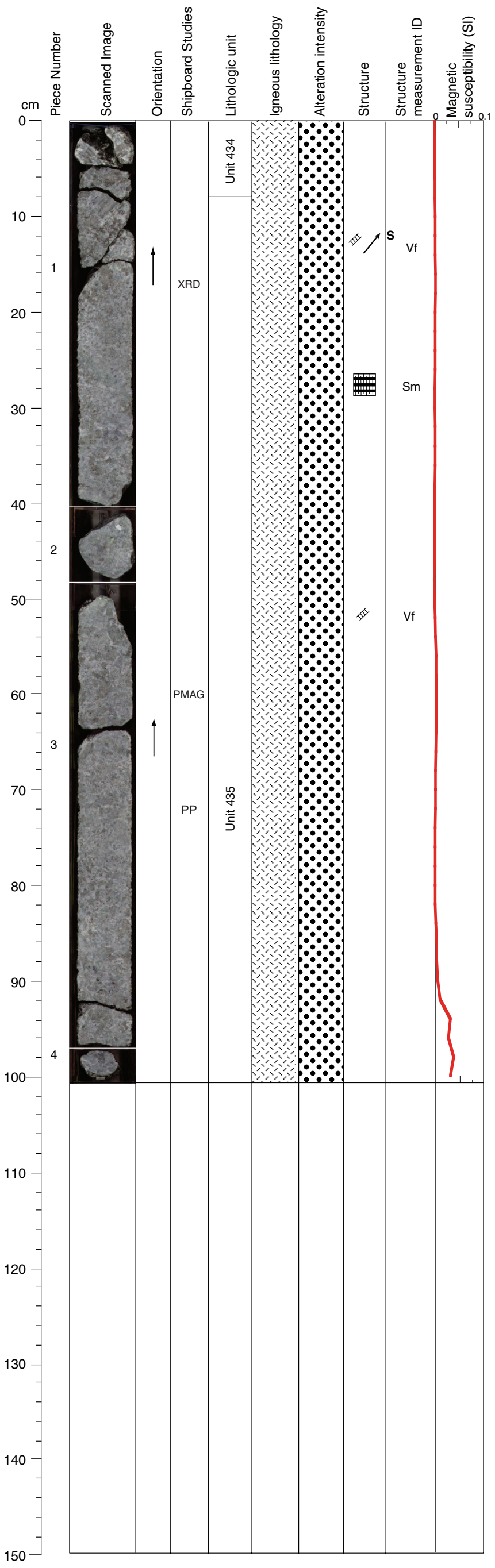
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to the previous section in terms of overall alteration. A green vein filling coats the surface between Pieces 9a and 9b. Additional green veins cut the section in several places.

VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

STRUCTURE: Medium-grained gabbro with coarse clinopyroxene, no ductile fabric. Open cracks, dark (early) and pale (later) green veins, and some cataclasis restricted to vein zones.

## Core Photo




**305-U1309D-164R-2 (Section top: 800.18 mbsf)**

UNIT-434: Gabbro
Pieces: 1a-c

PRIMARY MINERALOGY: Modal data from Section U1309-164R-001, Piece 8

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5-15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5-30 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 434 is coarse-grained gabbro.

UNIT-435: Gabbro
Pieces: 1c-4

PRIMARY MINERALOGY: Modal data from Piece 1e

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5-15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5-30 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 435 is medium- to coarse-grained gabbro.

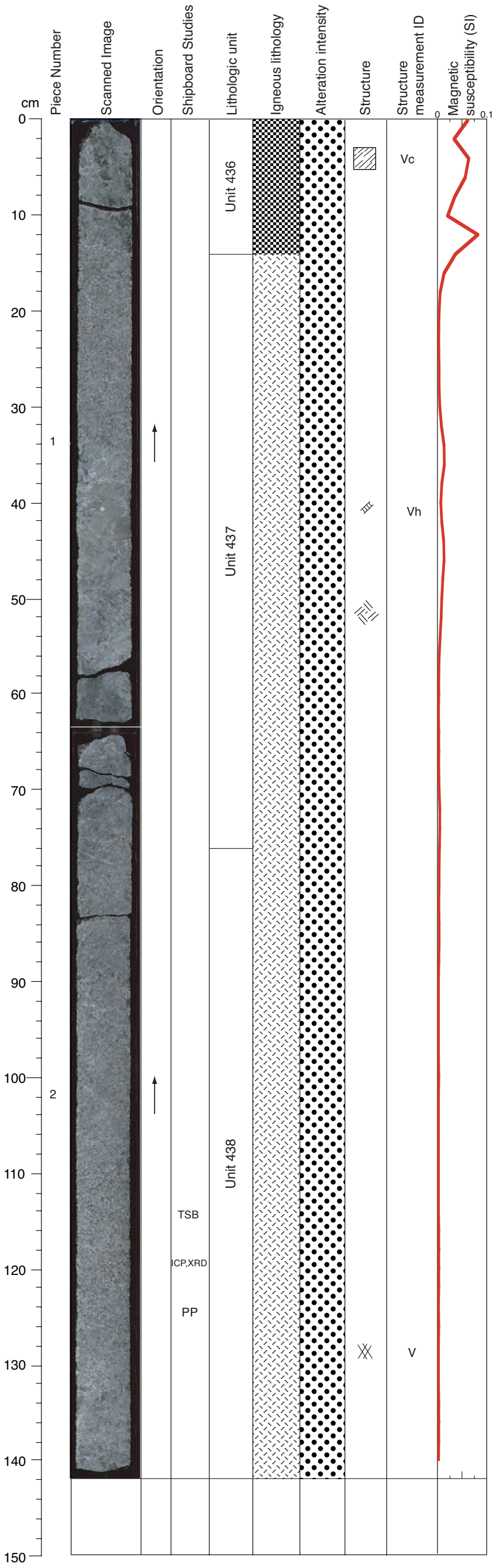
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration is similar to previous sections of medium-grained gabbro, with some patches of leucocratic alteration (and a patch of epidote?). A network of late green veins with pale green halos aobut 1 cm wide cut the core at 35 to 39 cm.

VEIN ALTERATION: Chlorite, talc, carbonate.

STRUCTURE: Fine-grained gabbro with weak magmatic fabric grading into coarse gabbro down core, losing the fabric. Very few veins.

## Core Photo




**305-U1309D-164R-3 (Section top: 801.19 mbsf)**

UNIT-436: Oxide Gabbro
Pieces: 1a-b

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 63%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 5 mm average<br>Shape subhedral to anhedral |
| Oxide | Modal 7%<br>Size 5 mm average<br>Shape subhedral |

COMMENTS: Unit 436 is coarse-grained oxide gabbro. Steeply dipping contact with adjoining gabbro.

UNIT-437: Gabbro
Pieces: 1b-2c

PRIMARY MINERALOGY: Modal data from Piece 1b, 13-35 cm

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 5 mm average<br>Shape subhedral to anhedral |

PRIMARY MINERALOGY: Modal data from Piece 1b, 35-70 cm

| | |
|---|---|
| Plagioclase | Modal 30%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 70%<br>Size to 100 mm<br>Shape subhedral |

COMMENTS: Unit 437 is medium-grained to pegmatitic gabbro. 13-35 cm medium-grained, 35-76 cm pegmatitic. Sharp grain size and modal change at 35 cm. Contact with Unit 438 below is more gradational than contact with Unit 436.

UNIT-438: Gabbro
Pieces: 2c

PRIMARY MINERALOGY: Modal data from Piece 2c

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 5 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 438 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The alteration of the coarse gabbro in the upper part of Piece 1 is similar to that of gabbro in the previous section. The finer grained gabbro from 13 to 36 cm is similarly altered, but the reaction rims on pyroxene grains are thinner. A second zone of coarse gabbro from about 33 cm (with an inclined contact) to about 74 cm has a few green veins (no halos). Some corona texture appears at the top of Piece 2 within this coarser gabbro. The finer grained gabbro at the bottom half of the section is similar to that in the upper part.

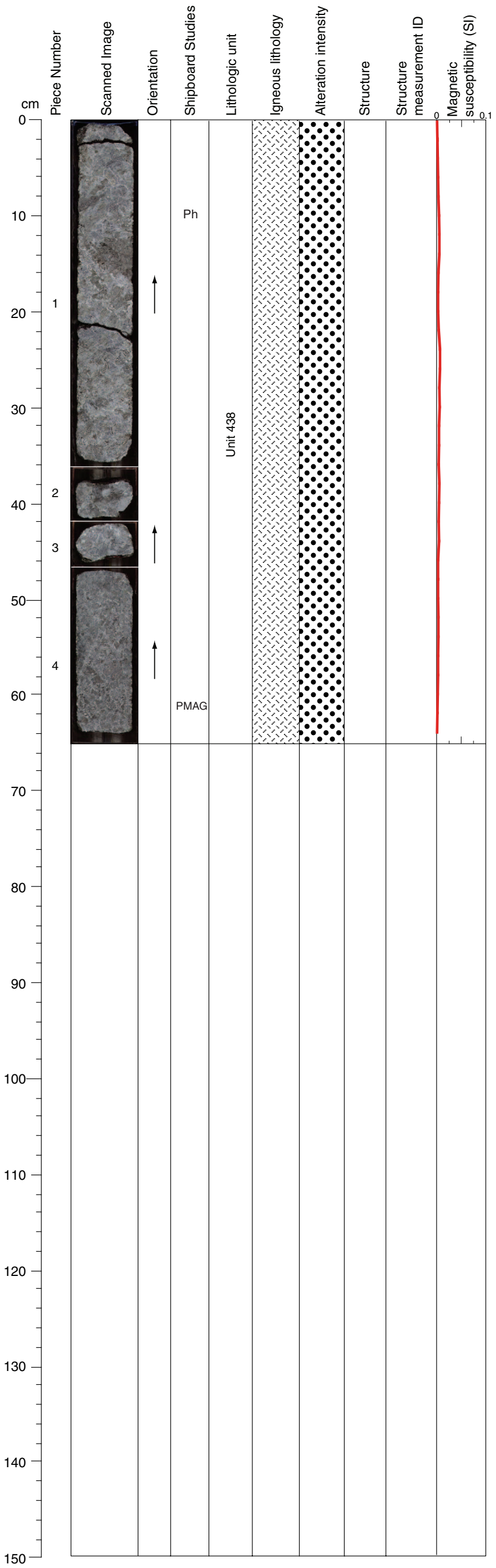
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-164R-3, 113-115 cm (#422)**

STRUCTURE: Fine grained gabbro with neither clear magmatic nor plastic fabric. Catalcastic zones locally.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-164R-3, 110-125 cm WET

## Core Photo




**305-U1309D-164R-4 (Section top: 802.61 mbsf)**

UNIT-438: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 60 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 438 coarse-grained gabbro. Pegmatitic clinopyroxene in upper half of section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

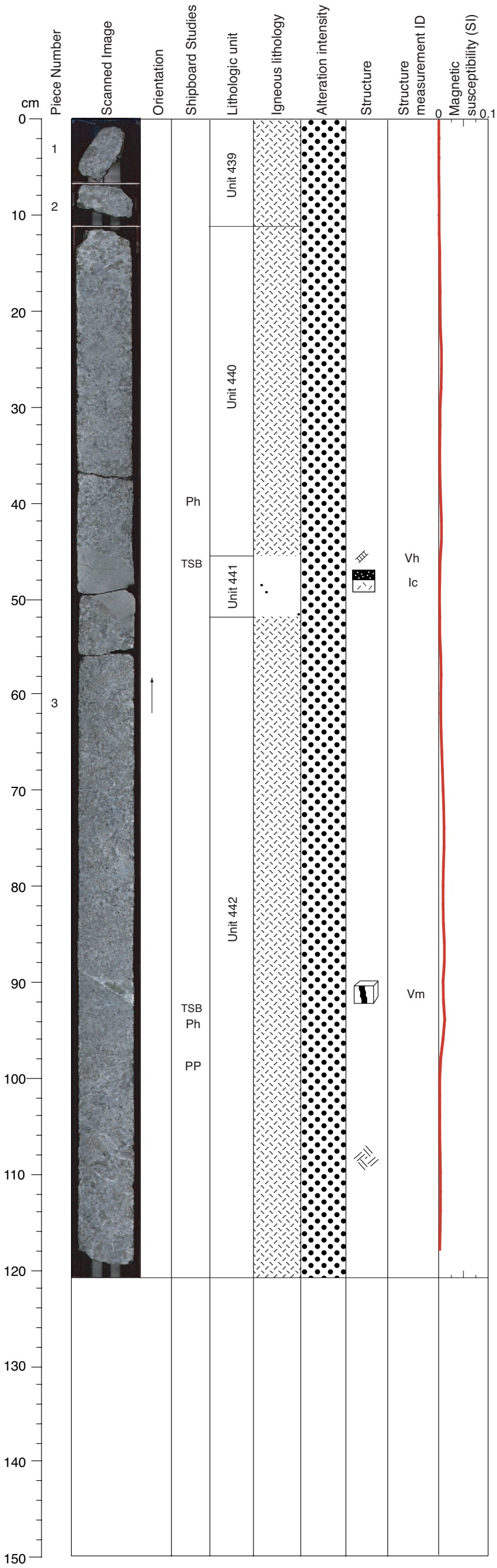
COMMENTS: This section is similar in alteration character to the coarser gabbro of the previous section. There is a slightly lighter alteration patch in the middle of Piece 1b. Pyroxene grains have a reaction rim of green amphibole, but no corona texture appears in this section.

VEIN ALTERATION: Chlorite, talc.

STRUCTURE: Fine-grained gabbro with neither clear magmatic nor plastic fabric. Catalcastic zones locally.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-164R-4, 0-22 cm WET

## Core Photo




**305-U1309D-165R-1 (Section top: 803.80 mbsf)**

UNIT-439: Gabbro rubble
Pieces: 1-2

COMMENTS: Unit 439 gabbro rubble, may be in place.

UNIT-440: Gabbro (gabbronorite)
Pieces: 3a-3b

PRIMARY MINERALOGY: Modal data from Piece 3a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 15 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 440 is medium-grained gabbro. Orthopyroxene up to 5% observed in thin section.

UNIT-441: Microgabbronorite
Pieces: 3b-3c

PRIMARY MINERALOGY: Modal data from the thin section

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 0.2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 0.2 mm average<br>Shape anhedral |
| Orthopyroxene | Modal 5%<br>Size 0.2 mm average<br>Shape anhedral |

COMMENTS: Unit 441 microgabbro dike, 4 cm wide with sharp contacts with surrounding gabbro.

UNIT-442: Gabbro
Pieces: 3c-3d

PRIMARY MINERALOGY: Modal data from Piece 3d

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 15 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 442 is medium-grained gabbro. Leucocratic dikelet (< 13 mm) at: 89-93 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The alteration of the gabbro in this section is similar to that of the previous section, but there are patches of light alteration in Pieces 2 and the top of Piece 3a. The diabase in the interval from 45 to 52 cm also has a green cast, suggesting a similar extent of alteration. There are no visible veins in the microgabbro, but a fracture (drilling related?) cuts the bottom of Piece 3b. Fine green veins with green alteration halos cut the section in the coarser gabbro. A zone of leucocratic alteration/intrusion cuts part way through Piece 3d at about 89 to 93 cm.

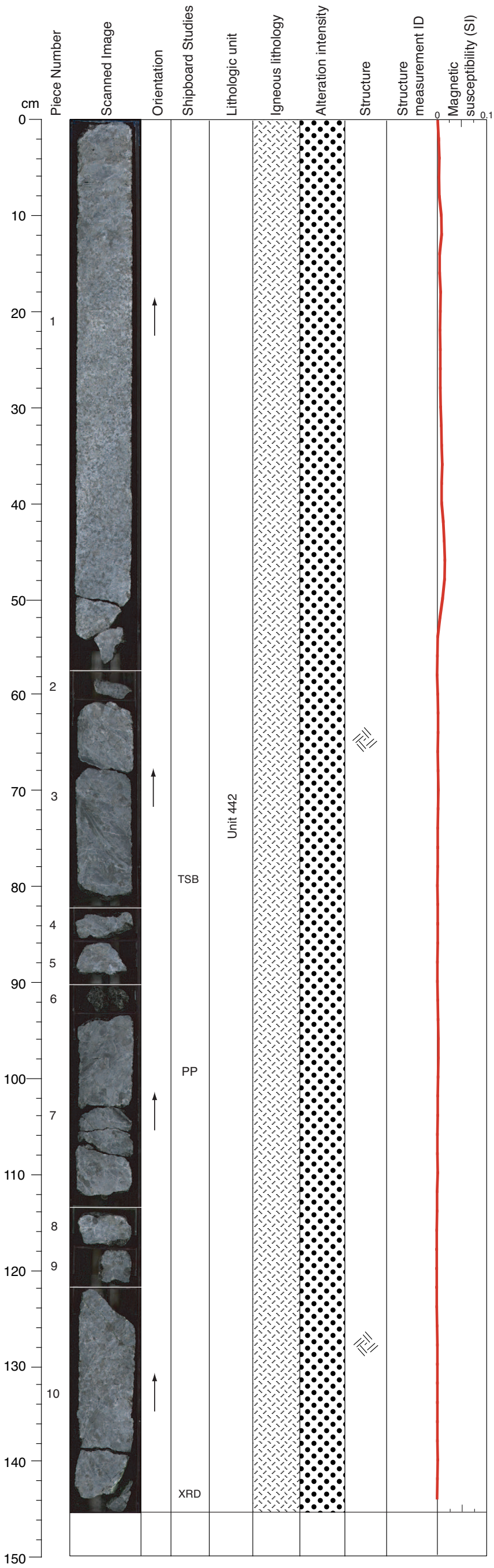
VEIN ALTERATION: Amphibole, plagioclase, chlorite.

THIN SECTIONS:
**305-U1309D-165R-1, 44-47 cm (#423)**
**305-U1309D-165R-1, 90-93 cm (#424)**

STRUCTURE: Medium-grained gabbro, slight coarsening toward bottom of core, no ductile fabric, igneous contact to microgabbro preserved. Dark green veins crosscut the dike contact, and open (drill?) cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-165R-1, 38-56 cm WET
305-U1309D-165R-1, 87-107 cm WET

## Core Photo




**305-U1309D-165R-2 (Section top: 805.02 mbsf)**

UNIT-442: Gabbro
Pieces: 1-10

PRIMARY MINERALOGY: Modal data from Pieces 1a, 3b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 35 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 442 is medium- to coarse-grained gabbro. Orthopyroxene up to 2% observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

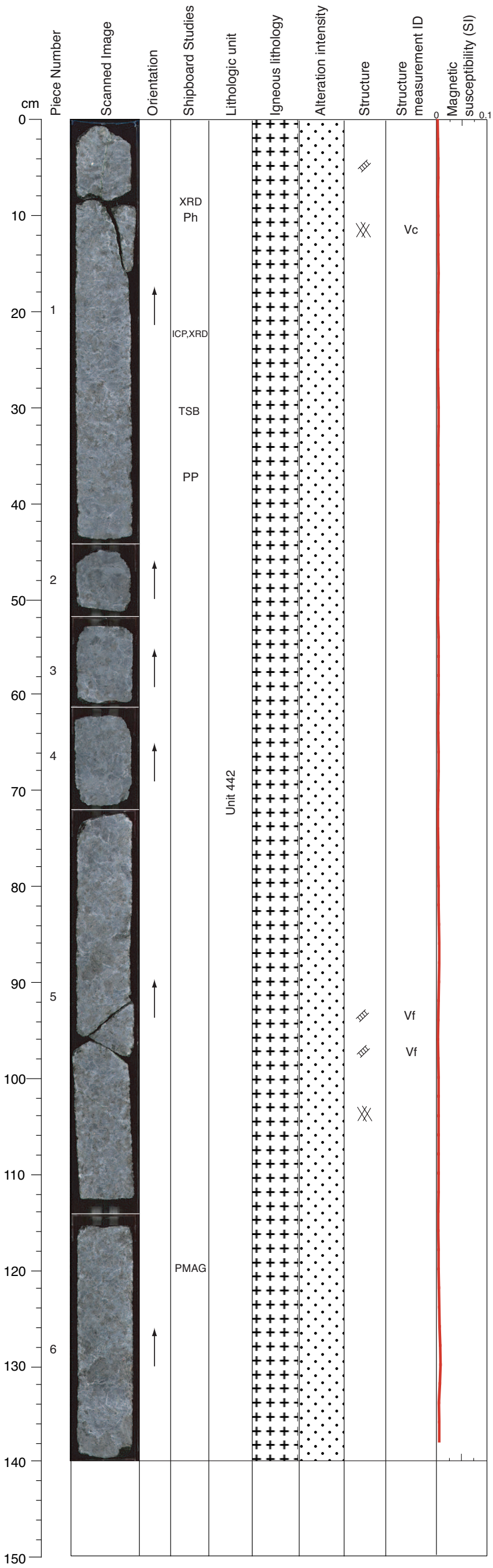
COMMENTS: The alteration of this section is similar to that of the previous indicating a similar degree of alteration of the gabbro despite changes in grain size. A thin zone of light alteration caps Piece 1 and occurs as patches throughout the coarser and finer grained areas of the piece. In the coarser gabbro of the bottom halt of the section numerous fractures (drilling related?) cut the core. Only one green vein is visible in the bottom part of Piece 6. It is discontinuous or possibly branching.

VEIN ALTERATION: Chlorite and talc.

THIN SECTIONS:
**305-U1309D-165R-2, 77-79 cm (#425)**

STRUCTURE: Gabbro with coarse clinopyroxene grains changing abruptly to medium grained and back to coarse grained, but no ductile fabric. No veins.

## Core Photo




**305-U1309D-165R-3 (Section top: 806.47 mbsf)**

UNIT-442: Gabbronorite
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 6

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Orthopyroxene | Modal 25%<br>Size to 55 mm<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 20%<br>Size to 55 mm<br>Shape anhedral to interstitial |

COMMENTS: Continuation of Unit 442 medium- to coarse-grained gabbronorite. Modes indicating gabbronorite determined after thin section inspection.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The background alteration of the gabbro is similar to that of previous sections. There is a green to green/white vein that cuts Piece 1a and into the top of Piece 1b/c where it branches and runs down the side of the piece. Patches of light alteration occur throughout the section. Between 92 and 99 cm two green/white conjugate veins crosscut the section.

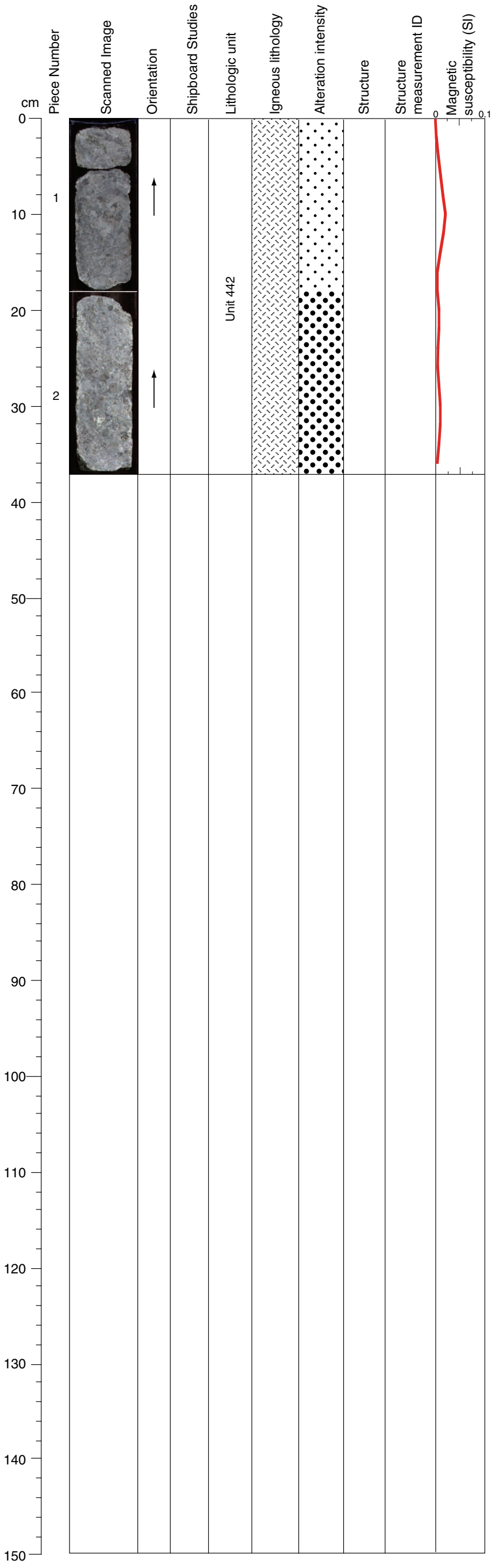
VEIN ALTERATION: Chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-165R-3, 28-31 cm (#426)**

STRUCTURE: Medium- to coarse-grained gabbro, no ductile fabric visible. Irregular cracks, possibly veins, which are crosscut by vertical, irregular pale green vein with white halo.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-165R-3, 0-20 cm WET
305-U1309D-165R-3, 24-44 cm WET

## Core Photo




**305-U1309D-165R-4 (Section top: 807.87 mbsf)**

UNIT-442: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from piece 2

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 30 mm<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 442 medium- to coarse-grained gabbro.

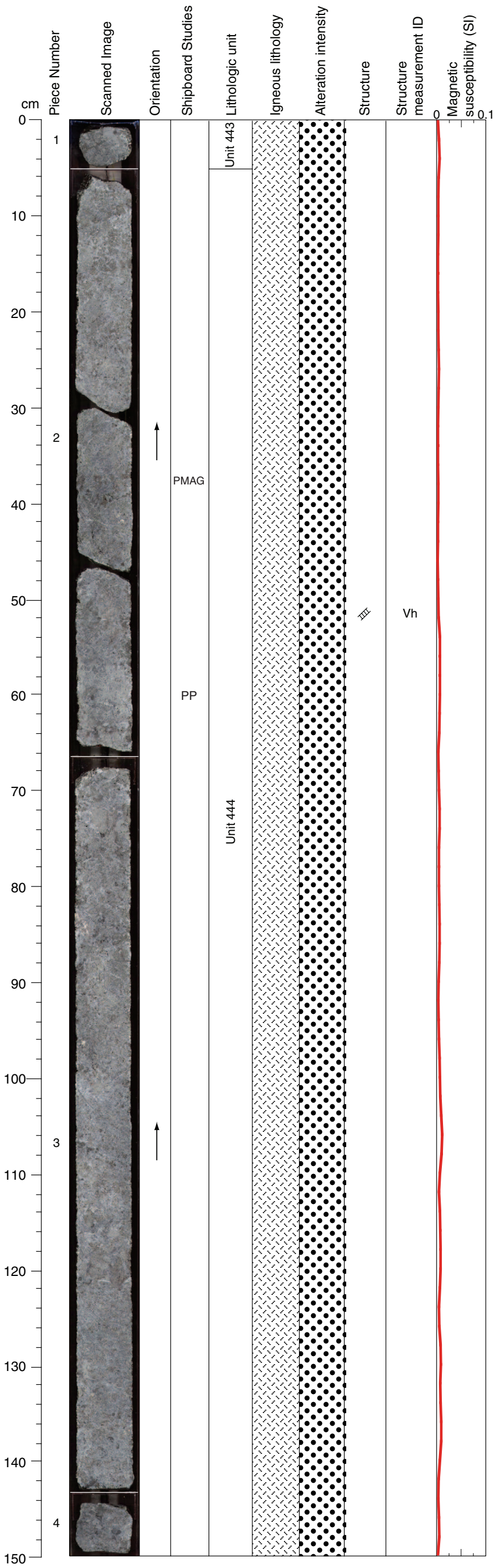
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The type of general background alteration is similar to the previous section, however, Piece 2 has distinctly more white (plagioclase) alteration and a white grain of replaced olivine(?) in Piece 2.

VEIN ALTERATION: Chlorite, talc.

STRUCTURE: Coarse-grained gabbro exhibiting no fabric. Irregular cracks, possibly veins.

## Core Photo




**305-U1309D-166R-1 (Section top: 808.60 mbsf)**

UNIT-443: Gabbro rubble
Pieces: 1

COMMENTS: Unit 443 gabbro rubble, may be in place.

UNIT-444: Gabbro
Pieces: 2-4

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 30 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 444 is medium- to coarse-grained gabbro. More clinopyroxene-rich at 67-80 cm.

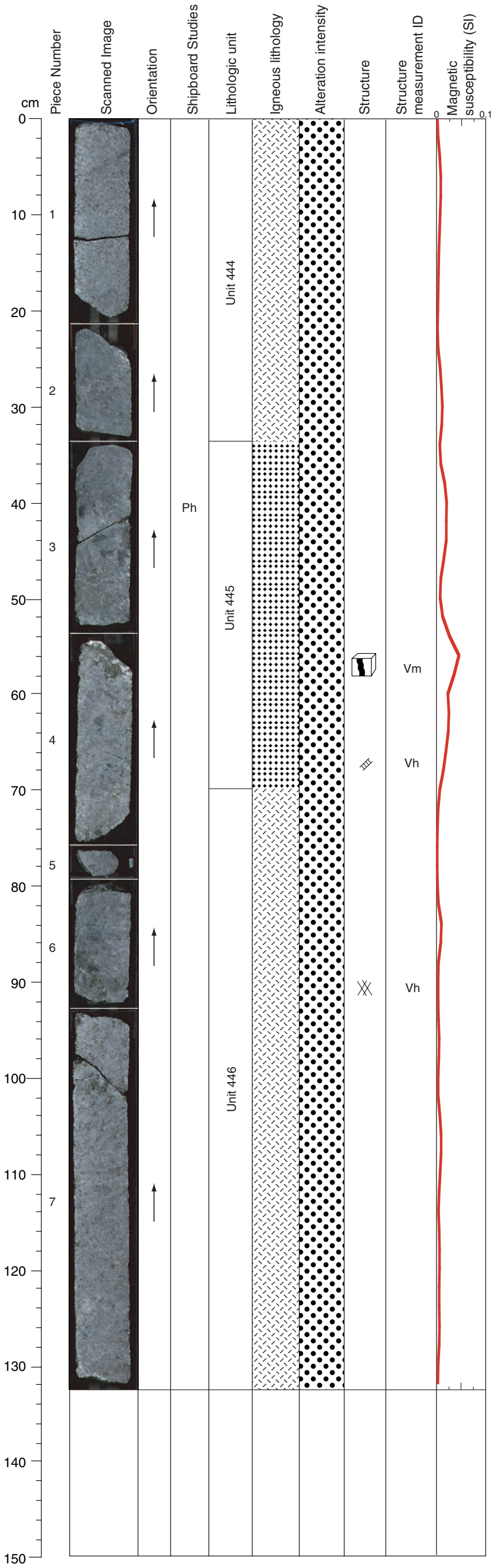
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration in this section, except for Piece 1, which is slightly less altered, is similar to Piece 2 of the previous section with distinctly more white (plagioclase) alteration and a few light-colored grains/patches of replaced olivine(?). There is development of faint corona texture in the pale green interval from 57 cm to 63 cm.

VEIN ALTERATION: Amphibole, chlorite, talc.

STRUCTURE: Coarse-grained gabbro with no ductile fabric. Few veins or cracks.

## Core Photo




**305-U1309D-166R-2 (Section top: 810.10 mbsf)**

UNIT-444: Gabbro
Pieces: 1-3a

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 30 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 444 is medium-grained gabbro.

UNIT-445: Olivine Gabbro
Pieces: 3a-4

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Olivine | Modal 8%<br>Size 2-13 mm<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 42%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 445 is medium- to coarse-grained olivine gabbro. Leucocratic dikelet at 54-58 cm.

UNIT-446: Gabbro
Pieces: 4-7

PRIMARY MINERALOGY: Modal data from Piece 6

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 10 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 446 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

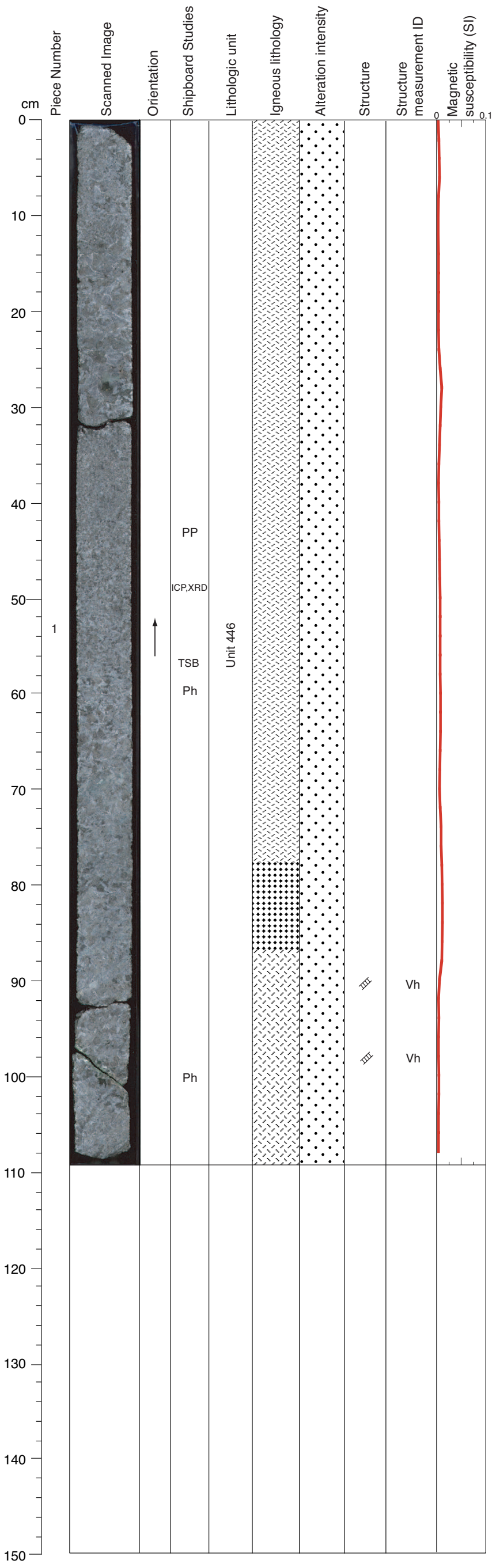
COMMENTS: General background alteration is somewheat less intense than in the previous section. However, there are several patches of light (plagioclase) alteration and green amphibole and green veins cutting the section, especially in Pieces 4 and 6.

VEIN ALTERATION: Chlorite, talc.

STRUCTURE: Coarse-grained gabbro with no ductile strain fabric. Dark green veins and minor cracks with white infills.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-166R-2, 34-53 cm WET

## Core Photo




**305-U1309D-166R-3 (Section top: 811.44 mbsf)**

UNIT-446: Olivine Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 10 mm<br>Shape subhedral to anhedral |

COMMENTS: Unit 446 is medium-grained gabbro. More clinopyroxene-rich at 24-45 cm, olivine gabbro at 75-86 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General background alteration is similar to other gabbro sections, but locally plagioclase grain boundaries appear to have more light colored alteration rims and a pyroxene at about 27 cm in Piece 1a is completely altered to green amphibole. A few green veins with narrow, surrounding leucocratic alteration zones cut the section and the rock has broken along three of them.

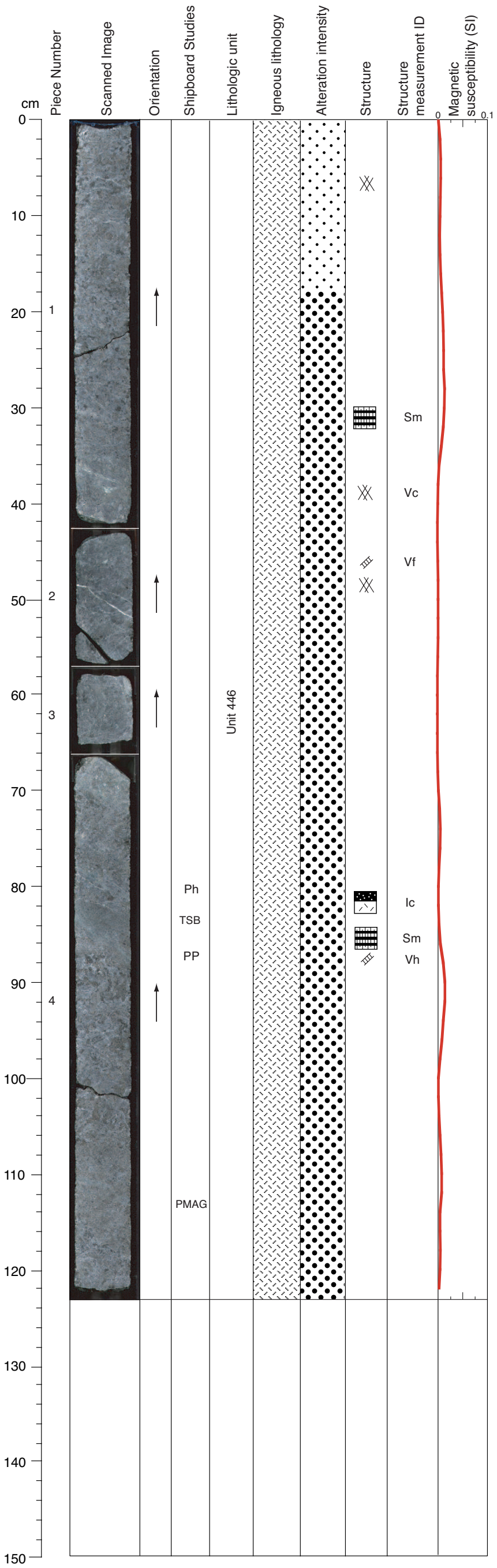
VEIN ALTERATION: Amphibole, chlorite, talc.

THIN SECTIONS:
**305-U1309D-166R-3, 55-57 cm (#427)**

STRUCTURE: Fairly mafic gabbro with coarse clinopyroxene grains and no ductile fabric. Almost no veins or cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-166R-3, 50-70 cm WET
305-U1309D-166R-3, 93-108 cm WET

## Core Photo




**305-U1309D-166R-4 (Section top: 812.53 mbsf)**

UNIT-446: Olivine-bearing Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 446 medium- to coarse-grained gabbro. An interval of microgabbro occurs at 80-88 cm. Local olivine-bearing (2% modal) interval from 16-34 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration of the gabbro in this section is similar to previous sections. Several green and white veins cut the section and vary in the amount of green vs white material, for example Piece 1a from 36 to 39 cm, Piece 2 from 48 to 52 cm and in Piece 4, the network of branching green and white veins from 78 to 83 cm. The top of Piece 4 is also slightly more altered than the remainder of the section. It contains at least two small green and white veins. Some of the veins are associated with irregular halos of light (leucocratic) alteration. A solitary patch of altered pyroxene at 38 to 39 cm may be associated with a nearby vein.

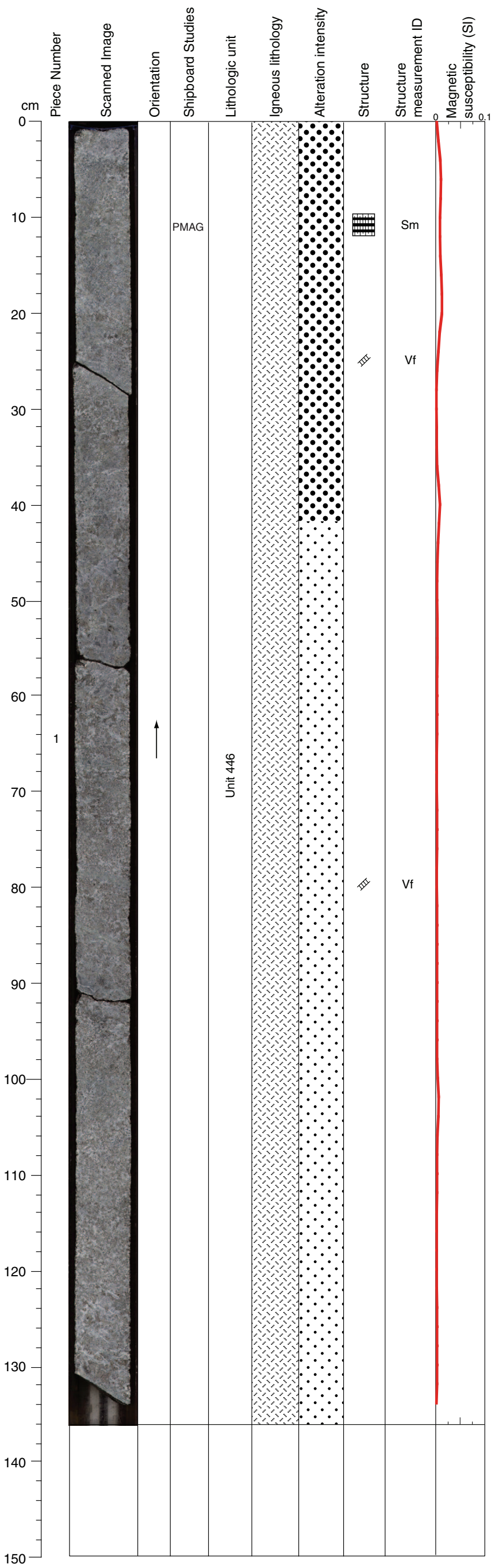
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-166R-4, 81-84 cm (#428)**

STRUCTURE: Medium- to coarse-grained gabbro showing locally weak magmatic foliation which is also seen in the microgabbroic interval. A few veins with dark green infill and minor cracks with white infill.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-166R-4, 75-95 cm WET

## Core Photo




**305-U1309D-167R-1 (Section top: 813.40 mbsf)**

UNIT-446: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 446 medium- to coarse-grained gabbro.

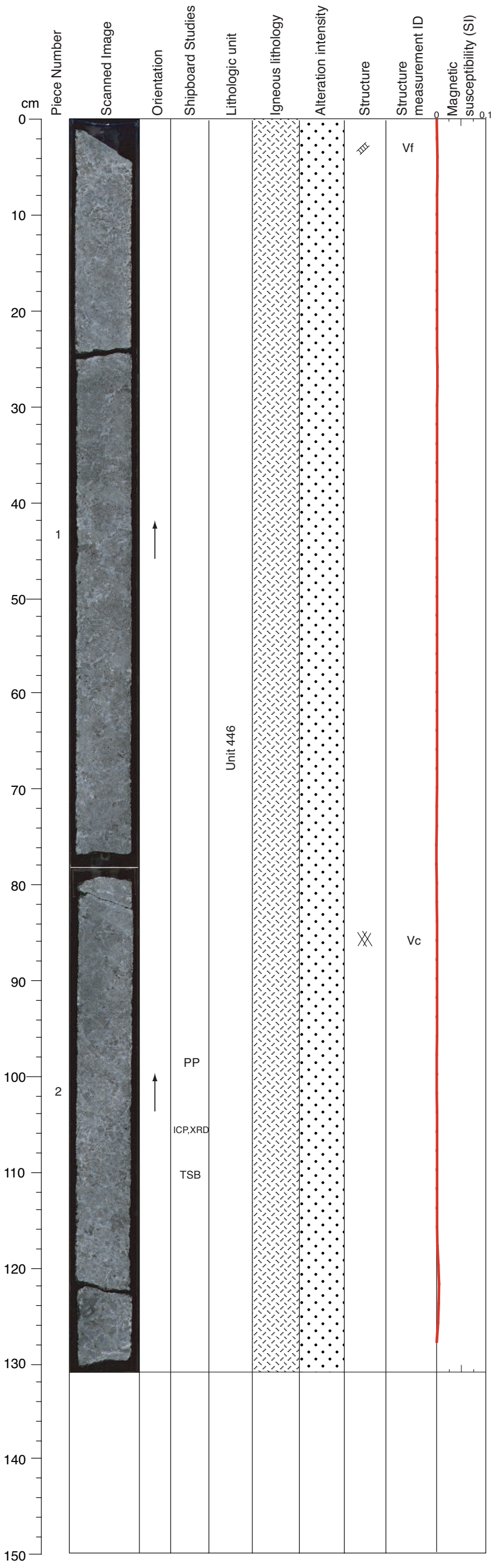
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General alteration is similar to the previous section. Veins that crosscut the section have halos of slightly more altered gabbro and the rock tends to break along vein surfaces.

VEIN ALTERATION: Amphibole, chlorite, talc.

STRUCTURE: Medium-grained gabbro with magmatic foliation, becomes coarse grained in lower half of section, no fabric except grain size layering. Alteration bands and some white veins.

## Core Photo




**305-U1309D-167R-2 (Section top: 814.76 mbsf)**

UNIT-446: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 446 medium- to coarse-grained gabbro. Orthopyroxene up to 2% observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration is low and similar to previous section.

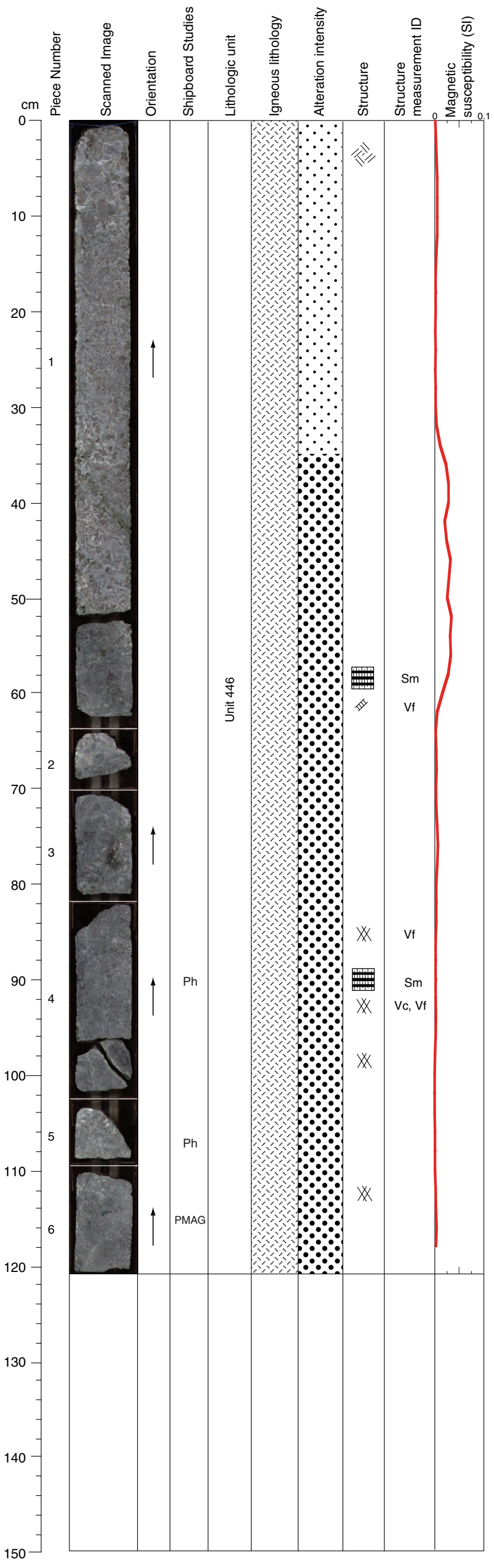
VEIN ALTERATION: Amphibole, chlorite, talc.

THIN SECTIONS:
**305-U1309D-167R-2, 109-111 cm (#429)**

STRUCTURE: Medium- to coarse-grained gabbro, no ductile fabric. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-167R-2, 100-120 cm WET

## Core Photo




**305-U1309D-167R-3 (Section top: 816.07 mbsf)**

UNIT-446: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 2-40 mm<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 446 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

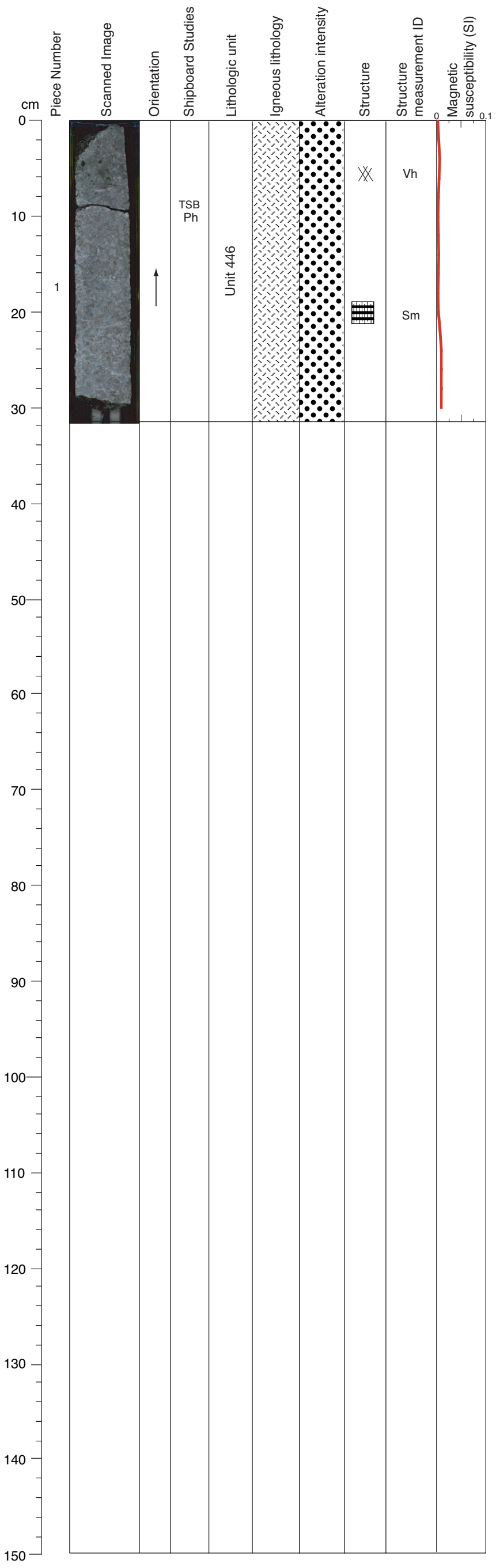
COMMENTS: Alteration is similar to previous sections with the exception that there are 3 zones of slightly higher alteration associated with fine green veins and which are related to a higher degree of green amphibole formation after pyroxene in the gabbro (bottom of Piece 1 and the center of Piece 3).

VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

STRUCTURE: Medium-grained gabbro with shallowly dipping magmatic foliation visible in finer grained parts. Some fault veins (pale green) crosscut by later white-filled cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-167R-3, 82-102 cm WET
305-U1309D-167R-3, 103-119 cm WET

## Core Photo




**305-U1309D-167R-4 (Section top: 817.28 mbsf)**

UNIT-446: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 2-40 mm<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 446 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration is the same as the previous section.

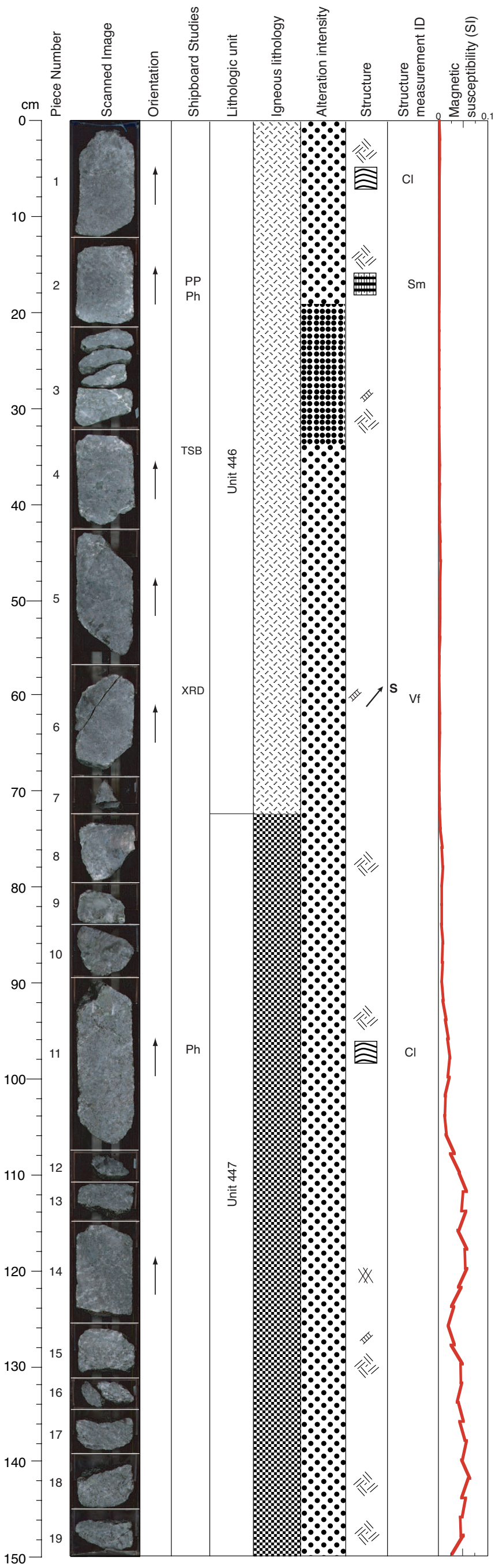
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-167R-4, 7-10 cm (#430)**

STRUCTURE: Medium-grained gabbro, patches with magmatic foliation visible. A few fault veins (pale green) crosscut by later white-filled cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-167R-4, 0-20 cm WET

## Core Photo




**305-U1309D-168R-1 (Section top: 818.20 mbsf)**

UNIT-446: Gabbro
Pieces: 1-7

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 1 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 446 medium-grained gabbro. Leucocratic (alteration zone? coarse plagioclase) at 20-35 cm. Oxides occur locally. Up to 3% orthopyroxene observed in thin section.

UNIT-447: Oxide Gabbro
Pieces: 8-19

PRIMARY MINERALOGY: Modal data from Piece 15

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 47%<br>Size 3 mm average<br>Shape subhedral to anhedral |
| Oxide | Modal 3%<br>Size 1 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 447 medium- to coarse-grained oxide gabbro. Green mineral altered from clinopyroxene?

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Background alteration is similar to the previous section, but there is more patchy leucocratic alteration, especially in intervals where the rock is broken into several pieces. Green and white veins cut the section in several places and vein-filling material can be seen mantling the faces of the tops and bottoms of many of the pieces (suggesting multiple sets of crosscutting veins).

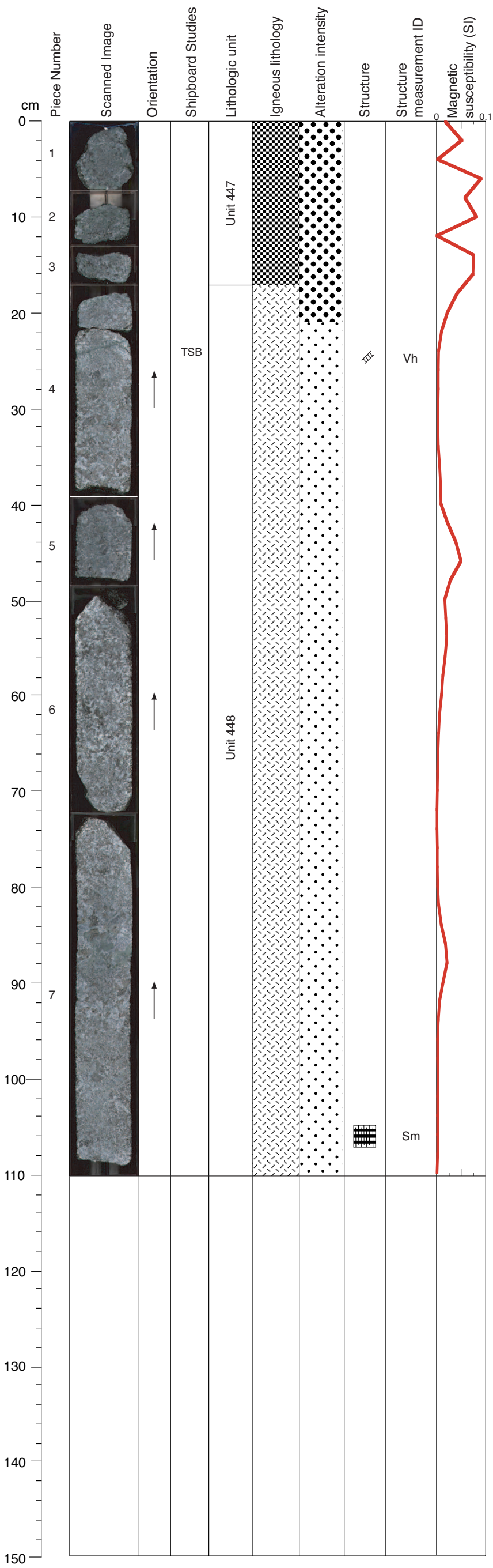
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-168R-1, 33-36 cm (#431)**

STRUCTURE: Grain size layering, fine- to medium-grained gabbro with weak magmatic fabric oblique to grain size layering. A few veins with fibrous mineral infill and minor distributed cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-168R-1, 14-42 cm WET
305-U1309D-168R-1, 90-107 cm WET

## Core Photo




**305-U1309D-168R-2 (Section top: 819.70 mbsf)**

UNIT-447: Oxide Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 47%<br>Size 3 mm average<br>Shape subhedral to anhedral |
| Oxide | Modal 3%<br>Size 1 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 447 medium- to coarse-grained oxide gabbro.

UNIT-448: Gabbro
Pieces: 4-7

PRIMARY MINERALOGY: Modal data from Piece 6

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 8 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 448 coarse-grained gabbro. Coarse grained clinopyroxene (dikelet) at 86 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to the previous section, for the most part although there are patches where green amphibole alteration after pyroxene grains dominate the alteration (center of Piece 7).

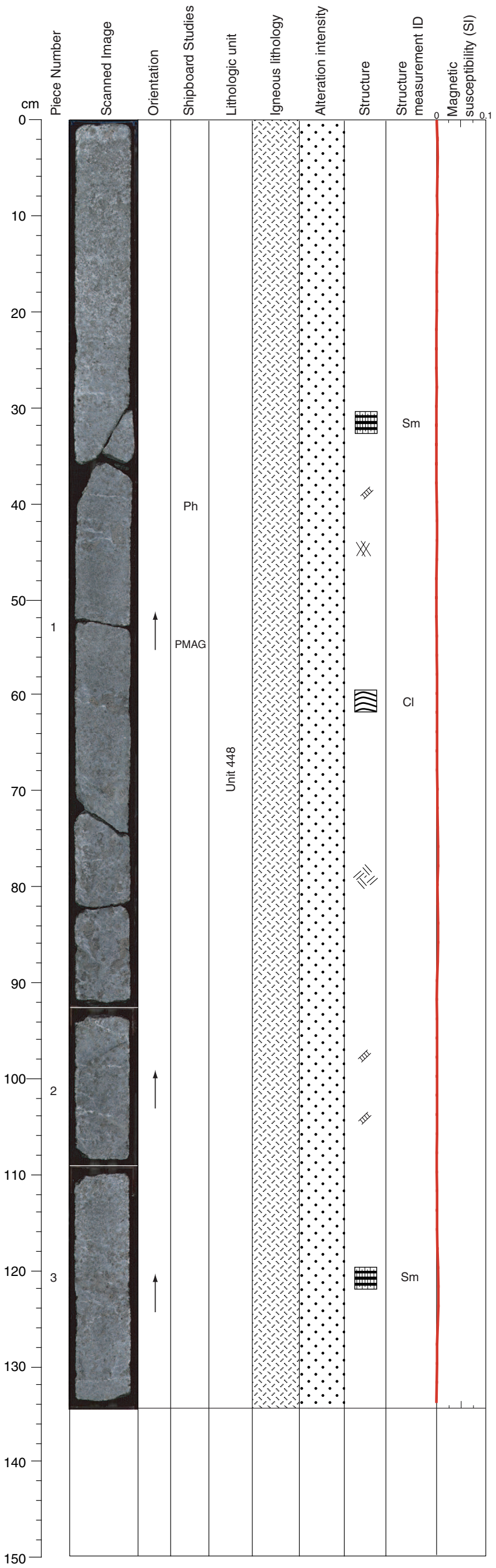
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-168R-2, 22-25 cm (#432)**

STRUCTURE: Medium to coarse gabbro with some grain size layering, in bottom of section finer grained interval with weak magmatic strain (Sm). A dark green vein with alteration halo and minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-168R-2, 17-39 cm WET

## Core Photo




**305-U1309D-168R-3 (Section top: 820.80 mbsf)**

UNIT-448: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 8 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium- to coarse-grained gabbro. Coarse-grained clinopyroxene (dikalet) at 28, 43, 60 and 105 cm. Fine-grained gabbro at 36-72 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

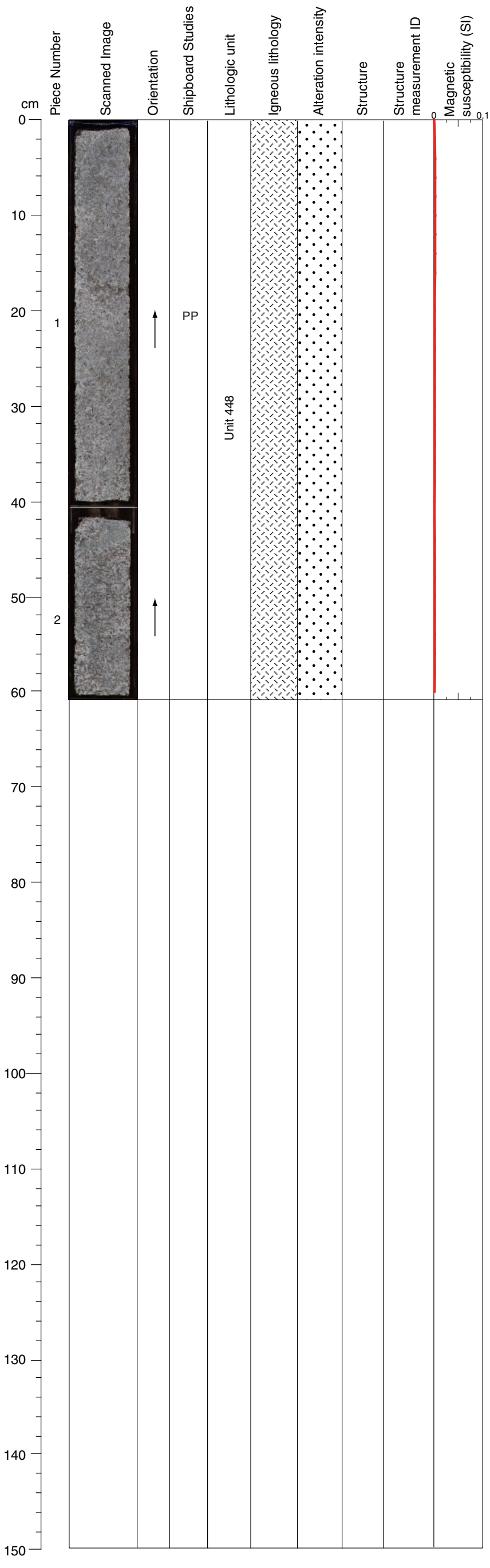
COMMENTS: Alteration is similar to the previous section, but less extensive.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine, locally coarser grained gabbro with clear shallowly dipping magmatic foliation (Sm) and grain size layering. Minor subhorizontal white cracks (veins?).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-168R-3, 37-53 cm WET

## Core Photo




**305-U1309D-168R-4 (Section top: 822.14 mbsf)**

UNIT-448: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 4 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium-grained gabbro.

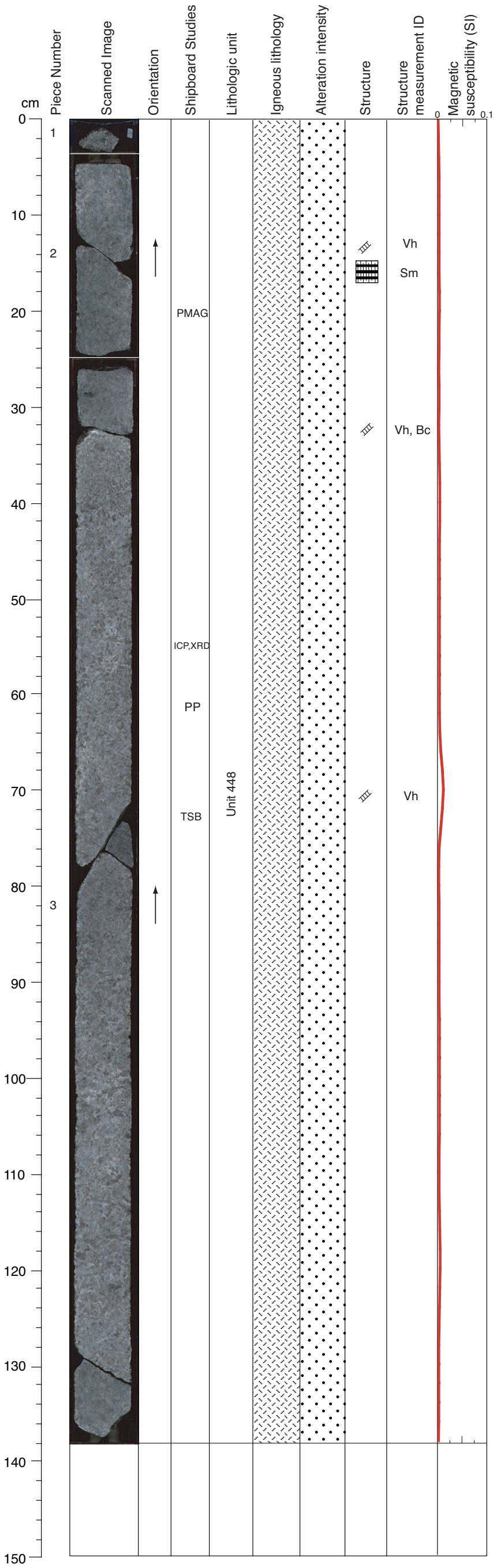
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration is similar to the previous section, but there is a green alteration halo around a vein that cuts the bottom of Piece 1 and the top of Piece 2.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Massive gabbro with irregular cracks, possibly veins.

## Core Photo




**305-U1309D-169R-1 (Section top: 823.00 mbsf)**

UNIT-448: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 2d

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 6 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium-grained gabbro. Thin leucocratic dikelet at 33 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Alteration is similar to the last section, but also includes a thin light-colored alteration zone at the top of Piece 3b. A green vein cuts nearly vertically through much of the section and is crosscut by sets of fine green veins along which several of the pieces have broken (see Piece 3, 71 to 81 cm).

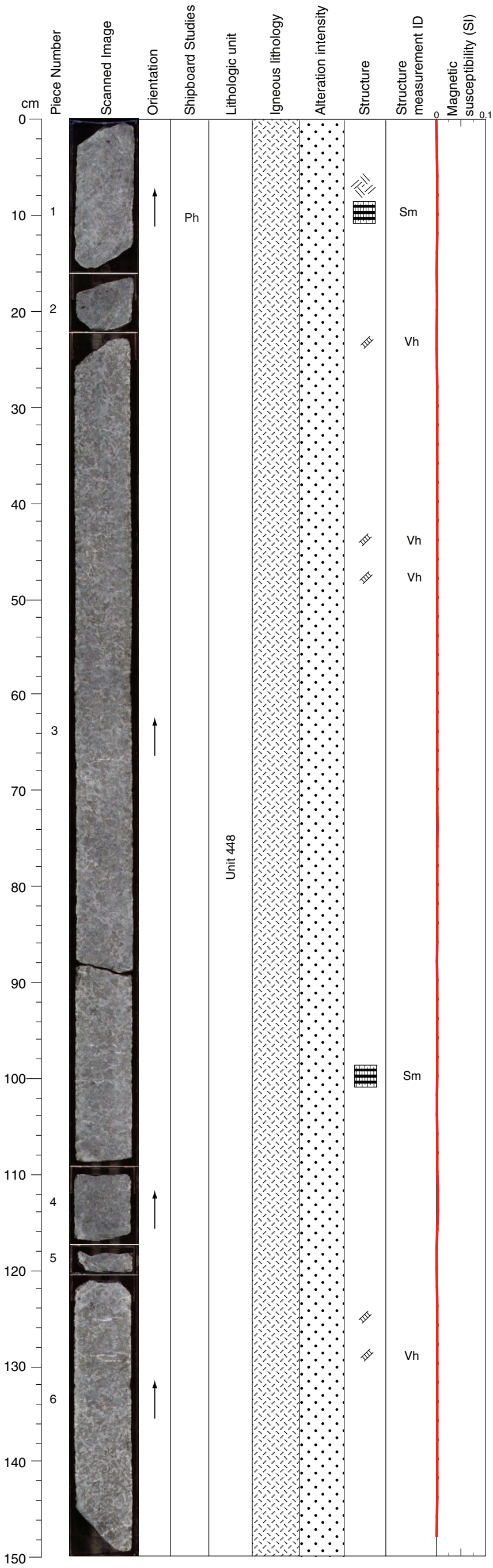
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-169R-1, 70-73 cm (#433)**

STRUCTURE: Medium- to coarse-grained gabbro with weak ductile fabric at top of section in finer grained part. A couple of dark green veins (a steep one extending over several pieces).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-169R-1, 60-77 cm WET

## Core Photo




**305-U1309D-169R-2 (Section top: 824.38 mbsf)**

UNIT-448: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 6 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Background alteration is very similar to the previous section including a green vein set that runs the length of the section and several crosscutting green/white veins along which the pieces are broken.

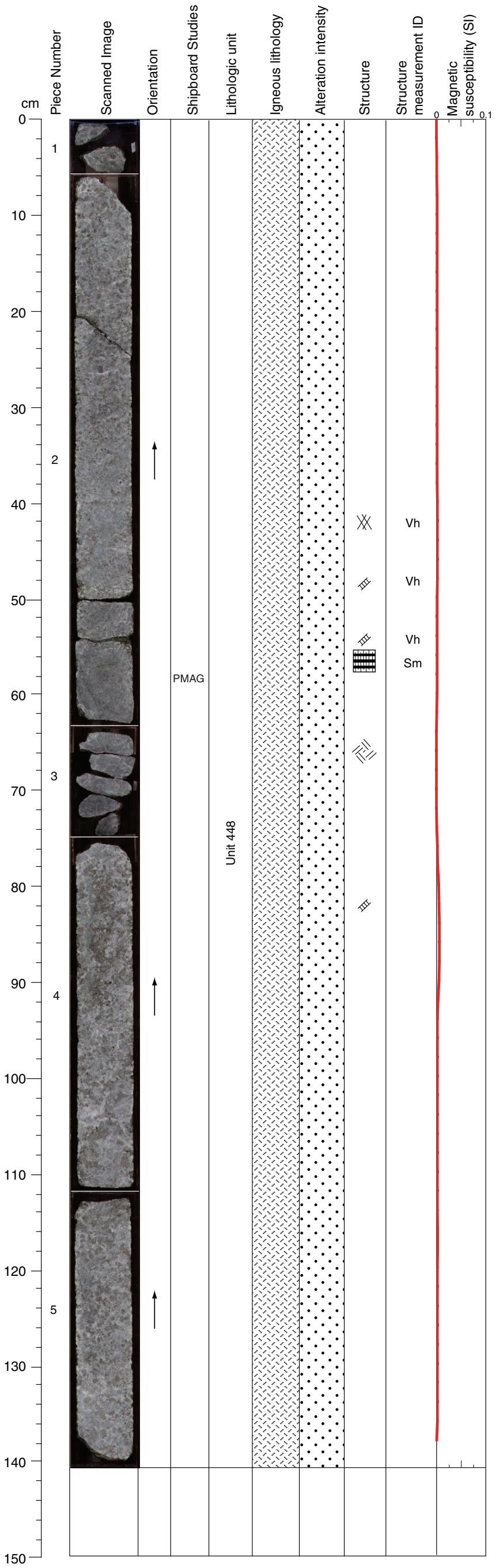
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:

STRUCTURE: Medium-grained gabbro with weak magmatic fabric visible in most parts. A few fractures at bottom.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-169R-2, 0-15 cm WET

## Core Photo




**305-U1309D-169R-3 (Section top: 825.88 mbsf)**

UNIT-448: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 6 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium-grained gabbro. Leucocratic band at 62-76 cm and contact at bottom of Piece 2d.

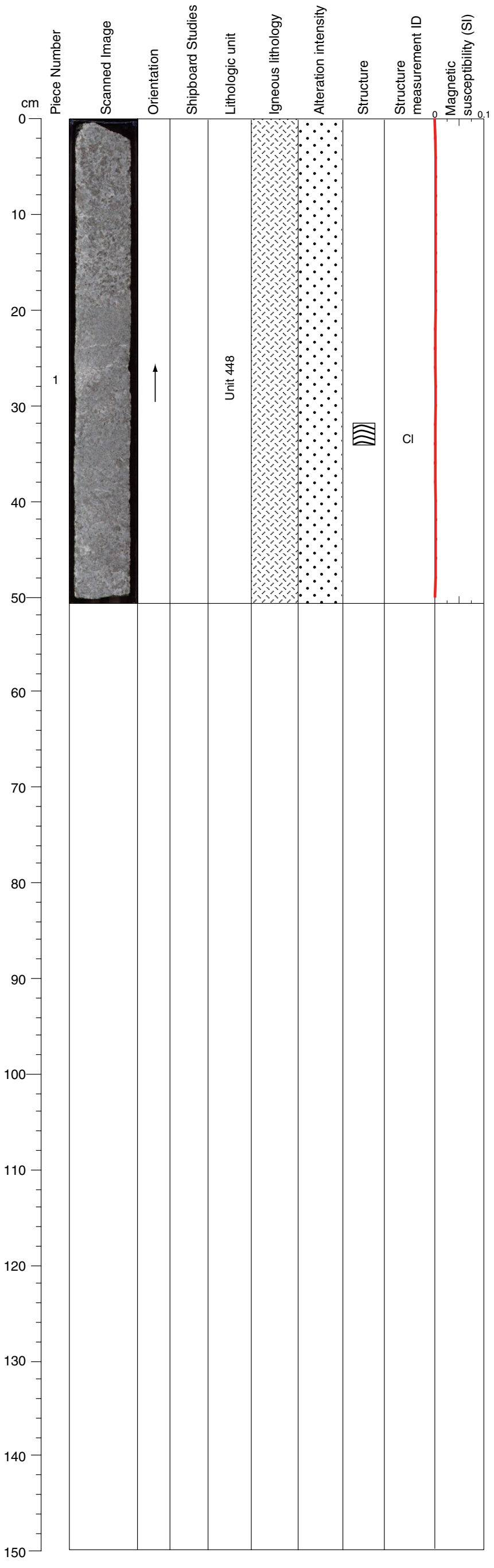
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Medium-grained gabbro with rim of green amphibole around the minerals. Dark green blue veins cut all the section. At 49 and 54 cm, pale green veins with alteration halos.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Fine- to medium-grained gabbro with weak fabric of magmatic origin locally visible. A few subhorizontal white veins.

## Core Photo




**305-U1309D-169R-4 (Section top: 827.28 mbsf)**

UNIT-448: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 6 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium-grained gabbro. Fine grained zone with diffusive contact at 19-25 cm.

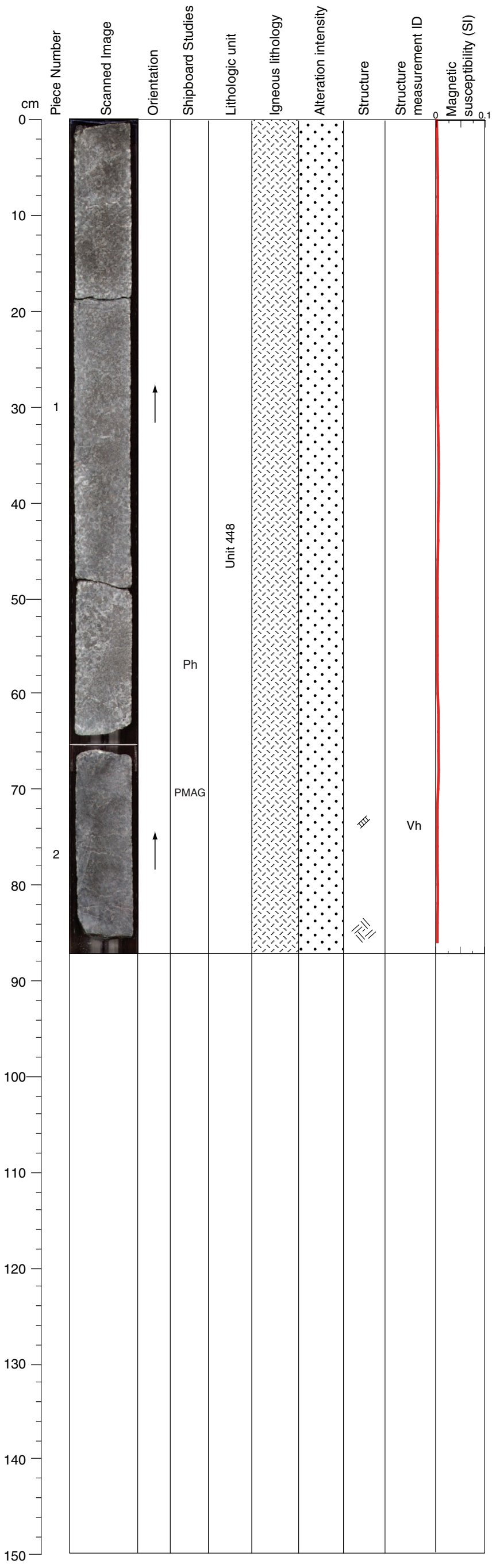
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section, but also contains a zone of finer grained gabbro and appears to have a fracture (or light-colored vein?) that cuts subhorizontally across the finer grained interval. The fine-grained gabbro has a patchy area of lighter, more heavily altered material (probably altered edges of plagioclase?).

VEIN ALTERATION: n/a

STRUCTURE: Fine- to medium-grained gabbro with pronounced grain size layering oblique to locally discernible weak magmatic foliation.

## Core Photo




**305-U1309D-170R-1 (Section top: 827.80 mbsf)**

UNIT-448: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1 and 2

| | |
|---|---|
| Plagioclase | Modal 60-65%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35-40%<br>Size 4-8 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium- to coarse-grained gabbro. Mode and grain size heterogeneous in this section. Rare oikocrystal pyroxene.

SECONDARY MINERALOGY: Chlorite, pale amphibole

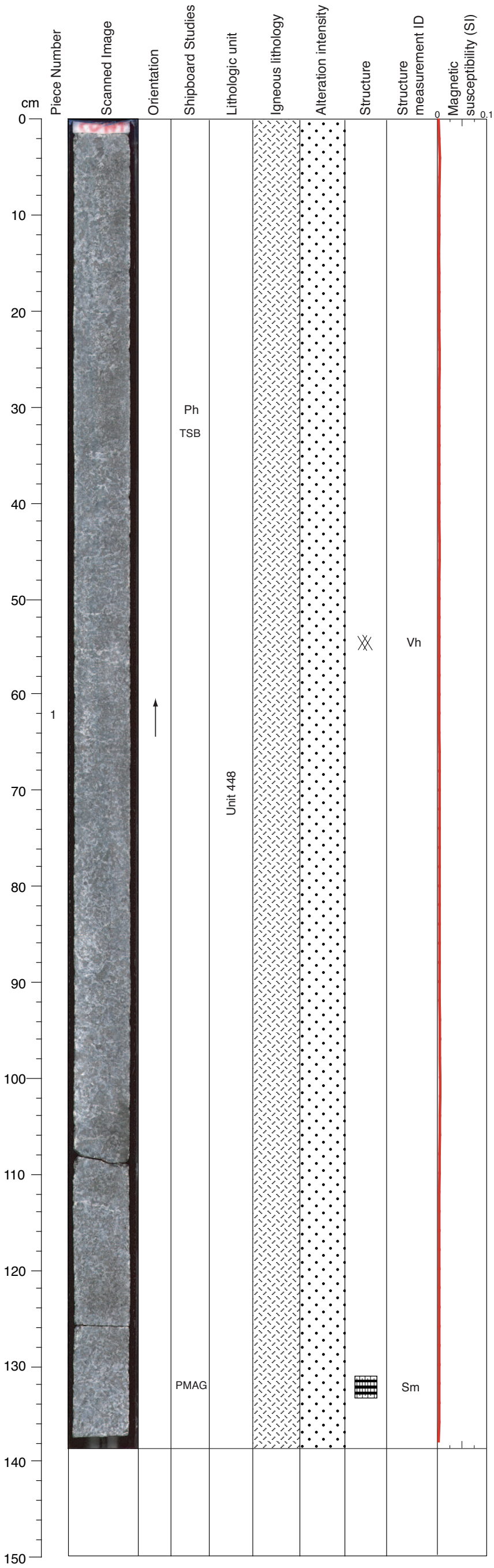
COMMENTS: The general background alteration is similar to the previous section. In this section the coarser grained gabbro appears to have more alteration at the edges of plagioclase, forming a white network of outlines around plagioclase grains. Alteration of plagioclase adjacent to fine green veins is also apparent.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Gabbro with sharp, discontinuous grain size differences, no consistent ductile fabric. A few subhorizontal white veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-170R-1, 50-65 cm WET

## Core Photo




**305-U1309D-170R-2 (Section top: 828.67 mbsf)**

UNIT-448: Gabbro (Gabbronorite)
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1a and 1c

| | |
|---|---|
| Plagioclase | Modal 60-65%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35-40%<br>Size 4-10 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 fine- to coarse-grained gabbro. Mode and grain size heterogeneous in this section. Up to 20% orthopyroxene observed in thin section, chosen to be representative for this unit.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section, with small rims of amphibole around the olivines and the pyroxene. From 1 to 90 cm, dark green-blue veins (chlorite, green amphibole) cut the section.

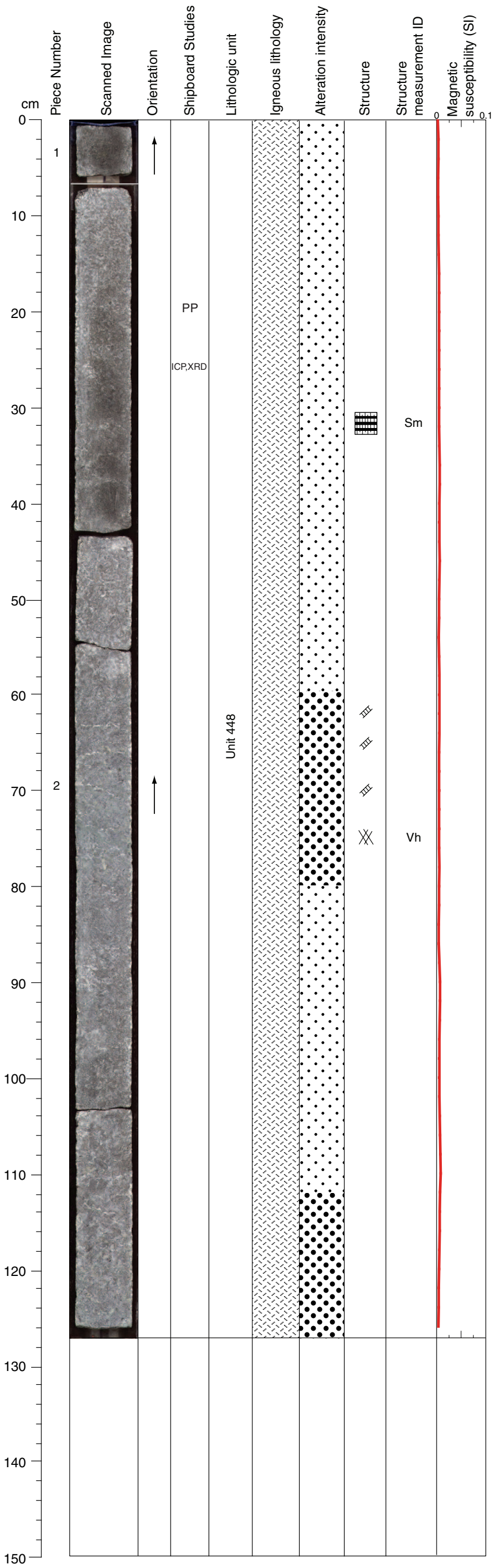
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-170R-2, 32-34 cm (#434)**

STRUCTURE: Medium-grained gabbro with local patches of fine-grained material, then with indication of weak magmatic fabric. A long subvertical dark green vein (Vh).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-170R-2, 20-40 cm WET
305-U1309D-170R-2, 126-135 cm WET

## Core Photo




**305-U1309D-170R-3 (Section top: 830.06 mbsf)**

UNIT-448: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 6 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium- to coarse-grained gabbro. Mode and grain size heterogeneous in this section.

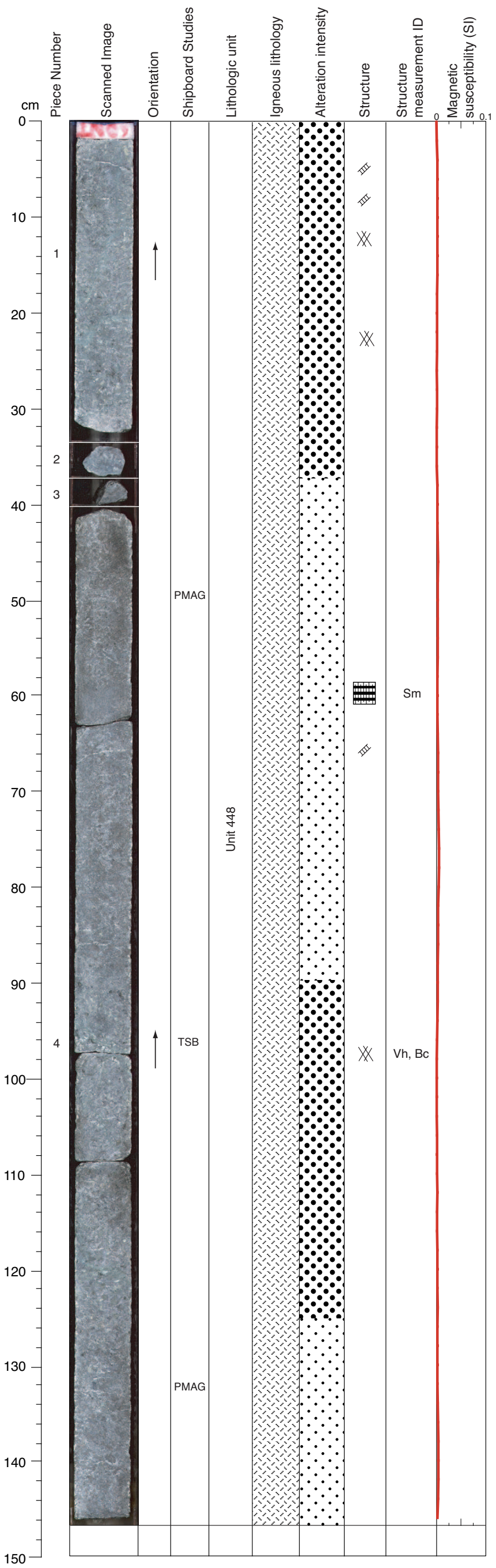
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Same type of rock as previous section with the same degree of alteration. From 60 to 80 cm, alteration zone rich in green amphibole (and chlorite?). Shiny pyroxenes (likely altered to green amphibole) appear. This amphibole-rich zone is also observed from 110 to 126 cm where the grain size is larger. The olivines and pyroxenes exhibit a rim of green amphibole.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium-grained gabbro with local patches of fine-grained material, with indication of weak magmatic fabric.

## Core Photo




**305-U1309D-170R-4 (Section top: 831.33 mbsf)**

UNIT-448: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium- to coarse-grained gabbro. Some clinopyroxene oikocrysts.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section looking more altered. Two blue green veins (amphibole, chlorite) of 0.5 cm thick each and with irregular shape are observed at 14 cm, and 18-31 cm and a significant amount of shiny pyroxene is found in the alteration zone related to these veins. Alteration halo observed from 93 to 128 cm related to the veins located at 94 and 119 cm. In these zones, the pyroxenes are altered to white and pale green minerals (?). Between these two zones, amphibole rims around the pyroxenes and olivines.

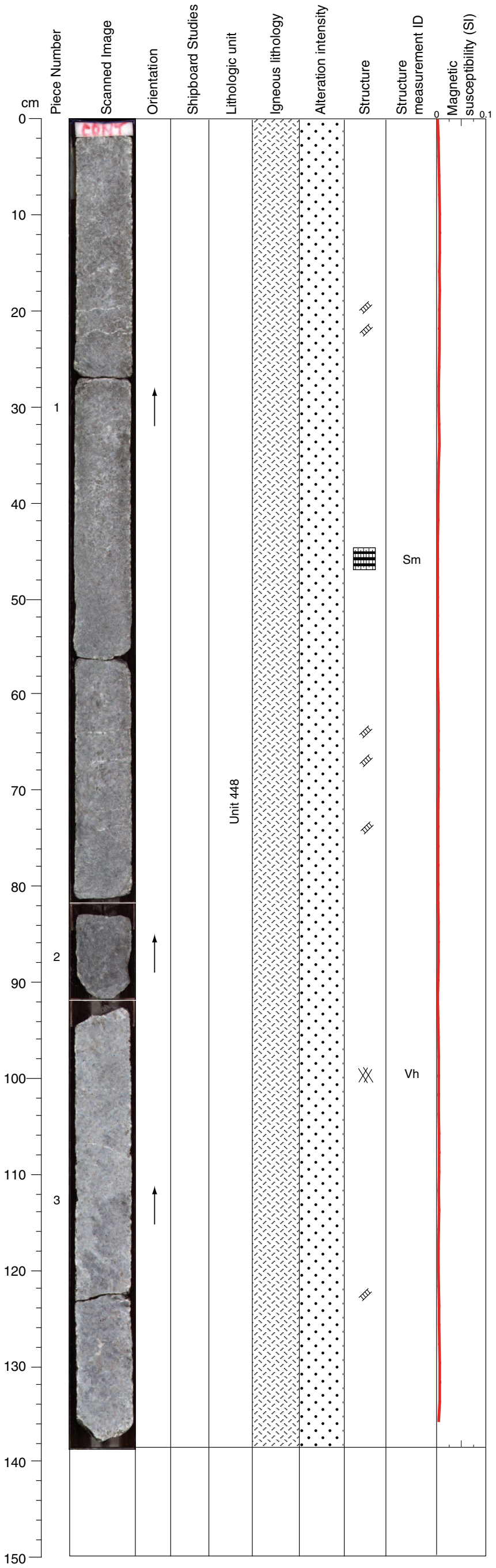
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-170R-4, 95-97 cm (#435)**

STRUCTURE: Medium-grained gabbro with local shallow magmatic fabric developed.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-170R-4, 80-97 cm DRY

## Core Photo




**305-U1309D-171R- 1 (Section top: 832.60 mbsf)**

UNIT-448: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 3b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 3 mm average<br>Shape subhedral to anhedral |

COMMENTS: Continuation of Unit 448 medium-grained gabbro.

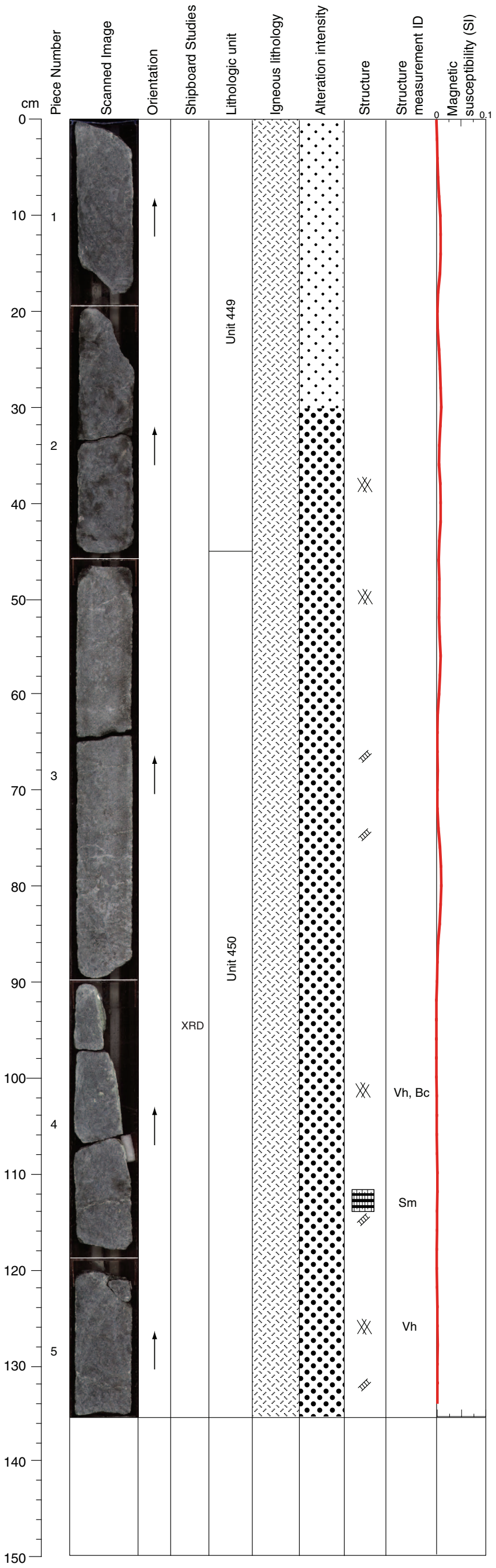
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Fine-grained gabbro with amphibole rims around the olivines and pyroxenes. The section exhibits a lot of white veins (or cracks?) perpendicular to the section.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine-grained gabbro with shallow magmatic fabric developed in upper part of section. A long subvertical dark green vein.

## Core Photo




**305-U1309D-171R-2 (Section top: 833.99 mbsf)**

UNIT-449: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 40%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 60%<br>Size 3 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 449 is coarse-grained gabbro.

UNIT-450: Gabbro
Pieces: 3-5

PRIMARY MINERALOGY: Modal data from Piece 4c

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size 5 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 450 is medium-grained gabbro. Clinopyroxene grain size decreases to fine grained at bottom and at top of next section.

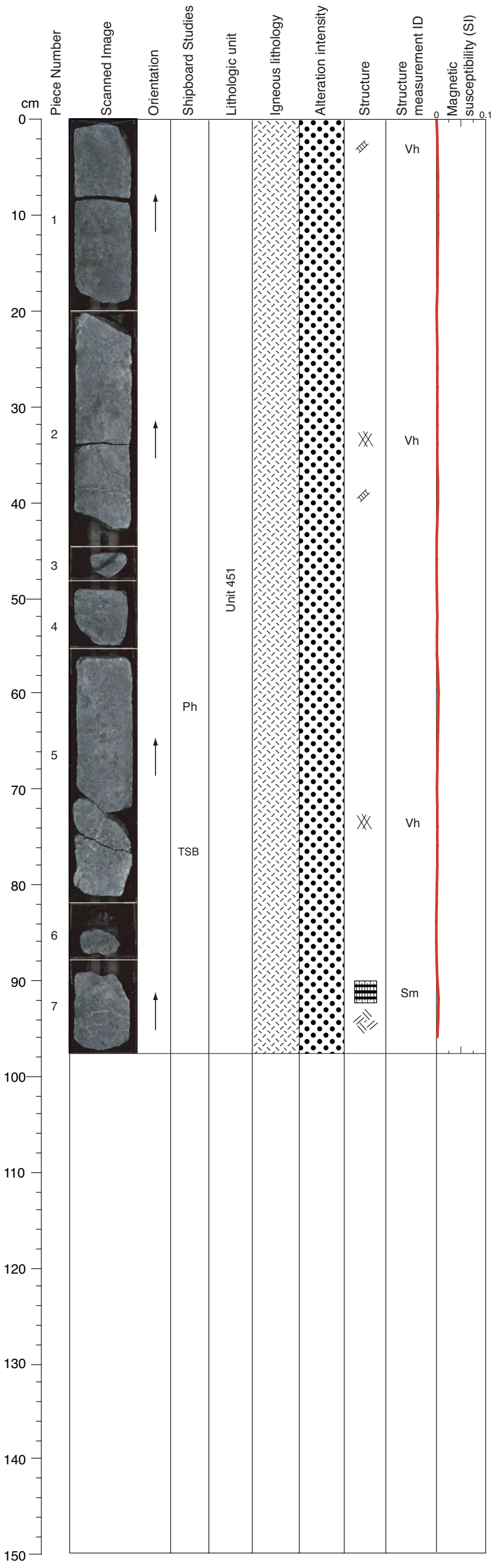
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Background alteration is the same as in the previous section. Dark green veins cut the section and some have alteration halos of green amphibole alteration in the surrounding gabbro. A 5 cm-wide, green vein with some carbonate coats the top and side of of Piece 4. (Dark patches are damp rock.)

VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

STRUCTURE: Medium-grained gabbro with finer grained parts showing a weak magmatic foliation with shallow dip. Minor subhorizontal white cracks and steeply dipping pale green fault veins.

## Core Photo




**305-U1309D-171R-3 (Section top: 835.34 mbsf)**

UNIT-451: Gabbro (Gabbronorite)
Pieces: 1-7

PRIMARY MINERALOGY: Modal data from Piece 2a, 5a

| | |
|---|---|
| Plagioclase | Modal 50-65%<br>Size 3-10 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35-50%<br>Size 3-10 mm average<br>Shape subhedral to anhedral |

COMMENTS: Unit 451 is medium- to coarse-grained gabbro. Probably this entire section consists of gabbronorite, since more than 10% medium-grained orthopyroxene was observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Medium- to coarse-grained gabbro with low alteration and a green background color. At 28-44 cm, a dark green/blue vein (amphibole, chlorite) with a 1 cm thick alteration halo occurs. White alteration zone (?) at 57-72 cm between two finer-grained parts. Other green veins at 71-81 cm with 1 cm wide alteratiion halo.

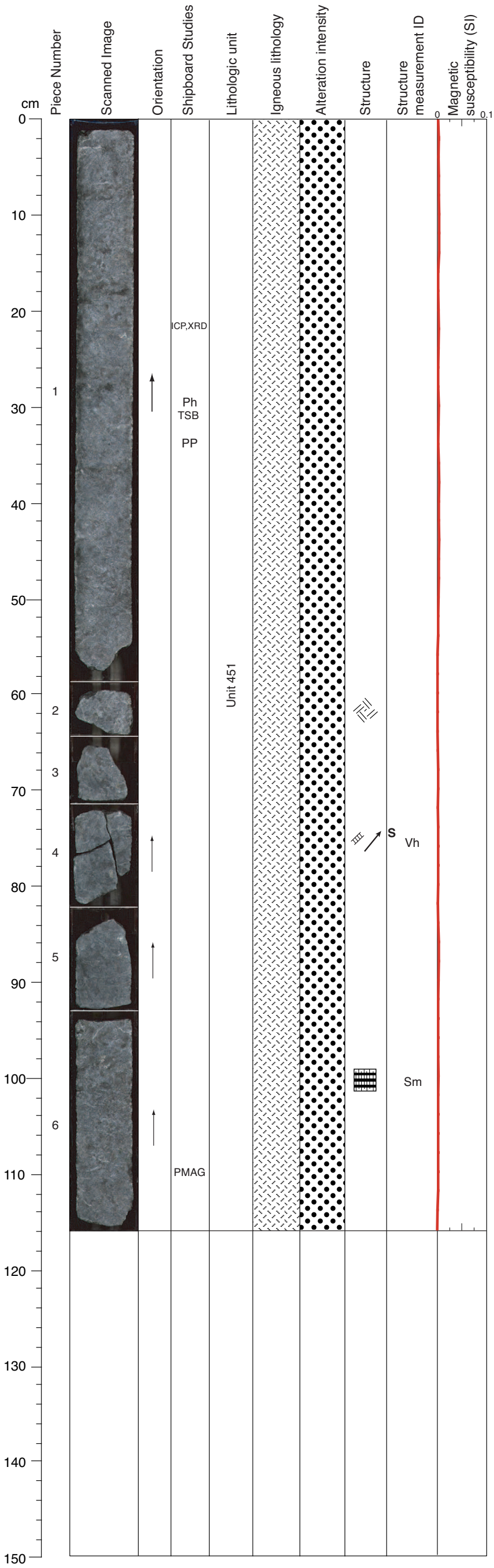
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-171R-3, 75-77 cm (#436)**

STRUCTURE: Medium-grained gabbro with faint magmatic foliation discernible at bottom of section. Dark green vein in Piece 1. Pale green veins with minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-171R-3, 56-80 cm WET

## Core Photo




**305-U1309D-171R-4 (Section top: 836.31 mbsf)**

UNIT-451: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 6

| | |
|---|---|
| Plagioclase | Modal 40%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 60%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 451 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Same lithology, medium-grained gabbro, with alteration coronas around olivines and pyroxenes. Green color of the background indicating a significant amount of amphibole. Some pyroxene have a yellow alteration color.

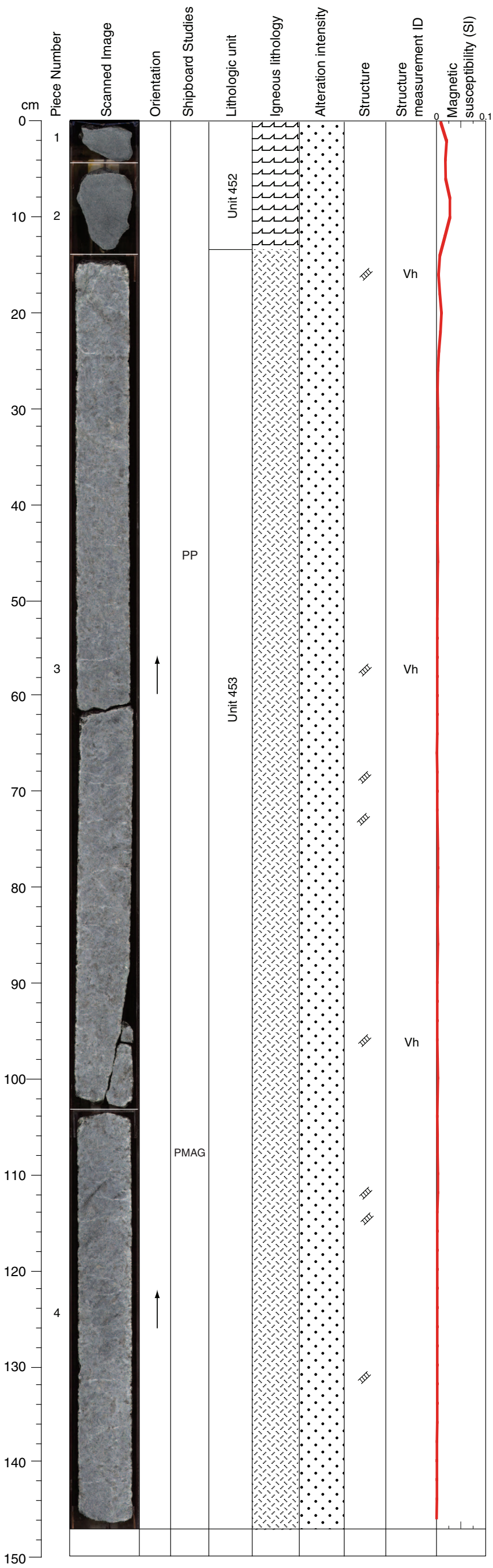
VEIN ALTERATION: Serpentine, carbonate.

THIN SECTIONS:
**305-U1309D-171R-4, 30-32 cm (#437)**

STRUCTURE: Medium-grained gabbro with faint magmatic foliation discernible at bottom of section. A few pale green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-171R-4, 24-44 cm WET

## Core Photo




**305-U1309D-172R-1 (Section top: 837.40 mbsf)**

UNIT-452: Diabase
Pieces: 1-2

PRIMARY MINERALOGY:

COMMENTS: Unit 452 diabase rubble.

UNIT-453: Gabbro
Pieces: 3-4

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 453 is medium- to coarse-grained gabbro.

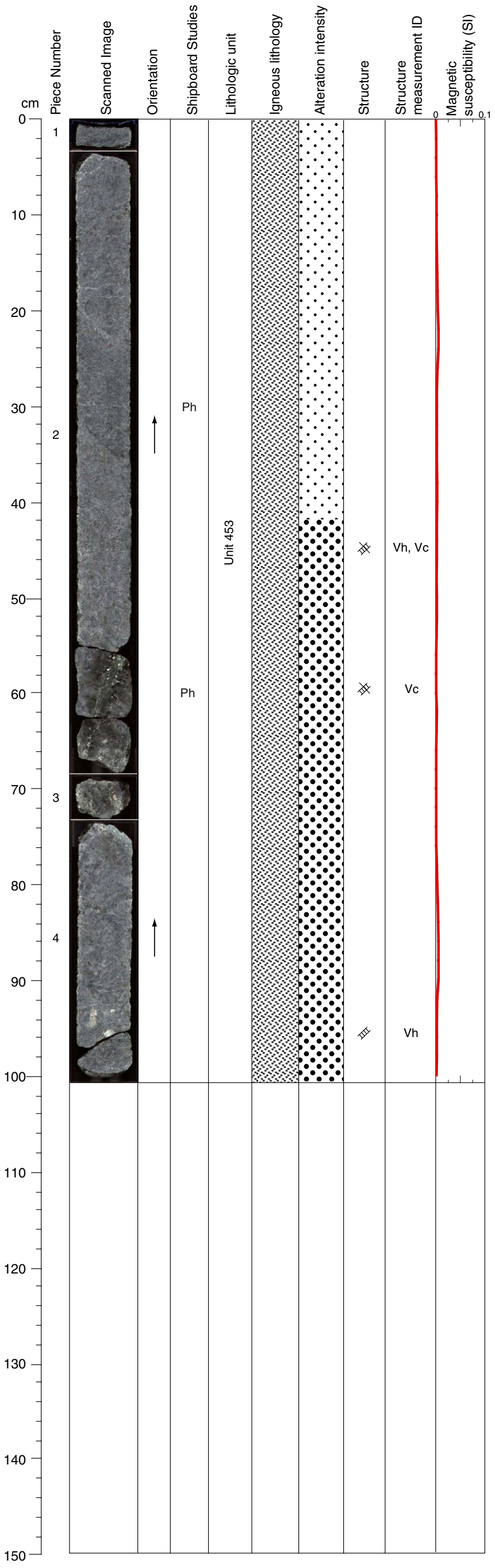
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Pieces 3 and 4 are coarse-grained gabbro with low to moderate alteration and with a green background color attesting to a significant amount of green amphibole. The pyroxene and olivines grain are altered and rimmed by green amphibole. The coarse-grained gabbro displays white veins/fractures perpendicular to the section (drilling induced?).

VEIN ALTERATION: Amphibole, carbonate.

STRUCTURE: Medium to coarse gabbro with pronounced development of elongate plagioclase, weak magmatic fabric in upper part mainly. Subhorizontal white veins (V1) and white-filled cracks (V2), and steep dark green veins (V3). V3<V1<V2

## Core Photo




**305-U1309D-172R-2 (Section top: 838.88 mbsf)**

UNIT-453: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 453 medium- to coarse-grained gabbro. Leucocratic at 55-73 cm due to severe alteration.

SECONDARY MINERALOGY: Chlorite, pale amphibole

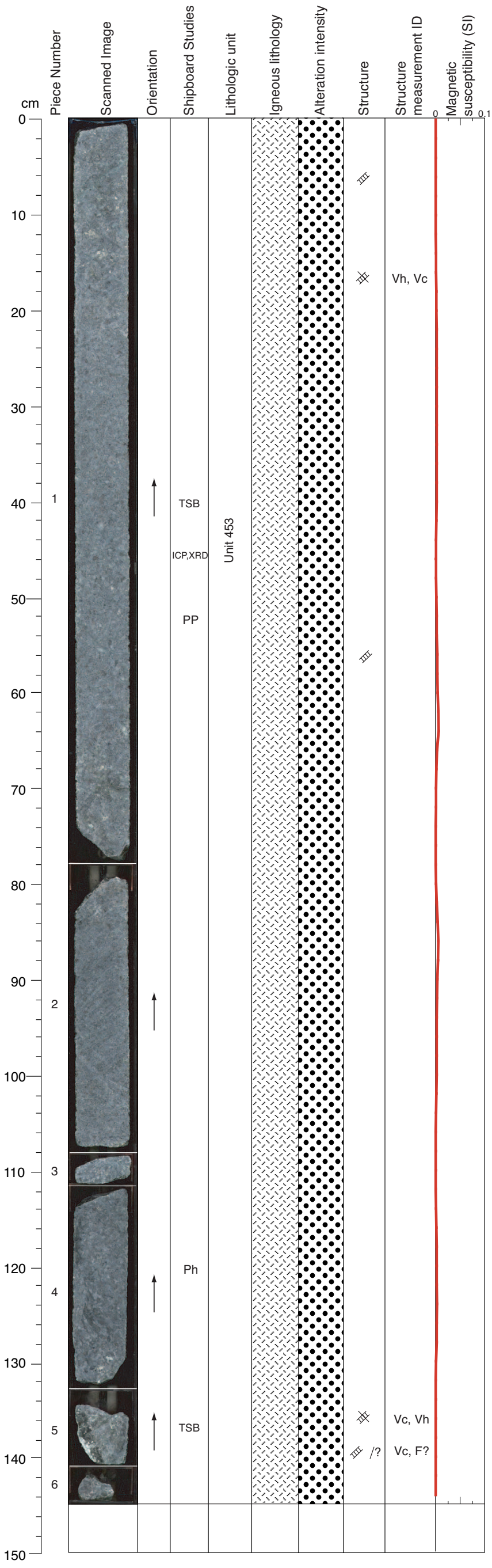
COMMENTS: Coarse-grained gabbro with green vein at 41 cm. At 56 cm, 1-2 cm thick brecciated green vein (talc, tremolite, actonilite?) surrounded by dark green amphibole. Below this zone, the pyroxene grains are altered (white mineral ? and rimmed by green amphibole). The breccia zone continues to 75 cm. Piece 4 is more altered and a bit brecciated, cut by numerous tiny white veins and 2 amphibole veins at 87 and 93 cm.

VEIN ALTERATION: Amphibole, carbonate.

STRUCTURE: Medium to coarse gabbro with locally fine grained matrix, local magmatic fabric and a 3 mm wide shallow dipping leucocratic vein. Subhorizontal white veins and white-filled cracks (V1) cross-cut by steeply dipping pale green vein. (V2) Dark green sets of veins (V3), and some distributed cataclasistic deformation (D1). V3>V1>V2. Thick vein with multi-stage evolution - pale green, cataclastic, and late calcite infill (Piece 2b).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-172R-2, 20-40 cm WET
305-U1309D-172R-2, 50-78 cm WET

## Core Photo




**305-U1309D-172R-3 (Section top: 839.89 mbsf)**

UNIT-453: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 453 seriate medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Fine-grained gabbro with local patches of alteration. At 6-8 cm, anastomosing tiny green veins. From 1 to 14 cm, the pyroxenes are altered to white mineral (?) and rimmed by green amphibole. At 40 and 52 cm, 2 subparallel green veins. At 68 cm, tiny brecciated vein. The olivines and pyroxenes are altered to green amphibole. At 132 cm, breccia zone with altered pyroxenes. On the edge of Piece 5 a big pale green vein (?).

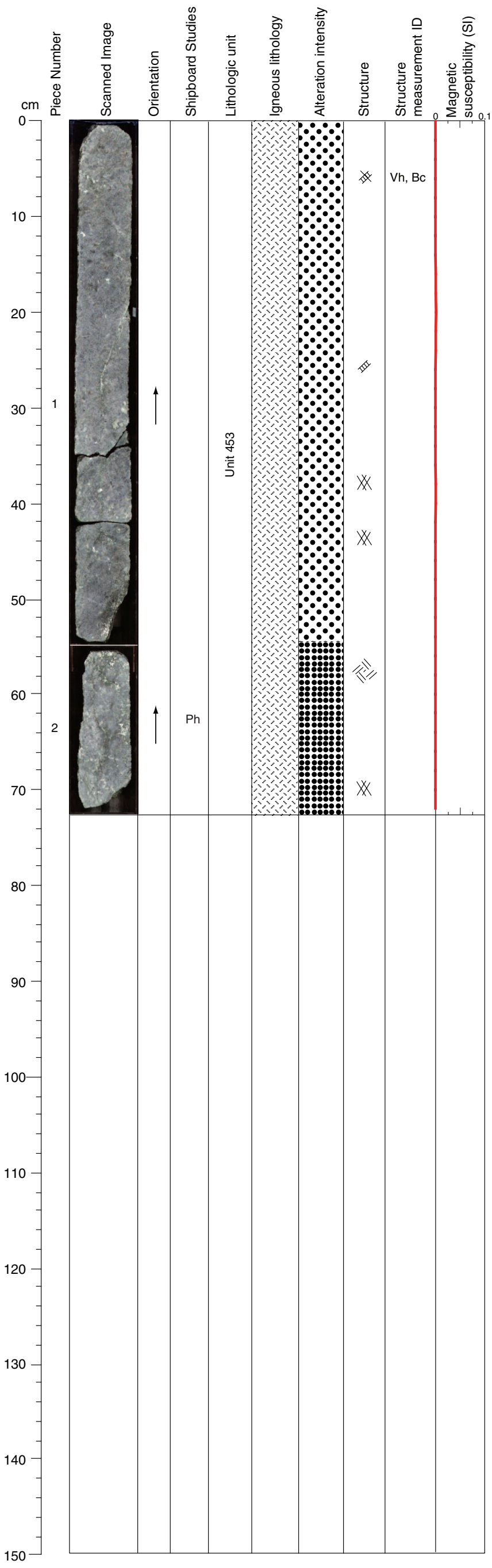
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-172R-3, 38-41 cm (#438)**
**305-U1309D-172R-3, 135-138 cm (#439)**

STRUCTURE: Medium-grained gabbro without magmatic or plastic fabric, more altered locally (white pyroxenes). Steep dark green veins (V1) and a steep pale green vein with cataclasis (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-172R-3, 30-50 cm WET
305-U1309D-172R-3, 112-139 cm WET

## Core Photo




**305-U1309D-172R-4 (Section top: 841.34 mbsf)**

UNIT-453: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 40%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 60%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 453 seriate medium-grained gabbro

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

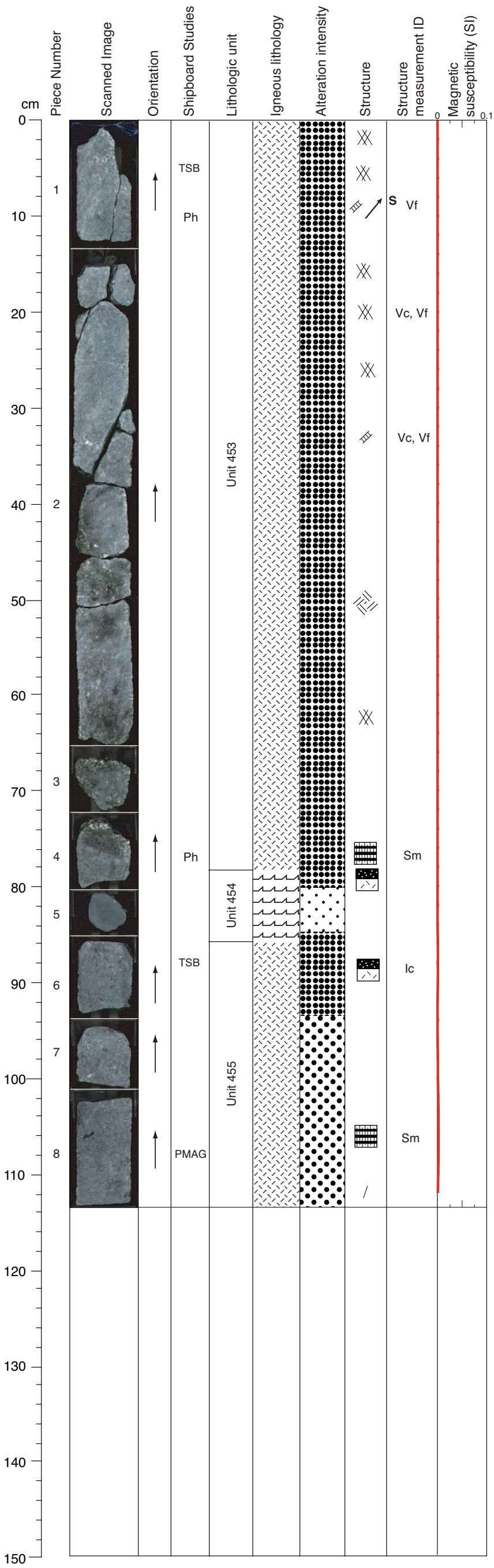
COMMENTS: Breccia zone cut by numerous pale green veins. The pyroxenes are altered (white + green amphibole rim). Veins at 5, 21-42, 45, and 44-50 cm. The section becomes more brecciated toward the end.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Fine- to medium-grained gabbro, more altered, no magmatic or plastic strain. Dark green vein (V1) crosscut by pale green vein (V2). Minor cataclasitic breccia with fracture network with pale green infill (C1). V1>V2=C1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-172R-4, 54-70 cm WET

## Core Photo




**305-U1309D-173R-1 (Section top: 842.20 mbsf)**

UNIT-453: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 2c

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 453 seriate medium-grained gabbro. At 0-74 cm severely altered zone continues from previous section, alteration boundary at 74 cm.

UNIT-454: Diabase
Pieces: 4-6

COMMENTS: Unit 454 diabase. Piece 5 is rubble but contact with gabbro seen in Piece 4 and Piece 6.

UNIT-455: Gabbro
Pieces: 6-8

PRIMARY MINERALOGY: Modal data from Piece 2c

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 455 seriate medium-grained gabbro. Same as Unit 453.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: From Pieces 1 to 4, gabbro breccia, with pyroxene grains altered to a white mineral (?) and rimmed by green amphibole. Numerous veins (white, pale green and dark green) cut this breccia. Edge of Pieces 4, 5 and 6, sharp contact between a coarse-grained gabbro and an aphyric basalt. Piece 7 is cut by several pale green to dark green veins and the minerals are more altered close to this vein zone.

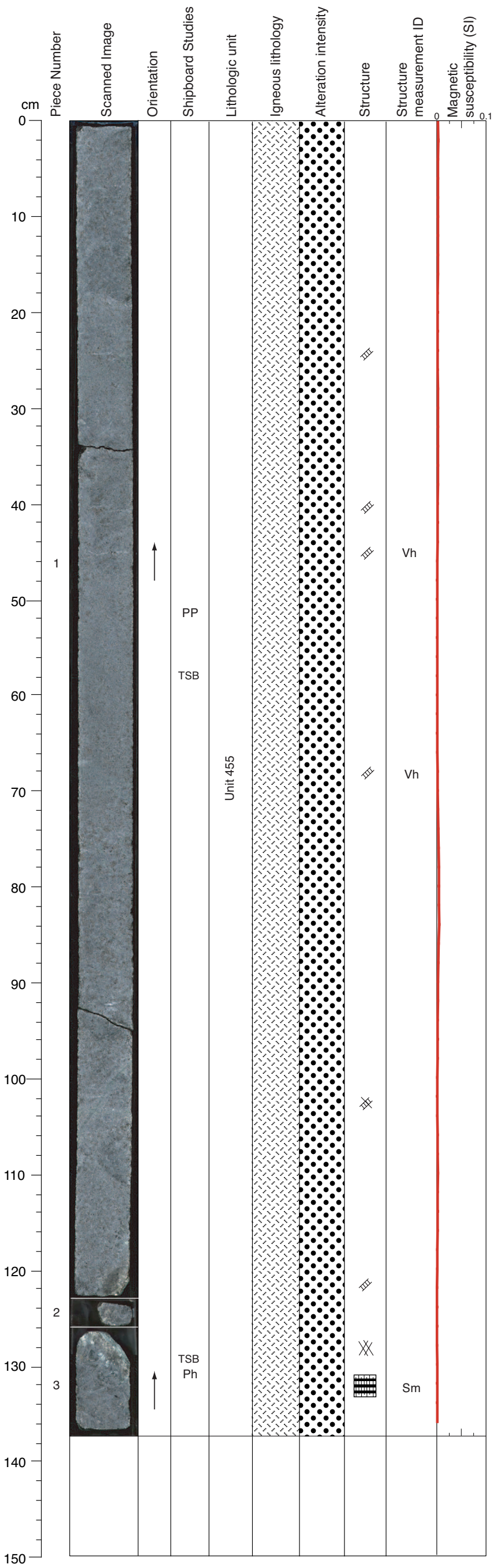
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-173R-1, 2-6 cm (#441)**
**305-U1309D-173R-1, 86-89 cm (#440)**

STRUCTURE: Fine- to medium-grained gabbro with local magmatic foliation and one steep igneous contact to diabase. Pale green veins with cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-173R-1, 0-25 cm WET
305-U1309D-173R-1, 71-92 cm WET

## Core Photo




**305-U1309D-173R-2 (Section top: 843.33 mbsf)**

UNIT-455: Gabbro (Gabbronorite)
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 455 seriate medium-grained gabbro. As much as 20% orthopyroxene observed in thin section Sample U1309D-173R-2, 55-58 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro to finer grained (25-73 cm). Green color of the background suggests a significant amount of green amphibole. At 95-107 cm, there is a green vein associated with a 2-mm-wide alteration halo. At the end of Piece 1 (121 cm) there is 1 cm wide alteration zone around a pale green vein. At 126 cm (top of Piece 6), there is a pale green vein with a 2 cm thick alteration halo where pyroxenes are altered to white mineral (?) and amphibole.

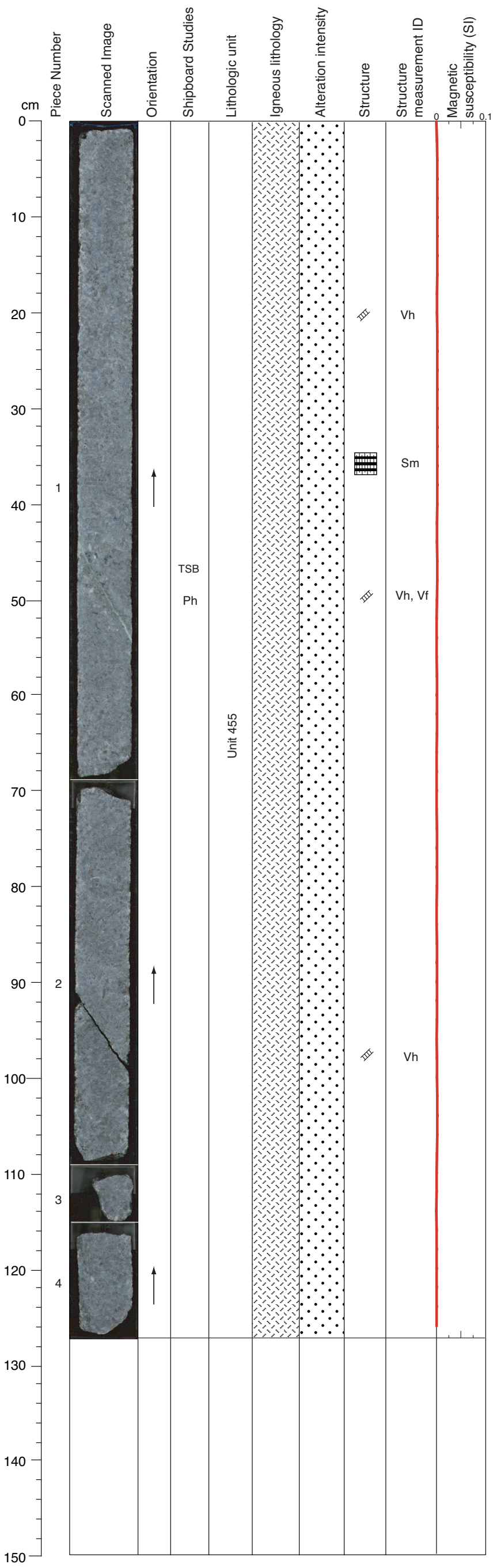
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-173R-2, 55-58 cm (#442)**
**305-U1309D-173R-2, 128-131 cm (#443)**

STRUCTURE: Fine- to medium-grained gabbro with weak fabric. Dark steep green vein (V1), steep pale green vein (V2) and subhorizontal irregular white vein (crack? V3). V1>V2>V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-173R-2, 43-63 cm WET
305-U1309D-173R-2, 126-137 cm WET

## Core Photo




**305-U1309D-173R-3 (Section top: 844.70 mbsf)**

UNIT-455: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 455 seriate medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Coarse-grained gabbro is cut by a long chlorite vein (1-36 cm). At 42-54 cm, green white vein with a 4 cm wide alteration halo with large green amphibole grains and altered pyroxene grains. The alteration zone appears brecciated and is dark green.

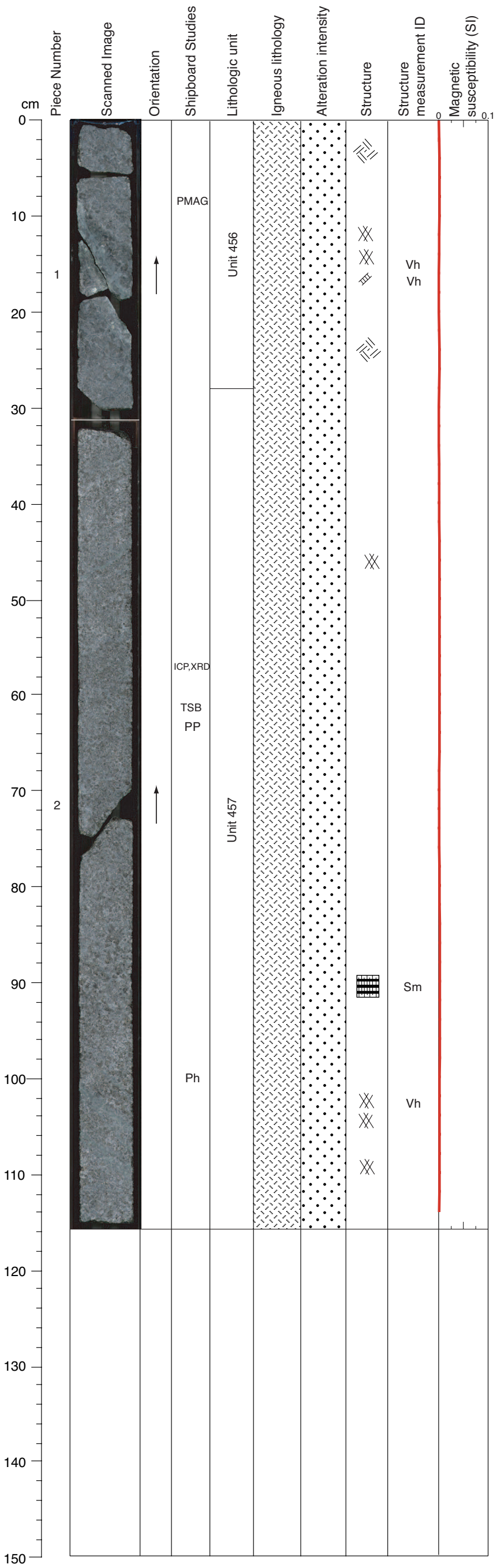
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-173R-3, 45-48 cm (#444)**

STRUCTURE: Fine- to medium-grained gabbro with weak fabric. Steeply dipping pale green veins, one of which at 50 cm has alteration halo of 3 cm.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-173R-3, 40-60 cm WET

## Core Photo




**305-U1309D-174R-1 (Section top: 847.00 mbsf)**

UNIT-456: Gabbro
Pieces: 1a-1d

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 13 mm<br>Shape anhedral |

COMMENTS: Unit 456 is seriate medium- to coarse-grained gabbro.

UNIT-457: Gabbro (Gabbronorite)
Pieces: 1d-2

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 457 is seriate medium-grained gabbro. As much as to 8% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Coarse-grained gabbro with a dark blue chlorite vein at 9-19 cm, with large grains of chlorite in the alteration halo. From 33 cm to the end, fine-grained gabbro is cut by numerous chlorite veins (at 85, 98, 101 and 106 cm).

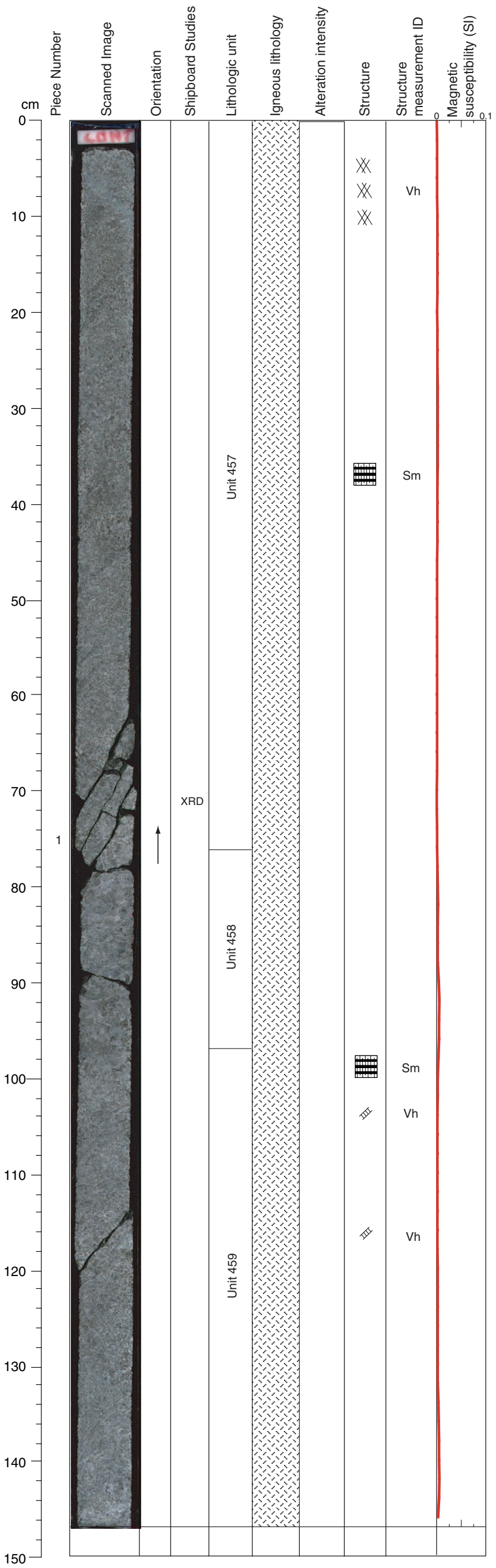
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-174R-1, 60-62 cm (#445)**

STRUCTURE: Medium-grained gabbro with local elongate clinopyroxene defining clear magmatic fabric. A dark green (V1) and a subparallel white vein (V2) at 14 cm in Piece 1, and earlier dark green vein set (V1) throughout the section (widely spaced). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-174R-1, 50-70 cm WET
305-U1309D-174R-1, 95-115 cm DRY

## Core Photo




**305-U1309D-174R-2 (Section top: 848.15 mbsf)**

UNIT-457: Gabbro
Pieces: 1a-1d

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 457 seriate medium-grained gabbro.

UNIT-458: Gabbro
Pieces: 1h

PRIMARY MINERALOGY: Modal data from Piece 1h

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size to 12 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 14 mm<br>Shape anhedral |

COMMENTS: Unit 458 is seriate medium- to coarse-grained gabbro.

UNIT-459: Gabbro
Pieces: 1i-1j

PRIMARY MINERALOGY: Modal data from Piece 1j

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 459 is seriate medium-grained gabbro.

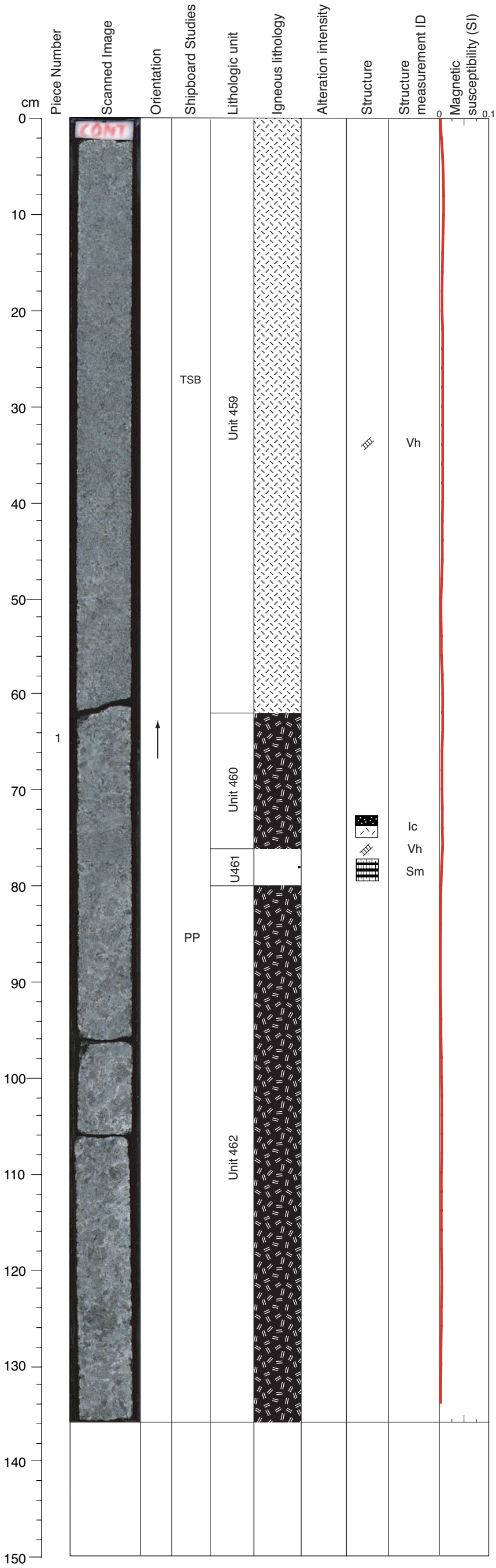
SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration is slight (blank alteration column) and shows pyroxene grains with narrow rims of green amphibole and plagioclase slightly altered to white secondary minerals. As with the previous section, fine-grained gabbro is cut by numerous chlorite veins (at 3, 5, 48, 57, and 128 cm). From 77 to 100 cm, the rock is coarser grained.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to medium-grained gabbro with variably strong magmatic fabric. Dark green veins (V1) and minor cataclasis with white fill (B1). V1>B1.

## Core Photo




**305-U1309D-174R-3 (Section top: 849.62 mbsf)**

UNIT-459: Gabbro
Pieces: 1a

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 459 is seriate medium-grained gabbro. Clinopyroxene rich zones. As much as 5% of olivine observed in thin section.

UNIT-460: Olivine-bearing Gabbro
Pieces: 1b

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 4%<br>Size 2 mm average<br>Shape interstitial |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 41%<br>Size to 40 mm<br>Shape subhedral |

COMMENTS: Unit 460 is seriate medium- to coarse-grained olivine-bearing gabbro.

UNIT-461: Microgabbro
Pieces: 1b

COMMENTS: Unit 461 is microgabbro.

UNIT-462: Olivine-bearing Gabbro
Pieces: 1b-1d

PRIMARY MINERALOGY: Modal data from Piece 1d

| | |
|---|---|
| Olivine | Modal 4%<br>Size 2 mm average<br>Shape interstitial |
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 41%<br>Size to 25 mm<br>Shape subhedral |

COMMENTS: Unit 462 is seriate medium- to coarse-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration is slight (blank alteration column) and shows pyroxene grains with narrow rims of green amphibole and plagioclase slightly altered to white secondary minerals. As with the previous section, the fine-grained gabbro grades into coarser grained (interlayered), cut by several fine green veins and is generally richer in plagioclase that is lighter from 60 cm to the end. At 74-77 cm there is a zone of finer grained gabbro with abrupt contacts with the surrounding coarser gabbro. Its lower boundary is rich in dark green amphibole.

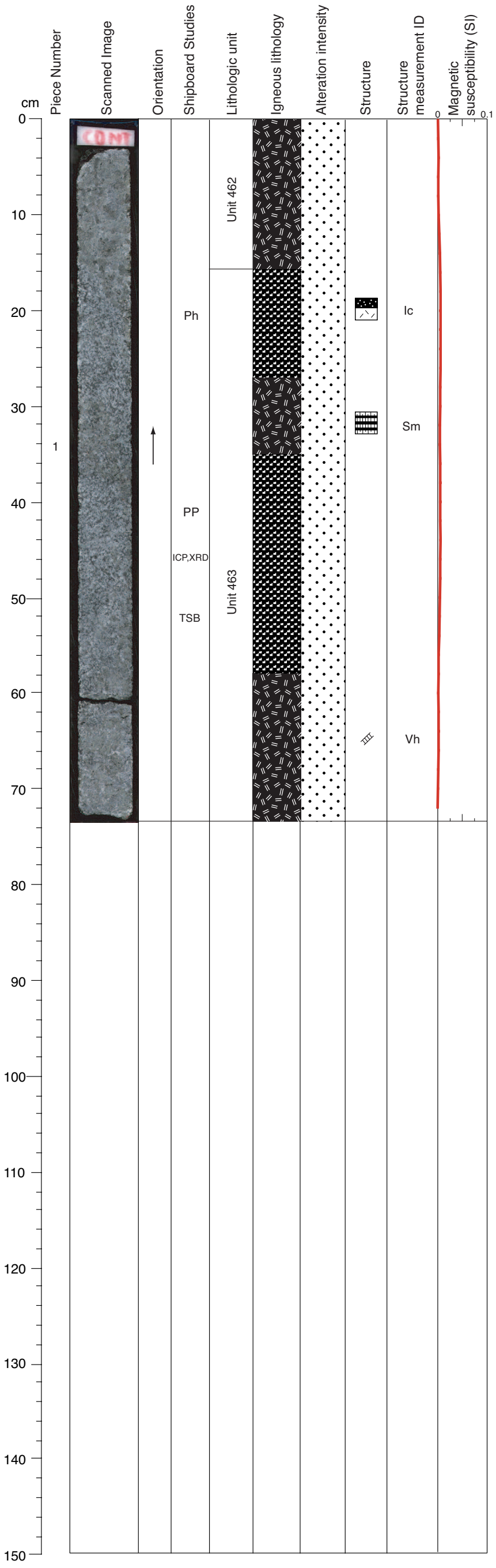
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-174R-3, 26-29 cm (#446)**

STRUCTURE: Medium- to coarse-grained gabbro with no clear magmatic or plastic fabric except for a 6 cm microgabbroic interval with sharp contacts. Dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-174R-3, 20-40 cm WET

## Core Photo




**305-U1309D-174R-4 (Section top: 850.98 mbsf)**

UNIT-462: Olivine-bearing Gabbro
Pieces: 1a

PRIMARY MINERALOGY: Modal data from Section U1309D-174R-003, Piece 1d

| | |
|---|---|
| Olivine | Modal 4%<br>Size 2 mm average<br>Shape interstitial |
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 41%<br>Size to 25 mm<br>Shape subhedral |

COMMENTS: Unit 462 is seriate medium- to coarse-grained olivine-bearing gabbro.

UNIT-463: Troctolite
Pieces: 1a

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 20%<br>Size 3 mm average<br>Shape interstitial |
| Plagioclase | Modal 76%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 4%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 463 is medium-grained troctolite. Patches of coarse-grained clinopyroxene (modal data does not include these grains). Mode varies between troctolite and olivine-bearing gabbro down section.

UNIT-463: Olivine-bearing Gabbro
Pieces: 1a-1b

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 3%<br>Size 2 mm average<br>Shape interstitial |
| Plagioclase | Modal 62%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 25 mm<br>Shape subhedral |

COMMENTS: Unit 463 is seriate medium- to coarse-grained olivine-bearing gabbro portion of the unit. Olivine enrichment as high as 20% observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. As with the previous section, the same lithology and degree of alteration. At 14-63 cm, finer grained part is richer in plagioclase and appears lighter as plagioclase are altered and the olivines are serpentinized.

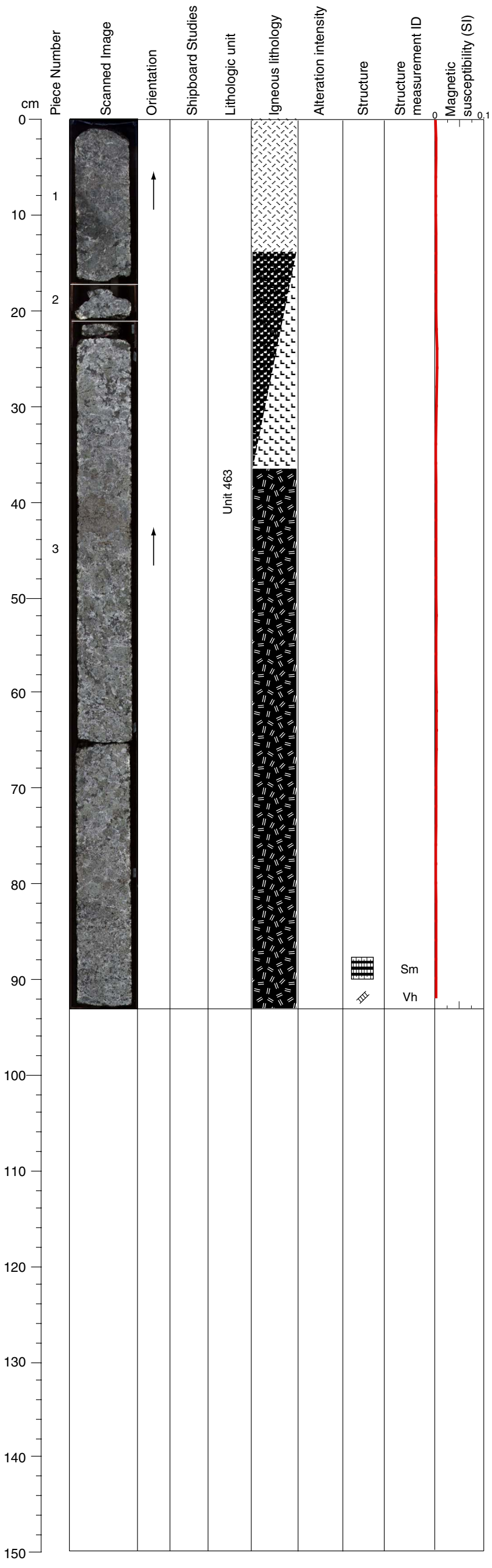
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-174R-4, 51-53 cm (#447)**

STRUCTURE: Grain size and mafic/felsic layering gabbro with clear magmatic fabric parallel to layering. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-174R-4, 8-28 cm WET
305-U1309D-174R-4, 8-28 cm DRY
305-U1309D-174R-4, 38-58 cm WET

## Core Photo




**305-U1309D-175R-1 (Section top: 851.80 mbsf)**

UNIT-463: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 15 mm<br>Shape subhedral |

COMMENTS: Unit 463 in this section is modally variable. This interval is seriate coarse-grained gabbro. Boundary between modal intervals is diffusive.

UNIT-463: Troctolite
Pieces: 1-3b

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 25%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 70%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 5%<br>Size to 25 mm<br>Shape subhedral |

COMMENTS: Medium- to coarse-grained troctolite interval of Unit 463.

UNIT-463: Troctolitic Gabbro
Pieces: 3b

PRIMARY MINERALOGY: Modal data from Piece 3b

| | |
|---|---|
| Olivine | Modal 10%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 80%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 10%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Medium-grained troctolitic gabbro interval of Unit 463.

UNIT-463: Olivine-bearing Gabbro
Pieces: 3b-3c

PRIMARY MINERALOGY: Modal data from Piece 3c

| | |
|---|---|
| Olivine | Modal 5%<br>Size 2 mm average<br>Shape interstitial |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Seriate medium- to coarse-grained olivine-bearing gabbro. Grain size changes to fine at 85 cm.

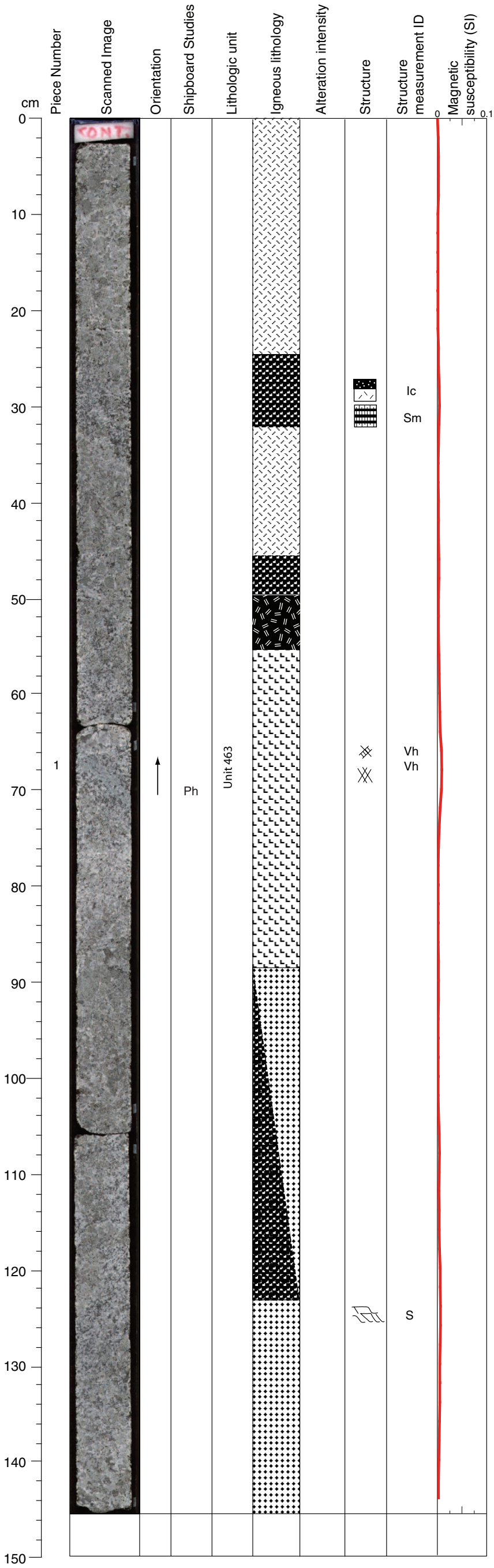
SECONDARY MINERALOGY: Chlorite

COMMENTS: The section starts in coarse gabbro similar to that of the previous section. The general background alteration is slight (blank alteration column) and shows pyroxene grains with narrow rims of green amphibole and plagioclase slightly altered to white secondary minerals. Numerous fractures surround grain boundaries and make a network of fine white lineaments in the rock. From 16 to 33 cm there is a slightly greater degree of alteration producing a lighter swath across the core.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium- to coarse-grained gabbro with local magmatic strain. A few dark green veins (V1) and minor cataclasis along grain boundaries with white fills (B1). V1>B1.

## Core Photo




**305-U1309D-175R-2 (Section top: 852.73 mbsf)**

Unit 463 in this section varies modally and comprises several lithologies described below:

UNIT-463: Gabbro
Pieces: 1a, 1b

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Medium- to coarse-grained gabbro interval of the unit at 0-25 and 33-46 cm.

UNIT-463: Troctolite
Pieces: 1b and 1c

PRIMARY MINERALOGY: Modal data from Pieces 1b and 1c

| | |
|---|---|
| Olivine | Modal 25% average<br>Size 3 mm average<br>Shape interstitial |
| Plagioclase | Modal 75% average<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Medium-grained troctolite interval of the unit at 27-33 cm, 46-51 cm, and gradationally from 115-124 cm. Plagioclase-rich zone at 29-33 cm.

UNIT-463: Olivine-bearing Gabbro
Pieces: 1b

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 5%<br>Size 1 mm average<br>Shape interstitial |
| Plagioclase | Modal 70%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 25%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Fine- to medium-grained olivine-bearing gabbro interval of the unit at 51-56 cm.

UNIT-463: Troctolitic Gabbro
Pieces: 1b

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 40%<br>Size 1 mm average<br>Shape interstitial |
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 10%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Fine- to medium-grained troctolitic gabbro interval of the unit at 56-89 cm. Volumes of clinopyroxene and olivine gradually change from this to next interval. This interval is troctolitic, next interval is gabbroic.

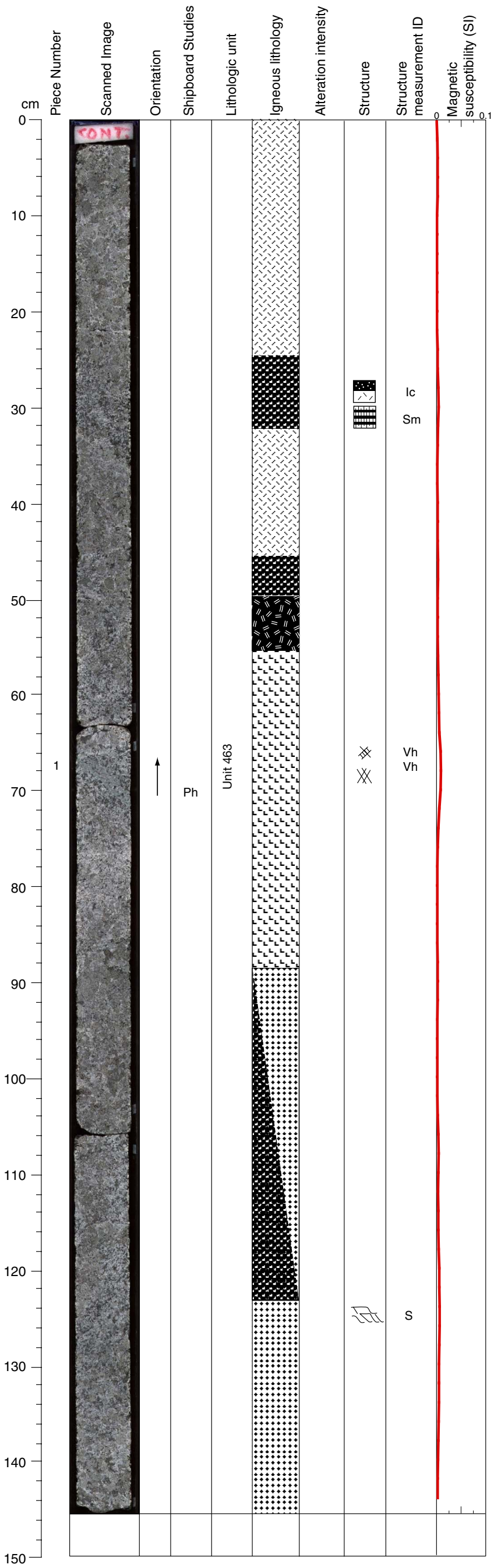
UNIT-463: Olivine Gabbro
Pieces: 1b, 1c

PRIMARY MINERALOGY: Modal data from Pieces 1b, 1c

| | |
|---|---|
| Olivine | Modal 10%<br>Size 3 mm average<br>Shape interstitial |
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Medium-grained olivine gabbro interval of the unit at 89-115 cm and 124-143 cm.

## Core Photo




**305-U1309D-175R-2, Continued (Section top: 852.73 mbsf)**

SECONDARY MINERALOGY: Chlorite

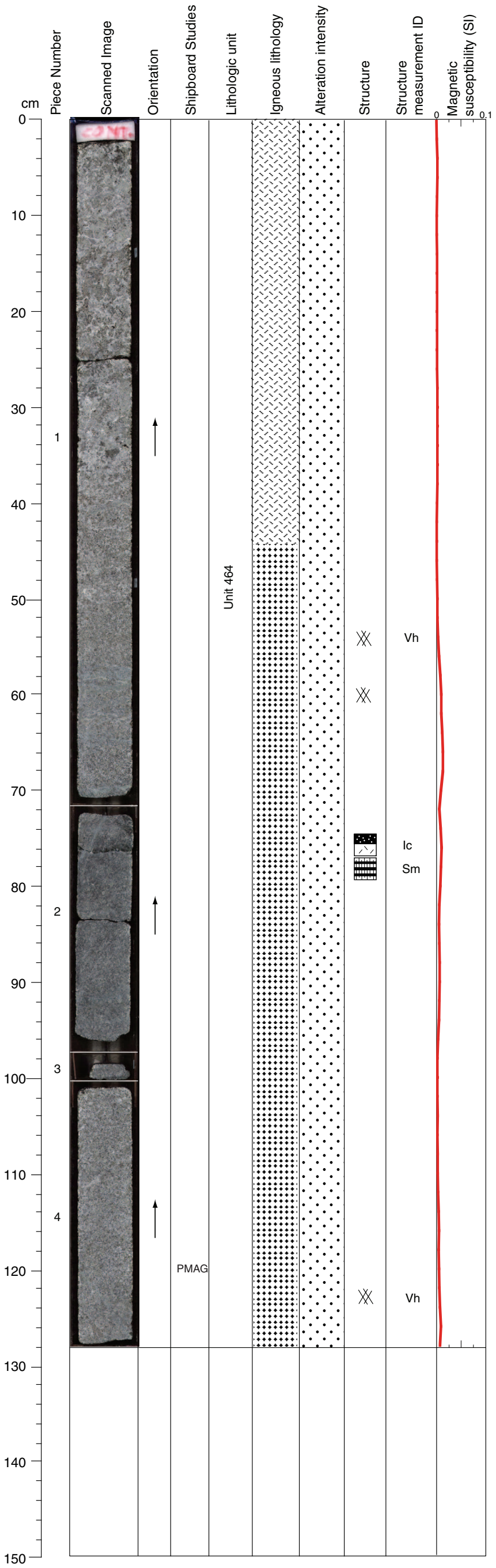
COMMENTS: Similar to previous section. The general background alteration is slight (blank alteration column) and shows pyroxene grains with narrow rims of green amphibole and plagioclase slightly altered to white secondary minerals. Two parallel green vein sets between 60 and 72 cm are narrow (about 5 mm wide vein set) and cut the section at about 45°.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to coarse-grained gabbro to leucogabbro with grain size layering and patches of different texture and locally weak magmatic strain. Dark green vein (V1) crosscut by subhorizontal white vein (V2). V1>V2. Poorly developed serpentine foliation (S).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-175R-2, 64-84 cm WET

## Core Photo




**305-U1309D-175R-3 (Section top: 854.19 mbsf)**

UNIT-464: Gabbro
Pieces: 1a

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 464 is coarse-grained gabbro. Clinopyroxene grain size gradually decreases from 30-45 cm.

UNIT-464: Olivine Gabbro
Pieces: 1b-4

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 15%<br>Size 1 mm average<br>Shape interstitial |
| Plagioclase | Modal 50%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: This part of Unit 464 is fine-grained olivine gabbro. Medium-grained band at 57-62 cm.

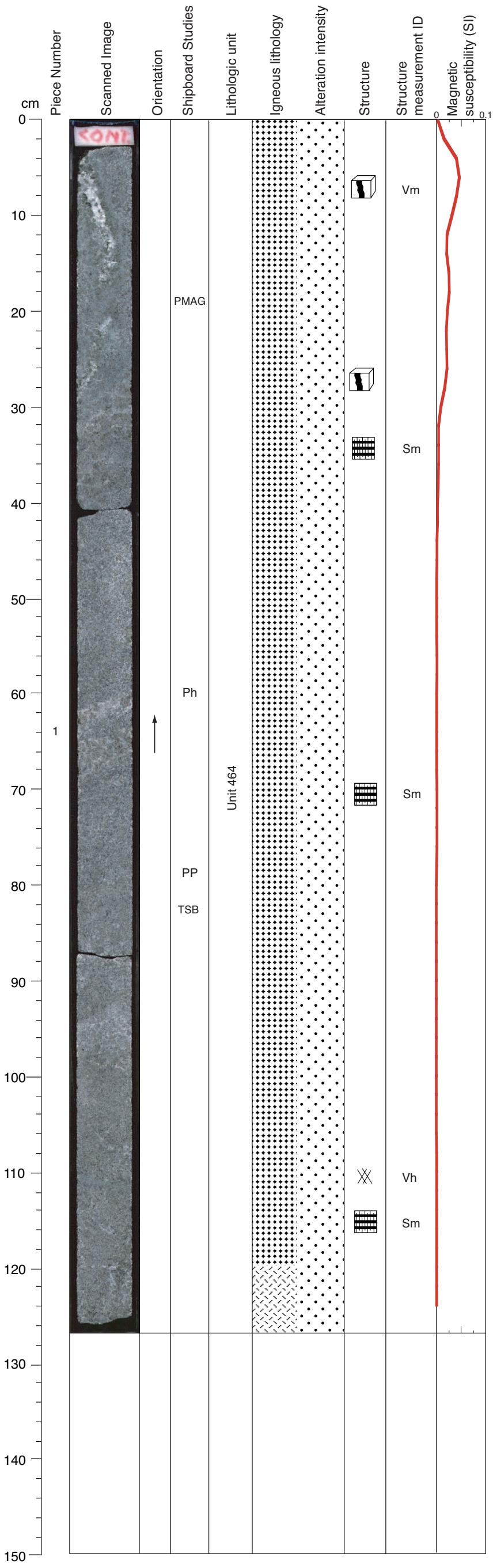
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Background alteration is similar to previous section to about 69 cm. The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. A set of very fine green veins at 40 to 41 has a narrow (4 mm) green halo and a zone of pale green alteration from 57 to 65 cm cuts across the section (subhorizontal) associated with a network of fine green veins. From 69 to 100 cm the core has an overprint of pale green alteration (suggesting a greater secondary green amphibole). From 220 cm to the end of the section a fine green vein with a diffuse green halo cuts from the finer to the coarser grained gabbro.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to medium-grained, strongly in both grain size and mafic/felsic components, but layers are irregular and not parallel to weak magmatic foliation. Dark green vein sets with alteration.

## Core Photo




**305-U1309D-175R-4 (Section top: 855.47 mbsf)**

UNIT-464: Olivine Gabbro
Pieces: 1a-1c

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 15%<br>Size 1 mm average<br>Shape interstitial |
| Plagioclase | Modal 50%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: This part of Unit 464 is fine-grained olivine gabbro.

UNIT-464: Gabbro
Pieces: 1c

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: This part of Unit 464 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General background alteration is similar to the previous section. The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. In addition, there is a late leucocratic intrusive feature in the top of the section from 3 to 29 cm that is haloed by a lighter alteration zone with surrounding patches of plagioclase grains altered to green amphibole. Between 60 and 69 cm the section contains some coarser gabbro that has more heavily altered plagioclase, that gives a white cast to the rock. A fine green vein with a 5 mm green halo cuts the rock from 110 to 112 cm.

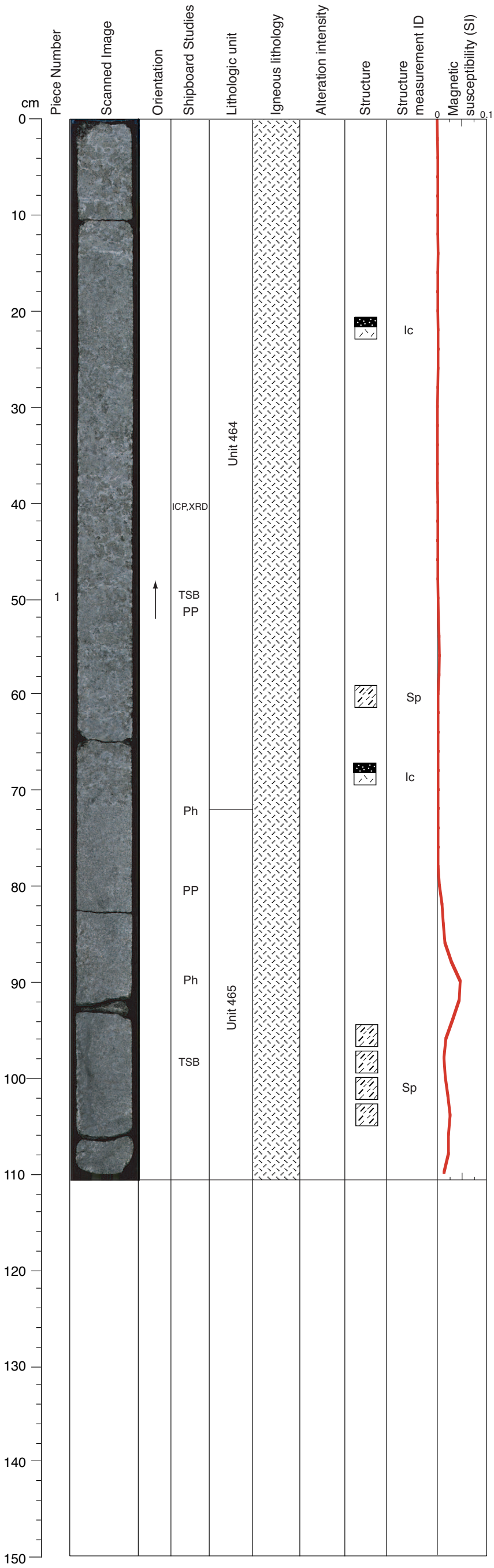
VEIN ALTERATION:Amphibole, plagioclase.

THIN SECTIONS:
**305-U1309D-175R-4, 80-83 cm (#448)**

STRUCTURE: Medium-grained gabbro with some banding and some subhorizontal dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-175R-4, 58-78 cm WET

## Core Photo




**305-U1309D-176R-1 (Section top: 856.60 mbsf)**

UNIT-464: Gabbro (Gabbronorite)
Pieces: 1a-1c

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 464 medium- to coarse-grained gabbro. As much as 8% orthopyroxene observed in thin section (half represented by clinoenstatite). Olivine enclosed in orthopyroxene and clinopyroxene.

UNIT-465: Gabbro (Gabbronorite)
Pieces: 1c-1f

PRIMARY MINERALOGY: Modal data from Piece 1e

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 465 is fine- to medium-grained gabbro. As much as 10% orthopyroxene observed in thin section. Small olivines enclosed in clinopyroxene and orthopyroxene.

SECONDARY MINERALOGY: Chlorite

COMMENTS: Background alteration is very similar to the previous section. The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. The edge of the piece from 93 cm to 110 cm is fringed by leucocratic material with an adjacent alteration zone about 1 cm wide. Thin, subhorizontal white veins/fractures cut the section and a fine white network of lineaments outline some grains.

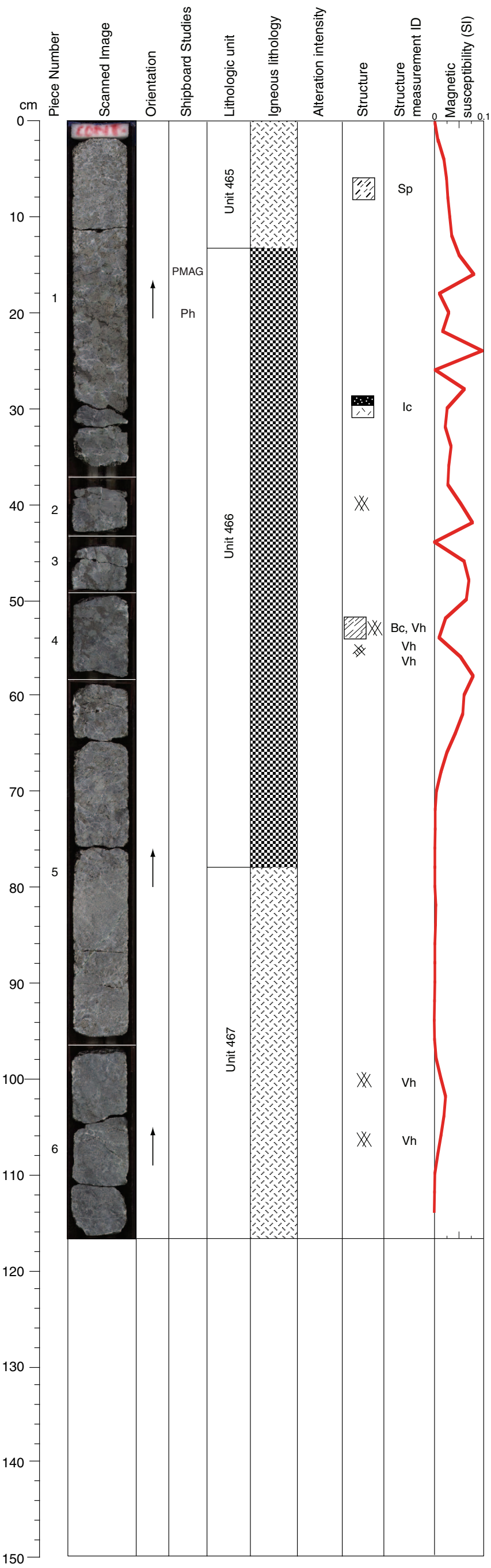
VEIN ALTERATION: n/a

THIN SECTIONS:
**305-U1309D-176R-1, 48-50 cm (#449)**
**305-U1309D-176R-1, 96-99 cm (#450)**

STRUCTURE: Fine- to coarse-grained gabbro with sharp grain size changes, no clear magmatic foliation but plastic strain developed along a grain size change (or igneous contact, e.g. Piece 1c) in bottom of section (Sp). Plastic strain merges into sharp 2 mm thick mylonitic shear zone of undetermined sense of shear. Note subparallelism of shear zone with igneous contact. Tiny green dark veins (V1), and some short subhorizontal white veins (V2). Ic>Sp>V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-176R-1, 40-60 cm WET
305-U1309D-176R-1, 66-84 cm WET
305-U1309D-176R-1, 84-106 cm WET
305-U1309D-176R-1, 84-106 cm WET (back)

## Core Photo




**305-U1309D-176R-2 (Section top: 857.71 mbsf)**

UNIT-465: Gabbro
Pieces: 1a

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 465 medium- to coarse-grained gabbro.

UNIT-466: Oxide Gabbro
Pieces: 1a-5c

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 30%<br>Size up to 20 mm<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size up to 28 mm<br>Shape anhedral |
| Oxide | Modal 15%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 466 is coarse-grained to pegmatitic oxide gabbro. Sulfide bearing.

UNIT-467: Gabbro
Pieces: 5c-6

PRIMARY MINERALOGY: Modal data from Piece 6

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 467 is fine- to medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite?, pale amphibole?

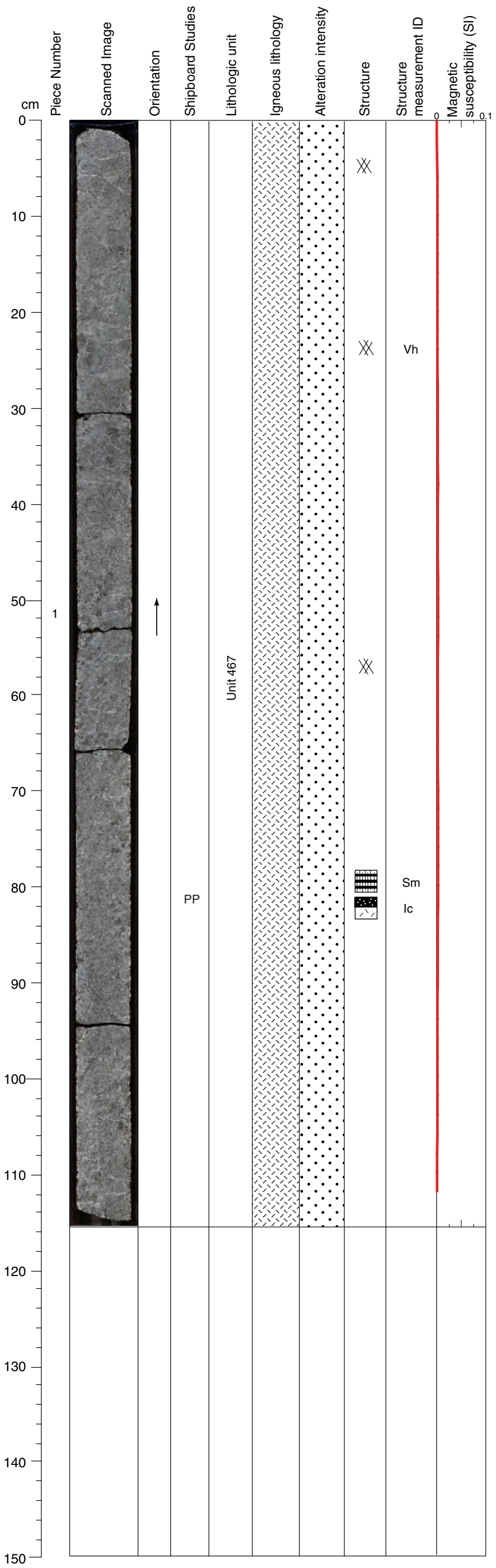
COMMENTS: Similar to the previous section. The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, the grain size increases over the interval from about 10 to 14 cm and in the coarser gabbro very distinct green amphibole reaction fringes surround brown fresher cores of pyroxenes and there is a significant amount of sulfides. A few dark green veins cut the section, one from 82 to 90 cm contains some white (carbonate?) patches associated with sulfides.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Fine- to coarse-grained gabbro, plastic shear associated with intrusion of coarse, partly melanocratic gabbro. Strong grain size changes of irregular attitude at bottom of section appear broadly related to intrusive events. Early dark green veins (V1), cataclastic narrow shear zones (B1), later pale green veins (V2) and open fractures with white infill (V3). Finer grain gabbro with set of dark green veins (V1) and later pale green veins (V2). V1>B1=?V2>?V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-176R-2, 0-28 cm DRY

## Core Photo




**305-U1309D-176R-3 (Section top: 858.87 mbsf)**

UNIT-467: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 7 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 467 medium- to coarse-grained gabbro. Clinopyroxene oikocrysts present.

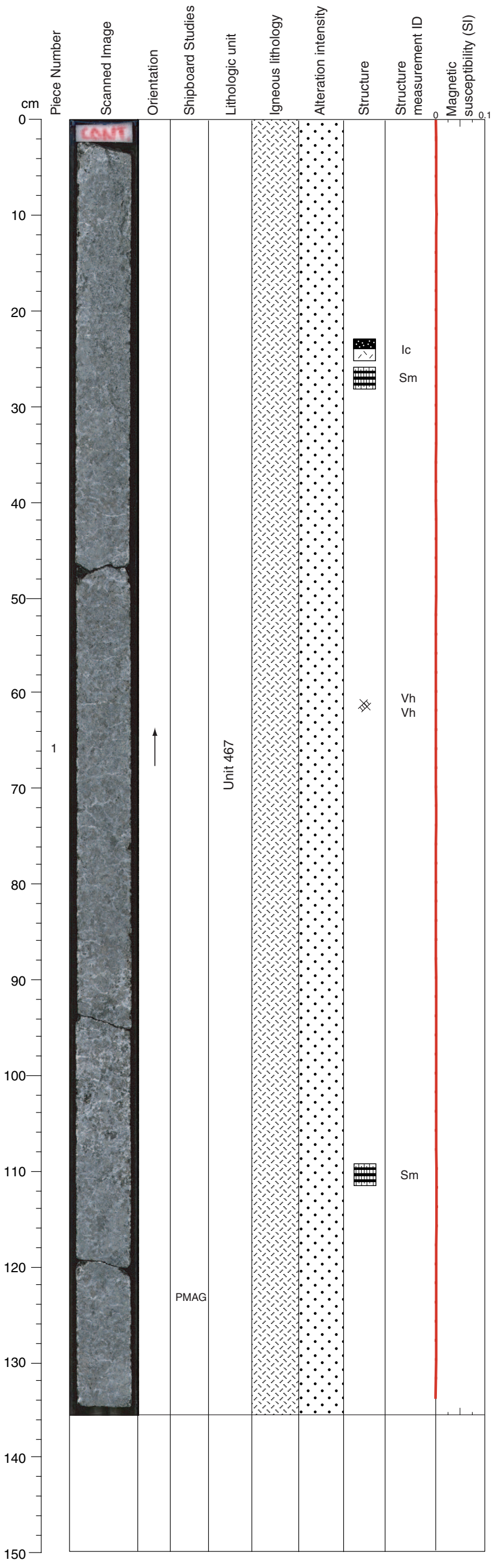
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Coarse-grained gabbro with numerous white veinlets/fractures perpendicular to the section and these lineaments are also observed around the grain boundaries. The pyroxene are slightly altered to green amphibole. From 98 to 114 cm, black zone related to the serpentinization of the olivines.

VEIN ALTERATION: n/a

STRUCTURE: Medium- to coarse-grained gabbro, heterogeneous grain size distribution of steep general attitude with magmatic fabric developed in fine-grained gabbro near contact to coarse gabbro. Sets of dark green veins with alteration zone (V1) and minor subhorizontal white cracks (V2). V1>V2.

## Core Photo




**305-U1309D-176R-4 (Section top: 860.02 mbsf)**

UNIT-467: Gabbro
Piece 1

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 467 coarse-grained gabbro.

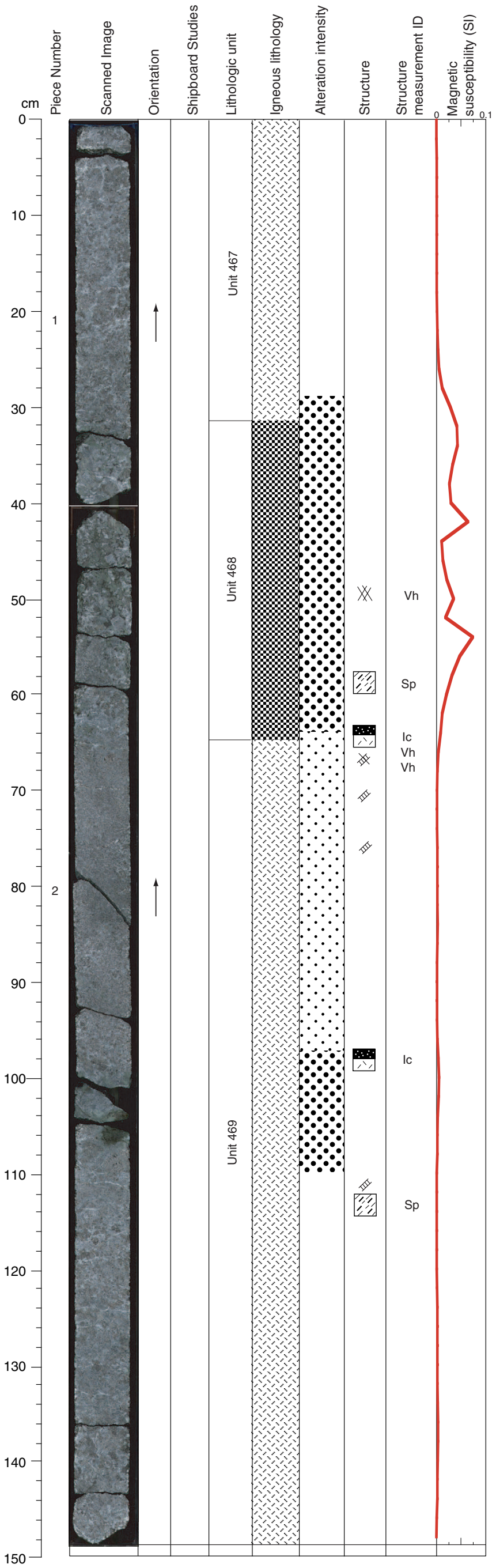
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, but with slightly more altered plagioclase toward the bottom of the section and a significant amount of sulfides.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine to coarse, locally pegmatitic gabbro. Fine-grained schlieren with near vertical attitude. Near their contact to coarser gabbro weak indication of steep magmatic fabric. Near bottom of section weak magmatic fabric locally visible with much shallower dip. Sets of dark green veins (V1) crosscut by subhorizontal white vein (V2) at 62 cm. V1>V2.

## Core Photo




**305-U1309D-177R-1 (Section top: 861.40 mbsf)**

UNIT-467: Gabbro
Pieces: 1a-1b

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 467 medium- to coarse-grained gabbro. Partly skeletal clinopyroxene, fine horizontal fracturing. Plagioclase needles to thin laths.

UNIT-468: Oxide Gabbro
Pieces: 1b-2d

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 7 mm average<br>Shape anhedral |
| Oxide | Modal 10%<br>Size 8 mm average<br>Shape anhedral |

COMMENTS: Unit 468 is coarse-grained oxide gabbro. Some coarse subhedral plagioclase surrounded by oxides. Strongly deformed. Below the microgabbro in the next unit, another 6 cm oxide-bearing band appears.

UNIT-469: Gabbro
Pieces: 2d-2j

PRIMARY MINERALOGY: Modal data from Piece 2h

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 469 is fine- to coarse-grained gabbro. Partly saussuritized plagioclase.

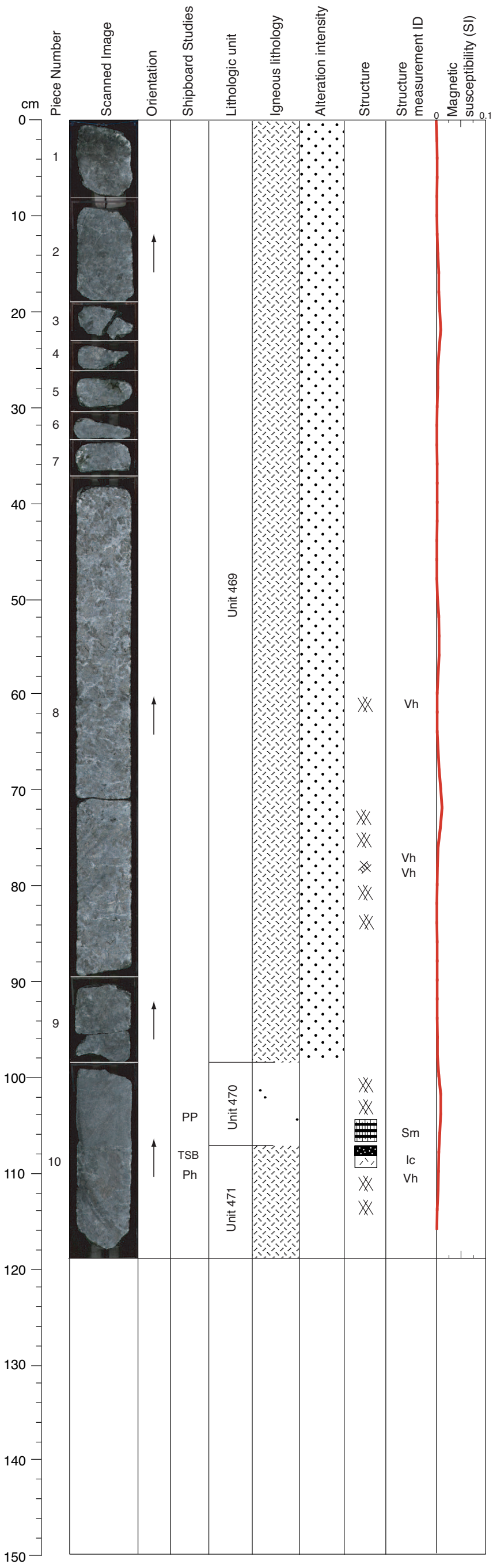
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, except between 41 and 64 cm, and between 98 and 108 cm, where the core looks brecciated along green veins. The adjacent pyroxene is more fully altered to green amphibole.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to coarse-grained gabbro with locally developed plastic strain (Sp). Sets of dark green veins (V1). A dark green vein crosscut by a subhorizontal white vein (V2) at 65 cm. Sp>V1>V2.

## Core Photo




**305-U1309D-177R-2 (Section top: 862.90 mbsf)**

UNIT-469: Gabbro
Pieces: 1-9

PRIMARY MINERALOGY: Modal data from Piece 8a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 7 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 15 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 469 coarse-grained gabbro.

UNIT-470: Olivine microgabbronorite
Piece: 10

PRIMARY MINERALOGY: Modal data from thin section (equigranular exture, average grain size 0.4 mm).

| | |
|---|---|
| Plagioclase | Modal 70%<br>Shape anhedral |
| Clinopyroxene | Modal 17%<br>Shape anhedral |
| Olivine | Modal 8%<br>Shape anhedral |
| Orthopyroxene | Modal 5%<br>Shape anhedral |

COMMENTS: Unit 470 olivine microgabbronorite.

UNIT-471: Gabbro
Pieces: 10

PRIMARY MINERALOGY: Modal data from Piece 10

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 471 is coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. There is a higher degree of alteration in the intervals of drilling biscuits where the top and bottom of pieces have coatings of secondary amphibole (at 1 cm, Piece 1, at 38-40 cm, Piece 8 and at 34-36 cm, Piece 7). Significant amount of sulfides.

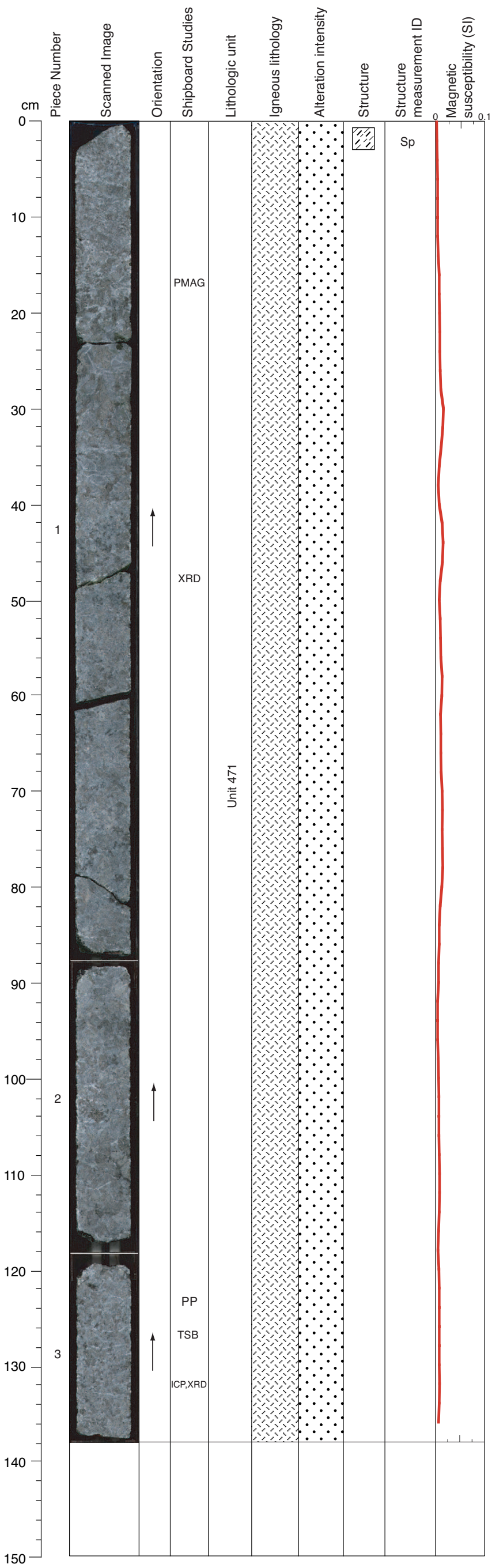
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-177R-2, 106-109 cm (#451)**

STRUCTURE: Coarse gabbro with weak magmatic (Sm) or plastic fabric and contact with later microgabbro. Magmatic flow in microgabbro is parallel to contact. Set of dark green veins (V1), high density over 10 cm interval at 60 and 108 cm. Sets of dark green veins (V1) crosscut by a subhorizontal white vein (V2) at 77 cm. Sm>V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-177R-2, 98-117 cm WET

## Core Photo




**305-U1309D-177R-3 (Section top: 864.09 mbsf)**

UNIT-471: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size to 15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 15 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 471 coarse-grained gabbro. Abundance of oikocrysts and skeletal clinopyroxene increases strongly from 37 cm downward.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Piece 1 is broken along what appear to have been green veins or very narrow networks of fine green veins and the adjacent rock is slightly more altered. From 40 cm, olivine is serpentinized and show rims of chlorite. The vein from 46 to 49 cm contains a white secondary mineral (carbonate?) and at 47 cm, a fracture filled by pale green minerals (actinolite?) occurs. Shiny pyroxene grains are observed at 69-75 cm.

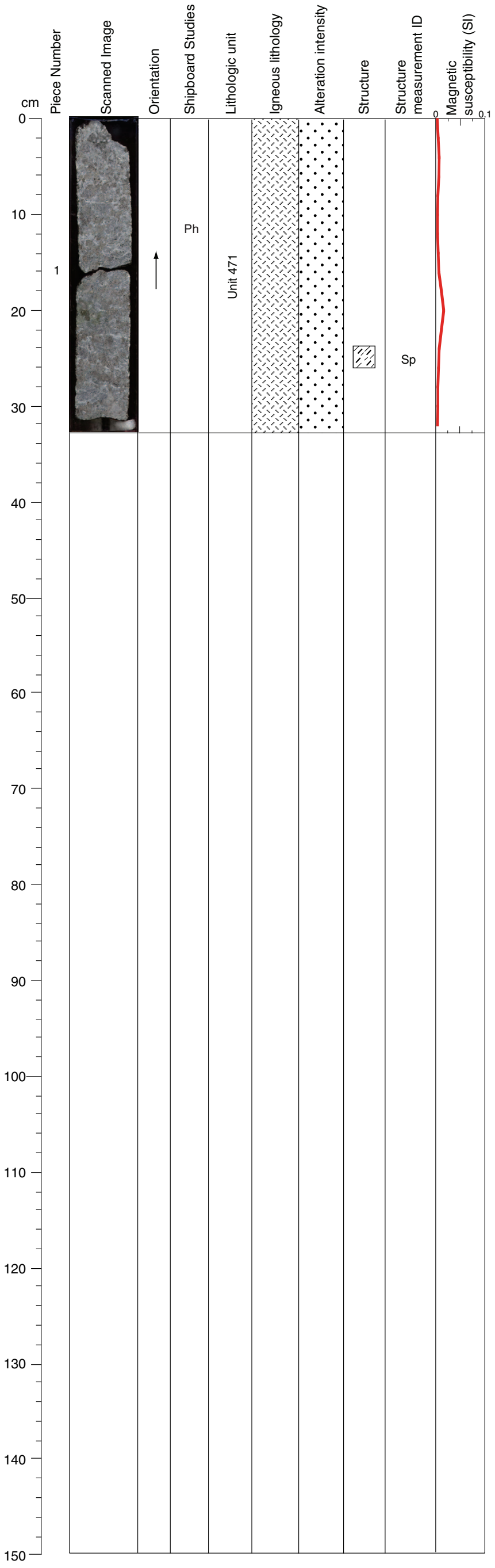
VEIN ALTERATION: Amphibole, carbonate.

THIN SECTIONS:
**305-U1309D-177R-3, 125-127 cm (#452)**

STRUCTURE: Fine- to coarse-grained gabbro with heterogeneous strain developed probably of plastic nature (Sp). Minor cataclasis or subhorizontal cracks with white infills through the section.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-177R-3, 118-137 cm WET

## Core Photo




**305-U1309D-177R-4 (Section top: 865.47 mbsf)**

UNIT-471: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size to 20 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 25 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 471 coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

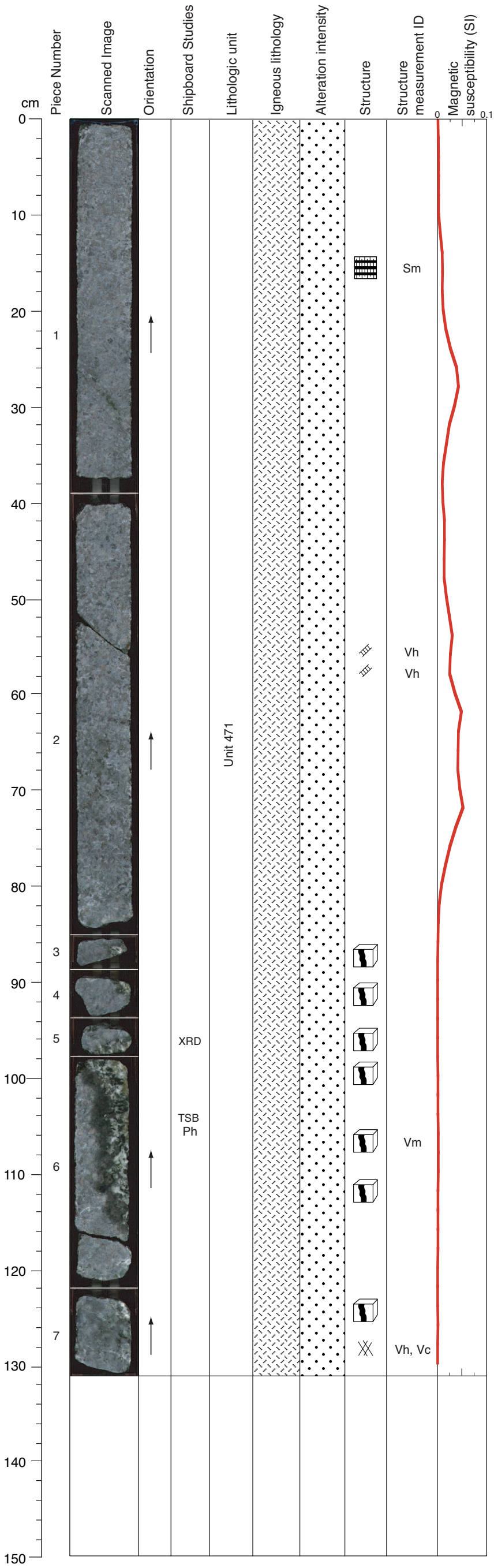
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, except for a small patch of more highly altered (to green amphibole) pyroxene grains associated with sulfides.

VEIN ALTERATION: n/a.

STRUCTURE: Coarse-grained gabbro with locally developed strain of probable plastic nature (Sp). Minor cataclasis or subhorizontal cracks with white infills throughout the section.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-177R-4, 0-25 cm WET

## Core Photo




**305-U1309D-178R-1 (Section top: 866.20 mbsf)**

UNIT-471: Gabbro
Pieces: 1-7

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 4 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 471 medium-grained gabbro. Oxides at 64-71 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, except for patches of more highly-altered gabbro scattered throughout the section. In Pieces 3, 4, and 5, there are more concentrated zones of alteration that are likely related to the leucocratic, epidote-bearing material that lies along the edge of Pieces 6, 7 and 8.

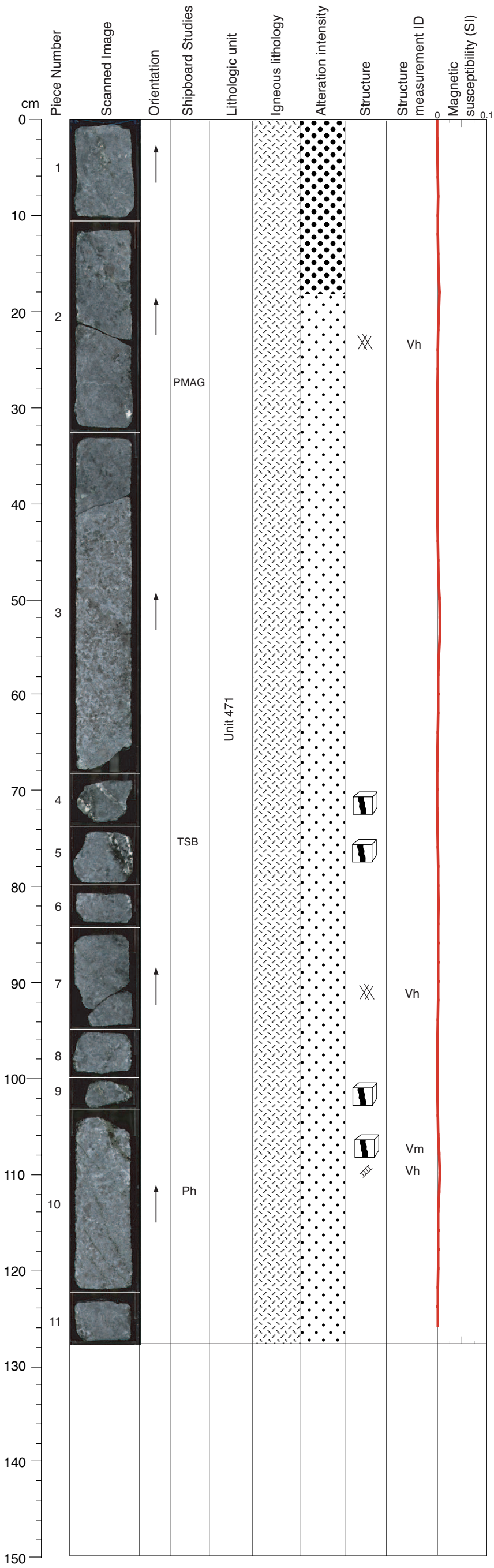
VEIN ALTERATION: Amphibole, plagioclase, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-178R-1, 103-106 cm (#453)**

STRUCTURE: Medium-grained gabbro with weak magmatic foliation (Sm), toward bottom of section coarsening associated with late leucocratic, epidote bearing vein (Vm). Dark green veins with minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-178R-1, 99-118 cm WET

## Core Photo




**305-U1309D-178R-2 (Section top: 867.51 mbsf)**

UNIT-471: Gabbro
Pieces: 1-11

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 4 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 471 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc?

COMMENTS: This section is generally more altered than the previous one and shows a continuation of the alteration associated with leucocratic intrusions (mainly dark green amphibole) or veining throughout the section at least to 109 cm. Another white mineral is found associated with this leucocratic vein (likely prehnite?). Several thin green veins cut the section.

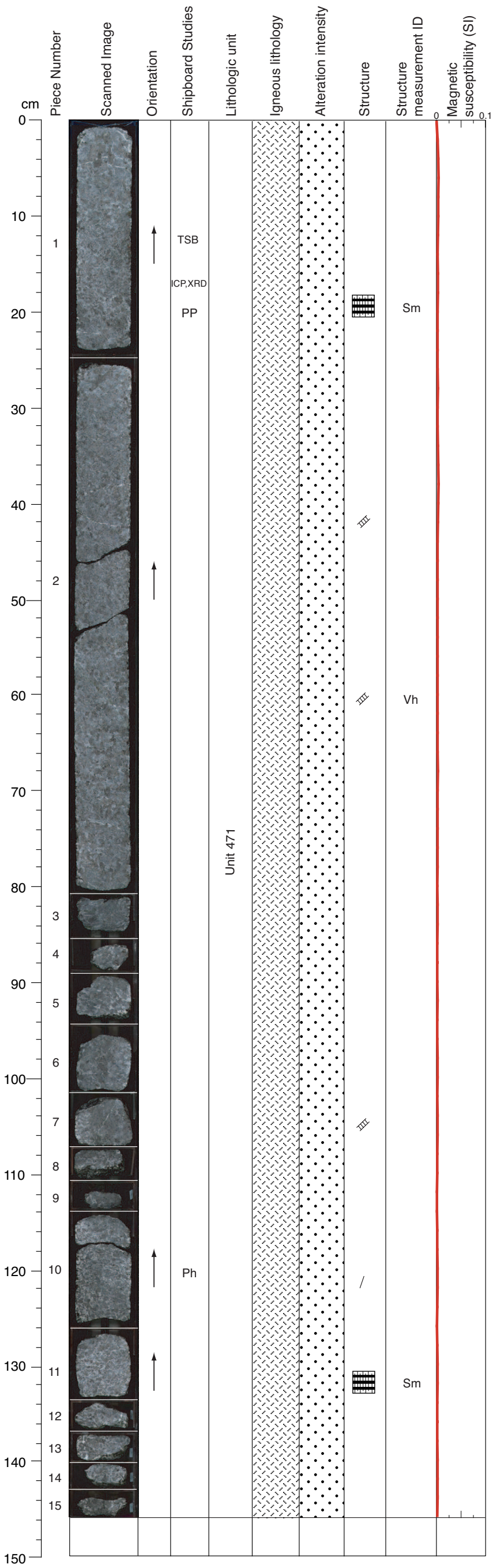
VEIN ALTERATION: Amphibole, plagioclase, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-178R-2, 74-77 cm (#454)**

STRUCTURE: Medium- to coarse-grained gabbro with no consistent magmatic or plastic foliation and with magmatic leucocratic veins (Vm). Set of dark green veins (V1) and minor white veins (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-178R-2, 68-83 cm WET
305-U1309D-178R-2, 104-122 cm WET

## Core Photo




**305-U1309D-178R-3 (Section top: 868.79 mbsf)**

UNIT-471: Gabbro
Pieces: 1-15

PRIMARY MINERALOGY: Modal data from Piece 2c

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 471 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: This section shows a return to the general background alteration typical in medium- to coarse-grained gabbro, with pyroxene fringed by alteration to green amphibole and plagioclase altered to a white secondary mineral assemblage. There are locally greater degrees of alteration showing diffuse areas of lighter white plagioclase grains. Several subhorizontal white veins are observed, and there is a significant amount of sulfides.

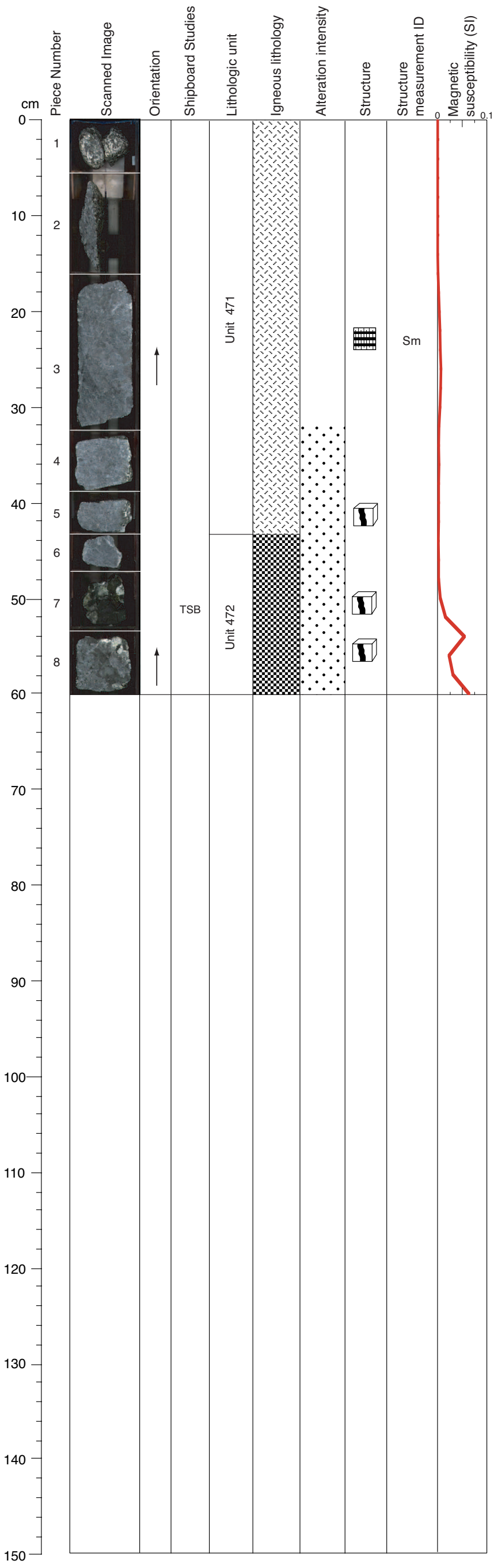
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-178R-3, 11-13 cm (#455)**

STRUCTURE: Weak to locally stronger magmatic foliation (Sm) in coarse gabbro. A few dark green veins (V1) and late white cracks (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-178R-3, 0-24 cm WET
305-U1309D-178R-3, 114-133 cm WET

## Core Photo




**305-U1309D-179R-1 (Section top: 871.00 mbsf)**

UNIT-471: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 471 medium-grained gabbro. Coarse grained clinopyroxene at 23-29 cm.

UNIT-472: Oxide Gabbro
Pieces: 6-8

PRIMARY MINERALOGY: Modal data from Piece 8

| | |
|---|---|
| Plagioclase | Modal 30%<br>Size to 15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size to 20 mm<br>Shape anhedral |
| Oxide | Modal 15%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 472 is coarse-grained oxide gabbro. Dark green mineral estimated as clinopyroxene.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Pieces 1, 2, and 3, show only very slight alteration. Background alteration in the rest of the section is slight with pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. The alteration is somewhat less than the previous section, except in patches adjacent to leucocratic material (plagioclase, epidote and amphibole replacing pyroxene), which appear throughout the section. Sulfides are observed.

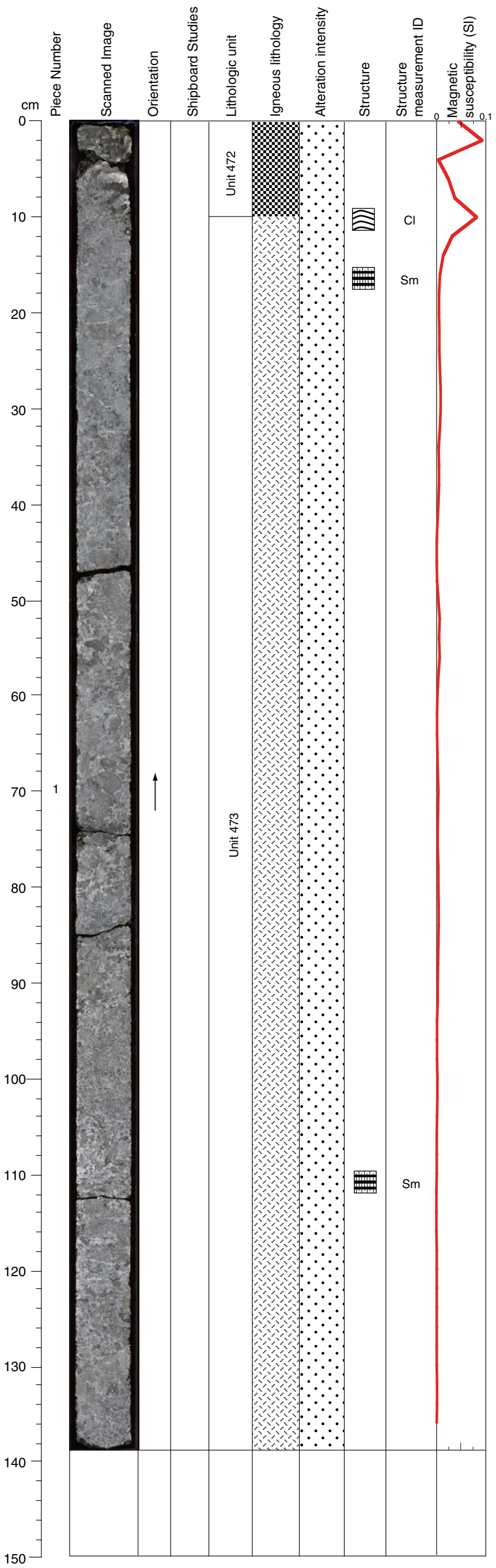
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-179R-1, 48-51 cm (#456)**

STRUCTURE: Medium-grained gabbro with weak magmatic strain developing locally. Leucocratic magmatic vein (Vm) at bottom (pegmatitic). Minor subhorizontal cracks with white infill (V1). Vm>V1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-179R-1, 44-60 cm WET

## Core Photo




**305-U1309D-179R-2 (Section top: 871.60 mbsf)**

UNIT-472: Oxide Gabbro
Pieces: 1a-1b

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size to 15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size to 20 mm<br>Shape anhedral |
| Oxide | Modal 10%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 472 is coarse-grained oxide gabbro. Dark green mineral estimated as clinopyroxene. Diffuse contact with gabbro below.

UNIT-473: Gabbro
Pieces: 1b-1f

PRIMARY MINERALOGY: Modal data from Piece 1e

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 4 mm<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Unit 473 is medium- to coarse-grained gabbro.

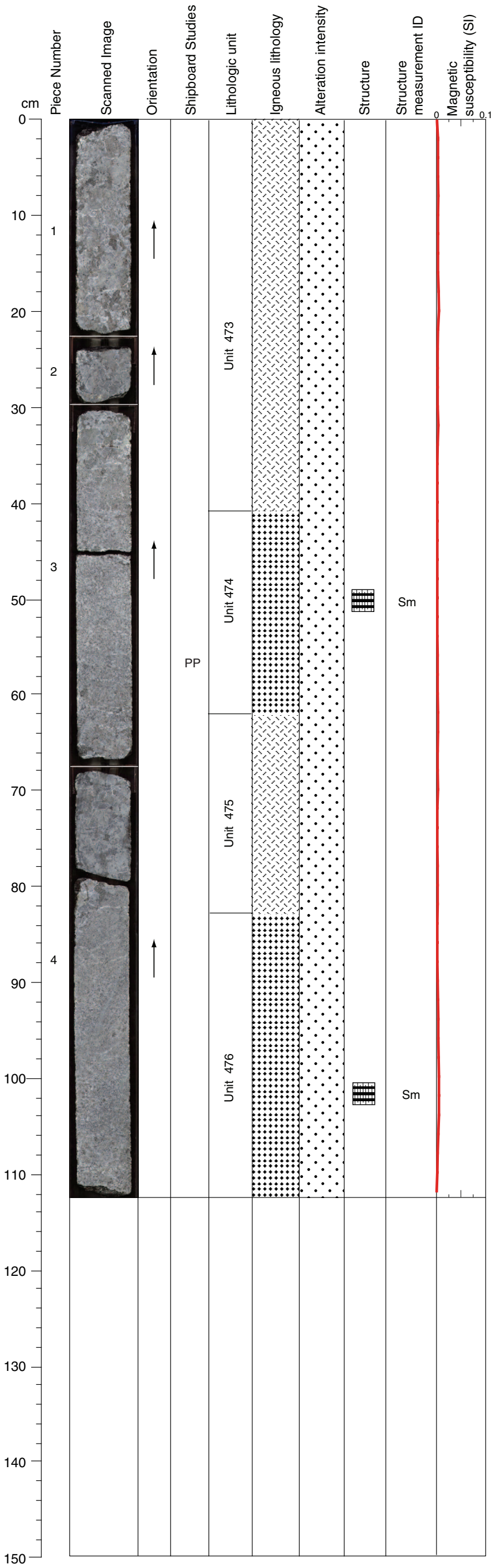
SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, the degree of alteration is quite variable in this section with patches of lighter, more heavily altered gabbro scattered throughout. Leucocratic alteration on top (1 to 8 cm) where green amphibole replace the pyroxenes. Significant amount of sulfides.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium-grained gabbro with grain size layering and weak magmatic strain developed locally. Some white cracks and alteration zones.

## Core Photo




**305-U1309D-179R-3 (Section top: 872.99 mbsf)**

UNIT-473: Gabbro
Pieces: 1-3a

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 25 mm<br>Shape anhedral |

COMMENTS: Unit 473 is medium- to coarse-grained gabbro.

UNIT-474: Olivine Gabbro
Pieces: 3a-3b

PRIMARY MINERALOGY: Modal data from Piece 3b

| | |
|---|---|
| Olivine | Modal 20%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Unit 474 is fine-grained olivine gabbro. Too fine to distinguish olivine.

UNIT-475: Gabbro
Pieces: 3b-4b

PRIMARY MINERALOGY: Modal data from Piece 4b

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size to 7 mm<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 475 is medium- to coarse-grained gabbro. Upper contact at 62 cm is diffuse and lower contact at 82 cm is relatively sharp.

UNIT-476: Olivine Gabbro
Pieces: 4b

PRIMARY MINERALOGY: Modal data from Piece 4b

| | |
|---|---|
| Olivine | Modal 20%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Unit 476 is fine-grained olivine gabbro. Euhedral-subhedral plagioclase at 101-112 cm.

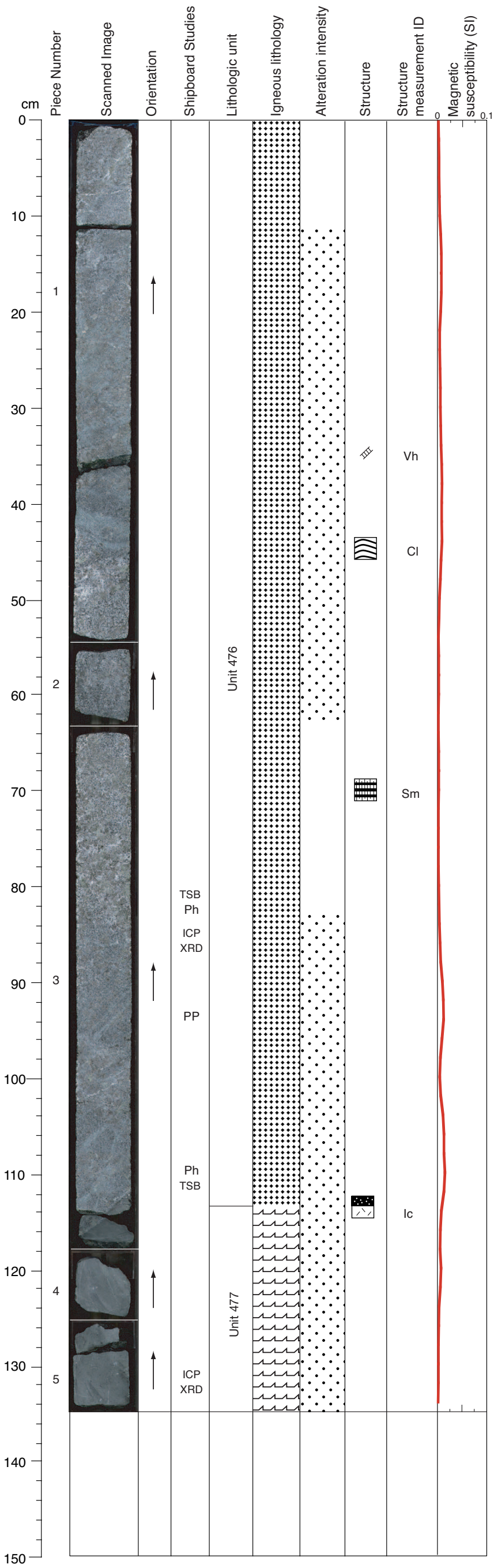
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Pyroxenes are slightly altered to green amphibole, significant amount of sulfides and several white veins are observed around the grain boundaries. At 45-66 cm and from 80 cm to the end, finer-grained part with dark blue-green amphibole veins and white veins.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Coarse- and fine-grained gabbro with magmatic foliation visible in fine-grained section having a shallow dip. Minor subhorizontal white cracks.

## Core Photo




**305-U1309D-179R-4 (Section top: 874.12 mbsf)**

UNIT-476: Olivine Gabbro
Pieces: 1-3a

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 20%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 20%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 476 is fine- to medium-grained olivine gabbro. Euhedral-subhedral plagioclase at 101-112 cm. Gradual change in grain size. Euhedral-subhedral plagioclase at 46-85 cm. Troctolitic zone at 45-93 cm.

UNIT-477: Diabase
Pieces: 3a-5

COMMENTS: Unit 477 is diabase. Contact seen at 112-117 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote

COMMENTS: In this section the areas of very slight background alteration (blank intervals in the alteration column), with pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, have been overprinted by alteration associated with numerous individual veins and networks of fine green veins (chlorite, tremolite, and actinolite). This alteration includes swaths of generally greener rock (pyroxene more heavily replaced by green amphibole). A less altered zone exists between about 45 and 80 cm. A diabase beginning at about 112 cm is cut by several narrow veins and has a general greenish cast. Sharp contact between the diabase and the coarse-grained gabbro.

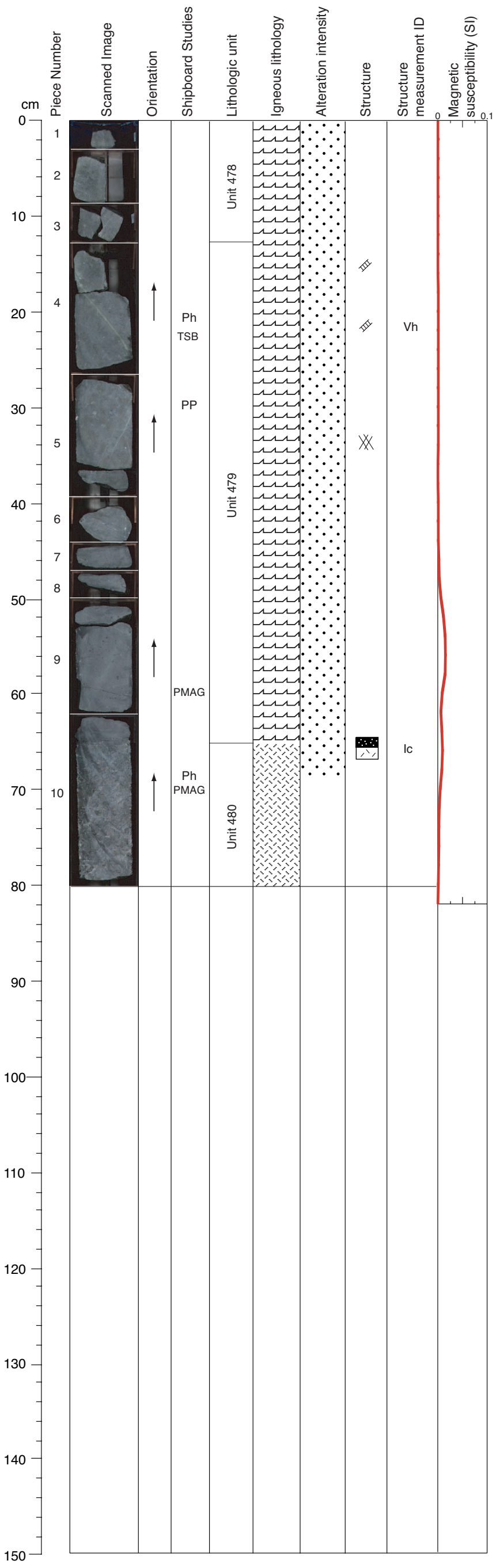
VEIN ALTERATION: Amphibole, plagioclase, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-179R-4, 80-83 cm (#457)**
**305-U1309D-179R-4, 109-112 cm (#458)**

STRUCTURE: Coarse gabbros with a few pale green veins and some white subhorizontal cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-179R-4, 75-95 cm WET
305-U1309D-179R-4, 107-124 cm WET

## Core Photo




**305-U1309D-180R-1 (Section top: 875.80 mbsf)**

UNIT-478: Diabase
Pieces: 1-3

COMMENTS: Unit 478 is diabase. Rubble may be in place.

UNIT-479: Diabase
Pieces: 4-10

COMMENTS: Unit 479 is diabase. Larger grains (<5 mm) of plagioclase and olivine.

UNIT-480: Gabbro
Piece 10

PRIMARY MINERALOGY: Modal data from Piece 10a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 480 is medium- to coarse-grained gabbro. Sharp wavy contact, finer grained gabbro near contact, transitioning to coarser grained 40 mm from contact.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Diabase continues from last section with similar alteration. One 2-mm-wide light green vein (actinolite?) with a diffuse green halo cuts the diabase from 19 to 27 cm. Several additional thin green veins cut the other diabase pieces. Below the contact with gabbro the rock is only very slightly altered (blank alteration column).

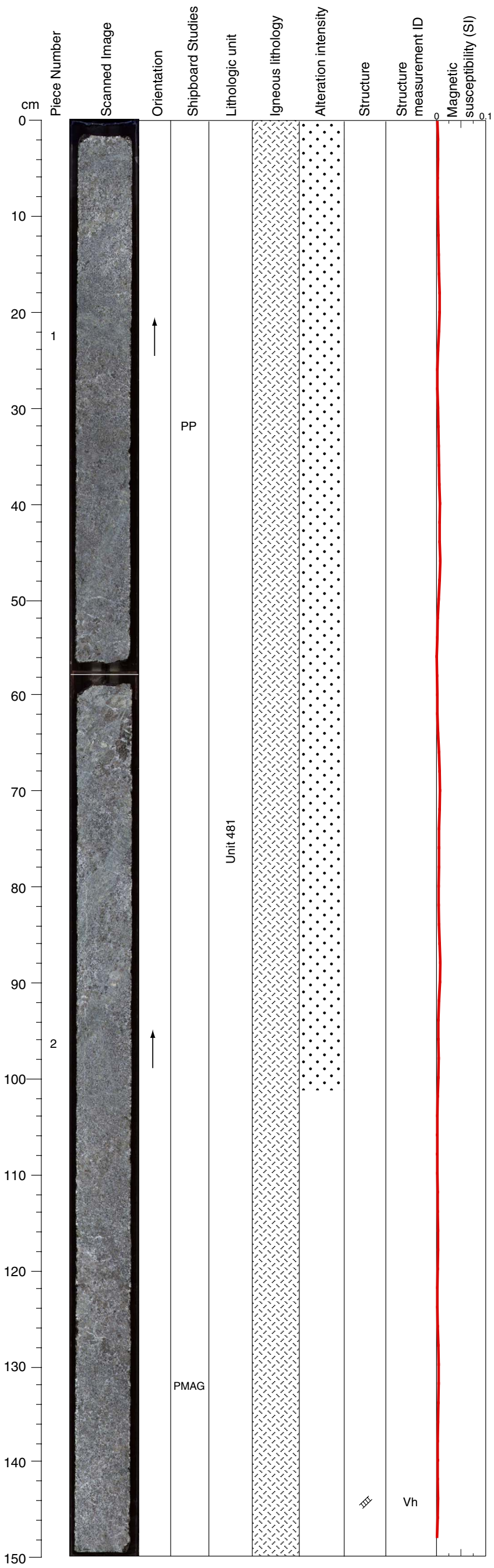
VEIN ALTERATION: Amphibole, carbonate.

THIN SECTIONS:
**305-U1309D-180R-1, 20-23 cm (#459)**

STRUCTURE: Diabase in sharp contact to isotropic coarse gabbro. Yellowish open veins in diabase. Minor cracks with white infill in gabbro.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-180R-1, 13-26 cm WET
305-U1309D-180R-1, 63-79 cm WET

## Core Photo




**305-U1309D-180R-2 (Section top: 876.63 mbsf)**

UNIT-481: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Pieces 1 and 2

| | |
|---|---|
| Plagioclase | Modal 60% average<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40% average<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 481 is medium-grained gabbro. Downhole modal variation 50-65% plagioclase and 35-50% clinopyroxene.

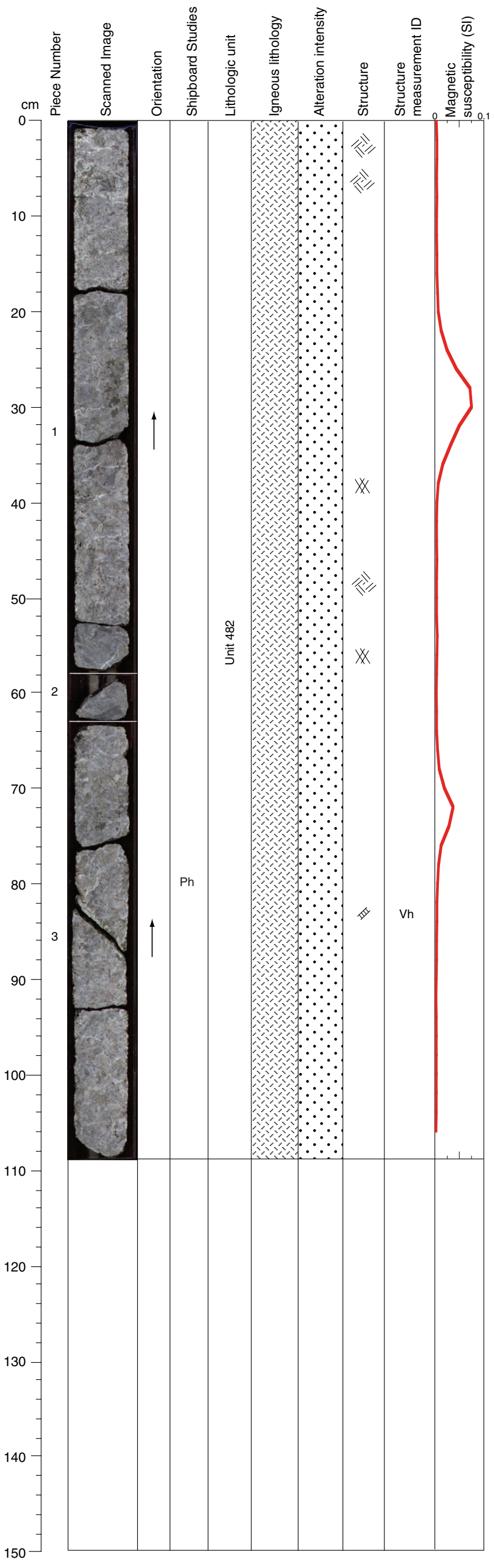
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. The coarser gabbro grades rapidly into finer grained gabbro from 1 to 4 cm and the remainder of the section is only very slightly altered as in previous sections (blank altration column) except in the vicinity of numerous fine green vein networks that crosscut the core. The rock adjacent to these is slightly more altered (greener and dark blue).

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to medium-grained gabbro without any consistent magmatic or plastic fabric. A single tiny, pale green vein.

## Core Photo




**305-U1309D-180R-3 (Section top: 878.13 mbsf)**

UNIT-482: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 65% average<br>Size to 20 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35% average<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Unit 482 is medium- to coarse-grained gabbro. Sulfide trace (up to 1% in Pieces 1b and 3a); bands and patches of oxides (< 10 mm) at 12-35 cm and 70-75 cm (about 3% in these areas).

SECONDARY MINERALOGY: Chlorite? pale amphibole?

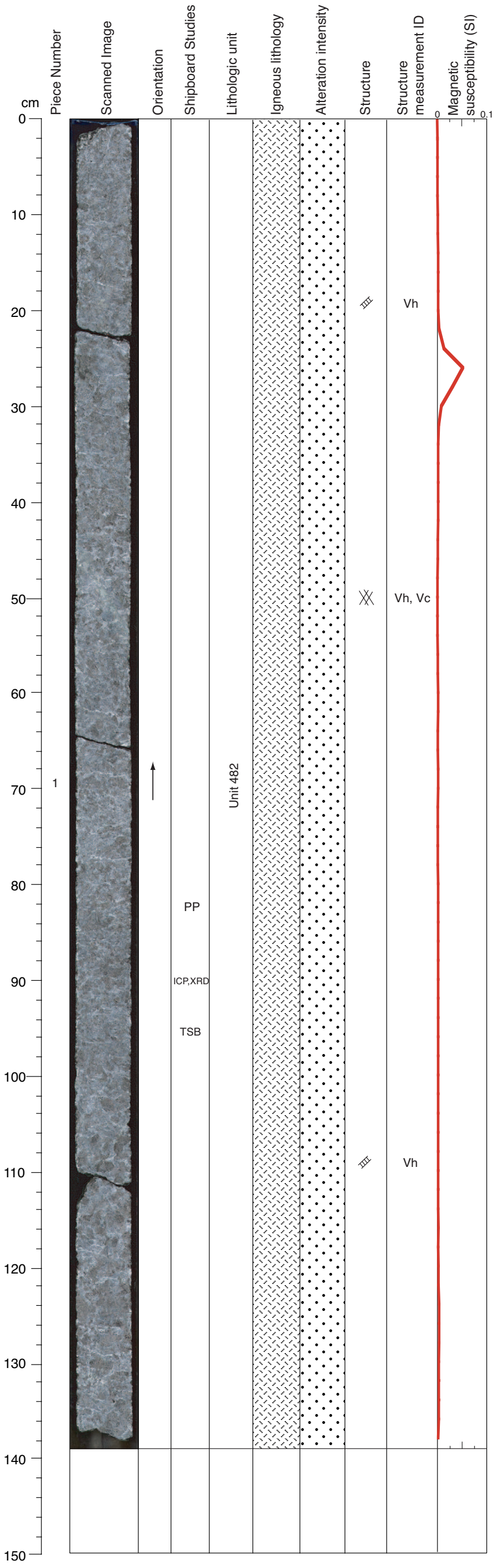
COMMENTS: Although the general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, as in previous sections, this coarser grained gabbro is less altered than the previous section to about 52 cm where it is crosscut to about 63 cm by green veins and their attendant alteration halos. Another branching green vein (actinolite?) between 81 and 88 cm has a narrow alteration halo and contains white secondary minerals.

VEIN ALTERATION: Amphibole, talc, carbonate.

STRUCTURE: Coarser grained gabbro with no magmatic or plastic foliation. A few pale green veins and subhorizontal minor cracks with white infill.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-180R-3, 76-92 cm WET

## Core Photo




**305-U1309D-180R-4 (Section top: 879.22 mbsf)**

UNIT-482: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Unit 482 is medium- to coarse-grained gabbro. Oxides at 23-30 cm (about 2%), clinopyroxene patches.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals.This section also contains one notable fine green vein from 44 to 54 cm.

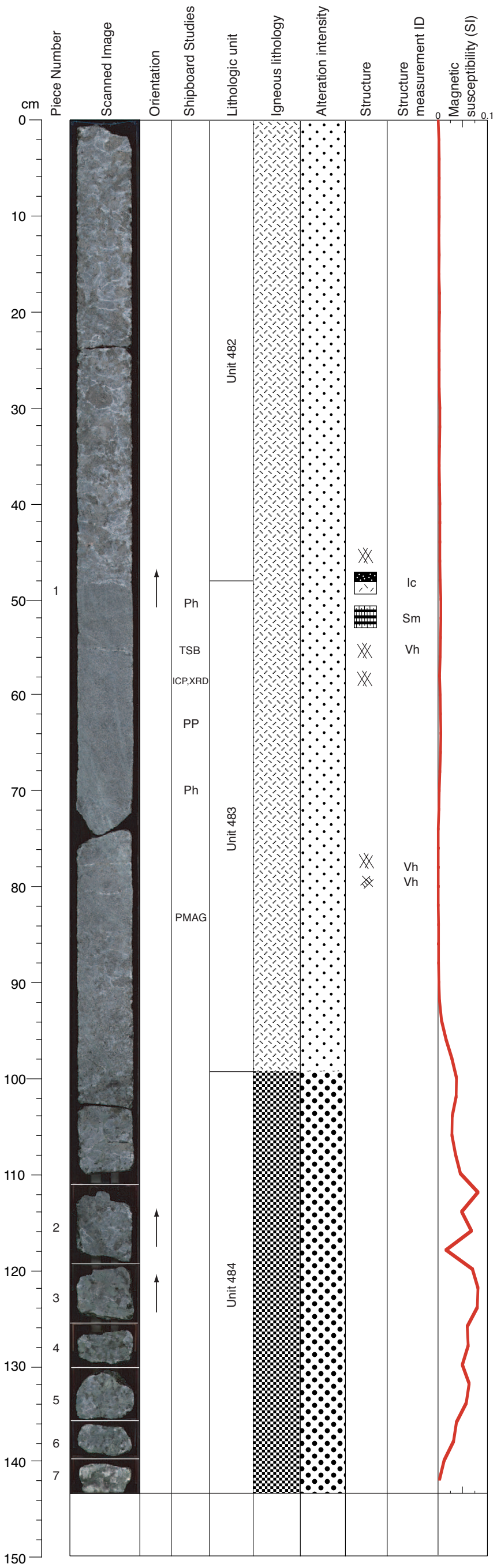
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-180R-4, 94-96 cm (#460)**

STRUCTURE: Coarse-grained gabbro with no magmatic or plastic foliation. Pale green veins (V1) and later subhorizontal cracks with white infill (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-180R-4, 84-104 cm WET

## Core Photo




**305-U1309D-181R-1 (Section top: 880.60 mbsf)**

UNIT-482: Gabbro
Pieces: 1a-1b

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size to 35 mm<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size to 50 mm<br>Shape anhedral |

COMMENTS: Unit 482 coarse-grained gabbro.

UNIT-483: Gabbro to Microgabbro
Pieces: 1b-1c

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Unit 483 is fine-grained gabbro to microgabbro. Less clinopyroxene at 50-70 cm, grain size variation. Olivine up to 5% in thin section.

UNIT-484: Oxide Gabbro
Pieces: 1c-7

PRIMARY MINERALOGY: Modal data from Pieces 3-5

| | |
|---|---|
| Plagioclase | Modal 75%<br>Size to 20 mm<br>Shape anhedral |
| Clinopyroxene | Modal 20%<br>Size to 20 mm<br>Shape anhedral |
| Oxide | Modal 5%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 484 is coarse-grained oxide gabbro. Leucocratic alteration, trace of sulfides.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Background alteration is similar to previous section and shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Several green veins cut the core and have diffuse green alteration halos extending about 5 mm to either side of all veins. These crosscut both fine- and coarse-grained parts of the section. One wider (about 3 mm) branching set of veins cuts the section between 93 and 102 cm and lacks an alteration halo. Sulfides are observed. At 140-143 cm (Piece 7) leucocratic alteration with amphibole, plagioclase and epidote.

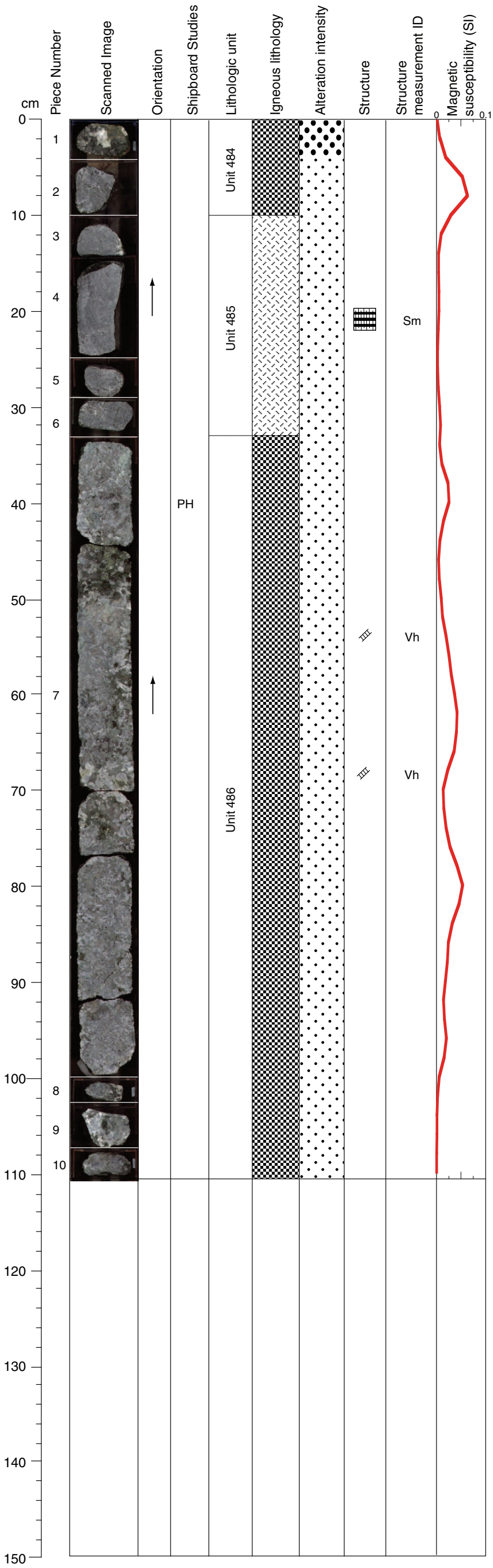
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-181R-1, 54-56 cm (#461)**

STRUCTURE: Coarse gabbro with no fabric cut by microgabbro with magmatic foliation (Sm). Little veining and distributed cataclasis in coarse gabbro. The microgabbro has a set of dark green veins (V1) crosscut by later pale green veins (V2). Minor subhorizontal cracks with white infill (V3). V1>V2>V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-181R-1, 40-60 cm WET
305-U1309D-181R-1, 62-82 cm WET

## Core Photo




**305-U1309D-181R-2 (Section top: 882.04 mbsf)**

UNIT-484: Oxide Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 52%<br>Size to 20 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 10 mm<br>Shape anhedral |
| Oxide | Modal 8%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 484 coarse-grained oxide gabbro, epidote alteration.

UNIT-485: Gabbro
Pieces: 3-6

PRIMARY MINERALOGY: Modal data from Pieces 5

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size to 2 mm<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size to 2 mm<br>Shape anhedral |

COMMENTS: Unit 485 is fine-grained gabbro.

UNIT-486: Oxide Gabbro
Pieces: 7-10

PRIMARY MINERALOGY: Modal data from Piece 7b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size to 20 mm<br>Shape anhedral |
| Clinopyroxene | Modal 31%<br>Size to 25 mm<br>Shape anhedral |
| Oxide | Modal 4%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 486 is coarse-grained oxide gabbro with epidote and leucocratic alteration; vertical zone with grain size reduction at 52-63 cm, olivine-bearing.

SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote

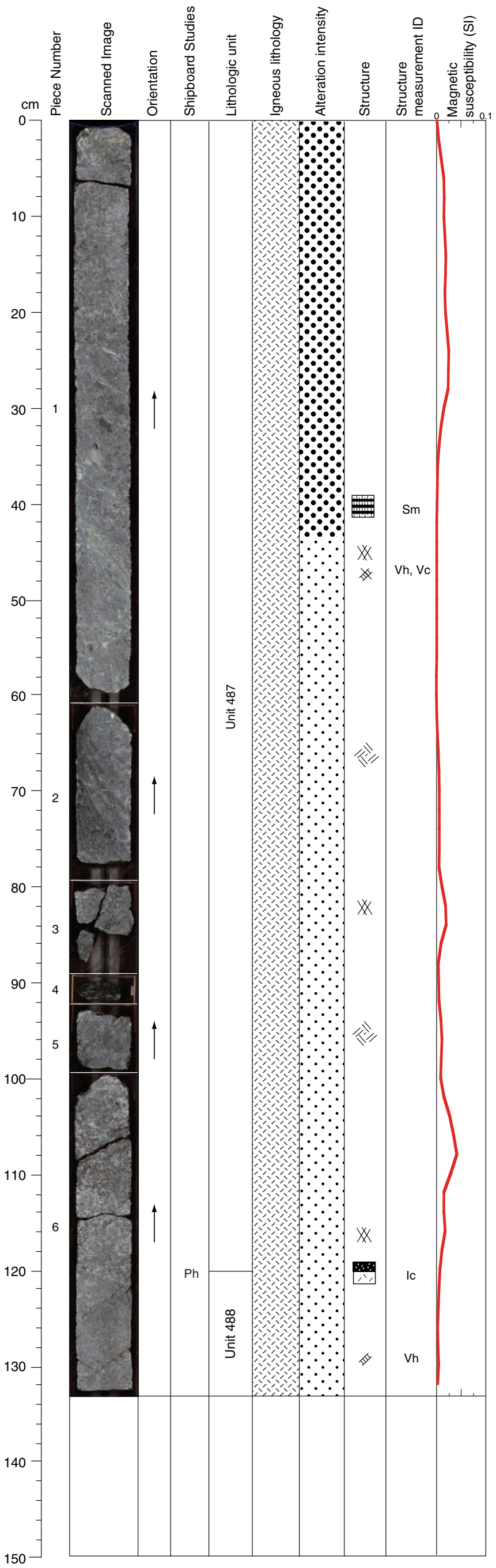
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. The coarser grained material in Piece 1 shows a higher degree of alteration possibly accompanied by epidote (leucocratic alteration). Pieces 2, 3, 4, 5, and 6a have patches of higher alteration where plagioclase is lighter and pyroxene are replaced by green amphibole and Piece 6b has another patch of more highly altered material like that in Piece 1. The side of Piece 6b also has higher alteration from about 53 to 70 cm with much greater green amphibole replacement of pyroxene. Parts of Piece 6c also show this type of alteration (patchy) as does Piece 8.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Coarse gabbro with no magmatic or plastic foliation. Unpreserved contacts to microgabbro which has a magmatic foliation. Steep dark green veins (V1) and shallow dipping pale green veins (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-181R-2, 37-57 cm WET

## Core Photo




**305-U1309D-181R-3 (Section top: 883.14 mbsf)**

UNIT-487: Gabbro
Pieces: 1-6a

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size up to 25 mm<br>Shape anhedral |

COMMENTS: Unit 487 is fine- to coarse-grained gabbro. Scattered oxide grains, finer grained band at 72-78 cm.

UNIT-488: Gabbro
Pieces: 6b

COMMENTS: Unit 488 is fine-grained gabbro with trace of olivine. Too fine to estimate mode.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

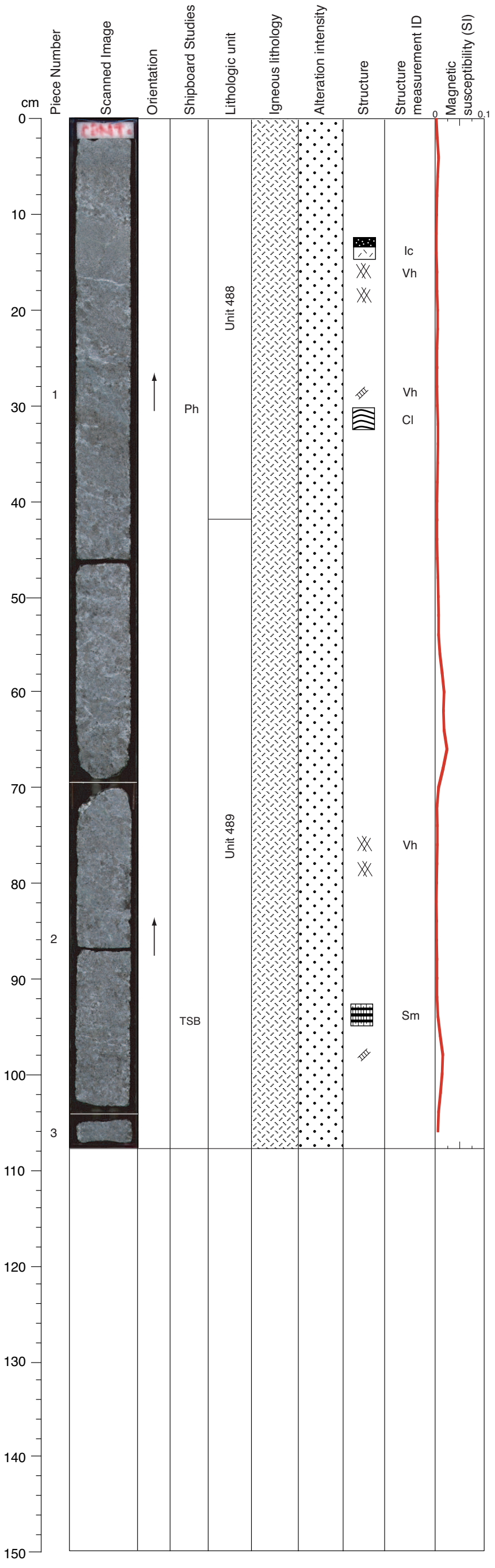
COMMENTS: The background alteration is typical of previous sections with green amphibole reaction rims on pyroxene and alteration of plagioclase to white secondary products (usually chlorite and some amphibole in thin section). Green veins cut the section as individual haloed veins or as branching systems with a more widespread overlapping halo. The veining begins at about 24 cm and extends to 50 cm. Piece 8 is fractured and the broken surfaces are mantled with green and white (carbonate or zeolite?). Two extant veins run diagonally across the section one from 121 to 126 cm and one from 128 cm to the end of the section (parallel to the one above).

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Coarse gabbro with weak but clear fabric and (multiply?) intrusive microgabbros. Note that grain size change to coarse appears to progress in steps. Set of dark green veins (V1) crosscut by pale green vein (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-181R-3, 114-133 cm WET

## Core Photo




**305-U1309D-181R-4 (Section top: 884.47 mbsf)**

UNIT-488: Gabbro
Pieces: 1a

COMMENTS: Unit 488 is fine-grained gabbro. Difficult to estimate mode across fine-grained intervals. Patches with medium-grained plagioclase and clinopyroxene. Large variation in grain size, one oblique clinopyroxene band (25 mm wide) at 30-36 cm.

UNIT-489: Gabbro
Pieces: 1a-3

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Unit 489 is medium- to coarse-grained gabbro. Probably continuous with Unit 488, but with more regular in grain size.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Several green veins cut across the section and have haloes about 1 cm wide. A lighter vein between 10 and 17 cm cuts both the coarser and finer grained gabbro and a green vein that lies within a zone of finer gabbro. A white subhorizontal vein appears to truncate the light green and white vein at about about 17 cm. Some of the white veins show zeolite mineralization in thin section.

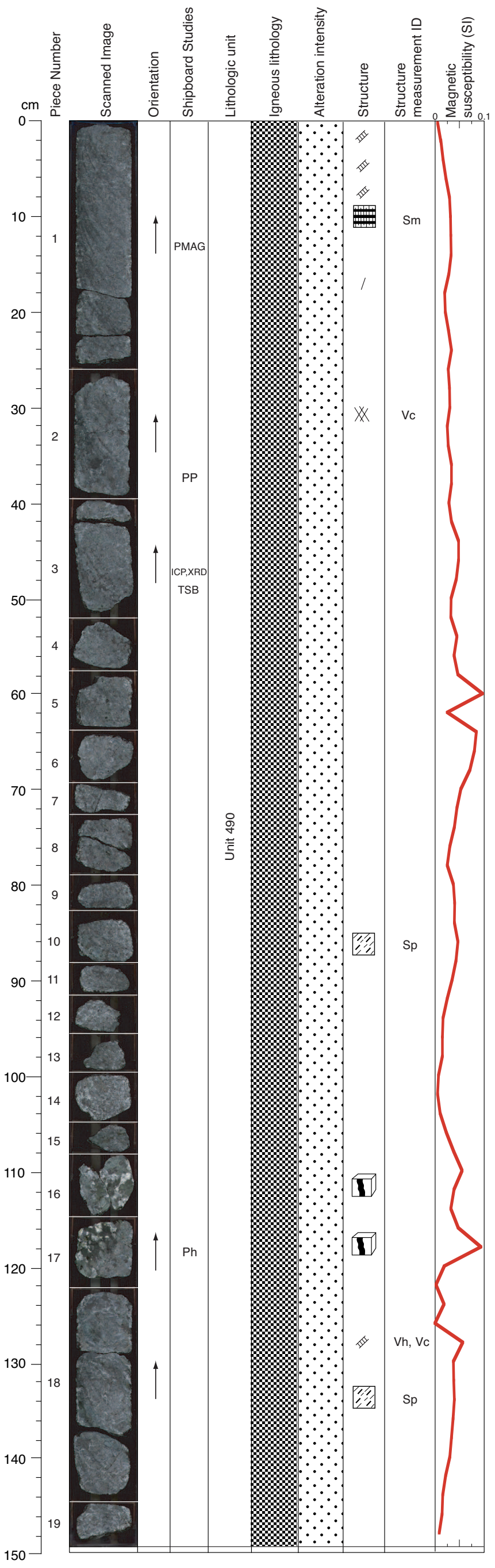
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-181R-4, 92-95 cm (#462)**

STRUCTURE: Clear grain size and modal layering in gabbro with possible intrusive events, good magmatic foliation in lower part (Sm). Set of dark green veins crosscut by subhorizontal cracks with white infill.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-181R-4, 20-40 cm WET

## Core Photo




**305-U1309D-182R-1 (Section top: 885.40 mbsf)**

UNIT-490: Oxide Gabbro
Pieces: 1-19

PRIMARY MINERALOGY: Modal data from Piece 3b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size to 10 mm<br>Shape anhedral |
| Oxide | Modal 15%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 490 is medium-grained oxide gabbro. Massive oxide (<10 mm grain size). Coarse-grained clinopyroxene at 104-149 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, but there are patches of leucocratic zones with more highly altered pyroxene (amphibolitized) and white plagioclase in the coarser material from about 84 to 121 cm. A significant amount of sulfides are observed.

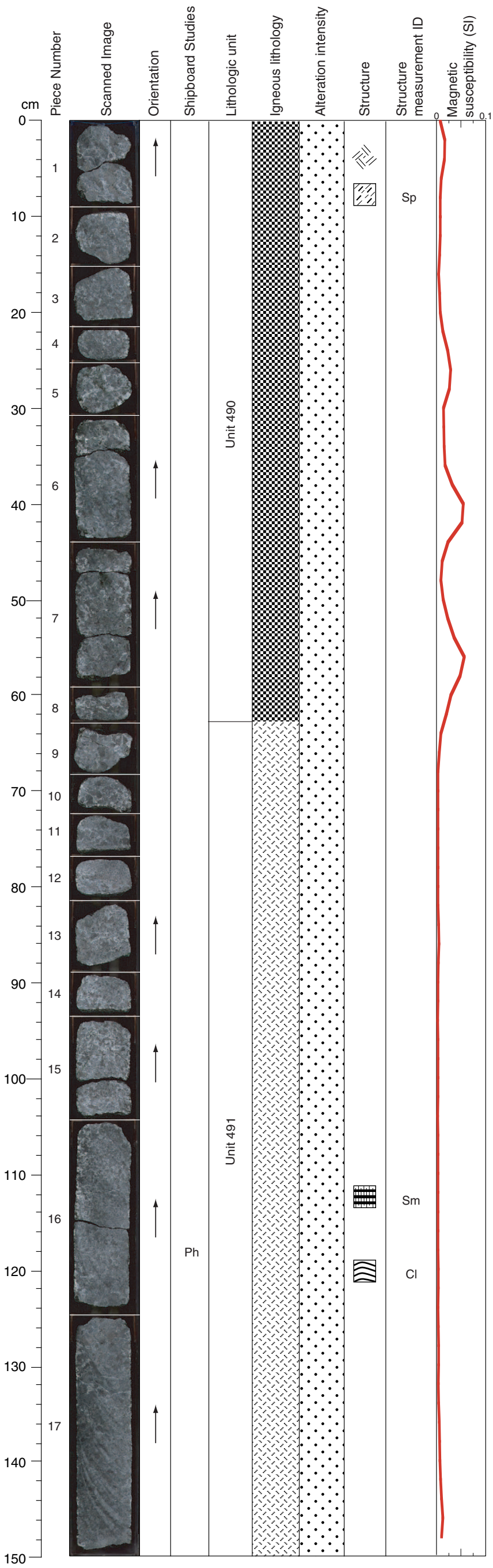
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-182R-1, 47-49 cm (#463)**

STRUCTURE: Heterogeneously strained fine- to medium-grained gabbro, possibly some plastic deformation. Oxide bearing at bottom of section, with minor cataclasis (V3) and complex network of irregular dark (V1) and pale green veins (V2). V1>V2>V3.

CLSOE-UP PHOTOGRAPHS:
305-U1309D-182R-1, 40-57 WET
305-U1309D-182R-1, 105-128 cm WET

## Core Photo




**305-U1309D-182R-2 (Section top: 886.90 mbsf)**

UNIT-490: Oxide Gabbro
Pieces: 1-8

PRIMARY MINERALOGY: Modal data from Piece 3b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size to 10 mm<br>Shape anhedral |
| Oxide | Modal 15%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 490 is medium-grained oxide gabbro. Oxide no longer visible at 63 cm, Piece 8.

UNIT-491: Gabbro
Pieces: 9-17

PRIMARY MINERALOGY: Modal data from Piece 16a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 5 mm<br>Shape anhedral |

COMMENTS: Unit 491 fine- to coarse-grained gabbro. Variable grain size that changes gradually down core. Clinopyroxene concentration (>80%) at 138-150 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

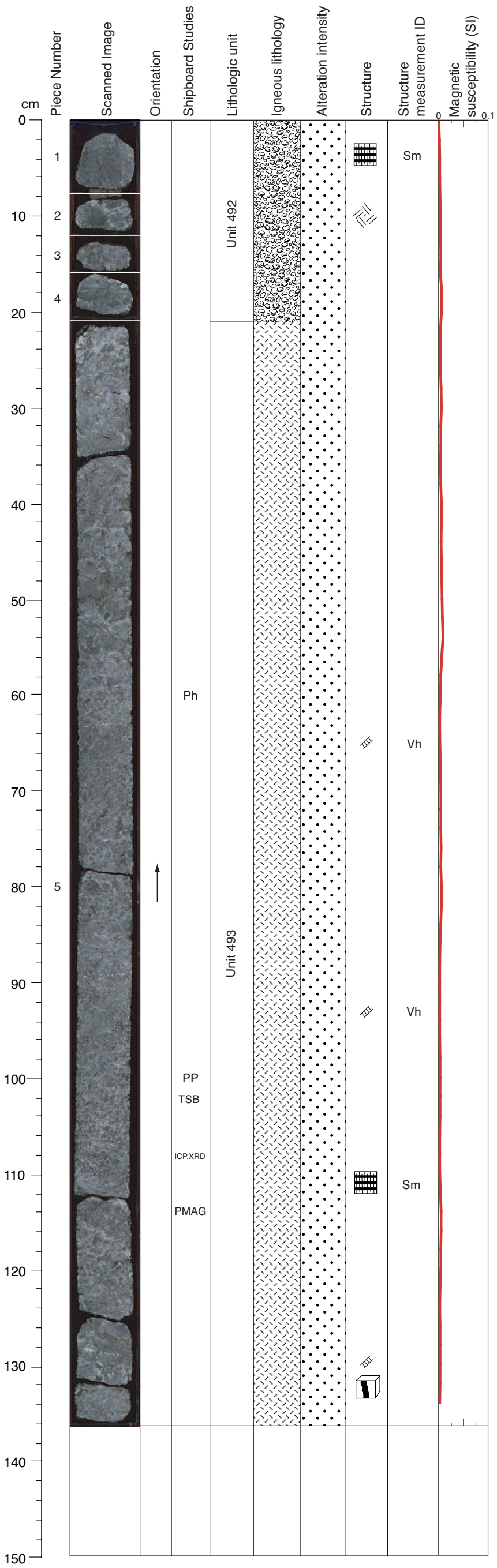
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Patches of lighter alteration are scattered throughout the section mainly showing up as white edges of plagioclase grain boundaries, but also as patches in some pieces. Significant amount of sulfides is observed.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium- to coarse-grained gabbro, locally oxide bearing and locally with weak magmatic strain and grain size layering. A dark green vein (V1), some irregular pale green veins (V2) and minor cataclasis (B) all occur. V1>V2>B0

CLOSE-UP PHOTOGRAPHS:
305-U1309D-182R-2, 105-124 cm WET.

## Core Photo




**305-U1309D-183R-1 (Section top: 890.20 mbsf)**

UNIT-492: Rubble
Pieces: 1-4

COMMENTS: Unit 492 is rubble.

UNIT-493: Gabbro
Pieces: 5

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Unit 493 is medium- to coarse-grained gabbro. Variable grain size.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, but in addition some green veins cut the section at about 60 to 70 cm, with a 5 mm green halo, at 89 to 96 cm. A patch of higher degree alteration with completely altered pyroxene (to green amphibole) is present in Pieces 5e and 5f. Leucocratic alteration is observed on the edge of Pieces 2 to 4. Significant amount of sulfides.

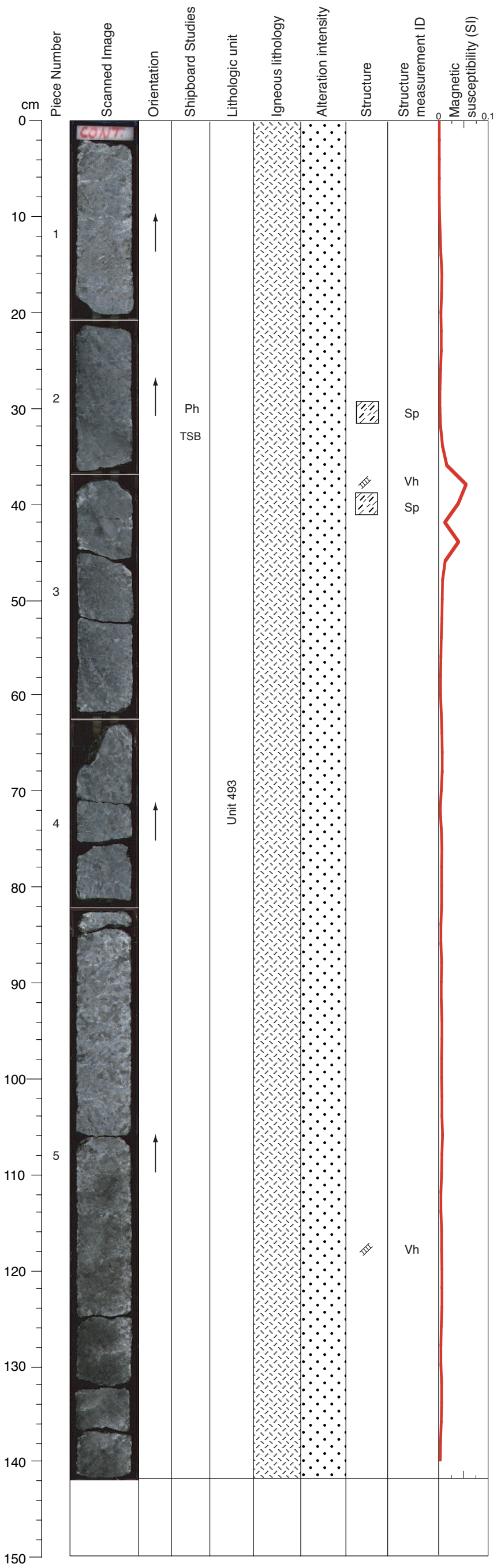
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-183R-1, 101-103 cm (#464)**

STRUCTURE: Medium-grained gabbro with weak magmatic fabric becoming coarse-grained and mafic down core with only local shear developed. A set of steep dark green veins (V1) and irregular white veins, subhorizontal and irregular (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-183R-1, 50-70 cm WET
305-U1309D-183R-1, 90-110 cm WET

## Core Photo




**305-U1309D-183R-2 (Section top: 891.56 mbsf)**

UNIT-493: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 5b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 12 mm<br>Shape anhedral |

COMMENTS: Unit 493 is medium- to coarse-grained gabbro. Quite inhomogeneous interval. Clinopyroxene concentration >85 modal% at 25-31 cm. Thin oxide dikelet (deformed?, 0.5 cm thick) at 32 cm. Coarse-grained clinopyroxene at 33-44 cm.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, but at 82 cm the gabbro appears slightly more altered with more white patches and white edges of plagioclase grains.

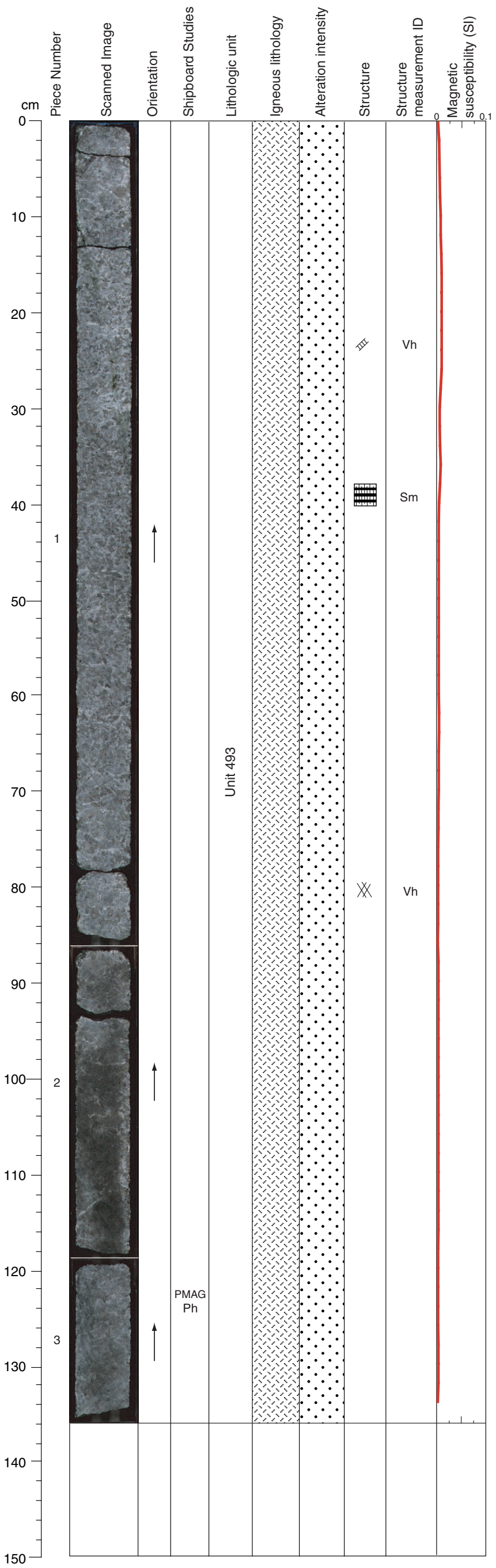
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-183R-2, 32-34 cm (#465)**

STRUCTURE: Medium- to coarse-grained gabbro with modal variation across diffuse boundaries with plastic strain developing in upper part of section, concentrating in a 0.5 cm shear zone consisting largely of oxides. Steely dipping dark green vein sets (V1) and minor subhorizontal irregular cracks with white infill (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-183R-2, 21-45 cm WET
305-U1309D-183R-2, 21-45 cm DRY

## Core Photo




**305-U1309D-183R-3 (Section top: 892.98 mbsf)**

UNIT-493: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 12 mm<br>Shape anhedral |

COMMENTS: Unit 493 is medium- to coarse-grained gabbro. Continued from previous section. Relatively homogeneous in grain size and modal ratio.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

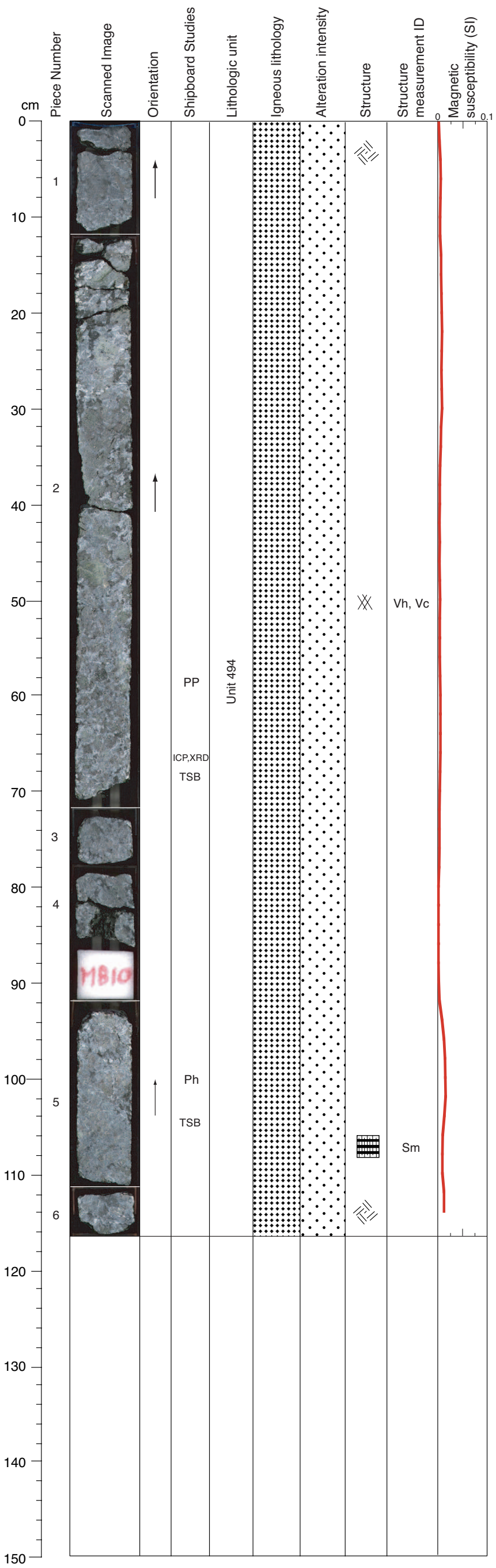
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. This section is also cut by a green vein from 10 cm to about 37 cm with a halo about 5 mm wide (total).

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Modally relatively homogeneous medium-grained gabbro with magmatic strain. Steely dipping dark green vein sets (V1) and minor subhorizontal irregular cracks with white infill (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-183R-3, 119-135 cm WET
305-U1309D-183R-3, 74-94 cm WET

## Core Photo




**305-U1309D-184R-1 (Section top: 895.00 mbsf)**

UNIT-494: Olivine Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 2d

| | |
|---|---|
| Olivine | Modal 5%<br>Size 3 mm<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size to 30 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 50 mm<br>Shape anhedral |

COMMENTS: Unit 494 is medium- to coarse-grained olivine gabbro. Epidote alteration, enrichment in olivine (10%) from 94-104 cm, mode data based on Piece 2d

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals from ~0-12 cm. Below that, the section shows a higher degree of alteration with patchy leucocratic areas and alteration of pyroxene to pale green secondary minerals and areas of serpentinized olivine. Green veins cut the section in several places. The alteration decreases slightly below 72 cm.

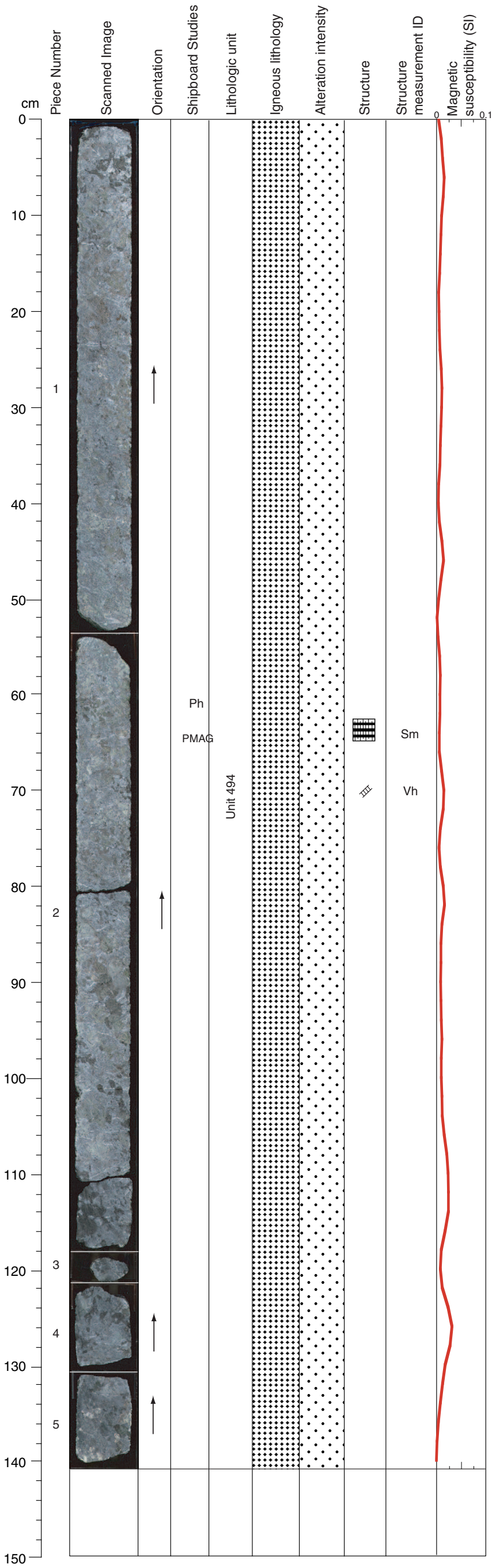
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-184R-1, 67-69 cm (#466)**
**305-U1309D-184R-1, 103-106 cm (#467)**

STRUCTURE: Mainly undeformed coarse to pegmatitic gabbro, some local shear of likely magmatic origin at base of section. Steeply dipping dark green vein sets (V1) and minor subhorizontal irregular cracks with white infill (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-184R-1, 51-71 cm WET
305-U1309D-184R-1, 92-111 cm WET
305-U1309D-184R-1, 92-111 cm WET (back)

## Core Photo




**305-U1309D-184R-2 (Section top: 896.16 mbsf)**

UNIT-494: Olivine Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 7%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 53%<br>Size to 30 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 50 mm<br>Shape anhedral |

COMMENTS: Unit 494 is medium- to coarse-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

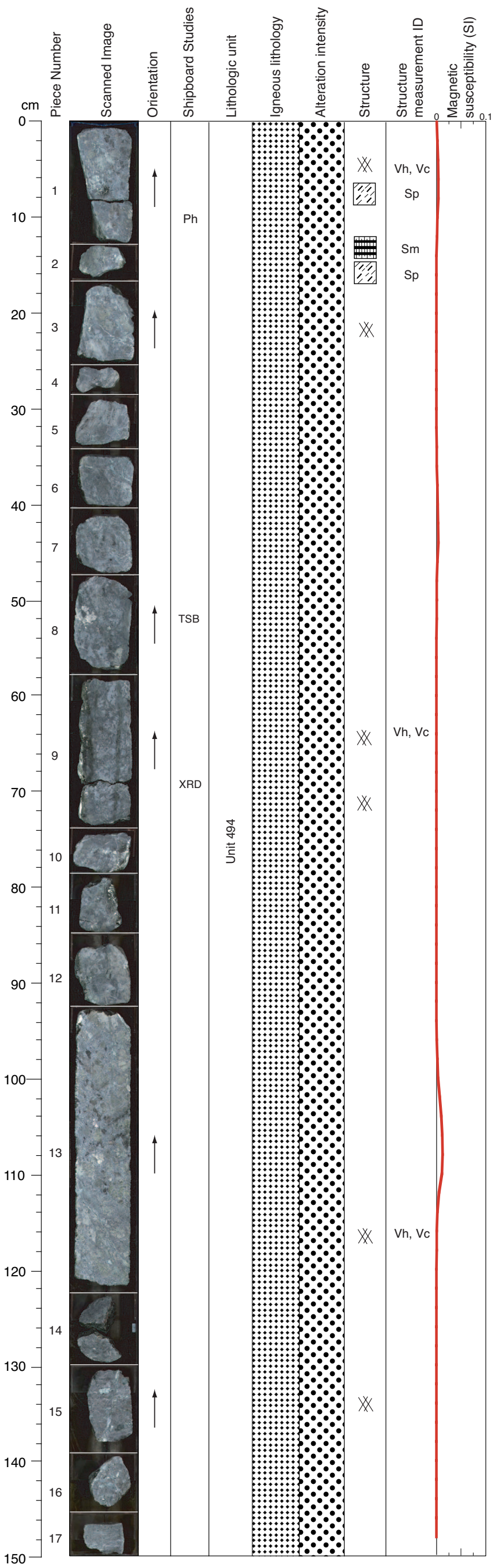
COMMENTS: General background alteration is similar to the end of the previous section. The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Throughout this section, pyroxene grains alternate between green cores with brown rims to brown cores with green rims.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Gabbro, corona textured, with locally developed strain of likely magmatic nature, medium- to coarse-grained, locally pegamtitic. Steely dipping dark green vein sets (V1) and minor subhorizontal irregular cracks with white infill (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-184R-2, 54-80 cm WET

## Core Photo




**305-U1309D-184R-3 (Section top: 897.57 mbsf)**

UNIT-494: Olivine Gabbro
Pieces: 1-17

PRIMARY MINERALOGY: Modal data from Piece 13

| | |
|---|---|
| Olivine | Modal 5%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 30 mm<br>Shape anhedral |

COMMENTS: Unit 494 is medium- to coarse-grained olivine gabbro. Diabase in Piece 8 (10 mm wide), trace of sulfides.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, however there are frequent patches of more highly altered zones in which leucocratic alteration products and green amphibole predominate. Some pale green coronas are completely altered to talc. There are several green veins with narrow halos that cut the section (most are subvertical). There are also several pieces at the top of the section that have white vein/fracture (?) networks. Veins of this type in previous cores have contained zeolites.

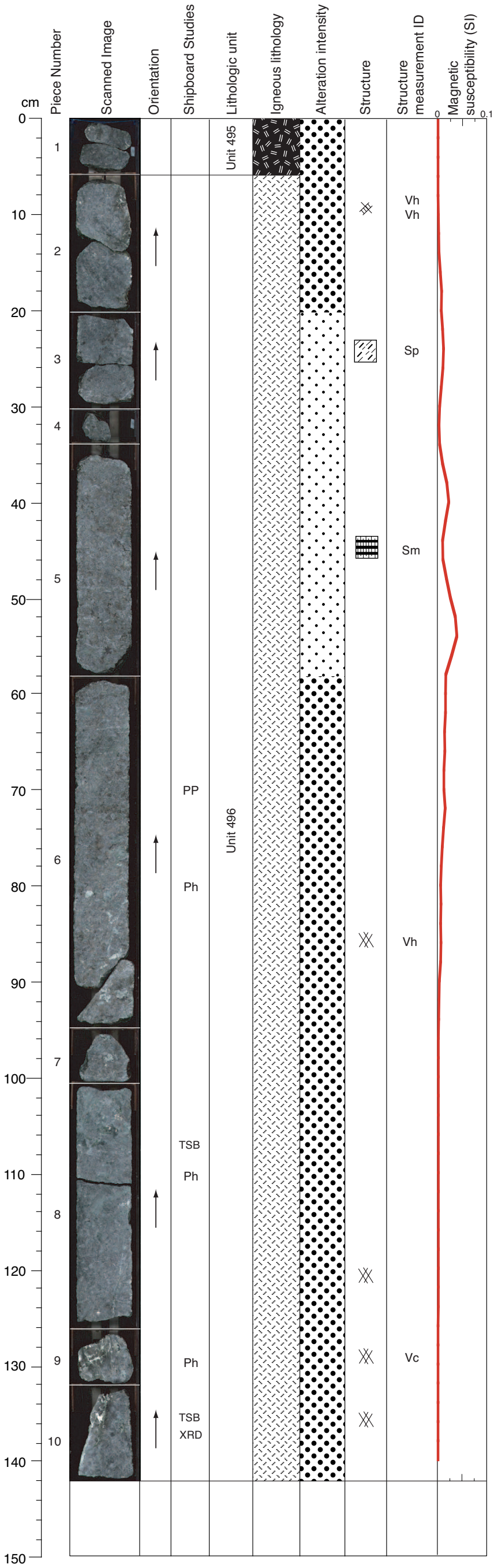
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-184R-3, 50-53 cm (#468)**

STRUCTURE: Medium- to coarse-grained gabbro with corona texture and heterogeneous strain overprint of possible magmatic or plastic origin. Sets of pale green veins (highly dipping, V1) and distributed cataclasis with white infill (B1). V1>B1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-184R-3, 0-24 cm WET

## Core Photo




**305-U1309D-185R-1 (Section top: 899.80 mbsf)**

UNIT-495: Rubble
Pieces 1

COMMENTS: Olivine-bearing gabbro rubble, probably not in place.

UNIT-496: Disseminated oxide gabbro
Pieces 2 to 10

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 5 mm average, to 15 mm<br>Shape anhedral |
| Oxide | Modal 1%<br>Size up to 2 mm<br>Shape interstitial |

COMMENTS: This unit consists of seriate medium-grained disseminated oxide gabbro. Interstitial oxide (overall less than 2%) patches occur throughout the section. Grain size varies gradually, olivine enrichments up to 30 % observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Pieces in this section, however, appear less altered in general than in the previous section. There are zones of branching of green veins that also contain a white (carbonate/zeolite?) secondary mineral. In Piece 8 there are patches of darker green (amphibolitic) replacement of pyroxene associated with a network of very fine veins that crosscut the section between about 103 cm and 109 cm. In Pieces 9 and 10 there is a branching set of green and white veins that are associated with patches of more highly altered gabbro.

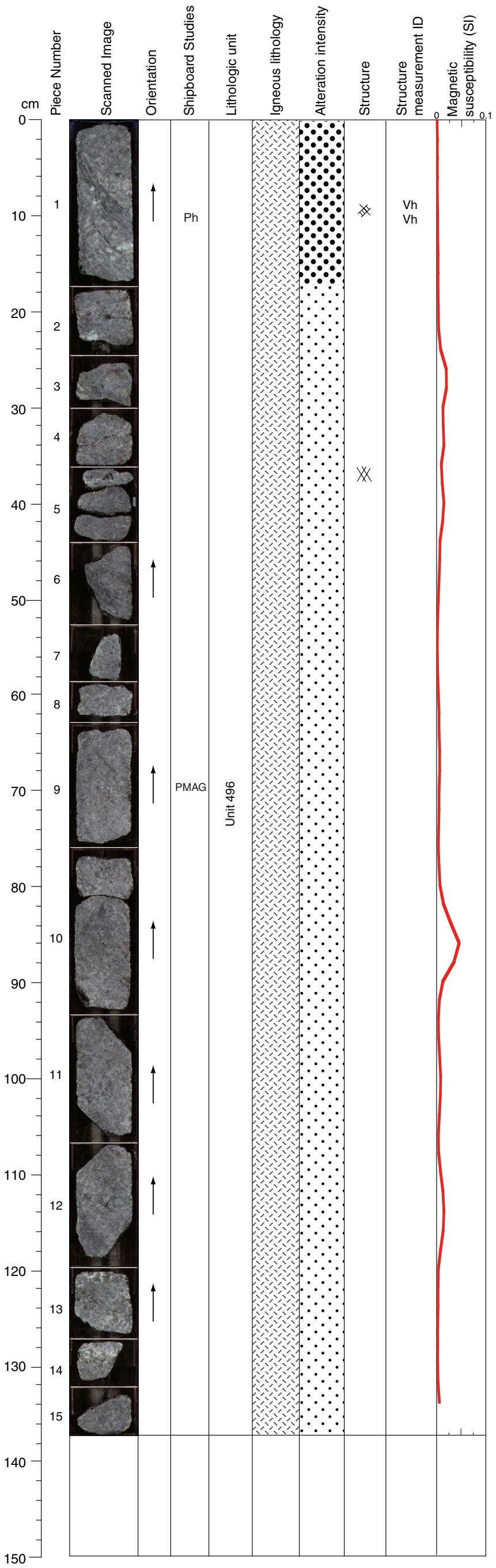
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-185R-1, 105-108 cm (#469)**
**305-U1309D-185R-1, 133-136 cm (#470)**

STRUCTURE: Locally magmatically strained oxide gabbro, short interval of plastic strain in top of section, alteration limits recognition of strain. Early dark green vein set (faint) (V1) and later fractures with pale green infill (V2). White veins (V3) may be cut by pale green veins. This section is underlain by a zone of more cataclasis and white infill in cataclastic zones (or pale green vein material) (B). A white vein at 10 cm crosscuts pale green veins. V1>V2=?B>V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-185R-1, 74-94 cm WET
305-U1309D-185R-1, 101-125 cm WET
305-U1309D-185R-1, 126-142 cm WET

## Core Photo




**305-U1309D-185R-2 (Section top: 901.22 mbsf)**

UNIT-496: Disseminated oxide gabbro
Pieces 1 to 15

PRIMARY MINERALOGY: Modal data from Piece 11

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 5 mm average, to 15 mm<br>Shape anhedral |
| Oxide | Modal 1%<br>Size to 2 mm<br>Shape interstitial |

COMMENTS: Seriate medium-grained disseminated oxide gabbro continues from the previous section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc, epidote

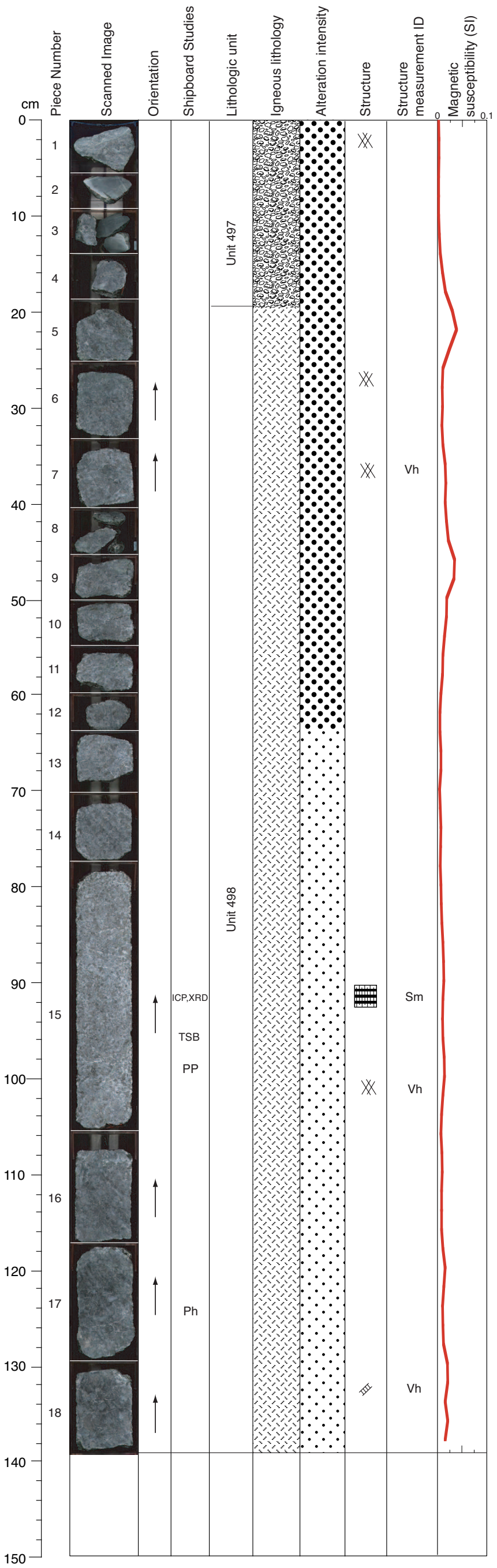
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, this section continues to have more highly patches near green veins that are scattered throughout. White and pale, chalky-green patches occur in most pieces.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Altered medium- to coarse-grained gabbro with no consistent magmatic or plastic fabric. Early set of dark green veins (V1) crosscut by later set of pale green veins (V2). Minor cataclasis with white infill sparsely distributed (B). V1>V2>B.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-185R-2, 0-17 cm WET

## Core Photo




**305-U1309D-186R-1 (Section top: 904.60 mbsf)**

UNIT-497: Mixed rubble
Pieces 1-4

COMMENTS: Olivine-bearing gabbro and diabase rubble, possibly in place.

UNIT-498: Disseminated oxide gabbro
Pieces 5 to 18

PRIMARY MINERALOGY: Modal data from Piece 15

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average, to 12 mm<br>Shape anhedral |
| Oxide | Modal 1%<br>Size to 3 mm<br>Shape interstitial |

COMMENTS: This unit consists of seriate medium-grained disseminated oxide gabbro. Interstitial oxide (overall less than 2%) patches occur throughout the section. Grain size varies gradually, modes appear relatively constant. As much as 5% olivine observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, this section continues to have more highly altered patches near green veins that are scattered throughout. White patches or networks of white on grain boundaries occur in most pieces.

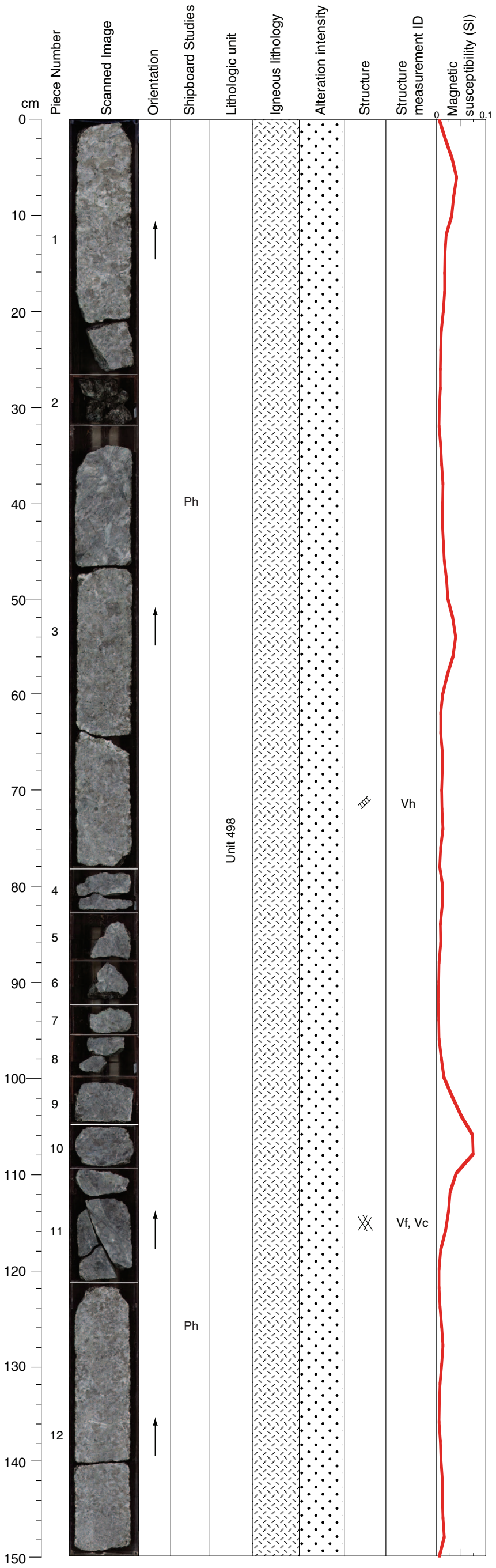
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-186R-1, 95-97 cm (#471)**

STRUCTURE: Medium-grained gabbro with weak magmatic foliation parallel to grain size layers locally developed. Set of dark green veins (V1) and subhorizontal white veins (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-186R-1, 85-105 cm WET
305-U1309D-186R-1, 118-139 cm WET

## Core Photo




**305-U1309D-186R-2 (Section top: 905.99 mbsf)**

UNIT-498: Disseminated oxide gabbro
Pieces 1 to 12

PRIMARY MINERALOGY: Modal data from Section U1309D-186R-001, Piece 15

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average, to 12 mm<br>Shape anhedral |
| Oxide | Modal 1%<br>Size to 3 mm<br>Shape interstitial |

COMMENTS: Continuation of medium-grained disseminated oxide gabbro from the previous section. Oxides, as well as dark green amphiboles appear to be more abundant in the smaller pieces.

SECONDARY MINERALOGY: Chlorite, pale amphibole

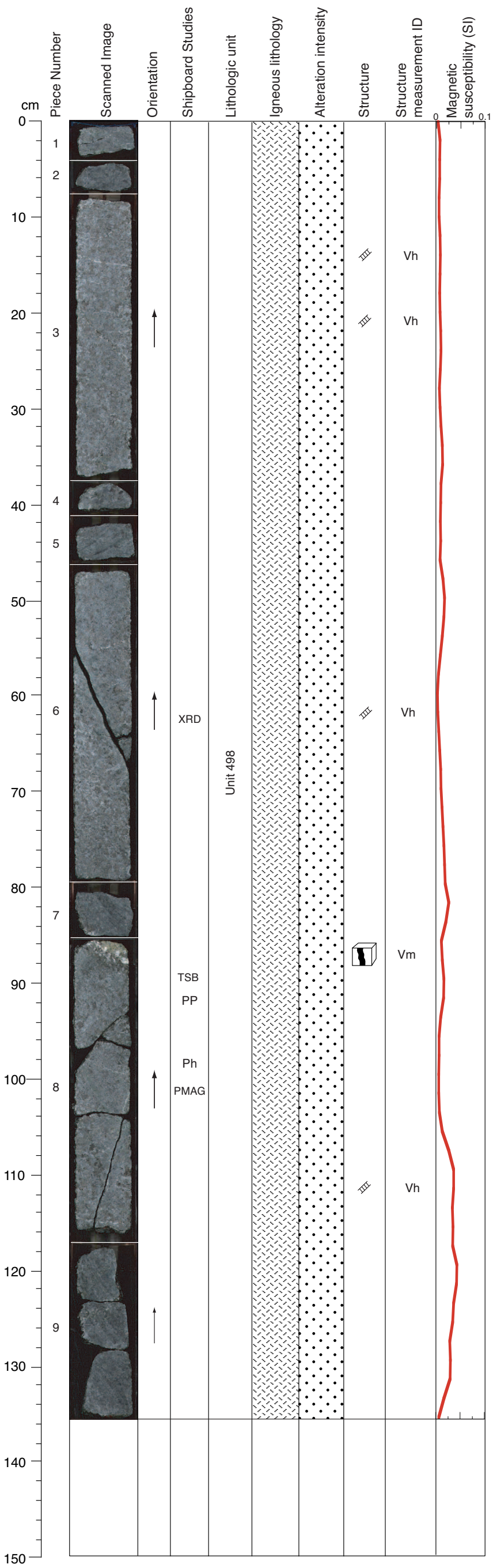
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, this section continues to have more highly altered patches near green veins that are scattered throughout. White patches or networks of white on grain boundaries occur in most pieces.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Coarse-grained gabbro with no mineral preferred alignment discernible. Some early dark green veins (V1), some associated with cataclasis (B1), and later lighter green veins (V2) along fracture networks with associated cataclasis (B2). V1=B1>V2=B2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-186R-2, 32-44 cm WET
305-U1309D-186R-2, 110-140 cm WET

## Core Photo




**305-U1309D-186R-3 (Section top: 907.49 mbsf)**

UNIT-498: Disseminated oxide gabbro
Pieces 1 to 9

PRIMARY MINERALOGY: Modal data from Section U1309D-186R-001, Piece 15

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average, to 12 mm<br>Shape anhedral |
| Oxide | Modal 1%<br>Size to 3 mm<br>Shape interstitial |

COMMENTS: Continuation of medium-grained disseminated oxide gabbro from the previous section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, this section continues to have more highly altered patches near green veins that are scattered throughout. White patches or networks of white on grain boundaries occur in most pieces.

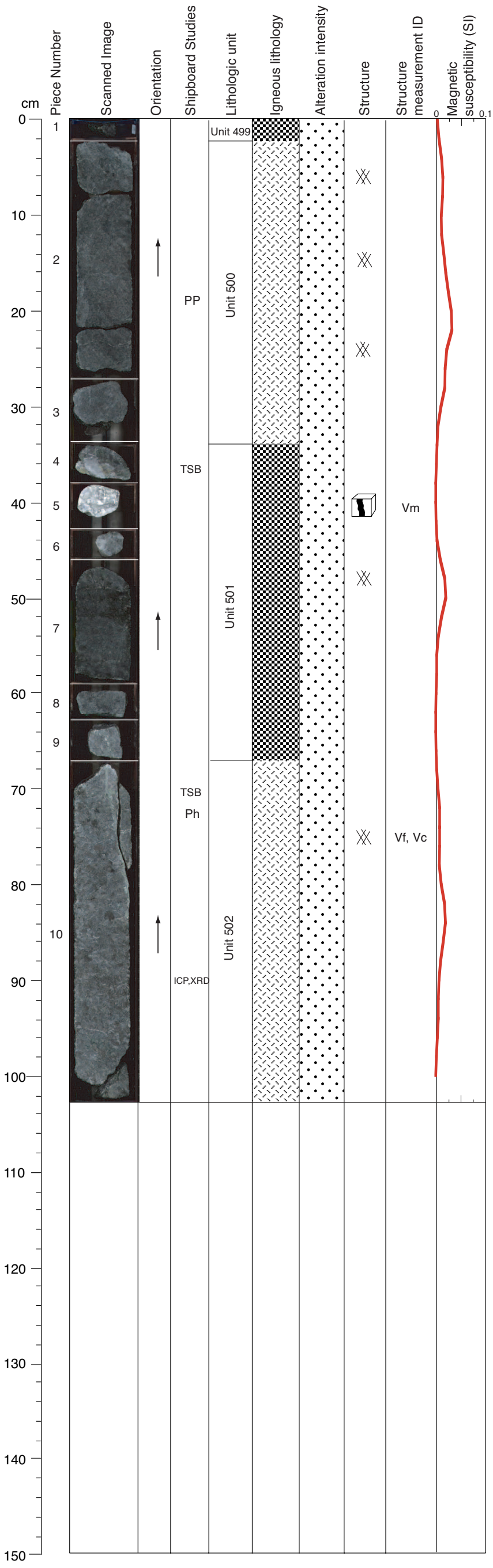
VEIN ALTERATION: Amphibole, plagioclase, chlorite, carbonate, epidote.

THIN SECTIONS:
**305-U1309D-186R-3, 87-90 cm (#472)**

STRUCTURE: Medium-grained gabbro with no mineral preferred orientation, leucocratic vein (Vm) in center of section. Set of steep, fine dark veins (V1) and subhorizontal white veins (V2). Vm>V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-186R-3, 86-105 cm WET

## Core Photo




**305-U1309D-187R-1 (Section top: 909.40 mbsf)**

UNIT-499: Rubble
Pieces: 1

COMMENTS: Unit 499 is rubble.

UNIT-500: Gabbro
Pieces: 2-3

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 500 is medium-grained gabbro.

UNIT-501: Oxide Gabbro
Pieces: 4-6

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 46%<br>Size 5 mm average<br>Shape anhedral |
| Oxide | Modal 4%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 501 is medium-grained oxide gabbro and rubble. Feldspar dikelet included.

UNIT-502: Oxide Gabbro
Pieces: 7-9

PRIMARY MINERALOGY: Modal data from Piece 7

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 5 mm average<br>Shape anhedral |
| Oxide | Modal 5%<br>Size 3 mm average<br>Shape anhedral |

UNIT-502: Gabbro
Pieces: 10

PRIMARY MINERALOGY: Modal data from Piece 10a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: This interval of Unit 502 is medium- to coarse-grained gabbro. Unit 502 is mainly oxide-bearing gabbros. some intervals and pieces do not contain oxide but is oxide discontinuously seen until the end of this unit .

SECONDARY MINERALOGY: Chlorite, pale amphibole, epidote

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, this section has patches more highly altered in Pieces 4, 5, and 6, and a greater degree of alteration near green veins, that are scattered throughout the section. White patches or networks of white on grain boundaries occur in some pieces.

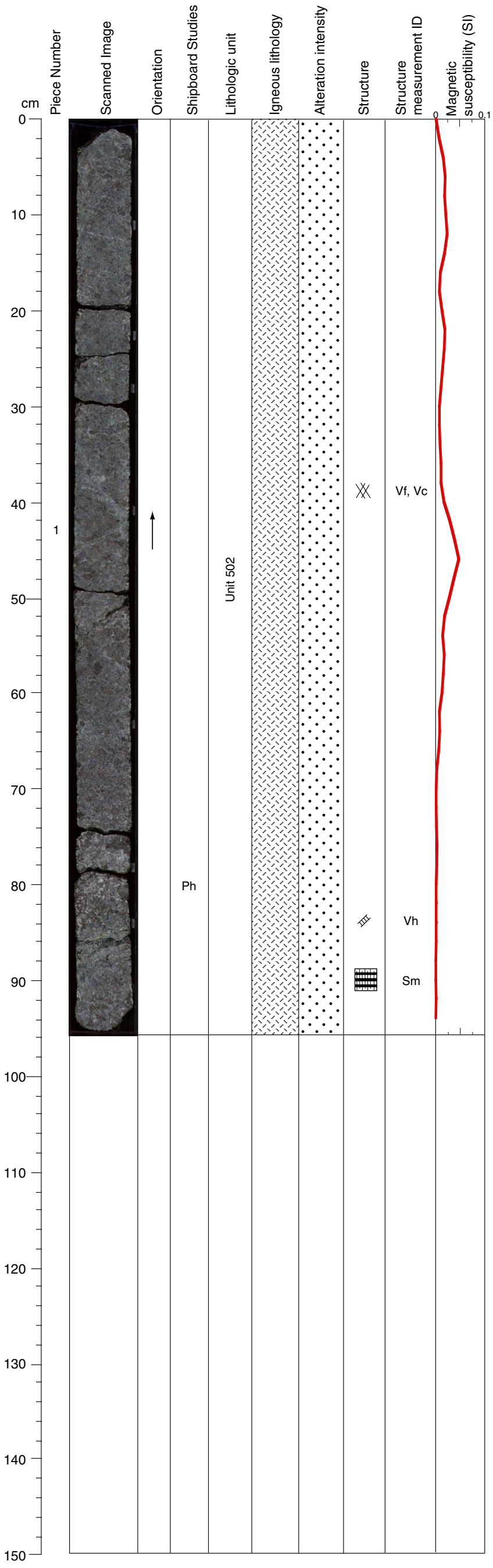
VEIN ALTERATION: Amphibole, plagioclase, carbonate.

THIN SECTIONS:
**305-U1309D-187R-1, 35-37 cm (#473)**
**305-U1309D-187R-1, 69-72 cm (#474)**

STRUCTURE: Medium-grained gabbro with no visible preferred mineral orientation and an unoriented leucocratic 5 cm vein (Vm). Pale green veins with associated cataclasis (V1) and a few subhorizontal white veins (V2). Vm>V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-187R-1, 27-46 cm WET
305-U1309D-187R-1, 67-87 cm WET

## Core Photo




**305-U1309D-187R-2 (Section top: 910.43 mbsf)**

UNIT-502: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 3 mm<br>Shape anhedral |

COMMENTS: Unit 502 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

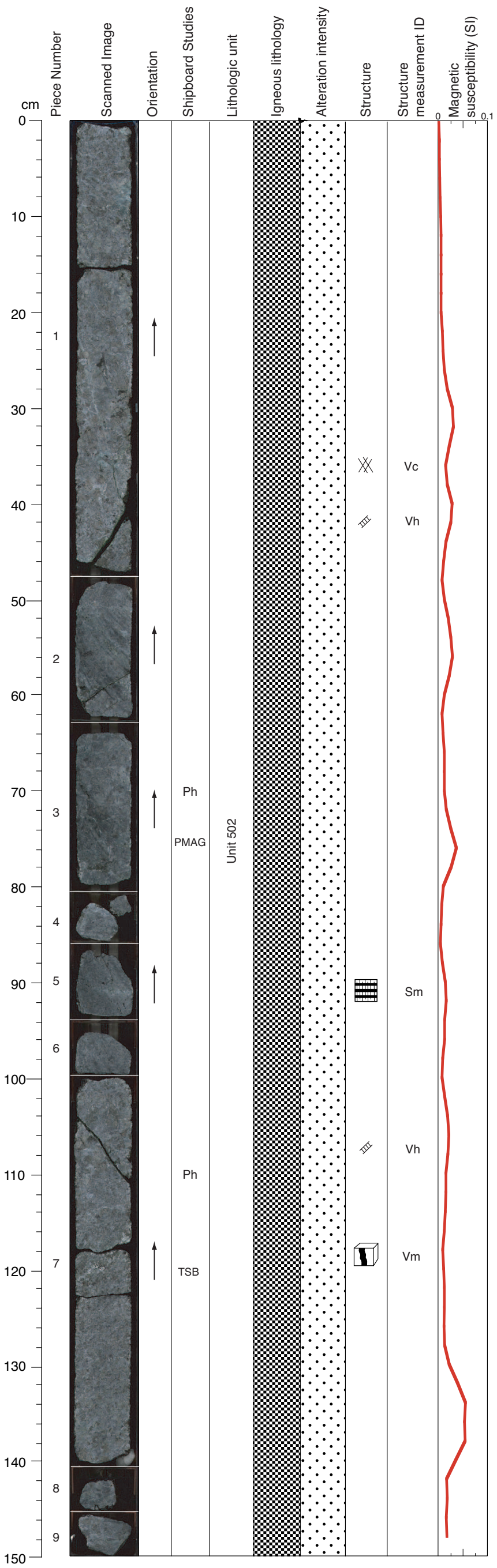
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, this section continues to have patches more highly altered, near green veins that are scattered throughout. White patches or networks of white on grain boundaries occur in most pieces.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium-grained gabbro with vague magmatic foliation (Sm) in lowest part of section. Dark green veins (V1), pale green veins with associated cataclasis (V2) and a few subhorizontal white veins (V3). Vm>V1>V2>V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-187R-2, 78-94 cm WET

## Core Photo




**305-U1309D-187R-3 (Section top: 911.38 mbsf)**

UNIT-502: Oxide Gabbro
Pieces: 1-9

PRIMARY MINERALOGY: Modal data from piece 1b

| | |
|---|---|
| Plagioclase | Modal 57%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 3 mm average<br>Shape anhedral |
| Oxide | Modal 3%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: This interval of Unit 502 is medium- to coarse-grained oxide gabbro. Medium-fine-grained gabbro at 118-130 cm. Oxide visible through this section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. However, this core continues to have patches of more highly altered areas, near green veins, that are scattered throughout the section. White patches or networks of white on grain boundaries occur in most pieces.

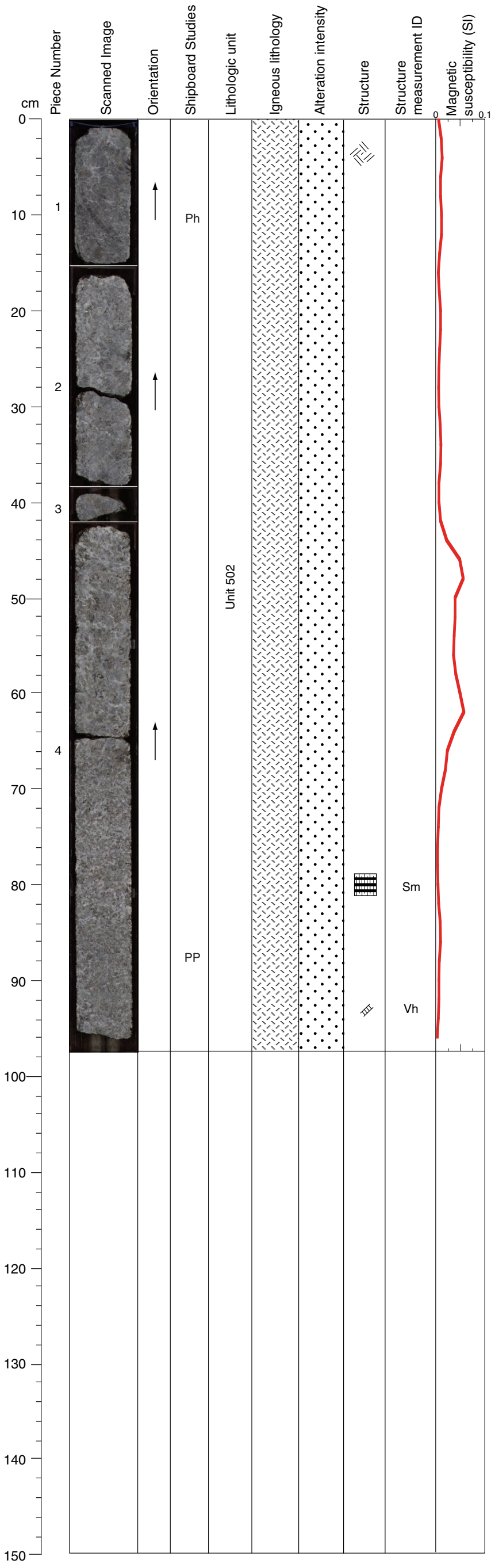
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-187R-3, 118-121 cm (#475)**

STRUCTURE: Medium to coarse, locally melanogabbro with an interval of weak magmatic fabric and one leucocratic vein (Vm). Dark green veins (V1), pale green veins with associated cataclasis (V2) and a few subhorizontal white veins (V3). Vm>>V1>V2>V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-187R-3, 63-79 cm WET
305-U1309D-187R-3, 100-122 cm WET

## Core Photo




**305-U1309D-187R-4 (Section top: 912.88 mbsf)**

UNIT-502: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Pieces 2a and 4b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 4 mm<br>Shape anhedral |

COMMENTS: Unit 502 is medium- to coarse-grained gabbro. Clinopyroxene grain size and modal abundance increases within this interval (20% to 75% modal variation). Oxide disseminated and rarely visible.

SECONDARY MINERALOGY: Chlorite, pale amphibole

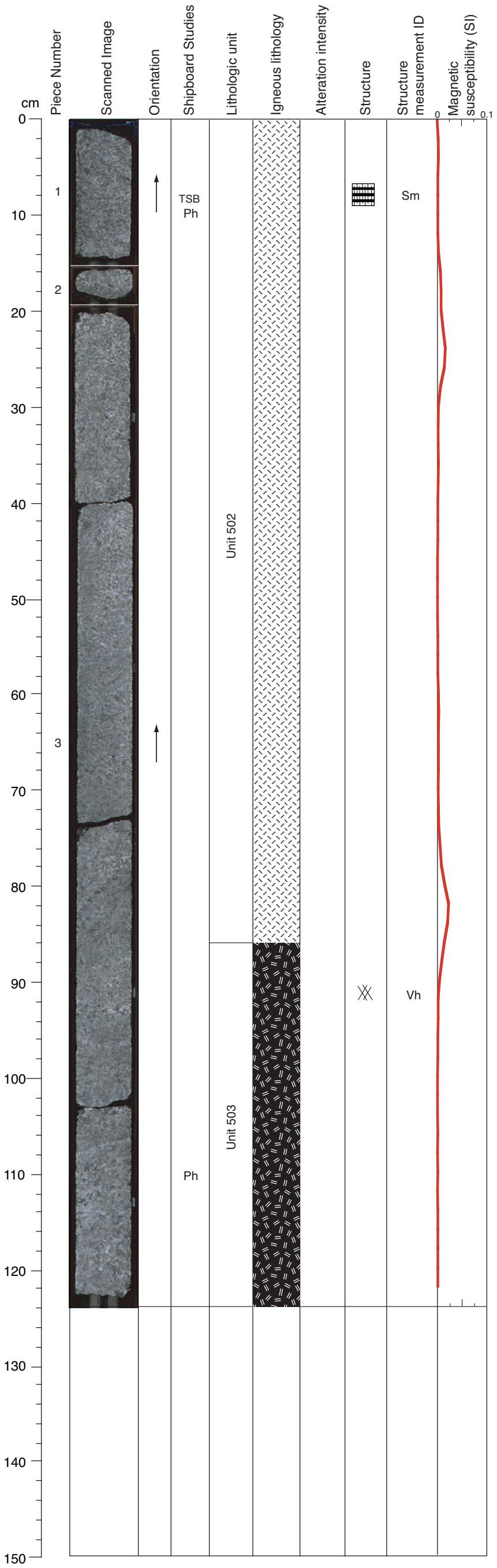
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces. A green vein network with a narrow green halo occurs at about 91 to 92 cm.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium-grained gabbro with weak magmatic fabric (Sm) developed locally. A few dark green veins (V1) and minor cataclasis with white infill (B1). V1>B1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-187R-4, 0-14 cm DRY

## Core Photo




**305-U1309D-188R-1 (Section top: 914.20 mbsf)**

UNIT-502: Gabbro
Pieces: 1-3c

PRIMARY MINERALOGY: Modal data from Piece 3a

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 502 medium- to coarse-grained gabbro. End of this unit defined by oxide disappearance. Up to 3% olivine observed in thin section.

UNIT-503: Olivine-bearing Gabbro
Pieces: 3c-3d

PRIMARY MINERALOGY: Modal data from Piece 3d

| | |
|---|---|
| Olivine | Modal 3%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 42%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 503 is medium-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces. A green subhorizontal vein cuts across the section at about 86 to 87 cm.

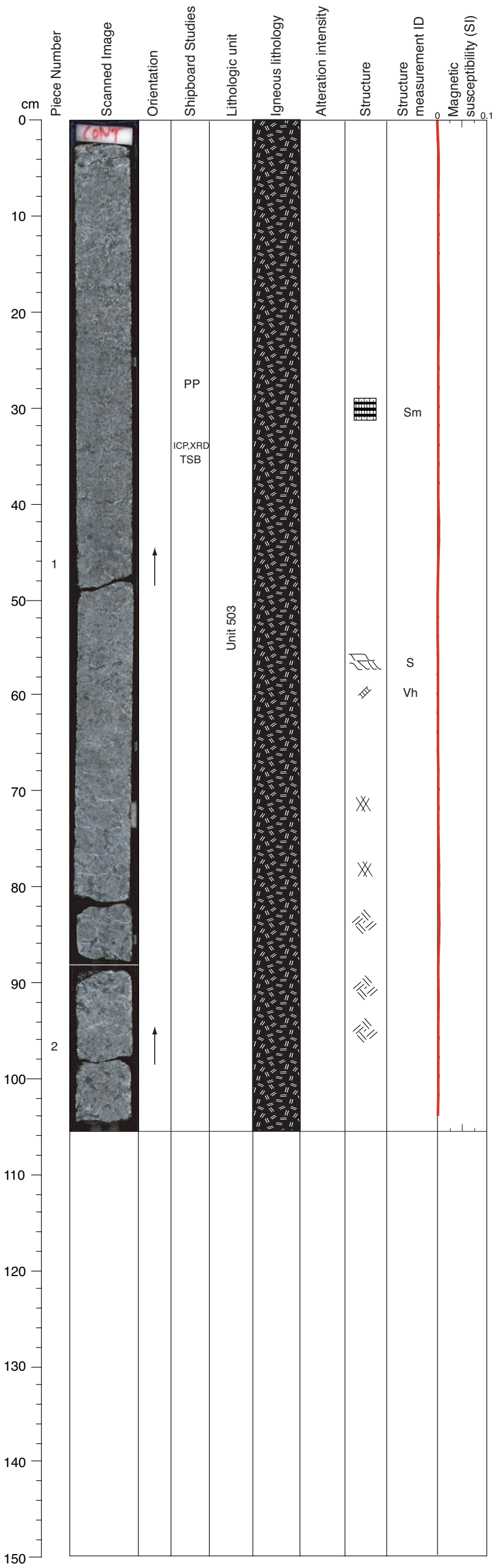
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-188R-1, 6-9 cm (#476)**

STRUCTURE: Medium-grained gabbro with local magmatic strain in upper part of section. A few dark green veins (V1) and slight cracking with white veining, subhorizontal (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-188R-1, 0-13 cm WET
305-U1309D-188R-1, 103-123 cm WET

## Core Photo




**305-U1309D-188R-2 (Section top: 915.44 mbsf)**

UNIT-503: Olivine-bearing Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from several pieces

| | |
|---|---|
| Olivine | Modal 3% average<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55% average<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 42% average<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 503 is fine- to coarse-grained olivine-bearing gabbro.This section is marked by modal and grain size variability.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces. Some white subhorizontal fractures/veins (commonly cuttiing the section only part way) occur.

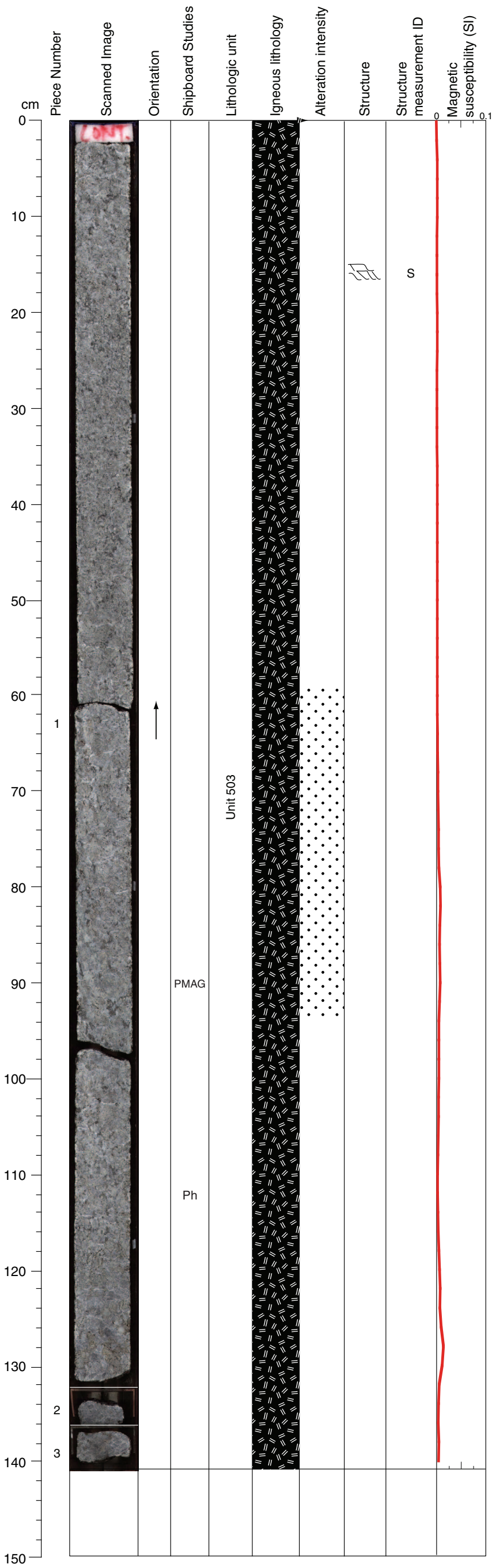
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-188R-2, 34-36 cm (#477)**

STRUCTURE: Medium-grained olivine-bearing gabbro with grain size layering and local magmatic foliation (Sm) developed. A few dark green veins (V1) and minor cracking with white veining (V2), subhorizontal. Locally weak serpentine foliation (S). Sm>V1>S>?V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-188R-2, 25-45 cm WET

## Core Photo




**305-U1309D-188R-3 (Section top: 916.49 mbsf)**

UNIT-503: Olivine-bearing Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 5%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 503 is medium- to coarse-grained olivine-bearing gabbro. Fine-grained troctolitic gabbro at edge of 120 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

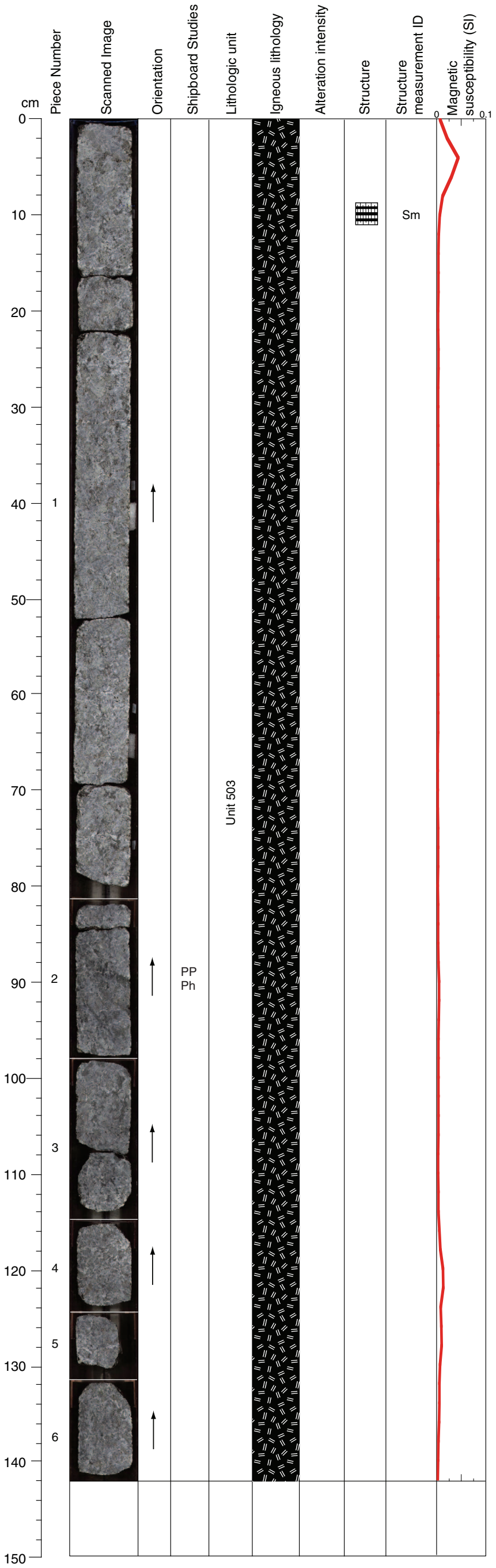
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces.

VEIN ALTERATION: n/a

STRUCTURE: Medium- to coarse-grained olivine-bearing gabbro with no magmatic or plastic strain. A few white subhorizontal veins (V1) and local serpentine foliation (S). S>?V1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-188R-3, 98-122 cm WET

## Core Photo




**305-U1309D-188R-4 (Section top: 917.90 mbsf)**

UNIT-503: Olivine-bearing Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 5%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 503 is medium- to coarse-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: No visible secondary mineral.

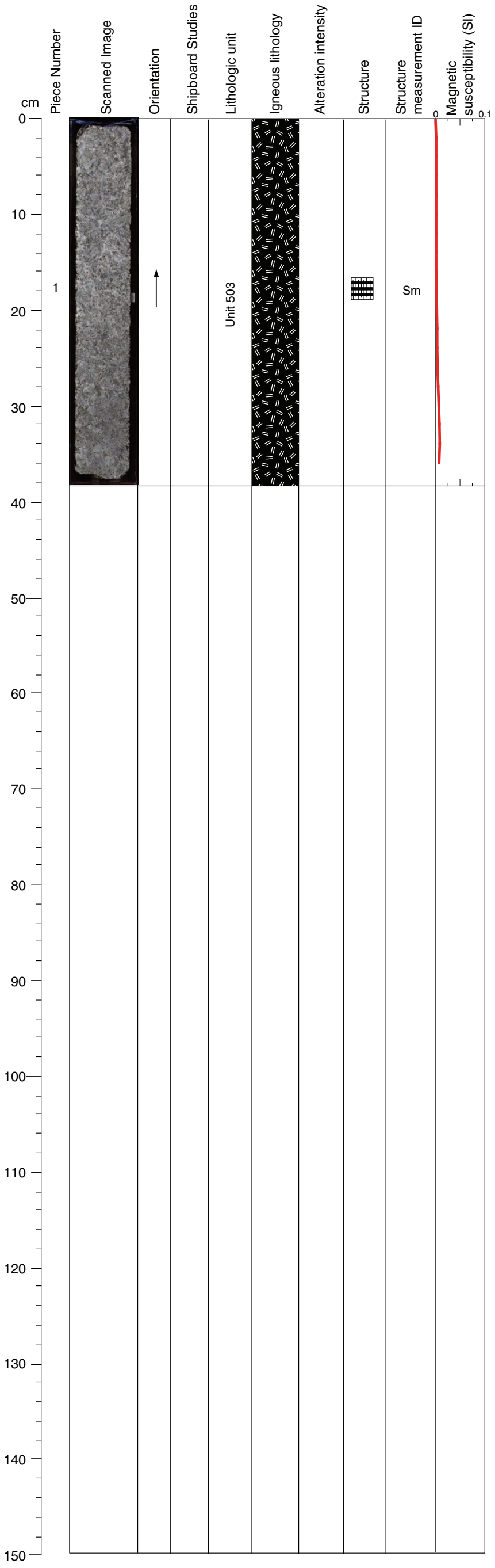
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained olivine gabbro with weak magmatic strain. Some minor irregular subhorizontal veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-188R-4, 81-97 cm WET

## Core Photo




**305-U1309D-188R-5 (Section top: 919.32 mbsf)**

UNIT-503: Olivine-bearing Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 5%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 503 is medium-grained olivine-bearing gabbro.

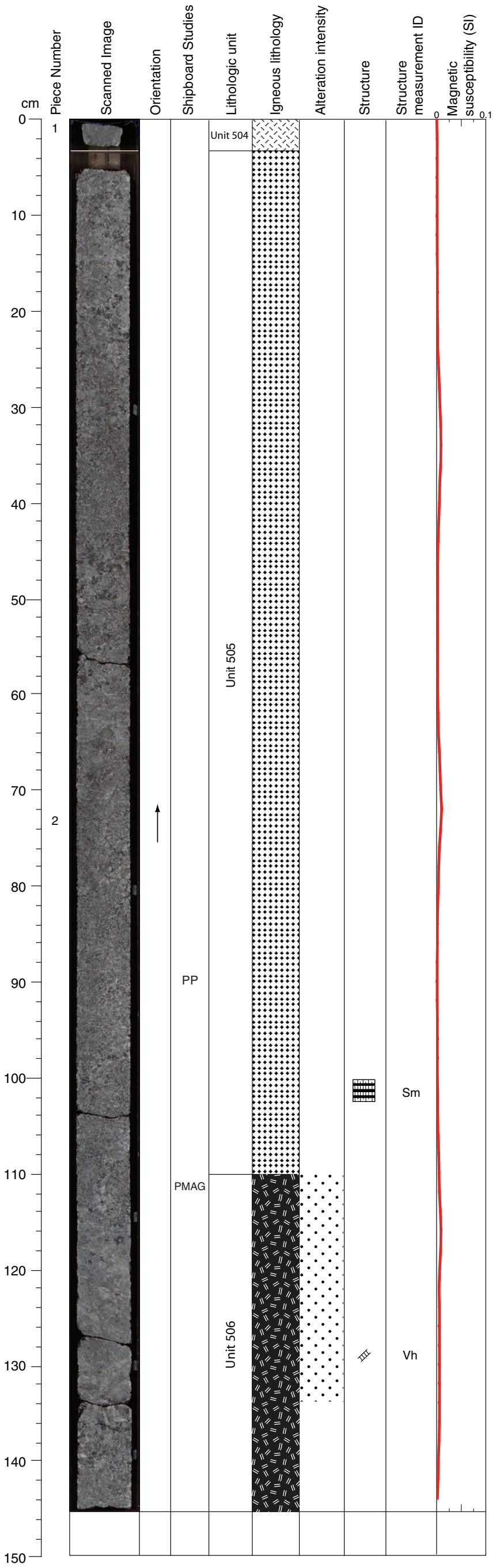
SECONDARY MINERALOGY: No visible secondary mineral.

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained olivine-bearing gabbro with weak magmatic strain. Minor irregular subhorizontal cataclasis with white infill.

## Core Photo




**305-U1309D-189R-1 (Section top: 919.00 mbsf)**

UNIT-504: Rubble
Piece 1

COMMENTS: Unit 504 is rubble.

UNIT-505: Olivine Gabbro
Pieces: 2a-2c

PRIMARY MINERALOGY: Modal data from Pieces 2a and 2b

| | |
|---|---|
| Olivine | Modal 30%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 20%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 505 medium-grained olivine gabbro. Gradual change in grain size and modal ratio at 99-120 cm. Coarse clinopyroxene at 50-70 cm.

UNIT-506: Olivine-bearing Gabbro
Pieces: 2c-2e

PRIMARY MINERALOGY: Modal data from Piece 2e

| | |
|---|---|
| Olivine | Modal 5%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 10 mm average<br>Shape anhedral |

COMMENTS: Unit 506 is coarse-grained olivine-bearing gabbro. Pegmatitic clinopyroxene oikocryst at boundary (120 cm).

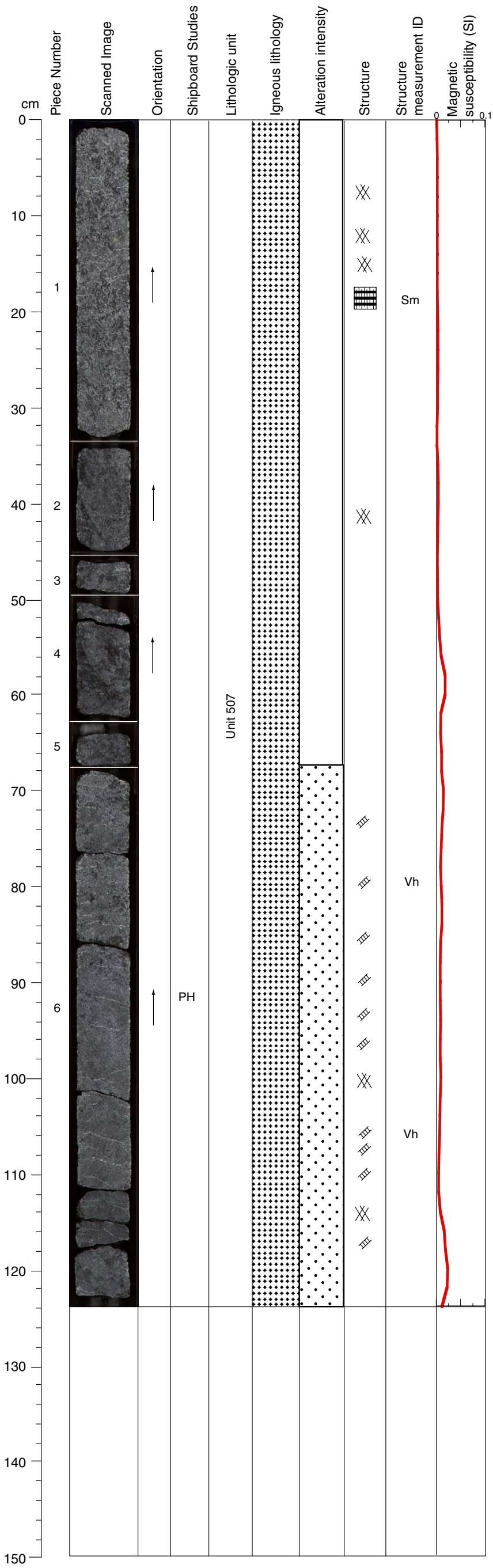
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Piece 1 is slightly finer grained than the rest of the section and has a green lower edge that may represent part of a vein halo. The general background alteration in the remainder of the section shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur throughout Piece 2. There is a green branching vein with a 3 mm green halo from 21 to 24 cm.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to coarse-grained gabbro, foliation (Sm) visible in fine-grained parts only. A few dark green veins.

## Core Photo




**305-U1309D-189R-2 (Section top: 920.45 mbsf)**

UNIT-507: Olivine Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 30%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 15%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 507 is medium-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

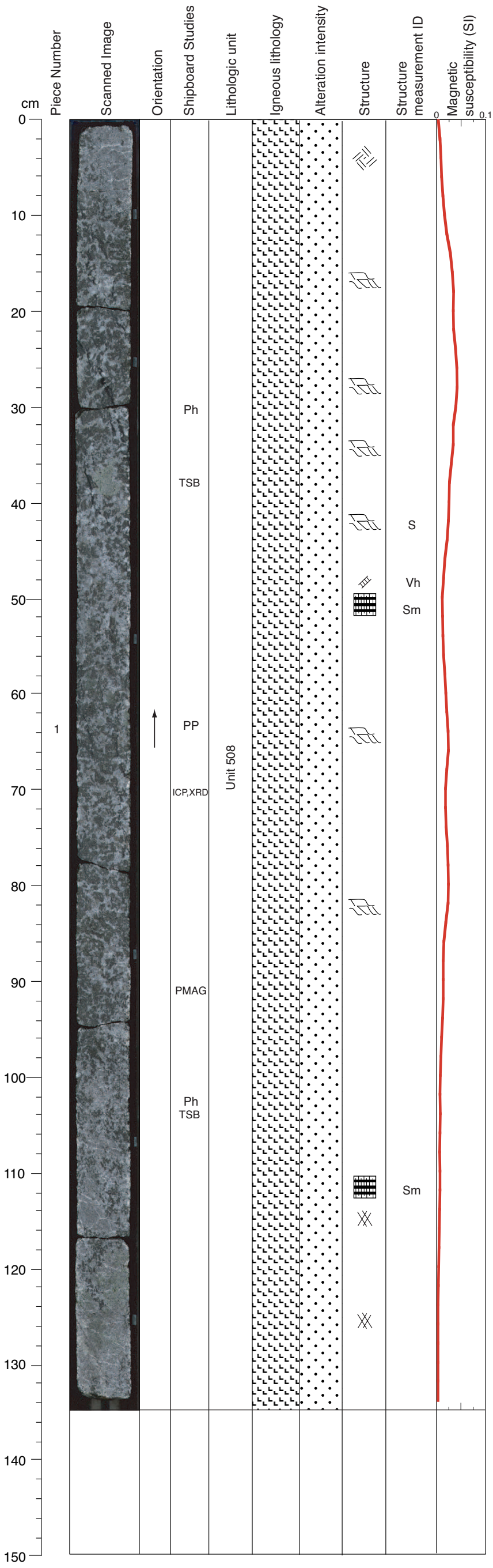
COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces and several subhorizontal fractures/veins occur through the section. A branching green vein cuts the section from about 70 to 74 cm.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Olivine gabbro with clear magmatic fabric (Sm). Subhorizontal, irregular open cracks (drilling induced) and little veining on top of section. Lower part of section has a more intense open fracture network (V1), and some steeply dipping green veins (V2). V2>V1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-189R-2, 76-101 cm WET

## Core Photo




**305-U1309D-189R-3 (Section top: 921.69 mbsf)**

UNIT-508: Troctolitic Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Olivine | Modal 40%<br>Size 7 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 5%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 508 is medium- to coarse-grained troctolitic gabbro. Pegmatitic clinopyroxene at 36 cm. Clinopyroxene-rich band at 120-124 cm. Plagioclase-rich zone at 125-133 cm.

SECONDARY MINERALOGY: Serpentine, chlorite

COMMENTS: The general background alteration, with pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals, occurs only in the top 9 cm of the section in a more pyroxene-rich region. White patches or networks of white on grain boundaries occur in this interval as well as in patches of similar material at depth greater than 100 cm. This section contains olivine-rich zones that are highly serpentinized and a high-angle set of serpentine veins cuts thorugh most of the section below 10 cm. Within the serpentinized zone there are large (up to 5 cm diameter) green amphibole patches (after pyroxene?).

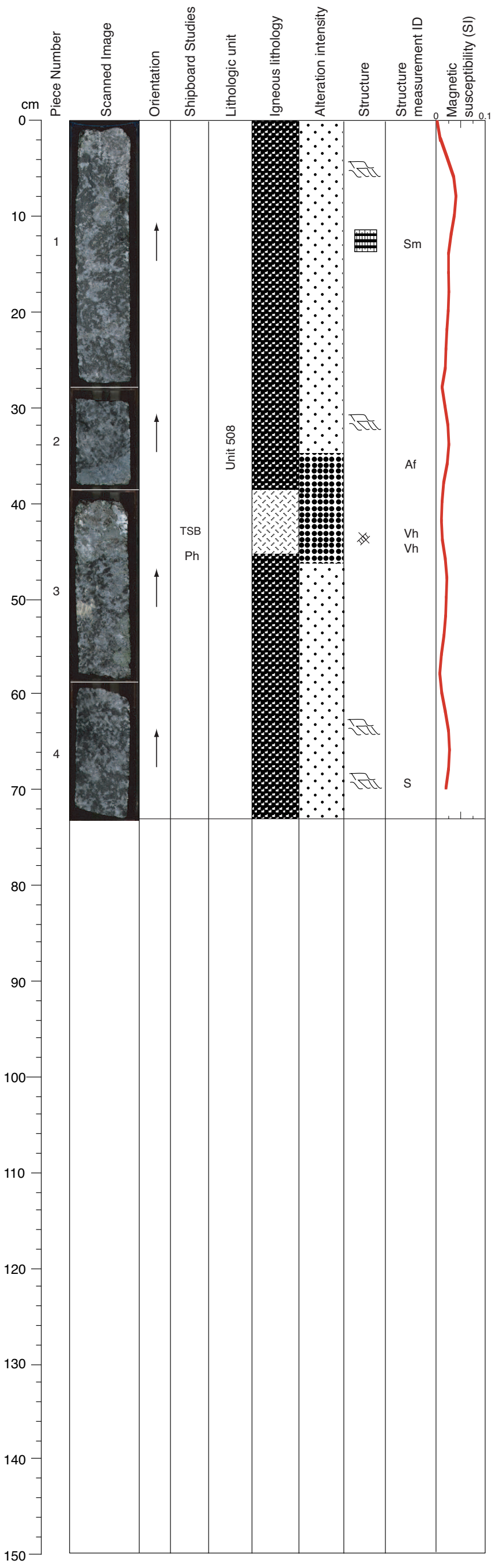
VEIN ALTERATION: Serpentine

THIN SECTIONS:
**305-U1309D-189R-3, 36-38 cm (#478)**
**305-U1309D-189R-3, 103-105 cm (#479)**

STRUCTURE: Troctolitic gabbro locally containing 2-3 cm clinopyroxene grains. Magmatic foliation varying from weak to clear with moderate to steep dips. Subvertical to steeply dipping serpentine foliation, irregular (45° to 70°) and discontinuous, and a subhorizontal dark green vein in middle of section.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-189R-3, 20-40 cm WET
305-U1309D-189R-3, 96-116 cm WET

## Core Photo




**305-U1309D-189R-4 (Section top: 923.04 mbsf)**

UNIT-508: Troctolite
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal <5%<br>Size 5 mm average<br>Shape anhedral |

UNIT-508: Gabbro
Piece 3

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 508 is medium- to coarse-grained troctolite and gabbro. Sharp boundary with gabbro. Oxide-bearing. Pegmatitic clinopyroxene oikocrysts at 51 and 55 cm.

SECONDARY MINERALOGY: Serpentine, chlorite, pale amphibole, talc

COMMENTS: The general background alteration seen in most of the previous sections, with pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals occurs only in the top 7 cm of the section. White patches or networks of white on grain boundaries occur in this interval. There are olivine-rich zones that are highly serpentinized. There is some steep serpentine foliation between ~3-35 cm and it reappears at about 46 cm. At about 34 cm there is an alteration front that continues to the bottom of Piece 2. A light green vein fill coats the bottom of Piece 2. The top of Piece 3 from 39 to ~46 cm is altered more heavily and is crosscut by pale green veins. The lower part of Piece 3 and all of Piece 4 contain highly serpentinized olivine and pyroxene that is altered to green amphibole.

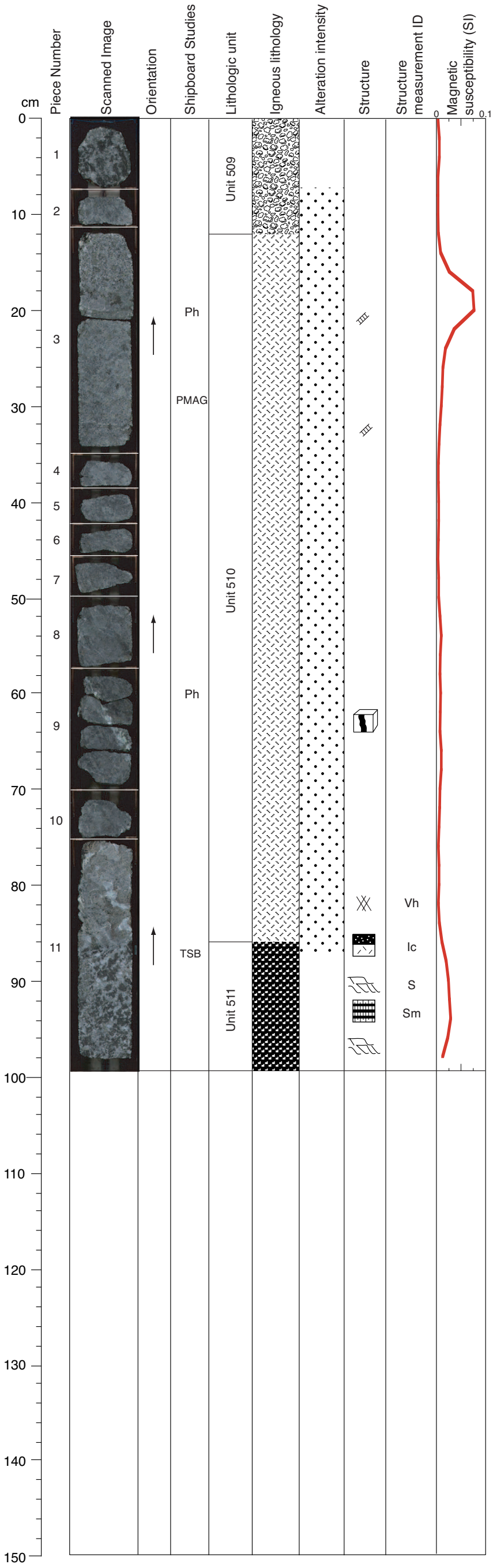
VEIN ALTERATION: Serpentine  amphibole, carbonate.

THIN SECTIONS:
**305-U1309D-189R-4, 42-44 cm (#480)**

STRUCTURE: Medium-grained troctolite with cm-scale local clinopyroxene crystals and mafic-felsic segregations. Alteration front with sharply defined olivine corona texture. Steep serpentine foliation (S). Set of dark green veins (V1). Later white, very steep hairline veins (V2). V1>?S>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-189R-4, 39-58 cm WET

## Core Photo




**305-U1309D-190R-1 (Section top: 923.80 mbsf)**

UNIT-509: Troctolite Rubble
Pieces: 1-2

COMMENTS: Unit 509 is coarse-grained troctolite rubble.

UNIT-510: Gabbro
Pieces: 3-11

PRIMARY MINERALOGY: Modal data from Piece 11

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 510 is medium- to coarse-grained gabbro. Medium-grained gabbro at 11-34 cm (Piece 3). Coarse-grained gabbro at 76-86 cm (Piece 11). Change in grain size from Pieces 4-10. Oxide-bearing dikelet at 19-20 cm.

UNIT-511: Troctolite
Pieces: 11

PRIMARY MINERALOGY: Modal data from Piece 11

| | |
|---|---|
| Olivine | Modal 45%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 511 is medium- to coarse-grained troctolite. Sharp boundary with gabbro.

SECONDARY MINERALOGY:Serpentine, chlorite, pale amphibole

COMMENTS: Piece 1 contains highly serpentinized olivine and plagioclase with white network of veins/fractures (along grain boundaries?). In the gabbro, the general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. White patches or networks of white on grain boundaries occur in most pieces and a subhorizontal fracture/vein occurs at about 32 cm in the section. A green and white vein with associated leucocratic alteration cuts through Piece 9. Highly serpentinized olivine again occurs in the section below about 86 cm (sharp contact with overlying gabbro).

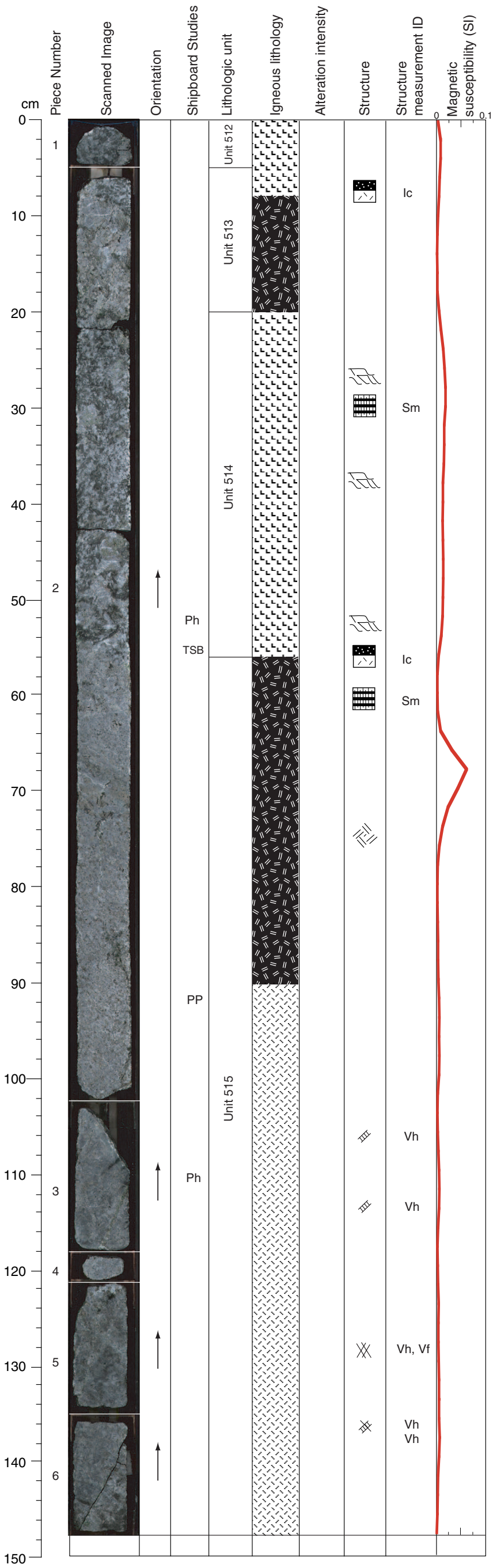
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-190R-1, 86-88 cm (#481)**

STRUCTURE: Troctolitic, medium-grained gabbro cut by medium grained olivine-free gabbro along a preserved igneous contact, at bottom of section magmatic foliation (Sm) visible. Steeply dipping set of white fractures (Vh) and serpentine foliations (S) in Piece 11. Sm>Vh=S.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-190R-1, 8-30 cm WET
305-U1309D-190R-1, 54-66 cm WET
305-U1309D-190R-1, 75-89 cm WET

## Core Photo




**305-U1309D-191R-1 (Section top: 924.80 mbsf)**

UNIT-512: Troctolitic Gabbro Rubble
Pieces: 1

COMMENTS: Unit 512 is medium-grained troctolitic gabbro. Rubble.

UNIT-513: Troctolitic Gabbro
Pieces: 2a

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Olivine | Modal 40%<br>Size 4 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 10%<br>Size 6 mm average<br>Shape anhedral |

UNIT-513: Olivine-bearing Gabbro
Pieces: 2a

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Olivine | Modal 5%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 513 is medium- to coarse-grained troctolitic to olivine-bearing gabbro.

UNIT-514: Troctolitic Gabbro
Pieces: 2b-2c

PRIMARY MINERALOGY: Modal data from piece 2b

| | |
|---|---|
| Olivine | Modal 40%<br>Size 4 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 10%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: Unit 514 is medium- to coarse-grained troctolitic gabbro with large pyroxene oikocrysts. Leucocratic and coarse-grained (~20 mm) in the lower boundary with olivine-bearing gabbro (at 54 cm).

UNIT-515: Olivine-bearing Gabbro
Pieces: 2c

PRIMARY MINERALOGY: Modal data from Piece 2c

| | |
|---|---|
| Olivine | Modal 3%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 57%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

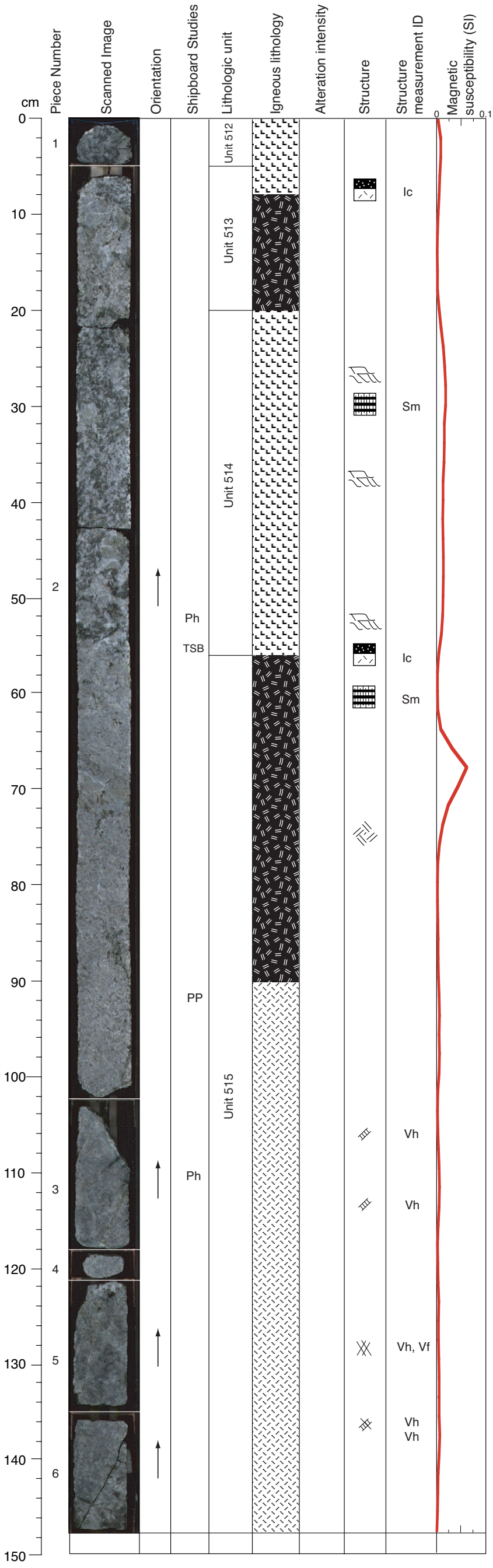
COMMENTS: Upper interval of Unit 515 is coarse-grained olivine-bearing gabbro. Pyroxene-rich band at 69-71 cm. Fine-grained part at 63-65 cm. Grades into gabbro down section.

UNIT-515: Gabbro
Pieces: 2c-6

PRIMARY MINERALOGY: Modal data from Piece 2c

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 3 mm average<br>Shape anhedral |

## Core Photo




**305-U1309D-191R-1 (continued) (Section top: 924.80 mbsf)**

COMMENTS: This interval of Unit 515 is medium- to coarse-grained gabbro. Grain size coarser down section.

SECONDARY MINERALOGY: Chlorite

COMMENTS: Piece 1 contains mainly highly-serpentinized olivine and plagioclase with a network of white veins/fractures. There is a contact with gabbro at the edge of a piece that has background alteration typical of most of the gabbros in previous sections, showing pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. The top of Piece 2 (to 10 cm) contains highly serpentinized olivine (similar to that in Piece 1). The contact with underlying coarser gabbro is sharp as is the return to typical gabbro alteration. The coarse gabbro contains patches or networks of white on grain boundaries until a gradual increase in olivine again returns the section to dominantly serpentinized olivine and plagioclase with white patches from about 17 to 55 cm. There are a few patches of brown amphibole at the edges of the green amphibole that partially replaces pyroxene in the coarser gabbro. A narrow green and white vein begins at 65 cm and continues down section to at least 109 cm. Vein material coats the top of Piece 3 and a wide (~ 8 mm) alteration halo is visible on the top surface of the piece. A vein continues from 111 to 118 cm and again from 122 cm to the end of the section.

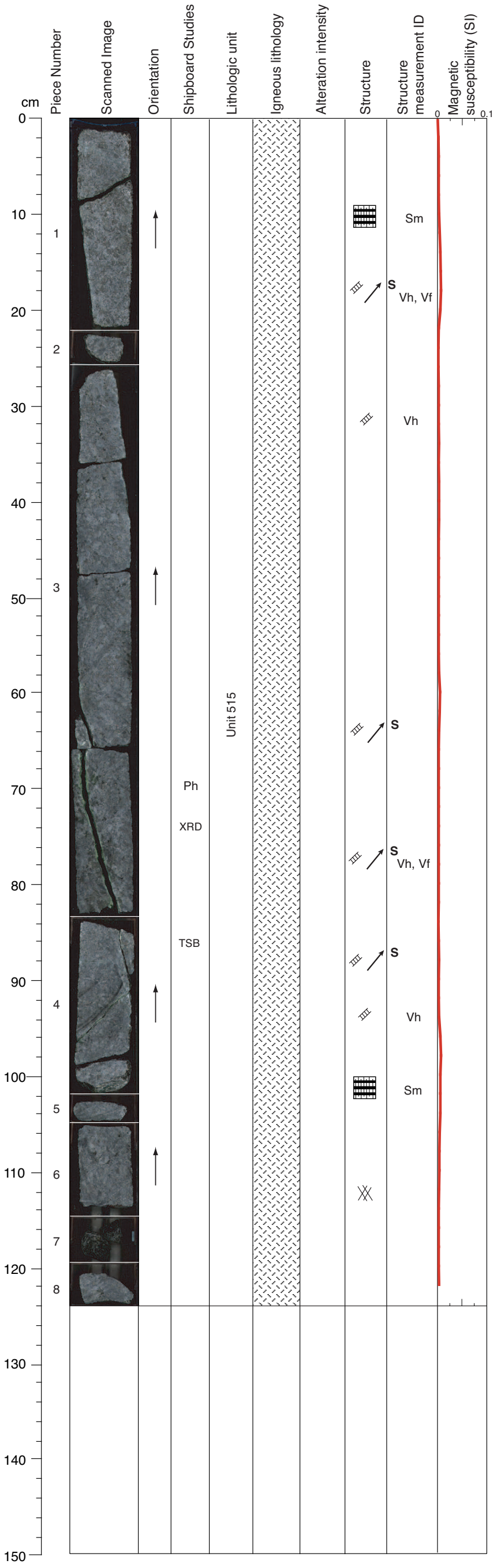
VEIN ALTERATION: Amphibole, plagioclase, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-191R-1, 54-56 cm (#482)**

STRUCTURE: Troctolitic gabbro with magmatic fabric and cm-sized clinopyroxene grains truncated by leucocratic gabbro with magmatic foliation and compositional banding at bottom of section. Troctolitic gabbro is also truncated by medium-grained gabbro with no visible magmatic or plastic fabric near top of section. Leucogabbro is no longer banded and has no foliation at bottom of section. Subvertical open fractures with white infill (B1) in troctolitic gabbro. Serpentinization is patchy and irregular. Set of steeply dipping dark green fault veins with slicken fibers (V1). Dark green vein (V2) cut by open cracks (B1). V2>V1>B1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-191R-1, 44-64 cm WET
305-U1309D-191R-1, 102-114 cm WET

## Core Photo




**305-U1309D-191R-2 (Section top: 926.28 mbsf)**

UNIT-515: Gabbro
Pieces: 1-8

PRIMARY MINERALOGY: Modal data from Pieces 1b, 3b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: This interval of Unit 515 is medium- to coarse-grained gabbro. Variable mode. Oikocrystal pyroxene

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Patches or networks of white on grain boundaries occur in most pieces. Green and white veins cut most of the section and coat the sides of some pieces.

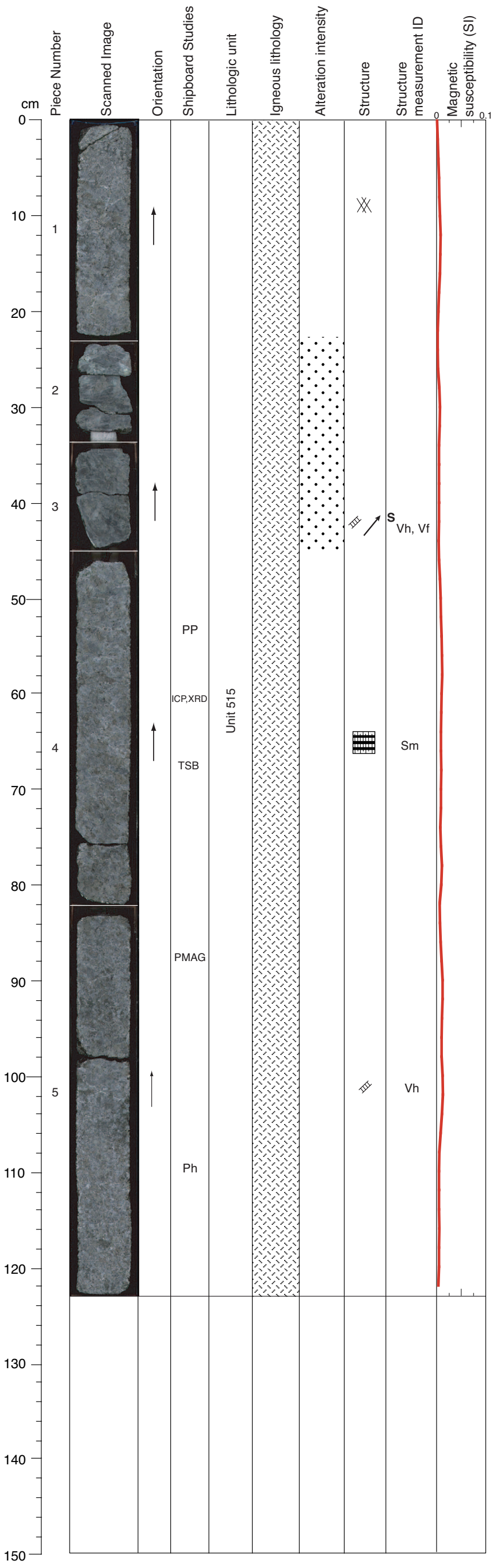
VEIN ALTERATION: Serpentine, amphibole, talc, carbonate.

THIN SECTIONS:
**305-U1309D-191R-2, 85-87 cm (#483)**

STRUCTURE: Medium-grained gabbro with local magmatic foliation (Sm). Set of steep green veins (V1) with talc crosscutting earlier dark green veins (V2). Sm>>V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-191R-2, 66-83 cm WET
305-U1309D-191R-2, 83-101 cm WET

## Core Photo




**305-U1309D-191R-3 (Section top: 927.52 mbsf)**

UNIT-515: Gabbro (Gabbronorite)
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 4a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 6 mm average<br>Shape anhedral |

COMMENTS: This interval of Unit 515 is medium- to coarse-grained gabbro. Up to 15% orthopyroxene observed in thin section. At least locally gabbronorite.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Patches or networks of white on grain boundaries occur in most pieces. Pieces 2 and 3 are slightly more altered than surrounding pieces and the edge of Piece 3 is coated with green and white vein material.

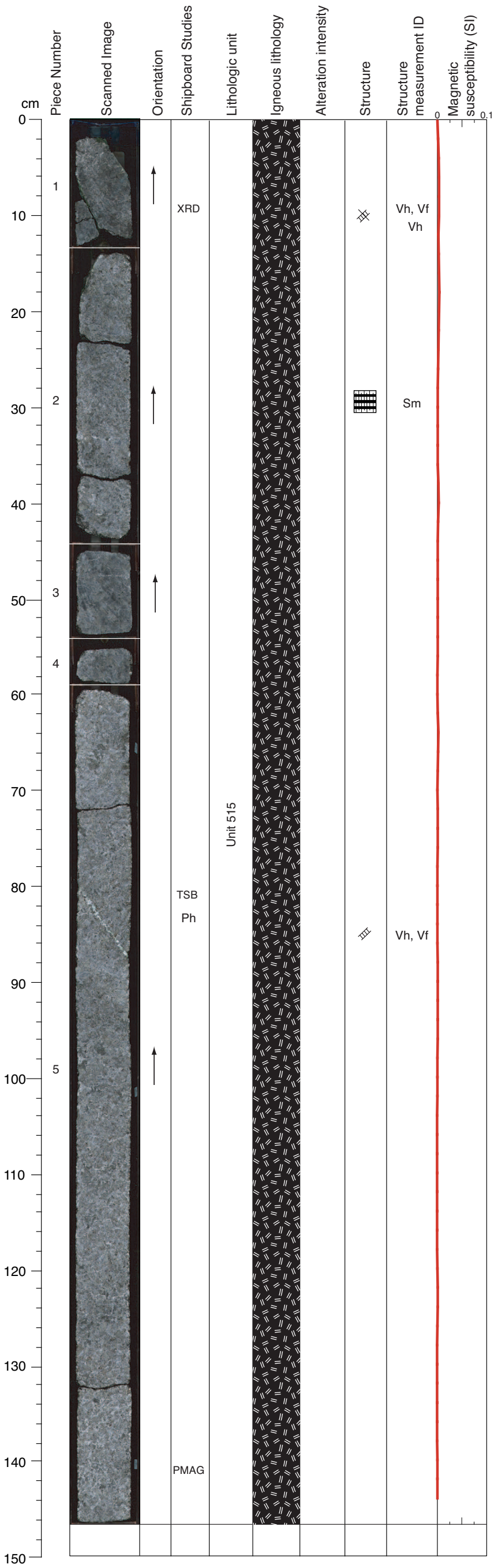
VEIN ALTERATION: Amphibole, talc, carbonate.

THIN SECTIONS:
**305-U1309D-191R-3, 66-69 cm (#484)**

STRUCTURE: Gabbro with local compositional banding and weak magmatic fabric recognizable over most of section. Dark green veins (V1) crosscut by steep, white open crack veins (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-191R-3, 46-76 cm WET
305-U1309D-191R-3, 99-122 cm WET

## Core Photo




**305-U1309D-192R-1 (Section top: 928.60 mbsf)**

UNIT-515: Olivine-bearing Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 5b

| | |
|---|---|
| Olivine | Modal 2%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 38%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: This interval of Unit 515 is medium-grained olivine-bearing gabbro. Tabular plagioclase grains, poikolitic texture. Up tp 2% orthopyroxene observed in olivine free thin section.

SECONDARY MINERALOGY: Chlorite, talc

COMMENTS: The general background alteration shows pyroxene grains rimmed by green amphibole and plagioclase rimmed by white secondary minerals. Patches or networks of white on grain boundaries occur in most pieces. Piece 1 has two green and white veins (that probably continue along the upper side of Piece 2). A white and pale green vein cuts the section from 80 to 88 cm (in Piece 5b). Plagioclase grains cut by the vein are more highly altered.

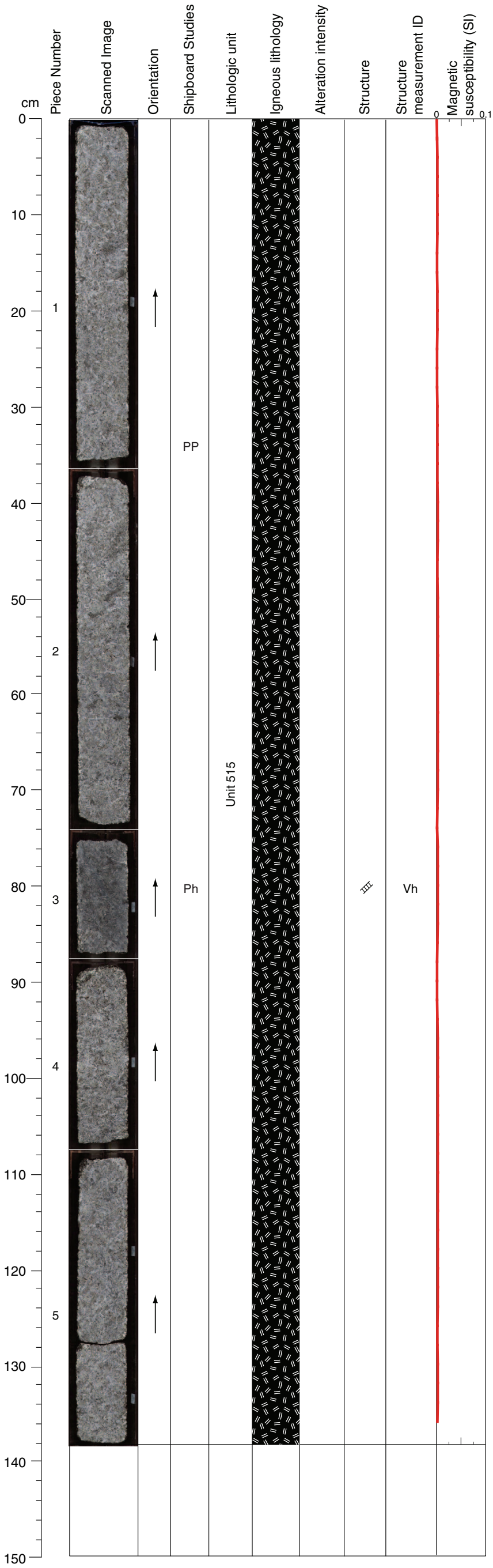
VEIN ALTERATION: Amphibole, talc, carbonate.

THIN SECTIONS:
**305-U1309D-192R-1, 80-82 cm (#485)**

STRUCTURE: Medium-grained isotropic gabbro with short interval at top of section showing weak magmatic fabric and grain size layering. Pale green vein with talc (V1) cutting earlier dark green vein (V2) in Piece 1. A pale green vein (V1) occurs within a magmatic vein (Vm) at 84 cm. Vm>V2>V1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-192R-1, 71-97 cm WET

## Core Photo




**305-U1309D-192R-2 (Section top: 930.07 mbsf)**

UNIT-515: Olivine-bearing Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Olivine | Modal 2%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 38%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: This interval of Unit 515 is medium-grained olivine-bearing gabbro. Tabular plagioclase grains, poikolitic texture.

SECONDARY MINERALOGY: Chlorite, pale amphibole

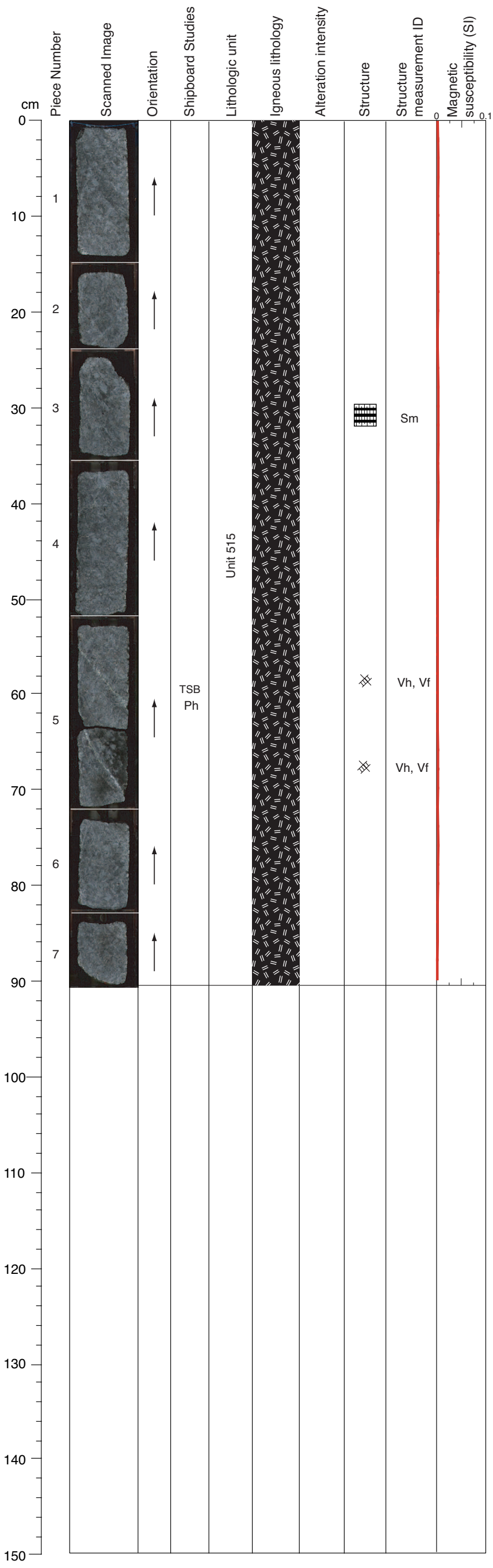
COMMENTS: Medium-grained gabbro cut at 2-7 cm by dark green amphibole veins. This section shows a low alteration and displays severalwhite veins perpendicular to the section. The Piece 3 is a little bit more altered in association with an oblique green vein cutting the piece.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium-grained isotropic gabbro. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-192R-2, 74-86 cm WET

## Core Photo




**305-U1309D-192R-3 (Section top: 931.45 mbsf)**

UNIT-515: Olivine-bearing Gabbro
Pieces: 1-7

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Olivine | Modal 2%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 43%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: This interval of Unit 515 is medium-grained olivine-bearing gabbro. Up to 10% orthopyroxene in thin section. The same thin section is olivine free.

SECONDARY MINERALOGY: Chlorite, talc

COMMENTS: Coarse-grained gabbro with a significant amount of sulfides. This gabbro looks more altered than the previous section, with green amphibole replacing the pyroxene. Piece 5 is cut by two pale green and white (plagioclase, amphibole) with alteration zones around these veins.

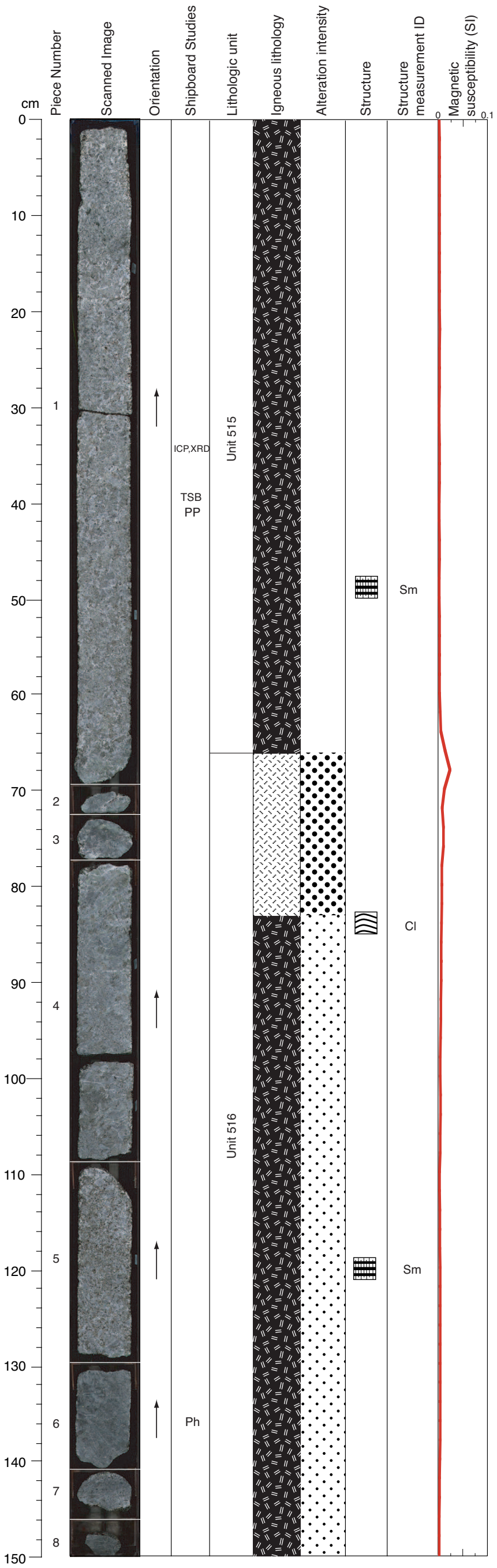
VEIN ALTERATION: Amphibole, carbonate.

THIN SECTIONS:
**305-U1309D-192R-3, 58-61 cm (#486)**

STRUCTURE: Medium-grained, weakly magmatically foliated gabbro. Two pale green veins (V1) cutting through magmatic veins in Piece 5.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-192R-3, 52-71 cm WET

## Core Photo




**305-U1309D-193R-1 (Section top: 933.40 mbsf)**

UNIT-515: Olivine-bearing Gabbro
Pieces: 1a-1b

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 2%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 48%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 515 medium-grained olivine-bearing gabbro. Some tabular plagioclase. Clinopyroxene-rich band at 9-14 cm.

UNIT-516: Olivine-bearing Gabbro
Pieces: 1b-8

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Olivine | Modal 2%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 48%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 516 is medium-grained olivine-bearing gabbro. Disseminated oxide gabbro with interstitial, irregular oxides in interval 66-83 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Medium-grained gabbro with a slight green background color attesting to a significant amount of green amphibole, partially replacing the pyroxenes. At 8-16 cm, pale green and white vein (amphibole, plagioclase) developing an alteration zone containing amphibole grains. At 68-80 cm, leucocratic and amphibole alteration. At 83 cm, the alteration increases with almost complete replacement of the previous minerals by amphibole. Significant amount of sulfides.

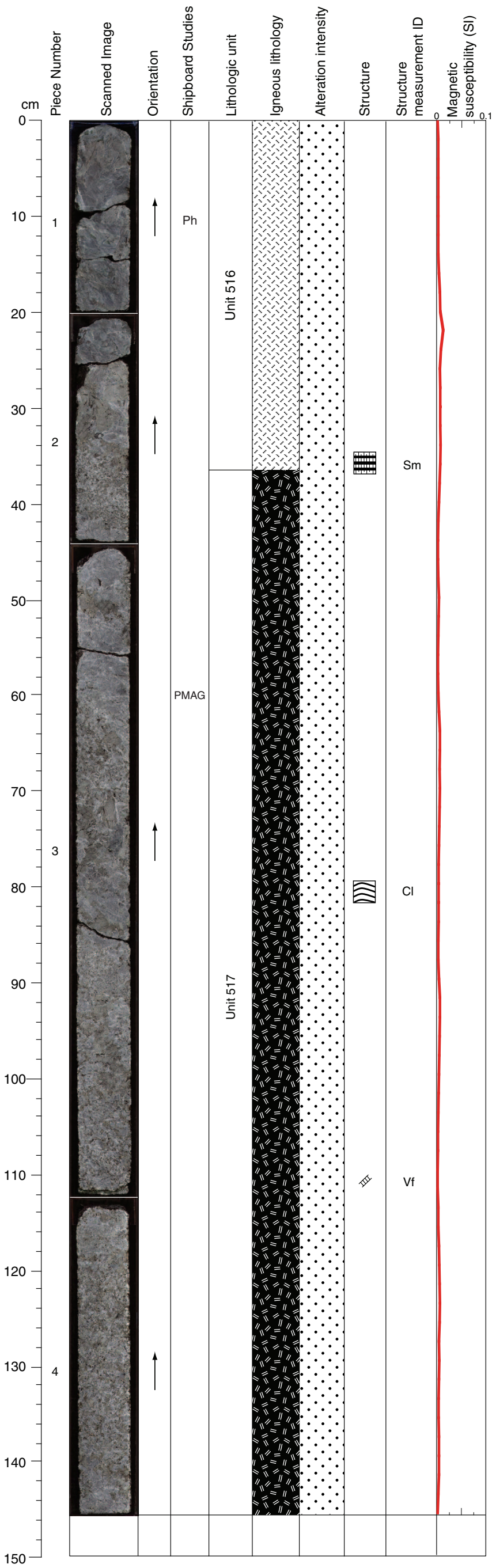
VEIN ALTERATION: Amphibole, plagioclase.

THIN SECTIONS:
**305-U1309D-193R-1, 38-40 cm (#487)**

STRUCTURE: Medium-grained gabbro with pegmatitic clinopyroxene grains and mafic schlieren as well as crude modal layering (Cl). Weak magmatic foliation (Sm) visible in most parts of section. Weak cataclasis distributed.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-193R-1, 31-51 cm WET
305-U1309D-193R-1, 130-141 cm WET

## Core Photo




**305-U1309D-193R-2 (Section top: 934.90 mbsf)**

UNIT-516: Gabbro with disseminated oxides
Pieces: 1-2b

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 40%<br>Size to 25 mm<br>Shape anhedral |
| Clinopyroxene | Modal 59%<br>Size to 30 mm<br>Shape anhedral |
| Oxides | Modal 1%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 516 coarse-grained disseminated oxide gabbro. Large tabular plagioclase crysts.

UNIT-517: Olivine-bearing Gabbro/Gabbro
Pieces: 2b-4

PRIMARY MINERALOGY: Modal data from Pieces 2b and 4

| | |
|---|---|
| Olivine | Modal 1%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 30-55%<br>Size to 35 mm<br>Shape anhedral |
| Clinopyroxene | Modal 44-70%<br>Size to 35 mm<br>Shape anhedral |

COMMENTS: Unit 517 is fine- to coarse-grained olivine-bearing gabbro to gabbro. Some tabular clinopyroxene and plagioclase crystals. Possibly olivine-bearing at 36-42 cm. Unit 517, 519 and 521 are gabbro. Olivine in gabbro is difficult to discern in hand specimen. Band of finer grained crystals, possibly olivine-bearing at 85-92 cm, magmatic boundary (?). Sulfides at 143 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

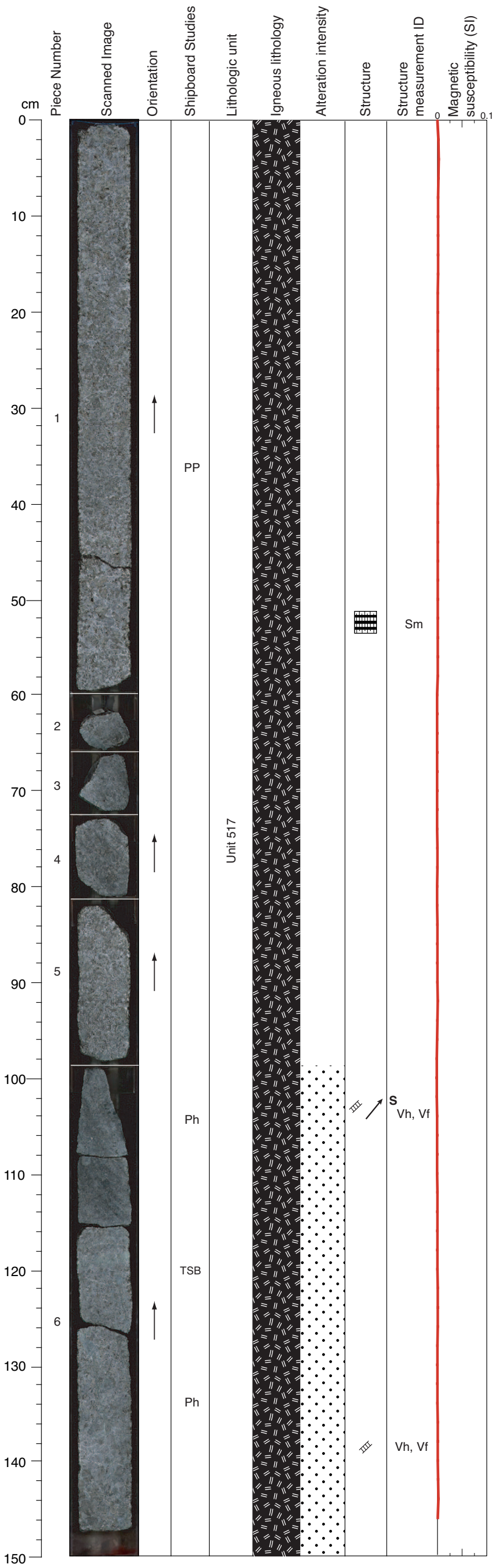
COMMENTS: Pieces 1 and 2 (1-35 cm) are a coarse-grained gabbro with a significant amount of sulfides and amphibole coronas around the olivines and pyroxenes. Variation of the grain size (finer grained part) is observed between 52 and 70 cm. Several white veins, perpendicular to the sections, are observed.

VEIN ALTERATION:Amphibole, carbonate.

STRUCTURE: Continued from Section U1309D-193R-001, medium-grained gabbro with pegmatitic clinopyroxene grains and mafic schlieren as well as crude modal layering (Cl). Weak magmatic foliation (Sm) visible in most parts of section. Few dark green veins (V1) and weak cataclasis (B1) distributed. Cl=?Sm>V1>>B1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-193R-2, 0-20 cm WET

## Core Photo




**305-U1309D-193R-3 (Section top: 936.36 mbsf)**

UNIT-517: Olivine-bearing Gabbro/Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 1%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 45%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 54%<br>Size to 30 mm<br>Shape anhedral |

COMMENTS: Unit 517 is medium- to coarse-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Medium-grained gabbro with low to moderate alteration. Olivines and pyroxenes are rimmed by green amphibole. Several white veins. Significant amount of sulfides. At 105-147 cm, several dark green-blue veins are observed and the minerals cut by these veins are highly altered and replaced by amphibole.

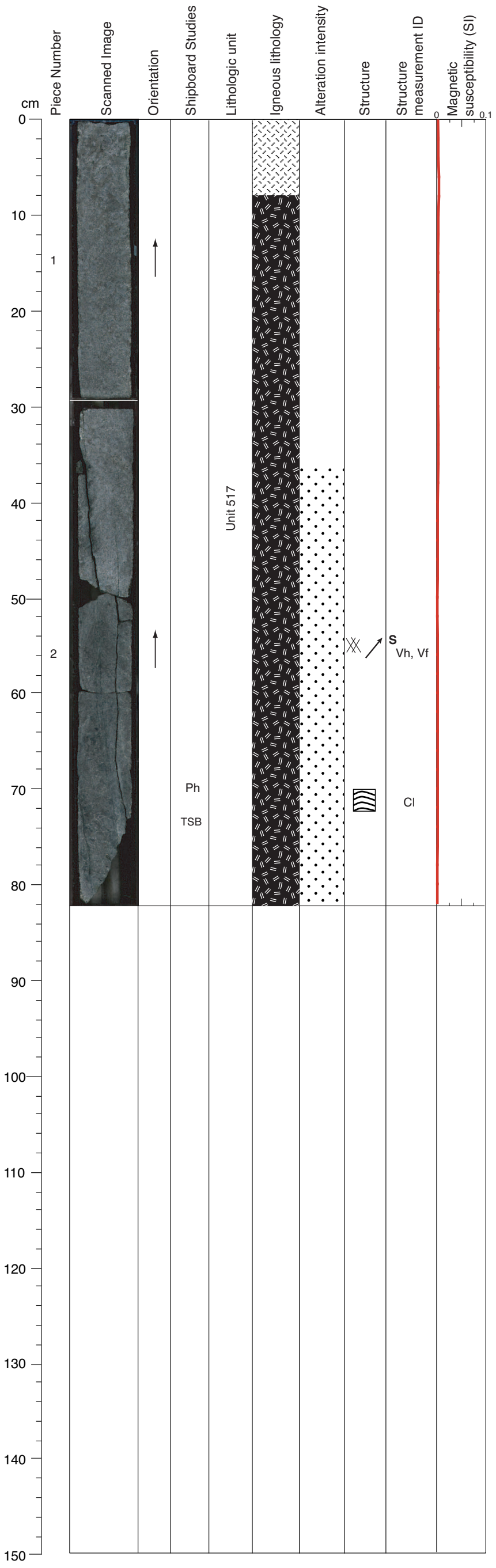
VEIN ALTERATION: Amphibole, plagioclase, chlorite.

THIN SECTIONS:
**305-U1309D-193R-3, 118-121 cm (#488)**

STRUCTURE: Medium-grained gabbro with weak magmatic foliation (Sm) in most parts of section. Dark green talc-bearing veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-193R-3, 99-126 cm WET
305-U1309D-193R-3, 127-147 cm WET

## Core Photo




**305-U1309D-193R-4 (Section top: 937.86 mbsf)**

UNIT-517: Olivine-bearing Gabbro/Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 1%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 35%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 65%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 517 is fine- to medium-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Fine-grained gabbro showing a fracture filled by white vein (?) and also several dark green amphibole veins. The alteration is low. The end of the section is broken in several pieces and these fractures are covered by green amphibole.

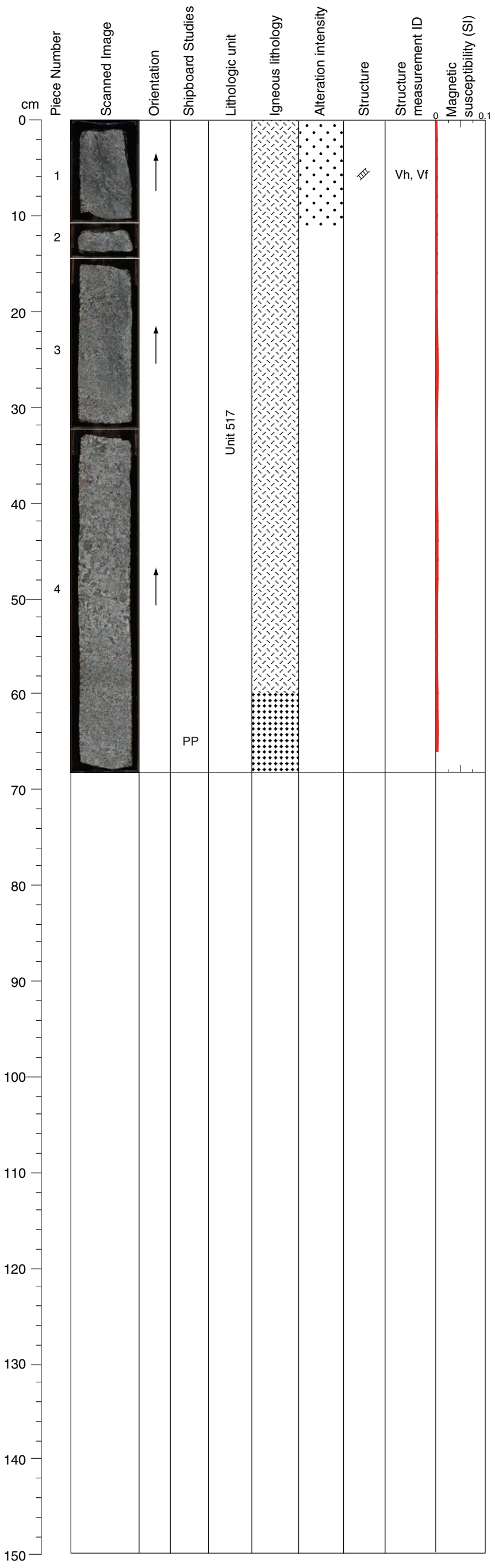
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-193R-4, 73-77 cm (#489)**

STRUCTURE: Medium-grained gabbro with weak magmatic foliation (Sm) and compositional banding (Cl). Irregular, steeply dipping dark green vein (fault vein).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-193R-4, 60-82 cm WET

## Core Photo




**305-U1309D-194R-1 (Section top: 938.20 mbsf)**

UNIT-517: Gabbro/Olivine Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Pieces 3, 4

| | |
|---|---|
| Olivine | Modal up to 5%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40-45%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 fine- to medium-grained gabbro to olivine gabbro. This section has variable grain size. Gradual change in grain size at 56-60 cm.

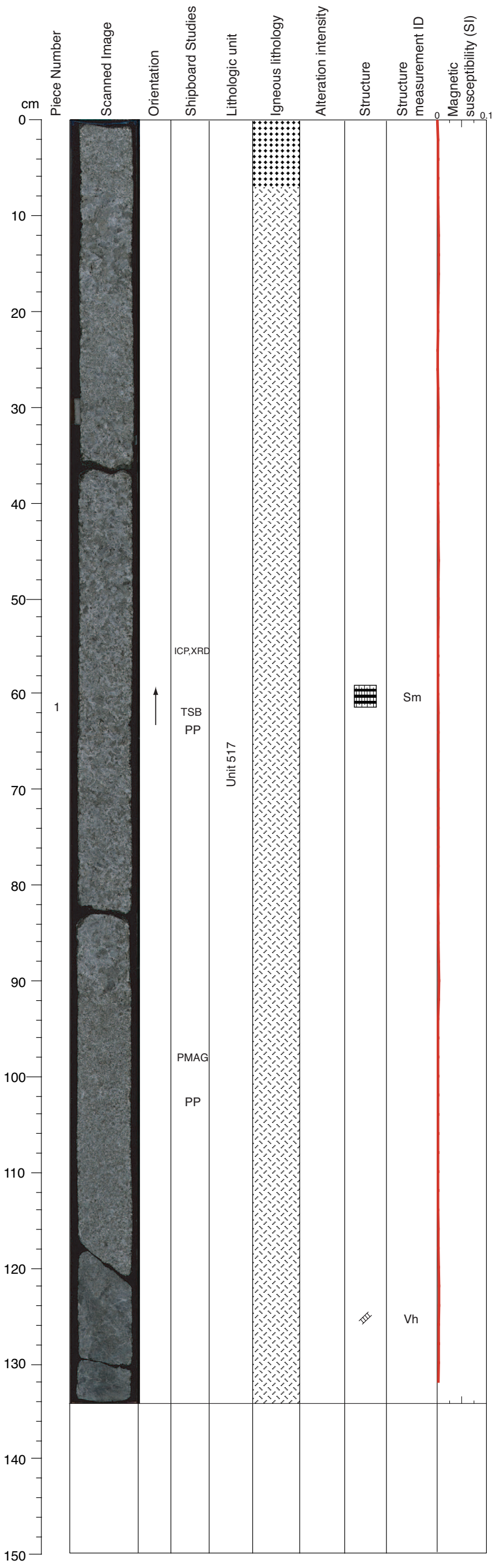
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Fine-grained gabbro cut by several green amphibole veins developing a narrow alteration halo around them. This section shows low alteration.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to medium-grained gabbro with local grain size layering and no consistent magmatic foliation. Steeply dipping dark green fault vein (Piece 1) that is the same vein as in the previous section.

## Core Photo




**305-U1309D-194R-2 (Section top: 938.88 mbsf)**

UNIT-517: Olivine Gabbro
Pieces: 1a

PRIMARY MINERALOGY: Modal data from Section U1309D-194-001, Pieces 3 and 4

| | |
|---|---|
| Olivine | Modal up to 5%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40-45%<br>Size 1 mm average<br>Shape anhedral |

UNIT-517: Gabbro (Gabbronorite)
Pieces: 1a-1e

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 fine-grained olivine gabbro and medium- to coarse-grained gabbro. Variable grain size and mode. Coarse-grained clinopyroxene at 7-18 cm and 31-92 cm. Up to 10% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Fine-grained gabbro with coarser-grained part between 7 and 18 cm and from 30 to 92 cm. Very low alteration. From 122 to 134 cm, the gabbro is cut by several white veins going around the grains and amphibole alteration is observed related to thin amphibole veinlets.

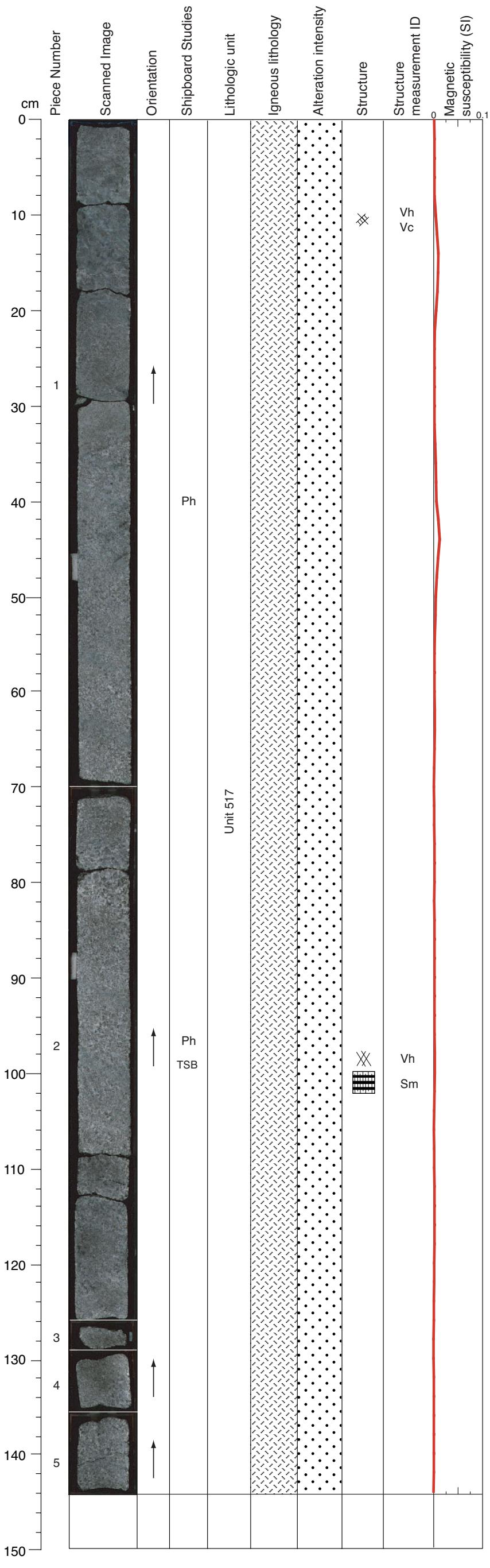
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-194R-2, 61-63 cm (#490)**

STRUCTURE: Fine- to medium-grained gabbro with weak magmatic foliation seen locally. Slight cataclasis (B1) and a dark green vein (V1). V1>B1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-194R-2, 50-70 cm WET

## Core Photo




**305-U1309D-194R-3 (Section top: 940.22 mbsf)**

UNIT-517: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 fine- to medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse- to fine-grained gabbro with a significant amount of amphibole. Several white veins and dark green amphibole veins (at 10, 19, and 34-56 cm). Pieces 2 to 5 have a higher plagioclase content. Several dark green veins are observed at 90, 97 and 100 cm and the pyroxenes close to these veins are altered to green amphibole.

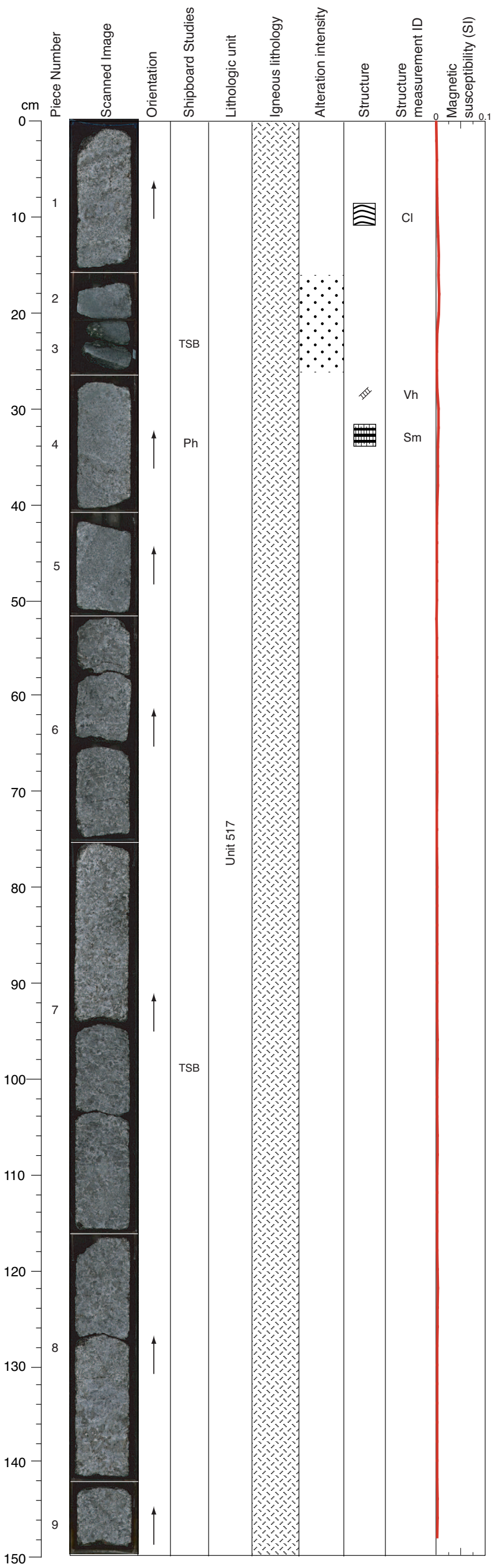
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-194R-3, 98-100 cm (#491)**

STRUCTURE: Mainly fine-, locally medium-grained gabbro with only faint magmatic foliation (Sm) in central part of section. Pale green vein (V1) crosscut by open crack with white infill (V2) at 10 cm. Set of hydrothermal dark green veins (V3) at 100 cm. V3>V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-194R-3, 30-50 cm DRY
305-U1309D-194R-3, 88-108 cm WET

## Core Photo




**305-U1309D-194R-4 (Section top: 941.66 mbsf)**

UNIT-517: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 1 mm average<br>Shape anhedral |

UNIT-517: Gabbro
Pieces: 5-9

PRIMARY MINERALOGY: Modal data from Piece 7b

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 fine- to medium-grained gabbro. Medium-grained clinopyroxene concentration band (1 cm thick) at 4, 9, and 37 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse- to fine-grained gabbro with a significant amount of amphibole. Piece 3 shows leucocratic alteration affecting the pyroxenes to green amphibole. Pieces 6 and 7 show several white veins surrounding the grains.

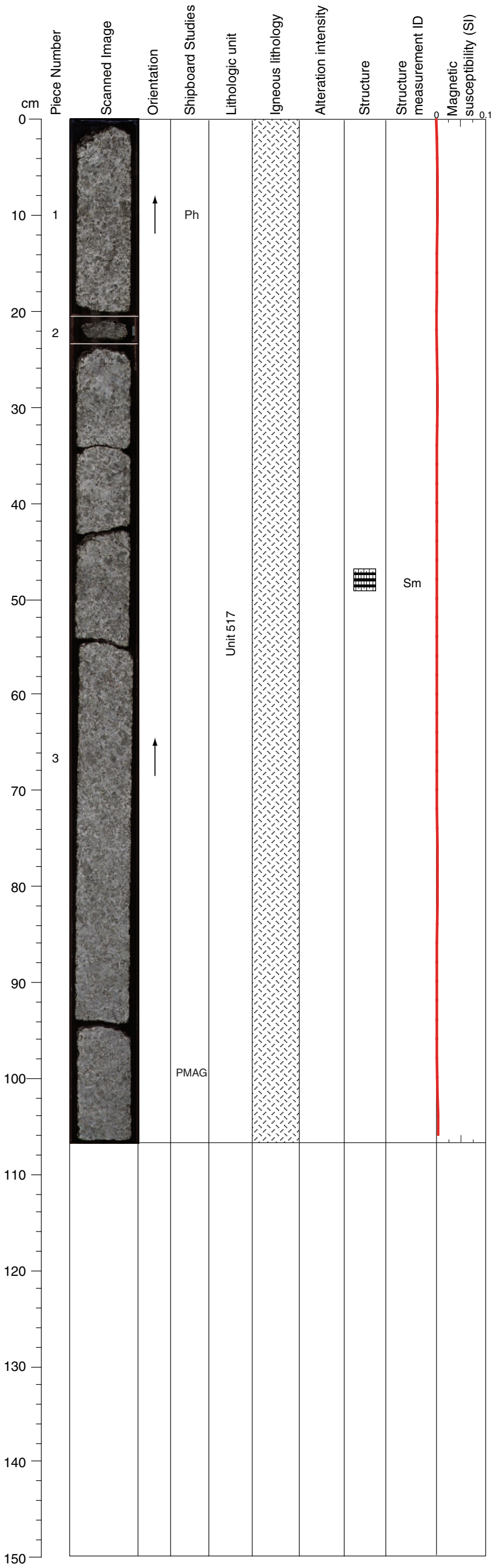
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-194R-4, 22-24 cm (#492)**
**305-U1309D-194R-4, 97-100 cm (#493)**

STRUCTURE: Fine- to medium-grained gabbro with locally prominent grain size banding (Cl) and magmatic foliation (Sm) of shallow dip mainly visible in upper part of section. An early green vein (Vh).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-194R-4, 16-40 cm WET
305-U1309D-194R-4, 94-104 cm WET

## Core Photo




**305-U1309D-195R-1 (Section top: 943.00 mbsf)**

UNIT-517: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 3d

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite

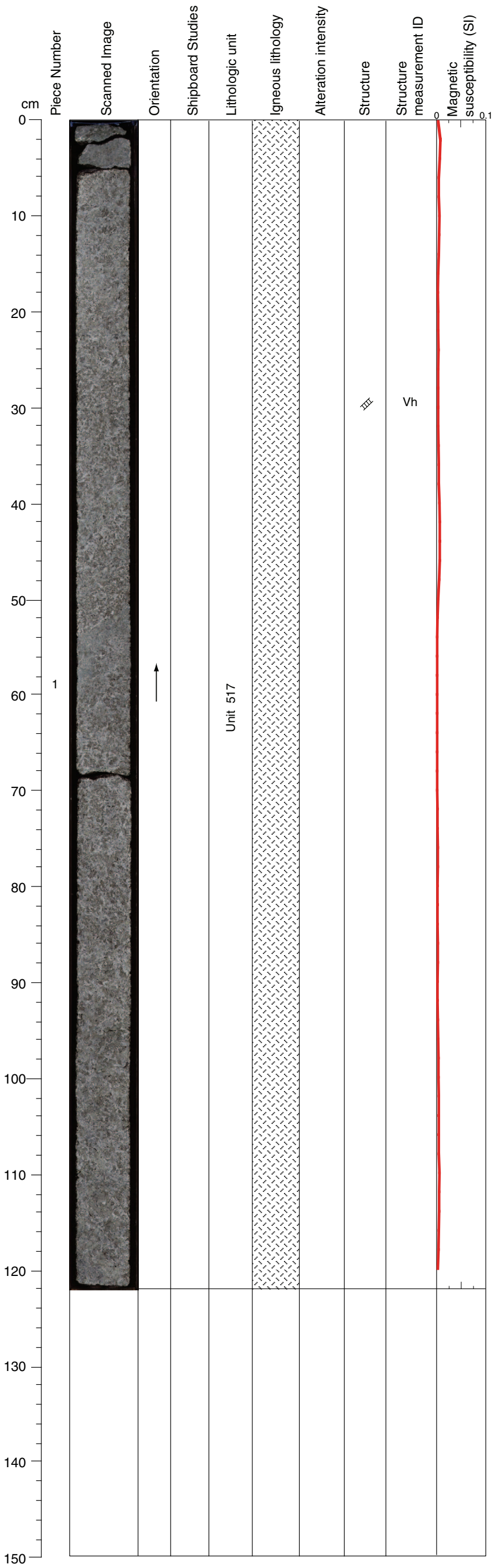
COMMENTS: Medium grained gabbro with low alteration.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained gabbro with weak magmatic foliation and compositional banding developed locally.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-195R-1, 0-20 cm WET

## Core Photo




**305-U1309D-195R-2 (Section top: 944.08 mbsf)**

UNIT-517: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 medium-grained gabbro.

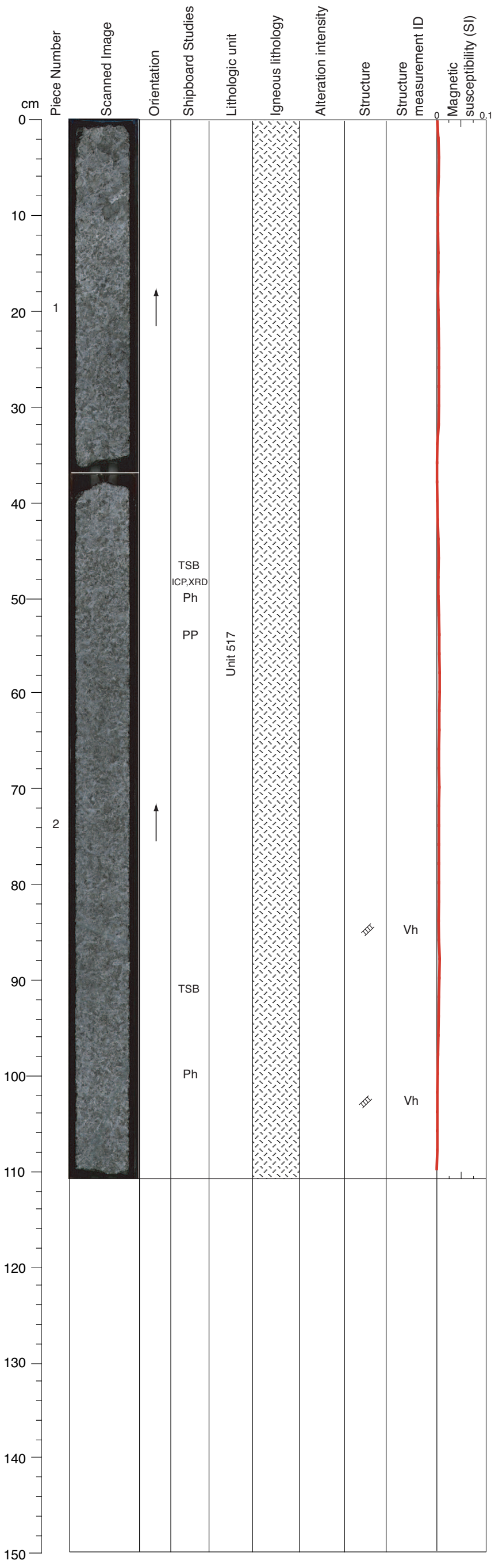
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Pieces 1a and 1b are slightly altered near a green and white vein in Piece 1a. The gabbro in the remainder of the section is only very slightly altered. There is a slightly higher zone of alteration from about 38 to 60 cm associated with sets of branching networks of fine green veins.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Fine- to medium-grained gabbro with magmatic foliation developed in fine-grained parts. A few dark green veins.

## Core Photo




**305-U1309D-195R-3 (Section top: 945.31 mbsf)**

UNIT-517: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: The gabbro is only very slightly altered, except adjacent to a narrow (1 mm) green vein that cuts the section at a low angle from 84 to 96 cm and another that cuts the section at a higher angle between 98 and 110 cm.

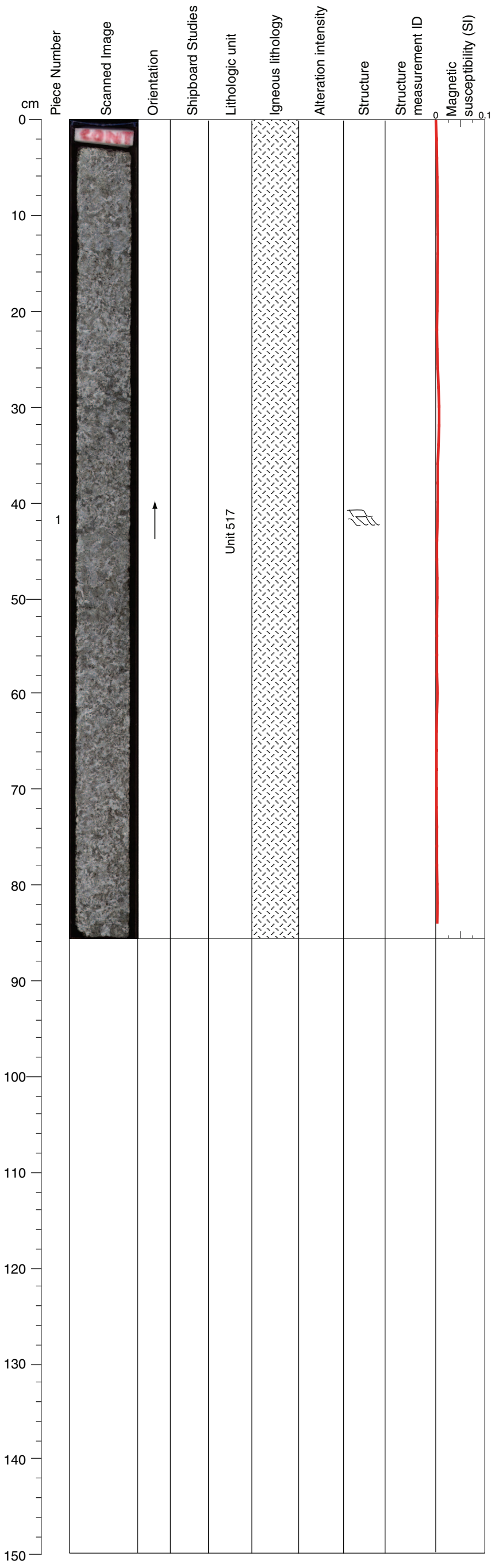
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-195R-3, 44-46 cm (#494)**

STRUCTURE: Medium-grained gabbro with no clear magmatic or plastic mineral fabric. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-195R-3, 40-60 cm WET
305-U1309D-195R-3, 90-110 cm WET

## Core Photo




**305-U1309D-195R-4 (Section top: 946.42 mbsf)**

UNIT-517: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 517 medium-grained gabbro.

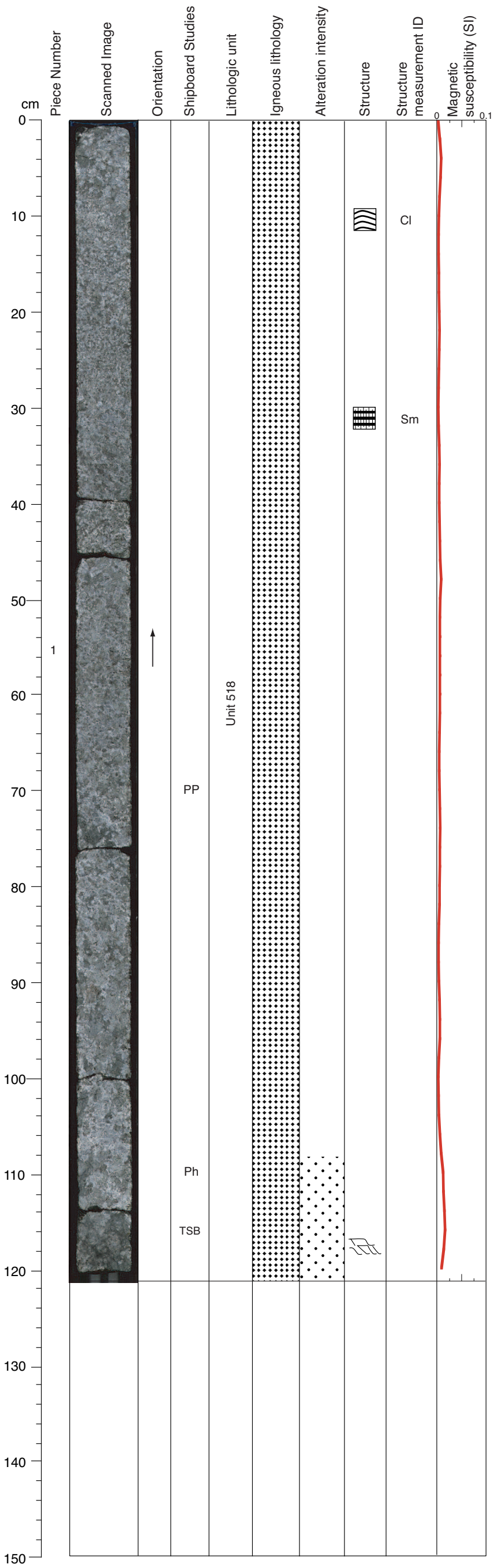
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Medium-grained gabbro with very slight alteration.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained gabbro with no clear magmatic or plastic mineral fabric. Weak serpentine foliation and a single dark green vein.

## Core Photo




**305-U1309D-196R-1 (Section top: 947.80 mbsf)**

UNIT-518: Olivine Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Pieces 1a

| | |
|---|---|
| Olivine | Modal up to 15%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 518 is medium- to coarse-grained olivine gabbro. Patches of varying grain size. Olivine rich zone at 108-118 cm.

SECONDARY MINERALOGY: Serpentine, chlorite

COMMENTS: Medium- to coarse-grained gabbro with very low alteration, except from 114 to 120 cm where a fine network of serpentine veinlets cut through the last piece.

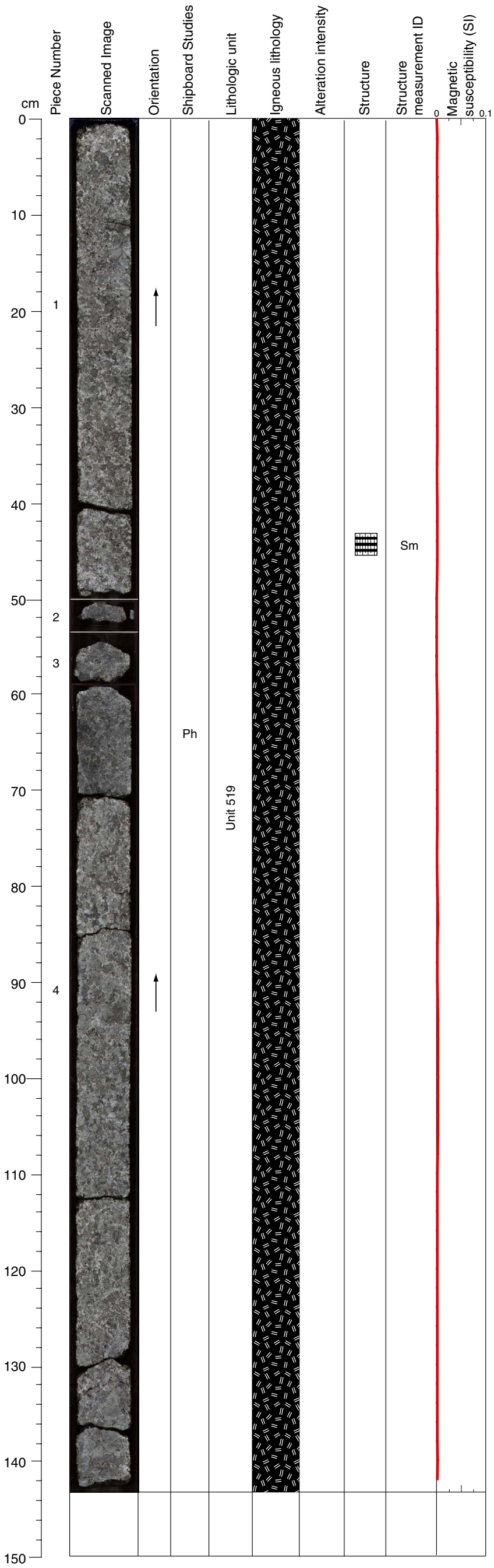
VEIN ALTERATION: Serpentine.

THIN SECTIONS:
**305-U1309D-196R-1, 115-117 cm (#495)**

STRUCTURE: Fine- to medium-grained gabbro exhibiting coarsening of grain size down core. Serpentine in the last piece.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-196R-1, 100-121 cm WET

## Core Photo




**305-U1309D-196R-2 (Section top: 949.02 mbsf)**

UNIT-519: Olivine-bearing Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Pieces 1a

| | |
|---|---|
| Olivine | Modal up to 4%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 41%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 519 is medium- to coarse-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite

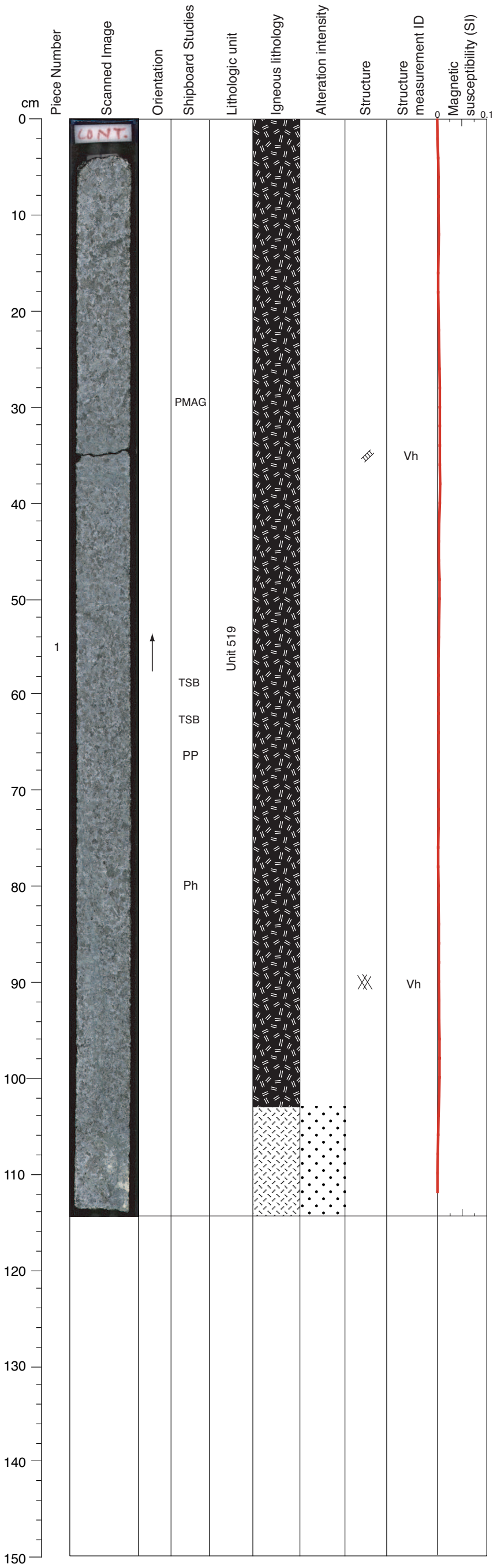
COMMENTS: Coarse-grained gabbro with very low alteration.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained gabbro with local magmatic fabric developed.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-196R-2, 59-70 cm WET

## Core Photo




**305-U1309D-196R-3 (Section top: 950.46 mbsf)**

UNIT-519: Olivine-bearing Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Pieces 1a

| | |
|---|---|
| Olivine | Modal 4%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 31%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 519 is medium- to coarse-grained olivine-bearing gabbro. Clinopyroxene oikocrysts.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Medium- to coarse-grained gabbro with very low alteration. A subhorizontal green amphibole vein is observed at 37 cm and a subvertical branching set of fine green veins cut the section from about 70 cm to the end.

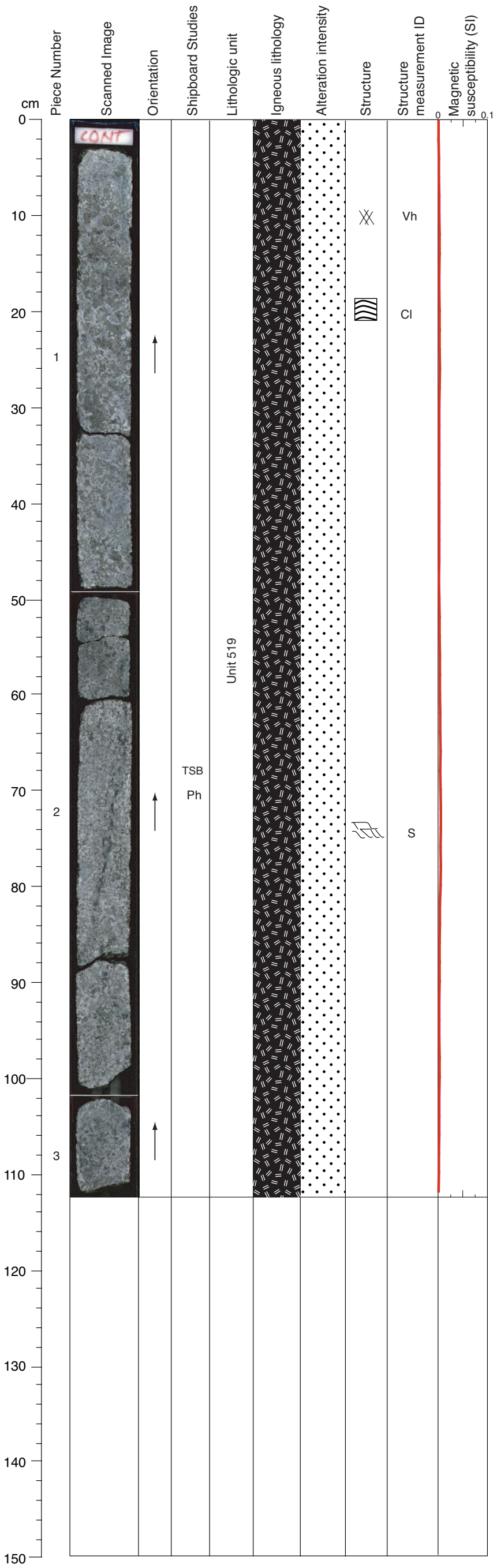
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-196R-3, 62-64 cm (#496)**

STRUCTURE: Medium-grained gabbro with no clear development of a magmatic or plastic mineral fabric. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-196R-3, 75-95 cm WET

## Core Photo




**305-U1309D-196R-4 (Section top: 951.61 mbsf)**

UNIT-519: Olivine-bearing Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 4%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 31%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 519 is fine- to coarse-grained olivine-bearing gabbro. Variable grain size. Clinopyroxene oikocrysts. Trace of sulfide in clinopyroxene-grains. Irregular vertical olivine-rich bands.

SECONDARY MINERALOGY: Chlorite, pale amphibole, dark amphibole?

COMMENTS: Coarse- to very coarse-grained gabbro with low alteration. Dark veins are observed in the middle of the section between 60 and 85 cm.

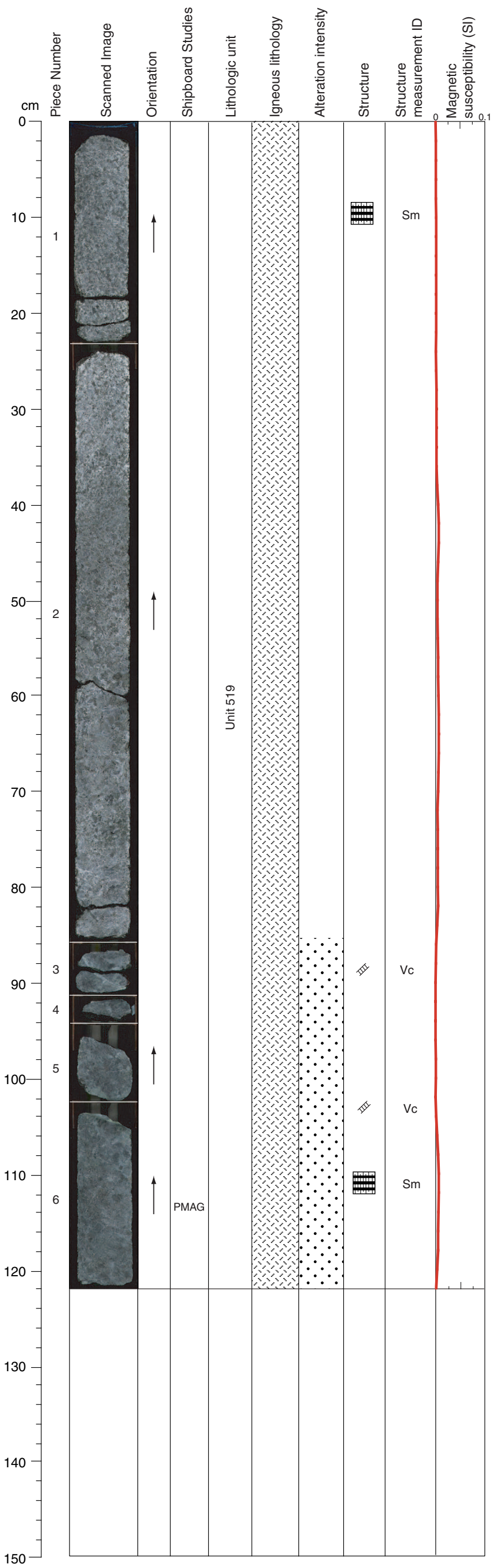
VEIN ALTERATION: Serpentine, amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-196R-4, 66-69 cm (#497)**

STRUCTURE: Medium-grained gabbro with local modal banding (Cl) and grain size variation, no clear magmatic or plastic foliation. Serpentine foliation (S) and set of dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-196R-4, 61-87 cm WET

## Core Photo




**305-U1309D-197R-1 (Section top: 952.60 mbsf)**

UNIT-519: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Pieces 1a

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 519 is medium-grained gabbro.

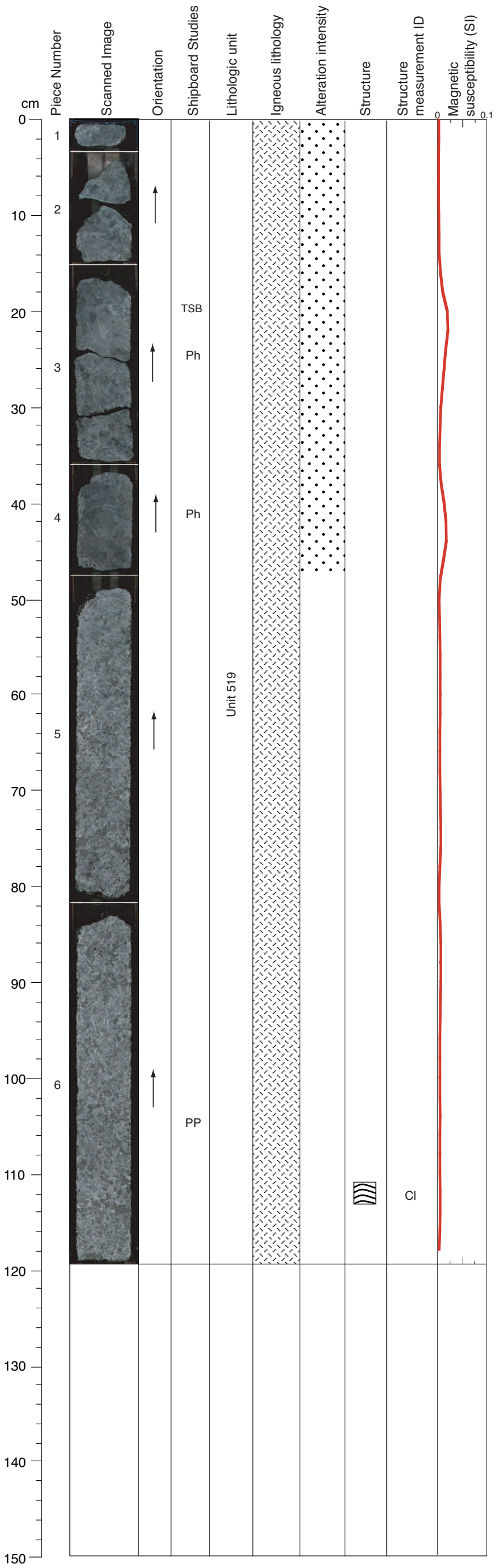
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Medium-grained gabbro with very low to low alteration. At 87-102 cm, the gabbro is cut by a pale green vein and associated alteration zone rich in amphibole. Several white veins around the grain boundaries are observed.

VEIN ALTERATION: Amphibole, carbonate.

STRUCTURE: Medium-grained gabbro with subtle magmatic foliation developed locally. A few pale green veins.

## Core Photo




**305-U1309D-197R-2 (Section top: 953.82 mbsf)**

UNIT-519: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Pieces 3a

| | |
|---|---|
| Plagioclase | Modal 35%<br>Size to 15 mm<br>Shape anhedral |
| Clinopyroxene | Modal 65%<br>Size to 40 mm<br>Shape anhedral |

COMMENTS: Unit 519 is coarse-grained gabbro. The coarser gabbro contains up to 40% orthopyroxene.

UNIT-519: Gabbro
Pieces: 5-6

PRIMARY MINERALOGY: Modal data from Pieces 6

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 519 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: From 1 to 47 cm, coarse-grained gabbro with several white veins around the grain boundaries and amphibole rich part (1 to 18 cm) related to thin green amphibole veins. From 49 cm to the end of the section, finer grained part with numerous white veins around the grains.

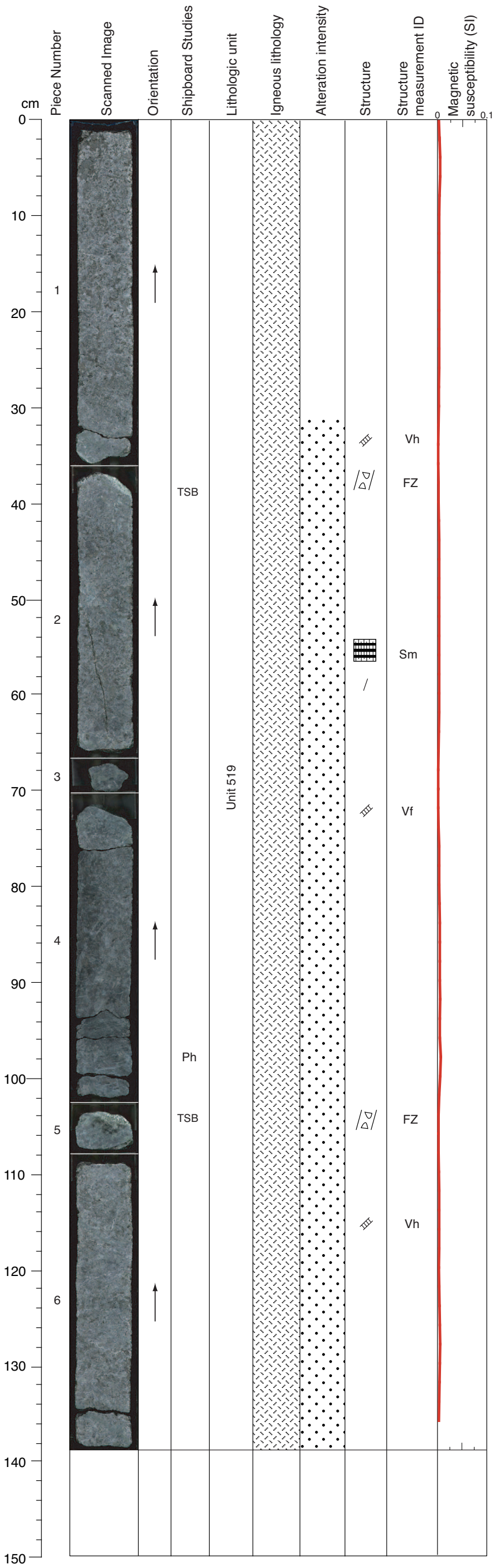
VEIN ALTERATION: Serpentine, amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-197R-2, 19-21 cm (#498)**

STRUCTURE: Medium-grained gabbro with faint magmatic layering developed, pegmatitic interval between 10 and 47 cm.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-197R-2, 16-35 cm WET
305-U1309D-197R-2, 30-46 cm WET

## Core Photo




**305-U1309D-197R-3 (Section top: 955.02 mbsf)**

UNIT-519: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 519 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with green amphibole veins at the end of Piece 1 (32-36 cm) and alteration of the previous minerals to amphibole. The top of Piece 2 (38-39 cm) has leucocratic alteration. Piece 3 and top of Piece 4 (67-75 cm) show alteration of the previous mineralogy to green amphibole and in Piece 4, numerous green amphibole veins and also white veins around the grain boundaries are observed. On top of Piece 5 (104-106 cm) leucocratic alteration associated with replacement of the pyroxenes to green amphibole.Piece 6 is cut by dark green veins at 118 and 137 cm.

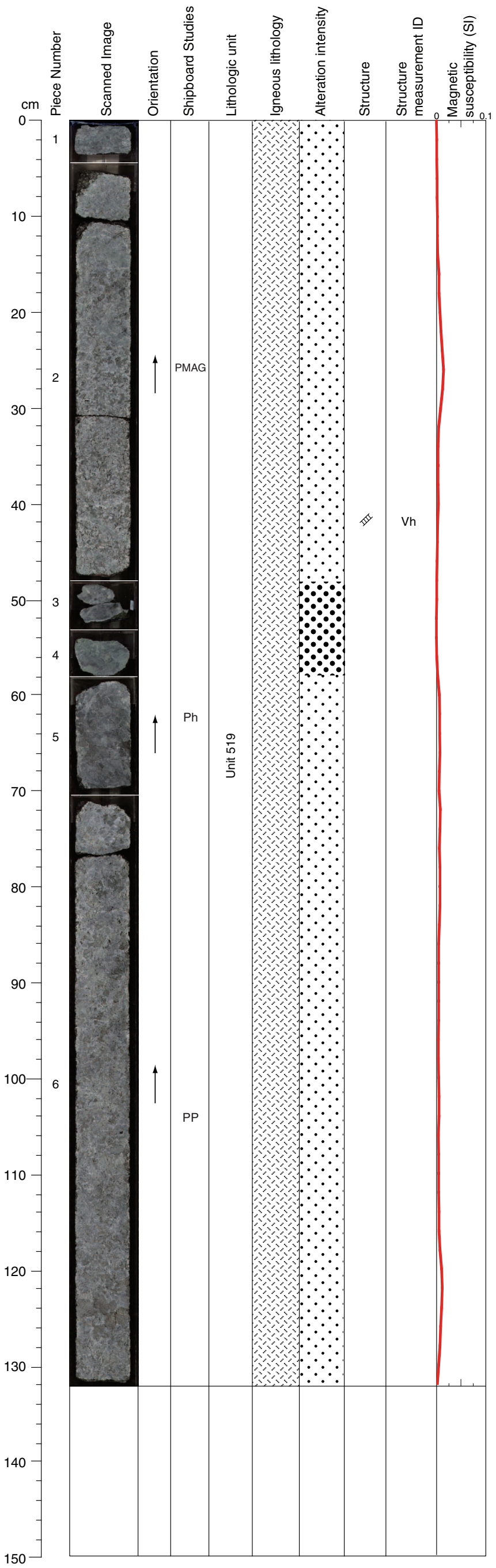
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-197R-3, 37-40 cm (#499)**
**305-U1309D-197R-3, 103-105 cm (#500)**

STRUCTURE: Medium-grained gabbro with weak mineral foliation in central part of section. An early dark green vein set (V1), several levels of possible fault gouge (FZ), and later open cracks (B1). Fault zones are vey localized, no thickness constraint, and no apparent crosscutting relationships with other features. V1>FZ>B1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-197R-3, 93-106 cm WET

## Core Photo




**305-U1309D-197R-4 (Section top: 956.41 mbsf)**

UNIT-519: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 6b

| | |
|---|---|
| Plagioclase | Modal 35%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 65%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 519 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

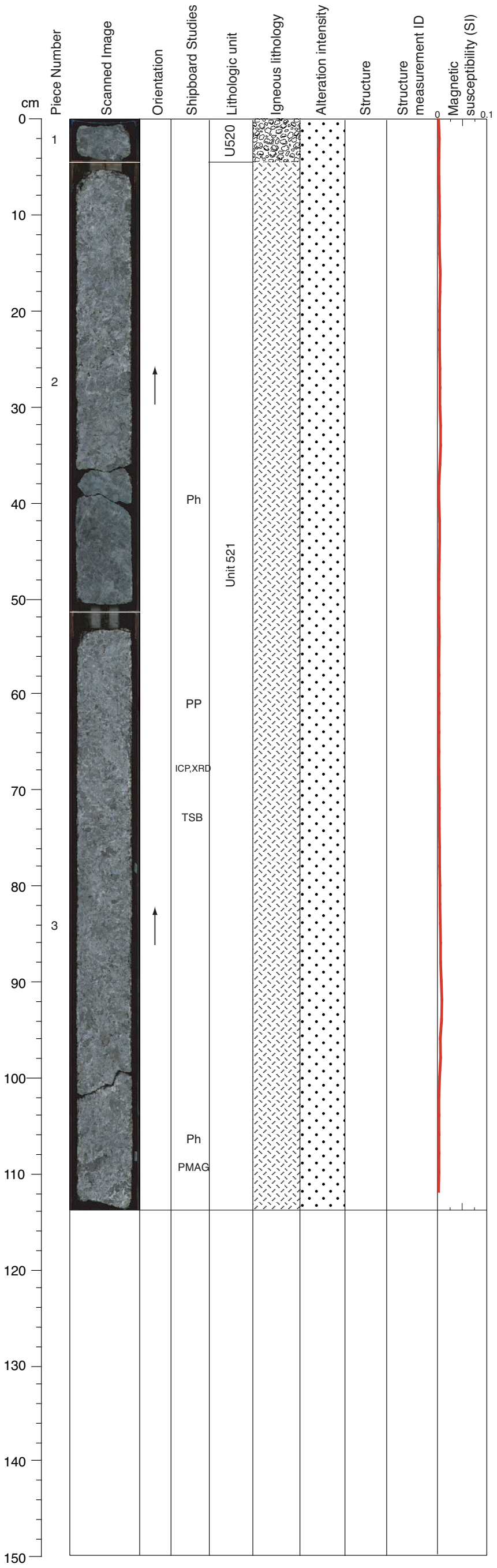
COMMENTS: Piece 1 displays green amphibole vein and the alteration of the pyroxenes to green amphibole related to this vein. Piece 2 is cut by numerous green amphibole veins (at 14-16 cm, 24 cm, 44 cm, and 47 cm). Pieces 3 and 4 show alteration and replacement of the previous mineralogy to green amphibole. From 59 to 70 cm, the coarse-grained gabbro is cut by several white veins filling the fractures.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium- to rarely coarse-grained isotropic gabbro. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-197R-4, 54-70 cm WET

## Core Photo




**305-U1309D-198R-1 (Section top: 957.40 mbsf)**

UNIT-520: Gabbro Rubble
Piece 1

COMMENTS: Unit 520 is rubble.

UNIT-521: Gabbro
Pieces: 2-3

PRIMARY MINERALOGY: Modal data from Piece 3a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 521 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite

COMMENTS: Coarse-grained gabbro with numerous white veins around the grains. Significant amount of sulfides. Low alteration.

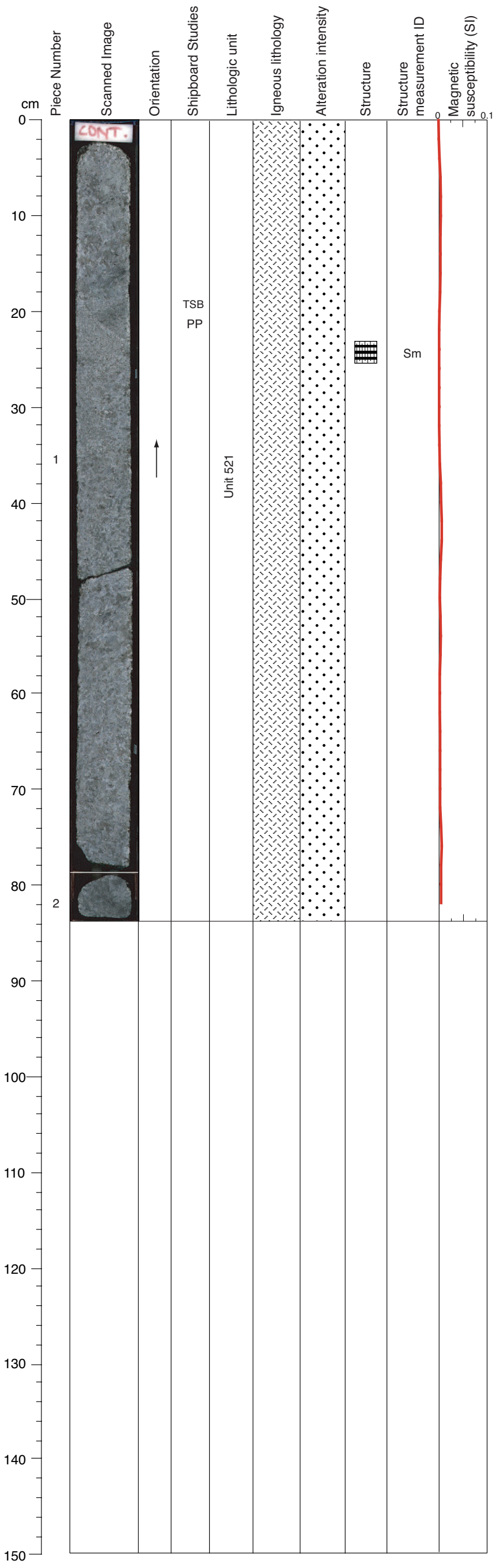
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-198R-1, 72-74 cm (#501)**

STRUCTURE: Medium-grained isotropic gabbro. A few poorly developed dark green veins, which are not visible in the cut face but are seen on the back side of the core.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-198R-1, 36-51 cm WET
305-U1309D-198R-1, 60-80 cm WET
305-U1309D-198R-1, 100-113 cm WET

## Core Photo




**305-U1309D-198R-2 (Section top: 958.54 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Unit 521 is fine- to medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Coarse-grained gabbro with numerous white veins around the grains. Significant amount of sulfides. Low alteration.

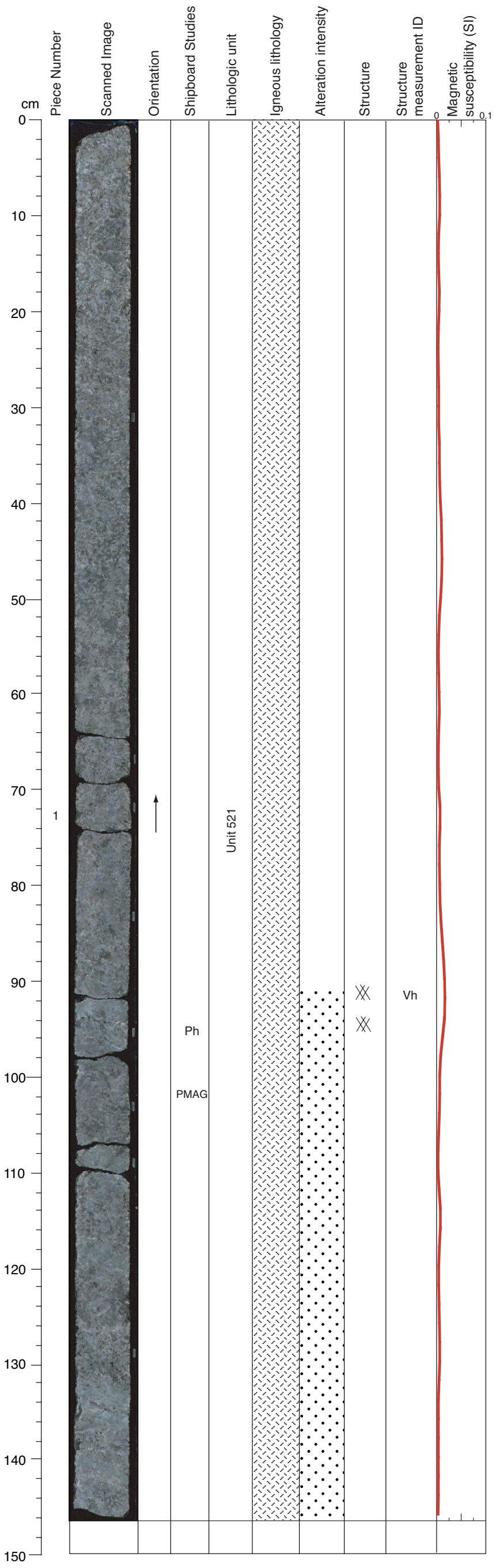
VEIN ALTERATION: n/a

THIN SECTIONS:
**305-U1309D-198R-2, 17-20 cm (#502)**

STRUCTURE: Medium-grained isotropic gabbro with microgabbroic interval showing a clear magmatic foliation (Sm). A few poorly developed dark green veins, which are not visible in the cut face but are visible on the back of the core.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-198R-2, 10-30 cm WET

## Core Photo




**305-U1309D-198R-3 (Section top: 959.38 mbsf)**

UNIT-521: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 521 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

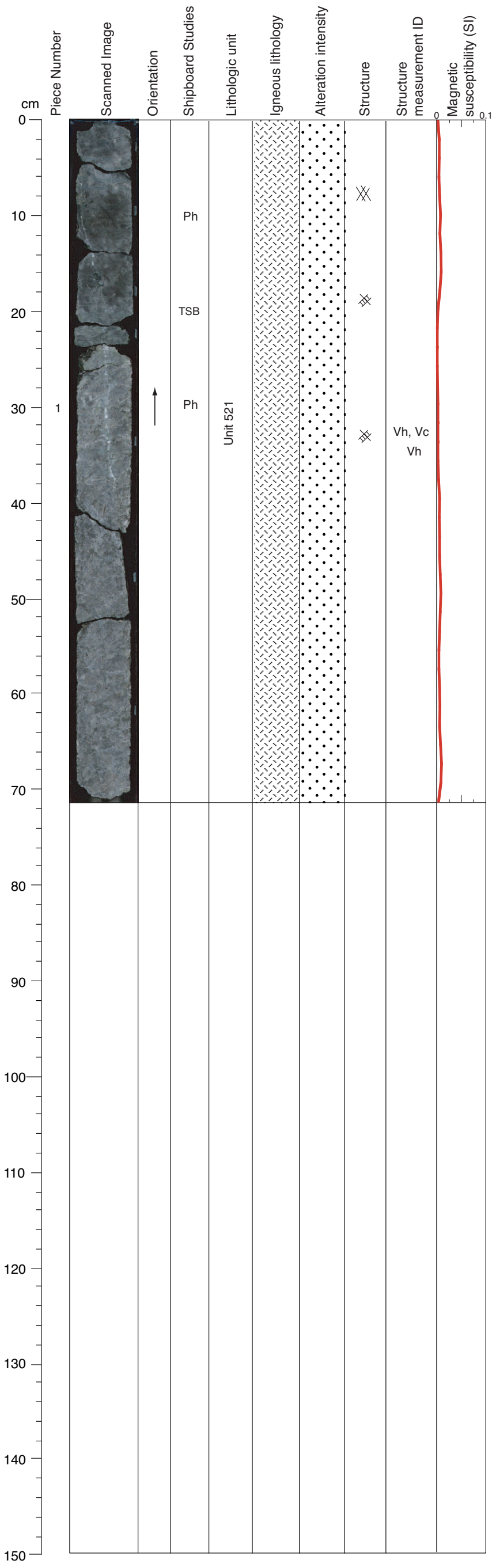
COMMENTS: Coarse-grained gabbro with numerous white veins around the grains. Significant amount of sulfides. Low alteration. From 90 cm to the end of the section, several green amphibole veins (at 98, 108, 117, 131 and 136 cm). The pyroxenes are altered to green amphibole.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium-grained isotropic gabbro. Shallowly dipping set of early dark green set of veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-198R-3, 92-110 cm WET

## Core Photo




**305-U1309D-198R-4 (Section top: 960.85 mbsf)**

UNIT-521: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 521 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Coarse-grained gabbro with numerous white veins around the grains and thin multiple pale green veins. Significant amount of sulfides. Low alteration. One big vein cuts the section from 5 to 43 cm (pale green amphibole + plagioclase?) with a narrow alteration zone. The background shows a green color attesting to the significant amount of green amphibole.

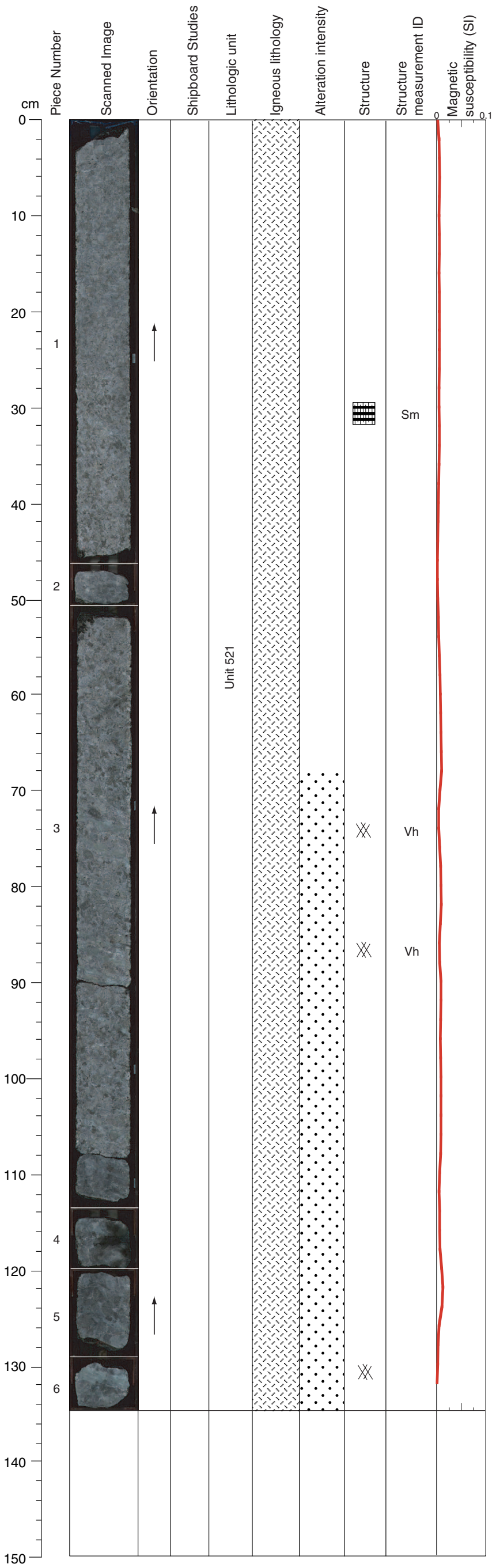
VEIN ALTERATION: Amphibole, chlorite, carbonate, zeolite (?).

THIN SECTIONS:
**305-U1309D-198R-4, 19-21 cm (#503)**

STRUCTURE: Medium-grained isotropic gabbro. Shallowly dipping set of early dark green set of veins (V1) and a later steeply dipping white (locally dark green) vein (V2). Some subhorizontal open cracks (B1). V1>V2>B1.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-198R-4, 0-21 cm WET
305-U1309D-198R-4, 24-43 cm WET

## Core Photo




**305-U1309D-199R-1 (Section top: 962.20 mbsf)**

UNIT-521: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 521 is medium- to coarse-grained gabbro continuing through this section. Homogeneous, but coarse-grained clinopyroxene at 57-75 cm.

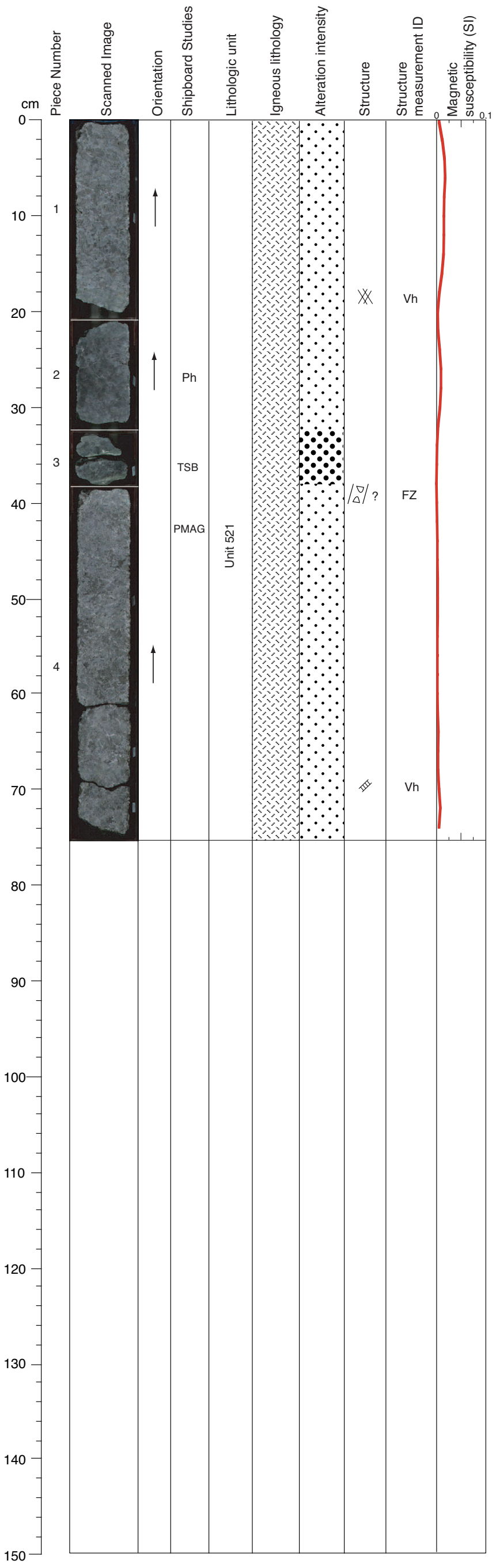
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with very low to low alteration and replacement of the previous mineralogy by green amphibole related to several thin green amphibole veins. Significant amount of sulfides.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium- to coarse-grained gabbro. Subhorizontal dark green veins.

## Core Photo




**305-U1309D-199R-2 (Section top: 963.54 mbsf)**

UNIT-521: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 521 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Coarse-grained gabbro with alteration and replacement of the previous mineralogy by green amphibole related to several thin green amphibole veins. Significant amount of sulfides. At 35 cm, brecciatic green pale veined zone and with an alteration halo around it.

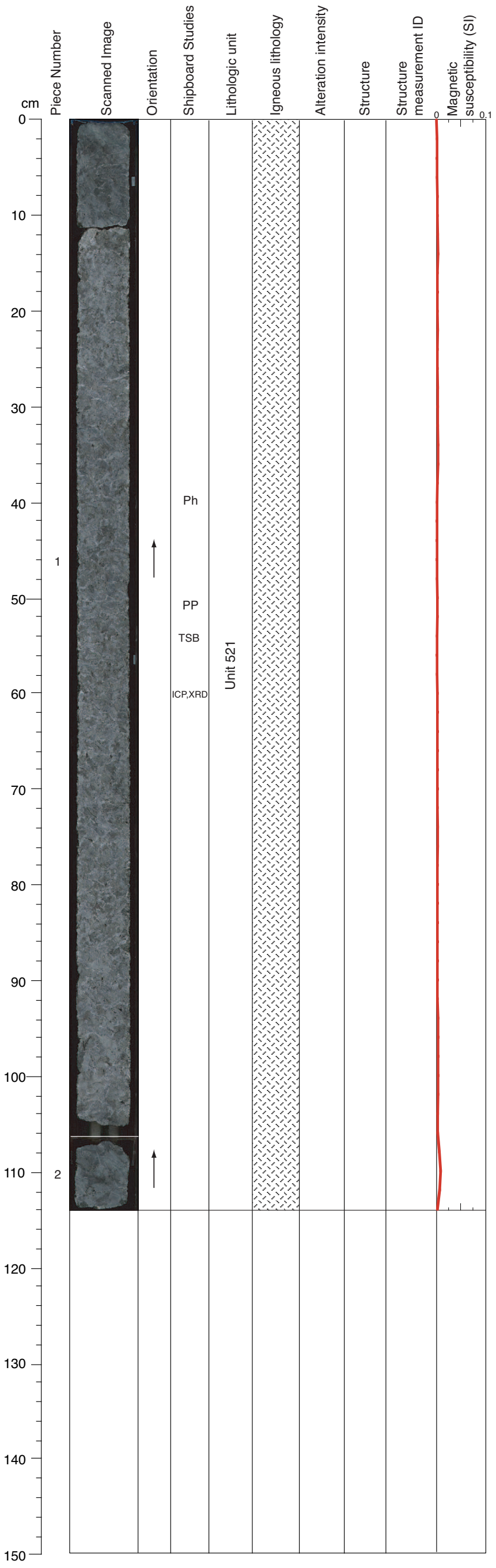
VEIN ALTERATION: Amphibole, carbonate.

THIN SECTIONS:
**305-U1309D-199R-2, 35-37 cm (#504)**

STRUCTURE: Medium-grained isotropic gabbro. Dark green veins and a fault zone (FZ).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-199R-2, 20-38 cm WET

## Core Photo




**305-U1309D-199R-3 (Section top: 964.30 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with very low alteration and replacement of the previous mineralogy by green amphibole related to several thin green amphibole veins. Significant amount of sulfides. Numerous white veins around the grains.

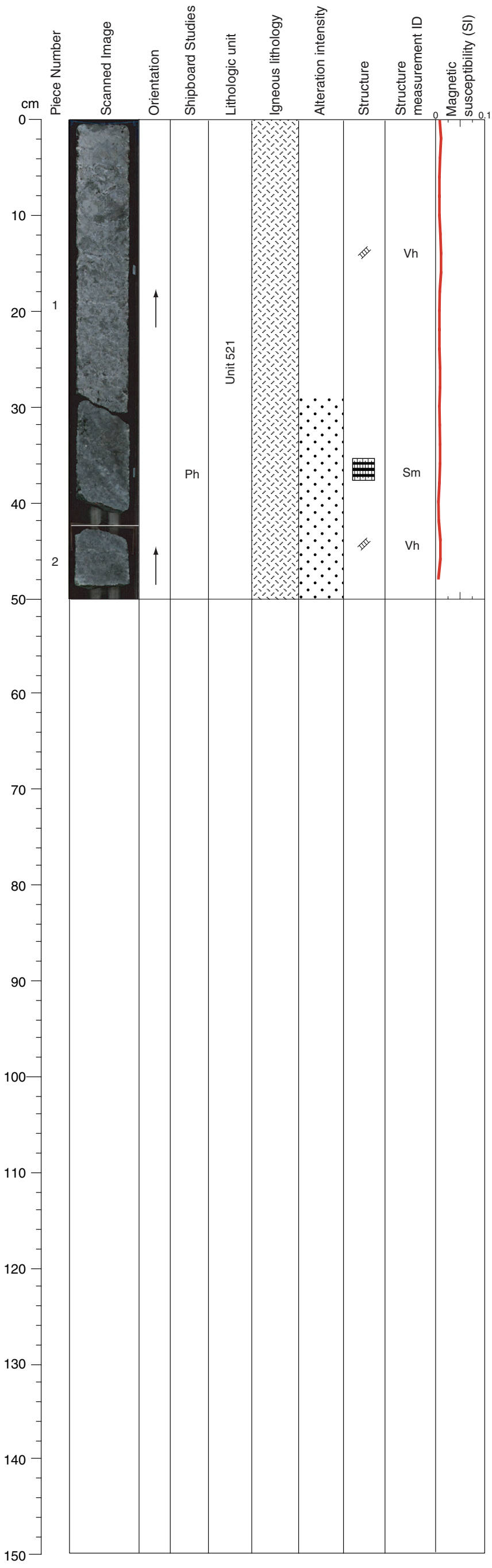
VEIN ALTERATION: n/a

THIN SECTIONS:
**305-U1309D-199R-3, 53-55 cm (#505)**

STRUCTURE: Medium to coarse grain size, at bottom of section nearly pegamatitic gabbro, all of which are isotropic. Minor cataclasis(?).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-199R-3, 30-50 cm WET
305-U1309D-199R-3, 50-70 cm WET

## Core Photo




**305-U1309D-199R-4 (Section top: 965.44 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

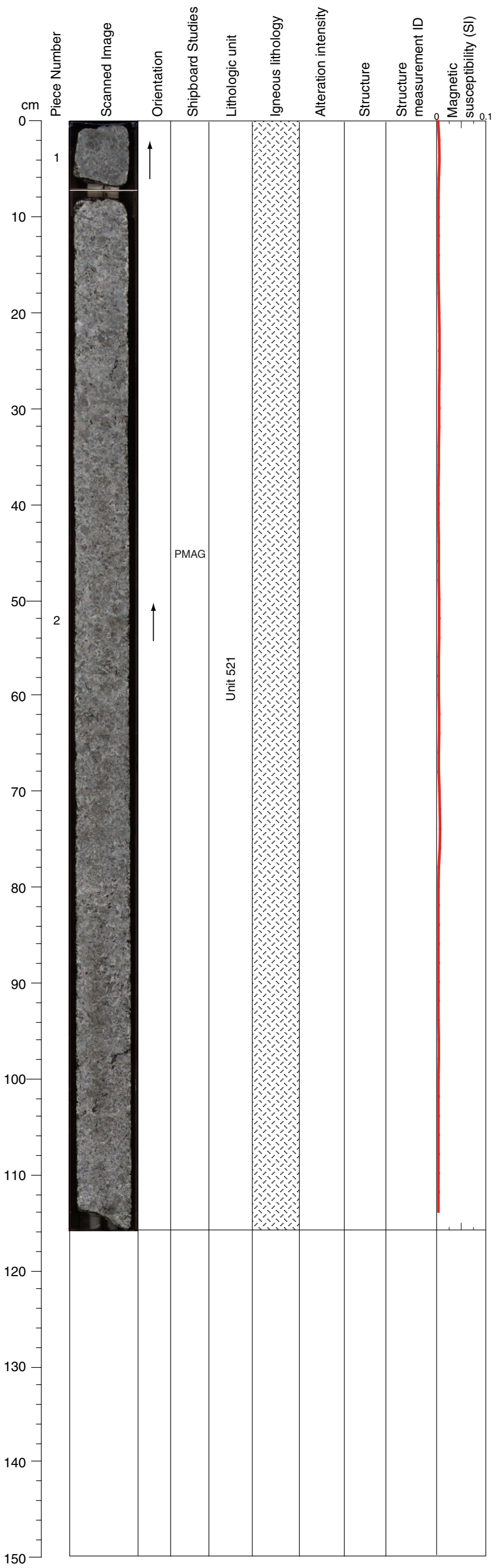
COMMENTS: Coarse-grained gabbro with very low to low alteration and replacement of the previous mineralogy by green amphibole related to several thin green amphibole veins. Significant amount of sulfides. Numerous white veins around the grains.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Coarse- to medium-grained gabbro with weak magmatic foliation in lower part of section. Slight veining.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-199R-4, 30-48 cm WET

## Core Photo




**305-U1309D-200R-1 (Section top: 965.20 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro.

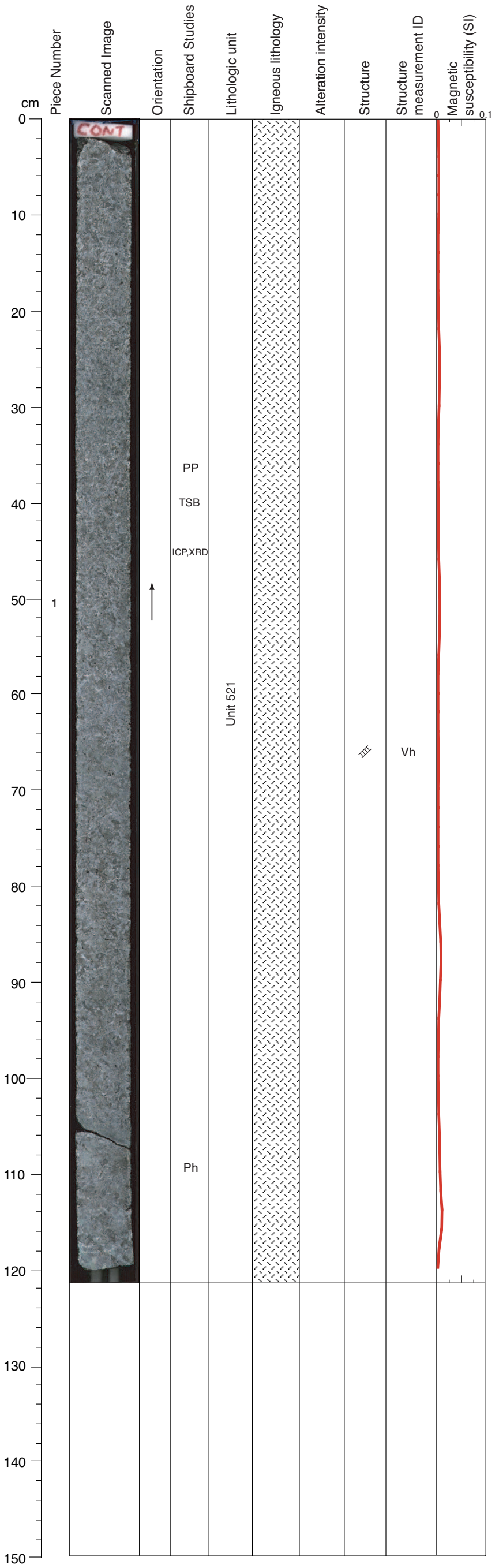
SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: Fine- to medium-grained gabbro with significant amount of sulfides. The previous mineralogy are slightly altered to green amphibole.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained isotropic gabbro with locally coarse clinopyroxene grains.

## Core Photo




**305-U1309D-200R-2 (Section top: 966.36 mbsf)**

UNIT-521: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro. Patchy distiribution of coarse grained-pegmatitic clinopyroxene oikocrysts.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Medium-grained gabbro cut by thin green veins (at 65 cm). The alteration of the pyroxenes to green amphibole increases toward the end of the section. Few sulfides.

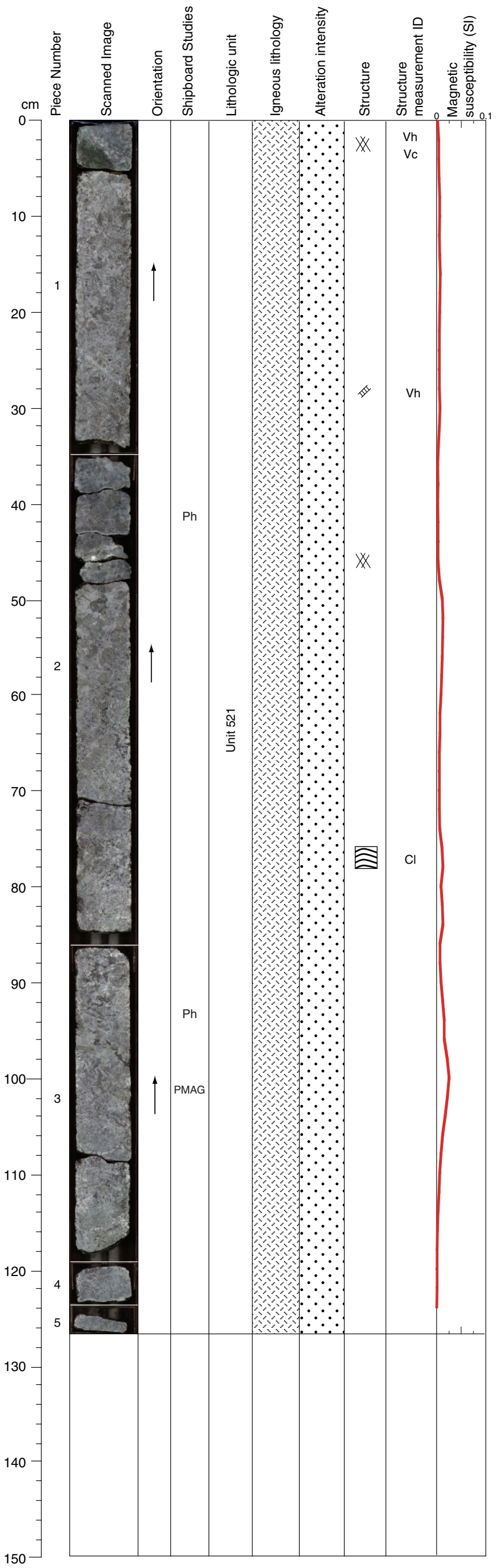
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-200R-2, 38-40 cm (#506)**

STRUCTURE: Medium-grained isotropic gabbro with locally coarse clinopyroxene grains. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-200R-2, 25-45 cm WET
305-U1309D-200R-2, 107-121 cm WET

## Core Photo




**305-U1309D-200R-3 (Section top: 967.58 mbsf)**

UNIT-521: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro. Oxide at 96-100 cm. Olivine present at 62-106 cm (1%).

SECONDARY MINERALOGY: Chlorite, pale amphibole

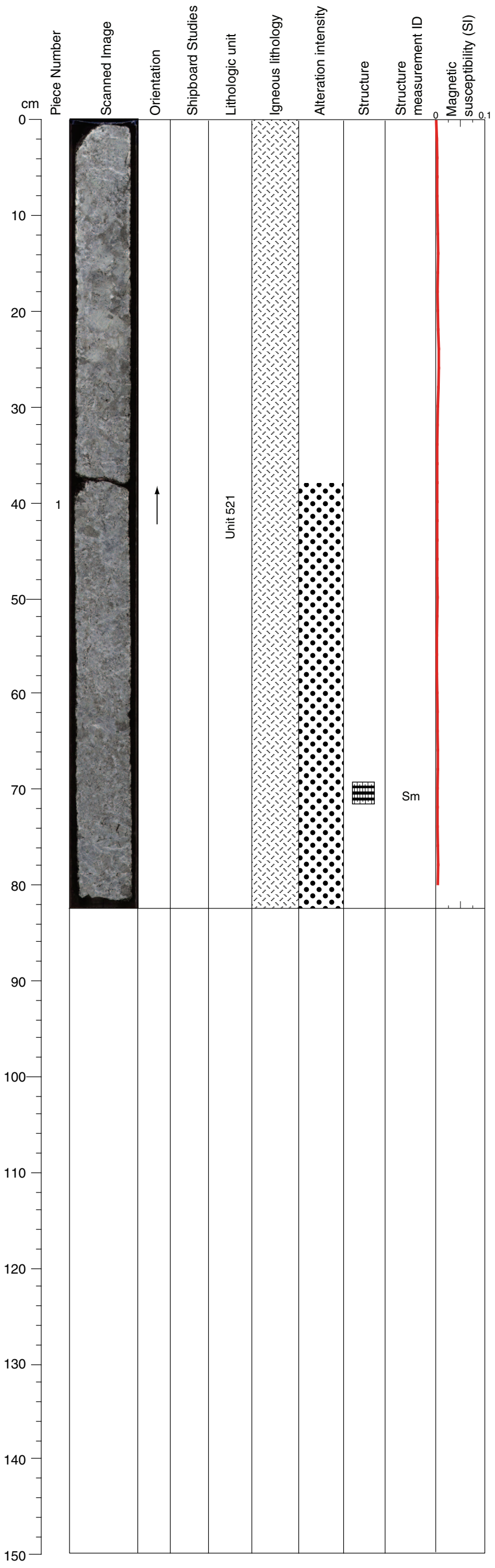
COMMENTS: Medium- to coarse-grained gabbro with alteration of the previous minerals to green amphibole (1-5 cm) related to green amphibole veins. At 45-46 cm, brecciated green amphibole and plagioclase zone. Several white veins are observed. Few coronas around olivine. Significant amount of sulfides.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium to coarse, locally pegmatitic gabbro with no magmatic or plastic strain but weak compositional layering locally. Minor fault zone poorly developed.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-200R-3, 35-48 cm WET
305-U1309D-200R-3, 87-108 cm WET

## Core Photo




**305-U1309D-200R-4 (Section top: 968.85 mbsf)**

UNIT-521: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 15 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 coarse-grained gabbro.

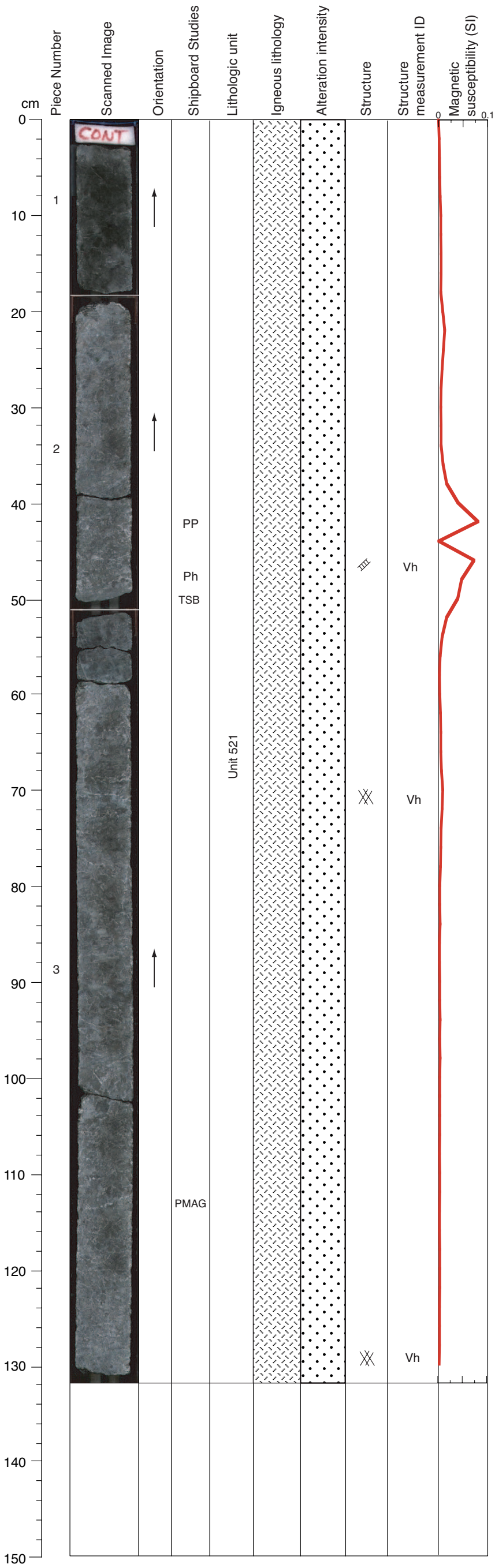
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with low alteration of the previous minerals to green amphibole. Some pyroxenes show rims of green amphibole. Several white veins are observed. Significant amount of sulfides.

VEIN ALTERATION: n/a

STRUCTURE: Medium to coarse, locally pegmatitic gabbro with mafic, discontinous zones. Magmatic foliation (Sm) visible in more felsic parts.

## Core Photo




**305-U1309D-201R-1 (Section top: 969.70 mbsf)**

UNIT-521: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 3c

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 15 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 coarse-grained gabbro. Oxides at 38-52 cm. AS much as 5% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Medium-grained gabbro cut by numerous white thin veinlets surrounding the veins and also several green amphibole veins, providing a general amphibole alteration (green background color). Signicant amount of sulfides.

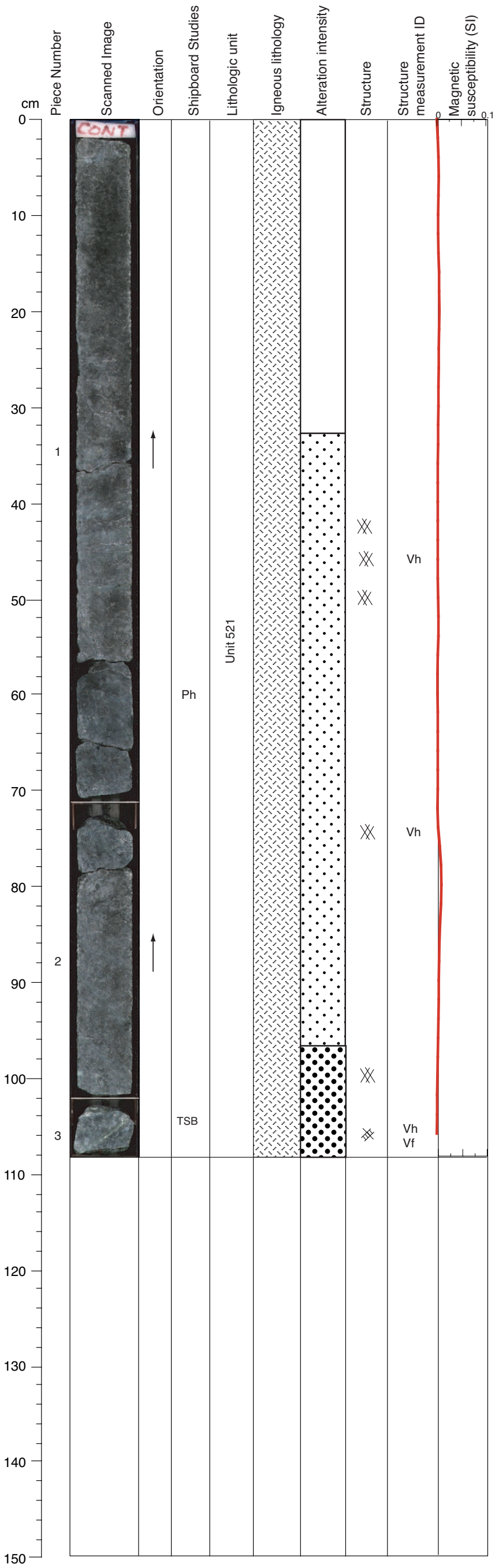
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-201R-1, 48-50 cm (#507)**

STRUCTURE: Medium to coarse grain size, isotropic gabbro. Set of dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-201R-1, 40-60 cm WET

## Core Photo




**305-U1309D-201R-2 (Section top: 971.02 mbsf)**

UNIT-521: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 15 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Coarse-grained gabbro cut by numerous green thin veinlets of amphibole, with amphibole alteration/replacement related to this vein (35-70 cm). At 101-107 cm (Piece 3), thick zone made of anastomosed pale-green veinlets.

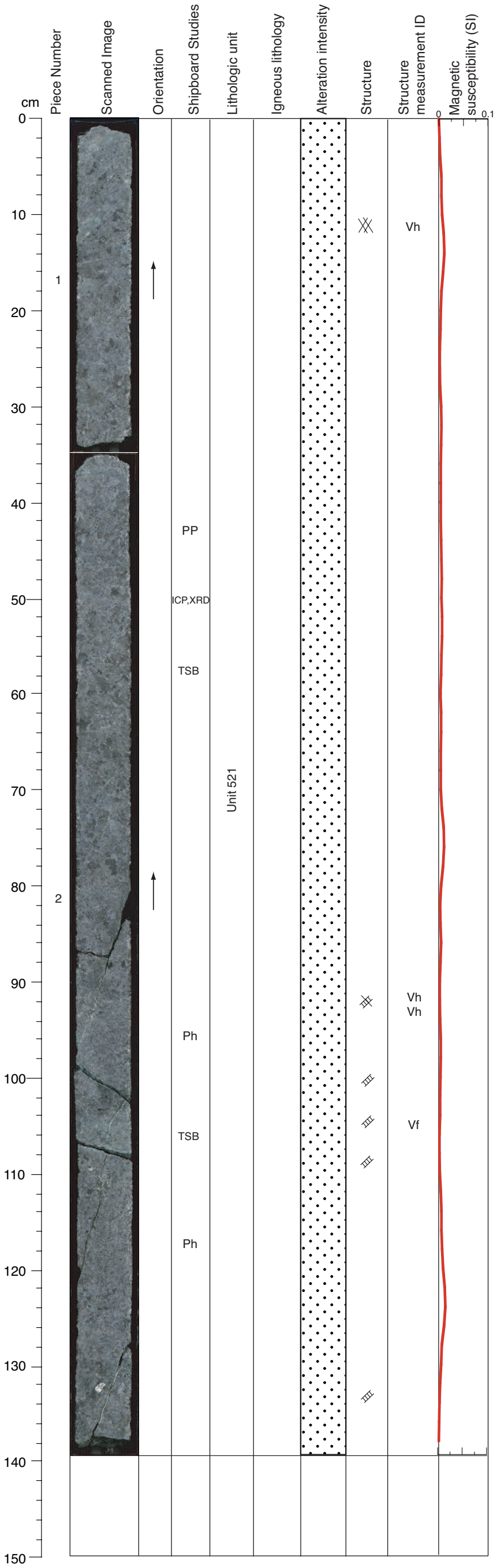
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-201R-2, 103-105 cm (#508)**

STRUCTURE: Medium to coarse grain size, isotropic gabbro. Set of subhorizontal dark green veins (V1) cut by pale green fault veins (V2). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-201R-2, 57-70 cm WET
305-U1309D-201R-2, 88-108 cm WET

## Core Photo




**305-U1309D-202R-1 (Section top: 972.00 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size to 15 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro. Grain size decreases down section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Coarse-grained gabbro moderately altered and cut by several green amphibole veins forming narrow alteration halos around them where the minerals are replaced to green amphibole. The section is intensively veined. At 87-100 cm, pale green and white vein (?) with alteration affecting the surrounding minerals. At 100 cm, fracture and the two edges of the gabbro show blue mineral (chlorite?). At 100-121 cm, fractures filled by thin white veins and with alteration zone between 100 and 107 cm (pale green and dark green amphiboles).

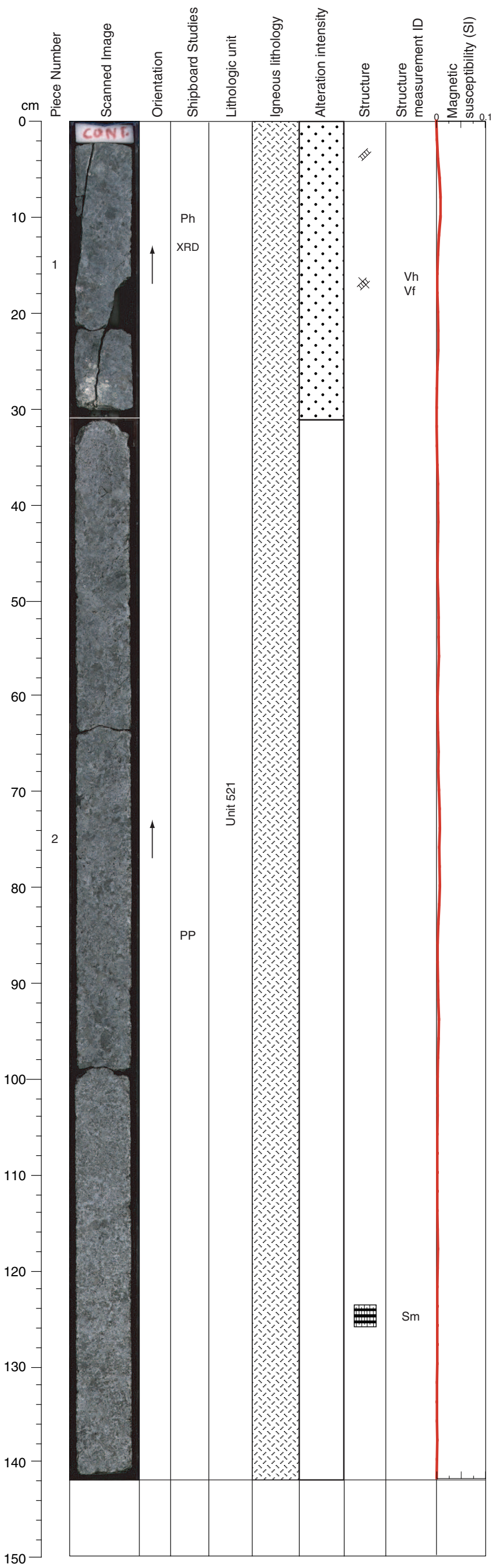
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-202R-1, 56-58 cm (#509)**
**305-U1309D-202R-1, 105-107 cm (#510)**

STRUCTURE: Medium- to coarse-, rarely fine-grained isotropic gabbro. Early dark green veins shallowly dipping (V1). Steeper light green veins (V2) crosscut by carbonate veins steeply dipping and opened (V3). V1>V2>V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-202R-1, 48-68 cm WET
305-U1309D-202R-1, 88-107 cm WET
305-U1309D-202R-1, 109-139 cm WET

## Core Photo




**305-U1309D-202R-2 (Section top: 973.39 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2c

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 7 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro. Coarse-grained clinopyroxene patches within medium-grained interval, 60-100 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

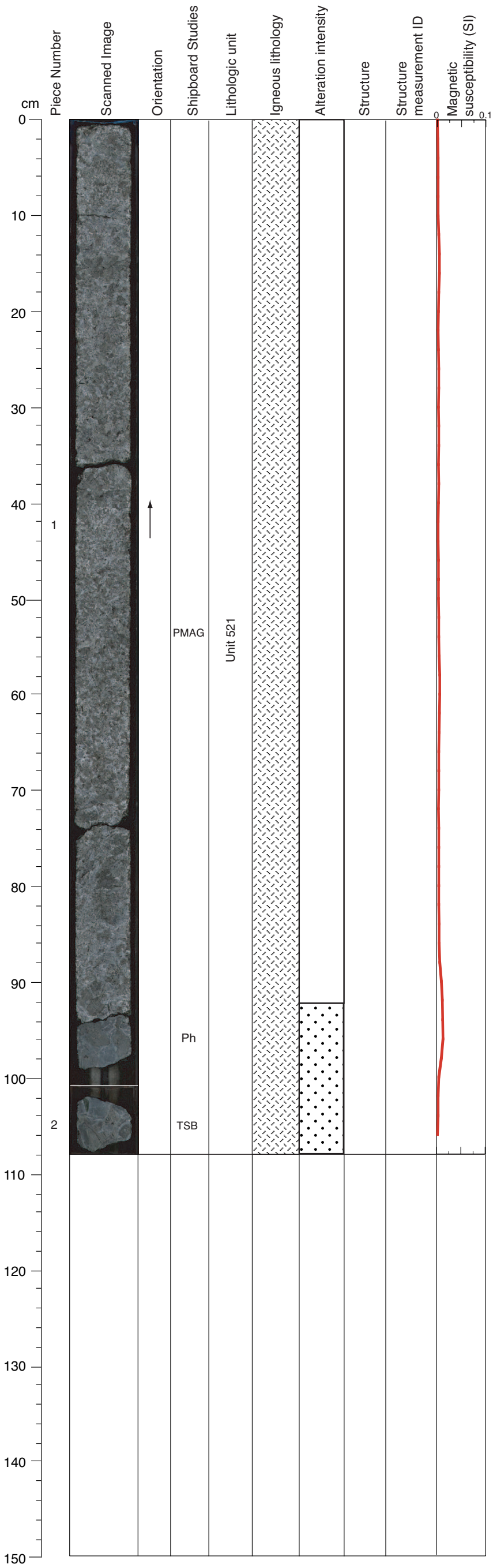
COMMENTS: Continuation of the previous section. Piece 1 is fractured and fractures are filled by veins. At 1-10 cm and 23-31 cm, white veins with alteration of the surrounding crystals to green amphibole. At 15 cm, dark green vein is crosscut by late thin veins (carbonate?). Piece 2 is a coarse-grained gabbro with decreasing grain size toward the end of the section.

VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

STRUCTURE: Medium- to coarse-grained gabbro, faint magmatic foliation (Sm) in lowest part of section. Early dark green veins shallowly dipping (V1). Steeper light green veins (V2) crosscut by carbonate veins steeply dipping and opened (V3). V1>V2>V3.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-202R-2, 0-28 cm WET

## Core Photo




**305-U1309D-202R-3 (Section top: 974.81 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size to 25 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro. Pegmatitic clinopyroxene in lower section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with white veins around the grains and late white veins filling the cracks. Low alteration. At 95 cm, pegmatitic gabbro with almost complete alteration of the pyroxenes to green amphibole.

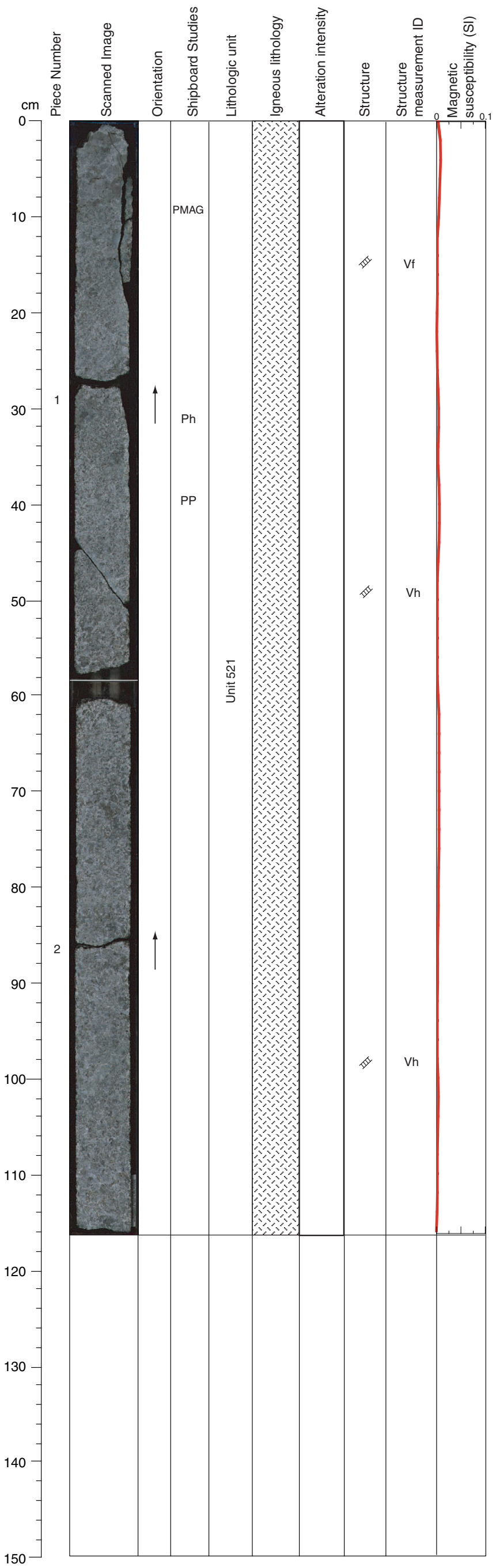
VEIN ALTERATION: n/a

THIN SECTIONS:
**305-U1309D-202R-3, 102-106 cm (#511)**

STRUCTURE: Medium to coarse, locally pegmatitic, isotropic gabbro.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-202R-3, 94-107 cm DRY

## Core Photo




**305-U1309D-202R-4 (Section top: 975.89 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro. Slightly increasing in grain size to bottom, Coarse clinopyroxene patch at 30 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

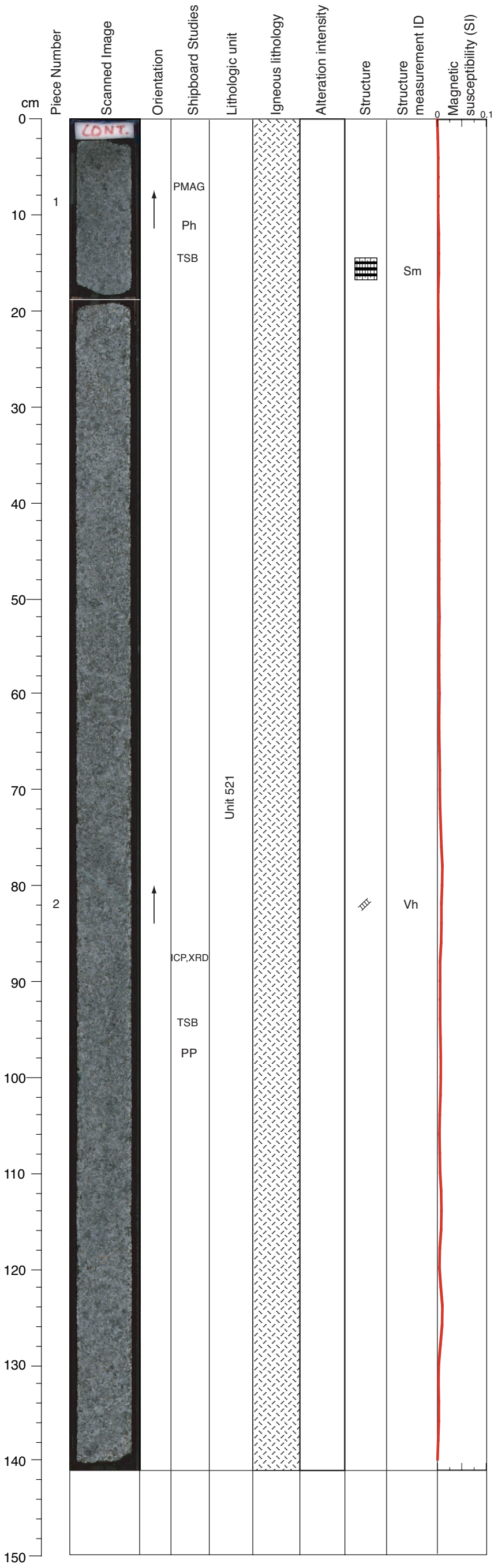
COMMENTS: Pegmatitic gabbro in contact with fine-grained gabbro at 10 cm. The fine-grained gabbro has low alteration and is cut by several green veins at 96-102 cm without formation of alteration zone.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium to coarse, locally pegmatitic, isotropic gabbro. Talc-bearing dark green fault veins (very irregular), and a few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-202R-4, 27-56 cm WET

## Core Photo




**305-U1309D-203R-1 (Section top: 976.80 mbsf)**

UNIT-521: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro. As much as 9% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: Continuation of the previous section. Fine-grained gabbro cut by green amphibole veins at 78-82 cm with alteration to amphibole of the surrounding crystals.

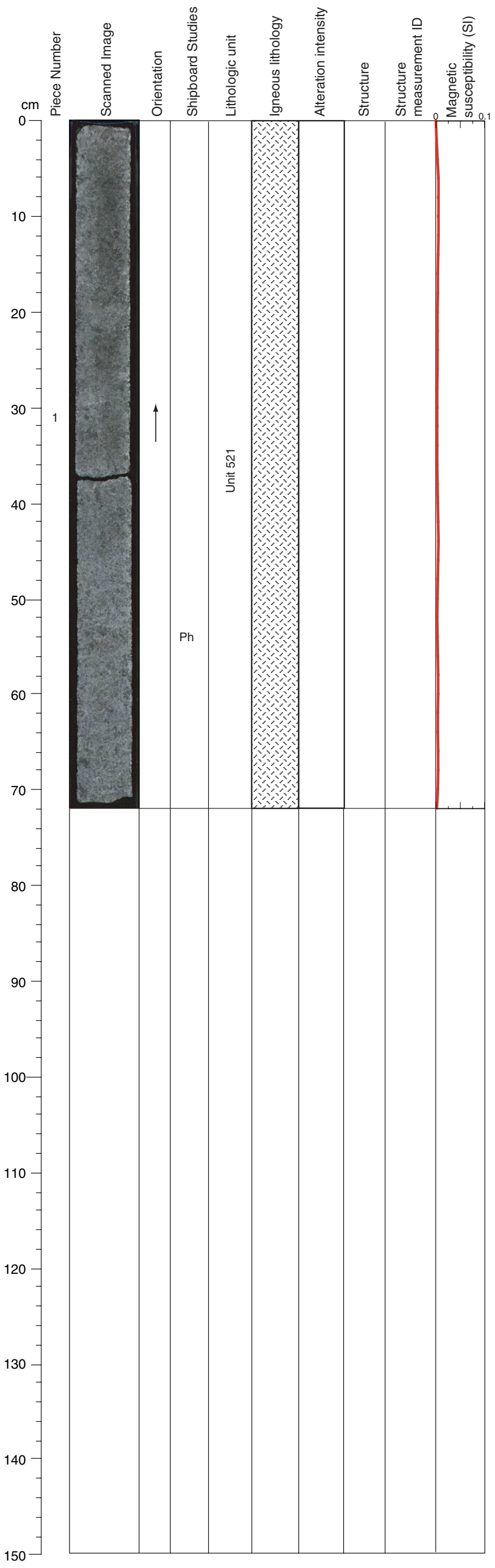
VEIN ALTERATION: n/a

THIN SECTIONS:
**305-U1309D-203R-1, 12-15 cm (#512)**
**305-U1309D-203R-1, 93-95 cm (#513)**

STRUCTURE: Medium-grained gabbro with weak magmatic foliation (Sm) in upper part. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-203R-1, 0-18 cm WET
305-U1309D-203R-1, 83-103 cm WET

## Core Photo




**305-U1309D-203R-2 (Section top: 978.22 mbsf)**

UNIT-521: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: No visible secondary minerals.

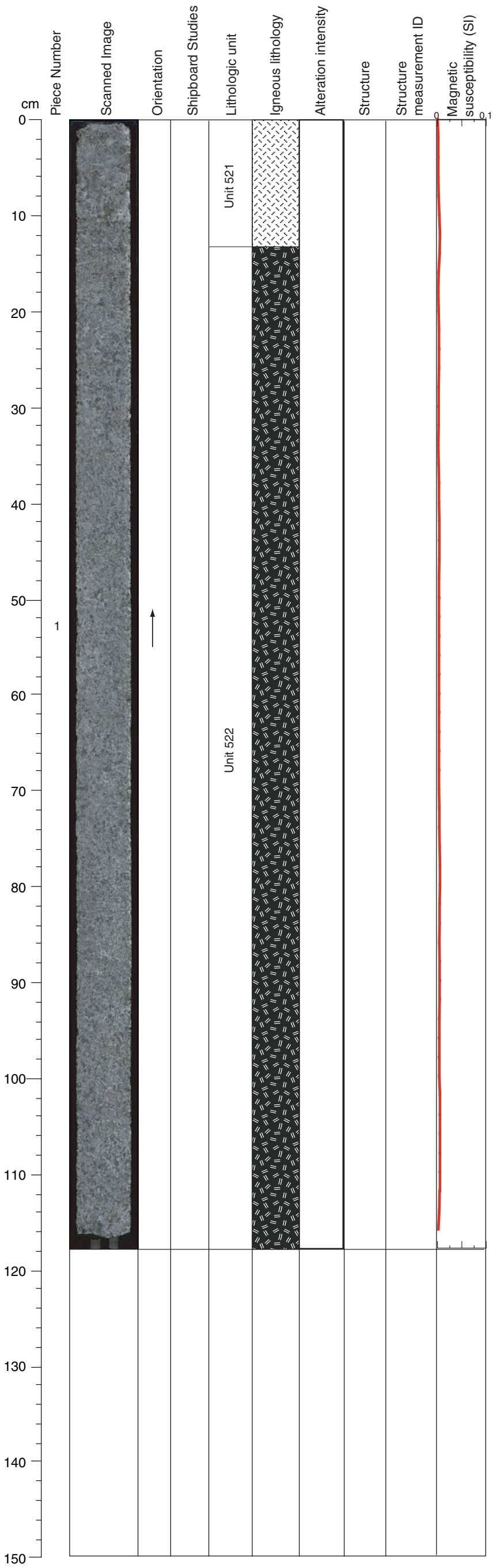
COMMENTS: Fine-grained gabbro without veins and with a low alteration.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium-grained, isotropic gabbro.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-203R-2, 49-69 cm WET

## Core Photo




**305-U1309D-204R-1 (Section top: 981.60 mbsf)**

UNIT-521: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 10 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 521 coarse-grained gabbro.

UNIT-522: Olivine-bearing Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Olivine | Modal 3%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 42%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 522 is medium-grained olivine-bearing gabbro.

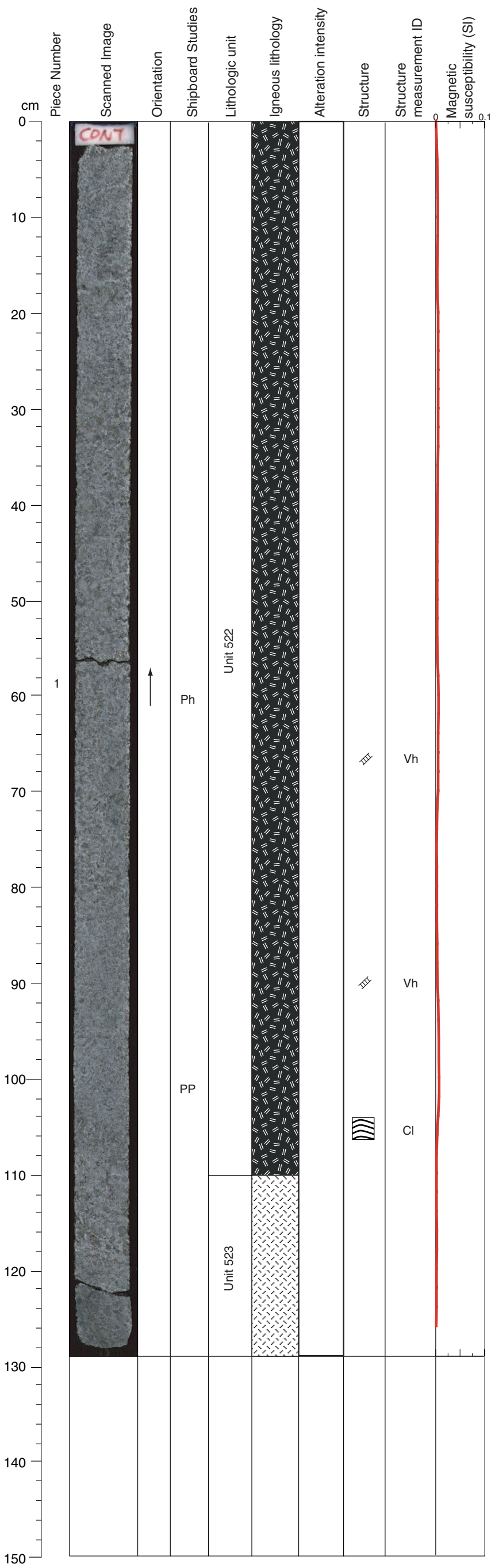
SECONDARY MINERALOGY: No visible secondary minerals.

COMMENTS: Fine-grained gabbro looking homogeneous, with a significant amount of sulfides, the pyroxenes exhibit thin rims of green amphibole.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained, isotropic gabbro.

## Core Photo




**305-U1309D-204R-2 (Section top: 982.78 mbsf)**

UNIT-522: Olivine-bearing Gabbro
Pieces: 1a-1b

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 1%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 59%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 522 medium-grained olivine-bearing gabbro.

UNIT-523: Gabbro
Pieces: 1b-1c

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 8 mm average<br>Shape anhedral |

COMMENTS: Unit 523 is coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

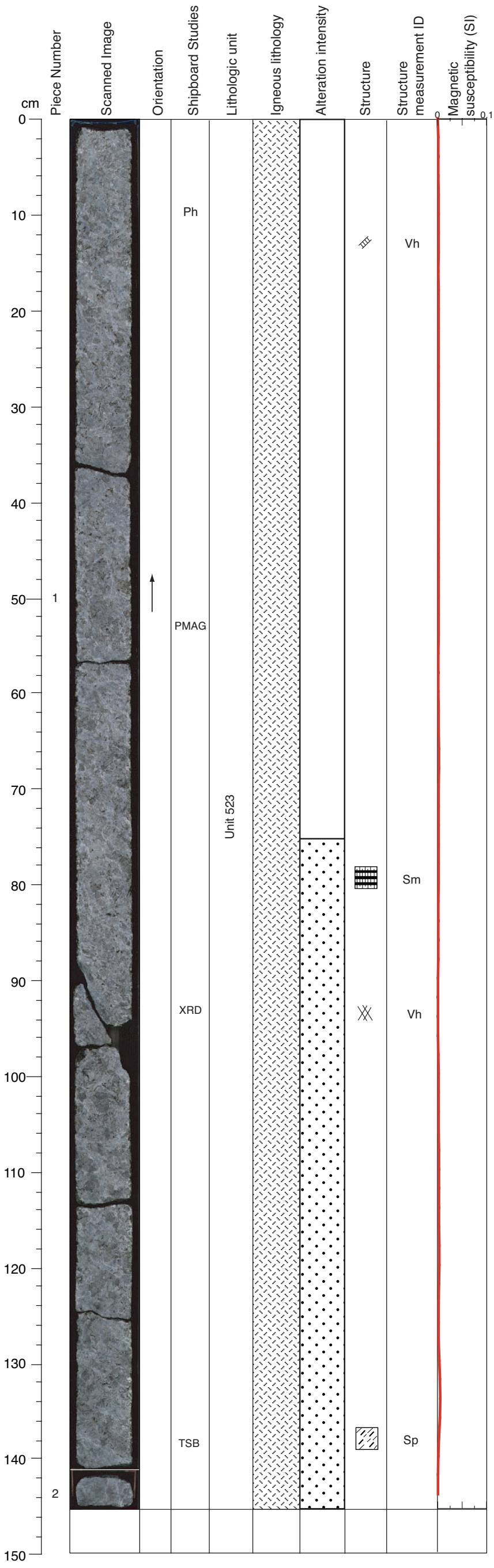
COMMENTS: Continuation of the previous section, medium-grained gabbro. From 40 to 79 cm and from 83 to 94 cm, dark green veins of amphibole, without formation of alteration zone. At the end of the section, thin white veinlets around the grains are observed.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Medium- to fine-grained gabbro with subtle indication of grain size layering but no clear magmatic or plastic mineral foliation. A few dark green veins with some branching.

CLOSE-UP PHOTPGRAPHS:
305-U1309D-204R-2, 57-77 cm WET

## Core Photo




**305-U1309D-204R-3 (Section top: 984.08 mbsf)**

UNIT-523: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 8 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 523 coarse-grained gabbro. As much as 7% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Medium-grained gabbro showing several dark green amphibole veins from 1 to 23 cm and big grain of amphibole are observed close to that vein. Significant amount of sulfides. The pyroxene are altered to green amphibole. From 110 cm to the end of the section, the background displays a greenish color.

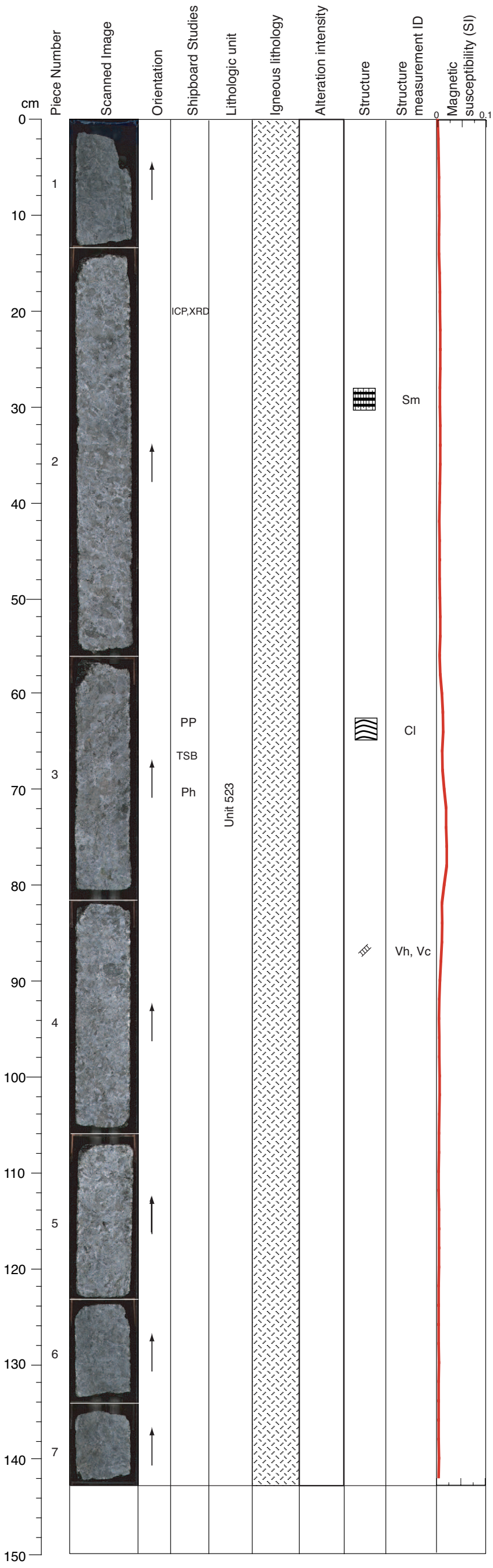
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-204R-3, 136-139 cm (#514)**

STRUCTURE: Medium-grained gabbro with moderate plastic strain (confirmed by thin section observation). A few steeply dipping dark green veins and minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-204R-3, 0-20 cm WET
305-U1309D-204R-3, 124-144 cm WET
305-U1309D-204R-3, 124-144 cm DRY (back)

## Core Photo




**305-U1309D-204R-4 (Section top: 985.53 mbsf)**

UNIT-523: Gabbro
Pieces: 1-7

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 8 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 8 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 523 coarse-grained gabbro. As much as 4% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Medium- to coarse-grained gabbro. Piece 1 is cut by several thin white veinlets around the grains. The pyroxenes are altered to green amphibole and significant amount of sulfides.

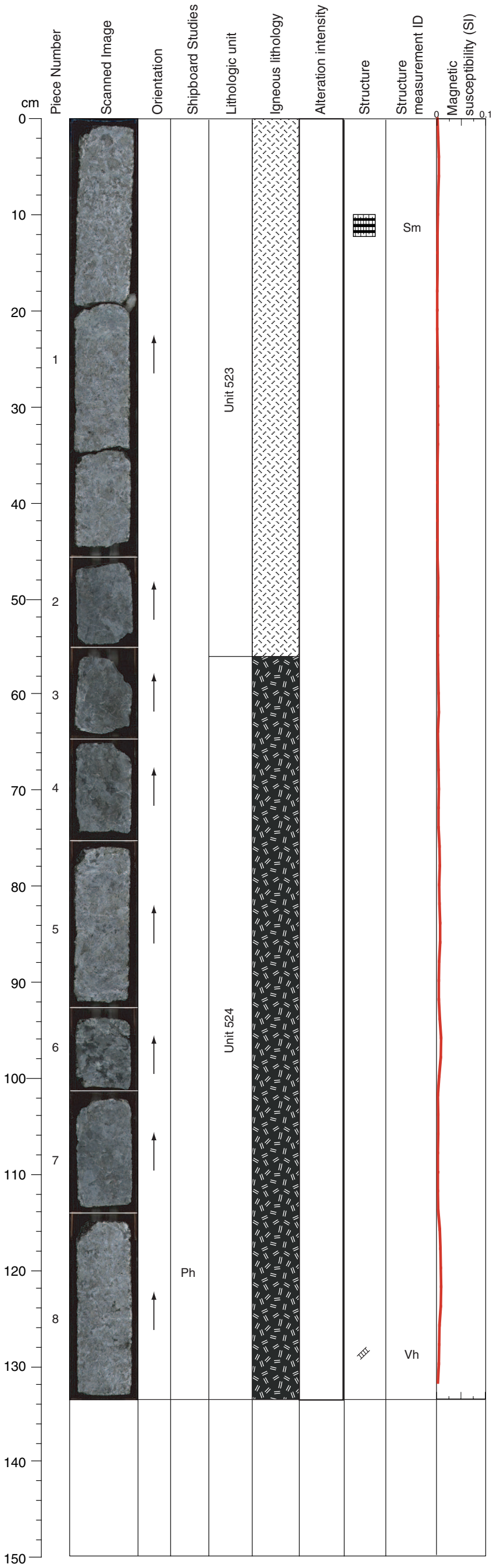
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-204R-4, 64-67 cm (#515)**

STRUCTURE: Medium-grained gabbro magmatic foliation locally developed, at high angle to pronounced mafic bands. A few steeply dipping dark green veins and minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-204R-4, 56-81 cm WET
305-U1309D-204R-4, 57-81 cm DRY

## Core Photo




**305-U1309D-204R-5 (Section top: 986.96 mbsf)**

UNIT-523: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 523 coarse-grained gabbro.

UNIT-524: Olivine-bearing Gabbro
Pieces: 3-8

PRIMARY MINERALOGY: Modal data from Piece 8

| | |
|---|---|
| Olivine | Modal 2%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 58%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 524 is medium-grained olivine-bearing gabbro. Olivine-rich in Pieces 3 and 6 (as much as 15%).

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

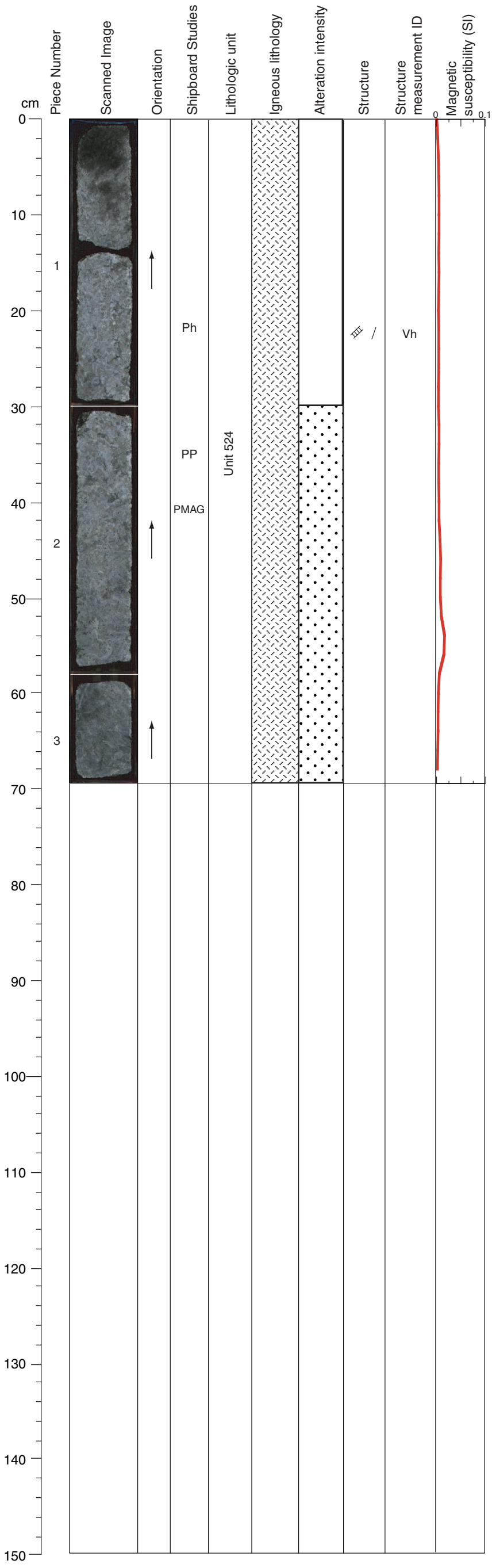
COMMENTS: Medium- to coarse-grained gabbro cut by green amphibole vein (at 6 cm). At 21 cm, green amphibole veins associated with alteration zone (3 cm thick) with replacement of the pyroxenes to green amphibole. Pieces 2 to 7 are cut by a lot of thin white veinlets around and cutting the crystals. These pieces display serpentinized olivine without corona texture when in contact with plagioclase. Piece 8 is cut from 115 to 130 cm by a white vein (?) with amphibole alteration close to it.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium- to coarse-grained gabbro with weak magmatic foliation in upper part of section. A steeply dipping white vein and minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-204R-5, 114-132 cm WET

## Core Photo




**305-U1309D-204R-6 (Section top: 988.30 mbsf)**

UNIT-524: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 524 is coarse-grained gabbro, possibly oxide-bearing in Piece 2.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

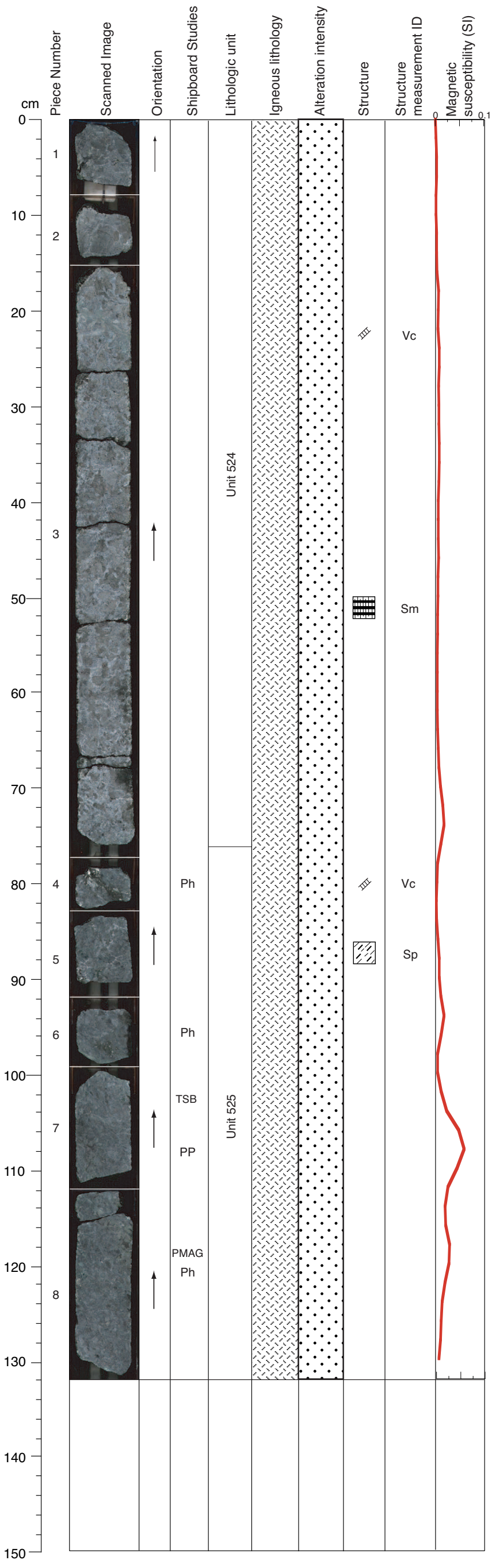
COMMENTS: Coarse-grained gabbro cut by white vein from 10 to 26 cm, and associated with amphibole grains close to it. Some part of this vein is amphibole rich. In Piece 2, greenish background around 55 cm, complete replacement of the previous mineralogy to green amphibole.

VEIN ALTERATION: Amphibole, carbonate.

STRUCTURE: Medium-grained isotropic gabbro with local oxide occurrence. A steeply dipping white vein and minor cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-204R-6, 14-30 cm WET

## Core Photo




**305-U1309D-205R-1 (Section top: 986.40 mbsf)**

UNIT-524: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 3e

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 10 mm average<br>Shape anhedral |

COMMENTS: Unit 524 is coarse-grained gabbro.

UNIT-525: Gabbro
Pieces: 4-8

PRIMARY MINERALOGY: Modal data from Piece 7

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 525 is medium-grained gabbro. Disseminated oxide at 104-120 cm and a long alteration vein (in Piece 4).

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Coarse-grained gabbro with white veins and olivine are altered to serpentine/tremolite with chlorite rim in contact with plagioclase. At 22 cm, dark green amphibole veins with alteration halo and development of pale green tremolite-talc-chlorite coronas. At 78-82 cm (Piece 4), leucocratic alteration/intrusion with thin dark green vein in the middle. Pieces 5 and 6 show patches of leucocratic alteration (plagioclase-amphibole). At 1112-117 cm, green-white vein with 1 cm thick alteration zone around with crystals of green amphibole.

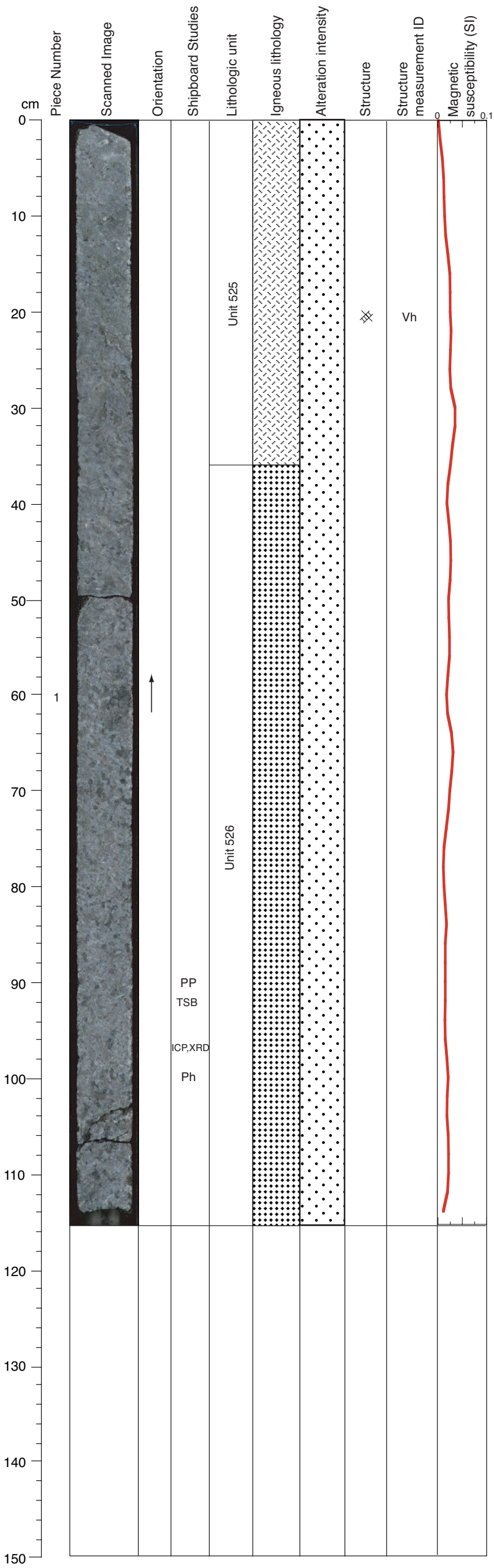
VEIN ALTERATION: Amphibole, plagioclase, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-205R-1, 100-103 cm (#516)**

STRUCTURE: Medium- to coarse-grained gabbro, locally with subtle magmatic foliation (Sm), near base of section with a moderately dipping plastic strain shear zone (Sp). A few dark green veins, one of which crosscut a magmatic vein.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-205R-1, 77-97 cm WET
305-U1309D-205R-1, 83-110 cm DRY
305-U1309D-205R-1, 83-110 cm WET
305-U1309D-205R-1, 112-131 cm WET

## Core Photo




**305-U1309D-205R-2 (Section top: 987.72 mbsf)**

UNIT-525: Gabbro
Pieces: 1a

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 525 medium-grained gabbro. Disseminated oxide to 36 cm.

UNIT-526: Olivine Gabbro
Pieces: 1a-1d

PRIMARY MINERALOGY: Modal data from Piece 1d

| | |
|---|---|
| Olivine | Modal 15%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 526 is medium-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Coarse-grained gabbro with dark green amphibole veins at 12 and 17 cm. The pyroxenes are altered to green amphibole, and the olivines are altered to pink coronas.

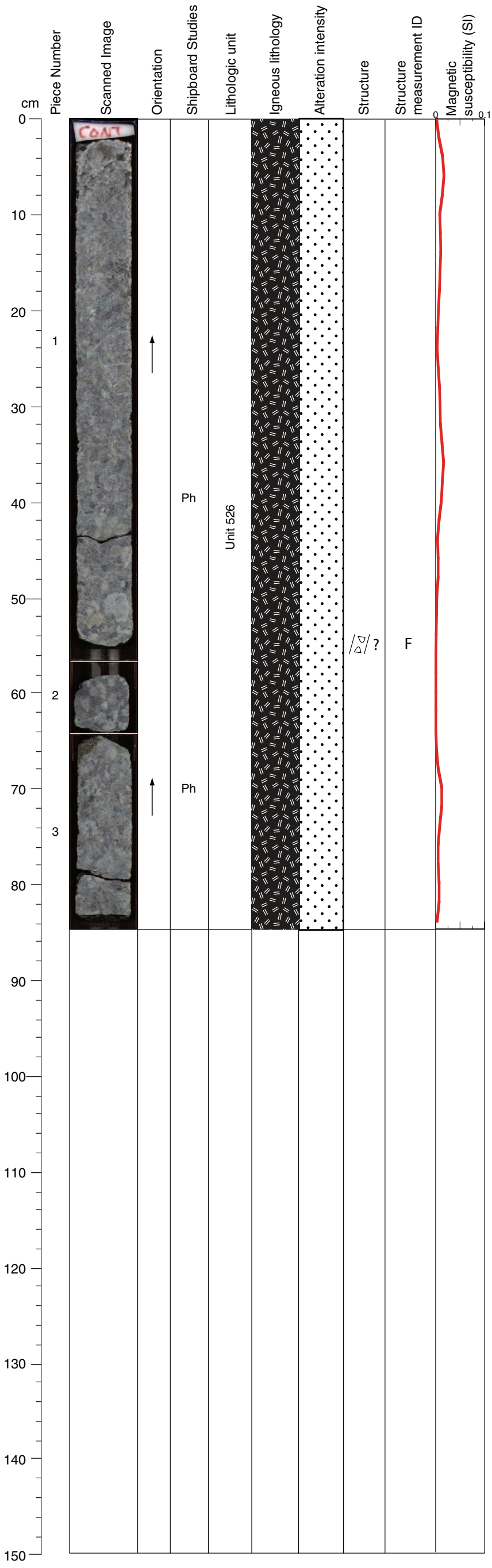
VEIN ALTERATION: Amphibole, chlorite.

THIN SECTIONS:
**305-U1309D-205R-2, 91-93 cm (#517)**

STRUCTURE: Medium- to coarse-grained, isotropic gabbro. A few dark green veins, one of which is crosscut by open crack with white infill at 20 cm.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-205R-2, 75-95 cm WET
305-U1309D-205R-2, 95-115 cm WET

## Core Photo




**305-U1309D-205R-3 (Section top: 988.88 mbsf)**

UNIT-526: Olivine-bearing Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 3a

| | |
|---|---|
| Olivine | Modal 5%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 526 is medium- to coarse-grained olivine-bearing gabbro. Coarse pegmatitic clinopyroxene oikocryst at 40-83 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

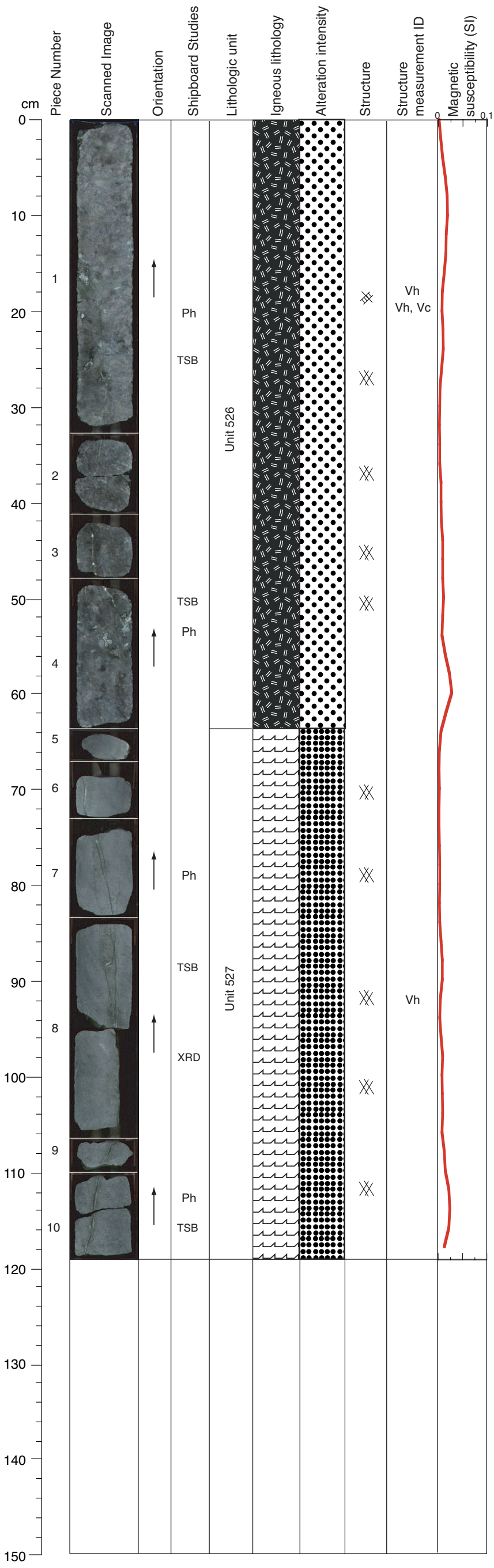
COMMENTS: Coarse-grained gabbro with pale green coronas. At 20-34 cm, numerous thin veins of green amphibole. From 50 to 56 cm, big crystals of pyroxene that are altered and cut by amphibole veins. Occurence of both pale green and pink coronas after olivine.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Medium- to coarse-grained, isotropic gabbro. Steep dark green veins (V1), and a possible small fault gouge (F). Minor irregular subvertical veins (V2). V1>F>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-205R-3, 37-57 cm WET
305-U1309D-205R-3, 57-84 cm WET

## Core Photo




**305-U1309D-205R-4 (Section top: 989.73 mbsf)**

UNIT-526: Olivine-bearing Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Olivine | Modal 5%<br>Size to 10 mm<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size to 30 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 526 coarse-grained olivine-bearing gabbro.

UNIT-527: Diabase
Pieces: 5-10

COMMENTS: Unit 527 is diabase with ophitic texture.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Coarse-grained gabbro with highly altered pale-green coronas and pink coronas after olivine related to pale green amphibole veins at 16-63 cm. At 31 cm, this pale green vein is crosscut by another green amphibole vein. From 33 to 40 cm, a brecciated gabbroic interval occurs. In Piece 4, two types of corona are seen: pale-green completely altered and with thick chlorite rims, and pink with a signicant amount of sulfides inside. From 64 cm to the end, green diabase cut by green and white veins. “Pull-apart” zones are observed at 76 and 89 cm, and the alteration halo related to these veins is about 4 cm thick. The white and green veins merge at the end of the section.

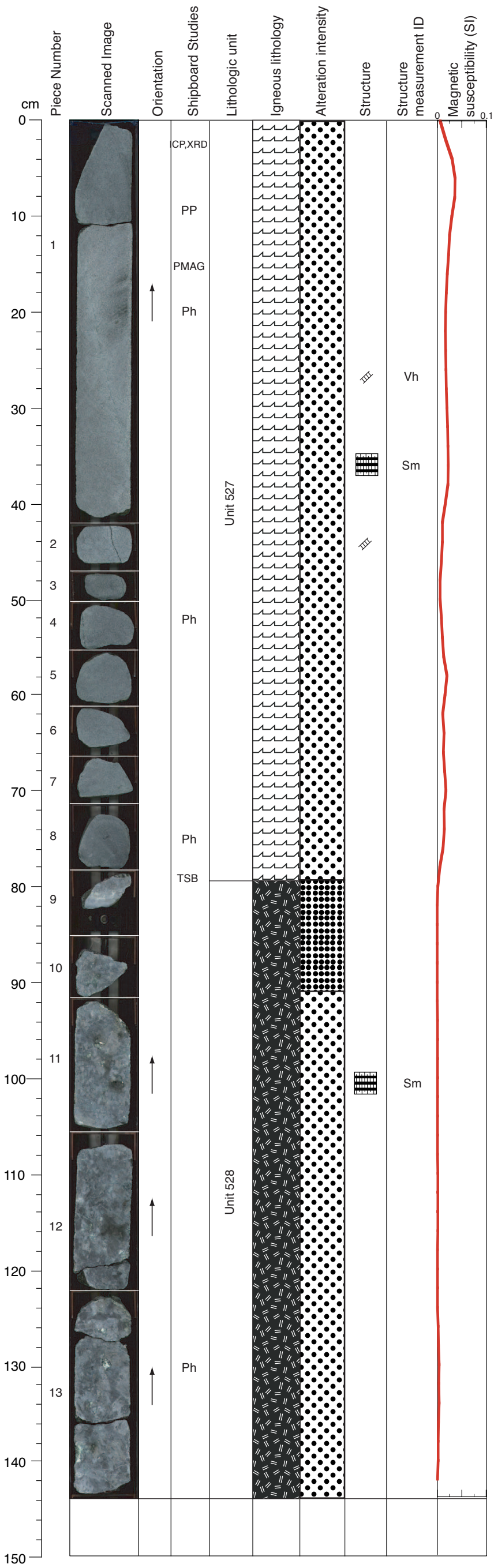
VEIN ALTERATION: Amphibole, chlorite, carbonate

THIN SECTIONS:
**305-U1309D-205R-4, 24-26 cm (#518)**
**305-U1309D-205R-4, 49-52 cm (#519)**
**305-U1309D-205R-4, 87-89 cm (#520)**
**305-U1309D-205R-4, 114-117 cm (#521)**

STRUCTURE: Medium-grained gabbro with no magmatic or plastic strain. Contact to diabase was not recovered. Diabase has clear magmatic foliation (Sm). A higher degree of cataclasis (no strain) and veining than the previous section. Subvertical, irregular dark green veins, opening direction subvertical (V1), which are locally crosscut by subhorizontal white veins (V2). Diabase is crosscut by a branching subvertical complex vein (V1) with green (talc?) and white material (carbonate?). V1>V2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-205R-4, 12-32 cm WET
305-U1309D-205R-4, 42-63 cm WET
305-U1309D-205R-4, 68-95 cm WET
305-U1309D-205R-4, 107-119 cm WET

## Core Photo




**305-U1309D-206R-1 (Section top: 991.20 mbsf)**

UNIT-527: Diabase
Pieces: 1-9

COMMENTS: Unit 527 is diabase. Lower contact in Piece 9. Microgabbro texture in Piece 1-8.

UNIT-528: Olivine-bearing Gabbro
Pieces: 9-13

PRIMARY MINERALOGY: Modal data from Piece 11

| | |
|---|---|
| Olivine | Modal 5%<br>Size to 10 mm<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 528 is coarse-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Pieces 1 to 8: diabase cut by pale green veins with alteration halo (14-35 cm). Pieces 2 to 4 are also cut by the same type of vein without alteration halo. Piece 9 shows the contact between the diabase and the coarse-grained gabbro. At the contact, 1 cm thick brecciated zone mixed with thin green veinlets. From Pieces 9 to 13, coarse-grained gabbro with both pale-green coronas and pinkish coronas after olivine with a significant amount of sulfides inside.

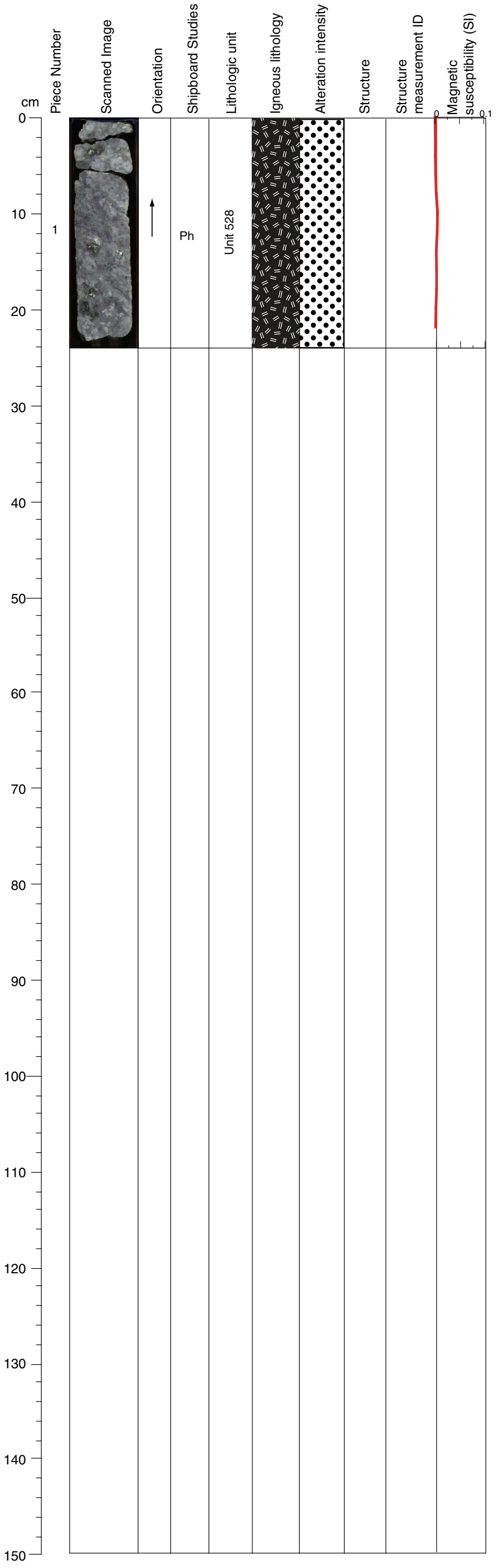
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-206R-1, 78-80 cm (#522)**

STRUCTURE: Diabase with magmatic foliation in slightly sheared contact (piece not oriented) to medium and coarse grained gabbro. Gabbro shows deformation for ~15 cm below contact to diabase in Piece 9. Diabase crosscut by a branching subvertical complex vein with green (talc?) and white material (carbonate?) - continuation of the previous section.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-206R-1, 15-35 cm WET
305-U1309D-206R-1, 43-61 cm WET
305-U1309D-206R-1, 72-91 cm WET
305-U1309D-206R-1, 123-143 cm WET

## Core Photo




**305-U1309D-206R-2 (Section top: 992.63 mbsf)**

UNIT-528: Olivine-bearing Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Olivine | Modal 5%<br>Size to 10 mm<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size to 10 mm<br>Shape anhedral |

COMMENTS: Unit 528 is coarse-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

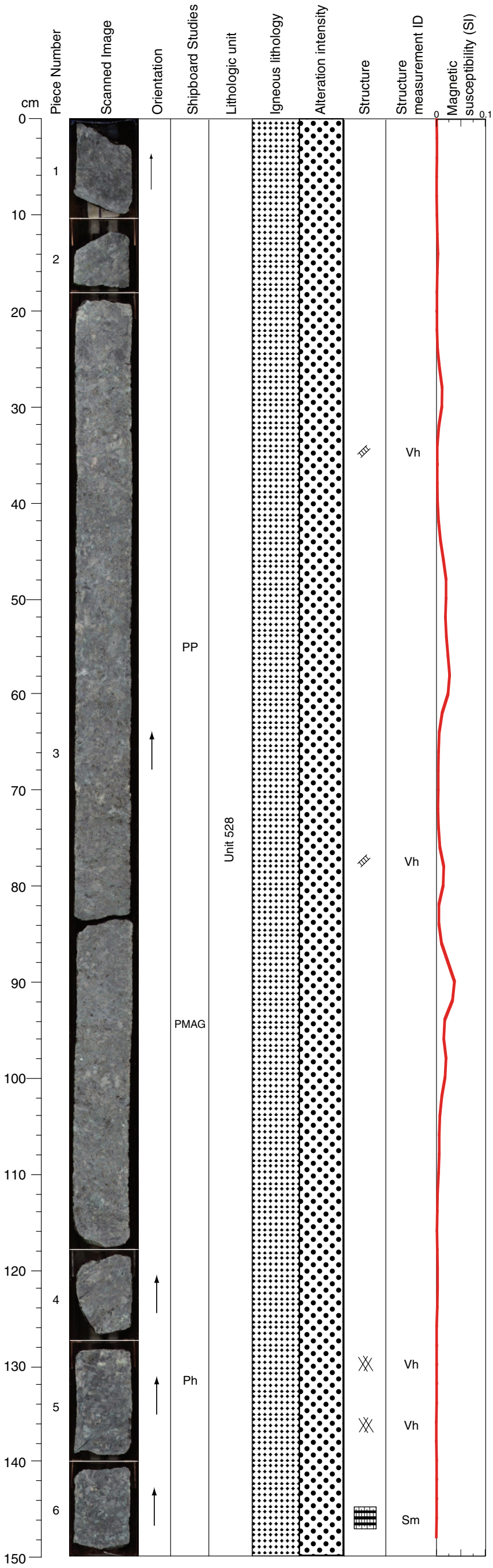
COMMENTS: Coarse-grained gabbro with pale green coronas with thick rims.

VEIN ALTERATION: Amphibole, chlorite.

STRUCTURE: Coarse-grained isotropic gabbro with slight cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-206R-2, 7-24 cm WET

## Core Photo




**305-U1309D-207R-1 (Section top: 994.20 mbsf)**

UNIT-528: Olivine Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 3a

| | |
|---|---|
| Olivine | Modal 15%<br>Size to 10 mm<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 25%<br>Size to 20 mm<br>Shape anhedral |

COMMENTS: Unit 528 is medium-grained olivine gabbro. Oxide at 124 cm. Olivine rich (20%) in Piece 6.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

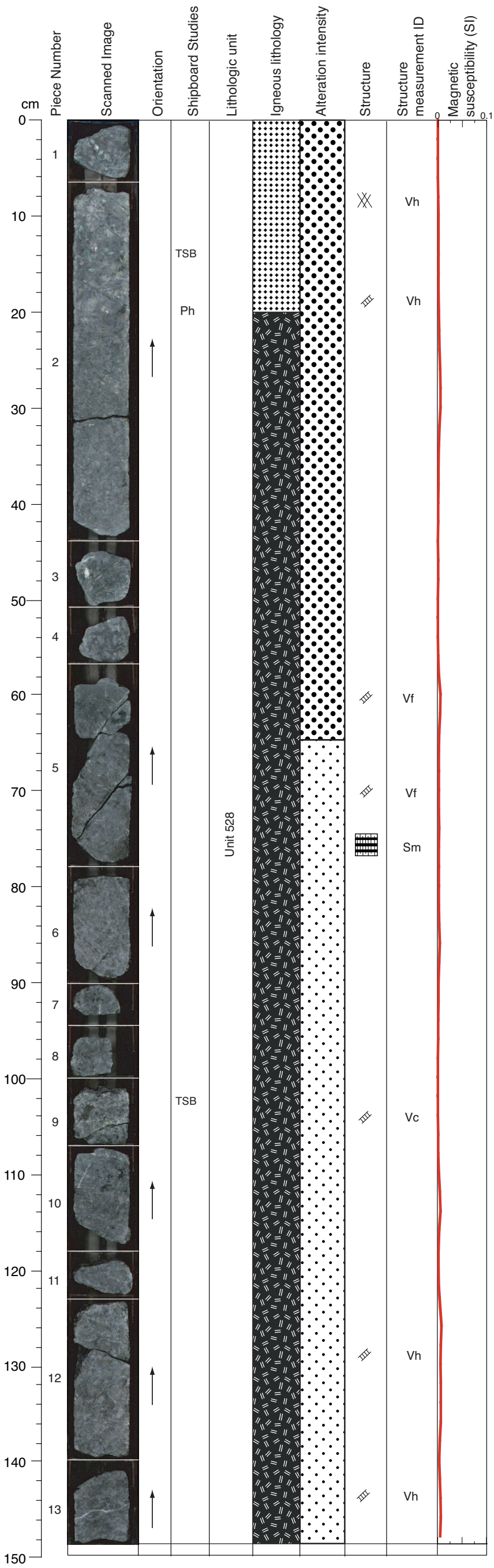
COMMENTS: Coarse-grained gabbro with both pale-green coronas moderately altered, and also pink corona after olivine. The section is cut by numerous thin veins (at 14-18 cm, 35 cm, 77-78 cm, 129 cm, 131 cm, and 139 cm). Alteration zone related to these veins is observed (129-130 cm) with alteration/replacement of the pyroxenes by green amphibole.

VEIN ALTERATION: Amphibole, chlorite, carbonate.

STRUCTURE: Fine- to medium-grained gabbro, local magmatic fabric (Sm) in lower part of section. Irregular, steeply dipping pale green veins with some branching in Piece 5 and 6.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-207R-1, 128-148 cm WET

## Core Photo




**305-U1309D-207R-2 (Section top: 995.70 mbsf)**

UNIT-528: Olivine Gabbro to Olivine-bearing Gabbro
Pieces: 1-13

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Olivine | Modal 15%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 25%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 528 is medium-grained olivine gabbro to olivine-bearing gabbro. Olivine abundance decreases from top to bottom of this section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Coarse-grained gabbro with several pale green amphibole veins (+ talc) with pale green coronas related to these veins. At 48 and 50 cm, same pale green amphibole/talc veins with altered pyroxene to green amphibole. Piece 4 is broken in different pieces and the fractures are filled by pale green veins (amphibole, talc, chlorite). At 105 cm, brecciated zone with a significant amount of suflides likely in a replaced olivine. At 145 cm, 5 mm thick white vein (?).

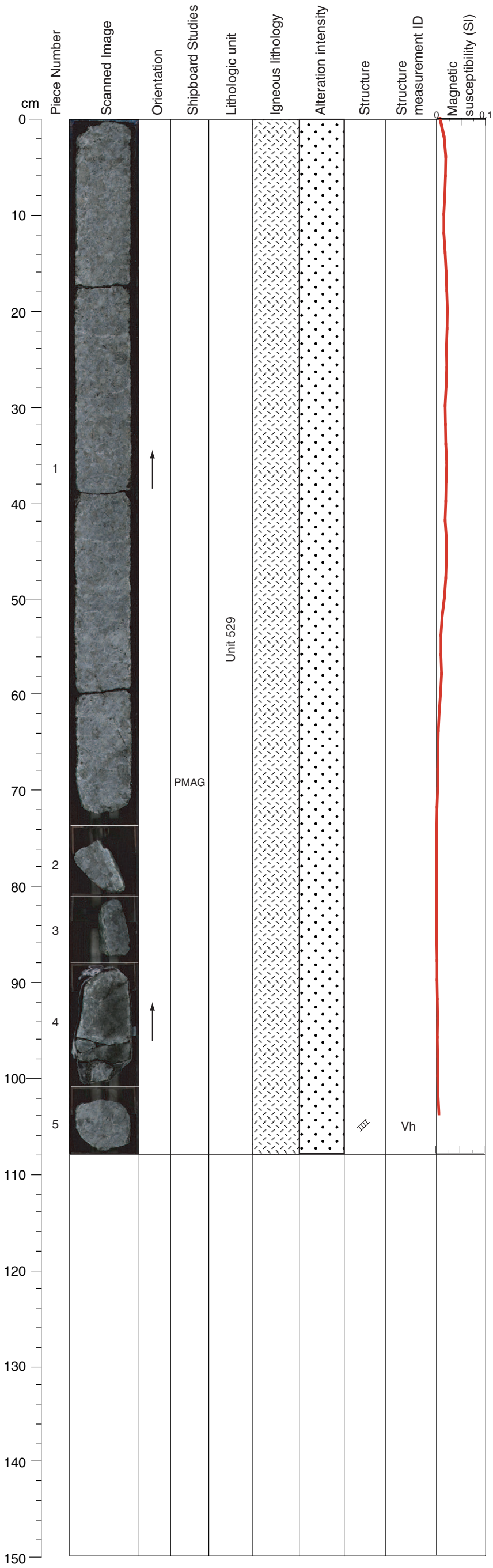
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-207R-2, 12-15 cm (#523)**
**305-U1309D-207R-2, 100-104 cm (#524)**

STRUCTURE: Fine- to medium-grained gabbro with common magmatic foliation. Set of dark green veins (V1) associated with later (?) carbonate white material and another set of pale green fault veins (V2). A white vein with quartz or anhydrite(?) infill in Piece 13.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-207R-2, 6-31 cm WET
305-U1309D-207R-2, 95-117 cm WET

## Core Photo




**305-U1309D-207R-3 (Section top: 997.20 mbsf)**

UNIT-529: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 6 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 9 mm average<br>Shape anhedral |

COMMENTS: Unit 529 is medium- to coarse-grained gabbro. Traces of oxide in this interval.

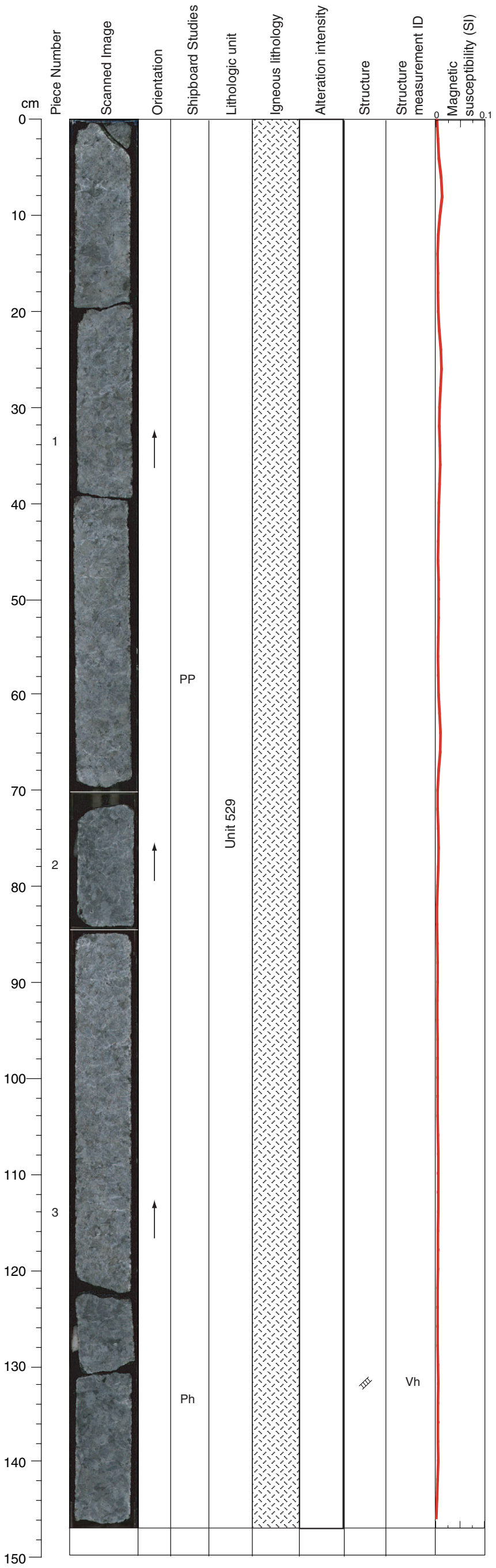
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with significant amount of sulfides. At 79 cm, leucocratic alteration (plagioclase and amphibole) continuing in Piece 3.

VEIN ALTERATION: Amphibole, chlorite, talc

STRUCTURE: Medium- to coarse-grained isotropic gabbro. A few dark green veins and later subhorizontal cracks with white infill.

## Core Photo




**305-U1309D-207R-4 (Section top: 998.28 mbsf)**

UNIT-529: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 3a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 529 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

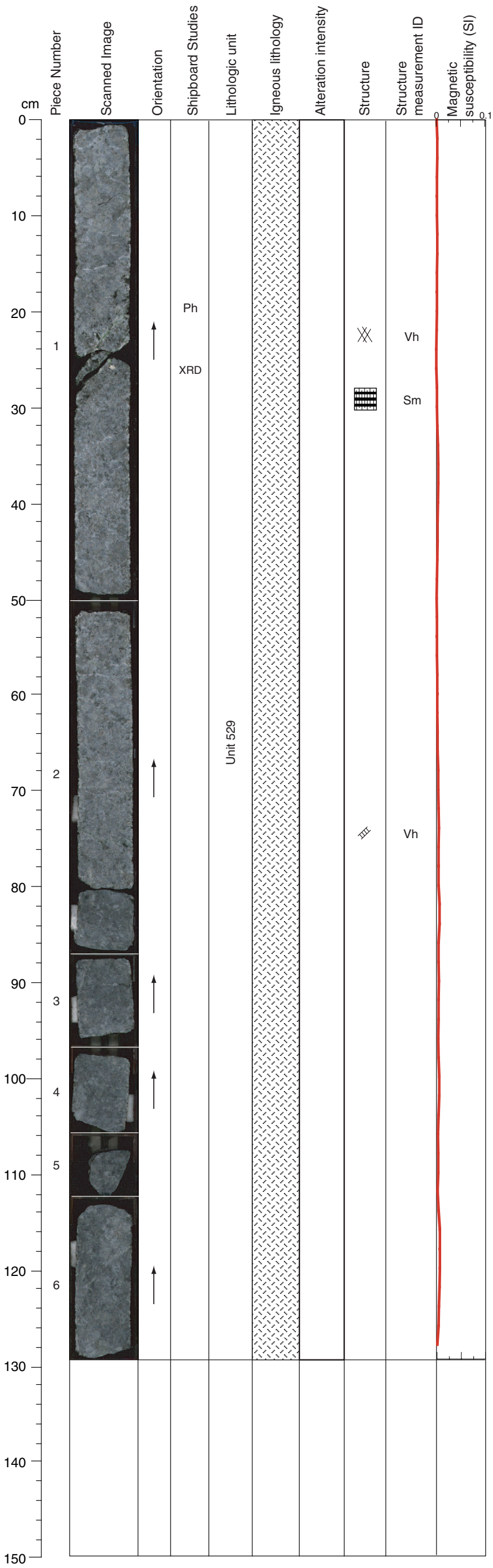
COMMENTS: Coarse-grained gabbro with several thin white veinlets around the grains. Significant amount of sulfides. At 130 cm, pale green amphibole veins with green amphibole replacing the previous minerals close to the vein.

VEIN ALTERATION: Amphibole, talc, carbonate.

STRUCTURE: Medium- to coarse-grained isotropic gabbro. A dark green vein (Vh) that locally shows white mineral (quartz?).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-207R-4, 122-145 cm WET

## Core Photo




**305-U1309D-207R-5 (Section top: 999.75 mbsf)**

UNIT-529: Gabbro
Pieces: 1-6

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 529 is medium-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

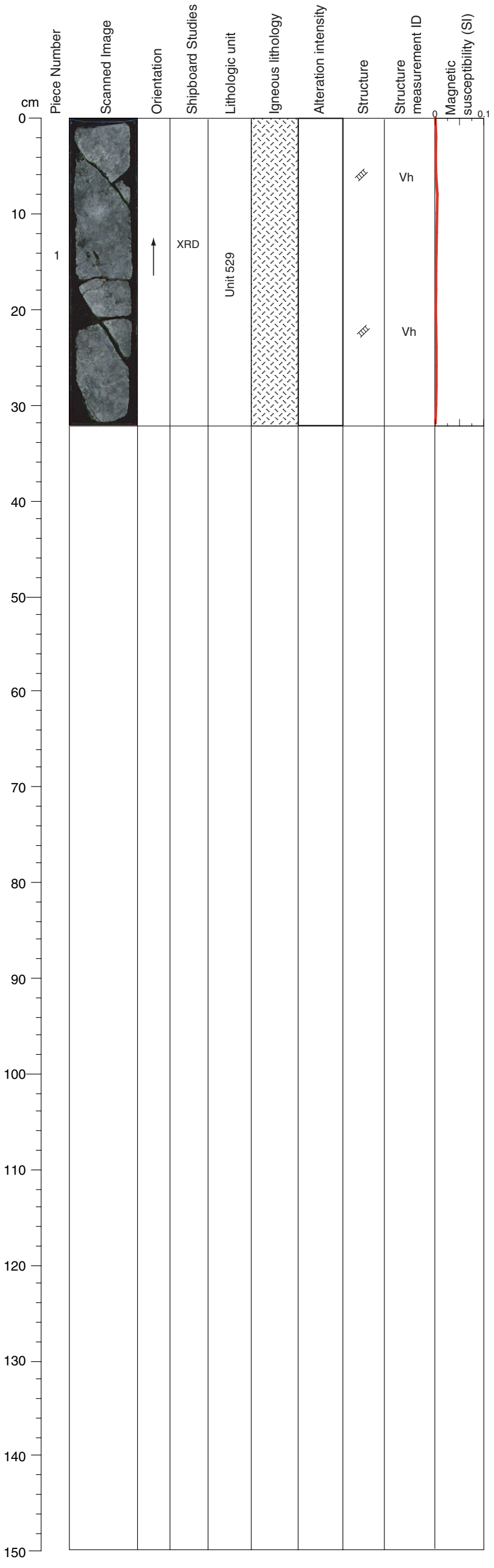
COMMENTS: Coarse-grained gabbro with pale green amphibole veins surrounded by leucocratic alteration at 20-28 cm. Close to this vein the olivines are altered and show rim of amphibole. Significant amount of sulfides.

VEIN ALTERATION: n/a

STRUCTURE: Coarse- to medium-grained gabbro with weak magmatic foliation in upper section. A few pale green veins with talc infill.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-207R-5, 15-34 cm WET

## Core Photo




**305-U1309D-207R-6 (Section top: 1001.04 mbsf)**

UNIT-529: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 529 is medium-grained gabbro.

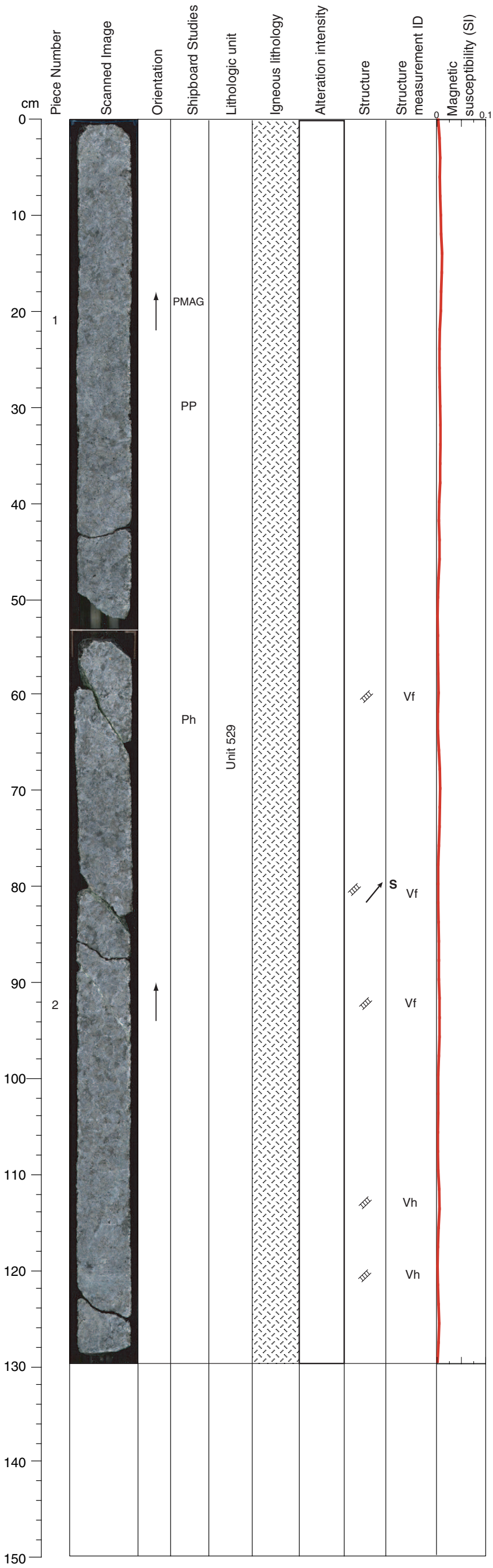
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with fractures filled by green amphibole. Significant amount of sulfides.

VEIN ALTERATION: n/a

STRUCTURE: Coarse gabbro with no definite magmatic foliation. Several pale green veins in this interval.

## Core Photo




**305-U1309D-208R-1 (Section top: 1000.80 mbsf)**

UNIT-529: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 529 medium-grained gabbro. Olivine-bearing at 111-116 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

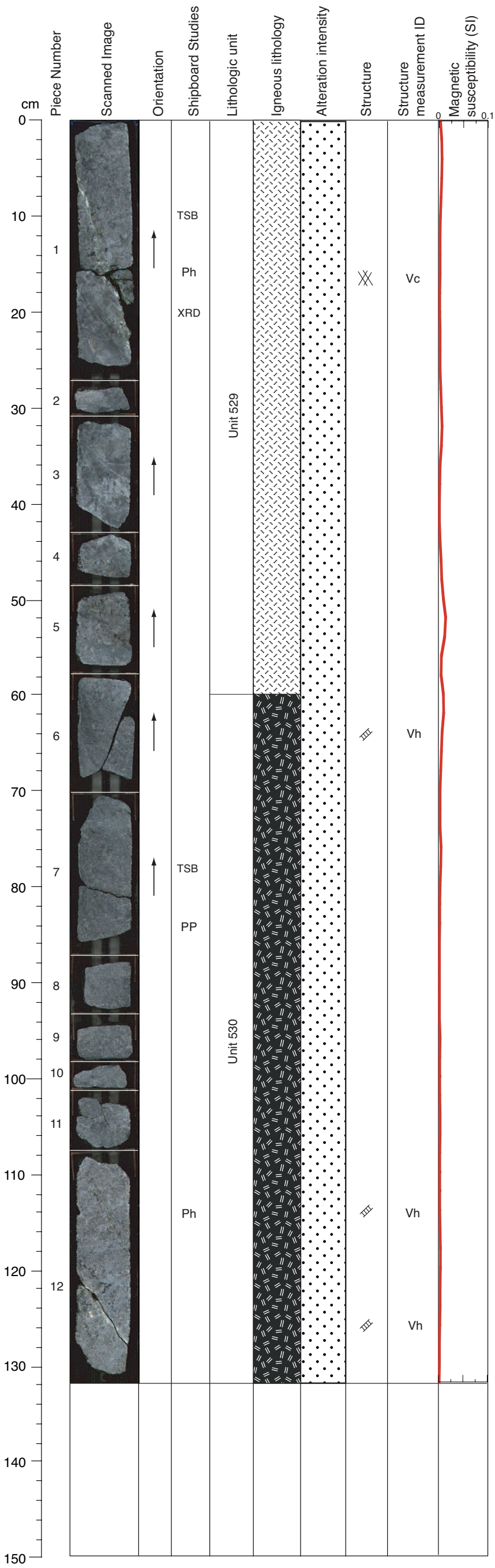
COMMENTS: Coarse-grained gabbro with low alteration and green amphibole vein at 24 cm. Piece 2 (at 57-62 cm, 78-83 cm, 88-94 cm), fractures filled by talc, amphibole veins with alteration of the surrounding crystals to green amphibole. The edge of Piece 2 (95-130 cm) is more altered in association with thin green amphibole veins.

VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

STRUCTURE: Medium- to coarse-grained isotropic gabbro. Steeply dipping pale green fault veins with talc infills, one of which shows fibrous texture.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-208R-1, 55-75 cm WET

## Core Photo




**305-U1309D-208R-2 (Section top: 1002.10 mbsf)**

UNIT-529: Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 30 mm<br>Shape anhedral |

COMMENTS: Unit 529 is coarse-grained gabbro.

UNIT-530: Olivine-bearing Gabbro
Pieces: 6-12

PRIMARY MINERALOGY: Modal data from Piece 12a

| | |
|---|---|
| Olivine | Modal 1%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 45%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Unit 530 is medium-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Medium- to fine-grained gabbro cut from 7 to 27 cm by pale green amphibole and carbonate veins with alteration halo that surrounds pyroxenes where they are altered to green amphibole. Piece 2 shows several thin white veinlets (talc?) and pink coronas after olivine. Sulfides occur in the matrix and also in great amount in the altered crystals. Piece 3 is highly altered to green amphibole with a significant amount of sulfides. At 55-56 cm, dark green amphibole veins with alteration and amphibole rims around the grains. Pieces 6 to 12 are finer grained and are cut by white thin veinlets (at 76-77cm, and 95 cm, and 101-107 cm). At 110-118 cm, pale green veins associated with dark green amphibole crystals replacing the previous minerals and at 121-128 cm dark green amphibole vein with leucocratic alteration around (1-1.5 cm thick) (plagioclase, amphibole, sphene).

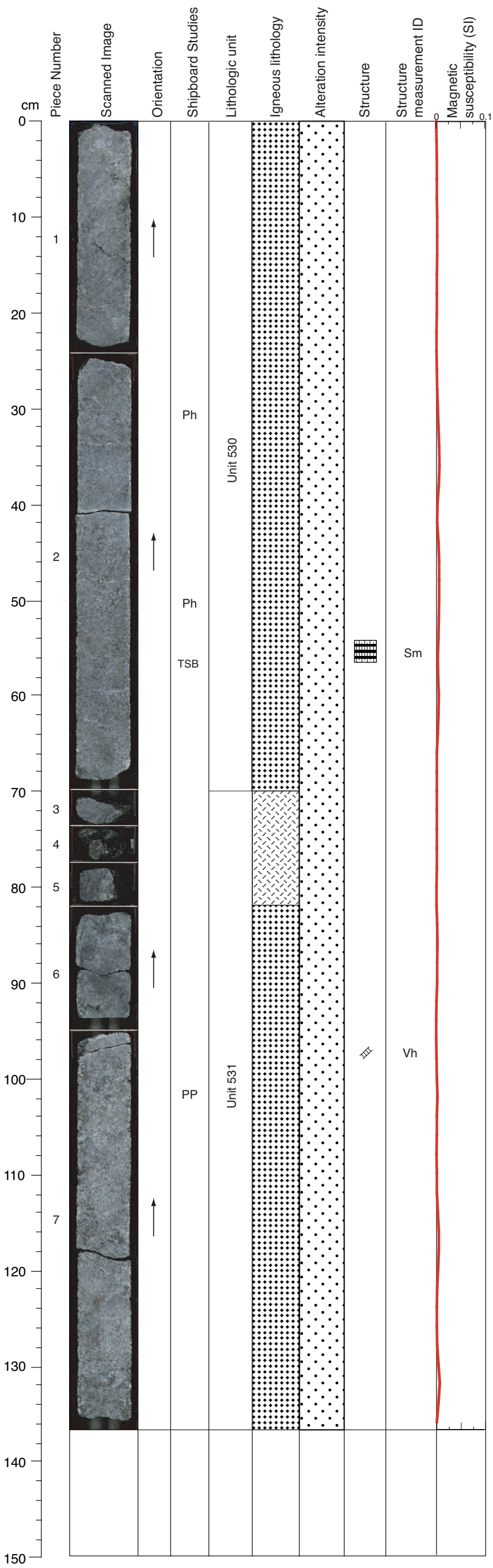
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-208R-2, 9-11 cm (#525)**
**305-U1309D-208R-2, 77-79 cm (#526)**

STRUCTURE: Medium- to coarse-grained isotropic gabbro. Steeply dipping pale green fault veins with some branching.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-208R-2, 0-26 cm WET
305-U1309D-208R-2, 70-86 cm WET
305-U1309D-208R-2, 108-130 cm WET

## Core Photo




**305-U1309D-208R-3 (Section top: 1003.42 mbsf)**

UNIT-530: Olivine Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Olivine | Modal 25%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 25%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 530 is fine- to medium-grained olivine gabbro. Troctolitic at 34-44 cm.

UNIT-531: Olivine Gabbro
Pieces: 3-7

PRIMARY MINERALOGY: Modal data from Piece 7a

| | |
|---|---|
| Olivine | Modal 5%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 4 mm average<br>Shape anhedral |

COMMENTS: Unit 531 medium-grained olivine gabbro. Pieces 3-5 are gabbroic rubble with uncertain modal composition. Coarse clinopyroxene fragments. Clinopyroxene oikocryst in Piece 6.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Fine-grained gabbro with alteration of the pyroxenes to green amphibole. At 1-8 cm, pale green amphibole veins without alteration halo. Significant amount of sulfides.

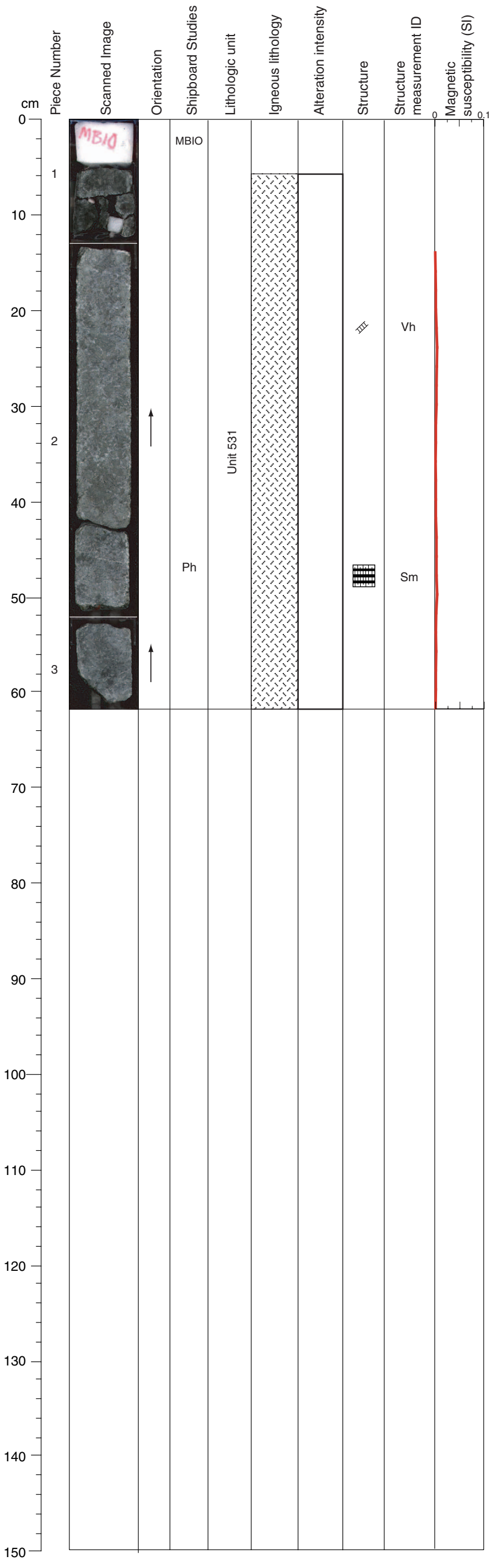
VEIN ALTERATION: Amphibole, chlorite, carbonate.

THIN SECTIONS:
**305-U1309D-208R-3, 55-58 cm (#527)**

STRUCTURE: Medium-grained gabbro with weak magmatic strain. A few subhorizontal pale green veins and subhorizontal cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-208R-3, 25-41 cm WET
305-U1309D-208R-3, 41-69 cm WET
305-U1309D-208R-3, 41-69 cm DRY

## Core Photo




**305-U1309D-208R-4 (Section top: 1004.79 mbsf)**

UNIT-531: Gabbro
Pieces: 2-3

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 35%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 65%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 531 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

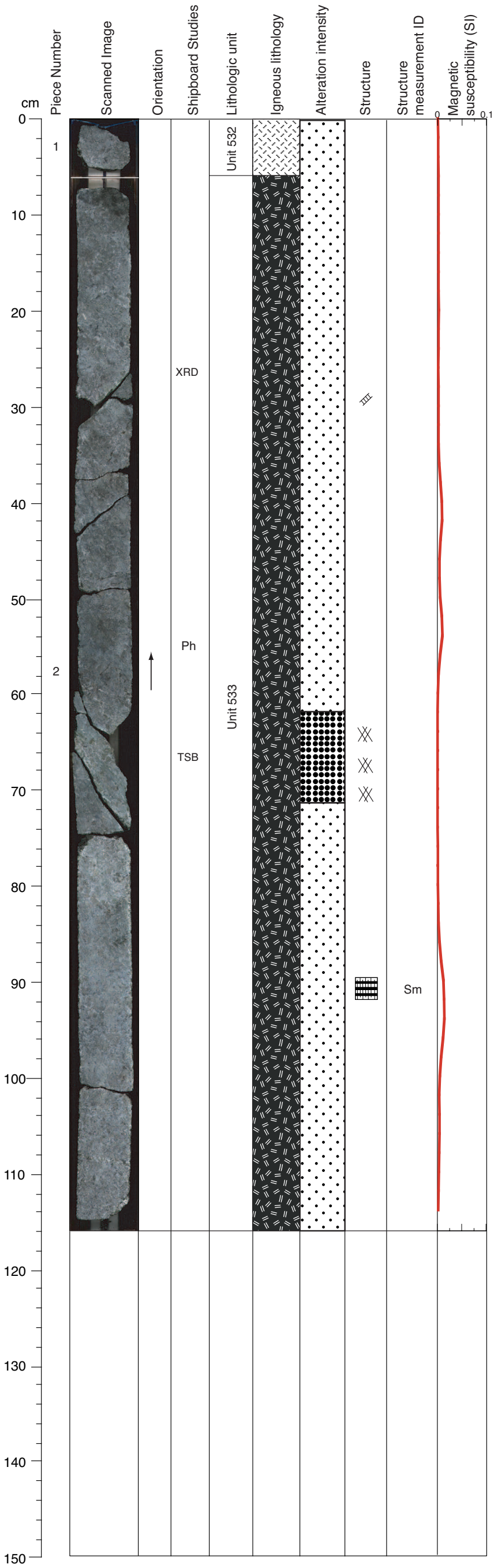
COMMENTS: Medium-grained gabbro with thin white veinlets (talc?) and dark green amphibole veins. The pyroxenes are altered to green amphibole. Significant amount of sulfides. Small patches where olivine is slightly altered to serpentine.

VEIN ALTERATION: n/a

STRUCTURE: Medium- to coarse-grained gabbro with grain size differences in schlieren, no magmatic or plastic foliation. A few dark veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-208R-4, 43-61 cm WET

## Core Photo




**305-U1309D-209R-1 (Section top: 1005.60 mbsf)**

UNIT-532: Gabbro Rubble
Pieces: 1

COMMENTS: Unit 532 is gabbroic rubble.

UNIT-533: Olivine-bearing Gabbro
Pieces: 2

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Olivine | Modal 2%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 33%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 533 is medium-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with serpentinzed olivine rimmed by tremolite (?). The pyroxenes are altered to green amphibole. At 26-32 cm, fracture filled by pale green vein (amphibole + talc?). From 60 to 75 cm, deformed interval with plagioclase, amphibole and altered pyroxenes cut by thin green veins. Dark green veins and related alteration to green amphibole occurs from 75 cm to the end of the section.

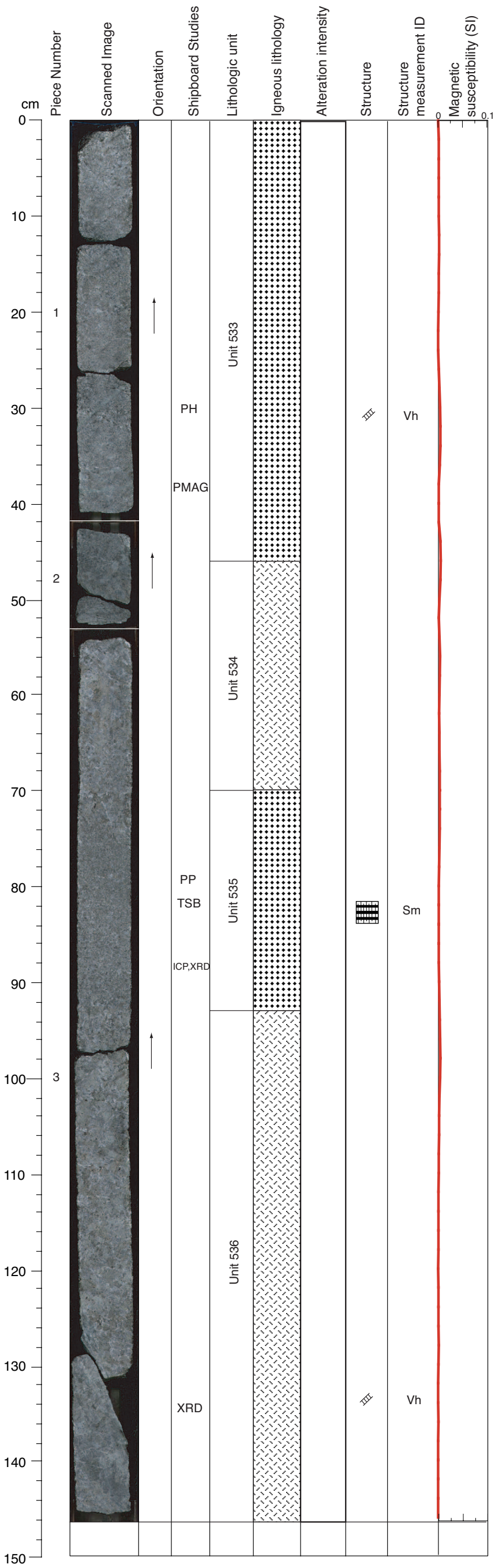
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-209R-1, 65-68 cm (#528)**

STRUCTURE: Medium- to coarse-grained gabbro with moderately dipping magmatic foliation. Leucocratic zone with intense veining and cataclasis between 60 and 75 cm in Piece 2.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-209R-1, 48-74 cm WET

## Core Photo




**305-U1309D-209R-2 (Section top: 1006.76 mbsf)**

UNIT-533: Olivine Gabbro
Pieces: 1-2a

PRIMARY MINERALOGY: Modal data from Piece 1c

| | |
|---|---|
| Olivine | Modal 10%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 30%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 60%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 533 fine-grained olivine gabbro.

UNIT-534: Gabbro
Pieces: 2a-3a

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 70%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 534 is coarse-grained gabbro.

UNIT-535: Olivine Gabbro
Pieces: 3a

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Olivine | Modal 10%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 535 is fine- to medium-grained olivine gabbro.

UNIT-536: Gabbro
Pieces: 3a-3c

PRIMARY MINERALOGY: Modal data from Piece 3b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 536 is coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Fine-grained gabbro with alteration of the previous mineralogy to green amphibole. Piece 3 is a coarse-grained gabbro with several thin white veins (carbonate?). Significant amount of sulfides. At 127-137 cm, fracture filled by amphibole-talc veins with small alteration halo around where dark green amphibole.

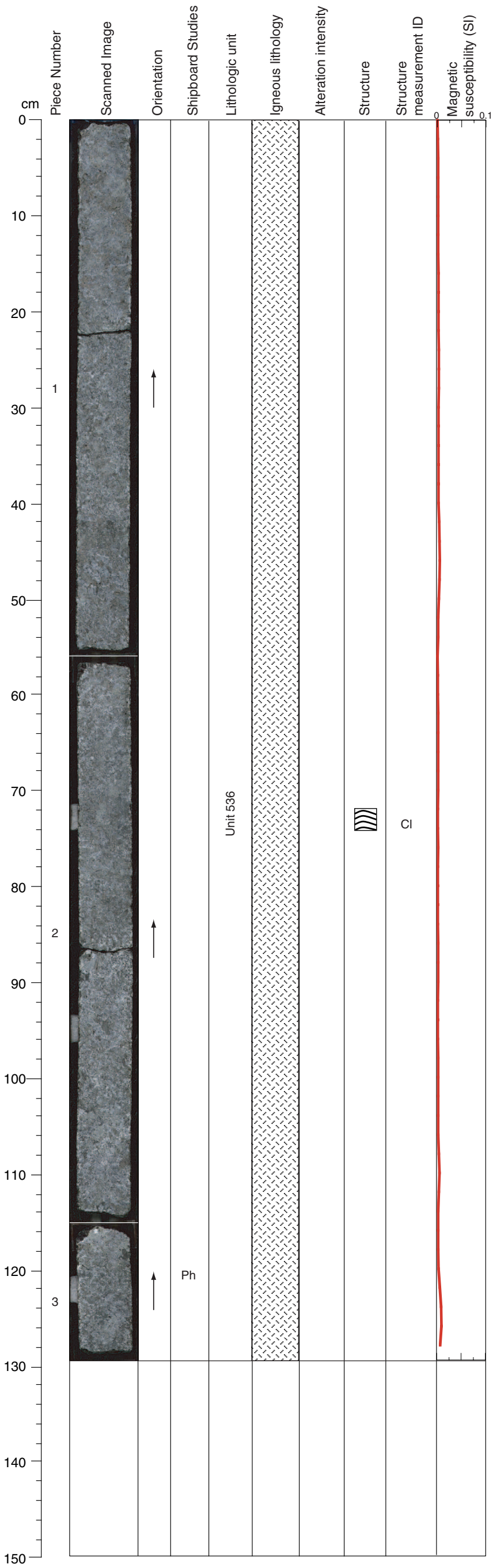
VEIN ALTERATION: Amphibole, chlorite, talc, carbonate.

THIN SECTIONS:
**305-U1309D-209R-2, 81-83 cm (#529)**

STRUCTURE: Medium- to coarse-grained gabbro showing a reasonably well developed grain size layering coincident with magmatic foliation development. A few dark green veins.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-209R-2, 26-41 cm WET
305-U1309D-209R-2, 75-95 cm WET

## Core Photo




**305-U1309D-209R-3 (Section top: 1008.23 mbsf)**

UNIT-536: Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 4 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 536 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: No visible secondary minerals.

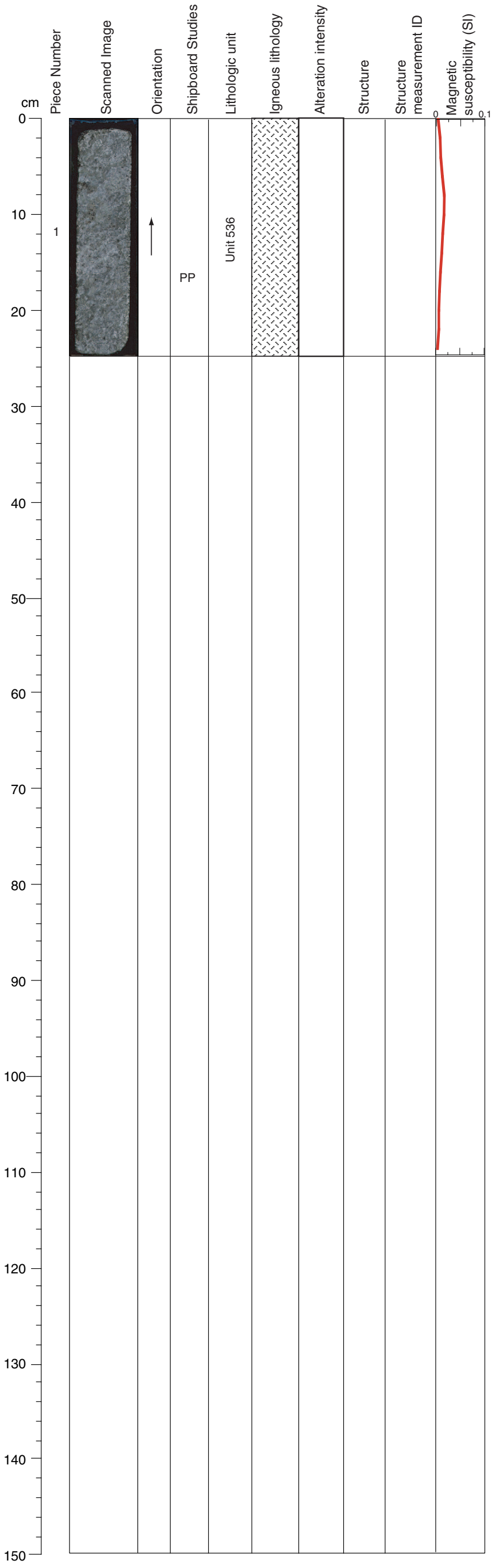
COMMENTS: Coarse-grained gabbro, low alteration of the pyroxene to green amphibole. Significant amount of sulfides.

VEIN ALTERATION: n/a

STRUCTURE: Medium- to coarse-grained gabbro showing modal layering (Cl) but no magmatic foliation developed.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-209R-3, 115-128 cm WET

## Core Photo




**305-U1309D-209R-4 (Section top: 1009.53 mbsf)**

UNIT-536: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 50%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 536 is medium-grained gabbro.

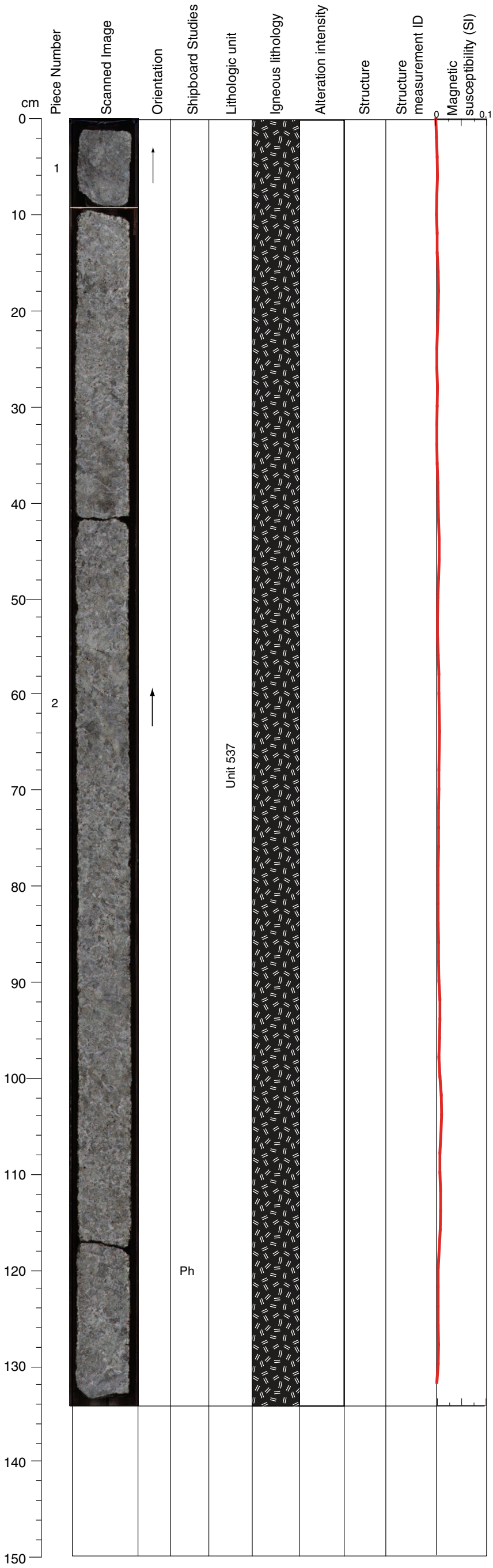
SECONDARY MINERALOGY: No visible secondary minerals.

COMMENTS: Coarse-grained gabbro, low alteration of the pyroxene to green amphibole. Significant amount of sulfides.

VEIN ALTERATION: n/a

STRUCTURE: Medium- to coarse-grained isotropic gabbro with no magmatic or plastic foliation.

## Core Photo




**305-U1309D-210R-1 (Section top: 1010.40 mbsf)**

UNIT-537: Olivine-bearing Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Olivine | Modal 5%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size 10 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size 5 mm average<br>Shape anhedral |

COMMENTS: Unit 537 is medium- to coarse-grained olivine-bearing gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

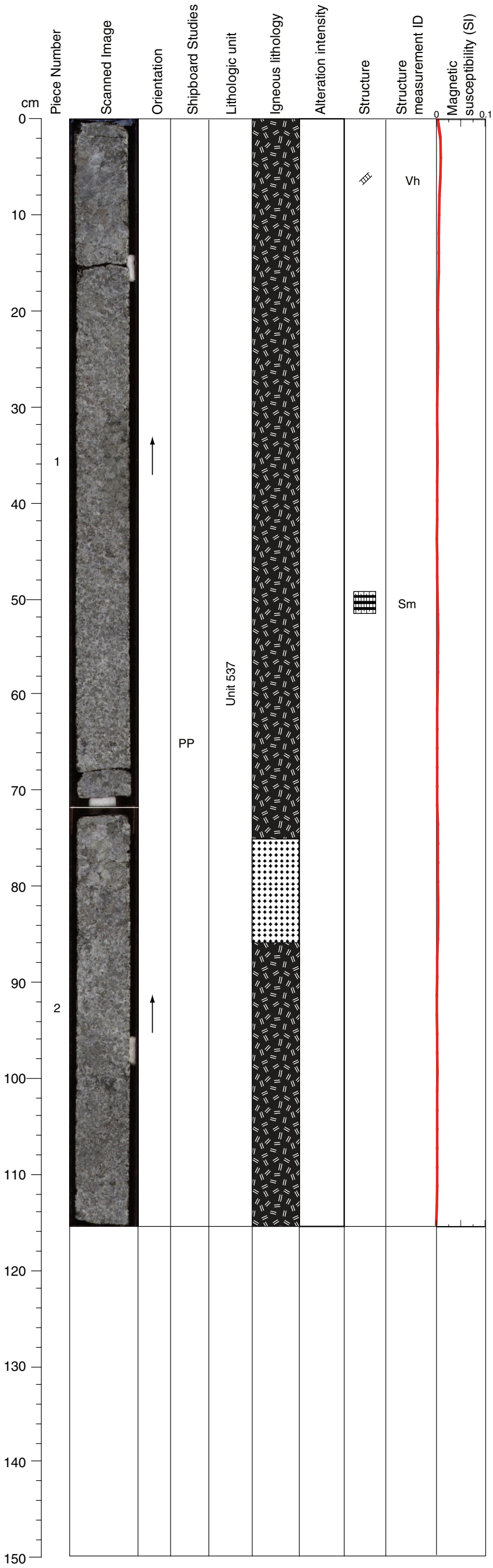
COMMENTS: Coarse-grained gabbro with several white thin veins and a significant amount of sulfides. The pyroxenes are slightly altered to green amphibole.

VEIN ALTERATION: Amphibole, plagioclase, chlorite.

STRUCTURE: Medium-grained isotropic gabbro.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-210R-1, 118-134 cm WET

## Core Photo




**305-U1309D-210R-2 (Section top: 1011.74 mbsf)**

UNIT-537: Olivine-bearing Gabbro and Olivine Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1b and 2

| | |
|---|---|
| Olivine | Modal 2-20%<br>Size 2-6 mm average<br>Shape anhedral |
| Plagioclase | Modal 60-65%<br>Size 4-10 mm average<br>Shape elongate to anhedral |
| Clinopyroxene | Modal 20-40%<br>Size 4-10 mm average<br>Shape anhedral |

COMMENTS: Unit 537 medium- to coarse-grained olivine-bearing and olivine gabbro (75-85 cm).

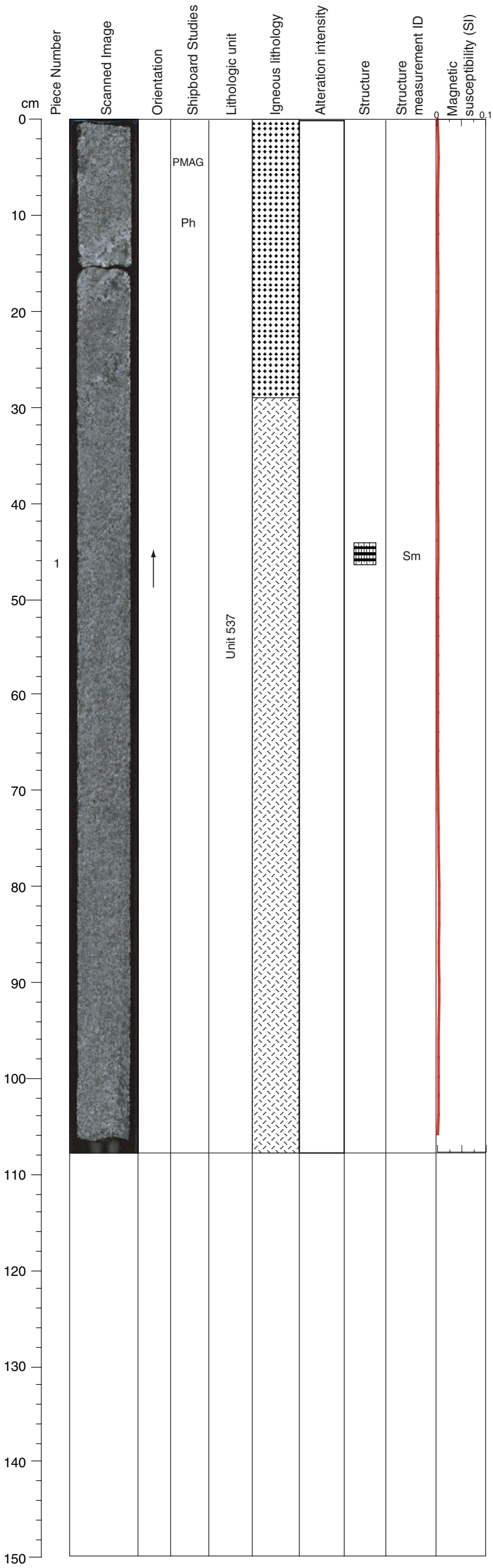
SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: Coarse-grained gabbro with several white thin veins and significant amount of sulfides. The pyroxenes are slightly altered to green amphibole and the olivines are slightly altered to serpentine.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained gabbro with magmatic foliation (Sm) developed in most parts of section. Few dark green vein.

## Core Photo




**305-U1309D-210R-3 (Section top: 1012.90 mbsf)**

UNIT-537: Olivine Gabbro
Pieces: 1a-1b

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 10%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 70%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 20%<br>Size 2 mm average<br>Shape anhedral |

UNIT-537: Gabbro
Pieces: 1b

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Unit 537 is medium-grained olivine gabbro (0-29 cm) grading to medium-grained gabbro (29-107 cm). Olivine-rich (clinopyroxene-poor) at 25-28 cm. Vertical patch of olivine at edge of 92-107 cm.

SECONDARY MINERALOGY: No visible secondary minerals.

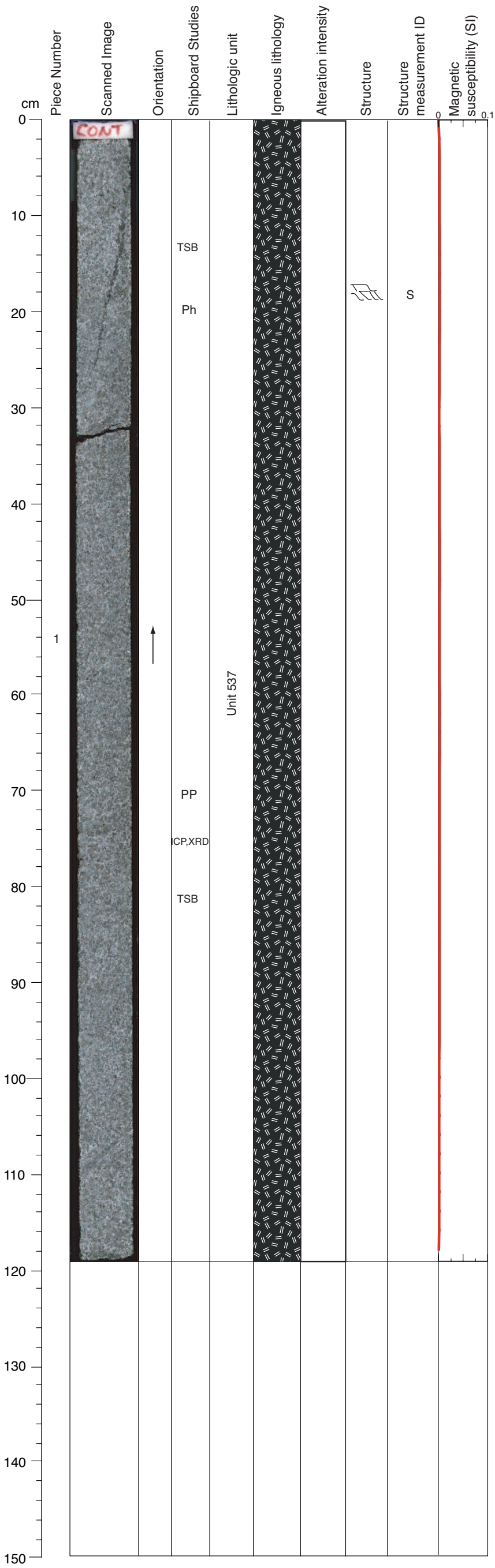
COMMENTS: Fine-grained gabbro with low alteration.

VEIN ALTERATION: n/a

STRUCTURE: Medium-grained gabbro with magmatic foliation developed (Sm) and modal layering in top of section.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-210R-3, 0-16 cm WET

## Core Photo




**305-U1309D-211R-1 (Section top: 1015.20 mbsf)**

UNIT-537: Olivine-bearing Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 2%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 50%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 48%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 537 is medium-grained olivine-bearing gabbro. Serpentine vein (3 mm thick) at 8-27 cm. Up to 3% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite? pale amphibole? dark amphibole?

COMMENTS: Continuation of the previous section. Fine-grained gabbro with very low alteration and cut by serpentine veins (10-27 cm).

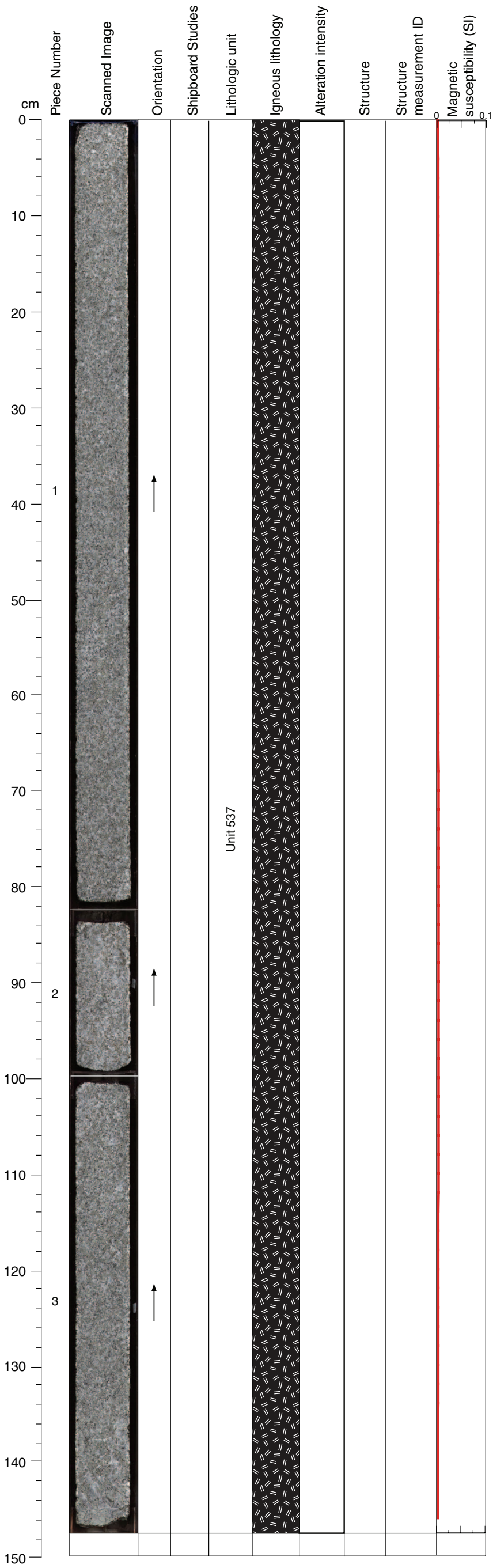
VEIN ALTERATION: Serpentine.

THIN SECTIONS:
**305-U1309D-211R-1, 12-14 cm (#530)**
**305-U1309D-211R-1, 80-82 cm (#531)**

STRUCTURE: Fine-grained gabbro with no magmatic or plastic fabric visible. A serpentinized olivine vein.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-211R-1, 6-30 cm WET
305-U1309D-211R-1, 70-90 cm WET

## Core Photo




**305-U1309D-211R-2 (Section top: 1016.39 mbsf)**

UNIT-537: Olivine-bearing Gabbro
Pieces: 1-3

PRIMARY MINERALOGY: Modal data from Piece 3

| | |
|---|---|
| Olivine | Modal <5%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 70%<br>Size up to 10 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size up to 20 mm average<br>Shape anhedral |

COMMENTS: Unit 537 is medium- to coarse-grained olivine-bearing gabbro.

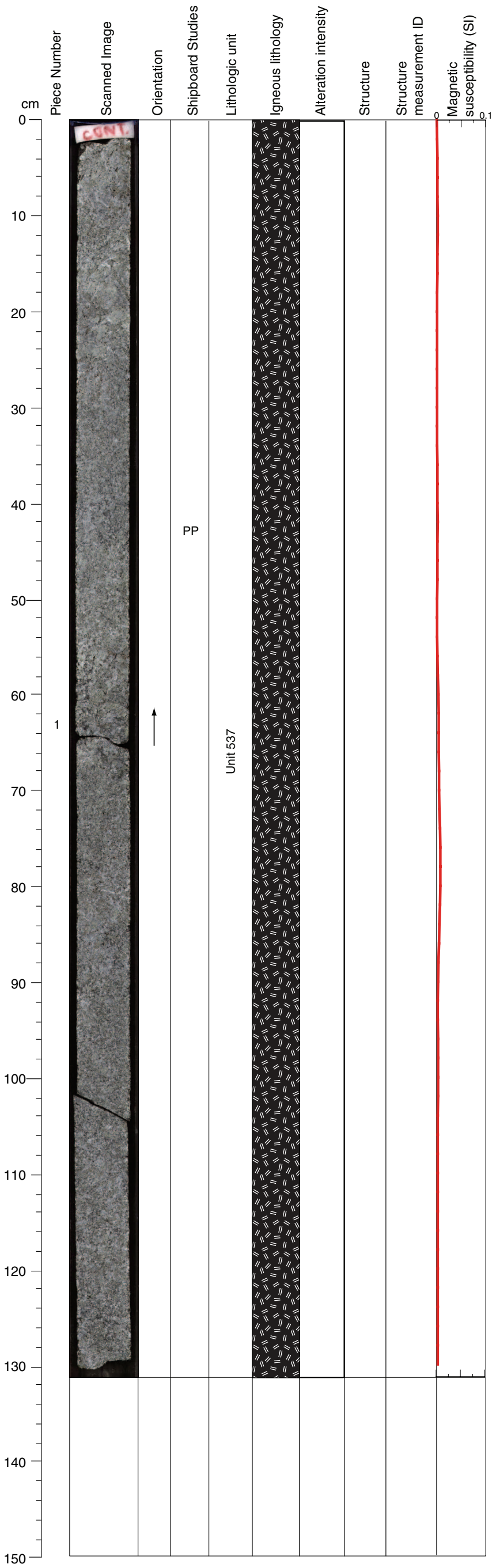
SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: Fine-grained gabbro relatively fresh.

VEIN ALTERATION: n/a

STRUCTURE: Fine- to medium-grained isotropic olivine gabbro.

## Core Photo




**305-U1309D-211R-3 (Section top: 1017.8 mbsf)**

UNIT-537: Olivine-bearing Gabbro
Pieces: 1a-1c

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal <5%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 40%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Unit 537 is medium-grained olivine-bearing gabbro.

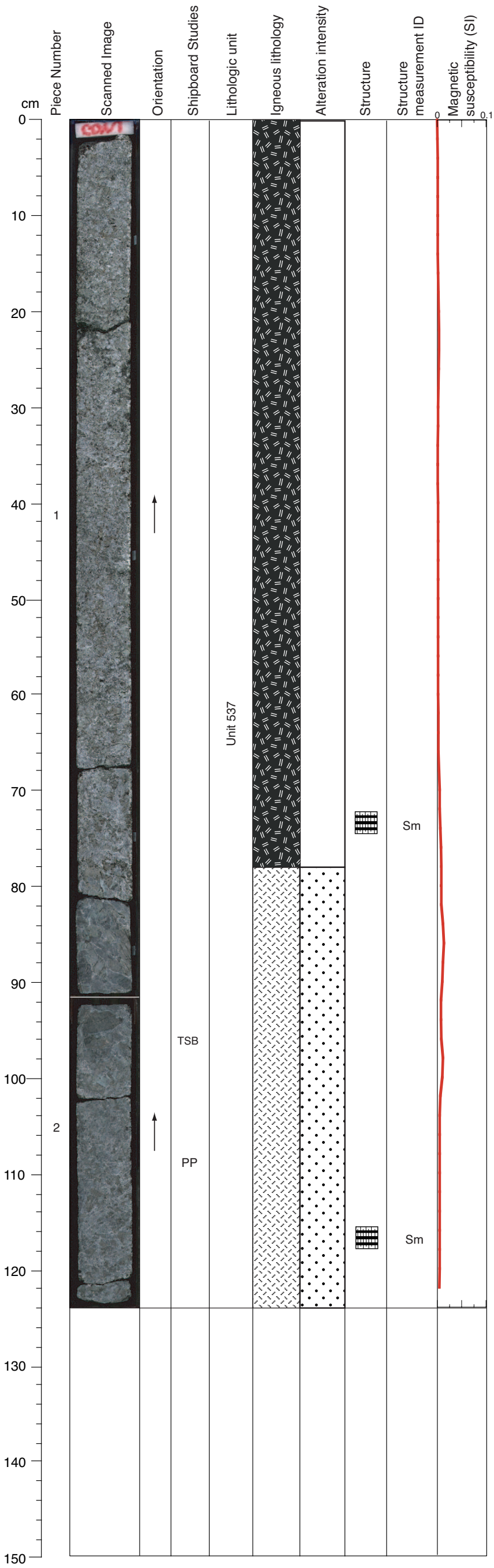
SECONDARY MINERALOGY: Chlorite? pale amphibole?

COMMENTS: Continuation of the previous section. Very low alteration and significant amount of sulfides.

VEIN ALTERATION: n/a

STRUCTURE: Fine- to medium-grained isotropic olivine gabbro.

## Core Photo




**305-U1309D-211R-4 (Section top: 1019.19 mbsf)**

UNIT-537: Olivine-bearing Gabbro
Pieces: 1a-1c

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal <5%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 40%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size 3 mm average<br>Shape anhedral |

UNIT-537: Gabbro
Pieces: 1c-2

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Plagioclase | Modal 40%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 60%<br>Size up to 30 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 537 medium-grained olivine-bearing gabbro grading into coarse-grained gabbro. Olivine-rich at 17-32 cm. Pegmatitic clinopyroxene at 80-102 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Low alteration. From 80 to 100 cm pegmatitic gabbro with significant amount of sulfides, thin white veinlets, coronas and alteration of the pyroxenes to green amphibole.

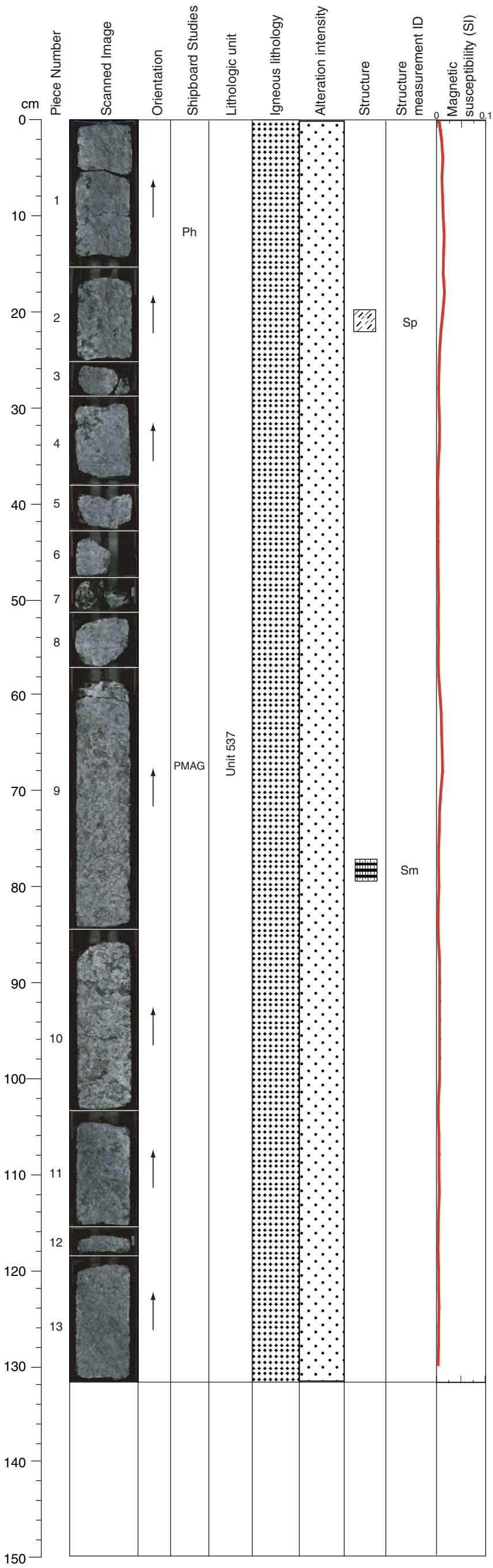
VEIN ALTERATION: n/a

THIN SECTIONS:
**305-U1309D-211R-4, 94-97 cm (#532)**

STRUCTURE: Medium, coarse, and locally pegmatitic gabbro with weak magmatic foliation (Sm) locally present. Weak cataclasis within the pegmatitic gabbro.

CLOSE-UP PHOTGRAPHS:
305-U1309D-211R-4, 67-90 cm WET
305-U1309D-211R-4, 91-120 cm WET

## Core Photo




**305-U1309D-211R-5 (Section top: 1020.43 mbsf)**

UNIT-537: Olivine Gabbro
Pieces: 1-13

PRIMARY MINERALOGY: Modal data from Piece 4

| | |
|---|---|
| Olivine | Modal 20%-30%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%-65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 5%-15%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 537 medium- to coarse-grained olivine gabbro. Oxide in Piece 2. Troctolitic zone at 85-112 cm. Modal abundance irregularly changes through this section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

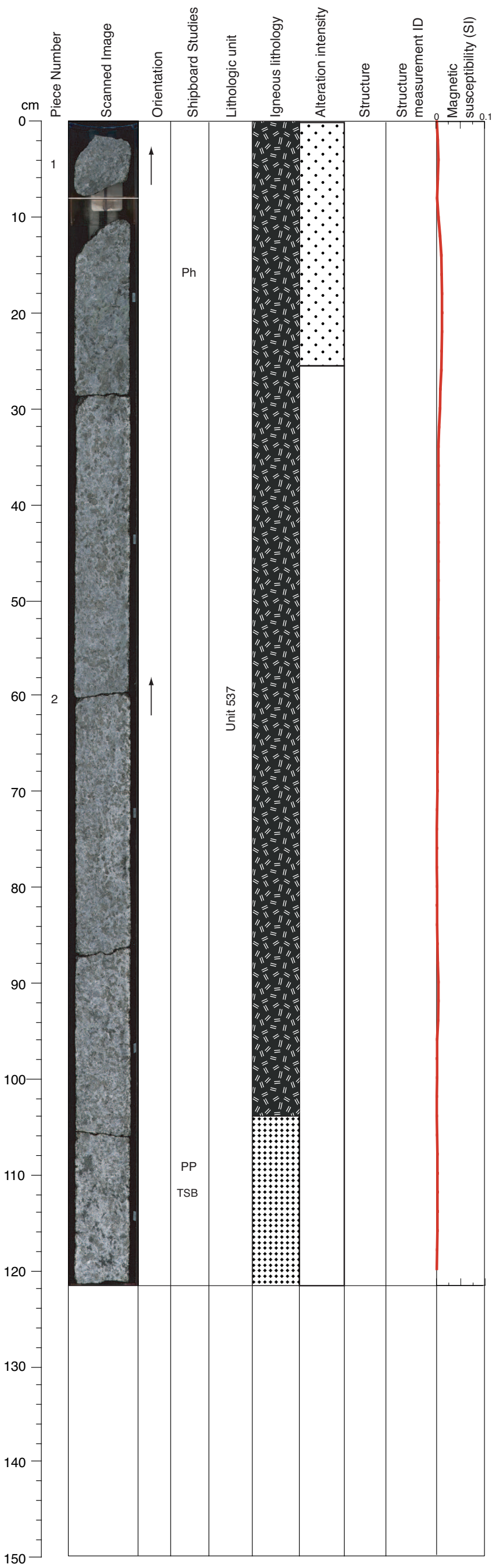
COMMENTS: Coarse-grained gabbro with a significant amount of sulfides. Olivine is slightly altered to serpentine. Some thin white veinlets around the grains (talc?). At 60-62 cm, alteration rim of green amphibole around the pyroxene related to green amphibole veins.

VEIN ALTERATION: Carbonate

STRUCTURE: Medium- to coarse-grained gabbro with local magmatic foliation (Sm) and plastic strain (Sp) in uppermost section. Weak cataclasis within the coarse gabbro.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-211R-5, 0-24 cm WET

## Core Photo




**305-U1309D-212R-1 (Section top: 1020.00 mbsf)**

UNIT-537: Olivine-bearing Gabbro
Pieces: 1-2d

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Olivine | Modal <5%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 3 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 30%<br>Size 5 mm average<br>Shape anhedral |

UNIT-537: Olivine Gabbro
Pieces: 2d-2e

PRIMARY MINERALOGY: Modal data from Piece 2e

| | |
|---|---|
| Olivine | Modal 15%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 70%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 15%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 537 medium- to coarse-grained olivine-bearing, grading to olivine gabbro. Oxide at 13-30 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with a significant amount of sulfides. Alteration rim on the olivine and pyroxene of green amphibole. The olivines are slightly serpentinized.

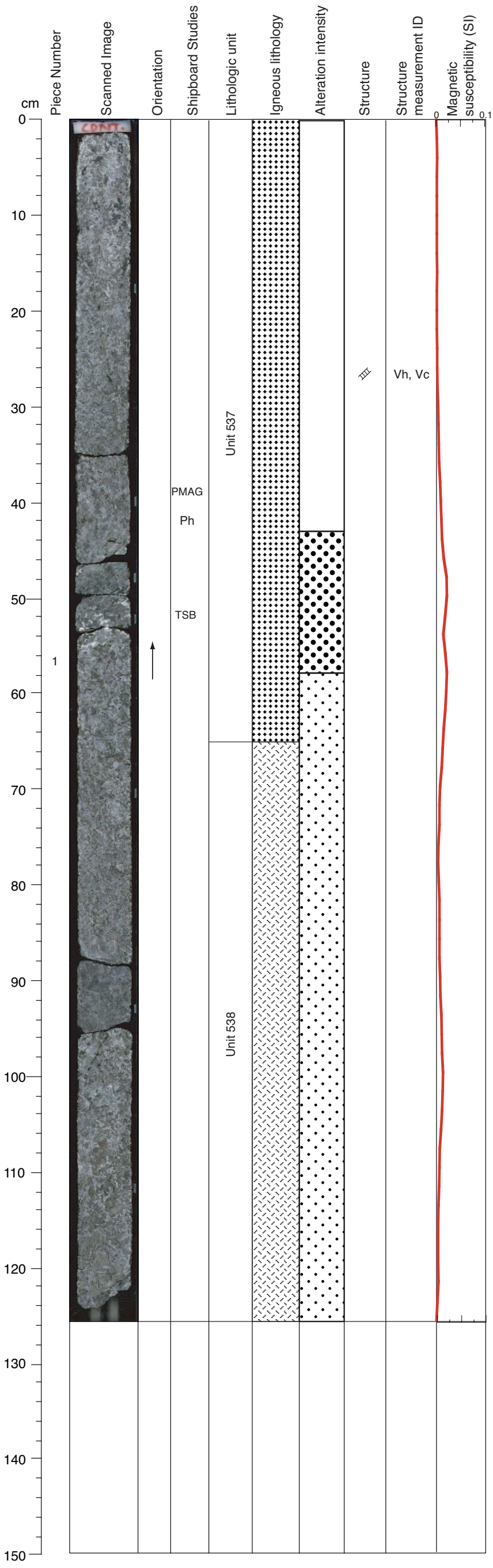
VEIN ALTERATION: n/a

THIN SECTIONS:
**305-U1309D-212R-1, 111-113 cm (#533)**

STRUCTURE: Fine- to medium-grained isotropic gabbro. Locally serpentinized olivine in the lower part.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-212R-1, 8-27 cm WET
305-U1309D-212R-1, 105-120 cm WET

## Core Photo




**305-U1309D-212R-2 (Section top: 1021.21 mbsf)**

UNIT-537: Olivine Gabbro
Pieces: 1a-1e

PRIMARY MINERALOGY: Modal data from Section U1309D-212R-001, Piece 2e

| | |
|---|---|
| Olivine | Modal 15%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 70%<br>Size 5 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 15%<br>Size 2 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 537 medium- to coarse-grained olivine gabbro. Leucocratic gabbro (dispersed oxides, titanites) in Piece 1c and 1d.

UNIT-538: Gabbro
Pieces: 1e-1g

PRIMARY MINERALOGY: Modal data from Piece 1e

| | |
|---|---|
| Plagioclase | Modal 65%<br>Size up to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 35%<br>Size up to 10 mm<br>Shape anhedral |

COMMENTS: Unit 538 is medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole, dark amphibole?

COMMENTS: Continuation of the previous section. Coarse-grained gabbro with slight serpentinization of the olivine. From 17 to 34 cm, white veins and alteration halo around it with dark green amphibole grains. From 44 to 57 cm, leucocratic alteration (plagioclase, amphibole) replacing pyroxenes. Significant amount of sulfides.

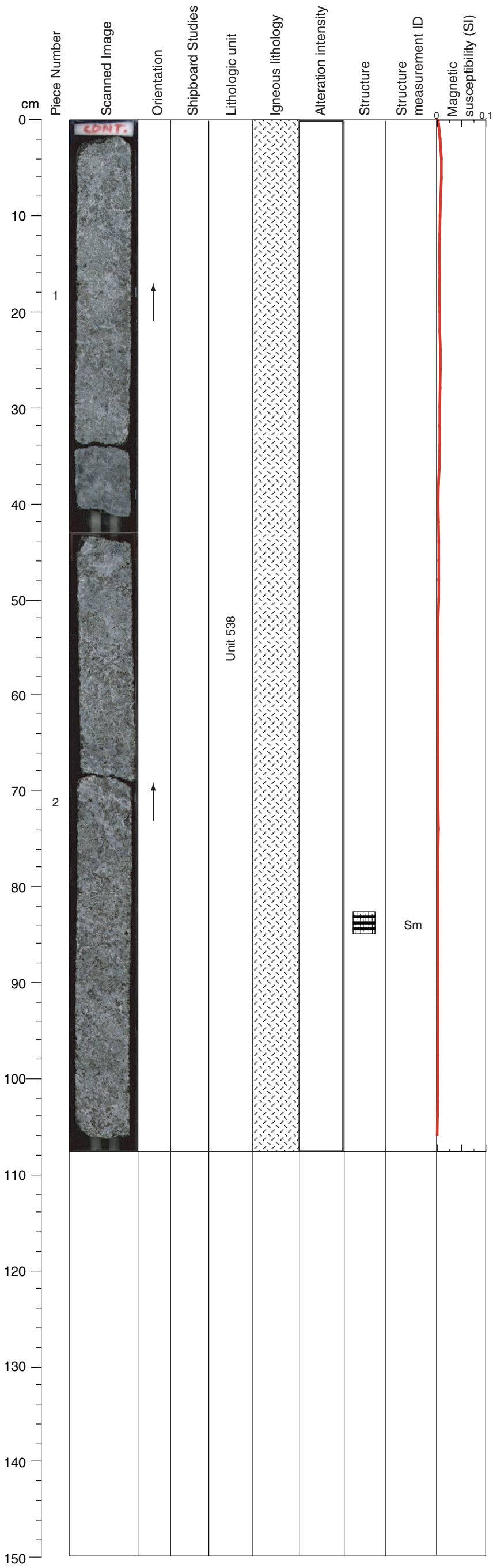
VEIN ALTERATION: Amphibole, plagioclase, carbonate, zeolite.

THIN SECTIONS:
**305-U1309D-212R-2, 50-53 cm (#534)**

STRUCTURE: Medium- to coarse-grained isotropic gabbro. Irregular, subvertical open crack vein (Vh, Vc).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-212R-2, 36-60 cm WET

## Core Photo




**305-U1309D-212R-3 (Section top: 1022.47 mbsf)**

UNIT-538: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2b

| | |
|---|---|
| Plagioclase | Modal 60%<br>Size up to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size up to 20 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 538 medium-grained gabbro. Coarse-grained clinopyroxene in Piece 2a.

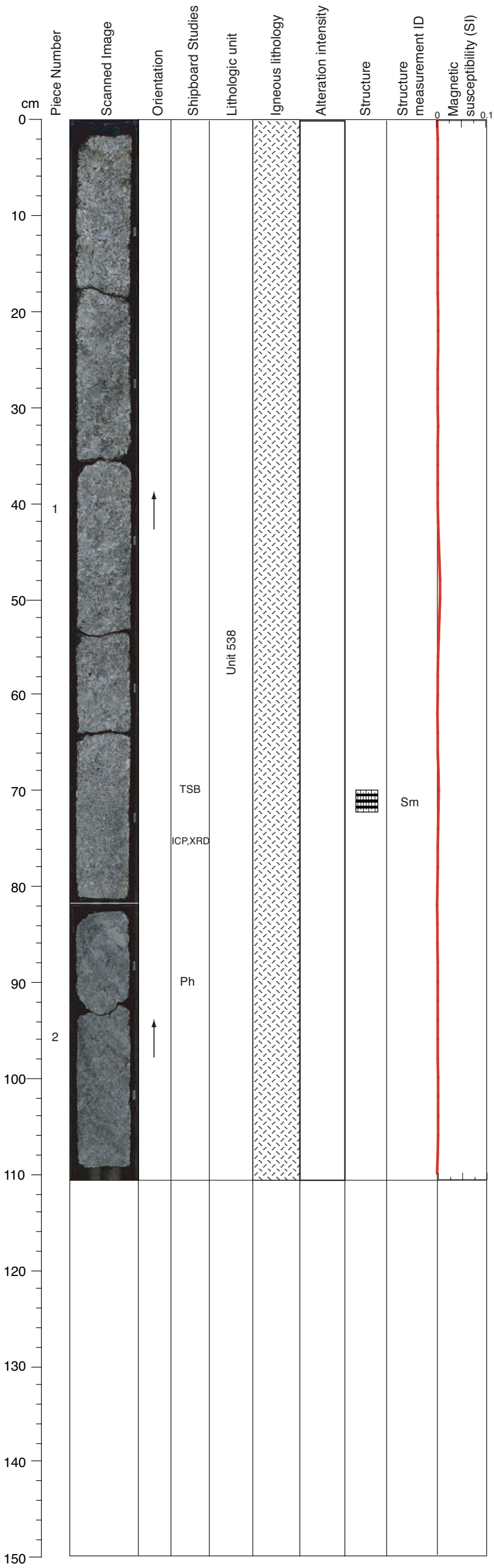
SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Continuation of the previous section. Coarse-grained gabbro with thin white veinlets. Low alteration of the pyroxene to green amphibole.

VEIN ALTERATION: no vein

STRUCTURE: Medium- to coarse-grained gabbro with magmatic foliation present except in upper part of section. Slight cataclasis.

## Core Photo




**305-U1309D-212R-4 (Section top: 1023.54 mbsf)**

UNIT-538: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2b and thin section

| | |
|---|---|
| Plagioclase | Modal 50%<br>Size up to 10 mm<br>Shape anhedral |
| Clinopyroxene | Modal 41%<br>Size up to 20 mm<br>Shape anhedral |
| Orthopyroxene | Modal 9%<br>Size up to 2 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 538 medium- to coarse-grained gabbro. Up to 9% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Coarse-grained gabbro with finer grained part (69-80 cm) and pegmatitic gabbro in Piece 2. Low alteration. Some pyroxenes are rimmed by green amphibole. Significant amount of sulfides.

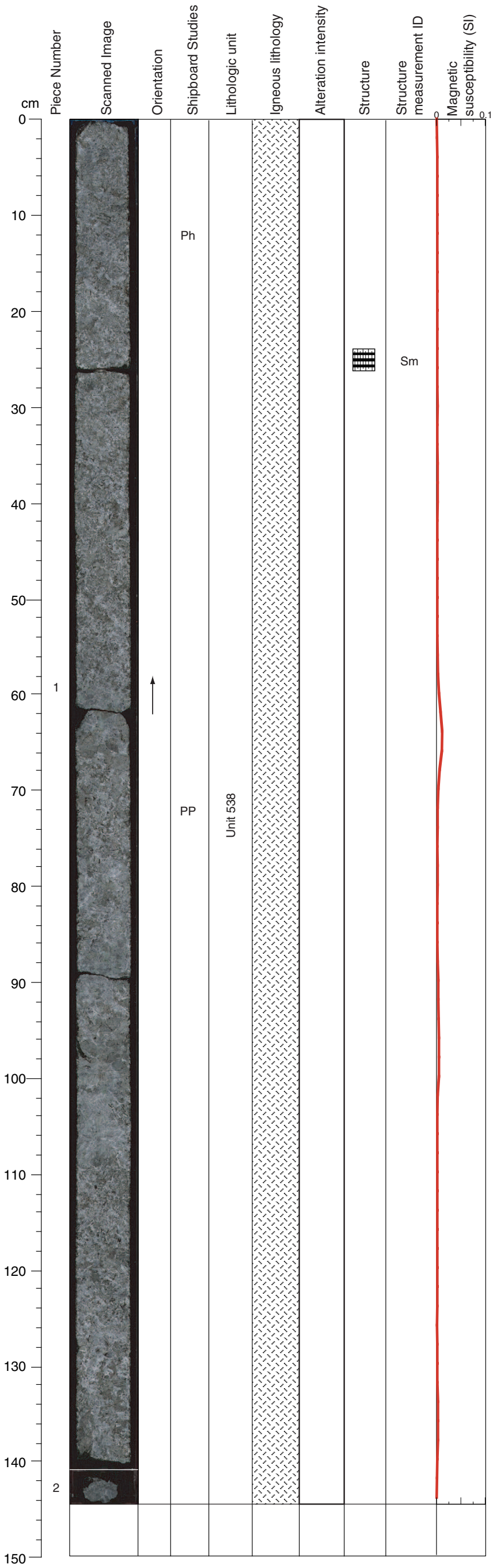
VEIN ALTERATION: no vein

THIN SECTIONS:
**305-U1309D-212R-4, 69-71 cm (#535)**

STRUCTURE: Medium- to coarse-grained isotropic gabbro except in central part of section where a weak, moderately dipping magmatic foliation is developed. Slight cataclasis.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-212R-4, 63-80 cm WET
305-U1309D-212R-4, 83-109 cm WET

## Core Photo




**305-U1309D-213R-1 (Section top: 1024.80 mbsf)**

UNIT-538: Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size up to 15 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 538 medium- to coarse-grained gabbro. Tabular plagioclase grains. Patches of fine grained crysts.

SECONDARY MINERALOGY: Chlorite, pale amphibole

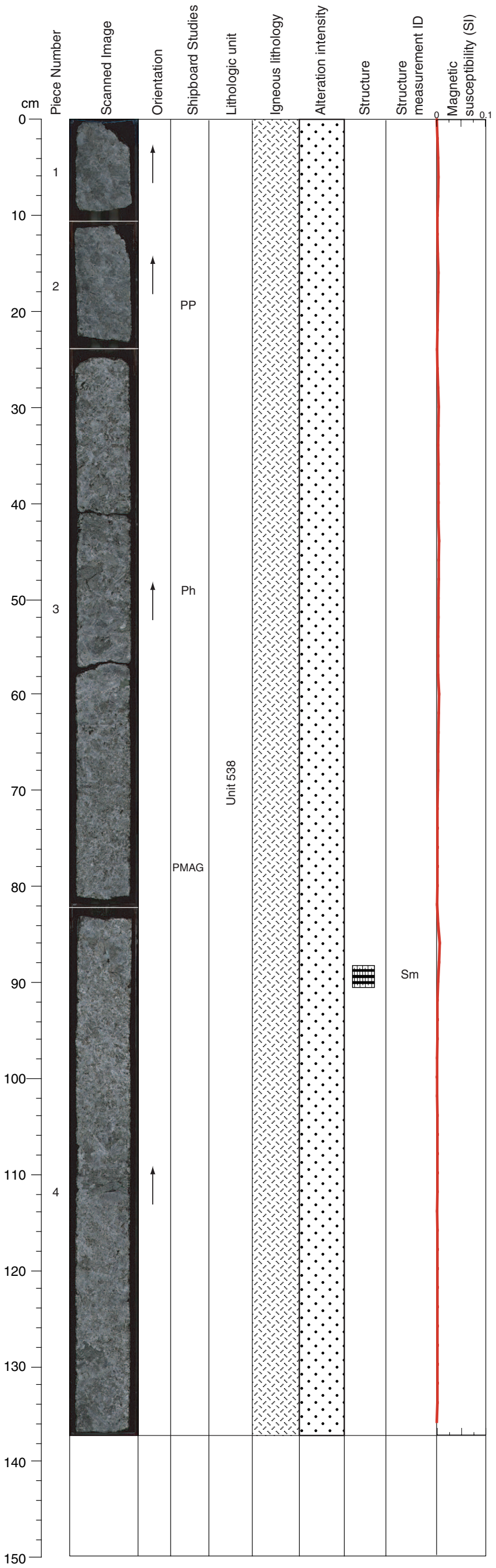
COMMENTS: Generally low alteration. Some alteration to green amphibole between 60 to 64 cm adjacent to break between Pieces 1b and 1c, and again from 86 to 91 cm adjacent to the break between Pieces 1c and 1d. There is a slightlly more altered zone with more prevalent green amphibole between 100 and 109 cm. Significant amount of sulfides.

VEIN ALTERATION: no vein

STRUCTURE: Medium- to coarse-grained gabbro showing a weak magmatic fabric (Sm) in most parts of the section.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-213R-1, 0-26 cm WET

## Core Photo




**305-U1309D-213R-2 (Section top: 1026.25 mbsf)**

UNIT-538: Gabbro
Pieces: 1-4

PRIMARY MINERALOGY: Modal data from Piece 3a

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size up to 20 mm<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size up to 50 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 538 medium- to coarse-grained gabbro. Some tabular plagioclase grains. Oblique 40 mm wide band of finer grained crysts at 97-104 cm.

SECONDARY MINERALOGY: Chlorite, pale amphibole

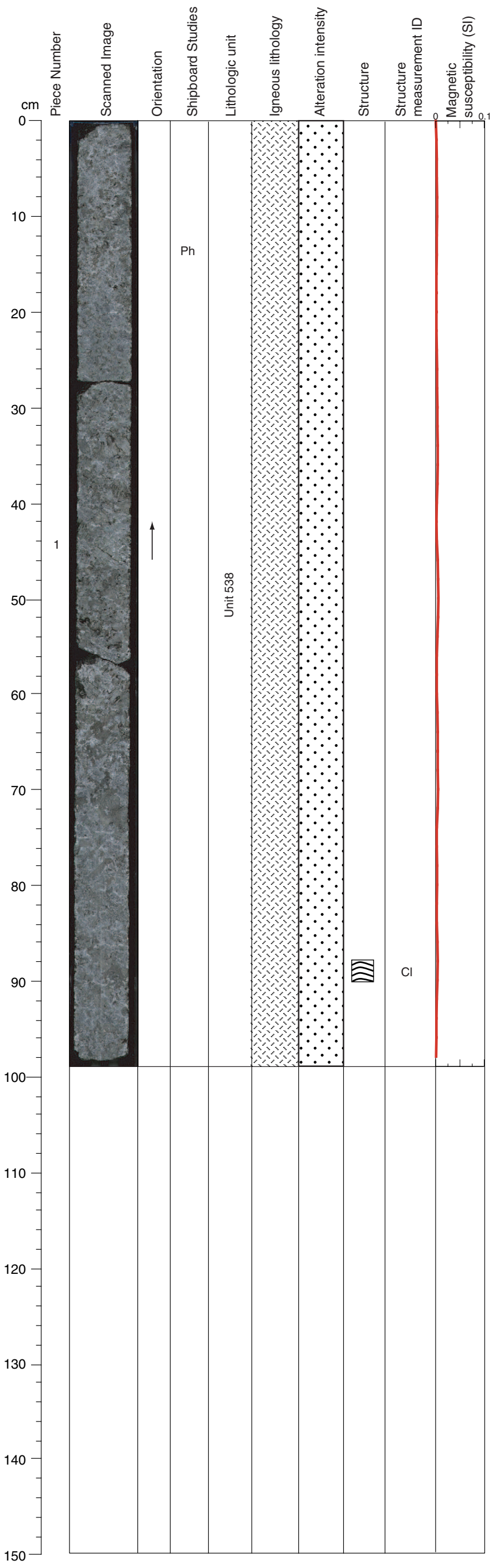
COMMENTS: Slight alteration. Some green amphibole around edges of pyroxene, some white edges on plagioclase. Significant amount of sulfides. Several white thin veinlets around the grains.

VEIN ALTERATION: Amphibole, chlorite

STRUCTURE: Medium- to coarse-grained gabbro showing locally a weak magmatic foliation (Sm) subparallel to a weak modal banding.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-213R-2, 41-57 cm WET

## Core Photo




**305-U1309D-213R-3 (Section top: 1027.63 mbsf)**

UNIT-538: Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 55%<br>Size to 30 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 538 medium- to coarse-grained gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

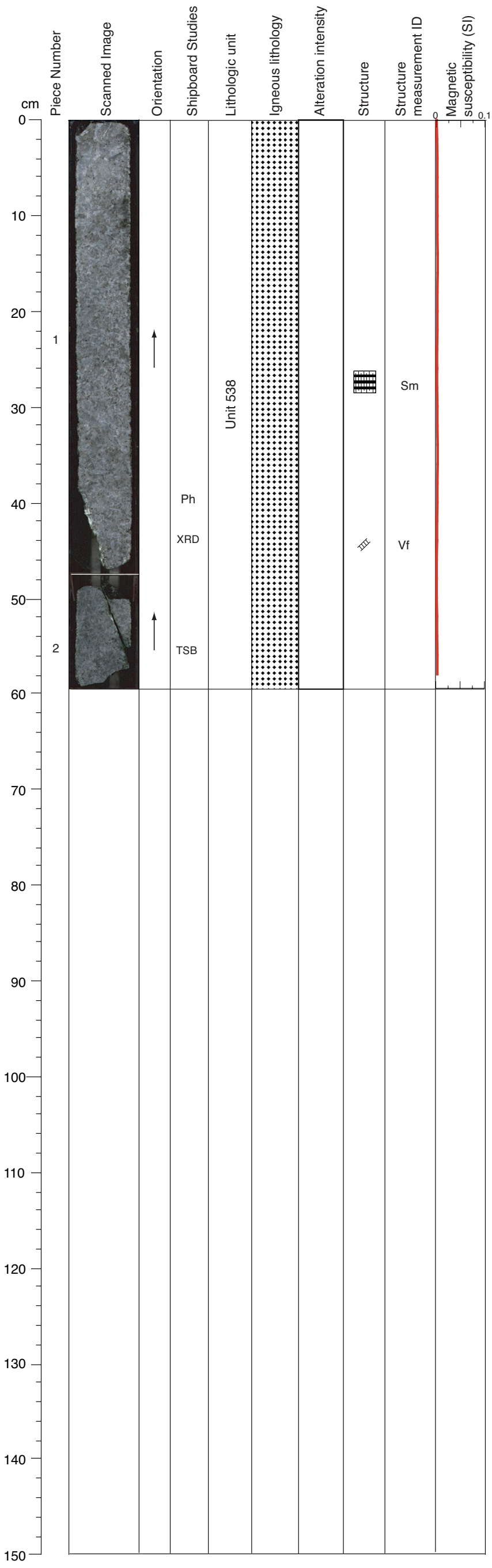
COMMENTS: Slight alteration. Some green amphibole around edges of pyroxene, some white edges on plagioclase. Several white thin veinlets around the grains. Significant amount of sulfides.

VEIN ALTERATION: Amphibole, chlorite

STRUCTURE: Medium- to coarse-grained gabbro with weak modal and grain size layering (Cl) developed but magmatic or plastic foliation not visible.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-213R-3, 0-27 cm WET

## Core Photo




**305-U1309D-213R-4 (Section top: 1028.63 mbsf)**

UNIT-538: Olivine gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1 and thin section

| | |
|---|---|
| Plagioclase | Modal 45%<br>Size 2 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 49%<br>Size up to 30 mm<br>Shape anhedral |
| Olivine | Modal 6 %<br>Size up to 8 mm<br>Shape anhedral |

COMMENTS: Continuation of Unit 538 medium- to coarse-grained gabbro. Up to 2% orthopyroxene observed in thin section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc

COMMENTS: Piece 1 shows slight alteration with some green amphibole around edges of pyroxene, some white edges on plagioclase. From about 38 cm to the end of Piece 2 a green and white vein cuts the section. There is no alteration visible adjacent to the vein and Piece 2 shows the same general background alteration as Piece 1.

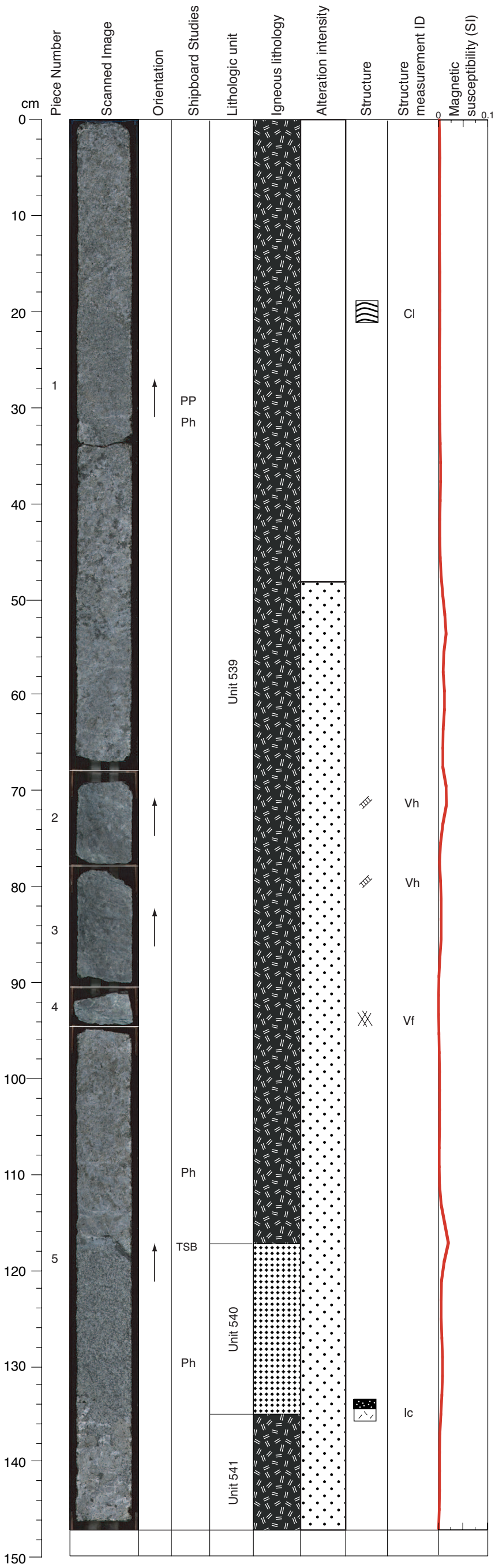
VEIN ALTERATION: Amphibole, talc, carbonate

THIN SECTIONS:
**305-U1309D-213R-4, 55-57 cm (#536)**

STRUCTURE: Medium- to coarse-grained gabbro with weak magmatic foliation developed throughout. Pale green fault vein.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-213R-4, 37-59 cm WET

## Core Photo




**305-U1309D-214R-1 (Section top: 1029.60 mbsf)**

UNIT-539: Olivine-bearing Gabbro
Pieces: 1-5

PRIMARY MINERALOGY: Modal data from Pieces 1a and 5

| | |
|---|---|
| Olivine | Modal 2%<br>Size 4 mm average<br>Shape anhedral |
| Plagioclase | Modal 68%<br>Size 5 mm average<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 28%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 539 is fine- to coarse-grained olivine-bearing gabbro. Fine-scale grain size variation between coarse-grained and fine-grained. Less olivine in fine-grained parts. Corona texture in 68-94 cm.

UNIT-540: Olivine Gabbro
Pieces: 5

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Olivine | Modal 30%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 40%<br>Size 1 mm average<br>Shape anhedral |
| Clinopyroxene | Modal 40%<br>Size 1 mm average<br>Shape anhedral |

COMMENTS: Unit 540 is fine-grained olivine gabbro. Wehrlitic. Large pyroxene grains at the lower contact (~35 mm).

UNIT-541: Olivine-bearing Gabbro
Pieces: 5

PRIMARY MINERALOGY: Modal data from Piece 5

| | |
|---|---|
| Olivine | Modal 2%<br>Size 4 mm average<br>Shape anhedral |
| Plagioclase | Modal 68%<br>Size 5 mm average<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 28%<br>Size 7 mm average<br>Shape anhedral |

COMMENTS: Unit 541 is fine- to coarse-grained olivine-bearing gabbro. Same as the upper part of this section.

SECONDARY MINERALOGY: Chlorite, pale amphibole, talc, epidote

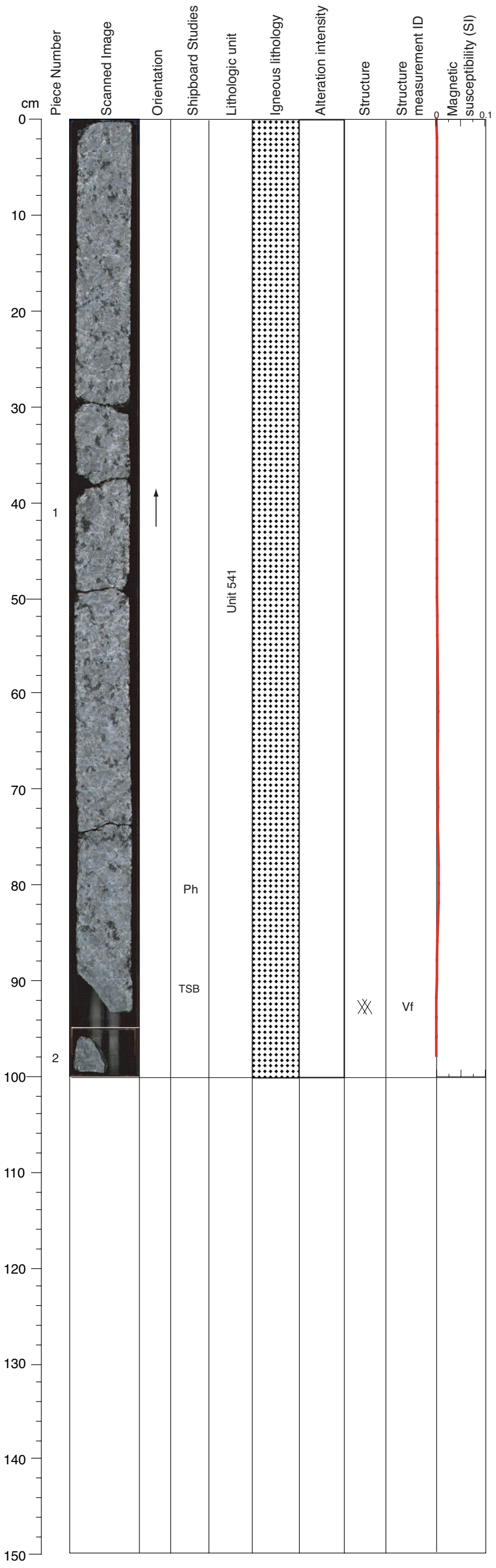
COMMENTS: Generally low alteration with some green amphibole around edges of pyroxene, and some white edges on plagioclase. There is a zone of greater alteration to green ampibole between about 54 cm to 95 cm. There is a green vein cutting (low angle) the section at 79 cm to 80 cm, and with coronas around olivine related to these veins. At the bottom of Piece 4 there is a network of green veins associated with a deformation zone about 1 cm wide. Piece 5 show serpentine vein network. The olivines are slighlty serpentinized. Significant amount of sulfides. The end of the section is made of a pegmatitic gabbro.

VEIN ALTERATION: Serpentine, amphibole, chlorite, carbonate

THIN SECTIONS:
**305-U1309D-214R-1, 116-118 cm (#537)**

STRUCTURE: Medium- to fine-grained gabbro exhibiting occasional oxides and weak magmatic foliation. Set of shallow dipping dark green vein with slight catalcasis and later subhorizontal white cracks.
305-U1309D-214R-1, 20-45 cm WET
305-U1309D-214R-1, 107-127 cm WET
305-U1309D-214R-1, 107-127 cm DRY
305-U1309D-214R-1, 127-146 cm WET
305-U1309D-214R-1, 127-146 cm DRY

## Core Photo




**305-U1309D-214R-2 (Section top: 1031.08 mbsf)**

UNIT-541: Olivine Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 10%<br>Size 4 mm average<br>Shape anhedral |
| Plagioclase | Modal 65%<br>Size 4 mm average<br>Shape subhedral |
| Clinopyroxene | Modal 25%<br>Size 8 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 541 coarse-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General alteration is low, but olivine has been serpentinized. There is a zone about 15 mm wide of higher alteration at the bottom of Piece 1e that contains several thin green veins. Piece 2 is also slightly more altered.

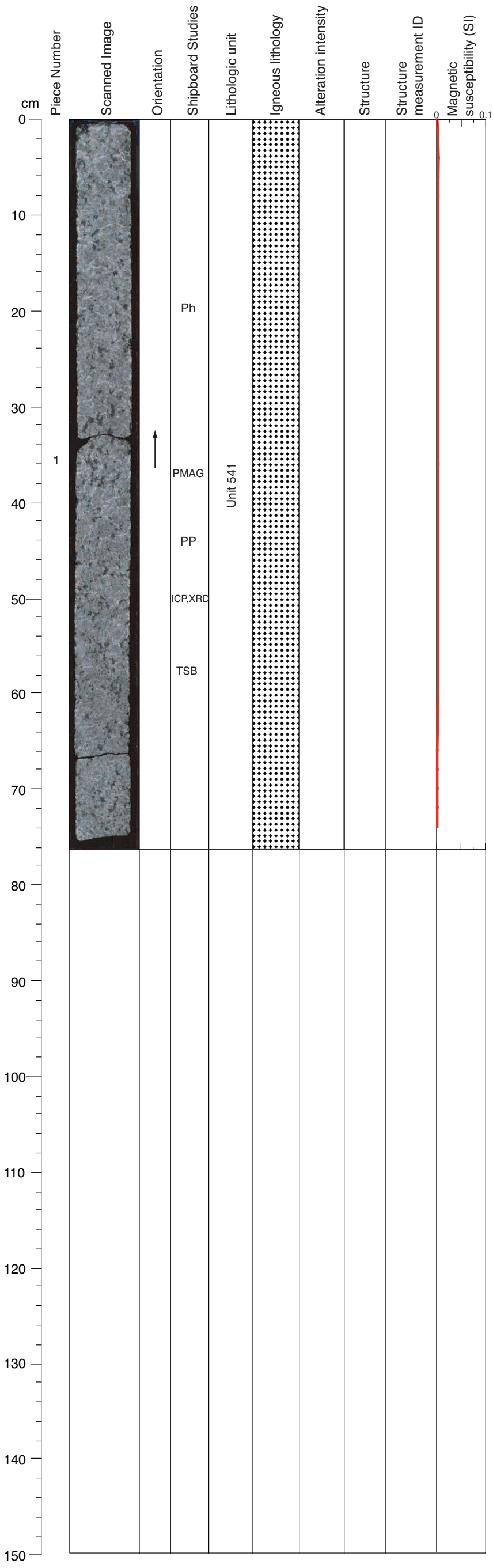
VEIN ALTERATION: Amphibole, chlorite, carbonate

THIN SECTIONS:
**305-U1309D-214R-2, 88-91 cm (#538)**

STRUCTURE: Coarse-grained olivine gabbro showing no magmatic foliation, but weak serpentinization. Set of dark green veins at 90 cm.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-214R-2, 74-93 cm WET

## Core Photo




**305-U1309D-214R-3 (Section top: 1032.08 mbsf)**

UNIT-541: Olivine Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 10%<br>Size 5 mm average<br>Shape anhedral |
| Plagioclase | Modal 60%<br>Size 5 mm average<br>Shape subhedral |
| Clinopyroxene | Modal 30%<br>Size 8 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 541 coarse-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: General alteration is low, but olivine has been serpentinized.

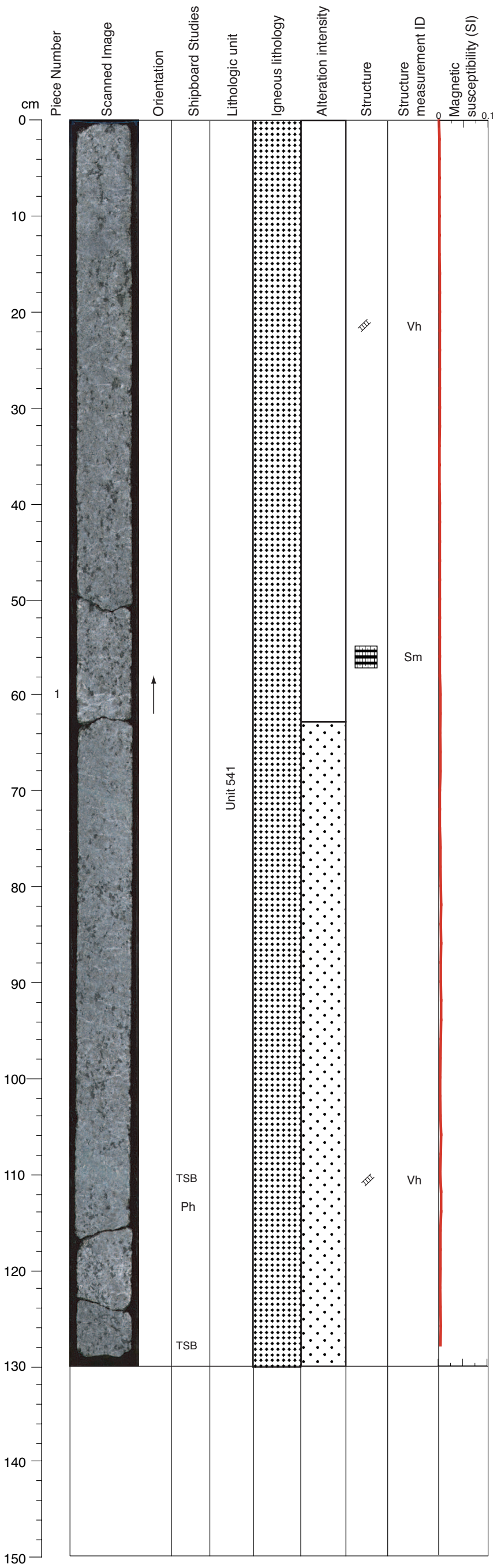
VEIN ALTERATION: no vein

THIN SECTIONS:
**305-U1309D-214R-3, 56-58 cm (#539)**

STRUCTURE: Coarse-grained olivine gabbro with serpentinized olivine showing no magmatic foliation.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-214R-3, 15-40 cm WET
305-U1309D-214R-3, 46-66 cm WET

## Core Photo




**305-U1309D-214R-4 (Section top: 1032.85 mbsf)**

UNIT-541: Olivine Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 15%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 30%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 541 coarse-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Pyroxene shows some alteration ot amphibole and olivine to serpentine, plagioclase has white patches or outlines through most of the section. Several intervals show higher alteration to green amphibole, development of corona texture, and are associated with thin green veins between 49 and 52 cm, 66 and 73 cm, and 106 to 112 cm.

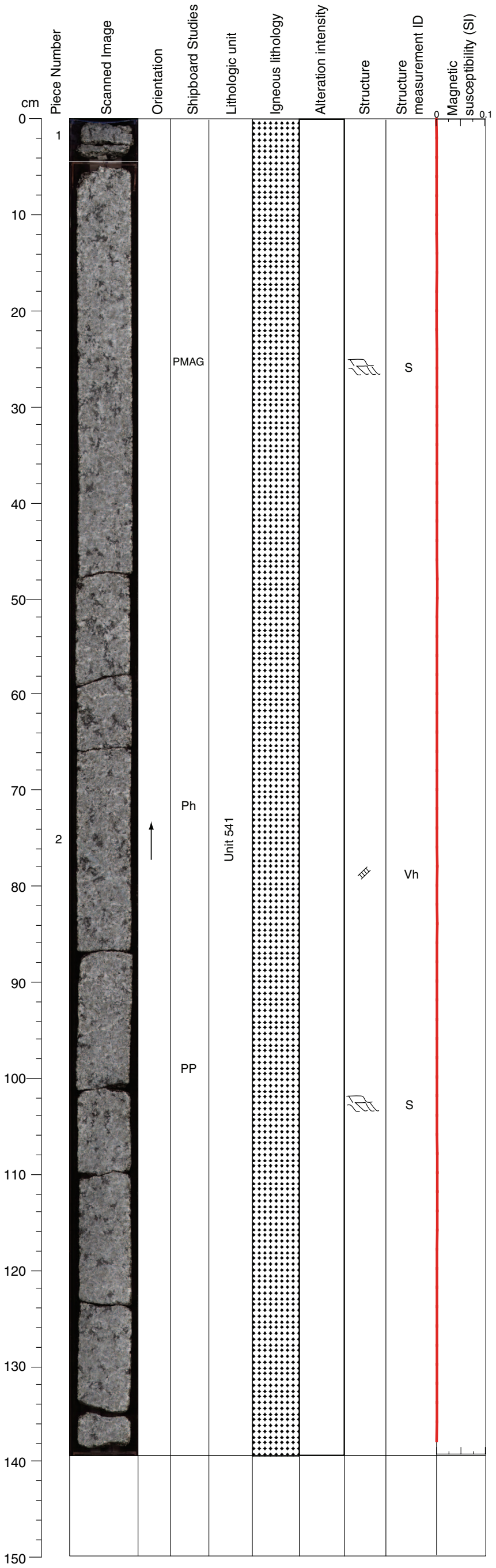
VEIN ALTERATION: Amphibole, chlorite

THIN SECTIONS:
**305-U1309D-214R-4, 109-112 cm (#540)**
**305-U1309D-214R-4, 127-129 cm (#541)**

STRUCTURE: Medium- to coarse-grained olivine gabbro with weak magmatic foliation in center of section. A dark green vein and some subhorizontal white cracks.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-214R-4, 105-130 cm WET

## Core Photo




**305-U1309D-215R-1 (Section top: 1034.40 mbsf)**

UNIT-541: Olivine Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2a

| | |
|---|---|
| Olivine | Modal 15%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 30%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 541 coarse-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

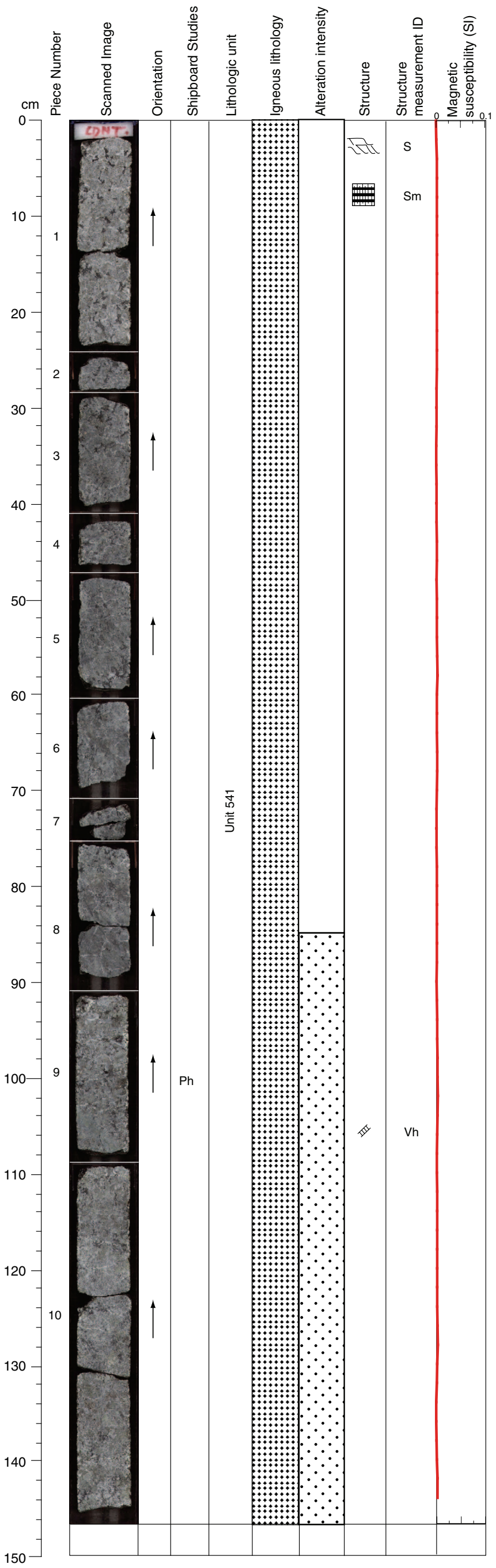
COMMENTS: General alteration is similar to the previous section with slight alteration of pyroxene to green amphibole at the edges, serpentinization of olivine, and white patches or borders on plagioclase. Several green veins cut the section between 75 and 82 cm, 108-109 cm and 112-114 cm. Significant amount of sulfides.

VEIN ALTERATION: Amphibole, chlorite

STRUCTURE: Medium- to coarse grained-olivine gabbro showing no fabric. Patchy serpentinite zones and no foliation.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-215R-1, 66-87 cm WET

## Core Photo




**305-U1309D-215R-2 (Section top: 1035.79 mbsf)**

UNIT-541: Olivine Gabbro
Pieces: 1-10

PRIMARY MINERALOGY: Modal data from Piece 1a

| | |
|---|---|
| Olivine | Modal 15%<br>Size 3 mm average<br>Shape anhedral |
| Plagioclase | Modal 55%<br>Size 4 mm average<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 30%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 541 coarse-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

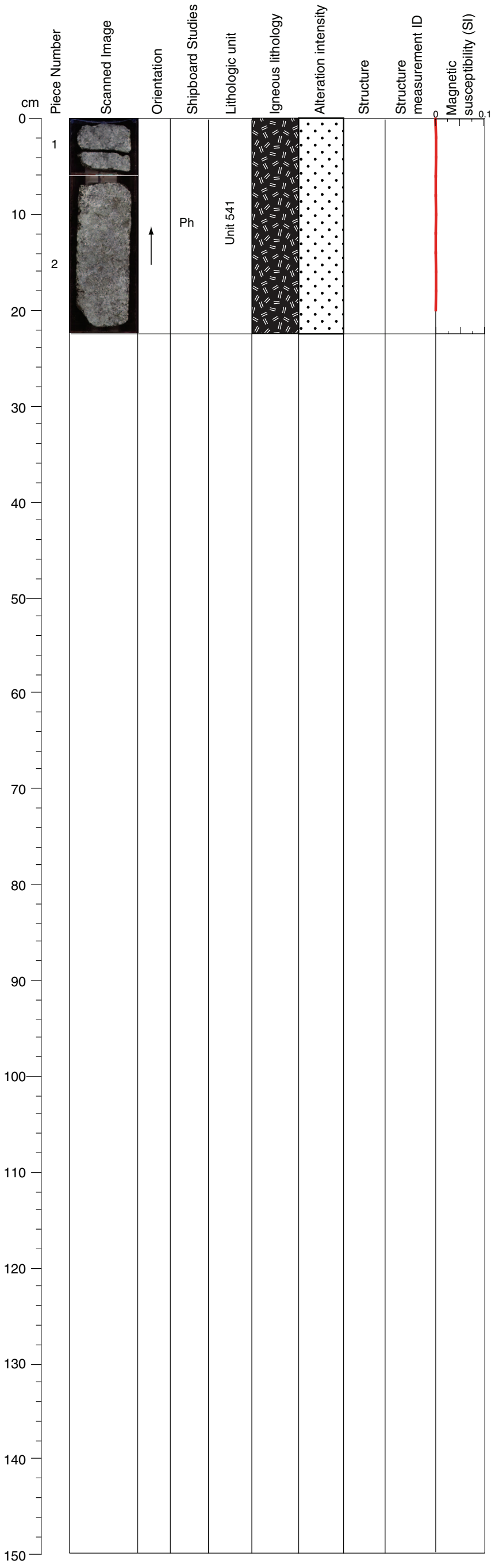
COMMENTS: General alteration is similar to previous section with some alteration of pyroxene to green ampibole, serepntinized olivine, patches of white on plagioclase or at grain boundaries (making a network of white “veins”). A green, branching vein network from 103 to 108 cm with an alteration halo about 15 mm wide (total).

VEIN ALTERATION: Amphibole, chlorite

STRUCTURE: Medium- to coarse-grained olivine gabbro exhibiting a weak magmatic foliation (Sm) at the top of the section. The olivine gabbro shows patchy, weak serpentinization with no apparent foliation.

CLOSE-UP PHOTOGRPAHS:
305-U1309D-215R-2, 91-108 cm WET

## Core Photo




**305-U1309D-215R-3 (Section top: 1037.26 mbsf)**

UNIT-541: Olivine-bearing Gabbro
Pieces: 1-2

PRIMARY MINERALOGY: Modal data from Piece 2

| | |
|---|---|
| Olivine | Modal 1%<br>Size 2 mm average<br>Shape anhedral |
| Plagioclase | Modal 64%<br>Size 4 mm average<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 35%<br>Size 10 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 541 coarse-grained olivine-bearing gabbro. Olivine content gradually decreases down core.

SECONDARY MINERALOGY: Chlorite, pale amphibole

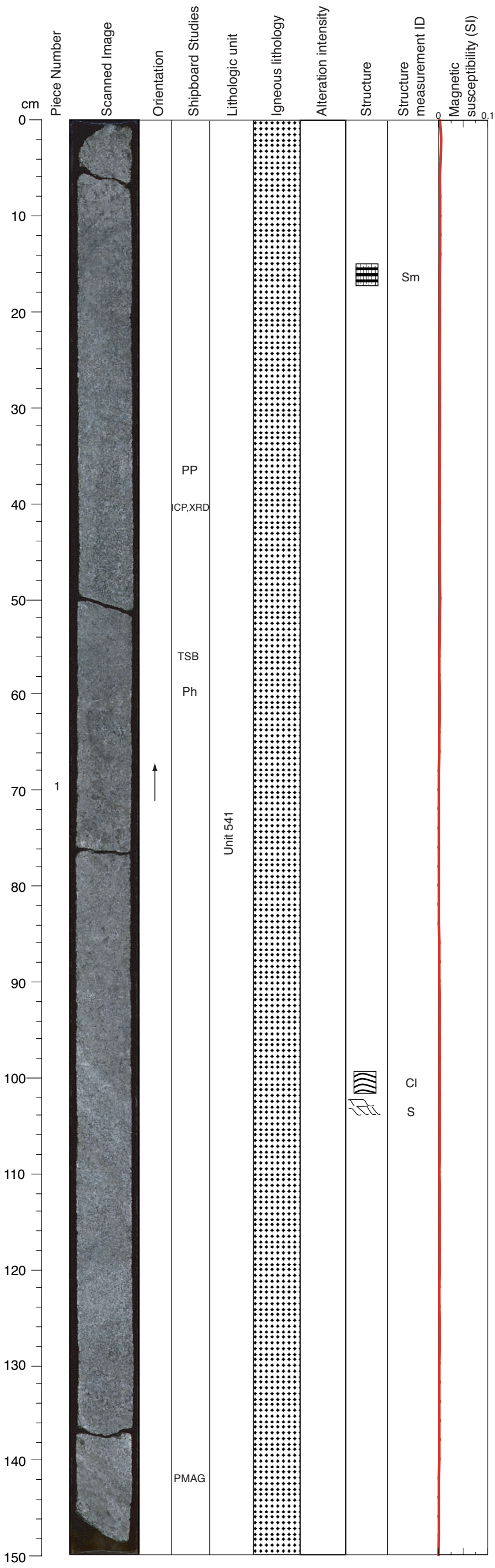
COMMENTS: Similar to previous section with some alteration of pyroxene to green amphibole, serpentinization of olivine, and white patches and lineations in plagioclase.

VEIN ALTERATION: no vein

STRUCTURE: Coarse olivine gabbro with no magmatic or plastic foliation.

CLOSE-UP PHOTOGRAPHS:
305-U1309D-215R-3, 7-21 cm WET

## Core Photo




**305-U1309D-215R-4 (Section top: 1037.48 mbsf)**

UNIT-541: Olivine Gabbro
Pieces: 1

PRIMARY MINERALOGY: Modal data from Piece 1b

| | |
|---|---|
| Olivine | Modal 20%<br>Size 1 mm average<br>Shape anhedral |
| Plagioclase | Modal 45%<br>Size 3 mm average<br>Shape subhedral to anhedral |
| Clinopyroxene | Modal 35%<br>Size 3 mm average<br>Shape anhedral |

COMMENTS: Continuation of Unit 541 fine-grained olivine gabbro.

SECONDARY MINERALOGY: Chlorite, pale amphibole

COMMENTS: Similar to previous section with some alteration of pyroxene to green amphibole, serpentinization of olivine, and white patches and lineations in plagioclase.

VEIN ALTERATION: no vein

THIN SECTIONS:
**305-U1309D-215R-4, 54-57 cm (#542)**

STRUCTURE: Rapid transition from the coarse-grained olivine gabbro of previous section to now fine-grained olivine gabbro showing a clear magmatic foliation (Sm) and modal and grain size banding (Cl). Weak serpentine foliation locally (S).

CLOSE-UP PHOTOGRAPHS:
305-U1309D-215R-4, 51-77 cm WET
305-U1309D-215R-4, 51-77 cm DRY