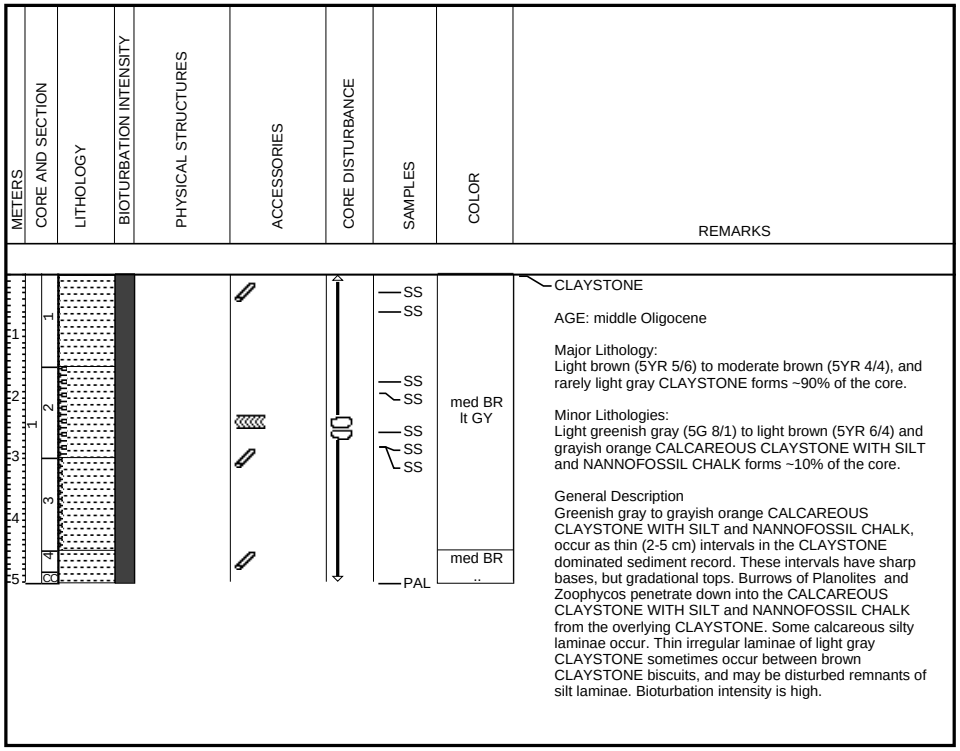
SITE 1070 HOLE A CORE 1R **CORED 599.0-608.7 mbsf**



CLAYSTONE

AGE: middle Oligocene

Major Lithology:
Light brown (5YR 5/6) to moderate brown (5YR 4/4), and rarely light gray CLAYSTONE forms ~90% of the core.

Minor Lithologies:
Light greenish gray (5G 8/1) to light brown (5YR 6/4) and grayish orange CALCAREOUS CLAYSTONE WITH SILT and NANNOFOSSIL CHALK forms ~10% of the core.

General Description
Greenish gray to grayish orange CALCAREOUS CLAYSTONE WITH SILT and NANNOFOSSIL CHALK, occur as thin (2-5 cm) intervals in the CLAYSTONE dominated sediment record. These intervals have sharp bases, but gradational tops. Burrows of Planolites and Zoophycos penetrate down into the CALCAREOUS CLAYSTONE WITH SILT and NANNOFOSSIL CHALK from the overlying CLAYSTONE. Some calcareous silty laminae occur. Thin irregular laminae of light gray CLAYSTONE sometimes occur between brown CLAYSTONE biscuits, and may be disturbed remnants of silt laminae. Bioturbation intensity is high.

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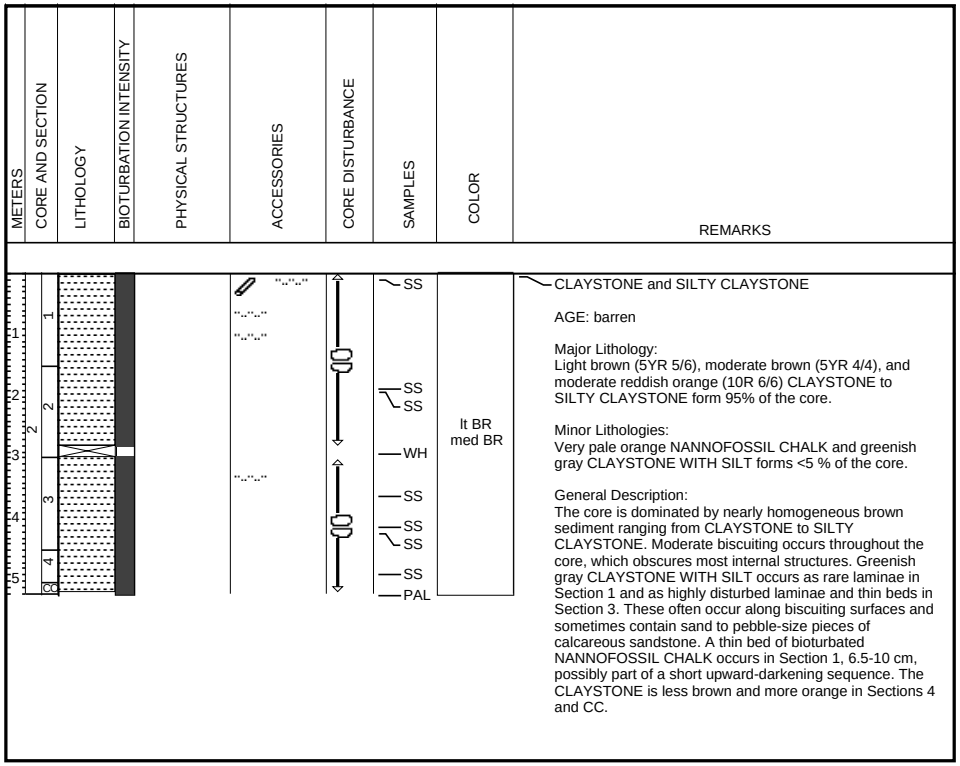
SITE 1070 HOLE A CORE 2R **CORED 608.7-618.3 mbsf**



CLAYSTONE and SILTY CLAYSTONE

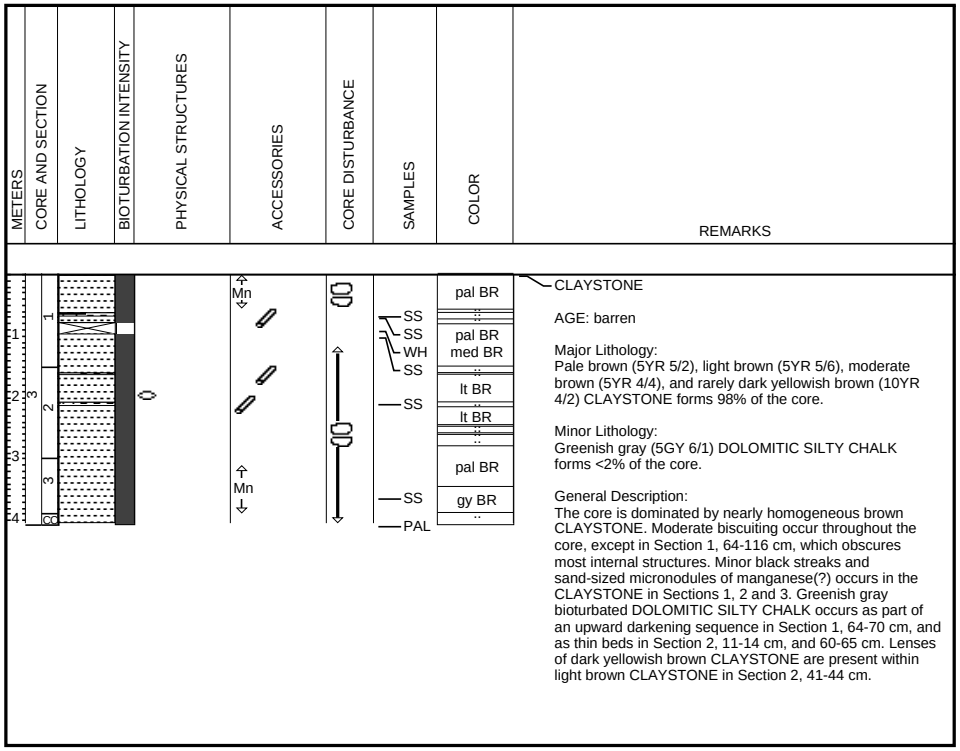
AGE: barren

Major Lithology:
Light brown (5YR 5/6), moderate brown (5YR 4/4), and moderate reddish orange (10R 6/6) CLAYSTONE to SILTY CLAYSTONE form 95% of the core.

Minor Lithologies:
Very pale orange NANNOFOSSIL CHALK and greenish gray CLAYSTONE WITH SILT forms <5 % of the core.

General Description:
The core is dominated by nearly homogeneous brown sediment ranging from CLAYSTONE to SILTY CLAYSTONE. Moderate biscuiting occurs throughout the core, which obscures most internal structures. Greenish gray CLAYSTONE WITH SILT occurs as rare laminae in Section 1 and as highly disturbed laminae and thin beds in Section 3. These often occur along biscuiting surfaces and sometimes contain sand to pebble-size pieces of calcareous sandstone. A thin bed of bioturbated NANNOFOSSIL CHALK occurs in Section 1, 6.5-10 cm, possibly part of a short upward-darkening sequence. The CLAYSTONE is less brown and more orange in Sections 4 and CC.

SITE 1070 HOLE A CORE 3R **CORED 618.3-627.9 mbsf**



CLAYSTONE

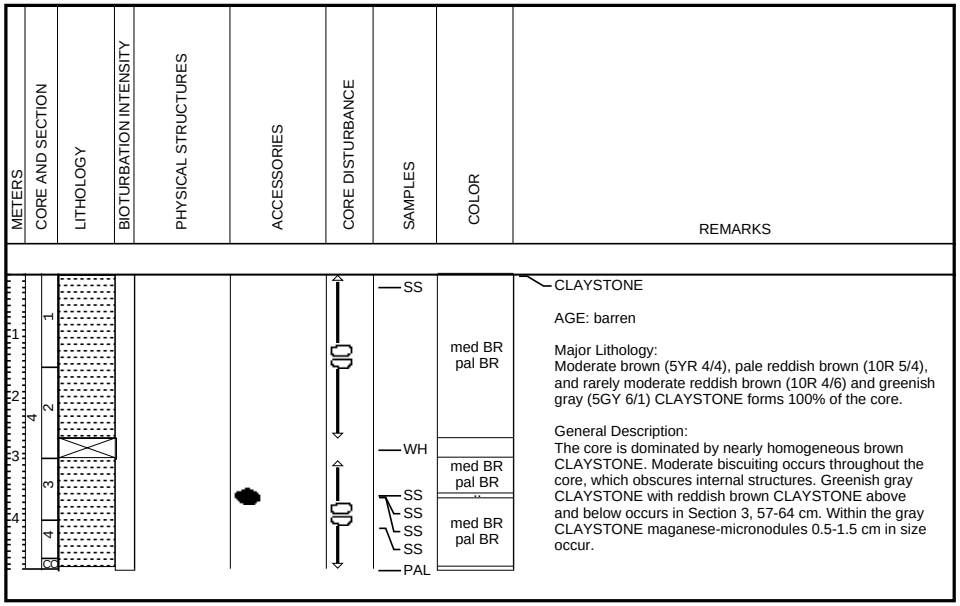
AGE: barren

Major Lithology:
Pale brown (5YR 5/2), light brown (5YR 5/6), moderate brown (5YR 4/4), and rarely dark yellowish brown (10YR 4/2) CLAYSTONE forms 98% of the core.

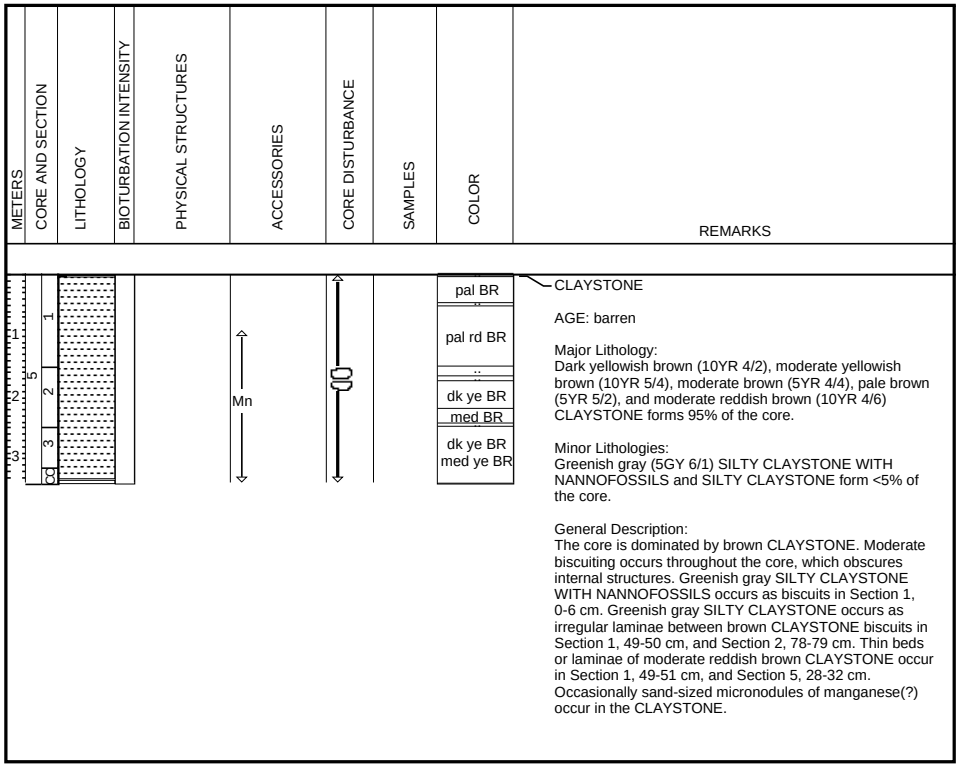
Minor Lithology:
Greenish gray (5GY 6/1) DOLOMITIC SILTY CHALK forms <2% of the core.

General Description:
The core is dominated by nearly homogeneous brown CLAYSTONE. Moderate biscuiting occur throughout the core, except in Section 1, 64-116 cm, which obscures most internal structures. Minor black streaks and sand-sized micronodules of manganese(?) occurs in the CLAYSTONE in Sections 1, 2 and 3. Greenish gray bioturbated DOLOMITIC SILTY CHALK occurs as part of an upward darkening sequence in Section 1, 64-70 cm, and as thin beds in Section 2, 11-14 cm, and 60-65 cm. Lenses of dark yellowish brown CLAYSTONE are present within light brown CLAYSTONE in Section 2, 41-44 cm.

SITE 1070 HOLE A CORE 4R **CORED 627.9-637.6 mbsf**



SITE 1070 HOLE A CORE 5R **CORED 637.6-647.2 mbsf**



CLAYSTONE

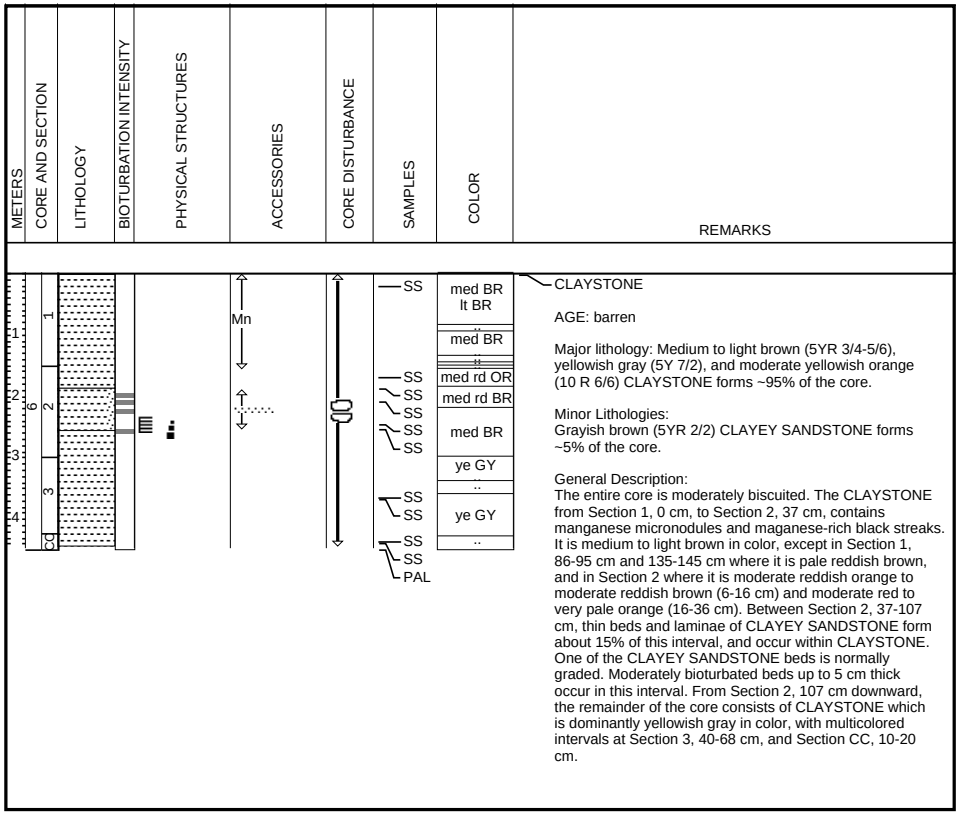
AGE: barren

Major Lithology:
Dark yellowish brown (10YR 4/2), moderate yellowish brown (10YR 5/4), moderate brown (5YR 4/4), pale brown (5YR 5/2), and moderate reddish brown (10YR 4/6) CLAYSTONE forms 95% of the core.

Minor Lithologies:
Greenish gray (5GY 6/1) SILTY CLAYSTONE WITH NANNOFOSSILS and SILTY CLAYSTONE form <5% of the core.

General Description:
The core is dominated by brown CLAYSTONE. Moderate biscuiting occurs throughout the core, which obscures internal structures. Greenish gray SILTY CLAYSTONE WITH NANNOFOSSILS occurs as biscuits in Section 1, 0-6 cm. Greenish gray SILTY CLAYSTONE occurs as irregular laminae between brown CLAYSTONE biscuits in Section 1, 49-50 cm, and Section 2, 78-79 cm. Thin beds or laminae of moderate reddish brown CLAYSTONE occur in Section 1, 49-51 cm, and Section 5, 28-32 cm. Occasionally sand-sized micronodules of manganese(?) occur in the CLAYSTONE.

SITE 1070 HOLE A CORE 6R **CORED 647.2-656.9 mbsf**



CLAYSTONE

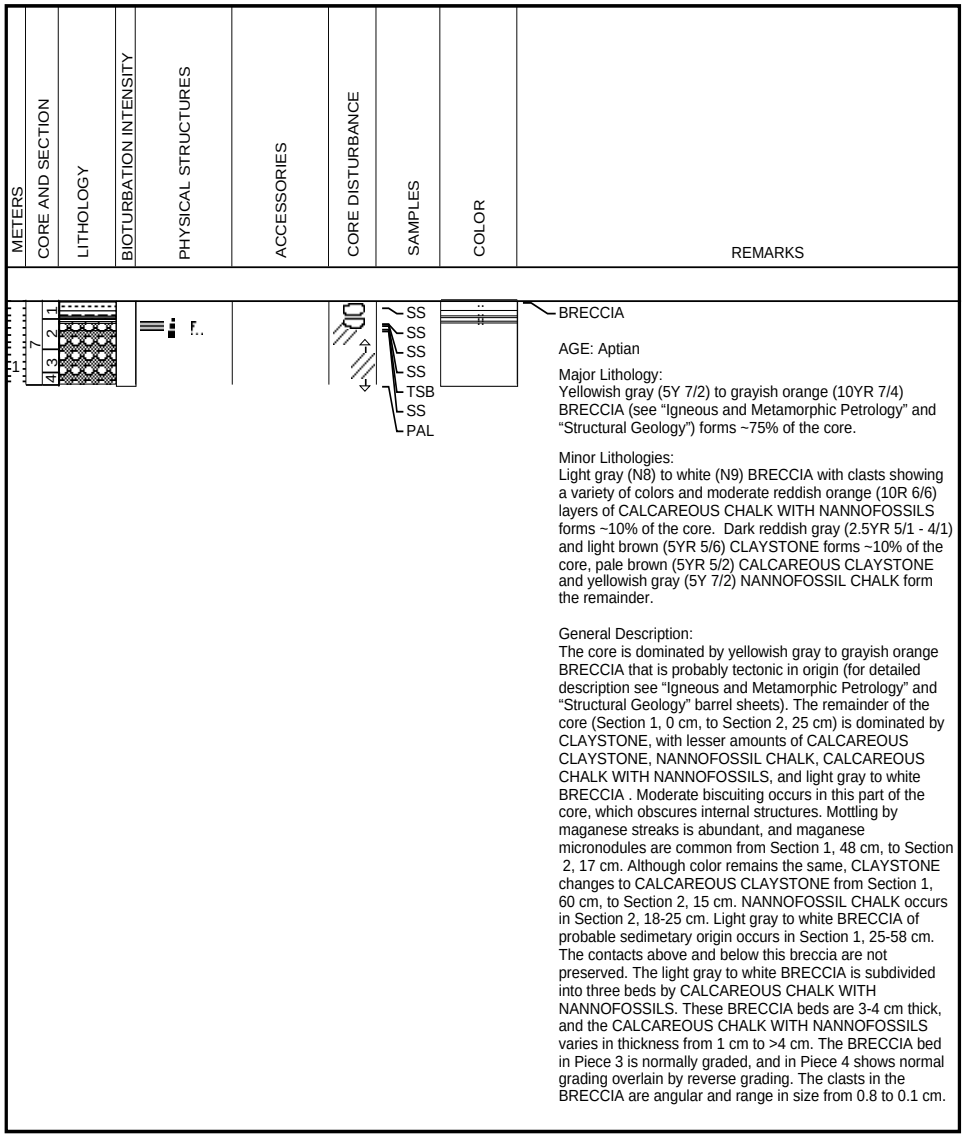
AGE: barren

Major lithology: Medium to light brown (5YR 3/4-5/6), yellowish gray (5Y 7/2), and moderate yellowish orange (10 R 6/6) CLAYSTONE forms ~95% of the core.

Minor Lithologies:
Grayish brown (5YR 2/2) CLAYEY SANDSTONE forms ~5% of the core.

General Description:
The entire core is moderately biscuited. The CLAYSTONE from Section 1, 0 cm, to Section 2, 37 cm, contains manganese micronodules and maganese-rich black streaks. It is medium to light brown in color, except in Section 1, 86-95 cm and 135-145 cm where it is pale reddish brown, and in Section 2 where it is moderate reddish orange to moderate reddish brown (6-16 cm) and moderate red to very pale orange (16-36 cm). Between Section 2, 37-107 cm, thin beds and laminae of CLAYEY SANDSTONE form about 15% of this interval, and occur within CLAYSTONE. One of the CLAYEY SANDSTONE beds is normally graded. Moderately bioturbated beds up to 5 cm thick occur in this interval. From Section 2, 107 cm downward, the remainder of the core consists of CLAYSTONE which is dominantly yellowish gray in color, with multicolored intervals at Section 3, 40-68 cm, and Section CC, 10-20 cm.

SITE 1070 HOLE A CORE 7R CORED 656.9-666.5 mbsf



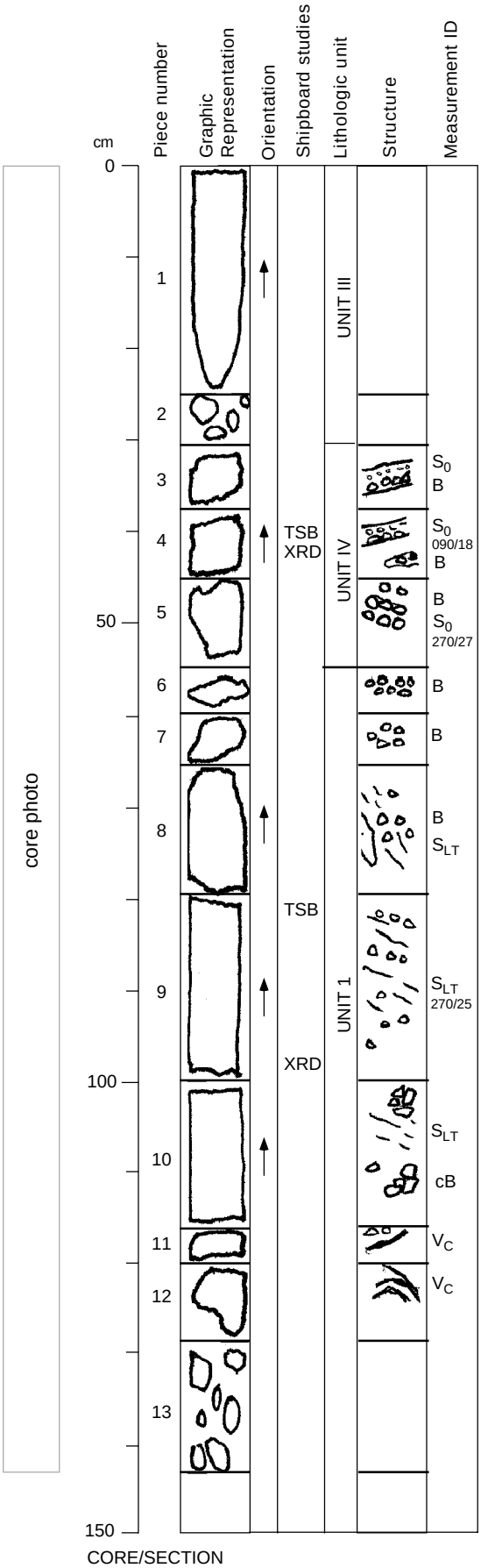
BRECCIA

AGE: Aptian

Major Lithology:
Yellowish gray (5Y 7/2) to grayish orange (10YR 7/4) BRECCIA (see "Igneous and Metamorphic Petrology" and "Structural Geology") forms ~75% of the core.

Minor Lithologies:
Light gray (N8) to white (N9) BRECCIA with clasts showing a variety of colors and moderate reddish orange (10R 6/6) layers of CALCAREOUS CHALK WITH NANNOFOSSILS forms ~10% of the core. Dark reddish gray (2.5YR 5/1 - 4/1) and light brown (5YR 5/6) CLAYSTONE forms ~10% of the core, pale brown (5YR 5/2) CALCAREOUS CLAYSTONE and yellowish gray (5Y 7/2) NANNOFOSSIL CHALK form the remainder.

General Description:
The core is dominated by yellowish gray to grayish orange BRECCIA that is probably tectonic in origin (for detailed description see "Igneous and Metamorphic Petrology" and "Structural Geology" barrel sheets). The remainder of the core (Section 1, 0 cm, to Section 2, 25 cm) is dominated by CLAYSTONE, with lesser amounts of CALCAREOUS CLAYSTONE, NANNOFOSSIL CHALK, CALCAREOUS CHALK WITH NANNOFOSSILS, and light gray to white BRECCIA . Moderate biscuiting occurs in this part of the core, which obscures internal structures. Mottling by maganese streaks is abundant, and maganese micronodules are common from Section 1, 48 cm, to Section 2, 17 cm. Although color remains the same, CLAYSTONE changes to CALCAREOUS CLAYSTONE from Section 1, 60 cm, to Section 2, 15 cm. NANNOFOSSIL CHALK occurs in Section 2, 18-25 cm. Light gray to white BRECCIA of probable sedimetary origin occurs in Section 1, 25-58 cm. The contacts above and below this breccia are not preserved. The light gray to white BRECCIA is subdivided into three beds by CALCAREOUS CHALK WITH NANNOFOSSILS. These BRECCIA beds are 3-4 cm thick, and the CALCAREOUS CHALK WITH NANNOFOSSILS varies in thickness from 1 cm to >4 cm. The BRECCIA bed in Piece 3 is normally graded, and in Piece 4 shows normal grading overlain by reverse grading. The clasts in the BRECCIA are angular and range in size from 0.8 to 0.1 cm.



173-1070A-7R-2

UNIT 1: BRECCIA

Pieces 6-13

COLOR: Matrix: mottled; very light gray (N8); dark yellowish orange (10YR 6/6). Clast: serpentinite, light bluish gray (5B 7/1) to grayish yellow green (5GY 7/2); unidentified black material, black (N1).

CLASTS: 40% of rock:

Serpentinite: 98% of clasts (size: <1 mm to 7 cm, shape: irregular to rounded)

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	90+	micro	anhedral	mesh texture
"Bastite"	<10	<10	anhedral	Replacing pyroxene
Oxides	1	<2	anhedral	

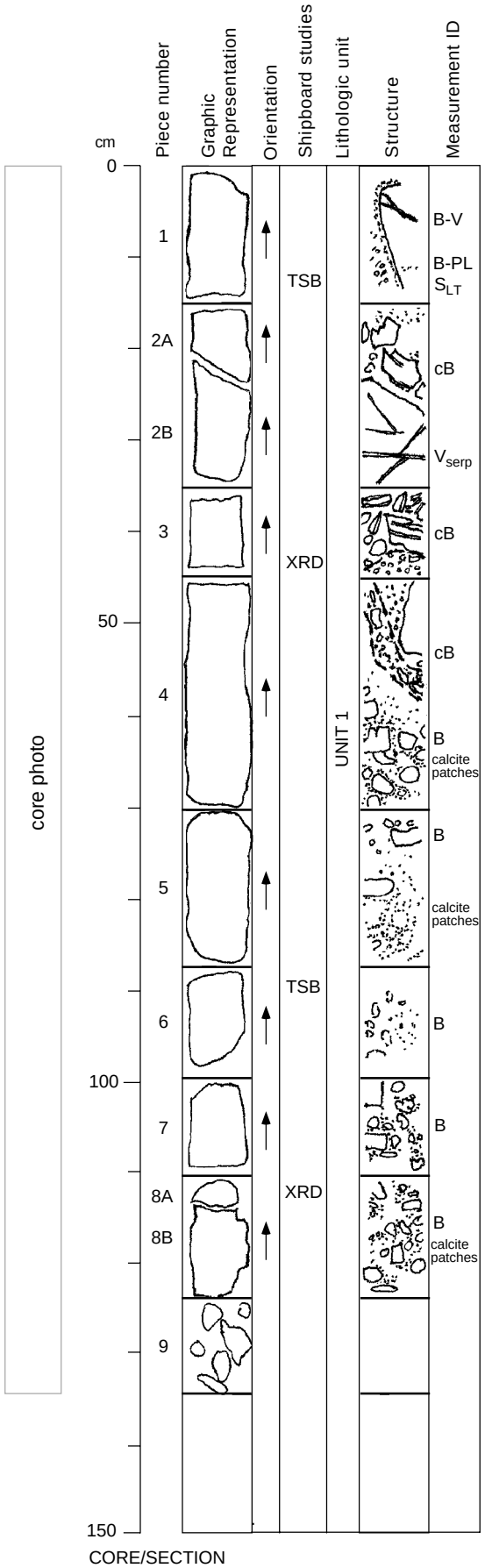
Unidentified fine-grained black material: 2% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
?	?	?	?	mineralogy unknown

MATRIX: 60% of rock: mostly calcite and micro- to cryptocrystalline Fe oxyhydroxides and millimeter to sub millimeter-sized lithic fragments.

Veins: Calcite and Fe-oxyhydroxides veins in clasts.

ADDITIONAL COMMENTS: Matrix appears composed of clay to millimeter sized material. Piece 13 shows drilling disturbance.



173-1070A-7R-3

UNIT 1: BRECCIA

Pieces 1-9

COLOR: Matrix: mottled; very light gray (N8); light brown (5YR 5/6). Clasts: serpentinite, light bluish gray (5B 7/1) grayish yellow green (5GY 7/2), dusky yellow green (5GY 5/2); unidentified black material, black (N1).

CLASTS: 50-70% of rock:

Serpentinite: 98% of clasts (size: <1 mm to 13 cm, shape: angular to rounded)

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	70-90	micro	anhedral	mesh texture, after olivine
"Bastite"	<10-30	<15	subhedral to anhedral	Replacing pyroxene, cumulate in Piece 1
Oxides	1-3	<2	subhedral to euhedral	Pseudomorphs after spinel

Unidentified fine-grained black material: 1% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Unknown	?	?	?	mineralogy unknown

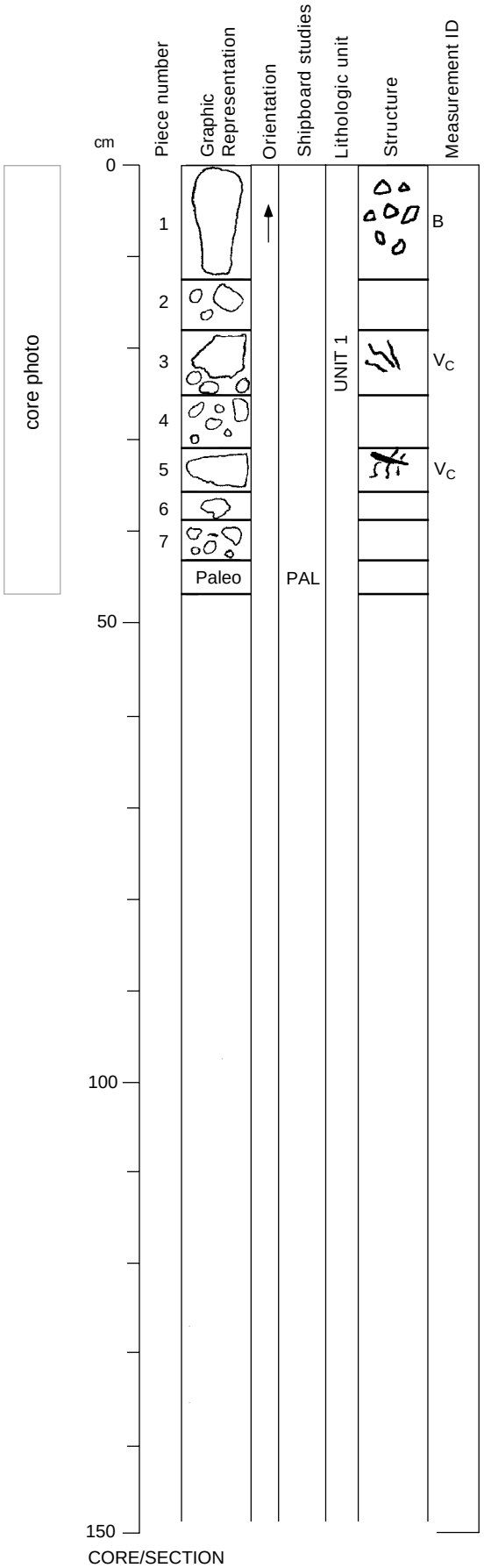
Metagabbro?: 1% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase(?)	50%	<2	anhedral	whitish material
Pyroxene/ amphibole	50%	<2	anhedral	blackish material

MATRIX: 30%-50% of rock: mostly calcite and micro- to cryptocrystalline Fe hydroxides and millimeter to sub millimeter-sized lithic fragments.

Veins: Calcite and Fe-oxyhydroxide veins in clasts. Serpentinite veins in largest serpentinite clasts.

ADDITIONAL COMMENTS: Large serpentinite clast (Piece 1) shows relict layering of pyroxene (olivine pyroxenite). A few small (<2 cm) clasts in Pieces 6 and 8 may be foliated metagabbro. Several serpentinite clasts (e.g., Piece 4, largest clast) have granular texture. Matrix appears composed of clay to mm sized material. Piece 9 shows drilling disturbance.



173-1070A-7R-4

UNIT 1: BRECCIA

Pieces 1-7

COLOR: Matrix: mottled; mostly very light gray (N8); light brown (5YR 5/6) at top. Clasts: serpentinite, light bluish gray (5B 7/1), grayish yellow green (5GY 7/2), dusky yellow green (5GY 5/2); unidentified black material, black (N1)**.**

CLASTS: 70% of rock: Size: <1 mm to 7 cm, shape: angular to rounded.

Serpentinite: 80-95% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	50-90	micro	anhedral	mesh texture, after olivine
"bastite"	<10-50	<15	subhedral to anhedral	Replacing pyroxene, cumulate in Piece 1
Oxides	<1	<1		

Unidentified fine-grained black material: 1% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
?	?	?	?	mineralogy unknown

Altered Gabbro?: 5% of clasts. Consists of heavily oxidized and/or altered reddish material with black and white mineral grains. A clast in Piece 1 contains a radiating spray of a green mineral. Some of these clasts may be oxidized serpentinite.

Gabbro?: 1% of clasts

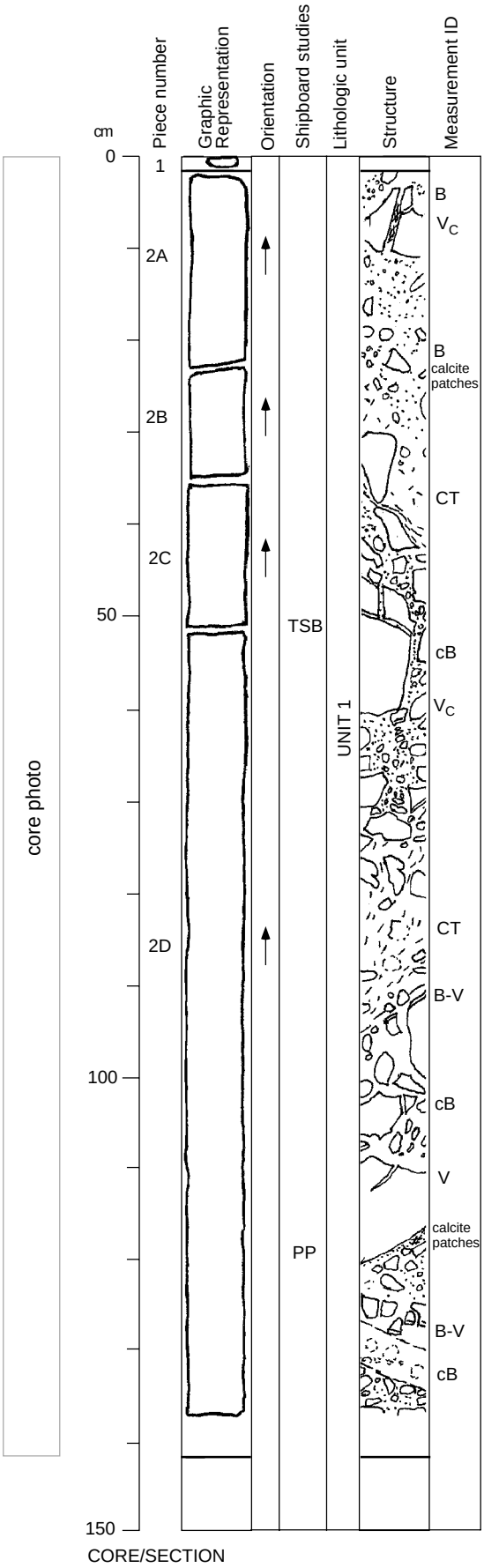
Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	50%	<10	anhedral	
Px/amph	50%	<10	anhedral	

MATRIX: 30% of rock: mostly calcite, lesser amounts of micro- to cryptocrystalline Fe-oxyhydroxides and millimeter to sub millimeter-sized lithic fragments.

Veins: Calcite and Fe-oxyhydroxide veins in clasts.

ADDITIONAL COMMENTS: Matrix/clast percentage estimates made on Piece 1. All other pieces show strong drilling disturbance. Coarse gabbro in Piece 7. Small serpentinite fragment in Piece 1 appears to contain cumulate pyroxene (now bastite). Pyroxene-rich (now bastite) part may be olivine pyroxenite (Piece 3).

173-1070A-8R-1



UNIT 1: BRECCIA

Pieces 2A-D

COLOR: Matrix: mottled; mostly very light gray (N8); some parts medium bluish gray (5B 5/1) or light brown (5YR 5/6). Clasts: oxidized serpentinite, blackish red (5R 2/2) with moderate yellowish green (10GY 6/4) interspersed patches.

CLASTS: 50-70% of rock: Size: <1 mm to 14 cm, shape: angular to rounded. Commonly brecciated in place into "jigsaw" breccias.

Serpentinite: 90-95% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	70-80	micro	anhedral	mesh texture, after olivine
"Bastite"	20-30	5-10	anhedral	bright green, replacing pyroxene
Clinopyroxene?	5-10	<5	anhedral	black mineral
Oxides	<1	<1	subhedral	

Anorthosite: 5% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	100	1-10?	anhedral?	Some appears fresh

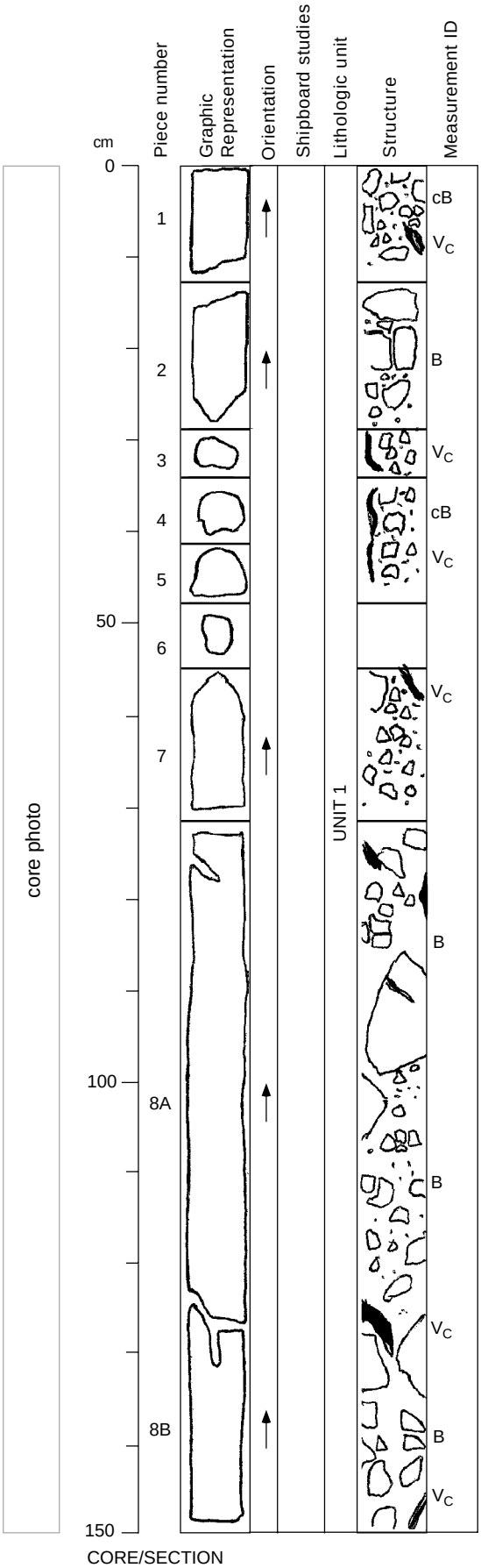
Amphibolite: 1% of clasts.

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	30	1-5	anhedral	elongate parallel to foliation
Amphibole	70	<1	anhedral	elongate parallel to foliation
Oxides	<5	1	anhedral	

MATRIX: 30-50% of rock: Mostly calcite, grades into veins and vugs, some of which contain quartz. Greenish in places due to chlorite?

Veins: Mostly calcite+/- quartz. Veins brecciate clasts and appear to then grade into calcitic matrix. Cavities and open veins lined with drusy calcite+/- quartz common.

ADDITIONAL COMMENTS: Piece 1 is a small fragment of (exotic?) greenish chalk. Amount of matrix variable and difficult to determine due to presence of occasional large clasts. Tectonic, "jigsaw" breccias locally well-developed. Difficult to determine if all brecciation is tectonic or if it is, in part, a tectonized sedimentary breccia. Native copper noted in whitish (anorthosite?) clasts at 130 cm.



173-1070A-8R-2

UNIT 1: BRECCIA

Pieces 1-8

COLOR: Matrix: mottled; mostly very light gray (N8); some parts medium bluish gray (5B 5/1) or light brown (5YR 5/6). Clasts: oxidized serpentinite, blackish red (5R 2/2) with moderate yellowish green (10GY 6/4) interspersed patches. Meta-gabbros and/or amphibolites black (N1) and white (N9).

CLASTS: Pieces 1,2,7,8 50-70% of rock: Size: <1 mm to 15 cm, shape: angular to rounded. Commonly brecciated in places into "jigsaw" breccias.

Serpentinite: 95% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	70-80	micro	anhedral	mesh texture, after olivine
"Bastite"	20-30	5-10	anhedral	bright green, replacing pyroxene
Clinopyroxene(?)	5-10	<5	anhedral	black mineral
Oxides	<1	<1	subhedral	

Anorthosite: 5% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	100	1-10?	anhedral(?)	Some appears fresh

CLASTS: Pieces 3,4,5,6 50-70% of rock: Size: <1 mm to 4 cm, shape: angular to rounded.

Coarse-grained gabbro: 60% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	50	1-10	anhedral	texture appears igneous
Amph/px	50	1-10	anhedral to anhedral	may be pyroxene rimmed by amphibole.

Metagabbro: 20% of clasts

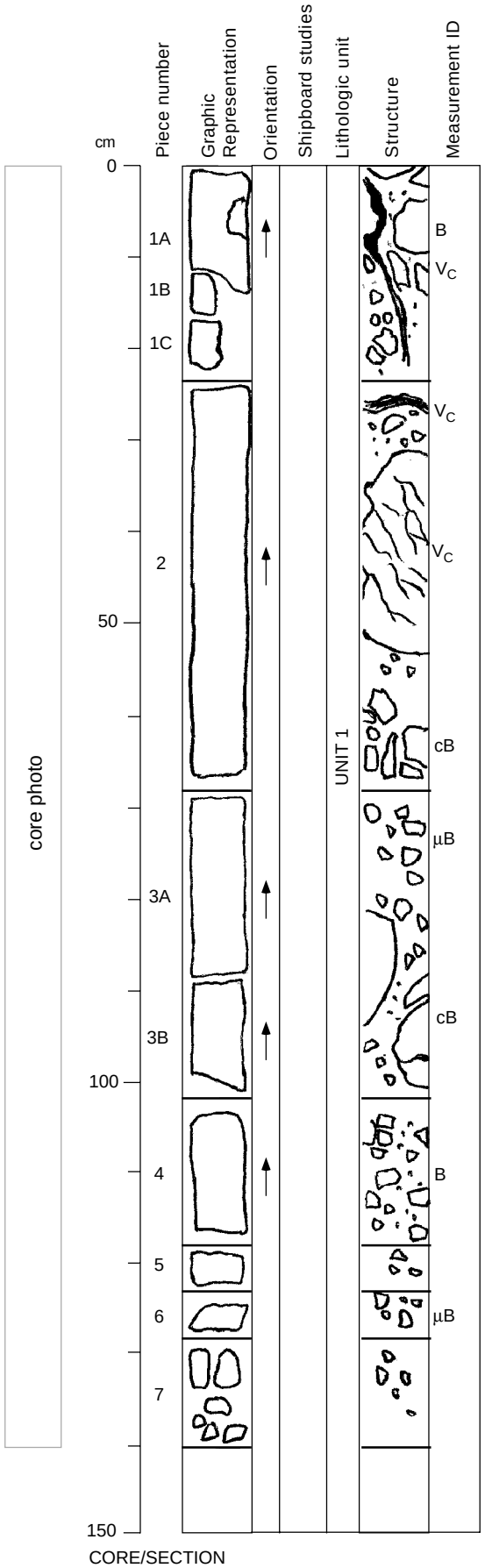
Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	70	1-5	anhedral	elongate parallel to foliation
Amph/px	30	1-5	anhedral	elongate parallel to foliation

Serpentinite: 20% of clasts. Mineralogy as in Pieces 1,2,7,8

MATRIX: 30-50% of rock: Mostly calcite, grades into veins and vugs, some of which contain quartz.

Veins: Mostly calcite+/- quartz. Veins brecciate clasts and appear to then grade into calcitic matrix. Cavities and open veins lined with drusy calcite+/- quartz common.

ADDITIONAL COMMENTS: Amount of matrix variable and difficult to determine due to presence of occasional large clasts. Tectonic, "jigsaw" breccias locally well developed. Difficult to determine if all brecciation is tectonic or if it is, in part, a tectonized sedimentary breccia.



173-1070A-8R-3

UNIT 1: BRECCIA

Pieces 1-7

COLOR: Matrix: mottled; mostly very light gray (N8); some parts medium bluish gray (5B 5/1) or light brown (5YR 5/6). Clasts: oxidized serpentinite, blackish red (5R 2/2) with moderate yellowish green (10GY 6/4) interspersed patches. Patches become oxidized, moderate brown (5YR 4/4) towards bottom of section.

CLASTS: 50-70% of rock: Size: <1 mm to 20 cm, shape: mostly rounded. Locally brecciated in place into angular "jigsaw" breccias.

Serpentinite: 95% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	70-80	micro	anhedral	mesh texture, after olivine
"Bastite"	20-30	5-10	anhedral	bright green, replacing pyroxene
Clinopyroxene?	5-10	<5	anhedral	black mineral
Oxides	<1	<1	subhedral	

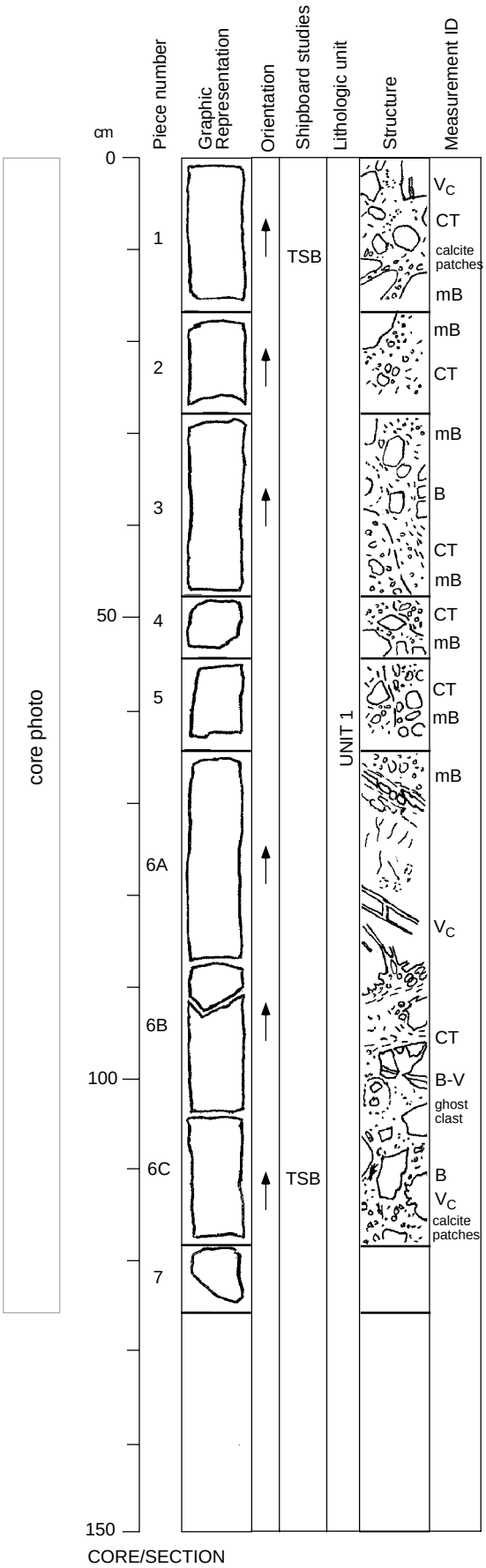
Anorthosite: 5% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	100	1-10?	anhedral(?)	Some appears fresh

MATRIX: 30-50% of rock: Mostly calcite, grades into veins and vugs, some of which contain quartz.

Veins: Mostly calcite+/- quartz. Veins brecciate clasts and appear to grade into calcitic matrix. Cavities and open veins lined with drusy calcite+/- quartz common.

ADDITIONAL COMMENTS: Amount of matrix variable and difficult to determine due to presence of occasional large clasts. Tectonic, "jigsaw" breccias locally well developed. Difficult to determine if all brecciation is tectonic or if it is, in part, a tectonized sedimentary breccia.



173-1070A-8R-4

UNIT 1: BRECCIA

Pieces 1-7

COLOR: Matrix: mottled; mostly very light gray (N8); some parts medium bluish gray (5B 5/1) or light brown (5YR 5/6). Clasts: oxidized serpentinite, blackish red (5R 2/2) with moderate yellowish green (10GY 6/4) to moderate brown (5YR 4/4) interspersed patches.

CLASTS: 50-70% of rock: Size: <1 mm to 20 cm, shape: mostly rounded. Locally brecciated in place into angular "jigsaw" breccias.

Serpentinite: 70% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	70-80	micro	anhedral	mesh texture, after olivine
"Bastite"	20-30	5-10	anhedral	bright green, replacing pyroxene
Clinopyroxene?	5-10	<5	anhedral	black mineral
Oxides	<1	<1	subhedral	

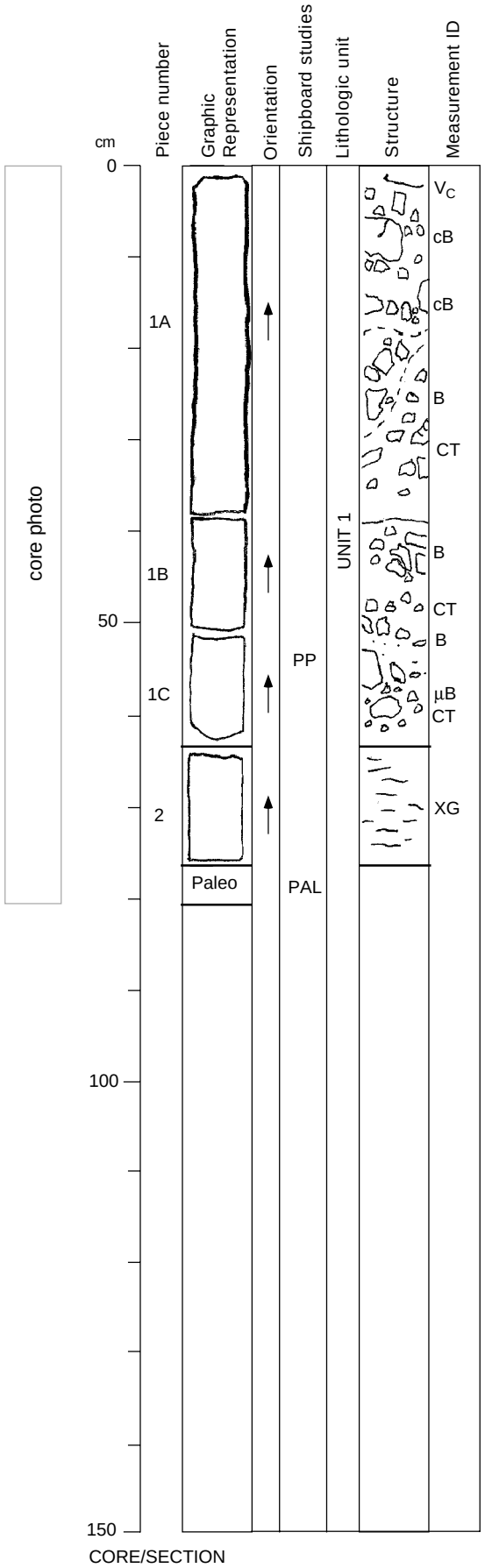
Anorthosite: 30% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Plagioclase	100	1-10?	anhedral?	Some appears fresh

MATRIX: 30-50% of rock: Mostly calcite, locally to rarely grades into veins and vugs, some of which may contain quartz. More streaked appearance than previous section, with diffuse Fe-oxyhydroxide streaks common (e.g. Piece 3).

Veins: Mostly calcite+/- quartz veins brecciating clasts. Some drusy veins and cavities, but these are less common than in previous sections.

ADDITIONAL COMMENTS: Amount of matrix variable and difficult to determine due to presence of occasional large clasts. Anorthosite clasts most common in top of section. Large serpentinite clast in Piece 6a extensively veined with Fe-oxyhydroxides. Drusy veins and cavities and jigsaw breccias less common than in previous sections.



173-1070A-8R-5

UNIT 1: BRECCIA/CATACLASITE

Pieces 1-2

COLOR: Matrix: mottled; mostly very light gray (N8), light brown (5YR 5/6). Locally grayish red (5R 4/2). Becomes grayish-green (10GY 5/2) at base. Clasts: serpentinite, dusky green (5G 3/2) blackish red (5R 2/2) with moderate yellowish green (10GY 6/4) to moderate brown (5YR 4/4) interspersed patches.

CLASTS: 60% of rock: Size: <1 mm to cm, shape: rounded to angular. Locally brecciated in place into angular "jigsaw" breccias. Rounded clasts at base cataclastic? Serpentinites become distinctly green towards base.

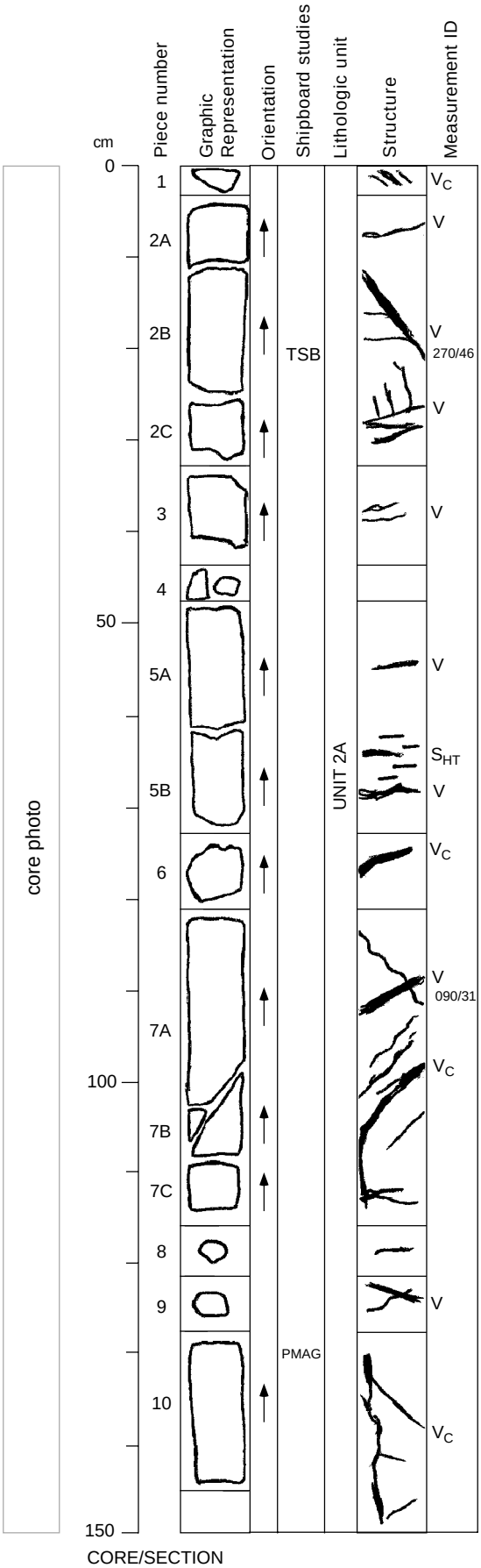
Serpentinite: 100% of clasts

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	70-80	micro	anhedral	mesh texture, after olivine
"Bastite"	20-30	5-10	anhedral	bright green, replacing pyroxene
Clinopyroxene?	5-10	<5	anhedral	black mineral
Oxides	<1	<1	subhedral	

MATRIX: 40% of rock: Mostly calcite, matrix becomes very greenish at base of section.

Veins: Mostly calcite veins brecciating clasts.

ADDITIONAL COMMENTS: Serpentinite clasts become distinctly greenish towards base of section. Drusy cavities/veins rare at top of section, absent at bottom. Drilling disturbance in Piece 2.



173-1070A-9R-1

UNIT 2A: COARSE-GRAINED (PEGMATITIC) GABBRO

Pieces 1-10

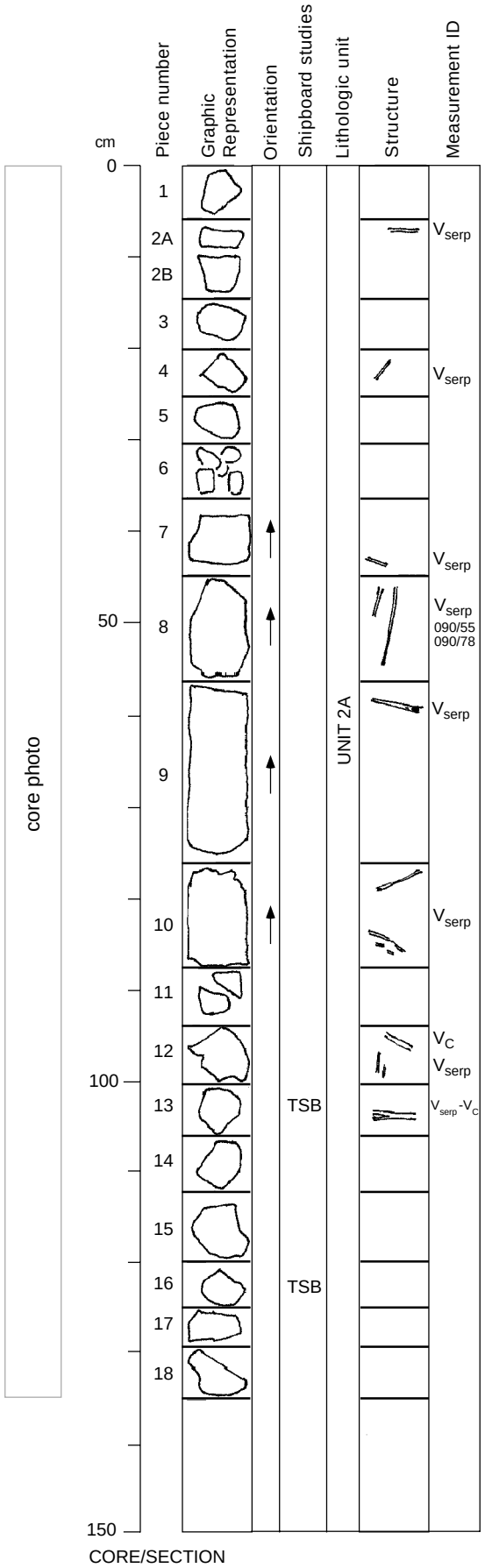
COLOR: Fresh plagioclase, medium dark gray(N4); altered plagioclase, white N9 and pale green (10G 6/2); amphibole, blackish red (5R 2/2) to black (N1); pyroxene, light brownish gray (5YR 6/1); oxides, black (N1).
IGNEOUS STRUCTURES: Very large, subhedral plagioclase with interstitial amphibole. Amphibole locally seen to mantle pyroxene.
METAMORPHIC STRUCTURES: Local veining and minor brecciation by calcite veins. Locally strong deformation may be late magmatic.

MINERALOGY:

Mineral	Mode (%)	Orig. Size (mm)	Shape	Comments
Plagioclase	70	5-70	subhedral	most tabular to equant, grains 2 cm or larger. Greenish alteration rims.
Amphibole	25	up to 40	anhedral	interstitial to plagioclase, locally replaces pyroxene.
Black on				broken surface, brownish on cut surface.
Pyroxene	5	10-30	anhedral	relict grains surrounded by amphibole
Oxides	1-2	1-2	anhedral	occurs in interstitial polycrystalline aggregates
Alteration	5-40	<10	anhedral	greenish rims on plagioclase. Probably chlorite/sericite.

VEINS: <5% of rock. Calcite, chlorite, serpentine(?).
Comments: Calcite veining causes local, weak brecciation. Greenish chloritic/serpentine veins associated with greenish alteration in plagioclase.

ADDITIONAL COMMENTS: Very coarse rock, probably pegmatitic. Amphibole seems fresh. Fresh plagioclase apparently preserved in cores of altered crystals. Involvement of apparently fresh amphibole and plagioclase in deformation zones (e.g. Pieces 3 and 5) suggests high-T deformation. Piece 1 very strongly deformed and altered and may be part of the overlying breccia unit.



173-1070A-9R-2

UNIT 2A: COARSE-GRAINED (PEGMATITIC) GABBRO

Pieces 1-18

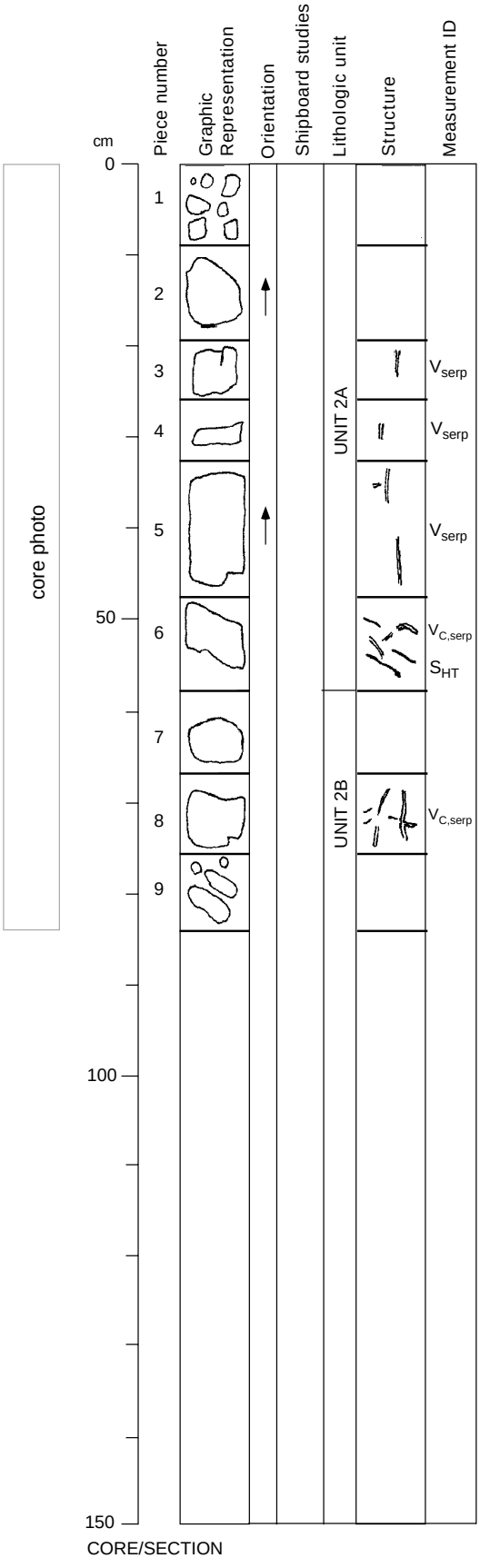
COLOR: Fresh plagioclase, medium dark gray(N4); altered plagioclase, white (N9) and pale green (10G 6/2); amphibole/orthopyroxene?, blackish red (5R 2/2) to black (N1); pyroxene, light brownish gray (5YR 6/1); oxides, black (N1).
IGNEOUS STRUCTURES: Very large, subhedral plagioclase with interstitial amphibole. Amphibole locally seen to mantle pyroxene. Plagioclase and pyroxene in Piece 9 have hypidomorphic texture with interstitial amphibole.
METAMORPHIC STRUCTURES: Local veining. Locally strong plastic? deformation may be late magmatic.

MINERALOGY:

Mineral	Mode (%)	Orig. Size (mm)	Shape	Comments
Plag**io**clase	40-70	5-70	subhedral	most tabular to equant, grains 2 cm or larger. Greenish alteration rims.
Amphibole/ orthopyroxene?	10-25	up to 40	anhedral	interstitial to plagioclase, locally replaces pyroxene. Black on broken surface, brownish on cut surface, may be orthopyroxene.
Pyroxene	5-50	10-30	anhedral	relict grains surrounded by amphibole. Abundant in Pieces 9,10
Oxides	1-2	1-2	anhedral	occurs in interstitial polycrystalline aggregates
Alteration	5-40	<10	anhedral	greenish rims on plagioclase. Probably chlorite/sericite.

VEINS: <5% of rock. Calcite, chlorite, serpentine(?).
Comments.Veins sparse in much of section. Greenish chloritic/serpentine veins associated with greenish alteration in plagioclase.

ADDITIONAL COMMENTS: Very coarse rock, probably pegmatitic. Amphibole seems fresh. Fresh plagioclase commonly preserved. Pieces 9-10 very fresh, with little alteration of plagioclase and abundant pyroxene.



173-1070A-9R-3

UNIT 2A: COARSE-GRAINED (PEGMATITIC) GABBRO

Pieces 1-6

COLOR: Fresh plagioclase, medium dark gray(N4); altered plagioclase, white (N9) and pale green (10G 6/2); amphibole/orthopyroxene?, blackish red (5R 2/2) to black (N1); pyroxene, light brownish gray (5YR 6/1); oxides, black (N1).
IGNEOUS STRUCTURES: Very large, subhedral plagioclase with interstitial amphibole. Amphibole locally seen to mantle pyroxene.
METAMORPHIC STRUCTURES: Local veining. Locally strong plastic? deformation may be late magmatic.

MINERALOGY:

Mineral	Mode (%)	Orig. Size (mm)	Shape	Comments
Plagioclase	70	5-120	subhedral	most tabular to equant, grains 2 cm or larger. Greenish alteration rims.
Amphibole/ orthopyroxene(?)	25	up to 40	anhedral	interstitial to plagioclase, locally replaces pyroxene. Black on broken surface, brownish on cut surface, may be orthopyroxene.
pyroxene	5	10-30	anhedral	relict grains surrounded by amphibole.
Oxides	1-2	1-2	anhedral	occurs in interstitial polycrystalline aggregates
Alteration product	5-40	<10	anhedral	greenish rims on plagioclase. Probably chlorite/sericite.

VEINS: <5% of rock. Calcite, chlorite, serpentine(?).
Comments.Veins sparse in much of section. Greenish chloritic/serpentine veins associated with greenish alteration in plagioclase.

ADDITIONAL COMMENTS: Very coarse rock, probably pegmatitic. Amphibole seems fresh. Fresh plagioclase commonly preserved. Subhedral plagioclase locally to 12 cm.

UNIT: 2B: SERPENTINIZED PERIDOTITE

Pieces 7-9

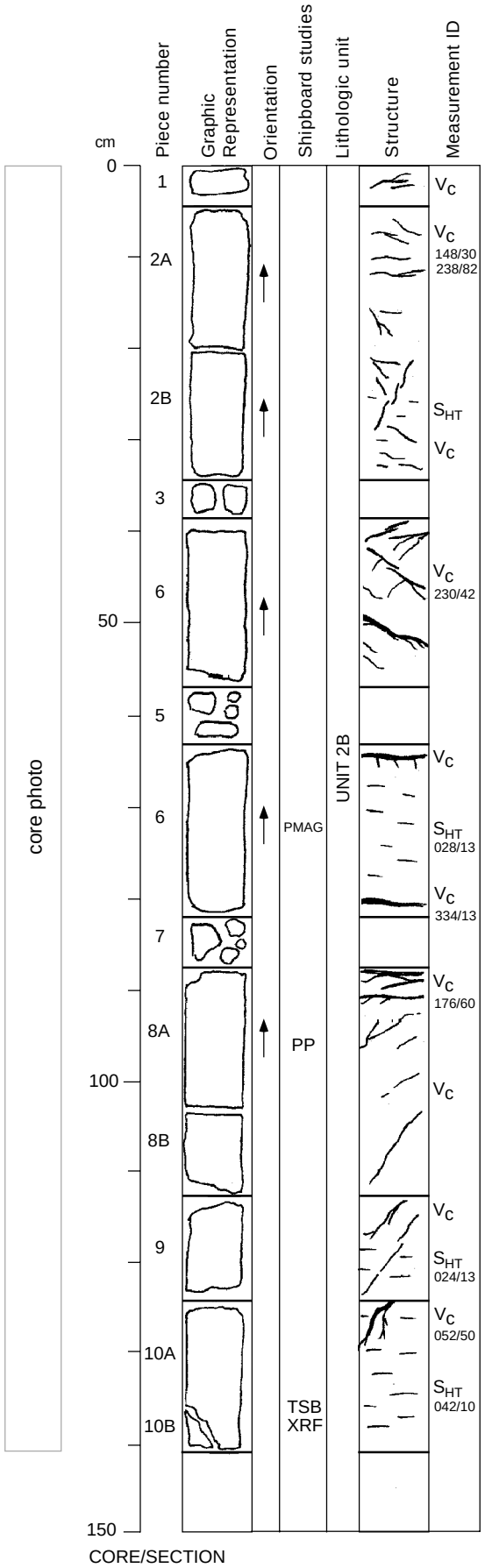
COLOR: Serpentine, dark gray (N3); and bastite, yellowish gray (5Y7/2).
IGNEOUS STRUCTURES: Discordant contact in Piece 8 between peridotite and gabbro (pyroxene, plagioclase, amphibole) similar to Pieces 1-6 in this section. Preferential crystallization of pyroxene in gabbro along the contact. Plagioclase is altered.
METAMORPHIC STRUCTURES: Weak foliation

MINERALOGY:

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	85-95	-	-	Pseudomorphs after olivine
Bastite	5-15	1-5	anhedral	Pseudomorphs after pyroxene
Chlorite	<1	<1	anhedral	Pseudomorphs after plagioclase
Spinel	<1	<<1	anhedral	

VEINS: 5 % (of rock).
Comments: Calcite veins (0.2-1 mm). Calcite vein in Piece 8 cuts gabbro serpentinized peridotite contact.

ADDITIONAL COMMENTS: Chlorite rims around spinel. Abundance of pseudomorphs of pyroxene is variable from 5 to 15%.



173-1070A-10R-1

UNIT 2B: Serpentinized peridotite

Pieces 1-10

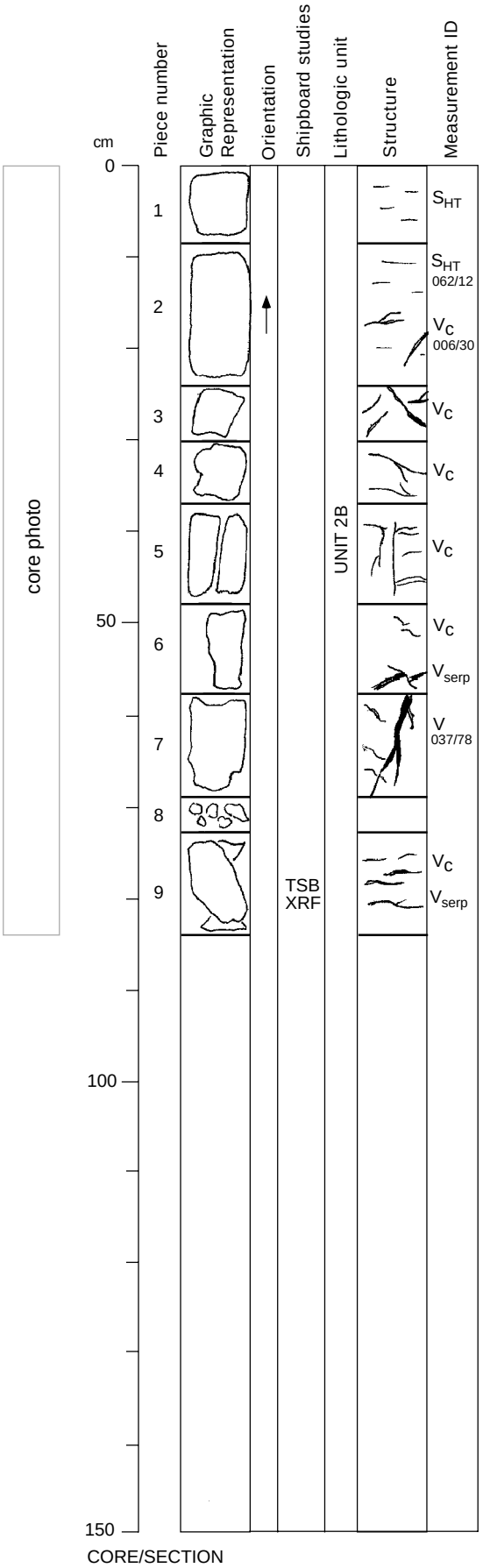
COLOR: Serpentinite dark gray (N3); and pyroxene pseudomorph, light greenish gray (5G 8/1) to grayish orange pink (5YR 7/2).
METAMORPHIC STRUCTURES: Weak foliation present. Trails of bastite are aligned in Pieces 6 and 8A.

MINERALOGY:

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	75-95	-	-	Pseudomorphs after olivine
Bastite	5-20	1-10	anhedral	Pseudomorphs after pyroxene
Spinel	<1	<2	anhedral	
Chlorite	<1	<1	anhedral	Pseudomorphs after plagioclase

VEINS: <5 % (of rock).
Comments: Veins with calcite margins and green serpentine interiors (4 mm wide); small calcite veins (1 mm wide).

ADDITIONAL COMMENTS: Highest pyroxene modes in Pieces 6 and 8. Calcite within serpentine matrix.



173-1070A-10R-2

UNIT 2B: SERPENTINIZED PERIDOTITE

Pieces 1,2,4,6

COLOR: Serpentine matrix, dark gray (N3); orthopyroxene pseudomorphs, moderate orange pink (10R 7/4); and clinopyroxene pseudomorphs, grayish green (10GY 5/2).

MINERALOGY:

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	70-90	-	-	Pseudomorphs after olivine
Bastite	5-15	2-10	anhedral	Pseudomorphs after orthopyroxene
Green serpentine	5-25	2-5	anhedral	Pseudomorphs after clinopyroxene
Spinel	<<1	<<1	anhedral	

VEINS: <3 % (of rock).
Comments: Thin calcite veins (<1 mm). Calcite and serpentine veins (0.5-2 mm).

UNIT 2B: SERPENTINIZED OLIVINE PYROXENITE

Pieces: 3,5,7,8,9

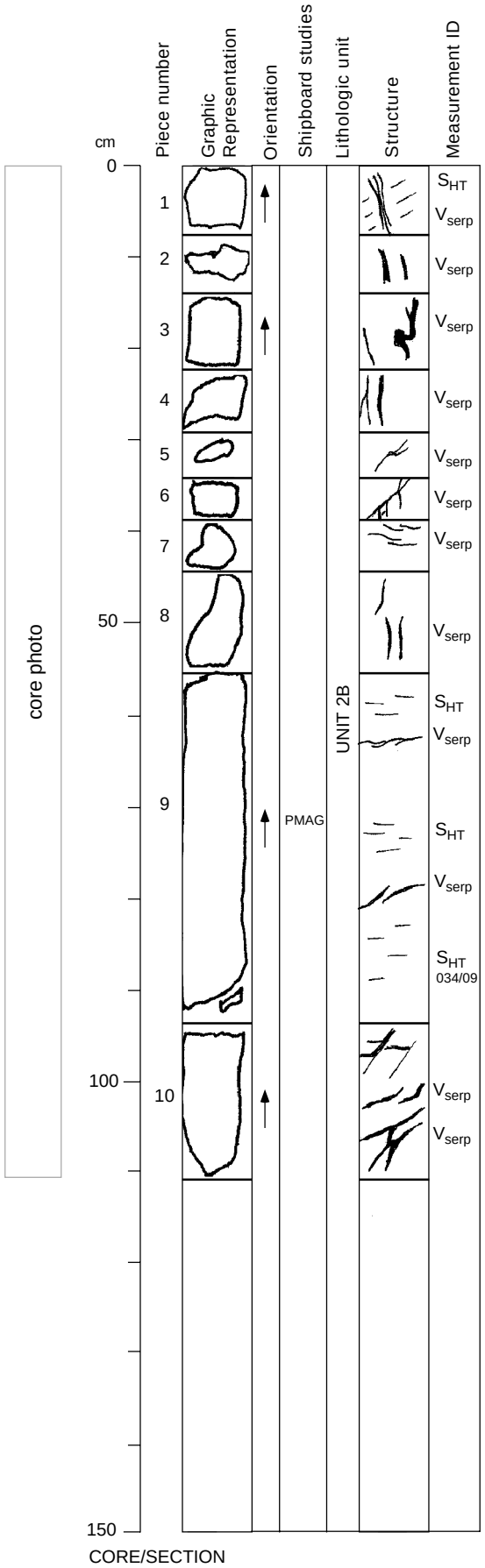
COLOR: Serpentine matrix, dark gray (N3); clinopyroxene pseudomorphs, grayish green (10GY 5/2); orthopyroxene pseudomorphs, grayish orange (5YR 7/2).

MINERALOGY:

Mineral Name	Mode (%)	Size (mm)	Shape	Comments
Serpentine	20-50	-		Pseudomorphs after olivine
Green serpentine	45-70	4-10	anhedral	Pseudomorphs after clinopyroxene
Bastite	5-10	5-15	anhedral	Pseudomorphs after orthopyroxene
Spinel	<<1	<1	anhedral	

VEINS: <2% (of rock).
Comments: Calcite veins (1 mm). Calcite plus serpentine veins (3 mm).

ADDITIONAL COMMENTS: Modal abundances are gradational between pieces. Highest clinopyroxene abundances in Piece 3.



173-1070A-11R-1

UNIT 2B: SERPENTINIZED PERIDOTITE

Pieces 1-10

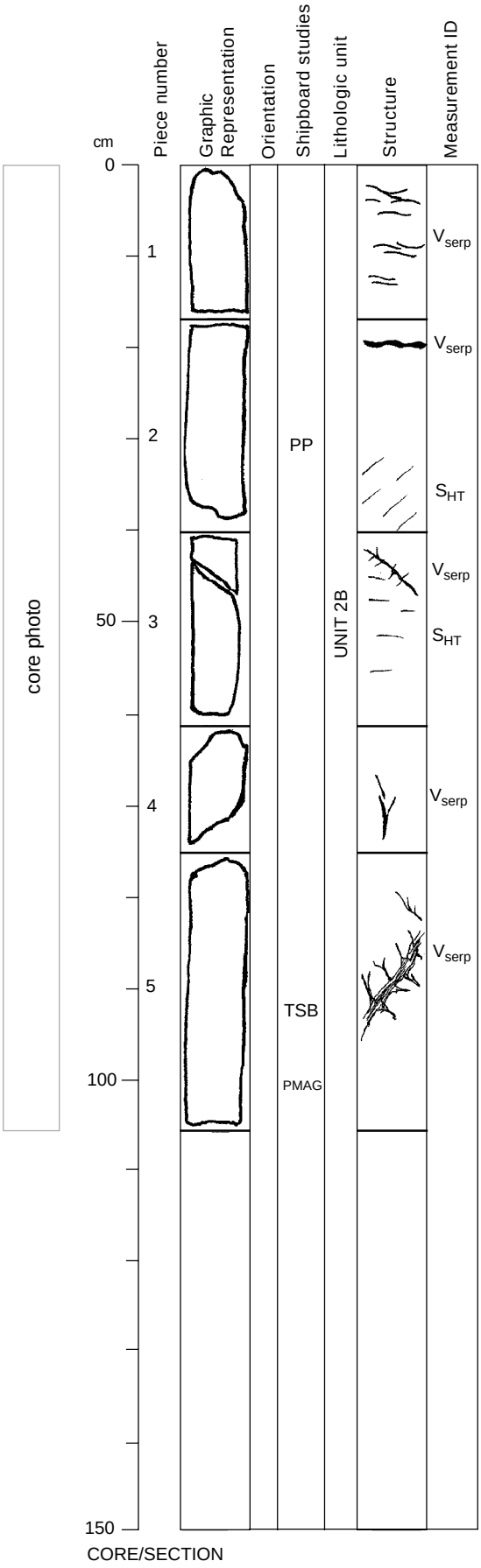
COLOR: Serpentinite, dark greenish gray (5GY 4/1); orthopyroxene pseudomorphs, grayish orange pink (5YR 7/2); serpentine vein, light greenish gray (5GY 8/1).
METAMORPHIC STRUCTURES: Foliation; strong foliation in Piece 9.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	80-95	-	-	Pseudomorphs after olivine
Bastite	5-20	1-10	anhedral	Pseudomorphs after orthopyroxene
Spinel	<1	1-7		

VEINS: 1% of rock:.
Comments: Serpentine veins have planar and irregular patterns. Serpentinite and abundant thin veins in Piece 10 are sheared.

ADDITIONAL COMMENTS: Some pyroxene-rich layers are up to 2 cm thick and subparallel to foliation.



173-1070A-11R-2

UNIT 2B: SERPENTINIZED PERIDOTITE

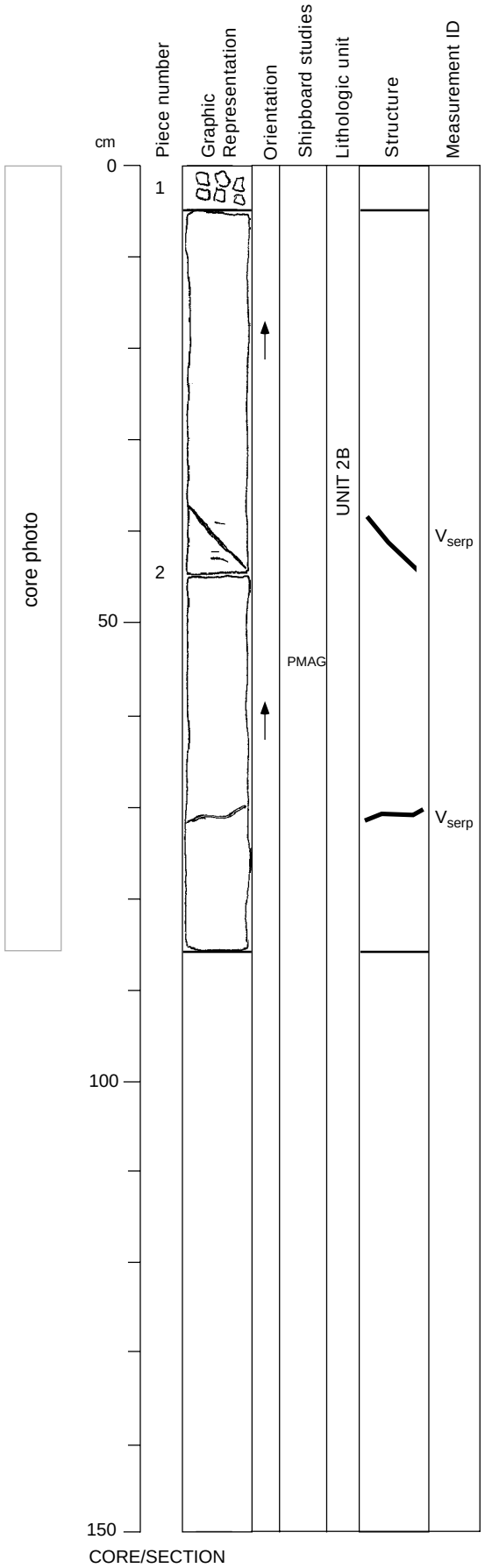
Pieces 1-5

COLOR: Serpentinite, dark greenish gray (5GY 4/1); pyroxene pseudomorphs, grayish orange-pink (5YR 7/2); vein minerals, light greenish gray (5GY, 8/1), light brown (5YR 5/6) and dusky brown (5GY 8/1).
METAMORPHIC STRUCTURES: Moderate foliation defined by alignment of bastites.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	80-90	-	-	Pseudomorphs after olivine
Bastite	10-20	2-12	anhedral	Pseudomorphs after orthopyroxene
Spinel	<<1	<1	anhedral	

VEINS: 1% of rock.
Comments: Serpentine veins are typically 3-5 mm wide. Vein in Piece 5 is 30 mm wide and composed of light greenish gray serpentine, altered brown mineral (pyroxene?), and black serpentinized olivine. This vein could be a highly altered olivine gabbro vein or dikelet.



173-1070A-12R-1

UNIT 2B: SERPENTINIZED PERIDOTITE

Piece 2

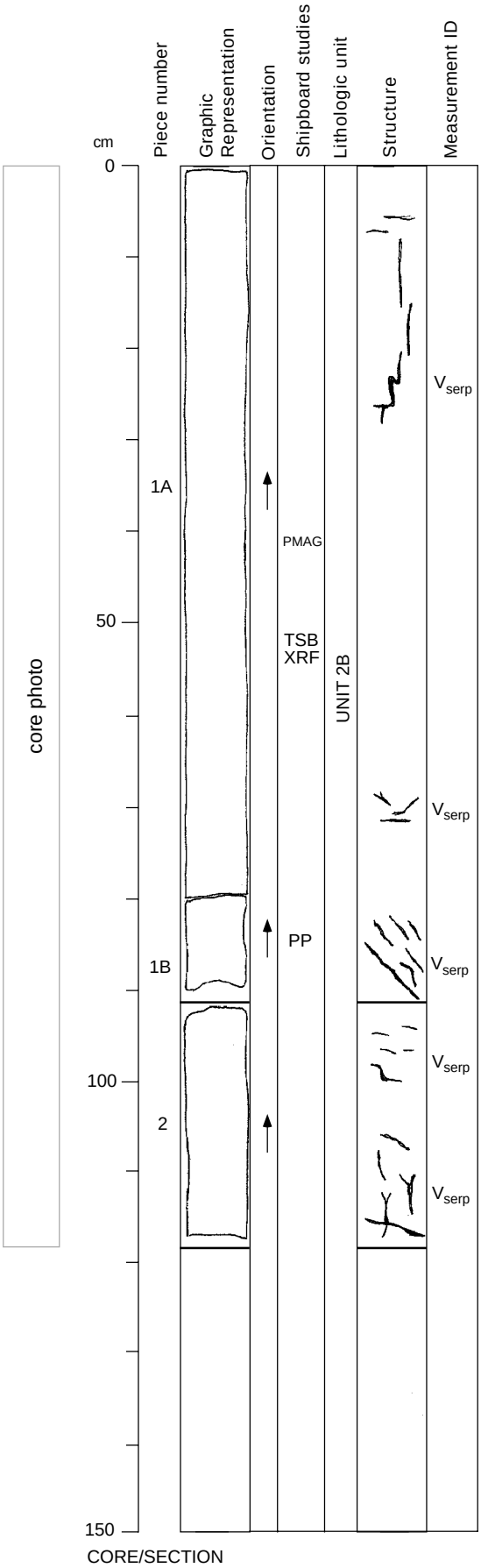
COLOR: Serpentinite, dusky green (5G 3/2); pyroxene pseudomorphs, grayish orange pink (5YR 7/2); serpentine veins, light greenish gray (5G 8/1).
METAMORPHIC STRUCTURES: No clear foliation.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	80	-	-	Pseudomorphs after olivine
Bastite	15	2-15	anhedral	Pseudomorphs after orthopyroxene
Spinel	2	1	anhedral	
Chlorite	<2	1-3	anhedral	Pseudomorphs after plagioclase and rims around spinel

VEINS: <1% of rock.
Comments: Serpentine veins are 1 mm wide.

ADDITIONAL COMMENTS: Piece 1 consists of soft serpentinite fragments.



173-1070A-12R-2

UNIT 2B: SERPENTINIZED PERIDOTITE

Pieces 1 and 2

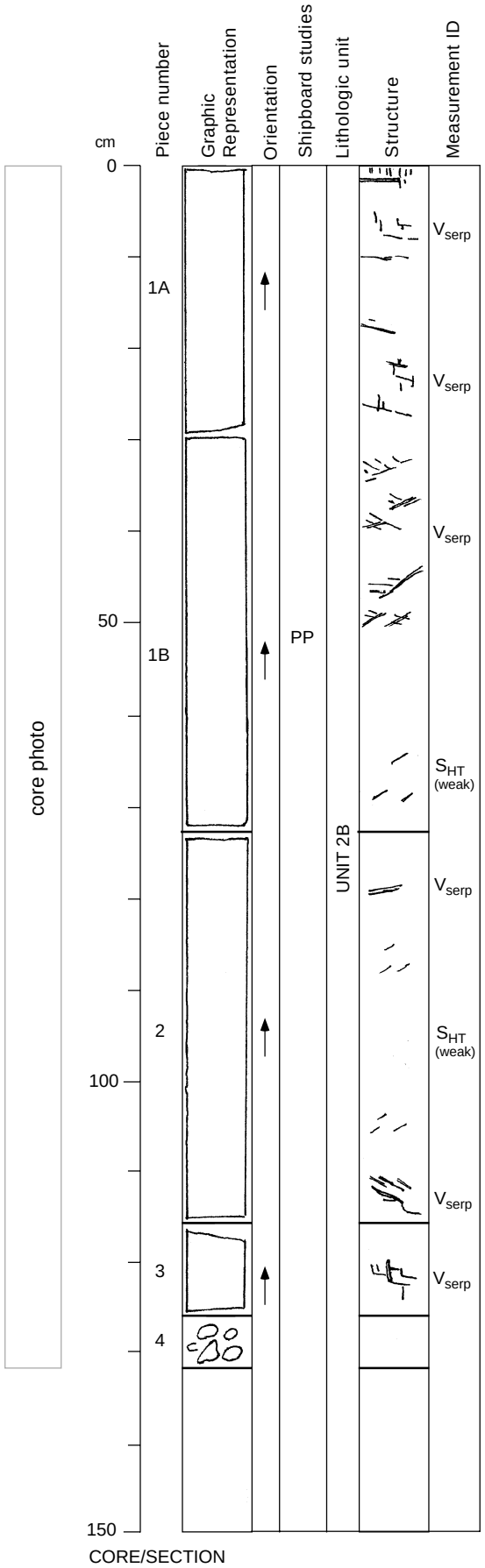
COLOR: Serpentinite, dusky green (5G 3/2) to dusky yellow green (5GY 3/2); pyroxene pseudomorphs, grayish orange pink (5YR 7/2); serpentine veins, light greenish gray (5G 8/1).
METAMORPHIC STRUCTURES: No clear foliation.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	72-87	-	-	Pseudomorphs after olivine
Bastite	10-25	2-10	anhedral	Pseudomorphs after orthopyroxene
Spinel	<2	1-3	anhedral	
Chlorite	<1	1-3	anhedral	Pseudomorphs after plagioclase and rims around spinel

VEINS: <5% of rock.
Comments: Serpentine veins are 2 mm wide and become more abundant in Pieces 1B and 2 which corresponds with color change in serpentinite to dusky yellow green.

ADDITIONAL COMMENTS:



173-1070A-13R-1

UNIT 2B: SERPENTINIZED PERIDOTITE

Pieces 1-4

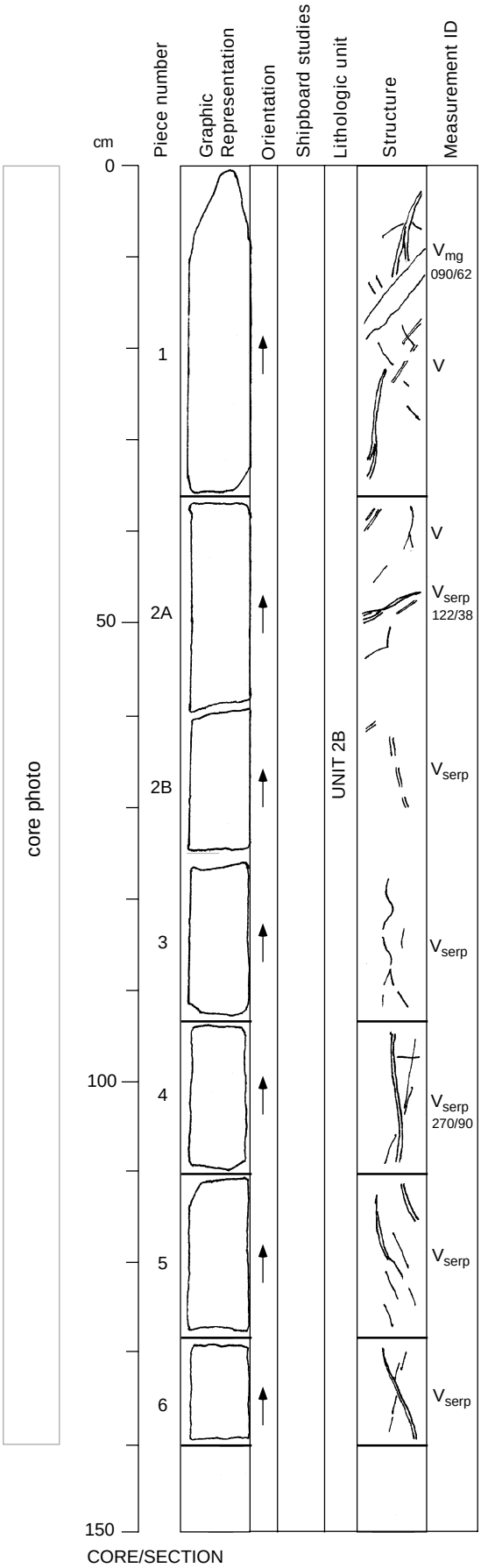
COLOR: Serpentinite, 0-53 cm dusky yellow green (5GY 5/2), becoming dusky green (5G 3/2), then yellow green (5GY 5/2) from 111 cm downwards. Spinels are black (N2), bastites grayish pink (5R 8/2). Veins are pale green (5G 7/2).

METAMORPHIC STRUCTURES: No foliation

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	70-90	-	-	Pseudomorphs after olivine
Bastite	10-20	1-8	anhedral	Pseudomorphs after pyroxenes
Spinel	<1	1-3	anhedral	

VEINS: <1% of rock. Serpentine and calcite.
ADDITIONAL COMMENTS: Irregular modal variations along length of core. Color change along core may reflect varying degrees of alteration, with the lighter material being more altered.



173-1070A-13R-2

UNIT 2B: SERPENTINIZED PERIDOTITE

Pieces 1-6

COLOR: Serpentinite, dusky yellow green (5GY 5/2). Spinels are black (N2), bastites grayish pink (5R 8/2). Veins are pale green (5G 7/2). Altered gabbroic dike, felsic phase yellowish gray (5Y 8/1) to pinkish gray (5YR 8/1), reddish material moderate reddish orange (10YR 6/6), ilmenite, black (N1)

METAMORPHIC STRUCTURES: No foliation.

MINERALOGY: Serpentinite

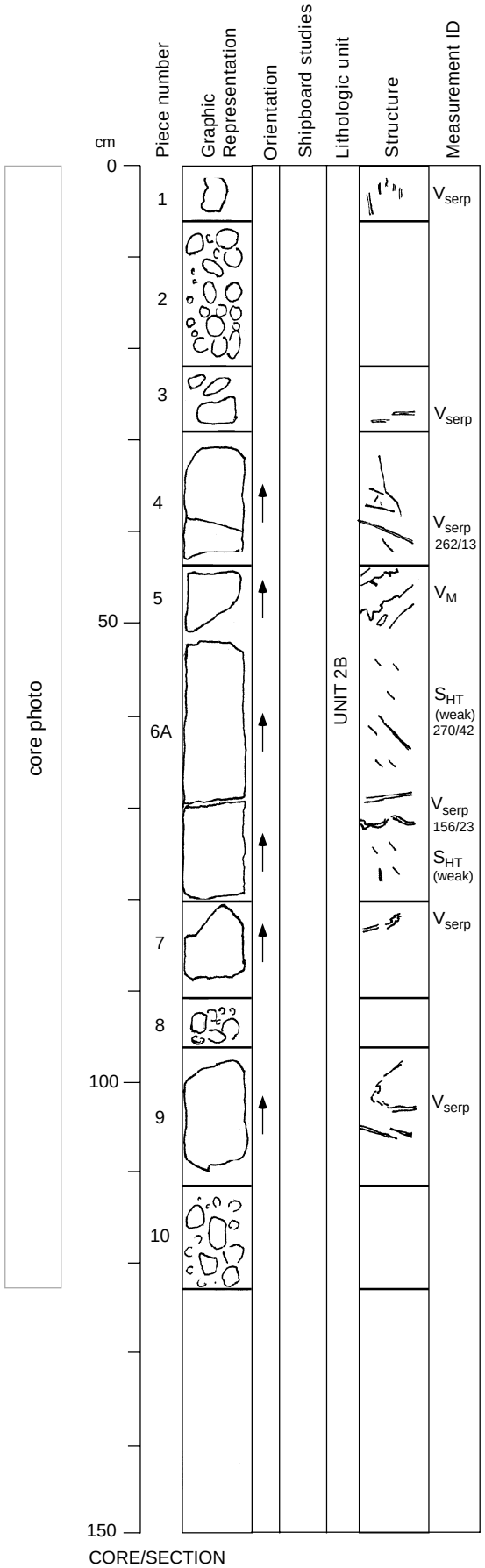
Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	70-90	-	-	Pseudomorphs after olivine
Bastite	10-20	1-8	anhedral	Pseudomorphs after pyroxenes
Spinel	<1	1-3	anhedral	

MINERALOGY: Altered gabbroic dike (Piece 1).

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
pyroxene/amph	30	1-15	anhedral	some may be fresh, largely altered to reddish phase
Plagioclase	65	8?	anhedral	largely or entirely altered, assemblage unknown
Ilmenite	5	<5	anhedral	appears fresh

VEINS: <1% of rock. Serpentine and calcite. See below for discussion of gabbroic dike.

ADDITIONAL COMMENTS: Gabbroic dike in Piece 1 is extensively altered. Possible alteration minerals include serpentine, zoisite, hydrogarnet, and chlorite. Dike zoned, with discontinuous mafic rim at margin. Serpentinite color darkens in vicinity of dike. Scattered irregular masses of reddish phase seen in dike (hydrogarnet?, amphibole?) occurs in serpentinite within 2 cm of dike margin. Ilmenite occurs in elongate masses parallel to dike margins. Numerous small veins project at right angles from dike into serpentinite matrix.



173-1070A-13R-3

UNIT 2B: SERPENTINIZED PERIDOTITE, ALTERED GABBRO

Pieces 1-10

COLOR: Serpentinite, dusky yellow green (5GY 5/2). Spinels are black (N2), bastites grayish pink (5R 8/2). Veins are pale green (5G 7/2). Altered gabbroic dike (Piece 5), felsic phase yellowish gray (5Y 8/1) to pinkish gray (5YR 8/1), reddish material moderate reddish orange (10YR 6/6), ilmenite, black (N1)
METAMORPHIC STRUCTURES: Foliation in Piece 6 (alignment of bastite).

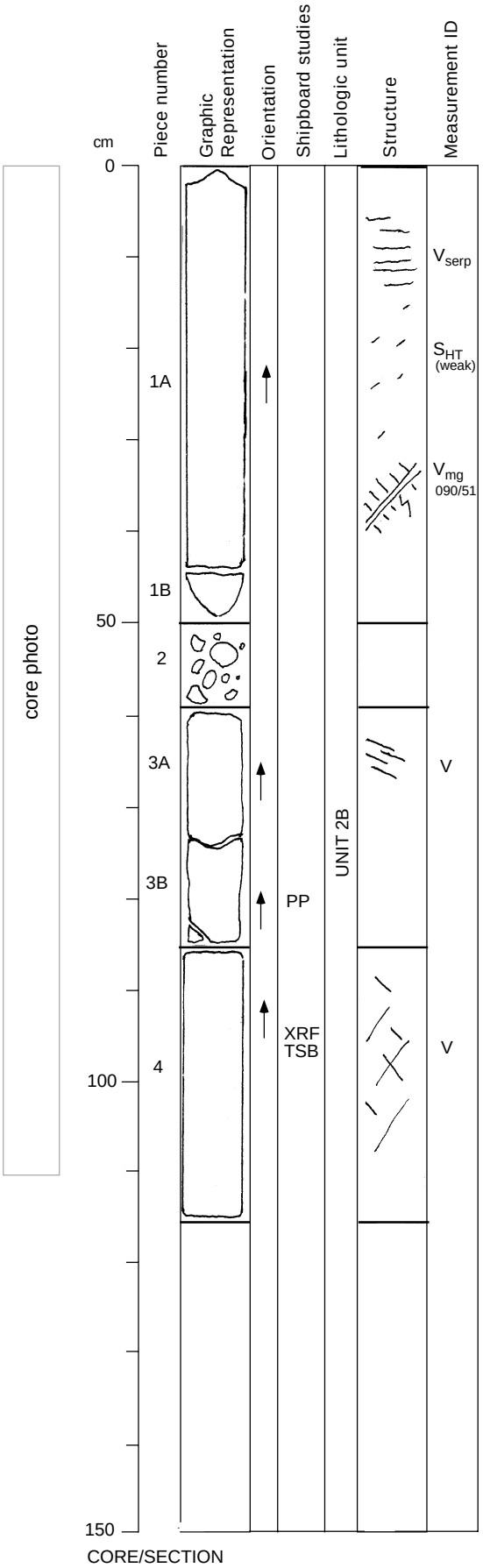
MINERALOGY: Serpentinite

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	80-90	-	-	Pseudomorphs after olivine
Bastite	15	1-8	anhedral	Pseudomorphs after pyroxenes
Spinel	<1	1-3	anhedral	

MINERALOGY: Altered gabbroic dike (Piece 5).

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Pyroxene/amph	30	1-15	anhedral	some may be fresh, largely altered to reddish phase
Plagioclase	65	8?	anhedral	largely or entirely altered
Ilmenite	5	<5	anhedral	appears fresh

VEINS: 3% of rock. Serpentine. See below for discussion of gabbroic dike.
ADDITIONAL COMMENTS: Gabbroic dike in Piece 5 extensively altered. Possible alteration minerals in gabbroic dike include serpentine, zoisite, hydrogarnet, and chlorite. Pieces 1-3, 8, 10 small fragments.



173-1070A-13R-4

UNIT 2B: SERPENTINIZED PERIDOTITE

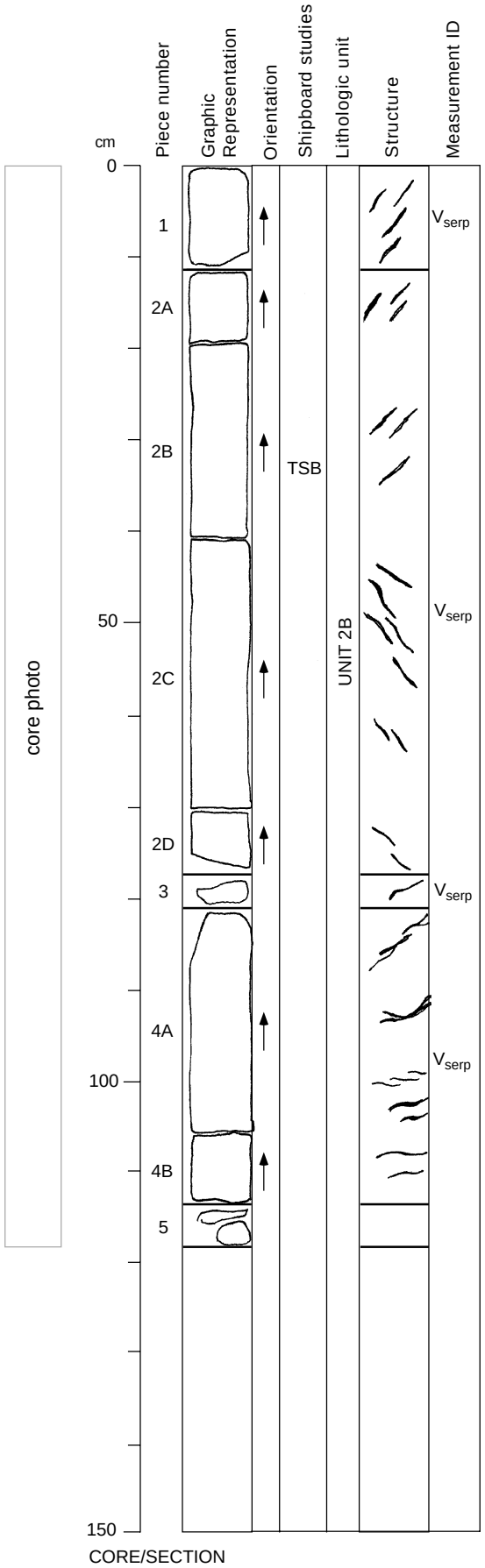
Pieces 1-4

COLOR: Serpentinite, dusky yellow green (5GY 5/2). Spinexls are black (N2), bastites grayish pink (5R 8/2). Veins are pale green (5G 7/2). Vein/dike in Piece 1 has moderate reddish orange (10R 6/6) crystals.
METAMORPHIC STRUCTURES: Foliation in Piece 6 (alignment of bastite).

MINERALOGY: Serpentinite

Mineral Name	Mode	Orig. Size (mm)	Orig. (%)	Shape	Comments
Serpentine	80-95	-	-		Pseudomorphs after olivine
Bastite	5-15	1-8	anhedral		Pseudomorphs after pyroxenes
Spinel	<1	1-3	anhedral		
Orthopyroxene	tr	<1	anhedral		Greenish, altered

VEINS: 2% of rock. Serpentine. Heavily serpentinized vein 3 mm thick in Piece 1 may be relict, thin gabbroic dike.
ADDITIONAL COMMENTS: Bastite decreases from 15 to 5% from Piece 1 to Piece 4. Piece 2, small fragments.



173-1070A-14R-1

UNIT 2B: SERPENTINIZED PERIDOTITE

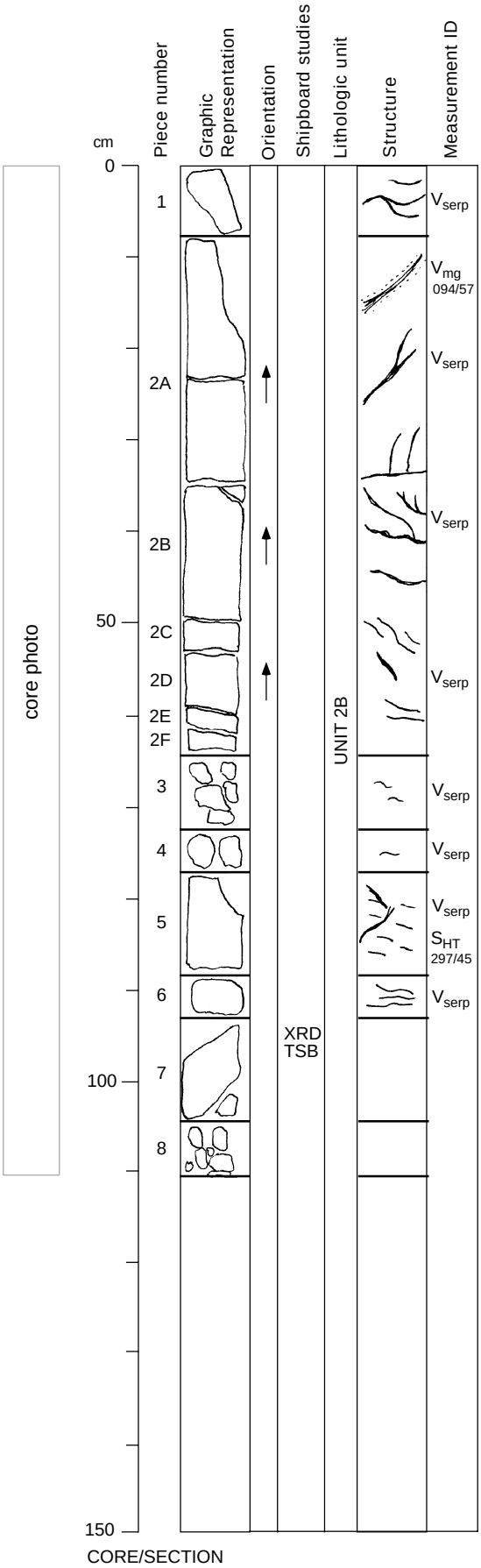
Pieces 1-5

COLOR: Serpentinite, dusky green (5G 3/2) to grayish green (10G 4/2); bastite, grayish orange pink (10R 8/2); serpentinite veins, pale yellowish green (10GY 7/2).
METAMORPHIC STRUCTURES: No clear foliation.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	78-87	-	-	Pseudomorphs after olivine
Bastite	5-10	1-10	anhedral	Pseudomorphs after orthopyroxene
Dark green serpentine	5	1-5	anhedral	Pseudomorphs after clinopyroxene and rims bastite
Spinel	<2	≤4	anhedral	
Chlorite	<1	<1	anhedral	Pseudomorphs after plagioclase and intergrown with spinel

VEINS: 1% of rock.
Comments: Light green serpentine veinlets are short (<3 cm long) and thin (<0.5 mm wide). Larger serpentine veins are 1-2mm in wide in Piece 4A.



173-1070A-14R-2

UNIT 2B: SERPENTINIZED PERIDOTITE WITH RODINGITE DIKE

Pieces 1-8

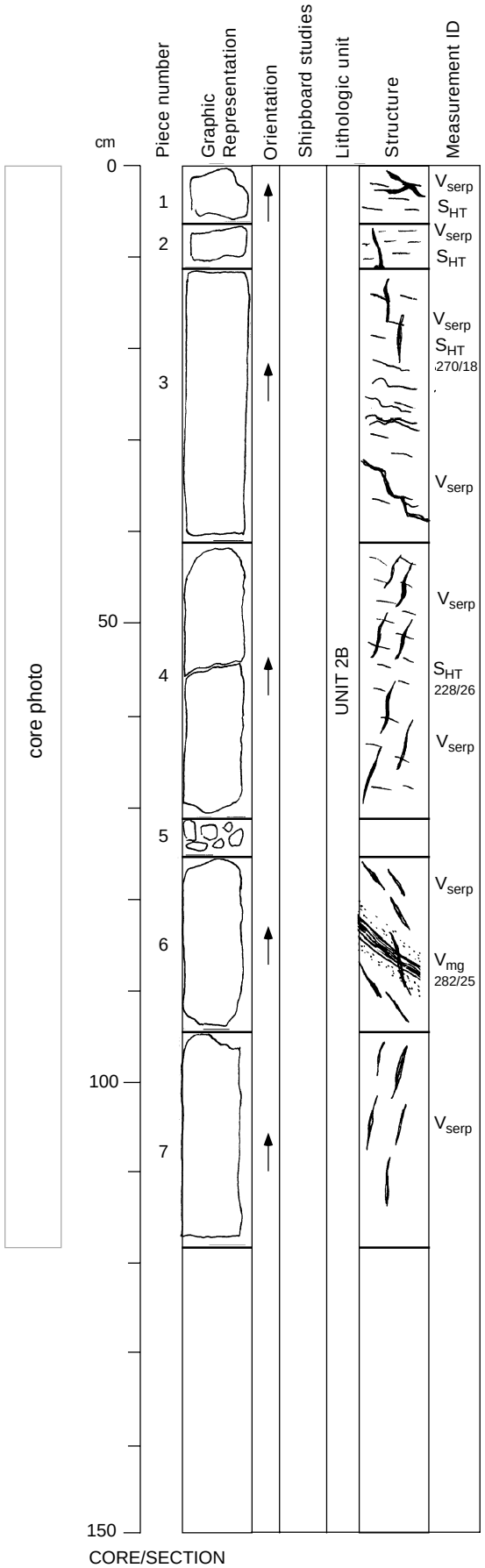
COLOR: Serpentinite, grayish green (10G 4/2); bastite, grayish orange pink (10R 8/2); serpentinite veins, pale yellowish green (10GY 7/2).
IGNEOUS STRUCTURES:
METAMORPHIC STRUCTURES: No clear foliation.

MINERALOGY: Serpentinized Peridotite (Pieces 1-6, 8)

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	72	-	-	Pseudomorphs after olivine
Bastite	10	2-15	anhedral	Pseudomorphs after orthopyroxene
Dark green Serpentine	15	1-5	anhedral	Pseudomorphs after clinopyroxene and rims around bastite
Spinel	3	≤2	anhedral	

VEINS: <3% of rock.
Comments: Light green serpentine veinlets are short (<3 cm long) and thin (<0.5 mm wide). Larger serpentine veins are 1-2 mm in width.

ADDITIONAL COMMENTS: White metasomatic rock (Piece 7) is mostly composed of a white translucent mineral with poor cleavage, green amphibole?, chlorite?, platy yellow mineral, white acicular mineral, and a light brown hydrogrossular. Serpentine is found on the top of this piece. A small dikelet of metasomatic rock (Piece 2A) is lenticular in shape and 1 cm wide. This dikelet is similar in appearance and composition to the dike described in Section 13R-2.



173-1070A-14R-3

UNIT 2B: SERPENTINIZED PERIDOTITE

Pieces 1-7

COLOR: Serpentinite, dusky yellowish green (10GY 3/2) to grayish green (10G 4/2); bastite, grayish orange pink (10R 8/2); serpentinite veins, pale yellowish green (10GY 7/2).
IGNEOUS STRUCTURES:
METAMORPHIC STRUCTURES: Foliation present.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
Serpentine	66-86	-	-	Pseudomorphs after olivine
Bastite	5-20	2-15	anhedral	Pseudomorphs after orthopyroxene
Dark green serpentine	5-10	1-5	anhedral	Pseudomorphs after clinopyroxene and rims around bastite
Spinel	3	≤5	anhedral	
Chlorite	<1	<1	anhedral	Pseudomorphs after plagioclase and intergrown with spinel

VEINS: <3% of rock.
Comments: Light green serpentine veinlets are short (<3 cm long) and thin (<0.5 mm wide). Larger serpentine veins are 4 mm in width in Piece 4A.

ADDITIONAL COMMENTS: Dike of metasomatic rock (Piece 6) is 5-15 mm wide with a 5 cm halo of darker serpentine along its margins. The dike is composed of a white milky mineral (50%) and an orange-red mineral with boxwork structure (50%). This dike is similar in appearance and mineralogy to the dikes described in Sections 13R-2 and 14R-2.