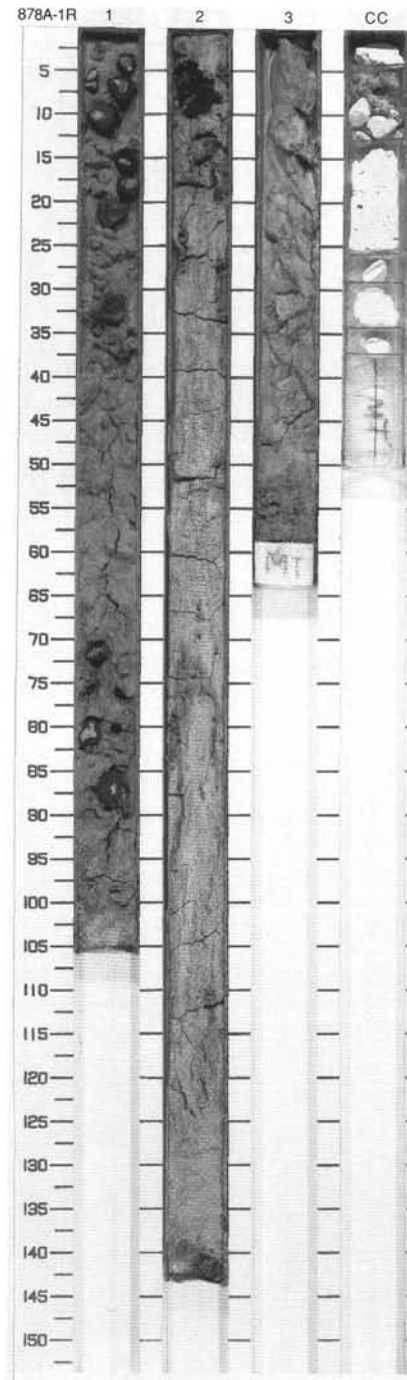
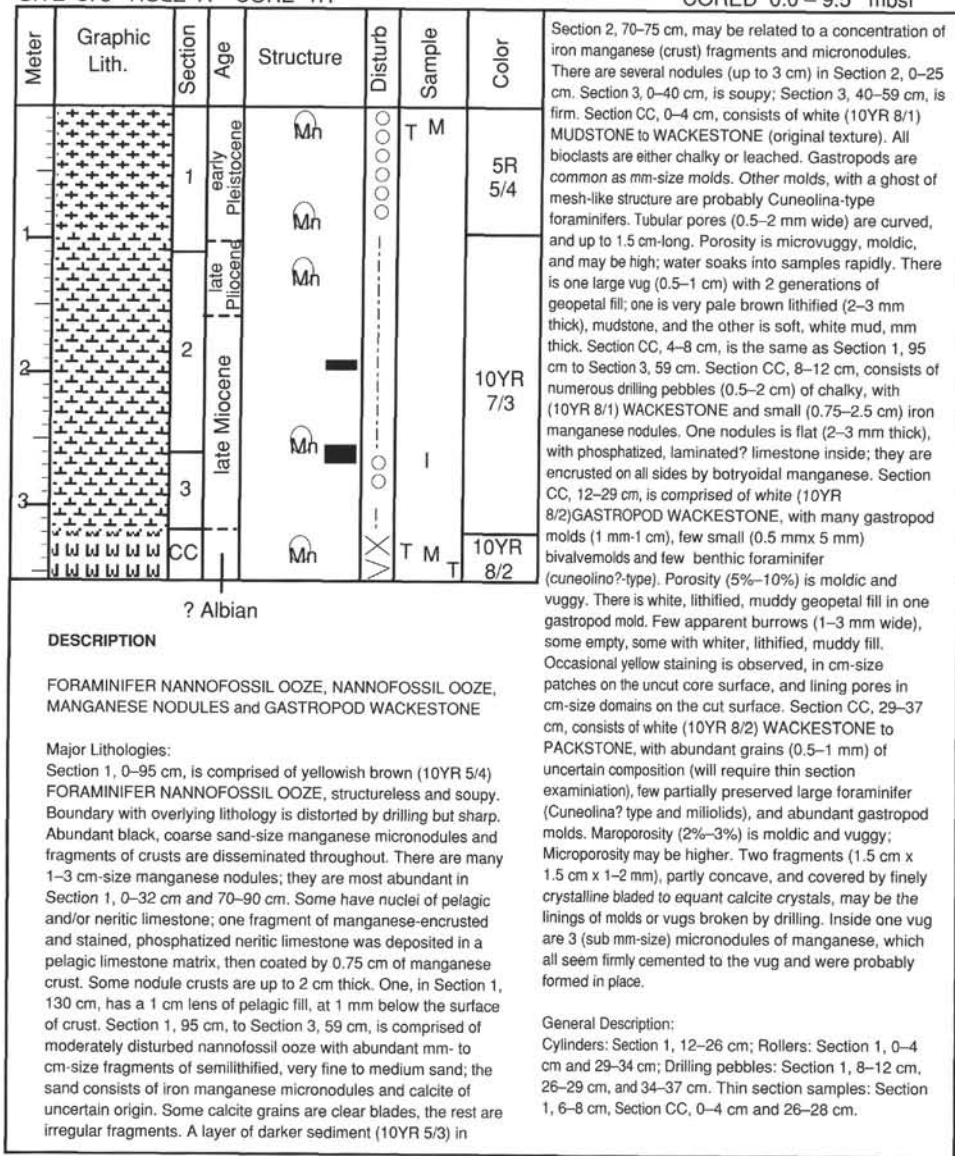


SITE 878 HOLE A CORE 1R

CORED 0.0 – 9.5 mbsf

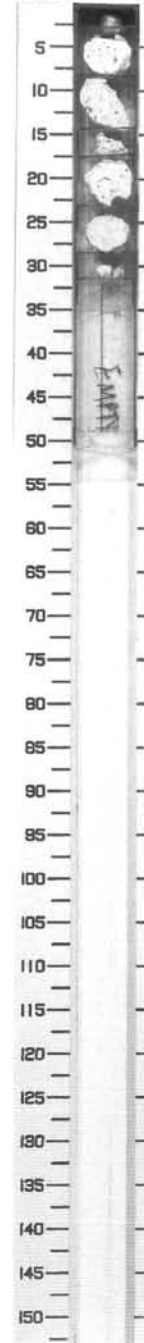


SITE 878 HOLE A CORE 2R

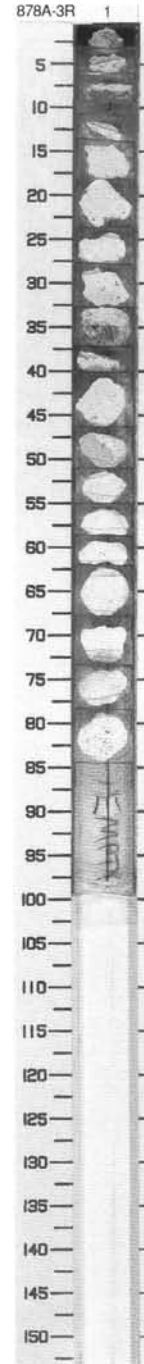
CORED 9.5 – 19.0 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1	W W	1	? Albian	⊂		T	10 YR 8/2	DESCRIPTION GASTROPOD WACKESTONE and PELOID? SKELETAL PACKSTONE Major Lithologies: Section 1, 0–23 cm, consists of white (10YR 8/2) GASTROPOD WACKESTONE, with abundant casts of gastropods, 5 mm to 3 cm in size (15% of sample), and rare foraminifers (Cuneolina-type). Vugs are empty; some have small bladed calcite crusts. Porosity is 10%. Tiny tubular porosity may be due to leached sponge spicules. Some vugs are stained pink; the top of one vug has silt-sized packstone, probably a burrow fill. Section 1, 23–32 cm, is comprised of white (10YR 8/2), chalky (high microporosity), coarse-grained (clasts up to 6 mm) PELOID? SKELETAL PACKSTONE. Some of the sand-size grains seem to be coated. There are gastropod molds and shell fragments (recrystallized?) up to 3 cm in size. Packstone has tiny tubular? Pores similar to Section 1, 0–23 cm; may be sponge spicules. General Description: Rollers: Section 1, 3–14 cm and 17–29 cm; Drilling pebbles: Section 1, 0–3 cm, 14–17 cm, and 29–32 cm. Thin section samples: Section 1, 3–4 cm and 25–27 cm.
.2	W W			⊂		T		
.3	P P							

878A-2R 1



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
5		1	? Albian	6		T	10YR 8/3	<p>GASTROPOD WACKESTONE and PACKSTONE</p> <p>Major Lithologies: Section 1, 0–10 cm, is comprised of very pale brown (10YR 8/3), coarse-grained, friable PACKSTONE, with a bimodal grain distribution (0.3 and 1–2 mm); some grains are rounded. A few casts of gastropod shells (<1 cm) are present. Texture in Section 1, 0–3 cm, may be a grainstone rather than packstone, but little cement or matrix is visible; composition is the same as in Section 1, 3–10 cm. All pieces in Section 1, 0–10 cm, show intensive leaching with vuggy, moldic, and interparticle porosity, 10%–15%. Section 1, 10–84 cm, is comprised of white (10YR 8/2), chalky, GASTROPOD WACKESTONE, with few, up to 15%, nerineid gastropods (up to 5 cm in length by 2 cm in width, but usually <1 cm in thickness). There are several unidentified, elliptical (probably skeletal) grains. Very fine tubular? pores may be sponge spicules. Other mollusk debris is rare (thick-walled shell in Section 1, 37–40 cm). Voids after gastropod shells are partially lined by honey colored bladed sparry calcite cement; however, the molds are open and unfilled. A few borings in Section 1, 58–62 cm are stained orange by iron oxide.</p> <p>General Description: Rollers: Section 1, 6–10 cm and 14–84 cm; Drilling pebbles: Section 1, 0–6 cm and 10–14 cm. Thin section samples: Section 1, 6–9 cm and 59–61 cm.</p>
						T	10YR 8/2	



878A-1R CORED 0.0 - 9.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1	[Cross-hatched pattern]	1	early Pleistocene	<i>H. sellii</i> <i>e. macrnt.</i>		(Mn)	○○○○○○	TM	5R 5/4
2		2	late Pliocene	CN12 CN11	N19/20 - N22	(Mn)	-----		10YR 7/3
3	[Wavy pattern]		late Miocene	CN9		(Mn)	○ ○ ○ ○	I	
				A,M	C,M	B	(Mn)	∇ ∇ ∇ ∇	TM
				B	R,P				
			? Albian		? Albian				

878A-2R CORED 9.5 - 19.0 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color					
.1	[Wavy pattern]	1	? Albian					T	10YR 8/2					
.2										B	B	F,M	(Mn)	
.3														

878A-3R CORED 19.0 - 28.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.5	[Wavy pattern]	1	? Albian					T	10YR 8/3
			? Albian		? Albian				10YR 8/2
				B	B	F,M			

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color
0–5	W P M M M M M M M M M M M M M M M M M M	1	? Albian				10YR 7/3 to 10YR 7/4
5–10							10YR 7/3
10–15							10YR 8/2

DESCRIPTION

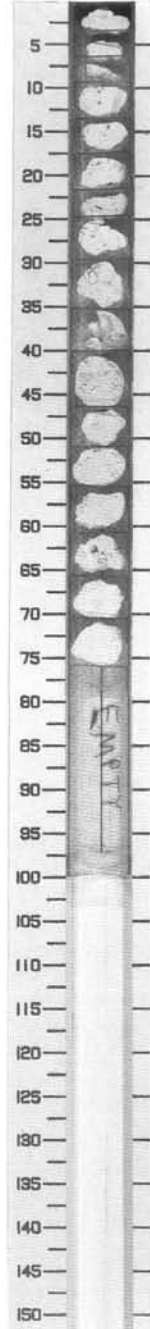
WACKESTONE, PACKSTONE, and MUDSTONE

Major Lithologies:
 Section 1, 0–42 cm, consists of white (10YR 8/2) GASTROPOD WACKESTONE, with patches of very pale brown (10YR 7/3 and 7/4) in Section 1, 0–6 cm. One mold is stained brownish yellow (10YR 6/8) in Section 1, 0–3 cm. Components include many gastropod molds throughout (Cerithids and smooth, low-spined forms), few bivalves (in Section 1, 6–42 cm), radiolarian algae? (in Section 1, 25–42 cm) and few dasycladacean algae ?? (in Section 1, 35–40 cm). All biota are represented by molds only, except for a few thick-walled bivalves. Many peloids in lower part of interval are visible in burrow fills. There are muddy intraclasts in Section 1, 18–21 cm and 25–30 cm. Common steinkerns appear as light gray (10YR 7/2) "clasts"; some are angular because of shell shape or incomplete fill. Steinkerns are casts of shells, mostly mollusks; in many cases the shell is entirely obliterated with no moldic porosity.

Some may represent incomplete fills or broken casts, so that original shell cannot be identified even by shape. Many burrows, some with very pale brown (10YR 7/3 and 7/4) stains or fills, show multiple burrow truncations (e.g., Section 1, 0–6 cm); some burrows are filled with packstone consisting of shells and intraclasts. Shells range from small to large; one part of gastropod? whorl steinkern in Section 1, 35–40 cm is 50 mm across. Bivalve shells to 7 mm thick are found in Section 1, 6–14 cm. Porosity (5%–8%, average 6%) is moldic with a few vugs (sx smg VUG) 0–3 cm in size. Porosity (5%–8%, average 6%) is moldic with a few (0.3 cm) vugs (sx smg VUG). Medium to coarse equant cement is rare (PE45) in molds and filled intraparticle pores. There are filled Clionid sponge borings in many molds. A gastropod mold in Section 1, 30–35 cm, shows an early diagenetic history: (1) shell cavity was filled with mud matrix, (2) shell was dissolved to produce a mold and a steinkern of (lithified) mud, (3) mud filled the lower part of the mold to produce a geopetal fill. Many, small (60–90 micron in diameter) tubes form open pores, commonly in clusters that are roughly parallel (especially within burrows and shells, and at shell and burrow margins); these are interpreted as sponge spicules, small worm tubes (perhaps with thin skeletons) or perhaps only holes. Some are solution enlarged in cross section, they can not be readily distinguished from the molds of rounded shells, peloids, or pellets. A contact at Section 1, 42 cm is ragged, with 6 mm relief; grains are truncated below the contact (geopetal gives orientatino). Section 1, 42–67 cm, is comprised of very pale brown (10YR 7/3), coarse sand-size, poorly sorted, MOLLUSK PELOID PACKSTONE, with common peloids (some may be rounded, micritic skeletal grains). Some ovoids, which are smooth (uniformly 1 mm long) and in clusters, are likely fecal pellets; these are best seen in shells and burrows. Grains with micritic coatings, or grains with very thick micrite envelopes, are common. There are a few grapestones, possibly reworked steinkerns, to 5 mm in diameter. Biota include: many gastropods (Cerithids, rare nerineids, and low-spined forms with smooth shells; one mold in Section 1, 56–61 cm, projects to >30 mm diameter); few to many bivalves (thin-shelled, 50 microns, in part); and, rare Codiacean algae (Orthonella, known as Cayeuxia in happier days). Burrows are many. A planar fabric is apparent locally, from oriented bivalve fragments. There is grainstone texture in many shell fillings and in some burrow. porosity averages 7%; it decreases from 11% at the top, to 5 % at base of interval.

Skeletal molds are >20 long; there is a vug at Section 1, 61–66 (smg vug). Cement is equant, coarse-grained calcite. Contact at Section 1, 67 cm is sharp, slightly wavy; the underlying mudstone has a thin gray rind. Possible intraclasts of mud are noted at the base of the packstone. Section 1, 67–76 cm, consists of white (10YR 8/2) MOLLUSCAN MUDSTONE, with sparse gastropod and bivalve molds, and many burrows, both vertical (Section 1, 67–71 cm) and horizontal (Section 1, 67–71 cm) and horizontal (Section 1, 71–76 cm). Burrow fill is wackestone to grainstone (>20 mm deep burrow in working half is filled with uncemented clasts, possibly steinkerns, to 2 mm diameter, the approximate burrow width). Porosity is 2%, in molds and burrows. There is no visible cement.

General Description:
 Rollers: Section 1, 10–76 cm; Drilling pebbles: Section 1, 0–10 cm. Thin section samples: Section 1, 18–21 cm and 52–54 cm.



SITE 878 HOLE A CORE 5R

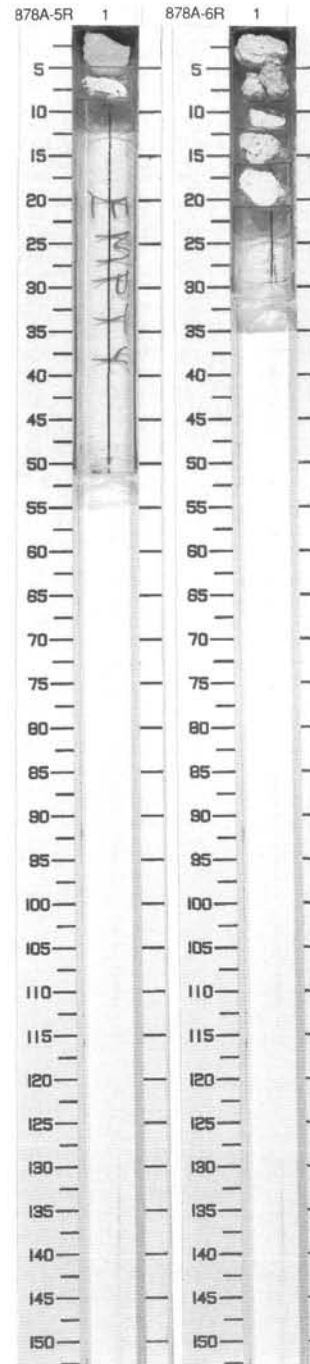
CORED 38.0–47.6 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
		1					10YR 8/2	<p>WACKESTONE</p> <p>Major Lithology: Section 1, 0–8 cm, consists of white (10YR 8/2) WACKESTONE, with common miliolids, a few gastropod molds (0.5 cm x 2 cm and 3 cm x 1.5 cm) and also bivalve molds. A few burrows (0.5 cm in diameter, up to 2 cm long) are either empty or filled by white (10YR 8/1) lithified mud; some burrows truncate each other on the cut face of the sample. "Macroporosity" (2%–3%) is moldic and vuggy; there are no visible cements. The wackestone may have high microporosity (seems a bit chalky).</p> <p>General Description: Rollers: Section 1, 0–8 cm. Thin section samples: none.</p>
			? Albian					

SITE 878 HOLE A CORE 6R

CORED 47.6–57.3 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	? Albian	●			10YR 8/2	<p>WACKESTONE</p> <p>Major Lithology: Section 1, 0–1 cm, consists of white (10YR 8/2), pebbly INTRACLAST PACKSTONE. Rounded, elliptical, 3–7 mm pebbles are mainly formed by an algae. Packstone is bimodal, sandy. Matrix is medium grained (0.25–0.5 mm), with subangular to angular skeletal debris. Laminae overlie skeletal wackestone with a sharp contact. Section 1, 1–20 cm, is comprised of white (10 YR 8/2), fine-grained SKELETAL WACKESTONE, with 0.4 cm of dense, well-cemented, laminated MUDSTONE at the top. The mudstone layer is stained yellow at the top and bottom. The fine-grained skeletal wackestone is grainier (packstone) in Section 1, 11–16 cm. Constituents are thin mollusk shell debris, small gastropod shell molds, and benthic foraminifers. Codiacean algae (Ortonella) are common. Porosity is moldic and vuggy (3%–7%). A fragment of an oyster shell, 2 cm long, occurs at Section 1, 20 cm; the shell is bored.</p> <p>General Description: Rollers: Section 1, 0–5 cm and 11–20 cm; Drilling pebbles: Section 1, 5–11 cm. Thin section samples: none.</p>



878A-4R CORED 28.5 – 38.0 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38		1	? Albian							10YR 8/2 10YR 7/3 10YR 7/3 to 10YR 7/4
				B	B	C.M				

878A-5R CORED 38.0 – 47.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
38 39 40 41 42 43 44 45 46 47 48		1	? Albian	B	B					10YR 8/2

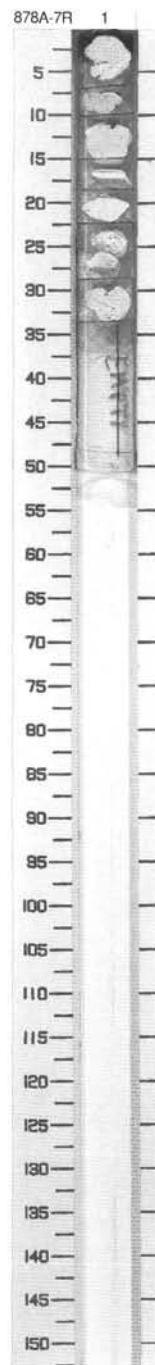
878A-6R CORED 47.6 – 57.3 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
47 48 49 50 51 52 53 54 55 56 57 58		1	? Albian	B	B	F,P				10YR 8/2

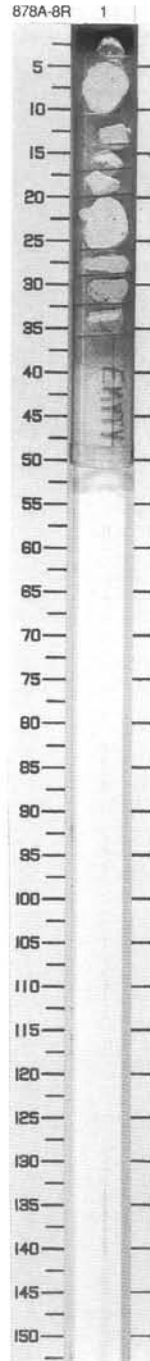
SITE 878 HOLE A CORE 7R

CORED 57.3–67.0 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	Albian	R G		T	10YR 8/2	<p>SKELETAL WACKESTONE</p> <p>Major Lithology: Section 1, 0–33 cm, is comprised of white (10YR 8/2) SKELETAL WACKESTONE, with many red algae, especially encrusters, many green algae, especially Codiacea, few gastropod fragments, few large benthic foraminifers, and rare corals?. Grain size is generally coarse to very coarse-grained sand. Some of the fragments may be steinkernen (cement or cemented-sediment infilling of gastropod chambers, with subsequent loss of shell wall). Porosity, generally, is 5%, although some intervals (Section 1, 15–19 cm) may be up to ~15%. Porosity is small micropore vuggy and moldic; the latter is especially common after gastropods. Calcite cement is rare, mostly as finely crystalline, bladed crusts (PB3C). Yellow-brown stain occurs in a few intergranular pores (Section 1, 0–10 cm). Mottling of sediment (10YR 8/2 and 10YR 7/3) occurs in Section 1, 28–33 cm. Coated grains are present in Section 1, 10–15 cm. Codiacean algae are concentrated in Section 1, 6–10 cm; grains are rounded to ovoid, 4 mm in diameter.</p> <p>General Description: Rollers: Section 1, 0–19 cm and 28–33 cm; Drilling pebbles: Section 1, 19–28 cm. Thin section sample: Section 1, 10–12 cm.</p>
.2			? Albian					
.3								



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0-0.1	W W	1	Albian	G			10YR 8/2 to 10YR 7/3	<p>DESCRIPTION</p> <p>GASTROPOD WACKESTONE, FENESTRAL PELOID PACKSTONE, and PELOID GRAINSTONE</p> <p>Major Lithologies: Section 1, 0–26 cm, is comprised of white (10YR 8/2), mottled GASTROPOD WACKESTONE, with many to few gastropod molds (few ~6.3 mm-long), few red algae, and rare mollusk fragments. Grain size of components is generally coarse sand. Some of the fragments may be steinkernen. Porosity generally is 7%, mostly small micropore vuggy, moldic, and rarely cement reduced moldic. Calcite cement is rare, mostly finely crystalline bladed crusts (PB3C). Rare molds have rusty brown or pinkish red to orange linings. There is an apparent "contact" between the white gastropod wackestone and very pale brown (10YR 7/3) wackestone in Section 1, 17–20 cm. The "contact" is accentuated by the concentration of small mesopore vugs. Section 1, 26–29 cm, is comprised of very pale brown (10YR 7/3) FENESTRAL PELOID(?) PACKSTONE with abundant light brown (5YR 5/6), bladed, fine to medium calcite crusts (PB34C) that fill fenestrae. Fenestrae orientation suggests horizontal bedding. Porosity is 5%, mostly cement reduced moldic (crMO). Components are difficult to identify, most are probably peloids(?). Section 1, 29–36 cm, is comprised of very pale brown (10YR 7/3), highly micritized PELOID GRAINSTONE with abundant peloids, rare mollusk fragments, and rare large benthic foraminifers. Porosity (20%) is mostly solution enlarged interparticle (sxBP) and cement reduced moldic (crMO). Grain size is medium to coarse sand.</p> <p>General Description: Rollers: Section 1, 3–10 cm and 20–26 cm; Drilling pebbles: Section 1, 0–3 cm, 10–20 cm and 26–36 cm. Thin section sample: Section 1, 33–36 cm.</p>
0.1-0.2	P P		? Albian					
0.2-0.3	G G G G G G G G G G G G G G G G G G			●		T		

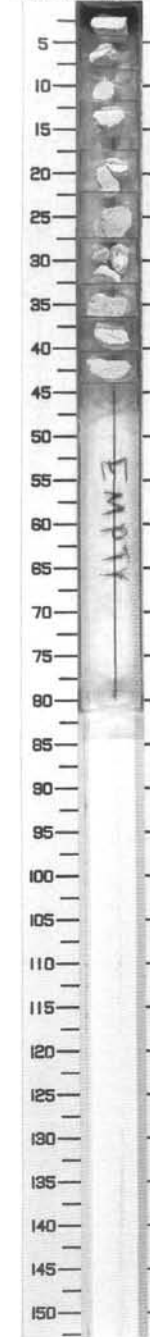


SITE 878 HOLE A CORE 9R

CORED 76.6 - 86.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION	
.1	W W W W W W W W W W W W W W W W	1	? Albian	W G			10YR 8/2	PELOID ALGAL WACKESTONE and SKELETAL FENESTRAL WACKESTONE-PACKSTONE Major Lithologies: Section 1, 0-26 cm, is comprised of white (10YR 8/2) PELOID ALGAL WACKESTONE, with rounded and highly micritized grains. Most of the unidentifiable grains are fine to medium sand size; other identifiable skeletal grains are as large as coarse sand. The latter include many green algae fragments (Codiacea), many to few peloids, few to rare gastropods, rare pellets in burrows and few to rare mollusk fragments. The coarse skeletal grains tend to be light brown (5YR 5/6). Porosity is 5%, mostly small micropore vugs and very rare moldic.	
.2	W W W W W W W W W W W W W W W W								
.3	W W W W W W W W W W W W W W W W							10YR 7/3	Section 1, 26-43 cm, is comprised of very pale brown (10YR 7/3) SKELETAL FENESTRAL WACKESTONE to PACKSTONE, with many to few mollusk(?) fragments, many to few peloids, few green algae (Codiacea), and rare large benthic foraminifers. The grain to mud ratio increases with depth, so that by Section 1, 36-43 cm, the interval is packstone. Components of the packstone include common mollusk fragments and rare coated grains. Porosity (20%) is mostly fenestral and moldic. Cement is mostly very fine to fine crystalline, bladed crusts (PB23C) and increases from few at the top of the interval, to common at the base. General Description: Rollers: Section 1, 32-43 cm; Drilling pebbles: Section 1, 0-32 cm. Thin section sample: Section 1, 33-35 cm.
.4	P P P P P P P P P P P P P P P P					X	T		

878A-9R 1



878A-7R CORED 57.3 - 67.0 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1	W W W W W W	1	? Albian				R G		T	10YR 8/2
.2	W W W W W W			B	B	F, M	O			
.3	W W W W W W									

878A-8R CORED 67.0 - 76.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1	W W W W W W	1	? Albian				6			10YR 8/2 to 10YR 7/3
.2	W W W W W W			B	B	F, M				
.3	W W W W W W									

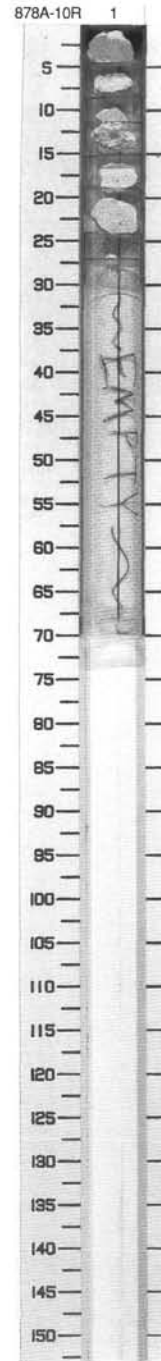
878A-9R CORED 76.6 - 86.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1	W W W W W W	1	? Albian				G ●			10YR 8/2
.2	W W W W W W			B	B	F, P				
.3	W W W W W W									T
.4	W W W W W W									

SITE 878 HOLE A CORE 10R

CORED 86.2 - 95.9 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1	W W W W W W P P P P P P W W W W W W W W W W W W W W W W W W	1	? Albian	● B		T	10YR 7/3	<p>PELOIDAL WACKESTONE</p> <p>Major Lithology: Section 1, 0-4 cm and 8-11 cm, is comprised of white (10YR 8/1), very fine WACKESTONE with foraminifers?, peloids? (visible in burrows), and gastropod molds. Burrows are from 0.2 mm to 4 mm in diameter, and are filled with mud or peloids. Borings are common in shell molds. Porosity (5%) is moldic (sms MO). Section 1, 4-8 cm, is comprised of white (10YR 8/1), PELOIDAL PACKSTONE, with a few mottles of very pale brown (10YR 7/3). Peloids are common, oncoids (concentric coating around crystalline bivalve fragment, 1 cm in diameter) are rare, and coated grains (micrite on thin, 1 cm long bivalve fragments) are trace. Very thin (50-75 microns) chips and gray fragments (0.4 mm-thick) may be bivalve fragments. Codiacean algae are rare. Mottles are areas without microporosity ("chalkification"); mollusk fragments and foraminifers are visible. Porosity is 10%, as molds. Section 1, 11-27 cm, is comprised of white (10YR 8/1) PELOIDAL WACKESTONE, similar to the packstone in Section 1, 4-8 cm, but slightly muddier. The peloidal wackestone contains: many bivalve fragments, many gastropod molds, many Codiacean algal plates, very rare Dasycladacean? algae molds, common peloids, very rare coated grains (many in Section 1, 19-24 cm), rare onkoids (in Section 1, 19-24 cm), and few vague burrows. Porosity (3%-6%) is moldic.</p> <p>General Description: Rollers: Section 1, 0-8 cm and 11-24 cm; Drilling pebbles: Section 1, 8-11 cm and 24-27 cm. Thin section sample: Section 1, 0-4 cm.</p>
.2	W W			⊗			10YR 8/1	



SITE 878 HOLE A CORE 11R

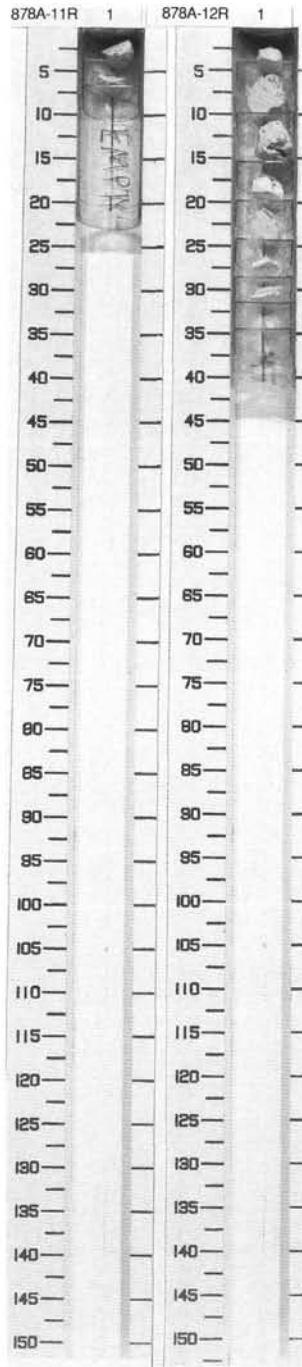
CORED 95.9 – 105.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
		1		B		T		ALGAL WACKESTONE TO PACKSTONE and GRAINSTONE TO PACKSTONE
			? Albian				10YR 8/2 to 10YR 8/3	<p>Major Lithologies:</p> <p>Section 1, 0–3 cm, is comprised of white (10YR 8/2) ALGAL WACKESTONE to PACKSTONE (varies throughout) with common algae (2–5 mm, possibly Orthonella-type) and a few gastropods as molds. A wackestone band, 1 cm thick, cuts across the face of one piece (in Section 1, 0–3 cm); this may be a burrow. Peloids, or small (1 mm or less) algal pieces, may be abundant, but there is not enough contrast to see clearly. Porosity (2%–3%) is moldic and vuggy; there are a few vugs with yellow stain. Wackestone portions may have high microporosity; they are chalky in places. No cement is visible. Section 1, 3–6 cm, is comprised of white (10YR 8/3) GRAINSTONE to PACKSTONE. Grains (12 mm) are unidentified, with many gastropod molds; a 1 cm-mold is from a fragment of a large gastropod. Porosity (10%–15%) is intergranular, moldic, and vuggy. There is some yellow staining in molds.</p> <p>General Description: Drilling pebbles: Section 1, 0–6 cm. Thin section sample: Section 1, 3–5 cm.</p>

SITE 878 HOLE A CORE 12R

CORED 105.5 – 115.1 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	? Albian	B O		T	10YR 8/2	<p>LIMESTONE</p> <p>Major Lithology:</p> <p>Section 1, 0–20 cm, is comprised of white (10 YR 8/2) WACKESTONE to RUDSTONE, with a few small gastropod and mollusk molds and a few unidentified grains (peloids? or algae?). Large (1 cm x 2 cm x 3 cm) mollusk fragments give Section 1, 10–15 cm, a rudstone texture; the matrix is the same wackestone as the adjacent pieces. All are burrowed; some burrows are empty, some are filled with fine-grained packstone. Porosity (2%–3%) is moldic and vuggy. Cement, mostly absent except for voids within large mollusk fragments, is fibrous to bladed, fine to coarse crystalline calcite crusts (PF34C and PB45C). Section 1, 20–34 cm, is consists of white (10YR 8/2), chalky, fine-grained PACKSTONE to GRAINSTONE. Porosity is 10% or more, vuggy, microvuggy, intergranular, and fenestral (in Section 1, 24–28 cm); faint laminae are visible. Grains are not recognizable.</p> <p>General Description: Rollers: Section 1, 4–15 cm; Drilling pebbles: Section 1, 0–4 cm and 15–34 cm. Thin section samples: Section 1, 4–8 cm and 22–29 cm.</p>
.2						T		
.3						T		



878A-10R CORED 86.2 - 95.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1	W W W W W W W W W W W W P P P P P P W W W W W W	1	? Albian				●		T	10YR 7/3
.2	W W			B	B	R,P	⊗			10YR 8/1

878A-11R CORED 95.9 - 105.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
	W W W W W W W W W W W W G G G G P P W W W W W W	1	? Albian	B	B	R,P	⊗		T	10YR 8/2 to 10YR 8/3

878A-12R CORED 105.5 - 115.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1	W W	1	? Albian				⊗		T	10YR 8/2
.2	P P P P G G G G P P P P G G G G P P P P G G G G			B	B	R,P			T	
.3	P P P P G G G G P P P P G G G G									

SITE 878 HOLE A CORE 13R

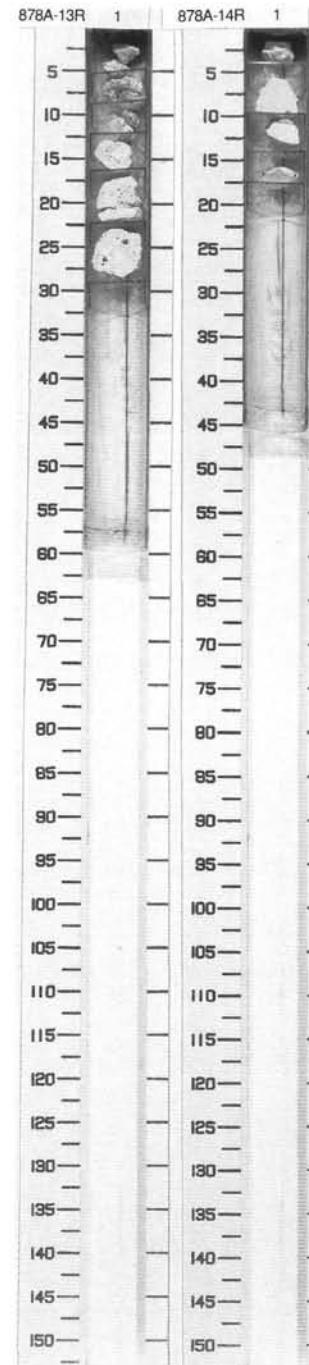
CORED 115.1 – 124.8 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1 2		1	? Albian	⊗		T	10YR 8/2	<p>DESCRIPTION</p> <p>MOLLUSK FLOATSTONE and PACKSTONE TO GRAINSTONE</p> <p>Major Lithologies: Section 1, 0–16 cm, is comprised of white (10 YR 8/2) MOLLUSK FLOATSTONE, with PACKSTONE to WACKESTONE MATRIX. The FLOATSTONE contains abundant mollusk fragments (1–5 cm) and one gastropod, (recrystallized) up to 2 cm long. The matrix includes some probable algae and mostly unidentifiable grains. Porosity may be as high as 5%–10%, it is moldic and vuggy. Some light yellow to clear, bladed cement lines a few vugs, molds and mollusk fragments. Section 1, 16–29 cm, is comprised of white (10YR 8/2), laminated PACKSTONE to GRAINSTONE, with abundant algae (some Orthonella type), codiacean algae, few probable Cuneolina-type foraminifers and possible miliolids (grainstone domains are chalky and difficult to identify). Porosity may be up to 20% in some parts; average porosity is 10%, vuggy, intergranular, and fenestral. Some voids are noted, with geopetal fill of white, lithified mud (up to 3 mm-thick) and possible asymmetric cement crusts. Other cements include rare bladed crusts (PB34C).</p> <p>General Description: Cylinders: Section 1, 16–29 cm; Rollers: Section 1, 5–8 cm and 12–16 cm; Drilling pebbles: Section 1, 0–5 cm and 8–12 cm. Thin section samples: Section 1, 22–29 cm.</p>

SITE 878 HOLE A CORE 14R

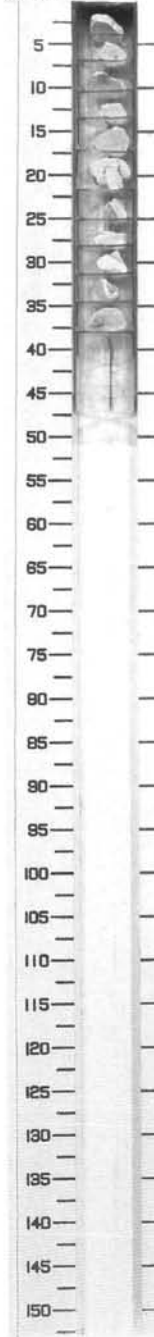
CORED 124.8 – 134.4 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	? Albian	●		T	10YR 8/2	<p>DESCRIPTION</p> <p>SKELETAL PELOID WACKESTONE</p> <p>Major Lithology: Section 1, 0–17 cm, is comprised of chalky, white (10YR 8/2), SKELETAL PELOID WACKESTONE with 5%–10% fine-grained skeletal debris. Constituents are rare foraminifers (“Cuneolina” type) and peloids in a mud matrix. The wackestone is dense and bioturbated. Burrows are infilled by chalky, softer wackestone. As result of chalkification, most grains are unidentifiable.</p> <p>General Description: Rollers: Section 1, 3–13 cm; Drilling pebbles: Section 1, 0–3 cm and 13–17 cm. Thin section sample: Section 1, 14–18 cm.</p>



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	? Albian	W		T	10YR 8/2	<p>WACKESTONE and PACKSTONE</p> <p>Major Lithologies: Section 1, 0-38 cm, is comprised of white (10YR 8/2) WACKESTONE, with local variation to PACKSTONE (in 0.5-1 cm domains that are probable the product of bioturbation). Constituents include few gastropod molds, rare recognizable algae (<i>Ortonella</i>-type) and rare recognizable foraminifers (<i>Cuneolina</i>-type). Other grains, not identified, vary from rounded (possible peloids?) to rectangular (probably mollusk fragments). Porosity varies from 2%, to over 10%, vuggy and moldic; some pores are irregular tubes - probably burrows. A few pieces (e.g. Section 1, 7-10 cm) have numerous fine tubes (0.1-0.2 mm), which are both perpendicular and parallel to the cut face; these are probably leached sponge spicules. There is a black grain of uncertain composition (0.5 mm size) in Section 1, 28-31 cm. A large mollusk shell fragment in Section 1, 34-38 cm, is replaced in places, and filled by medium to very coarse crystalline bladed and equant cement, clear with some cloudy centers.</p> <p>General Description: Drilling pebbles: Section 1, 0-38 cm. Thin section sample: Section 1, 25-28 cm.</p>
.2				W				
.3				W				

878A-15R 1



878A-13R CORED 115.1 - 124.8 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	? Albian		? Albian			T	10YR 8/2
.2				B	F, M				

878A-14R CORED 124.8 - 134.4 mbsf



Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	? Albian	B	R, M			T	10YR 8/2

878A-15R CORED 134.4 - 144.0 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	? Albian		? Albian			T	10YR 8/2
.2				B	F, P				
.3									

SITE 878 HOLE A CORE 16R




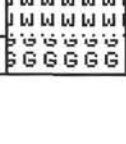

CORED 144.0 – 153.7 mbsf

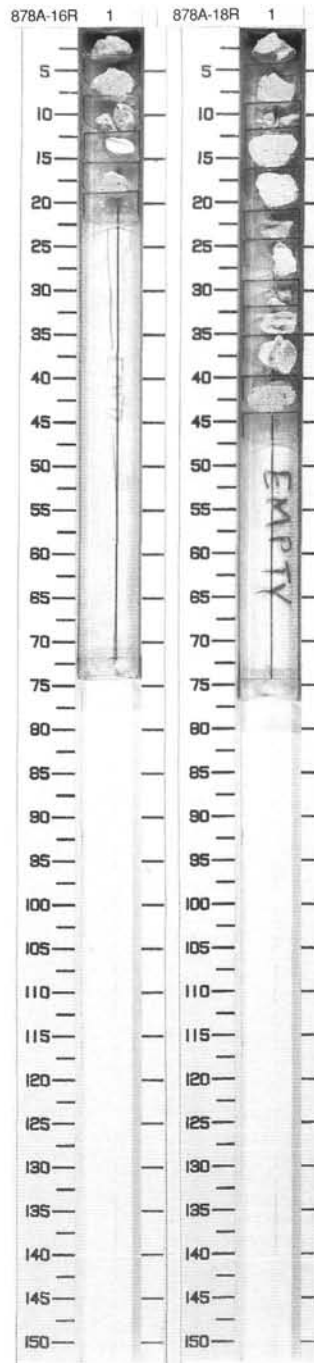
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	? Albian				10YR 8/1	<p>DESCRIPTION</p> <p>SKELETAL PELOID PACKSTONE</p> <p>Major Lithology: Section 1, 0–2 cm, consists of a single piece of an oyster shell (5 cm x 2 cm). The surface of the shell is bored; some of the borings are stained orange and lined with short drusy sparry calcite. Section 1, 2–18 cm, is comprised of white (10YR 8/1), fine-grained (0.1–0.4 mm), chalky SKELETAL PELOID PACKSTONE, with molds of gastropods, minor bivalves, algae (Codiacean), and sponge (lamellar); there is a question about the presence of polychaete worm tubes in Section 1, 2–7 cm. Peloids are common. Porosity (7%–15%) is vuggy, intraparticle, and fine-point-interparticle.</p> <p>General Description: Rollers: Section 1, 2–7 cm, Drilling pebbles: Section 1, 0–2 cm and 7–18 cm. Thin section sample: Section 1, 15–18 cm.</p>

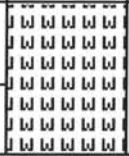

878A 17R NO RECOVERY

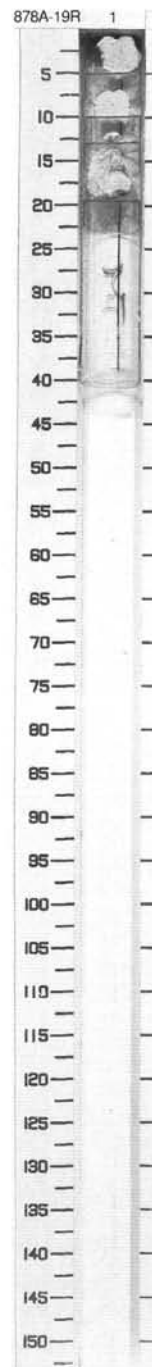
SITE 878 HOLE A CORE 18R

CORED 163.4 – 173.1 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	? Albian			T	10YR 8/1	<p>DESCRIPTION</p> <p>WACKESTONE and GRAINSTONE</p> <p>Major Lithologies: Section 1, 0–31 cm, is comprised of fine-grained, chalkified, white (10YR 8/1) WACKESTONE, with nerineid gastropod molds, few thin-walled mollusk debris, few ostracods, rare foraminifers, and rare algae (Codiacean). There are several well-preserved molds of sponge spicules, some partially infilled by calcite, which in previous cores were preserved only as tiny holes at the limestone surface. The origin of some of the grains is unrecognizable, due to micritization. Porosity (1%–7%) is vuggy and interparticle. Section 1, 31–40 cm, consists of WACKESTONE, as above, but 60% of the bioclasts are oyster shells (5–6 mm thick). Cavities within these shells are partially infilled by honey-colored, coarse, bladed sparry calcite. The contact between the wackestone and the underlying grainstone was not recovered. Section 1, 40–44 cm, is comprised of pebbly, pale brown (10YR 8/3), GRAINSTONE; the grain distribution is bimodal, with average sizes of 0.3 mm and 2.6 mm. Constituents are common large gastropod molds, common algae (Ortonella-type) which are well preserved, few mollusk shell debris, rare foraminifers, and worn, micritic intraclasts. Grains are cemented by bladed drusy sparry calcite. Porosity is vuggy, inter- and intraparticle and high (15%).</p> <p>General Description: Rollers: Section 1, 0–8 cm, 11–20 cm, 23–28 cm, and 31–44 cm; Drilling pebbles: Section 1, 8–11 cm, 20–23 cm and 28–31 cm. Thin section samples: Section 1, 16–21 cm and 40–43 cm.</p>
.2								
.3								
.4								



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	? Albian				10YR 8/2	<p>WACKESTONE</p> <p>Major Lithology: Section 1, 0–13 cm, is comprised of white (10YR 8/2) WACKESTONE, with few gastropod and small bivalve molds, rare recognizable algae (Codiaccian?), and rare recognizable foraminifers (Cuneolina-type?). Other grains are vague spheres and ovoids. Microporosity is high (chalky). Visible porosity (3%–5%) is vuggy and moldic, with some irregular, sub-mm-sized tubes that may be burrows. There is no visible cement. There are some voids with geopetal fill. Some 0.5 cm-size burrows are also filled. Section 1, 13–19 cm, consists of a whole oyster valve, partly filled by very pale brown wackestone; there is a 2–3 mm thick layer of very coarse bladed and equant, pale yellow cement between the wackestone and the shell, possibly a replaced aragonitic layer. The exposed surface of the wackestone fill is encrusted by fine crystalline calcite cement; probably missing a valve.</p> <p>General Description: Rollers: Section 1, 0–10 cm and 13–19 cm; Drilling pebbles: Section 1, 10–13 cm. Thin section samples: none.</p>



878A-16R CORED 144.0 – 153.7 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	? Albian	B	B	P ? Albian			10YR 8/1

878 17R NO RECOVERY

878A-18R CORED 163.4 – 173.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	? Albian	B	B	F,P		T	10YR 8/1
.2									
.3									
.4								T	

878A- 19R CORED 173.1 – 182.8 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	? Albian	B	B	P ? Albian			10YR 8/2

SITE 878 HOLE A CORE 20R

CORED 182.8-192.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
3 cm		1	? Albian				10YR 8/2	<p>WACKESTONE</p> <p>Major Lithology: Section 1, 0-3 cm, is comprised of white (10YR 8/2) WACKESTONE, with one partial gastropod mold (3-4 mm wide) and filled burrows (one is cm wide). There is some brown staining in the mold. Microporosity may be high (chalky). There are no visible cements.</p> <p>General Description: Drilling pebbles: Section 1, 0-3 cm. Thin section samples: none.</p>

SITE 878 HOLE A CORE 21R

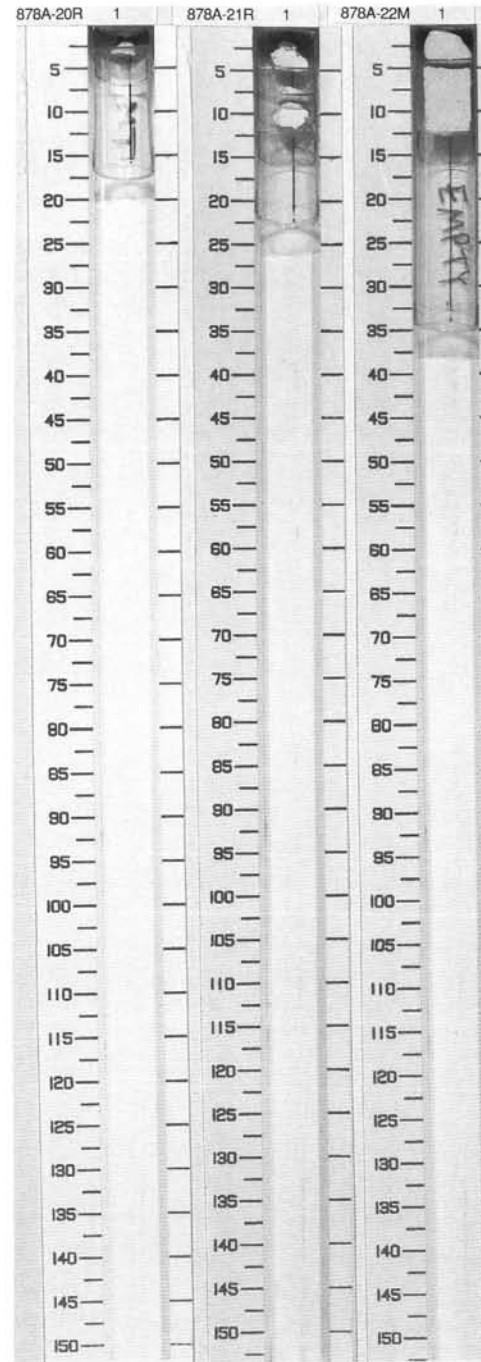
CORED 192.5-202.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0.1		1	? Albian			T	10YR 8/2	<p>SKELETAL WACKESTONE</p> <p>Major Lithology: Section 1, 0-12 cm, is comprised of white (10YR 8/2) SKELETAL WACKESTONE, with few to rare mollusk fragments (especially a thick-shelled fragment, 3 cm long, at Section 1, 4-7 cm), rare green algae fragments (Codiacea?), and rare red algae fragments. The recovered drilling pebbles are highly bored; some of the bores are filled with pelleted(?) lime mud. Bores are up to 3 cm in diameter. Grains are difficult to identify. Porosity is variable; it ranges from 5% to 10%, and possibly higher. Most of the porosity is moldic, with very rare interparticle. Calcite cement cannot be seen in hand sample.</p> <p>General Description: Drilling pebbles: Section 1, 0-12 cm. Thin section sample: Section 1, 0-4 cm.</p>

SITE 878 HOLE A CORE 22M

CORED 202.2-206.9 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0.1		1	? Albian			T	10YR 8/2	<p>FRIABLE PELOID GRAINSTONE</p> <p>Major Lithology: Section 1, 0-12 cm, is comprised of white (10YR 8/2), very friable GRAINSTONE. Skeletal components are very difficult to identify, but include abundant to common peloids, very rare large benthic foraminifer and very rare green algae (Codiacea?). Grains are moderately well sorted and are medium sand size. Porosity is ~25%, almost entirely interparticle.</p> <p>General Description: Rollers: Section 1, 0-4 cm; Cylinders: Section 1, 4-12 cm. Thin section sample: Section 1, 3-4 cm.</p>



878A-20R CORED 182.8 - 192.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. foram.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
3 cm		1	? Albian	B	B	R/P				10YR 8/2

878A-21R CORED 192.5 - 202.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. foram.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.1		1	? Albian	B	B	F/M	⊗		T	10YR 8/2

878A-22M CORED 202.2 - 206.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. foram.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.1		1	? Albian	B	B	F/M	●		T	10YR 8/2

SITE 878 HOLE A CORE 23M

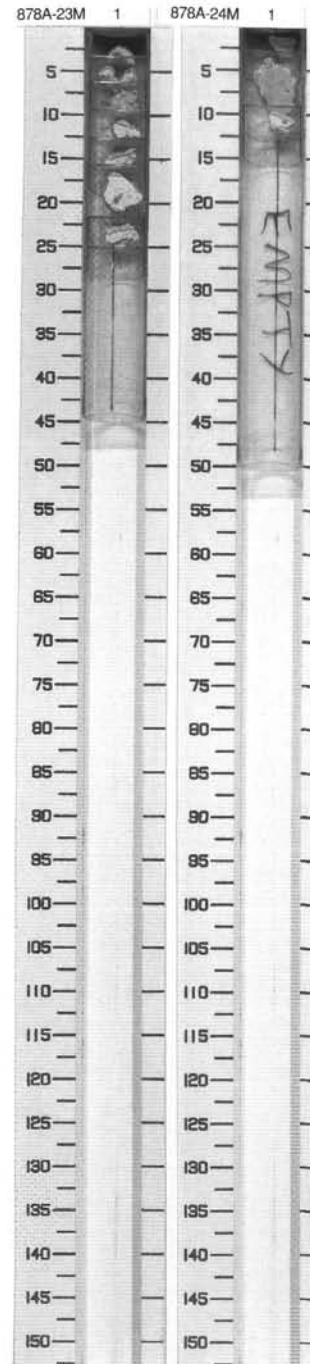
CORED 206.9 – 216.6 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0.1		1	? Albian	●		T	10YR 8/2	<p>SKELETAL PELOID PACKSTONE</p> <p>Major Lithology: Section 1, 0–2 cm, is comprised of white (10YR 8/2), very friable GRAINSTONE. Skeletal components are very difficult to identify, but include abundant to common peloids, very rare large benthic foraminifer, and very rare green algae (Codiacea?). Grains are moderately well sorted and are medium sand size. Porosity is about 25%, almost entirely interparticle. Section 1, 2–25 cm, consists of white (10YR 8/2) PELOID PACKSTONE. Skeletal components are easier to identify than in overlying unit and include common peloids, few to rare gastropods (especially Cerithids and Nereneids at Section 1, 9–12 cm), rare to few algal fragments, and rare to few large benthic foraminifers (e.g., miliolids). Pellet-filled burrows are few; there is little mottling of sediment. Porosity is 10%, mostly moldic. Calcite cement is rare, and is concentrated at Section 1, 16–21 cm. Cement is finely crystalline bladed crusts (PB3C), light brown (5YR 6/6) and pale yellow (2.5Y 7/4).</p> <p>General Description: Roller: Section 1, 16–21 cm; Drilling pebbles: Section 1, 0–16 cm and 21–25 cm. Thin section sample: Section 1, 13–16 cm.</p>
0.2								

SITE 878 HOLE A CORE 24M

CORED 216.6 – 226.3 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0.1		1	? Albian	○			10YR 8/2	<p>PELOID WACKESTONE</p> <p>Major Lithology: Section 1, 0–12 cm, is comprised of white (10YR 8/2), mottled PELOID WACKESTONE. Skeletal grains nearly impossible to identify. Pellet-filled burrows are few to many, borings are many to few, and coated grains are few to rare. Porosity (5%) is moldic, interparticle, and due to small micropore vugs. There is no calcite cement.</p> <p>General Description: Rollers: Section 1, 3–9 cm; Drilling pebbles: Section 1, 0–3 cm and 9–12 cm. Thin section samples: none.</p>



SITE 878 HOLE A CORE 25M

CORED 226.3 – 235.9 mbsf

878A-25M 1

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
		1					10YR 8/2	<p>MUDSTONE</p> <p>Major Lithology: Section 1, 0–3 cm, is comprised of white (10YR 8/2) MUDSTONE; no grains are discernable. The only discernable fabric is the occurrence of common empty tubes, ~3 mm or less in diameter, that may be borings(?) or possibly worm tubes(?). There is not much to see in this single drilling pebble. Porosity is 15%, possibly boring (BO). There is no calcite cement.</p> <p>General Description: Drilling pebbles: Section 1, 0–3 cm. Thin section samples: none.</p>



878A-23M CORED 206.9 - 216.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.1		1	? Albian			? Albian	●		-	10YR 8/2
0.2				B	B	R/P				

878A-24M CORED 216.6 - 226.3 mbsf


Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.1		1	? Albian	B	B	? Albian R/P	○			10YR 8/2

878A-25M CORED 226.3 - 235.9 mbsf

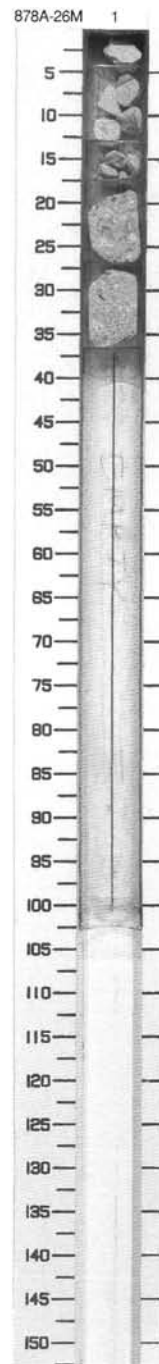
Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
3cm		1	? Albian	B	B	R/P				10YR 8/2

SITE 878 HOLE A CORE 26M

CORED 235.9 – 245.6 mbsf



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1	P F W W W P F W W W P F H H H G G R R R G G R R R G G R R R G G R R R G G R R R	1	late Aptian–Albian			T	10YR 8/3	<p>DESCRIPTION</p> <p>FORAMINIFER WACKESTONE and SKELETAL RUDSTONE AND GRAINSTONE</p> <p>Major Lithologies: Section 1, 0–8 cm, is comprised of very pale brown (10YR 8/3) FORAMINIFER WACKESTONE, with pockets of PELOIDAL PACKSTONE, probably in burrows. Constituent grains include: many small and medium benthic foraminifers (Miliolids, Cuneolina?), few gastropod molds, few thin-shelled bivalve fragments (few as molds) and peloids; peloids are common in burrows?, not seen elsewhere. Porosity includes open tubes, that are slightly curved, about 50 microns in diameter, and >1 mm-long, with no skeleton evident. Porosity (2%) is moldic (sms, smg MO), and in burrows. There is no visible cement. Pebbles of this lithology comprise about 1/2 of drilling pebbles in Section 1, 13–17 cm. Section 1, 8–13 cm and 15–17 cm, is comprised of very pale brown (10YR 7/3), moderately sorted and rounded, fine sand to gravel, SKELETAL RUDSTONE and GRAINSTONE. Some shells are brown (10YR 5/3). Constituents include: few larger benthic foraminifers (Orbitolina), many thick-walled (to 10 mm) bivalves, red algae (to 5 mm), many encrusting foraminifers? (on bivalves), very rare Codiacean algae?, and very rare coral fragments. Micrite envelopes are thin, but persistent. Porosity (3%) is moldic and very rare interparticle. There are many filled molds and partial molds (cf MO). Cement is coarsely to very coarsely crystalline bladed calcite (PB56C).</p> <p>General Description: Cylinders: Section 1, 17–37 cm; Drilling pebbles: Section 1, 0–17 cm. Thin section samples: Section 1, 4–12 cm and 31–34 cm.</p>
.2							10YR 7/3	
.3						T		

878A 27M NO RECOVERY





SITE 878 HOLE A CORE 28M

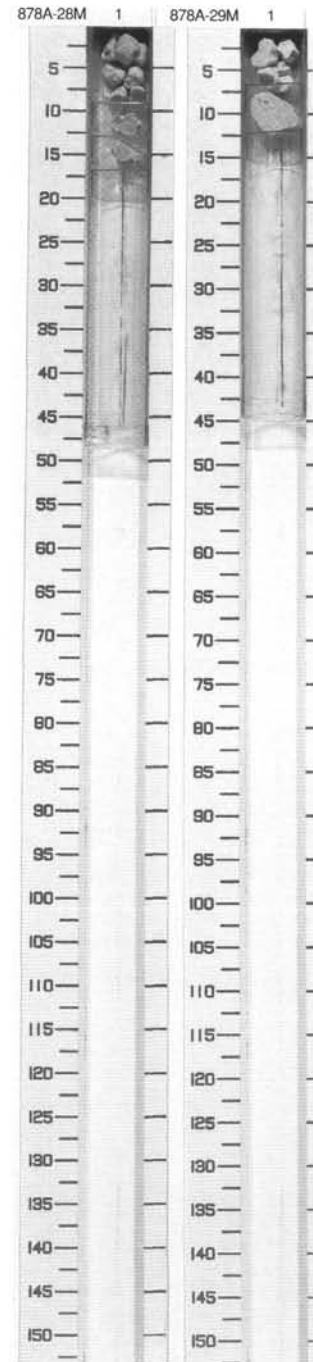
CORED 255.2 – 264.9 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	late Aptian				10YR 7/3	<p>SKELETAL RUDSTONE AND PACKSTONE</p> <p>Major Lithology: Section 1, 0–17 cm, is comprised of very pale brown (10YR 7/3) SKELETAL RUDSTONE AND PACKSTONE. Pebbles are well indurated. The rudstone is primarily composed of rudist fragments in a matrix of skeletal packstone. Other pebbles have a composition that is similar to the rudstone matrix. Skeletal components include: common peloids, many to few rudist fragments, few green algae (Codiacea), few red algae (squamariaceans?), few bores, rare corals, and rare stromatoporoids. Porosity is 5%–7%, mostly interparticle. Calcite cement is rare to few (PB3C).</p> <p>General Description: Drilling pebbles: Section 1, 0–17 cm. Thin section samples: none.</p>

SITE 878 HOLE A CORE 29M

CORED 264.9 – 274.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	late Apt.				10YR 7/3	<p>GRAINSTONE</p> <p>Major Lithology: Section 1, 0–12 cm, is comprised of fine-grained (0.15 mm), moderately sorted, very pale brown (10YR 7/3) GRAINSTONE; it is lightly leached in Section 1, 0–6 cm. Vague laminations are indicated by the parallel orientation of larger grains. Rudist and gastropod shell debris are minor (5%); larger benthic foraminifers are rare. Small foraminifers are common, but most of the other grains are unidentifiable. Porosity (5%) is vuggy and interparticle. Cement is minor, drusy sparry calcite.</p> <p>General Description: Rollers: Section 1, 6–12 cm; Drilling pebbles: Section 1, 0–6 cm. Thin section samples: none.</p>



878A-26M CORED 235.9 – 245.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian-Albian		late Aptian or late Albian ?	late Aptian-Albian			T	10YR 8/3
.2				B	R/P					10YR 7/3
.3					F/M				T	

878A-27M NO RECOVERY

878A-28M CORED 255.2 – 264.9 mbsf

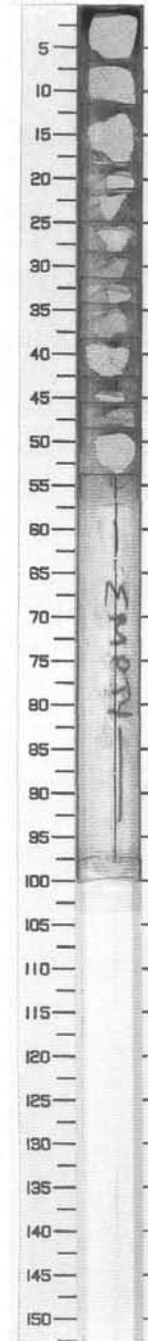
Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian	B	B	late Aptian				10YR 7/3

878A-29M CORED 264.9 – 274.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian	B	B	late Aptian				10YR 7/3

R/P

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
5		1	late Aptian			T	10YR 7/3	<p>GRAINSTONE</p> <p>Major Lithology: Section 1, 0–54 cm, is comprised of very pale brown (10YR 7/3), medium-grained (0.25–0.5 mm), leached, GRAINSTONE. The constituent grains include: mollusk debris (rare), gastropod fragment molds (few), large benthic foraminifers (few), and small foraminifers (common). Small grains are unidentifiable; larger skeletal fragments are 0.8–1 cm in size. Cement is drusy sparry calcite (10%–20%). Porosity is interparticle (10%). Some of the larger skeletal fragments are worn and usually concentrated into spots, rather than evenly dispersed.</p> <p>General Description: Rollers: Section 1, 0–18 cm, 34–42 cm, and 48–54 cm; Drilling pebbles: Section 1, 18–34 cm and 42–48 cm. Thin section sample: Section 1, 29–31 cm.</p>

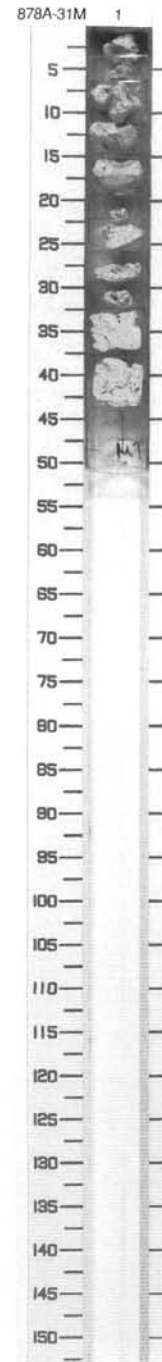


SITE 878 HOLE A CORE 31M

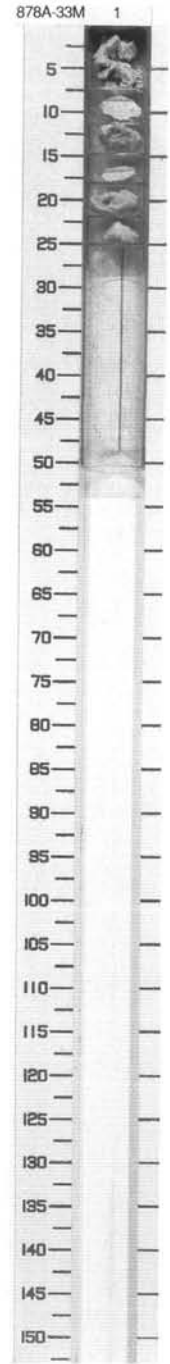
CORED 284.1 – 293.4 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0-0.1		1	late Aptian			T	10YR 8/3	<p>LIMESTONE and MOLLUSK RUDSTONE</p> <p>Major Lithologies: Section 1, 0–44 cm, is comprised of very pale brown (10YR 8/3) MOLLUSK RUDSTONE, with a fine to coarse sand, poorly-sorted, skeletal grainstone matrix. Constituent grains include: common peloids in the sand fraction, common large bivalves (possible rudists, but no characteristic structures were seen), many larger benthic foraminifers (Orbitolinids), few gastropods as molds (including Cerithids); there are also very rare corals, encrusting worm tubes (in Section 1, 7–11 cm), smaller foraminifers (Textularids?), and algae (Codiacian? Coralline?). Bivalve shells are observed to 7 mm thick, although some are also very thin (50 µm thick, 6 mm long); these are common as filled molds or partial molds (cf MO), but the wall structure is well preserved in some shells. Micrite envelopes are extensive, and up to 60 µm thick. Large shells are extensively bored: small tubes (Cyanobacteria?), connected ovoids (Clonid sponges), and sack-shaped hollows (bivalve borings). There is probably some mud (packstone) in fills. Fills are fine sand and calcite spar. "Gray grains", or stained bioclasts, are sparse, but widely distributed. One coral (in Section 1, 26–30 cm; 30 mm in diameter) is bright blue; this color covers the entire colony, but none of the matrix. Porosity (5%–20%, average 15%), may increase downward; it is partially scalenohedral. Large scale porosity (bivalve molds, cavities, and vugs) cannot be accurately estimated in small pieces; it may be very high. Pores include molds (cr/ms/smg MO), >> interparticle (sms BP), intraparticle (1 ms WD), and shelter. Cements are coarse to very coarse, equant, or bladed PB56C>PE5>PB6. The last (e.g., Section 1, 15–19 cm) is doubly terminated.</p> <p>General Description: Cylinders: Section 1, 38–44 cm; Rollers: Section 1, 7–19 cm, 22–30 cm, and 32–38 cm; Drilling pebbles: Section 1, 0–7 cm, 19–22 cm, and 30–32 cm. Thin section sample: Section 1, 22–26 cm.</p>

878A 32M NO RECOVERY



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1 .2		1	late Aptian				10YR 7/3	<p>DESCRIPTION GRAINSTONE</p> <p>Major Lithology: Section 1, 0–25 cm, is comprised of very fine-grained, pale brown (10YR 7/3), leached, GRAINSTONE, with low interparticle and vuggy porosity (5%). Enclosed are fragments (up to 5 cm-long) of either calcisponges or corals. A rhodolith (2 cm in diameter), formed by encrusting algae, occurs in Section 1, 14–18 cm. There are calcisponges in Section 1, 11–14 cm, 18–21 cm, and 21–25 cm. The recognition of other grains requires thin section study.</p> <p>General Description: Rollers: Section 1, 7–14 cm and 18–25 cm; Drilling pebbles: Section 1, 0–7 cm and 14–18 cm.</p>



878A-30M CORED 274.5 – 284.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.5		1	late Aptian						T	10YR 7/3
				B	B	R/P				

878A-31M CORED 284.1 – 293.4 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian							
.2				B	B	F/P			T	10YR 8/3
.3										
.4										

878A-32M NO RECOVERY

878A- 33M CORED 302.9 – 312.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian							
.2				B	B	R/P				10YR 7/3

SITE 878 HOLE A CORE 34M

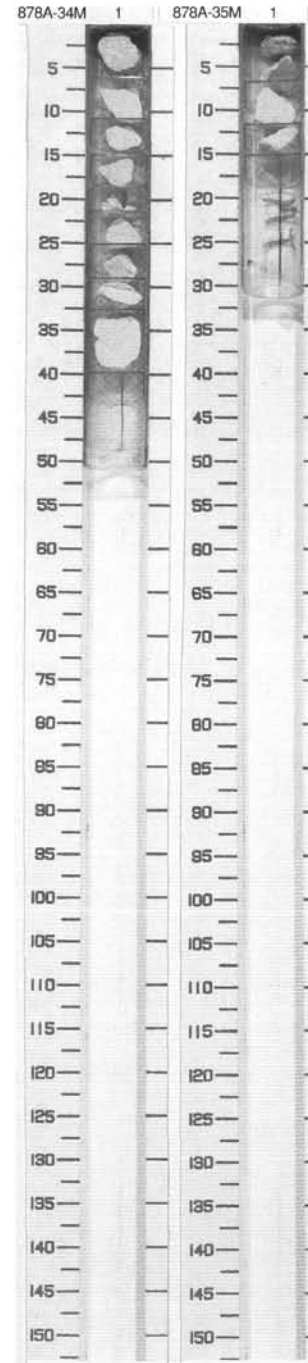
CORED 312.6 – 322.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1 .2 .3		1	late Aptian				10YR 8/3	<p>GRAINSTONE</p> <p>Major Lithology: Section 1, 0–40 cm, is comprised of very pale brown (10YR 8/3), friable, fine-grained (0.1 mm), GRAINSTONE. Most grains are rounded and ovoid, but are unidentifiable without thin section samples; a few are rectangular to lath shaped (probably mollusk fragments). Larger (1 cm), thin-shelled mollusk fragments are rare. Rare coated tubes (0.5 mm) filled with the same material as matrix, are probably worm tubes. There are trace orbitolina foraminifers (mostly fragments; one whole, 3 mm diameter). At least half of the piece in Section 1, 0–6 cm is some type of encrustation that is partly bored and recrystallized. It has internal structure similar to a sponge in places, similar to algae in other places, and looks like encrusted worm tubes in another; it may be all three. The encrustation itself may be bored. Some grains within the encrustation are micrite envelopes. Porosity is probably at least 15%, mostly intergranular, with only trace moldic and burrow porosity. Virtually no crystalline cement is visible, however, most grains appear to have a clear coating cementing them together.</p> <p>General Description: Cylinders: Section 1, 32–40 cm; Rollers: Section 1, 0–18 and 21–32 cm; Drilling pebbles: Section 1, 18–21 cm. Thin section samples: none.</p>

SITE 878 HOLE A CORE 35M

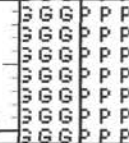

CORED 322.2 – 331.9 mbsf

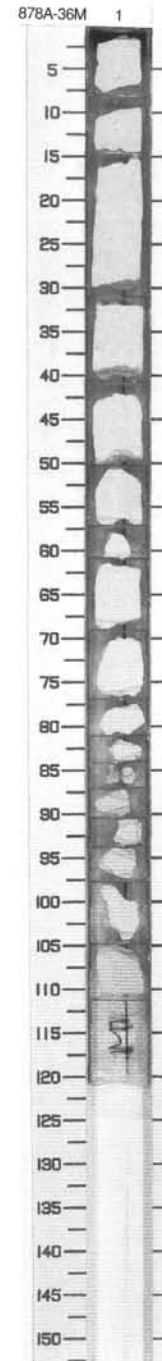
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	late Aptian				10YR 8/3	<p>GRAINSTONE</p> <p>Major Lithology: Section 1, 0–15 cm, is comprised of fine-grained (0.1 mm), very pale brown (10YR 8/3), soft, friable GRAINSTONE. The grainstone is massive (homogenous) in appearance. High interparticle porosity (10%) is the result of either leaching or uncomplete cementation. Cement is sparse, drusy (10%–15%) calcite. Few recognizable bioclasts are mollusk shell fragments (mainly parallel oriented), worm tubes (rare), and poorly preserved benthic foraminifers (few). Most of the grains are unidentifiable.</p> <p>General Description: Rollers: Section 1, 7–15 cm; Drilling pebbles: Section 1, 0–7 cm. Thin section samples: none.</p>



SITE 878 HOLE A CORE 36M

CORED 331.9 – 341.6 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1		1	late Aptian			T	10YR 8/3	<p>GRAINSTONE TO PACKSTONE</p> <p>Major Lithology: Section 1, 0–111 cm, is comprised of very pale brown (10YR 8/3), friable, fine-grained (0.1mm) GRAINSTONE or PACKSTONE with sparse matrix. Most grains are rounded and ovoid but are unidentifiable without thin section samples, a few are rectangular or lath shaped (probably mollusk fragments). Larger (1 cm), thin-shelled mollusk fragments are rare. Rare coated tubes (0.5 mm), filled with the same material as the matrix, are probably worm tubes. One tube, cut obliquely, is at least 2 cm long. Porosity probably exceeds 10% and is primarily intergranular. There is no visible cement. Pieces in Section 1, 87–91 cm and 105–111 cm, have less matrix and are definite grainstones (they are similar to Cores 144-878A-34M and -35M).</p> <p>General Description: Cylinders: Section 1, 0–57 cm, 61–77 cm, and 105–111 cm; Rollers: Section 1, 57–61 cm, 77–81 cm, and 94–105 cm. Thin section sample: Section 1, 57–60 cm.</p>



878A-34M

CORED 312.6 – 322.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian	B	R/P				10YR 8/3
.2									
.3									

878A-35M

CORED 322.2 – 331.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian	B	late Aptian				10YR 8/3

R/P

878A-36M

CORED 331.9 – 341.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian	B	late Aptian			T	10YR 8/3

SITE 878 HOLE A CORE 37M

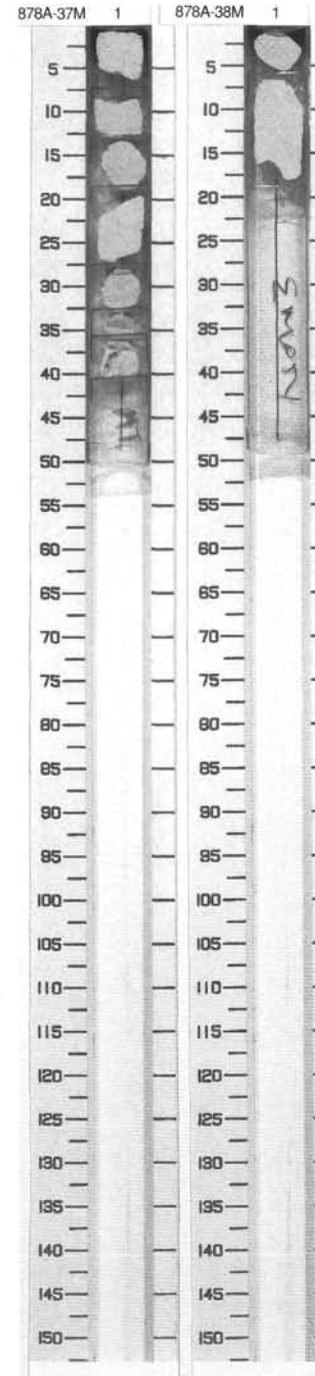
CORED 341.6 – 351.2 mbsf

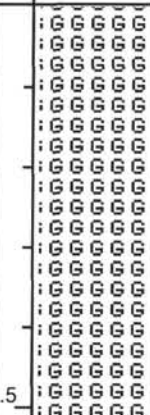

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1 .2 .3		1	late Aptian			T	10YR 8/2	<p>SKELETAL FORAMINIFER GRAINSTONE</p> <p>Major Lithology: Section 1, 0–27 cm, consists of white (10YR 8/2), fine-grained, friable, poorly cemented, SKELETAL FORAMINIFER GRAINSTONE. Most small grains are not identifiable. Larger grains (7%) are benthic foraminifers (2%), mollusk fragments (2%–3%), and a few worm tubes. Porosity averages 7%, and is interparticle (BP). Bladed sparry calcite is sparse. Section 1, 27–40 cm, is comprised of white (10YR 8/2), coarse-grained, SKELETAL FORAMINIFER GRAINSTONE. The sorting is bimodal, with a coarse fraction of 3 mm, and a fine fraction of 0.3–0.4 mm. The coarse fraction is dominated by orbitolinids; mollusk fragments and worm tubes are also present. Porosity is 10%–15%, mostly interparticle (BP). Some bioclasts are aligned. A rudist? shell, 5 cm in size, is encrusted by algae and bored by bivalves; its cavity is partially filled by bladed spar.</p> <p>General Description: Cylinders: Section 1, 0–6 cm and 18–27 cm; Rollers: Section 1, 6–18 cm, 27–32 cm, and 35–40 cm; Drilling pebbles: Section 1, 32–35 cm. Thin section sample: Section 1, 32–35 cm.</p>

SITE 878 HOLE A CORE 38M

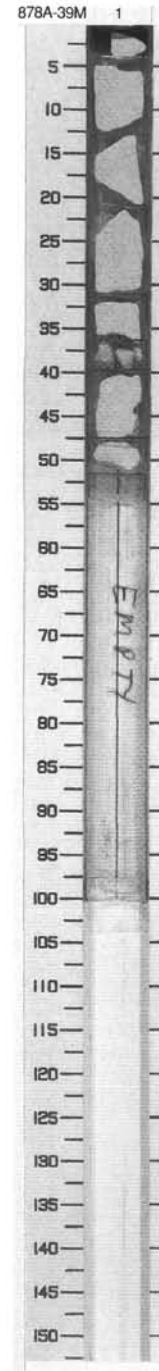
CORED 351.2 – 360.9 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	late Aptian				10YR 8/2	<p>SKELETAL PELOIDAL GRAINSTONE</p> <p>Major Lithology: Section 1, 0–19 cm, is comprised of white (10YR 8/2), fine-grained, well-sorted, SKELETAL PELOIDAL GRAINSTONE, with abundant peloids and common bivalve fragments. Porosity is 15%–20%, interparticle (BP).</p> <p>General Description: Cylinder: Section 1, 6–19 cm; Roller: Section 1, 0–6 cm. Thin section samples: none.</p>



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150		1	late Aptian			T	10YR 8/2	<p>DESCRIPTION</p> <p>SKELETAL PELOIDAL GRAINSTONE</p> <p>Major Lithology: Section 1, 0–52 cm, is comprised of white (10YR 8/2) SKELETAL PELOIDAL GRAINSTONE; it is fine to medium grained, except in Section 1, 48–52 cm, where it is medium to coarse grained. Peloids are abundant, skeletal fragments are common and consist of bivalve fragments, benthic foraminifers (orbitolinids) are very rare (in Section 1, 4–13 cm). There are rare oncoids in Section 1, 13–21 cm, 21–31 cm, and 40–48 cm. Burrows are noted in Section 1, 21–31 cm. The backside of Section 1, 13–21 cm, is stained very pale brown (10YR 8/4). Porosity is 10%–15% and is interparticle (BP).</p> <p>General Description: Cylinders: Section 1, 4–13 cm, 13–21 cm, 21–31 cm, and 40–48 cm; Rollers: Section 1, 0–4 cm, 31–37 cm, and 48–52 cm; Drilling pebbles: Section 1, 37–40 cm. Thin sections: Section 1, 48–51 cm.</p>

878A 40M NO RECOVERY



878A-37M CORED 341.6 – 351.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian							
.2				B	B	R/P			T	10YR 8/2
.3										

878A-38M CORED 351.2 – 360.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian							
				B	B	R/P				10Y 8/2

878A-39M CORED 360.9 – 370.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
		1	late Aptian							
				B	B	R/P			T	10YR 8/2
.5										

878A-40M NO RECOVERY

SITE 878 HOLE A CORE 41M

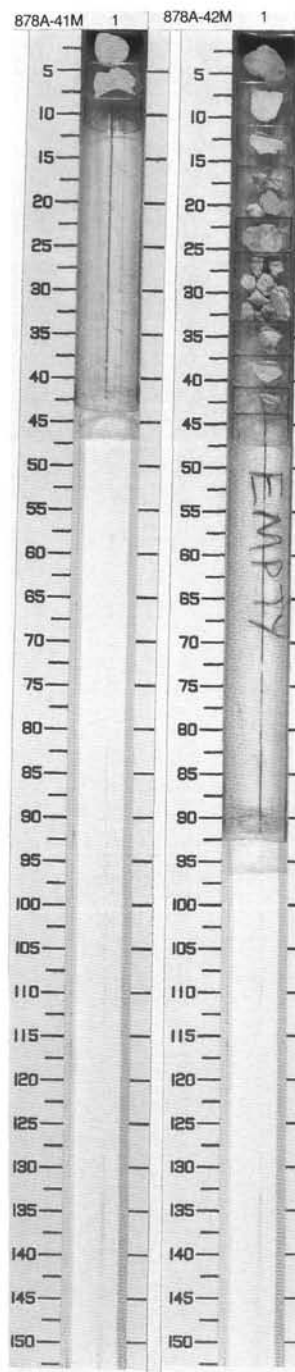
CORED 380.2 – 389.8 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0		1	late Aptian			T	10YR 8/2	<p>PELOIDAL GRAINSTONE</p> <p>Major Lithology: Section 1, 0–8 cm; white (10YR 8/2), fine-grained PELOIDAL GRAINSTONE with rare to few skeletal fragments (bivalve fragments). Porosity is 10%–15%, interparticle (BP).</p> <p>General Description: Rollers: Section 1, 0–8 cm. Thin section sample: Section 1, 4–8 cm.</p>

SITE 878 HOLE A CORE 42M

CORED 389.8 – 399.3 mbsf

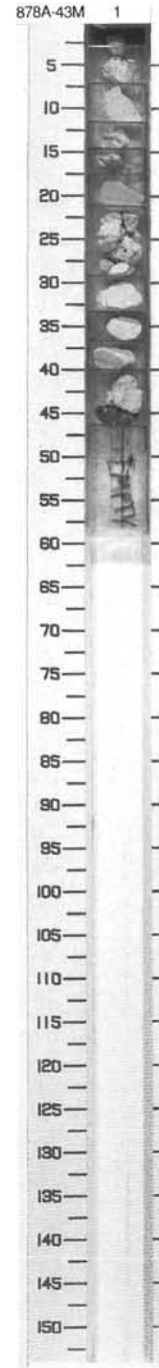
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0.1		1	late Aptian				10YR 7/2	<p>SKELETAL FORAMINIFER WACKESTONE and MUDSTONE</p> <p>Major Lithologies: Section 1, 0–11 cm; light gray (10YR 7/2) SKELETAL FORAMINIFER WACKESTONE with common benthic foraminifers (small miliolids), smooth-shelled ostracods, very rare oncolids, and unidentified recrystallized bioclasts. In 0–6 cm a fracture is filled by calcite cement including benthic foraminifers similar to those occurring in the wackestone; this suggests that the infilling results from the recrystallization of micrite with benthic foraminifers. In this infilling there are some tubes (= borings?) filled by a silt-size yellow (10YR 8/8) sediment. Porosity is 1%, moldic (MO), and results from the leaching of small benthic foraminifers. 6–22 cm; light gray (10YR 7/2) MUDSTONE with rare skeletal fragments with micritic coatings, small benthic foraminifers (miliolids) and very rare possible cyanobacterial bushes (Cayeuxia) are very rare. Burrows, 0.25 mm average diameter, occur in 16–22 cm. Porosity ranges from 1 to 3%, due to burrowing (BU). 22–26 cm; white (10YR 8/2) WACKESTONE with a conspicuous mottled aspect due to burrowing. Mottling is light gray (2.5Y 7/2). Components include rare small benthic foraminifers and tiny unidentified skeletal fragments; cyanobacterial bushes ("Cayeuxia") are rare.</p> <p>General Description: Rollers: Section 1, 0–6 cm, 11–16 cm, 22–26 cm; Drilling pebbles: Section 1, 6–11 cm, 16–22 cm, 26–44 cm. Thin sections: Section 1, 11–15 cm, 26–32 cm.</p>
0.2							10YR 8/2	
0.3								
0.4								



SITE 878 HOLE A CORE 43M

CORED 399.3 - 406.0 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	late Aptian			T	10YR 7/3	<p>SKELETAL PELOID WACKESTONE and CLAY</p> <p>Major Lithologies: Section 1, 0-44 cm; very pale brown (10YR 7/3) and white (10YR 8/2) SKELETAL PELOID WACKESTONE. Skeletal components are difficult to identify (highly recrystallized ?), but include many peloids; few to many unidentified bioclasts (algal fragments ? - 2-4 mm across); few coral fragments; and rare mollusk fragments. Borings are many. Porosity is 5%. Calcite cement is very rare. Pale yellowish orange (10YR 8/6) stains occur at 3-7 cm. Mudstone pebble occurs in 11-14 cm. Thick shelled mollusk (rudist ?) fragment occurs in 14-17 cm. Section 1, 44-46 cm; dark greenish gray (5G 4/1) CLAY with common fine-grained pyrite disseminated throughout and clasts of limestone (peloid wackestone).</p> <p>General Description: Rollers: Section 1, 17-21 cm; 29-33 cm; Drilling pebbles: Section 1, 0-17 cm; 21-29 cm; 33-46 cm. Thin sections: Section 1, 18-21 cm, 33-36 cm.</p>
.2								
.3								
.4								



878A-41M

CORED 380.2 – 389.8 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0		1					●		T	10YR 8/2

late Aptian
 |
 late Aptian F/M
 |
 late Aptian R/P
 |
R. angustus F/M

878A-42M

CORED 389.8 – 399.3 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian	B	B	R/P	●			10YR 7/2
.2										
.3										
.4										

878A-43M

CORED 399.3 – 406.0 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	late Aptian	B	B	R/P	●		T	10YR 7/3
.2										
.3										
.4										

5G 4/1

SITE 878 HOLE A CORE 44M

CORED 406.1 – 408.9 mbsf

878A-44M 1 2

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color
1		1	late Aptian			T	2.5YR 5/4
2		2				T	5GY 6/4 2.5YR 5/4

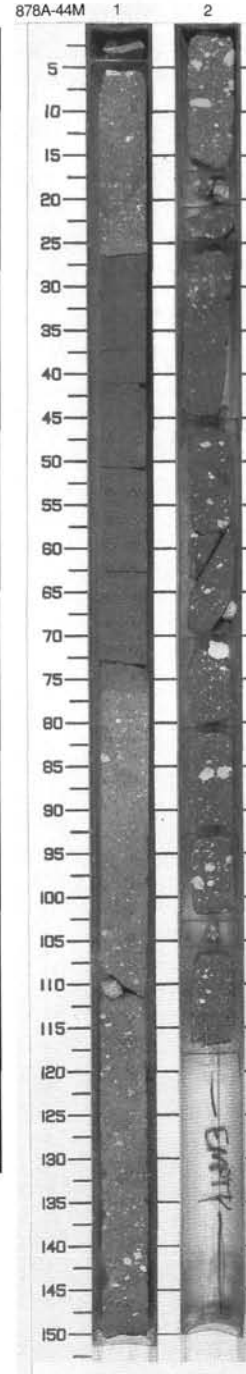
DESCRIPTION**LIMESTONE VOLCANIC BRECCIA****Major Lithology:**

Section 1, 0–25 cm and 76–148 cm; greenish gray (5GY 6/4) POLIMICTIC LIMESTONE VOLCANIC BRECCIA with angular to subangular clasts of altered vesicular and glassy basalt and limestone. Matrix is coarse volcanic sand cemented by calcite. Volcanic clasts (mm to 1 cm in size) are altered, but appear to have been lightly vesicular, glassy basalt. They contain ~50% vesicles, 0.1 mm round. Isolated (1%–2%) plagioclase phenocrysts ~ 0.5 mm in some clasts. Some have dense dark green rims and are commonly rich in pyrite. Limestone clasts are very pale brown (10YR 8/3), subangular, 2 mm to 2 cm in size and comprise about 5% of the breccia. Limestone is skeletal wackestone, fine-grained, with few miliolid foraminifers. Breccia has sharp contact at 25 cm with a bed of bedded tuff. Volcanic clasts below 76 cm are 2 to 8 mm in size, with two clasts up to 15 cm in size. Breccia has vague beds 1–3 cm in thickness. Breccia is coarser and pebbly from 103–148 cm. Dispersed limestone clasts are mostly few mm in size (ave. 8 mm) with a single clast of miliolid pelleted packstone at 110 cm that is 3 cm in length. Limestone clasts are mostly miliolid wackestone and mudstone. Few coarser grained laminae in the breccia occur at 120 cm, 131–134 cm, and 140–144 cm. At 148 cm is a sharp contact with bedded tuff as at 25–76 cm. Section 1, 26–76 cm and 148–151 cm; dark greenish gray (5GY 5/4), bedded TUFF. Sharp contact at Section

1, 25 cm and 76 cm, with polimictic limestone volcanic breccia. Clasts in the tuff are highly angular, highly vesicular (>60%) glassy lava. Elongate horizontally. Vesicles also elongate horizontally, typically 0.1x0.3 mm. No phenocrysts. Clasts appear to have been flattened. Matrix appears to be made up of angular glassy fragments. Texture of this unit is reminiscent of ash flow tuff displaying flattened clasts. However the thinness of this flow and its sharp contacts with debris flow breccias make an ash flow origin unlikely. Elongation of shards vesicles suggests a siliceous (trachyte?) lava. Some clasts (Section 1, 148–151 cm) appear to be altered pumice again suggesting the presence of trachytic lavas. Section 2, 0–17 cm; LIMESTONE VOLCANIC BRECCIA as in Section 1, clast supported, greenish gray with clasts mm to 1 cm in size, subangular in finer volcanic sand matrix cemented by calcite. Predominant clasts in 0–5 cm are equant, subangular vesicular basalt with ~50% round vesicles. Elongate clasts with elongate vesicles (see below) and pumice are also present. Several subangular clasts of a skeletal grainstone (with miliolids, micrite, intraclasts, white tubeform organisms), and miliolid wackestone (3–4 mm to 2.5 cm) in size intercalated within breccia. Limestone is pale brown (10YR 8/3). Section 2, 17–21 cm; Grainstone clast, 2 cm in size, with foraminifers, coral fragment, coated grains, cemented by sparry calcite. Second fragment is piece of mollusk shell (gastropod?). Section 2, 21–118 cm; reddish brown (2.5YR 5/4) LIMESTONE VOLCANIC BRECCIA comprised of altered vesicular basalt and glass clasts. Predominantly elongate, highly angular volcanic clasts in 5–118 cm with elongated vesicles parallel to clast elongation. Texture reminiscent of siliceous lavas (trachyte?) rather than basalt. Some pumice. Clasts are about 3 mm to 6 mm with few up to 2 cm in size, subrounded olive gray (5Y 4/2) and deposited in reddish brown (2.5YR 5/4) matrix of sand-size volcanic grains cemented by calcite. Many volcanic clasts are altered and most have dark green rims. Matrix is mostly red stained micrite. Limestone clasts of several mm up to 3 cm in size are dispersed in the breccia. Miliolid wackestone is abundant, less common mudstone. Some of clasts are angular with straight edges (broken). Breccia has very vague bedding on scale 1–3 cm. Most of the bedding results from minor grain size variation (more or less of coarser fragments). Bedding has 7%–10% inclination.

General Description:

Cylinders: Section 1, 4–151 cm; Section 2, 0–17 cm, 25–103 cm, 106–118 cm. Rollers: Section 1, 0–4 cm; Section 2, 21–25 cm. Drilling Pebbles: Section 2, 17–21 cm, 103–106 cm. Thin sections: Section 2, 12–15 cm, 114–118 cm.



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color
1	[Graphic Lith. 1]	1	late Aptian		↑	T	2.5YR 5/4 To 10R 4/6
2	[Graphic Lith. 2]	2			↑	T	
3	[Graphic Lith. 3]	3			↑	T	
4	[Graphic Lith. 4]	4			↑	T	
5	[Graphic Lith. 5]	4			↑		

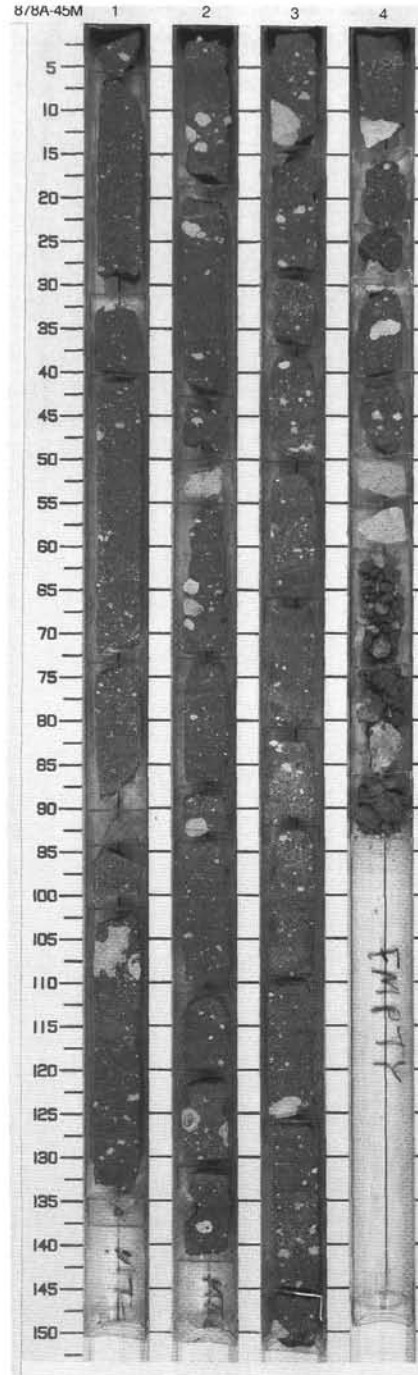
DESCRIPTION

LIMESTONE VOLCANIC BRECCIA

Major Lithology:

Section 1, 0–138 cm; reddish brown (2.5YR 5/4) LIMESTONE VOLCANIC BRECCIA. Matrix is fine sand size carbonate and volcanic grains in micritic matrix stained red by iron oxide. Volcaniclastic grains are highly altered fragments of vesicular and glassy basalt, average 3–8 mm in size, greenish gray color (10G 6/2), angular to subrounded. Volcanic clasts 2–3 cm in size occur at Section 1, 80 and 134 cm; Clasts in Section 1, 47–48 cm (1x1 cm) and 90–93 cm (3x3 cm) red gray microcrystalline basalt with 5% olivine microphenocrysts (0.2–0.5 mm) altered to iddingsite. Limestone clasts are pale brown (10YR 7/3), mm to 8 mm size, few larger clasts 2 to 7 cm. Small limestone clasts are mainly milliloid wackestone and mudstone. Limestone clast in Section 1, 100–107 cm is algal stromatolite-like, highly bored with borings infilled by a grainstone and coarse dogtooth sparry calcite. At Section 1, 120 cm gradual boundary with slightly coarser grained and darker colored (2.5YR 4/4) pebbly bed. Section 2, 0–142 cm; continuation of the same lithology as in core 45M-1. Small increase in limestone pebbles (5%–7%). Pebbles are subrounded, several mm in size, with few 2 cm in size. At 50–55 cm limestone is 4 cm in

size. Gastropod (2 cm in diameter), infilled by peloid-oolitic grainstone, volcanic glass and coarse sparry calcite is at Section 2, 126 cm. Most of the clasts are mudstone, few pelleted packstone (at Section 2, 51–55 cm, 89 cm). Clasts of grainstone occur at Section 2, 67 cm. Scoria pebble (3 cm diameter) at Section 2, 126 cm. Altered basalt pebbles in Section 1, 68–70 cm. Grain size variation is small within the Section 2, decrease in coarser volcanic fragments produce vague lamination/bedding on 2–4 cm scale. Coarse limestone pebbles seem to be concentrated into poorly delineated horizons. Section 3, 0–152 cm; more limestone volcanic breccia breccia, weak red (2.5YR 4/2). Coarser-grained portions are olive gray (5Y 4/2) speckled. Volcanic clasts are in average 2–5 mm in size, rarely 1.5 cm and few 2.5 cm in size. Concentration of clasts varies; the clast rich horizons with 70% of clasts occur at Section 3, 9–11, 24–34, 35–42, 56–60, 78–80, 86–95, 105–110, and 136–140 cm. Between these horizons content of clasts decrease to 10%. Average size of clasts in clast-rich horizons is 8 mm. Volcanic clasts are olive gray (5Y 4/2), lightly altered, vesicular, and glassy basalt. Less common are clasts with elongated vesicles (flow and trachytic texture). Only few scoria-like fragments are present. Limestone (very pale brown, 10YR 8/3) clasts form 5%–10% of the breccia; their size varies from several mm up to 6 cm. They are mainly subangular; the smaller clasts are rounded. They are mainly milliloid wackestone and mudstone. Skeletal-peloid grainstone clasts occur at Section 3, 0–5 cm (coarse-grained clast), 15 cm, 20 cm, and 140 cm. At Section 3, 152 cm a clast of fine-grained skeletal-peloid grainstone contains few ooids grains and tubiphytes. Grainstones have elongated vugs infilled by sparry calcite. Vugs are similar to fenestrae. Sedimentary structures are limited to poorly developed bedding resulting from grain size variation. Alteration of beds 1–6 cm thick, subhorizontally oriented, coarser, pebbly horizons (which are sparry calcite cemented) with beds of finer-grained "muddier" sediment produces vague bedding. There are no sharp boundaries between individual beds. The finer grained beds have about 1/3 of sand size volcanic grains deposited in iron oxide stained micritic carbonate matrix. At Section 3, 65–78 cm small-scale trough bedding. The "channel" is only 6 cm deep and is infilled by 1.7 mm volcanic clasts capped by 0.5–1 cm thick "muddy" layer. Section 4, 0–76 cm. LIMESTONE VOLCANIC BRECCIA, red (10R 4/6) color of matrix gives overall cast to rock. Volcanic clasts are dark grayish green (10G 4/2) where fresh, which is rare. Limestone clasts are very pale brown (10YR 7/3). Sorting is very poor, clay to 55 mm particles are present, many clasts are 1–2 mm. Layer from Section 4, 2–8 cm has 4 mm average clast size. Clasts are roughly equant (subspherical) but volcanic clasts are extremely angular as they are broken along vesicles; result looks like tear along perforations. Some carbonate clasts are also angular (because of solution etching?). Both vesicles and vugs/molds are filled with matrix. Bulk composition is 50% volcanic clasts, 10% limestone clasts and 40% (locally 50%) matrix, which includes fine sand, silt, and some clay. Matrix is 65% carbonate (irregular grains 2–50 microns diameter), 30% isotropic, greenish, equant to elongate and slightly angular grains (glass?), 5% brown aggregates



Site 878 Hole A Core 45M Description continued...

(Fe-oxide and clay?), and trace feldspar. Volcanic clasts are basalt, highly vesicular, and generally very altered; some with tubular vesicles, and a few fine pumice fragments. Deeply weathered clasts are so full of vesicles with various fillings, including quartz? and calcite (to 1 mm diameter), as to look like a very rounded sandstone with a few carbonate clasts. Only the less altered rims and ragged margin with matrix-filled vesicles reveals volcanoclastic origin. Rinds 25–100 microns thick; may be secondarily impregnated, e.g., with calcite. Carbonate clasts include: Section 4, 10–14 cm; OOLITE GRAINSTONE, medium sand (1/4–1/2 mm), very well sorted. Grains are >90% oolites (~60 volume percent), 35% calcite cement, 2% interparticle (BP) porosity, miliolid forams about 1%, bivalve molds about 10%, rare dasyclad algae. Ooids range from surficial, perhaps micritic, to thick cortices. Other oolite fragments in Section 4, 23–27 cm, 33–35 cm, 29–40 cm, and among pebbles in 60–74 cm. Section 4, 27–29 cm; MILIOLID WACKESTONE. Section 4, 40–49 cm; (in BRECCIA) a) Coral fragment with packstone matrix. b) Peloid, mollusk-fragment packstone. Section 4, 49–60 cm; ALGAL SPONGE BINDSTONE (2 clasts with red matrix and volcanics adhering). Squamariacean algae and calcisponge layers with encrusting forams appear to bind peloidal packstone matrix. Skeletal components are gastropod molds (few), coral fragments (rare) and bivalve fragments (rare). Section 4, 60–74 cm; about half of pebbles are limestone, including mudstone with sinuous open tubes 100–250 microns diameter, 6 mm long. Section 4, 76–86 cm; 2 limestone pieces, probably BRECCIA CLASTS. a) Ooid-peloid packstone. b) Peloid packstone with crystalline coral fragments to 20 mm, encrusted by foraminifers, corals, and red algae. One leached coral is filled with red matrix and volcanic clasts. Section 4, 86–93 cm; soft clay matrix, pale green (10 G 6/2), with small volcanic and carbonate clasts. Probably highly disturbed in drilling.

General Description:

Cylinders: Section 1, 6–90 cm, 94–135 cm, Section 2, 0–50 cm, 55–142 cm, Section 3, 0–152 cm, Section 4, 0–23 cm, 29–49 cm; Rollers: Section 1, 0–6 cm, 90–94 cm, Section 2, 50–55 cm, Section 4, 23–29 cm, 49–60 cm, 80–86 cm; Drilling Pebbles: Section 1, 135–138 cm, Section 4, 60–80 cm, 86–93 cm. Thin sections: Section 1, 105–109 cm, Section 2, 89–93 cm, Section 3, 47–49 cm, 123–125 cm.

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color
1		1	late Aptian				10G 6/1 To 10G 4/2
		2				T	
						T	
						T	

DESCRIPTION

LIMESTONE VOLCANICLASTIC BRECCIA

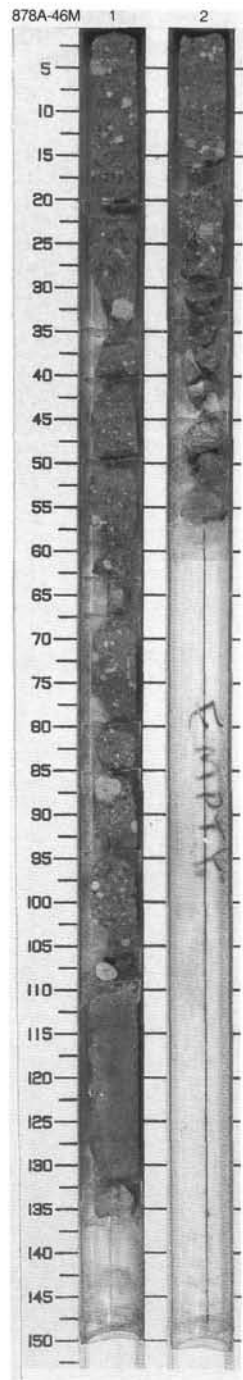
Major Lithology:

Section 1, 0 cm to Section 2, 57 cm; LIMESTONE VOLCANICLASTIC BRECCIA, average matrix is light grayish green (10G 6/1), average volcaniclastic clast is dark grayish green (10G 4/2), and average limestone clast is very pale brown (10YR 7/3). Vague 1 to 3 cm scale bedding appears as a variation in average grain size from 1 to 3 mm in some beds to 2-10 cm in alternate beds and slight variation in overall color. No clear evidence of grading; a few bedding contacts are sharp (e.g., Section 1, 3 cm). Matrix: about 50% of the matrix is white to light gray calcite with no visible crystals enclosing sand-sized volcaniclastics (some glass?), and sand-sized limestone lithoclasts, and skeletal (mollusk?) fragments. In Section 2, 0-16 cm, 3 isolated miliolid foraminifera and 3 isolated ooids? were found in the matrix (not as part of a lithoclast). Volcaniclastics: about 80%-95% of clasts are mm to cm sized predominantly aphanitic basalt clasts, equant and subangular in shape with 50% spherical vesicles. Minor clast types display elongate tubular vesicles, aphanitic texture with sparse, irregular vesicles, and trachyte texture outlined by relict feldspar laths. Limestone clasts: 5%-20% of total clasts, dominantly fine- to coarse-grained peloidal grainstone/packstone with fewer clasts of miliolid wackestone and mudstone. The limestone clasts vary from rounded to angular, but nearly all have sharp contacts with the matrix, suggesting lithification prior to breccia deposition. All are well cemented, with nearly all intergranular space in the grainstones filled by clear to

translucent cement with few visible crystal boundaries. Recognizable components include miliolids, peloids, and micrite envelopes. Several have burrows filled either by packstone/wackestone or by limestone volcaniclastic sand (similar to the breccia matrix); presumably, the former were filled prior to breccia deposition and the latter were empty burrows filled during or after breccia deposition. At Section 1, 3 cm, one limestone clast has 0.5 cm intraclasts and a 1 cm bivalve(?) fragment completely replaced by coarse, clear calcite. In section 1, 77-79 cm, there is a 2x2x3 cm limestone clast of coarse peloidal packstone grainstone that has a 2-3 mm-thick laminar coating of material similar to the breccia matrix; the contact between the laminae and the limestone is irregular with some small grains of the limestone spalled off into the laminae. It is possible that the limestone clast was soft and accumulated the fine laminae while tumbling around in the breccia (snowball effect). Another clast in Section 1, 85-87 cm, is coated with similar laminae; this packstone has a 0.75 diameter lines tube filled by coarse, clear equant calcite. Section 1, 132-136 cm contains a single piece (2x4x3 cm) of peloidal packstone/grainstone with burrows; one is partly filled by lime-volcaniclastic sand and part by several very coarse bladed calcite crystals (one is 5 mm long). Assorted pebbles (0.5 to 5.0 cm diameter) in Section 2, 37-52 cm are mostly limestone clasts broken from the breccia (all have breccia matrix cemented to surface and filling molds and burrows). Few are pieces of the breccia. One pebble is a well indurated mudstone with vague lamination that appears to have been disturbed by fluid escape. Curved linear voids (possible fluid escape fenestrae) are near perpendicular to laminae; some are partly filled by bladed and equant medium crystalline calcite. A second pebble is a wackestone with abundant miliolids, common bivalve fragments, 2-3 mm wide burrows filled with packstone, and many dark grains of unknown origin. One pebble in Section 2, 44-52 cm is a mudstone/wackestone with several partial gastropod molds that are 3-4 cm long and up to a cm wide. Addendum on volcanic clasts: Section 1: 0-110 cm; predominantly aphanitic basalt clasts, equant and subangular in shape with 50% spherical.

General Description:

Cylinders: Section 1, 0-34 cm, 40-58 cm, 67-79 cm, 85-105 cm, 109-132 cm, Section 2, 0-29 cm; Rollers: Section 1, 34-40 cm, 58-63 cm, 79-85 cm, 132-136 cm, Section 2, 29-37 cm, 52-57 cm; Drilling pebbles: Section 1, 63-67 cm, 105-109 cm, 37-52 cm. Thin sections: Section 1, 112-114 cm, Section 2, 21-23 cm, 52-57 cm.



878A-44M CORED 406.1 - 408.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian						T	2.5YR 5/4
2		2			B	B	F/P		T	5GY 6/4

878A-45M CORED 408.9 - 418.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian							2.5YR 5/4 to 10R 4/6
2		2							T	
3		3							T	
4		4							T	
5		5			B	B	F/M			

878A-46M CORED 418.5 - 428.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian							10G 6/1 to 10G 4/2
2		2			B	B	R/M		T	

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color
1		1	late Aptian		—		10G 6/1
2		2			—	T	

DESCRIPTION

LIMESTONE VOLCANIC BRECCIA

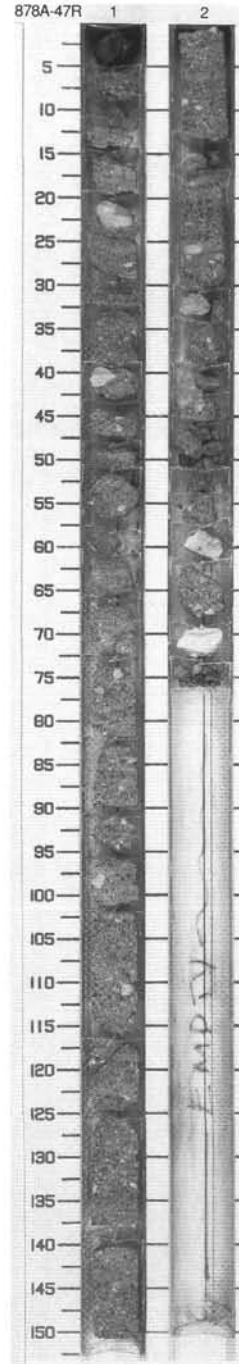
Major Lithology:

Section 1, 0–5 cm; 4 cm-thick fragment manganese crust either caved or drilled during reentry of hole. Section 1, 5 cm to Section 2, 76 cm. Limestone - volcanic breccia. Average matrix color is light grayish green (10G 6/1) with dark grayish green (10YR 3/1) volcanic clasts and very pale brown (10YR 7/3) limestone clasts. Matrix looks green because of fine to coarse sand volcanics, however calcite in matrix is white (10YR 8/2). For bulk rock, matrix is probably 50%: white fine-grained calcite, sand-sized volcaniclastics (vesicular basalt fragments and glass?), sand-sized limestone fragments, and rare isolated ooids (e.g. at Section 1, 10 cm). 1%–5% (ave ~2%) amber cement crusts, bladed and equant, lining voids in matrix and filling some vesicles in volcaniclastics. Bedding is apparent as 1–3 cm thick variations in grain size. Overall grain size is 1 mm to 15 mm, but some beds have predominantly 1–3 mm size clasts and others have a greater number of large clasts. In some cylinders, beds are inclined 5–20 degrees; may be evidence of

large-scale cross-bedding. Volcanic clasts (95%–80% of total clasts) are equant, subangular, highly vesicular basalts, some with tubular vesicles. A small number (5%?) of volcanic clasts may be pumaceous. Limestone clasts (5%–20% of total clasts) are predominantly miliolid wackestone and mudstone with minor amount of peloidal and ooidic grainstone. Clast size varies from sub mm size to cm size, with few larger than one cm. In Section 1, 20–23 cm, there is a 1x3x4 cm miliolid wackestone clast broken from matrix, with many 0.5 to 2 mm burrows, burrows in center of clast are filled by clear calcite cement, a few on edge are filled by breccia matrix. Section 1, 109–132 cm, is a single cylinder of medium gray (N4) microcrystalline basalt, with 5%–10% olivine microphenocrysts (0.3–1 mm) altered to dark green clay and iddingsite; there are 2%–3% spherical vesicles (0–5–2 mm) filled by calcite or dusky green (5G 3/2) clay. Some breccia matrix is cemented to the top and side of the clast; this is a large clast broken from the breccia. Similar basalt clasts were recovered in Section 2, 23–25 cm and 52–57 cm, with up to 50% 1 mm vesicles along one edge. In Section 1, 43–48 cm, there is a 2x2x4 cm clast broken from an algal/bacterial? concretion. Section 1, 116–125 cm, small intraformational fault, there are slickensides and small apparent offset in bedding. There are slickensides on pieces in Section 2, 33–39 and 42–45 cm. Grainstone pebble broken from breccia in Section 2, 30–33 cm consists of peloid, pellets, micrite envelopes, mollusk fragments up to 1.5 cm, ooids, and other coaled grains from 0.5 to 5 mm diameter; fine to coarse intergranular cement. White (10YR 8/2) mudstone with <1% burrow? porosity, some lined with cement, some filled partially with breccia matrix.

General Description:

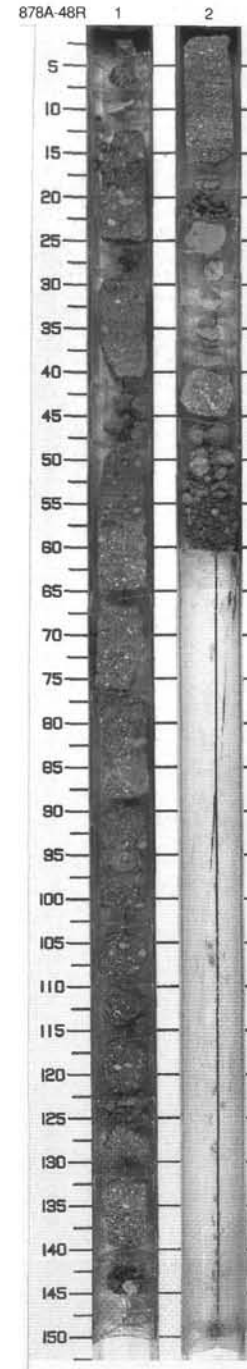
Cylinders: Section 1, 23–29 cm, 32–39 cm, 51–58 cm, 66–91 cm, 102–152 cm, Section 2, 0–13 cm, 17–30 cm; Rollers: 0–8 cm, 11–19 cm, 29–32 cm, 39–51 cm, 61–66 cm, 91–102 cm, Section 2, 30–39 cm, 54–73 cm; Drilling pebbles: Section 1, 8–11 cm, 19–23 cm, 58–61 cm, Section 2, 13–17 cm, 39–54 cm, 73–76 cm. Thin sections: Section 2, 30–32 cm.



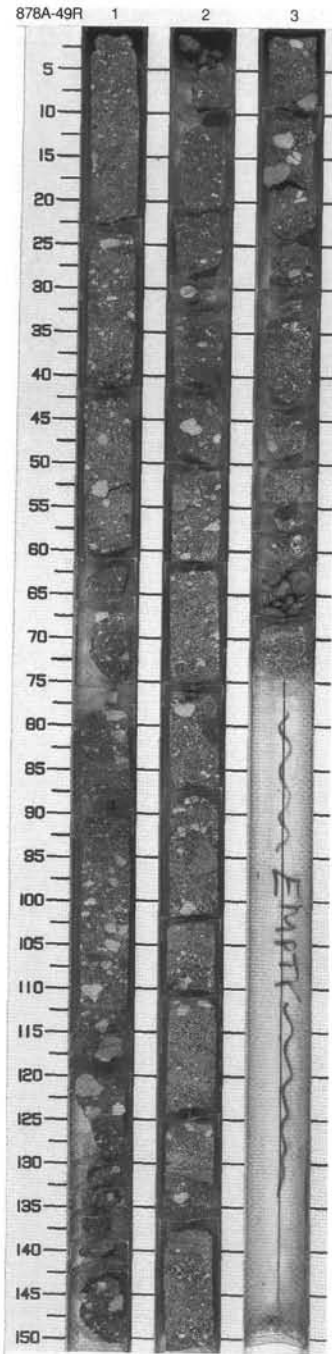
SITE 878 HOLE A CORE 48R

CORED 435.5 – 445.1 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1		1	late Aptian			T	10G 6/1 To 10G 4/2	<p>LIMESTONE VOLCANIC BRECCIA Major Lithology: Section 1, 0 cm to Section 2, 60 cm; light grayish green (10G 6/1) to grayish green (10G 4/2) LIMESTONE VOLCANIC BRECCIA. Volcanic clasts are very dark grayish green (10G 3/1). Limestone clasts are white (10YR 8/2) to very pale brown (10YR 7/3, 10YR 8/3). Sorting is poor. Clasts from 1 mm to 3 cm (coarse sands to pebbles). Bedding is apparent as changes in clast sizes; some intervals with graded bedding (e.g. 28–41 cm, 89–103 cm). Volcanic clasts angular to subangular, rarely rounded, most with vesicular texture. Few large volcanic clasts with laminar coating of fine-grained gray carbonate and volcanoclastics (e.g. 76–89 cm). Limestone about 20% of total clasts: wackestone with small benthic foraminifers (miliolids) and vuggy porosity; peloid-oid grainstone, with local keystone vugs; white to amber calcite fragments; coarse-grained peloid-oid grainstone; fragments of organisms (calcsponges); unidentified black grains; skeletal grainstone with fragments of bivalves, red algae, miliolids (e.g. Section 2, 33–36 cm); peloid grainstone (e.g. section 2, 39–45 cm); clasts with crusts of red algae. Limestone clasts less abundant in Section 2, except in Section 2, 23–39 cm. Layering apparent in Section 2, 0–16 cm. Seams of iron oxides occur locally, both in the matrix and clasts.</p> <p>General Description: Cylinders: Section 1, 11–25 cm, 28–41 cm, 47–109 cm, 115–122 cm, 131–141 cm, Section 2, 0–16 cm; Rollers: Section 1, 109–115 cm, 126–131 cm, Section 2, 23–26 cm, 39–45 cm; Drilling pebbles: Section 1, 0–11 cm, 41–47 cm, 122–126 cm, 141–146 cm; Section 2, 16–23 cm, 26–39 cm, 45–60 cm. Thin sections: Section 2, 36–39 cm, 61–64 cm.</p>
2		2						



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1		1	late Aptian			T	10G 6/1 To 10G 6/2	<p>LIMESTONE VOLCANIC BRECCIA Major Lithology: Section 1, 0 cm to Section 3, 74 cm; LIMESTONE VOLCANIC BRECCIA. Color is light grayish green (10G 6/1) to grayish green (10G 4/2). Volcanic clasts are very dark grayish green (10G 3/1). Limestone clasts are white (10YR 8/2) to very pale brown (10YR 7/3, 10YR 8/3). Sorting is poor. Clasts range in size from 1 mm to 6 cm (coarse sands to pebbles); larger clasts (<1 cm) of limestone concentrated in layers, especially in Section 2, 41–61 cm, 84–102 cm and Section 3, 0–18 cm. Vague 1–3 cm scale bedding is a variation in average grain size from 1–5 mm in some beds to 5 mm to 5 cm in alternate beds. No apparent bedding or orientation of clasts in Section 2, 0–61 cm. Vague bedding as 1–3 cm changes in abundance of large (cm-size) clasts in Section 2, 61–75 cm, inclined 30 degrees; inclined 10 degrees in Section 2, 124–136 cm. Volcanic clasts are angular to subangular, rarely rounded, most with vesicular texture, some vesicles locally filled by zeolites. Some clasts by surrounded laminar coating of breccia matrix. Some volcanic glass in the matrix (very angular fragments)? Large volcanic clasts, up to 3 cm, in Section 1, 61–65 cm. Limestone, angular (especially the largest clasts) to subrounded, about 20% of total clasts in Section 1, 15% of total clasts in most of Section 2 and 5%–10% of clasts in Section 3; 10% of clasts are limestone in Section 2, 0–41 cm, 61–75 cm, 102–153 cm. Dominant limestone lithology is wackestone and mudstone with small benthic foraminifers (miliolids), rare gastropods, mollusc fragments, and locally vuggy porosity. Other lithologies: miliolid-peloidal grainstone with local cyanobacterial bushes up to 1 cm ("Cayeuxia"); white to amber calcite fragments; fenestral (tiny tubules) mudstone; bivalve fragments at Section 1, 61–65 cm; few calcisponge fragments; peloidal packstone, skeletal grainstone-packstone with bivalve fragments and benthic foraminifers; clasts, up to 4 cm, with thick encrustations of red algae, ooid grainstone (5 cm-size clast in Section 2, 87–102 cm). In Section 3, 9–23 cm, a 3 cm-size clast of peloid-ooid packstone grainstone is broken and the space between the two parts of the clast are filled by the matrix; this implies a breakage in situ. Cavities in limestone clasts may be filled by breccia matrix (e.g. Section 1, 115–120 cm). Matrix has isolated carbonate grains (ooids, small bioclasts) and is locally stained grayish green (10G 4/2) or yellow (10YR 8/6). Measured bedding dips, Section 2: 25° @ 61–64 cm; 29° @ 127–133cm; 15° @ 136–141 cm. Section 3: 5° @ 67–70 cm. Fine-grained (fine-sand) lenses at Section 3, 43 cm.</p> <p>General Description: Cylinders: Section 1, 0–61 cm, 65–75 cm, 78–115 cm, 120–130 cm, Section 2, 9–28 cm, 31–153 cm, Section 1, 0–23 cm, 32–43 cm, 67–74 cm; Rollers: Section 1, 61–65 cm, 115–120 cm, 142–152 cm, Section 2, 5–9 cm, Section 3, 23–29 cm, 43–61 cm; Drilling pebbles: Section 1, 75–78 cm, 130–142 cm, Section 2, 0–5 cm, Section 3, 29–32 cm, 61–67 cm. Thin sections: section 2, 80–84 cm.</p>
2		2						
3		3						



878A-47R CORED 428.2 – 435.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian							
2		2		B	B	F/P			T	10G 6/1

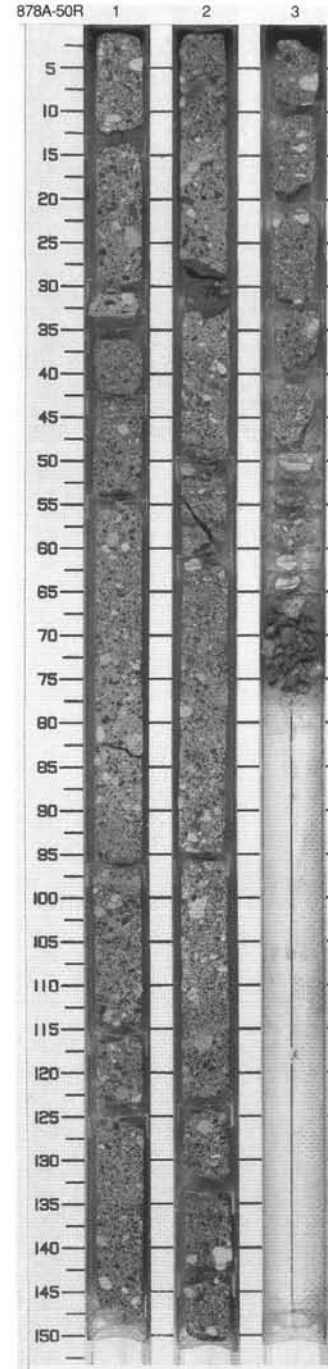
878A-48R CORED 435.5 – 445.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian						T	
2		2		B	B	R/P			T	10G 6/1 to 10G 4/2

878A-49R CORED 445.1 – 454.8 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1								
2		2	late Aptian							
3		3		B	B	R/P			T	10G 6/1 to 10G 6/2

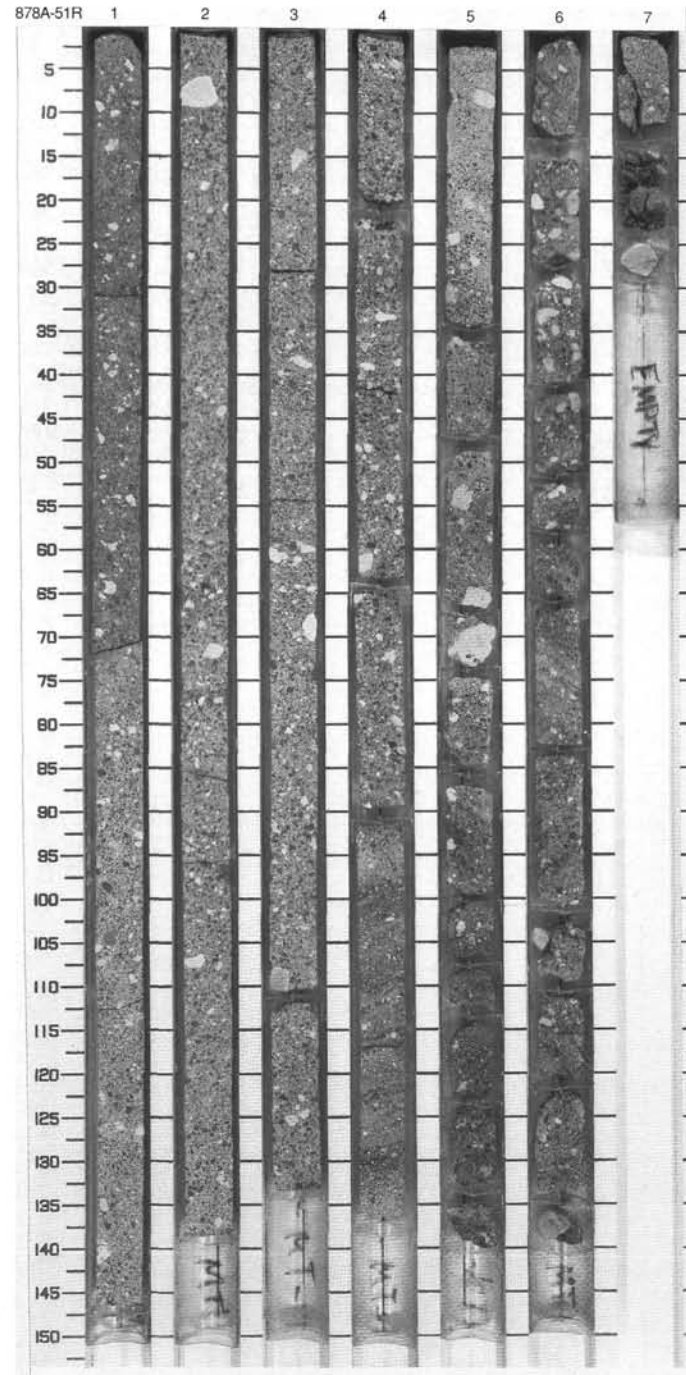
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION	
1		1	late Aptian				10G 4/1 To 10G 4/2	<p>VOLCANICLASTIC LIMESTONE BRECCIA</p> <p>Major Lithology: VOLCANICLASTIC-RICH LIMESTONE BRECCIA in a carbonate-rich matrix. Color ranges from light grayish green (10G 4/1), grayish green (10G 4/2), and very pale brown (10YR 7/3). The breccia consists of volcanic and limestone clasts. Volcanic clasts: angular, grayish green with abundant vesicles. Few of the vesicles are filled with very light gray (N8) and rusty orange crystals (zeolites?). Clasts are poorly sorted with individual clasts up to 5 mm across. Large, embayed clast in Section 2, 27–33 cm, may be highly altered basalt or possibly reworked breccia. Carbonate clasts: very pale brown (10YR 7/3) and pinkish gray (5YR 8/1), poorly sorted with clasts up to 3 cm across. Carbonate clasts are more rounded than volcanic clasts. Carbonate clasts include 1) peloid wackestone, 2) mollusk wackestone, 3) pellet grainstone, 4) ooid and oncolid wackestone, and 5) foraminifer wackestone. Coarse sparry calcite (PE56) occurs in limestone clast at Section 3, 20–22 cm. Matrix: carbonate-rich with few discernable grains, except for rare peloids. Fabric is highly recrystallized. Color ranges from light gray (N7) and light bluish gray (5B 7/1). Many rusty orange stains and crystals (zeolites?).</p>	
2		2				T			
3		3				T			
<p>General Description: Cylinders: Section 1, 0–146 cm, section 2, 0–49 cm, 52–124 cm, Section 3, 0–48 cm; Rollers: Section 2, 124–150 cm, Section 3, 48–60 cm; Drilling Pebbles: Section 2, 49–52 cm, Section 3, 60–77 cm. Thin sections: Section 2, 75–79 cm, 116–119 cm.</p>									



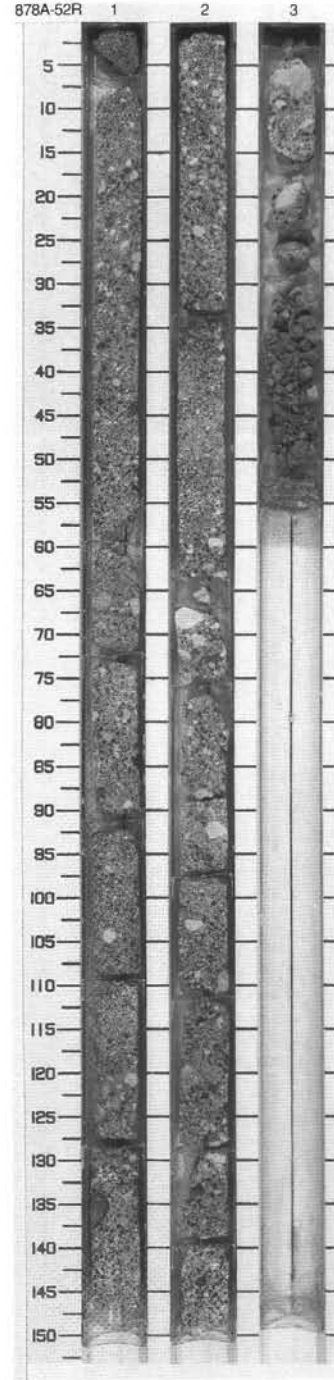
SITE 878 HOLE A CORE 51R

CORED 464.4 – 474.1 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1		1	late Aptian			T	10G 6/1	<p>VOLCANICLASTIC LIMESTONE BRECCIA Major Lithology: Section 1, 0 cm to Section 7, 28 cm; VOLCANICLASTIC LIMESTONE BRECCIA. Average matrix color is light greenish gray (5GY 7/1) but is really a combination of white (10YR 8/2) carbonate mud to sand and dark greenish gray (10G 3/2) sand-sized volcanoclastics. Matrix is about 50% of bulk rock; clasts are matrix supported. Clasts generally 1 mm to 1 cm but up to several cm rarely. Overall poor sorting. Volcanic clasts (95%–80% of total) are dark grayish green, subangular, equant, highly vesicular (most commonly spherical, minor elongate tubular) glassy, and microcrystalline basalt. Limestone clasts are subangular or rounded and very pale brown (10YR 8/3) to 10YR 7/3). Most common lithologies are foraminifer wackestone and peloidal ooid grainstone. Some peloid-oncoid grainstone in Section 1. Several large limestone clasts in Section 3 at 12–17 cm, 37–39 cm, 58–70 cm, 107–110 cm, 123–127 cm. Large (2 cm) clast at Section 5, 8 cm consists of a small (1 cm) rudist cross section in and filled by miliolid wackestone (also some VercoSELLa). A clast of peloid wackestone at Section 5, 30 cm, has high microporosity (chalky). There is an ooid grainstone clast, with a burrow filled by clear coarse spar, in Section 5, 53 cm. There are <i>bored algal/bacterial concretions</i> in Section 5, 65 cm and 68–73 cm, with burrows, borings and molds filled by either peloid grainstone of coarse clear calcite cement. Bedding is not obvious in Sections 1–3. Vague bedding (variation in grain size) visible in Section 4, 0–87 cm where average grain size then drops to about 1 mm with only rare clasts larger than 5 mm; large clasts are concentrated in coarse layers. Smaller grain size dominates from Section 4, 87 cm to Section 5, 17 cm. Beds (cm thick) are horizontal until Section 4, 98 cm, then dip at apparent 20–30 degrees. Cross-bedding is clear in Section 98–129 cm. Grain size increases again beginning at Section 5, 17 cm to a range of 2–10 mm. Bedding is vague in remainder of Section 5. Percent matrix drops from over 50% in the Section 5, 0–47 cm to 30% in Section 5, 47–100 cm. In Section 5, 100–141 cm, breccia is clast supported. Abundance of large (>1 cm) clasts increases in Section 6, 17–50 cm. Breccia is once again matrix supported in Section 6. Possible cycles (tenuous): Section 4, 95–25 cm: Upward coarsening. Section 5, 70 cm–Section 4, 95 cm: Upward fining. Section 6, 18 cm–Section 5, 70 cm: Upward coarsening. Section 6, 18 cm: Sharp contact between cycles. Section 6, 70–18 cm: Upward coarsening. Section 6, 141–70 cm: Upward fining. There appears to be a gradual downward increase in percent of volcanic clasts throughout Core 51R.</p> <p>General Description: Cylinders: Section 1, 0–148 cm, Section 2, 0–138 cm, Section 3, 0–133 cm, Section 4, 0–138 cm, Section 5, 0–67 cm, 74–100 cm, 113–133 cm, Section 6, 0–52 cm, 66–135 cm, Section 7, 0–13 cm; Rollers: Section 5, 67–74 cm, 100–113 cm, 133–141 cm, Section 6, 52–66 cm; Drilling Pebbles: Section 6, 135–141 cm, Section 7, 13–28 cm. Thin sections: Section 2, 5–10 cm, Section 5, 4–7 cm, 88–92 cm.</p>
2		2						
3		3						
4		4						
5		5						
6		6						
7		7						
8		8						



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION	
1		1	late Aptian	↑ F		T	5GY 7/1 To 10G 3/2	<p>VOLCANICLASTIC LIMESTONE BRECCIA</p> <p>Major Lithology: Section 1, 0 cm to Section 3, 55 cm; VOLCANICLASTIC LIMESTONE BRECCIA. Matrix color is light greenish gray (5GY 7/1); a combination of white (10YR 8/2) carbonate mud to sand and dark greenish gray (10G 3/2) sand-sized volcaniclastics. Matrix is 50% of bulk rock. Clasts are 1 mm to 1 cm and average about 2-3 mm. Volcanic clasts (95%–80% of total) are dark grayish green, subangular, equant, highly vesicular (most commonly spherical, minor elongate tubular) glassy and microcrystalline basalt. One volcanic clast is gray and 2x4 cm - altered basalt? Limestone clasts (5%–20% of total) are very pale brown, average same size as volcaniclastics, rarely up to 3x3x6 cm. Majority of limestones are mudstones and miliolid wackestone; few (<5%) grainstones with abundant coated grains. One clast (Section 1, 65 cm) is a 1.5 cm piece of algal/bacterial concretion and/or calcisponge? This piece, and a few others have a 2–3 mm laminar coating of carbonate and fine volcaniclastics - origin is uncertain (possible accretionary pyroclastic? i.e., piece of limestone tossed through hot cloud of shattered carbonate and volcaniclastics). Another 2x3x4 cm clast (Section 2, 72 cm) is a mudstone with vague laminations. One 1x1x2 cm ooid grainstone clast at 3x3 cm bored algal/bacterial encrusted piece. In Section 3, 12–15 cm piece has peloid and mud filled borings and some filled by spar cement. The base of Section 3 is highly disturbed by drilling; it appears finer grained than the rest of the section. Some vague bedding in Section 1, inclined up to 15 degrees in some pieces. Bedding is less clear in Sections 2 and 3. Possible cycles in core 52R: Section 1, 135 cm to Section 1, 95 cm: Upward coarsening. Section 2, 45 cm to Section 1, 135 cm: Upward fining. Section 2, 93 cm to Section 2, 45 cm: Upward coarsening. Section 3, 20 cm to Section 2, 115 cm: Upward coarsening?</p> <p>General Description: Cylinders: Section 1, 7–147 cm, Section 2, 0–150 cm, Section 3, 3–15 cm; Rollers: Section 1, 0–7 cm, Section 3, 15–30 cm; Drilling Pebbles: Section 3, 0–3 cm, 30–55 cm. Thin sections: Section 1, 136–138 cm, Section 2, 110 cm.</p>	
2		2		↑ C ↑ C					↑ F ↑ F
3		3		↑ F ↑ F					↑ F ↑ F



878A-50R CORED 454.8 - 464.4 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1	[Pattern]	1	late Aptian	B	B	R/P			T	10G 4/1 to 10G 4/2
2	[Pattern]	2								
3	[Pattern]	3								

878A-51R CORED 464.4 - 474.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1	[Pattern]	1	late Aptian	B	B	F/M			T	10G 6/1
2	[Pattern]	2								
3	[Pattern]	3								
4	[Pattern]	4	late Aptian	B	B	F/M			T	10G 6/1
5	[Pattern]	5								
6	[Pattern]	6	late Aptian	B	B	F/M			T	10G 6/1
7	[Pattern]	7								
8	[Pattern]	8	late Aptian	B	B	F/M			T	10G 6/1
	[Pattern]									

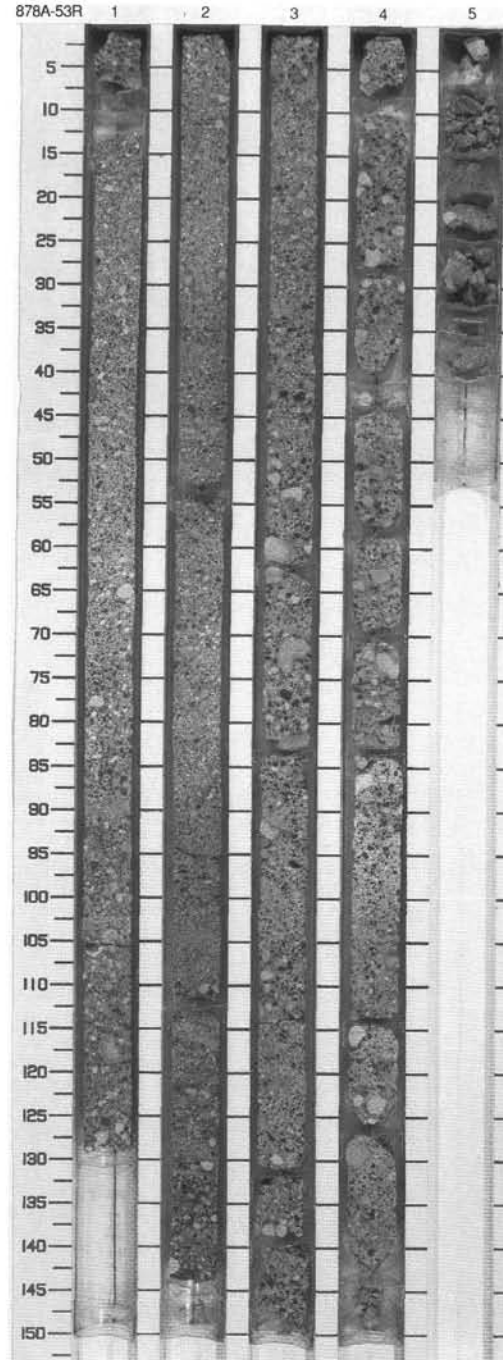
878A-52R CORED 474.1 - 483.7 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1	[Pattern]	1	late Aptian	B	B	F/P			T	5GY 7/1 to 10G 3/2
2	[Pattern]	2								
3	[Pattern]	3								

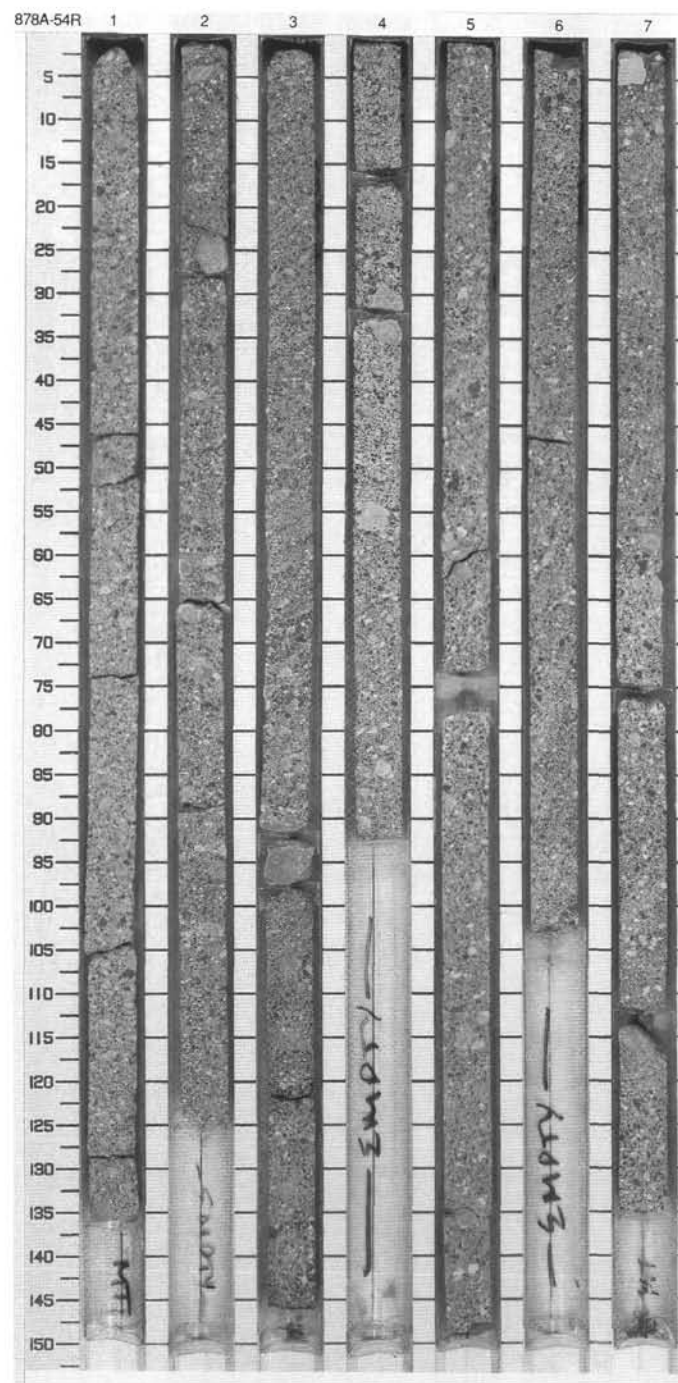
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color				
1	[Graphic Lith. 1]	1	late Aptian	↑ C ↑ C ↑ F ↑ F ↑ F	[Disturbance symbol]	T	10YR 7/2 To 5Y 3/1				
2	[Graphic Lith. 2]	2		↑ F ↑ F ↑ F							
3	[Graphic Lith. 3]	3		↑ F ↑ F ↑ F							
4	[Graphic Lith. 4]	4		↑ F ↑ F ↑ F							
5	[Graphic Lith. 5]	4		↑ F ↑ F							
6	[Graphic Lith. 6]	5		↑ F ↑ F							
DESCRIPTION											
VOLCANICLASTIC LIMESTONE BRECCIA											
Major Lithology: Section 1, 0 cm - Section 5, 40 cm; VOLCANIC LIMESTONE BRECCIA, light gray (10YR 7/2) speckled with very dark gray (5Y 3/1) by volcanic clasts and very pale brown (10 YR 8/3) limestone fragments. Section 1: matrix supported, average clast size 4–8 mm, rare clasts up to 1–5 cm, 20%–40% altered vesicular glassy basalt clasts (minor microcrystalline basalt, bleached gray), subangular, some angular. Limestone clasts are often coarser (8 mm to 3 cm) than volcanic clasts, 10%–15% of total breccia. Matrix is white, very fine-grained carbonate. No clear sedimentary stratification. Pebbles become coarser below 92 cm. Vague differences in clast concentration occur over 15–20 cm intervals. Limestone is mainly recrystallized mudstone, less wackestone with rare miliolids and rare grainstone. Some grainstone has gray color and are coated by a rim of pale yellow (0.5 cm) carbonate, suggesting that some could be											

intraclasts. Bacterial/algal concretion (*Bacinella irregularia*) at 7 cm. Section 2 is fine grained unsorted clasts mm size to 1.5 cm size matrix supported. Volcanic clasts, mm to 1 cm, are dark gray mainly vesicular basalt glass, minor (5%) fine crystalline basalt. Vesicles 50% filled by zeolites. Limestone clasts (10%) are dominantly mudstone, recrystallized mudstone, wackestone with rare miliolids. Clast of grainstone at 122 cm. Clasts are subangular, few are rounded. Sedimentary textures: from 100–130 cm alternating 1–3 cm thick beds of coarse sand-size clasts with laminae of volcanic gravel. Beds are 5–10 degrees inclined. In 130–138 cm beds of 1 cm clasts are clast supported. Section 3 is coarse grained overall, slightly coarsening down wards, 30% vesicular glassy basalt clasts, vesicles mostly unfilled. Clasts are subangular and angular, several mm to 1 cm in size. Limestone clasts (15%–20%) are coarser from mm size to 1 cm, with few 3–4 cm in size. Clasts are mainly subangular. Limestone clasts are very pale brown (10YR 8/4), dominated by mudstone, some skeletal wackestone, some with miliolids and less pelleted skeletal wackestone. At 72 cm, 4 cm limestone fragment is gastropod-miliolid wackestone. Breccia is unsorted and shows gradual increase in size of 5 mm at the top of the core, to 1 cm at the base. Section 4 is coarse, pebbly, unsorted, matrix supported, unorganized. Dominant coarse fraction are clasts of limestone (20%–25%), 1 cm in size with largest 3 cm. Clasts are subangular, rarely angular. Limestone is very pale brown miliolid peloid wackestone, 74 cm: skeletal-algal clast, 80 cm: algal "stromatolite" bored, 135 cm: small fragment of rudist (?). Few grayish colored limestone clasts (90, 106 cm). Volcanics: mostly angular, glassy basalt, vesicles mostly unfilled. 45 degree bedding surfaces 140 cm and 125 cm. Section 5 is a drilling breccia of fine-grained basalt-limestone mixed with grayish clay (10YR 7/1). 15–20 cm is small pebbly to granular bed with rounded limestone fragments, 3–5 mm in size. This could result from drilling in gray clay matrix. At 34 cm limestone fragment with slickenside surface. Possible textural sequences in Core 53: Section 1, 50 cm to Section 1, 0 cm: Upward coarsening. Alternatively, an upward-fining sequence may begin at Section 1, 10 cm, where there is some drilling disturbance, and continue into the base of Core 144-878-52R-3, where there is extensive drilling disturbance through a relatively fine-grained interval in Section 3, 23–56 cm. Section 1, 119 cm to Section 1, ~50 cm: Upward fining. Section 2, 101 cm to Section 2, 78 cm: Upward fining? Section 3, 5 cm to Section 2, 104 cm: Upward coarsening. Section 3, 54 cm to Section 3, 5 cm: Upward coarsening. Section 3, 66 cm to Section 3, 54 cm: Upward coarsening? Section 3, 89 cm to Section 3, 66 cm: Upward coarsening. Section 4, 37 cm to Section 3, 89 cm: Upward coarsening. Section 4, 88 cm to Section 4, 37 cm: Upward coarsening. Section 4, 131 cm to Section 4, 88 cm: Upward coarsening.

General Description:
Cylinders: Section 1, 0–130 cm, Section 2, 0–144 cm, Section 3, 0–150 cm, Section 4, 0–40 cm, 44–141 cm; Rollers: Section 4, 40–44 cm, Section 5, 14–25 cm, 32–40 cm; Drilling Pebbles: Section 5, 7–14 cm, 25–32 cm. Thin sections: Section 1, 140–141 cm, Section 3, 59–61 cm, Section 4, 54–55 cm, 78–80 cm.



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1		1	late Aptian			T	5Y 7/2	<p>LIMESTONE VOLCANIC BRECCIA</p> <p>Major Lithology: Section 1, fine-grained LIMESTONE VOLCANIC BRECCIA, white (10YR 8/2) and speckled black (10YR 3/1) with glassy basalt clasts. Breccia is matrix supported, unorganized. Volcanic clasts average 5 mm in size, rarely 1 cm and comprise about 25% of the rock. Limestone clasts (15%), mm to 2.5 cm in size, are subangular, mainly miliolid wackestone and mudstone. Other features: 1) a soft brown clast (8x3 mm) at Section 1, 7 cm (lignite); 2) a clast, 1 cm in size, of grayish bored algae at 11 cm; 3) a clast of miliolid wackestone with 10% blackened grains and few ostracods at 94 cm; and 4) a clast, 2 cm in diameter, of peloid grainstone with few miliolids at 135 cm. No sedimentary structures are present. Limestone clast that stands on its narrow side suggests transport as debris flow? (note the clast is on edge of core). Carbonate matrix is grainy (0.15 mm) mixture of muddy and fine sand-size limestone grains. Section 2 is unsorted, light gray (5Y 7/2), matrix supported. No clear organization of clasts. Volcanic clasts form 35% of the breccia. Their size is from several mm to 1.5 cm, but mainly 0.5 cm in size. Clasts are angular to subangular, dark gray color, comprised of glassy, vesicular basalt. Some are infilled by zeolites, but most vesicles are empty. Very pale brown (10 YR 8/3) limestone clasts range from mm size to 4 cm. Most are coarser than basalt clasts (0.5–1 cm), subangular to subrounded. They are comprised by mudstone, peloid-skeletal wackestone with few miliolids. A gray colored clast with blackened grains and miliolids at Section 2, 15 cm. A peloid packstone with few oolites and miliolids at Section 2, 170 cm. A 3 cm long gastropod fragment at Section 2, 104 cm. Section 3, 0–146 cm: LIMESTONE VOLCANIC BRECCIA with carbonate matrix. Matrix is gray (5Y 6/1). Clasts range from black (N/2) basalt to white (10YR 8/2) limestone. Some carbonate clasts are yellowish brown (10YR 6/4). Matrix is granular carbonate, mostly silt size, but locally very fine to fine sands (98–146 cm). Matrix comprises 40%–70% of rock. In some portions, clasts are small enough and few enough that grain size is coarse to very coarse sand. Some fossils are visible in matrix, mostly bivalve fragments, possibly some benthic foraminifers. Clasts, mostly basalt, range from 10%–40%; high concentration in Section 3, 48–51 cm (small <5 mm); Section 3, 66–71 cm (to 10 mm); and Section 3, 136–138 cm (to 10 mm). Most basalt clasts are 20 mm maximum. They are extremely angular with unabraded scoriaceous margins; some have larger scale irregularities, embayments, channel-like voids. Vesicles are open or calcite filled. Many show centripetal calcite filling from margins of clast. Iron-stained carbonate and probable zeolite vesicle fills are few. Many small fragments have stretched vesicles. Light gray (N7) volcanic clasts with few vesicles and large pyroxenes are rare (<1% rock volume). Some light gray clasts may be reworked, carbonate-poor matrix. Carbonate clasts represent 10% of the volume. Mostly rounded to subrounded. A few are embayed, probably by vugs and large molds. Size to 10 mm. Most about same</p>
2		2						
3		3						
4		4						
5		5						
6		6						
7		7						
8		8						



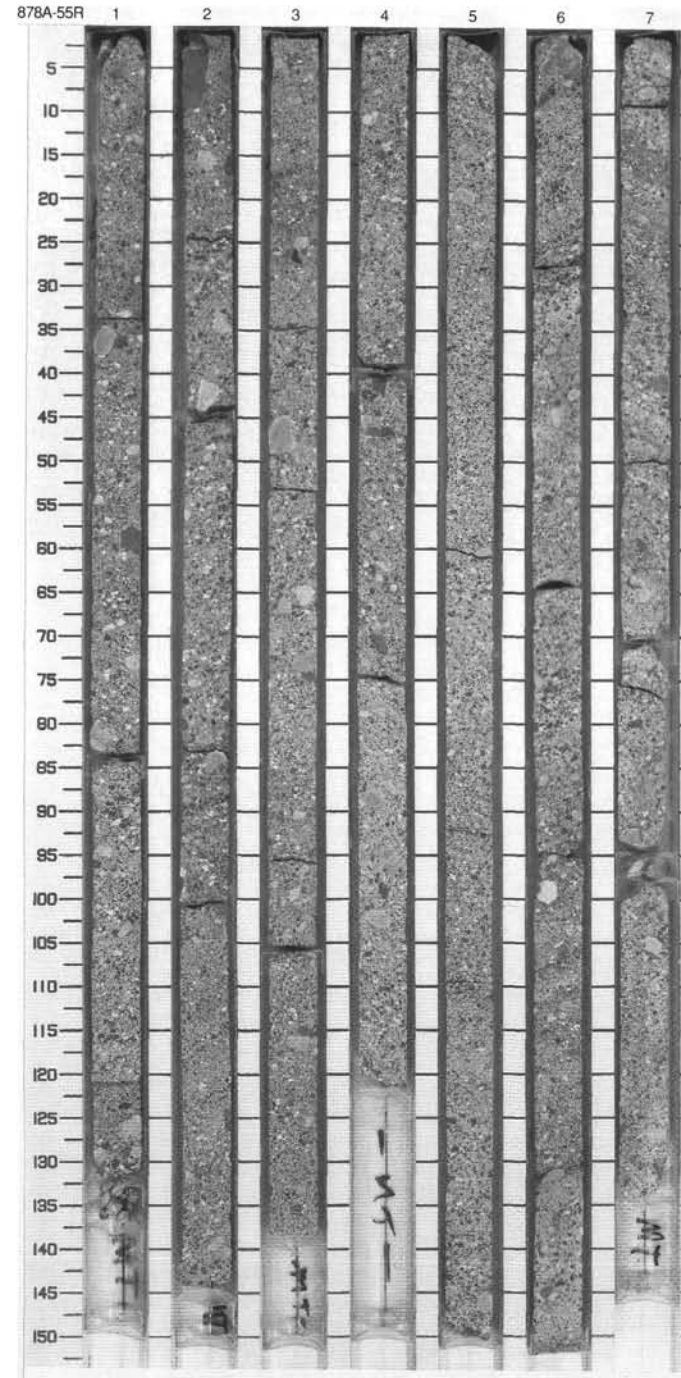
Site 878 Hole A Core 54R Description continued...

size as volcanics. Clast types include miliolid peloidal skeletal-peloid packstone and grainstone; some ooids, most surficial, a few with thick cortex. Bivalve fragments and corals are rare. Other prominent features observed in section include: 1) Section 3, 89–91 cm and 91–98 cm mollusk wackestone, yellowish brown (10YR 6/4). Many gastropod molds, few bivalve molds, few miliolids, many peloids. Molds filled by very coarsely crystalline calcite (PE6) and peloid sediment (geopetal; upright in present matrix); 2) Section 3, 106–107 cm: mudstone, embayed. Gray spots 7 mm in diameter; 3) cross bedding is prominent at Section 3, 47–70 cm; 25–30 degrees apparent dip angles; vague at Section 3, 98–107 cm, 30 degrees dip. Beds of coarse pebbles show slight dips (Section 3, 135–137 cm) to steep dips (Section 3, 25–27 cm, Section 3, 70–78 cm, Section 3, 110–120 cm; 40 degrees apparent dips). Possible graded in 0–98 cm, through cross-bedding, but it's vague. Sections 4, 5, 6, and 7; LIMESTONE VOLCANIC BRECCIA with carbonate matrix. The breccia consists of grayish green clasts of vesicular basalt and very pale brown clasts of neritic carbonate. Carbonate clasts tend to be better rounded and larger (i.e., many > 1 cm across versus many < 1 cm across) than basaltic clasts. Matrix is carbonate-rich, mostly silt size particles. Individual grains in the white (10YR 8/2) to gray (5Y 6/1) matrix are difficult to discern. Limestone clasts include miliolid wackestone with coarse blocky sparry calcite, foraminifer peloid wackestone (light bluish gray; 5B 7/1), and thick-shelled mollusk fragment. At Section 4, 53–58 cm there is a series of 5 limestone clasts in close association with each other. Pore space between these clasts are filled with matrix and volcanic clasts which are cemented together by coarse blocky sparry calcite. Volcanic clasts are 98% altered aphyric basaltic scoria. Majority of spherical vesicles are ~ 0.1 mm; most are unfilled. Filled vesicles contain mostly calcite, sometimes iron stained. Rare vesicles are filled with the zeolite mineral chabazite. The limestone clasts, less than 1 cm across, are more angular in Section 5 than in Section 4. Section 6 is the same as previous two sections. Grain size of clasts tends to be smaller in section 6. Limestone clasts in Section 7 are larger than in Section 6; some are up to 4.5 cm across. Few of the limestone clasts contain miliolids. Possible sequences: Section 4, 35–17 cm; Fining upward? Section 7, 116–13 cm; Fining upward.

General Description:

Cylinders: Section 1, 0–137 cm, Section 2, 0–125 cm, Section 3, 0–146 cm, Section 4, 0–93 cm. Section 5, 0–150 cm, Section 6, 0–104 cm, Section 7, 0–138 cm. Thin sections: Section 2, 0–3 cm, Section 5, 98–102 cm, 128–133 cm.

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
								LIMESTONE VOLCANIC BRECCIA
								Major Lithology: Section 1; LIMESTONE VOLCANIC BRECCIA. Matrix is carbonate-rich, mostly silt-size or finer particles. Color of matrix is greenish gray (5GY 6/1). Clasts consists of dark greenish gray (5GR 4/1) and greenish black (5G 2/1) vesicular basalt and light olive gray (5Y 6/1) limestone. Many of the vesicles in the basalt clasts are filled with calcite cement, few stained orange by Fe-oxide, and rare zeolite crystals. Limestone clasts are dominated by 2 facies: 1) peloid wackestone and 2) miliolid wackestone. Rare clasts of basalt and limestone are angular, some with embayments (e.g. 34–36, 80–83, 89–96 cm). In Section 2 the matrix is carbonate-rich, mostly silt-size or finer particles. Few equant calcite cement (coarsely crystalline). Color of matrix is greenish gray (5GY 6/1). Sorting is poor. No bedding apparent, except in 23–40 cm and 102–146 cm where layers are inclined at 30–35 degrees. Volcanic clasts are dark greenish gray (5GY 4/1) and greenish black (5GY 2/1) and olive yellow (5Y 6/6). They are mostly basalts with a vesicular texture. Vesicles may be filled by calcite. The outer edge of clasts is irregular to scalloped due to the vesicular texture of the basalts. Some clasts display large embayments. A large clast, 10 cm in size, occurs in 0–10 cm. Limestone clasts (10%–15% of total clasts) are light gray (10YR 7/1) to very pale brown (10YR 7/3). They are angular to subangular, rarely rounded. Their maximum size is 5 cm. They include: FORAMINIFER WACKESTONE (dominant lithology) with miliolids, rare biserial foraminifers and mollusc fragments, cavities of few mm diameter are filled by geopetal sediments (fine-grained peloids), clasts are usually recrystallized and display gray patches; Coarse-grained MOLLUSC-ONCOID PACKSTONE; MOLLUSC-PELOID PACKSTONE; PELOID-OOID GRAINSTONE (1 clast at 105 cm) and unidentified recrystallized fragments. Small carbonate grains, isolated in the matrix, include ooids and unidentified grains. Section 3. The color of the matrix is green (7.5G 7/6), basalt clasts are 30%, limestone clasts 15%, matrix is 55%. Basalt clasts are to 20 mm and limestone clasts to 45 mm. Matrix is medium sand, very poorly sorted with rounded carbonate particles and some extremely angular basalt "sand". Probably 90% or more carbonate. Volcanic clasts are extremely angular; they tend to break along vesicles as along perforations. Volcanic fragments are mostly vesicular basalt (40%–50% vesicles; some open, some filled with carbonate matrix, especially at outer rim. <1% light gray (N7) with few vesicles and large pyroxene phenocrystals. These resemble clasts interpreted as reworked volcanic-rich matrix in other sections. Presence of vesicles should be diagnostic. 25 cm: trachytic basalt, 2 cm, with very altered gray feldspar laths to 1–2 mm long. Olivine is abundant, weathered bright red in patches. Limestone fragments grade into matrix in size. Limestone clasts are mostly rounded, some subangular. Larger fragments (>2 mm) include: OOID GRAINSTONE (e.g. 4–12 cm); GASTROPOD-MILIOLID-PELOID WACKESTONE (e.g. 44–48 cm, 96 cm); MUDSTONE (e.g. 99–100 cm) and "SILTSTONE" (LIME PACKSTONE with 40%–60% round clear 50 micrometers grains that may be carbonate or quartz). A "denser" interval at 15–24 cm contains a greater percentage of volcanic clasts, with possible grain support. This coincides with
1		1				T	5GY 6/1 To 5G 4/1	
2		2				T		
3		3				T		
4		4	late Aptian					
5		4					5Y 8/2 To 5G 4/1	
6		5						
7		6					5Y 7/2 To 5G 4/1	
8		6				T		
9		7					2.5Y 7/2 To 5G 4/1	



Site 878 Hole A Core 55R Description Continued...

a cross-bedded interval that dips 40°. A coarser grained interval is at 34–75 cm. Section 4, White (5 Y 8/2), medium coarse, unsorted and unorganized. Volcanic clasts range 0.3–3 cm in size, average 5 mm, sharp edged, formed by glassy vesicular basalt, some vesicles elongated, some stained orange by iron hydroxide. About 1/2 of vesicles are infilled, mainly by zeolites. Volcanics form 25% of the breccia. Limestone clasts (very pale brown) 5–20 mm in size, subangular to rounded; composed by mudstone, wackestone with miliolids, wackestone with small gastropod molds, pelleted packstone. Fine-grained grainstone is rare (grains are unidentifiable). Matrix is silt-size carbonate in micritic matrix. Breccia is matrix supported. Section 4 is coarser than Section 5; about the same as Sections 3, 2, and 1, 60–138 cm. In Section 5, white (5Y 8/2), speckled dark gray by volcanic clasts. Breccia is fine-grained, with volcanic clasts 4 mm to 1 cm (20%) and limestone clasts 5 mm to 3 cm (10%). Matrix is silt-size carbonate debris in micrite. Limestone clasts are mudstone, miliolid wackestone, rare fine-grained peloid grainstone with miliolids and bioturbation. One skeletal fragment of mollusk shell (?rudist fragment). Sedimentary textures: steep bedding is indicated by alternation between sandy and pebbly beds, few cm in thickness. At 32 cm is sharp contact with scouring 2 cm deep. Basalt clasts dark gray to dark olive gray (5Y 3/2) formed by vesicular glass. 1/3 of vesicles infilled by zeolites and calcite. Section 6. Clast rich, light gray (5Y 7/2) to whitish; with alteration of finer and coarser gravelly beds. Beds are 2–3 cm to 5 cm thick and steeply inclined 20–30 degree. The interval 0–80 cm is coarsening toward the base. However, no sharp contacts are visible. Breccia has 20% dark grey, glassy basalt clasts, basalt is vesicular, 1/3 infilled by zeolites and calcite. Few vesicular fragments are gray colored and may represent an older material incorporated into breccia. Basalt clasts are 7–10 mm in size, angular. Limestone clasts, 10% of rock, size 3–20 mm, with one clast 5 cm, are mainly very pale brown, but few are grayish to bluish color. Clasts are mostly subrounded and composed by mudstone, wackestone with miliolids. Breccia is matrix supported. Section 7, light gray (2.5Y 7/2), medium grain size, matrix supported. Clasts of vesicular glassy basalt 1 mm to 5 mm size, few are 2 cm, mainly subangular, form 15% of the breccia and are dispersed throughout. Smaller clasts are concentrated at few places into laminae 2 cm thick. Basalt is vesicular, 1/3–1/2 vesicles are infilled by zeolites and calcite, Basalt is dark gray. 5% of clasts are grayish color and may represent volcanic. Limestone clasts are mm size to 2 cm; mostly dense mudstone, wackestone with miliolids and ostracods. Sedimentary texture: several beds show inclined bedding of 25 degrees. Beds are few cm in thickness and result from variation in grain size (alternation of pebbly and sandy size beds). There is a sharp boundary between beds (at 2 cm). Mostly contacts are gradational. Bed at 35–42 cm seems to be inversely graded. Possible textural sequences: Section 2, 11 cm to Section 1, 97 cm; Fining upward; may continue to Section 1, 0 cm. Section 3, 15 cm to Section 2, 0 cm; Coarsening upward. This overlaps the base of the overlying sequence.

General Description:

Cylinders: Section 1, 0–132 cm; Section 2, Section 3, Section 4, Section 5, Section 6, Section 7, 0–94 cm, 98–134 cm. Rollers: Section 7, 94–98 cm. Drilling pebbles: Section 1, 132–136 cm. Thin sections: Section 2, 26–32 cm, 42–45 cm, Section 3, 46–49 cm, Section 6, 106–107 cm.

878A-53R

CORED 483.7 - 493.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian	B	B	F/P			T	10YR 7/2 to 5Y 3/1
2		2								
3		3								
4		4								
5		4								
6		5								

878A-54R

CORED 493.2 - 502.4 mbsf

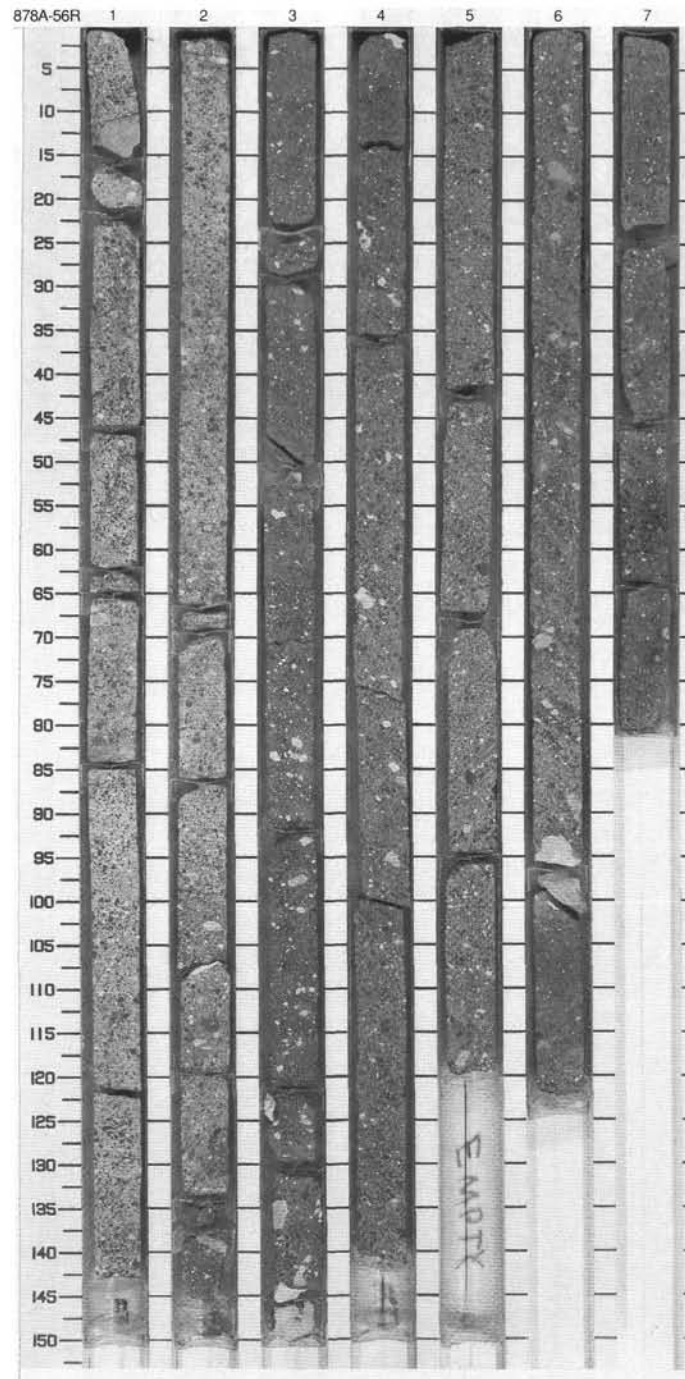
Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian	B	B	F/M			T	5Y 7/2
2		2								
3		3								
4		4								
5		5								
6		5								
7		6								
8		7								

878A-55R

CORED 502.5 - 511.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian	B	B				T	2.5Y 7/2 to 5G 4/1
2		2								
3		3								
4		4								
5		4								
6		5								
7		6								
8		6								
9		7								

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1	[Graphic Lith. Pattern]	1					10YR 7/1 To 5GY 4/1	<p>VOLCANIC LIMESTONE BRECCIA</p> <p>Major Lithology: Matrix (<2 mm): in Section 1, 0 cm to Section 2, 140 cm, matrix is light gray (10YR 7/1) and makes up 50% to 70% of bulk rock. 90%–95% of matrix consists of white (10YR 8/2) mud to coarse sand-size carbonate with lithoclasts, skeletal fragments, peloids, and ooids. 5%–10% of matrix is fine to coarse sand-size, dark grayish green (5GY 4/1) volcanoclastic similar to larger clasts described below. In Section 2, 140 cm to Section 7, 82 cm, matrix is light grayish green (5GY 6/1) and makes up 40% to 60% of bulk rock. Matrix ranges from only 2%–3% carbonate component (e.g. Section 2, 140–146 cm) to 75% carbonate similar to above. Volcanoclastic component of matrix ranges from 98%–25% fine to coarse similar to lithology described below. Volcaniclastics (>2 mm): in Section 1, 0 cm to Section 2, 140 cm volcanics are dominated by scoriaceous, aphyric basalt (60%–70%) with 50% spherical vesicles, generally 0.1 mm; usually dark grayish green (5GY 4/1). 30%–40% of clasts are light gray (N7), highly altered basalt, 20%–30% vesicles, usually spherical, but some irregular, partly or completely filled by clear calcite, some with clay linings. Primary mineralogy unclear except for 5% mafic microphenocrysts, prismatic 0.1–0.5 mm, replaced by dark green clay (5GY 2/1). There is large clast (7 cm) of above altered basalt (grayish green (5G 5/2) about 20% replaced by irregular patchy calcite, at Section 2, 126–132 cm. Equant, subangular to angular volcaniclastics are 80%–90% of total clasts, average 2–8 cm, up to 1.5 cm. In Section 2, 140 cm to Section 7, 82 cm, >80% of volcanics are vesicular basalt type and remainder are light gray type. Rarely, reddish iron-stained basalt clasts, usually 0.5–1 cm rectangular, containing tiny iddingsitised olivines occur. Volcanoclastic are: 95% of clasts, average size 2–4 mm in Section 2, 140–146; 90%–95% of clasts, average size 2–7 mm in Section 3 (except in 90–143 cm where 3 are up to 2 cm); 90%–95% of clasts, average size 2–5 cm in Section 4; 95% of clasts, average 2–5 mm in Section 5 (2 as large as 1.5 cm); 90%–95% of clasts, average 2–6 mm, max 1.3 cm in Section 6; and 90%–95% of clasts, 2–5 mm average, several 5–10 mm, one up to 1.5 cm in Section 7. Slight increase in coarser volcanics in Section 6, 35–95 cm; in Section 6, 102–122 cm most are less than 2 mm. Limestone clasts are very pale brown (10YR 8/3), subangular to rounded (rarely angular), mollusk-pellet packstone, miliolid wackestone, and rare peloid grainstone. Few clasts in Section 1, 0 cm to section 2, 140 cm are light bluish gray (5B 7/1) recrystallized mudstone or wackestone; none in section 2, 140 cm to section 7, 82 cm. Nearly all porosity, intergranular, vuggy, burrow, fenestral, filled by medium to coarse, clear, equant, rarely bladed, calcite. In Section 1, limestone clasts are 10%–20% of total, 2 mm–1 cm average, rarely to 5 cm (e.g. 10–15 cm). This last is a peloid packstone, components are vague, few miliolids, few fenestrae. Limestone is 15%–10% of clasts, most <5mm, few up to 1 cm in section 2. In Section 3, 5%–10% of clasts are</p>
2	[Graphic Lith. Pattern]	2				T		
3	[Graphic Lith. Pattern]	3				T		
4	[Graphic Lith. Pattern]	4					5GY 6/1 To 5GY 4/1	
5	[Graphic Lith. Pattern]	5						
6	[Graphic Lith. Pattern]	6						
7	[Graphic Lith. Pattern]	7						
8	[Graphic Lith. Pattern]	6						
9	[Graphic Lith. Pattern]	7						



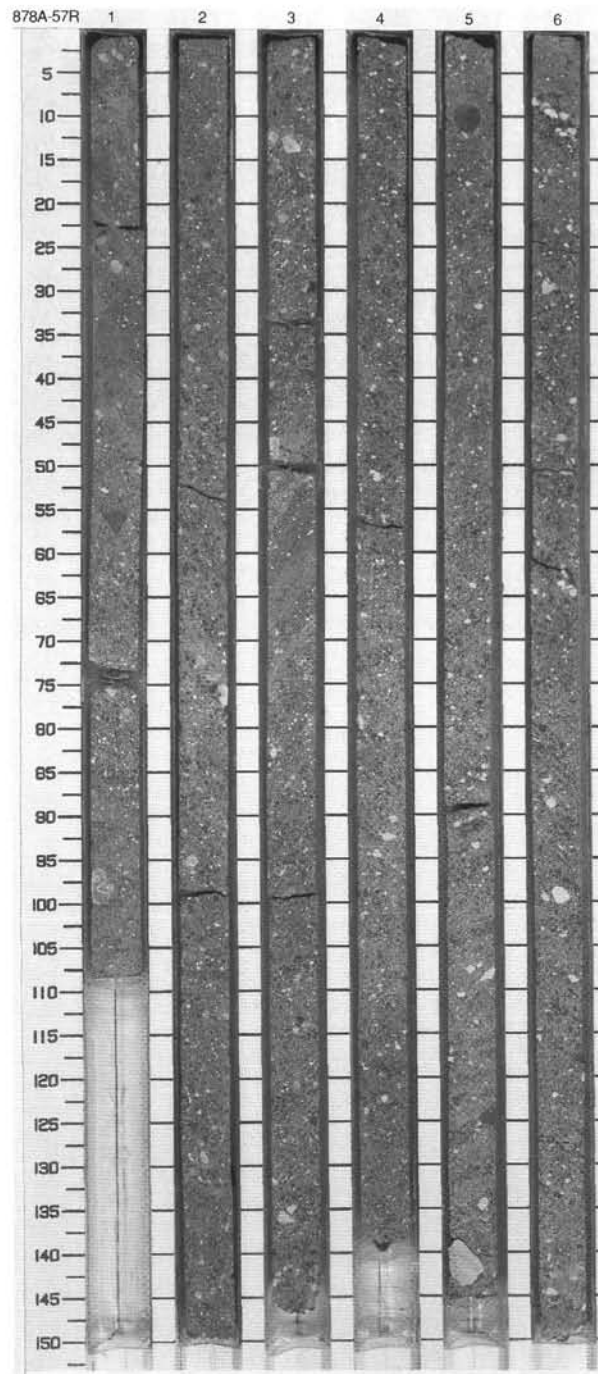
Site 878 Hole A Core 56R Description continued...

limestone, 2–4 mm, rarely to 1 cm, coarser in 80–150 cm, reaching 6 cm in 145–151 cm. In Section 4, 5%–10% of clasts are limestone, 2–4 mm size, largest 2.5 cm. In Section 5, 5% of clasts are limestone, 2–4 mm average, rare up to 1 cm, one at 118 cm is 1.5 cm. In Sections 6 and 7, 5%–10% clasts are limestone, 2–4 mm, with larger (1–2 cm) concentrated in a few beds. One 4x7 cm clast at section 6, 90–100 cm: bioturbated fenestral wackestone or packstone. Sedimentary structures. Section 1: only vague variations in concentration of coarse fragments in a 5–10 cm scale, mostly horizontal on a face and back except for steeply inclined (60 degree) "bed" of grain supported coarse volcanoclastic sand at 50–58 cm. Section 2: Vague variation in grain size, not easily visible, 3–5 cm thick increased content of volcanics at 30–34 cm, 39–42 cm, 61–66 cm (and Section 1, 138–144 cm. Slightly inclined bed at 99 cm, number of coarse grains increase in 99–134 cm. Contact between carbonate rich matrix and volcanic rich matrix at Section 2, 140 cm. Beds in lower unit are steeply inclined (50 degrees) and truncated by the contact, which is dipping 30 degrees at right angles to the underlying beds. Section 3: bedding (variations in grain size) generally horizontal, 2 cm thick, from 0–9 cm (graded?), inclined 20 to 30 degrees from 29–49 cm, horizontal from 52–62 cm, inclined from 70–90 cm. Section 4: vague, steeply inclined bedding (40–60 degrees) throughout section. Section 5: reversed grading in 3 beds, 7 cm thick, from 3–24 cm (horizontal). Inclination in bedding increases to about 30–45 degrees in 43–95 cm. Lower inclination from 97–120 cm. Section 6: Steeply inclined (25–45 degrees) beds from 0–96 cm, percent sand size volcanics increases in 100–123 cm (horizontal contact at 100 cm, then steep beds below). Section 7: vague horizontal bedding (0–25 cm), steeply inclined from 25–82 cm.

General Description:

Cylinders: section 1, 0–16 cm, 21–62 cm, 65–144 cm, Section 2, 0–134 cm, 138–146 cm, Section 3, 0–145 cm, Section 4, 0–142 cm, Section 5, 0–120 cm, Section 6, 0–123 cm, Section 7, 0–82 cm; Rollers: Section 1, 16–21 cm, 62–65 cm; Drilling Pebbles: Section 2, 134–138 cm. Thin sections: Section 2, 66–68 cm, section 3, 90–94 cm.

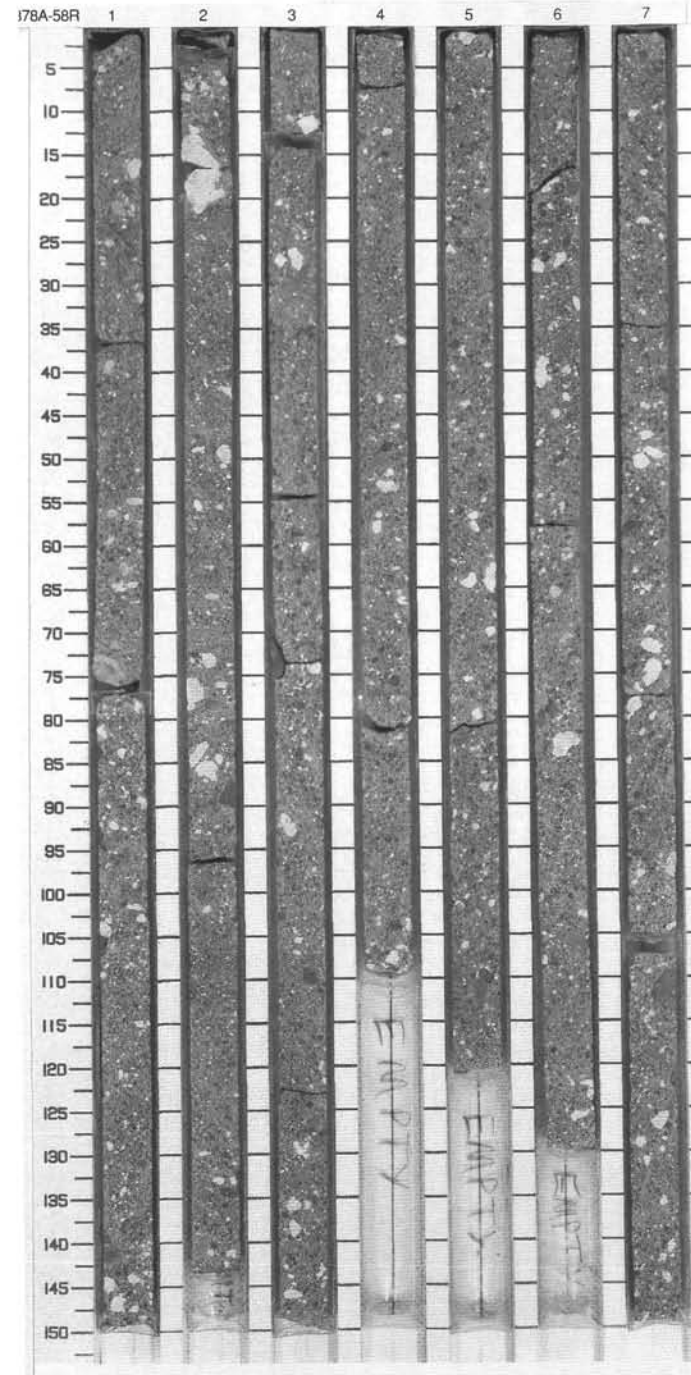
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1	[Graphic Lith. Pattern]	1			[Disturb. Pattern]	T		<p>VOLCANICLASTIC LIMESTONE BRECCIA</p> <p>Major Lithology: The entire 6 sections of Core 57R consist of VOLCANICLASTIC LIMESTONE BRECCIA. The matrix of the breccia is carbonate-rich and contains mostly silt size and smaller unidentifiable carbonate grains. There are also a few sand-size carbonate grains in the matrix. The matrix is greenish gray (5G 6/1). The clasts consist of dark greenish gray (5G 4/1) and greenish black (5G 2/1) basalt clasts and very pale brown (10YR 7/3) and light olive gray (5Y 6/1) limestone clasts. The latter are peloid wackestone and miliolid wackestone. Basalt clasts are abundant and limestone clasts are many, except in Section 6 where limestone clasts are common. The size of basalt clasts is mostly coarse to very coarse sand with rare pebbles and cobbles. Few of the limestone clasts have clear calcite cement (PB5) infilling pores. Other notable features of this core include 1) basalt clast at Section 1, 55–57 cm is triangular-shaped, greenish black, and contains fresher microcrystalline, nonvesicular basalt with 5%–10% olivine crystals, 0.1–0.2 mm; 2) limestone and basalt clasts at Section 1, 36–52 cm are aligned in such a way that indicates an apparent dip of 42°. Such "dipping" beds are made more prominent by the alternation of sand-size and pebble-size clasts; 3) bedding with an apparent dip of 48° at Section 2, 60–77 cm; 4) bedding with a true dip of 62° at Section 2, 60–77 cm. Such beds are made more prominent by alternating bands of coarse and fine clasts forming bedding couplets. Coarse beds composed of coarse granule to fine pebble-sized clasts, whereas fine beds are composed of coarse sand-size clasts; 5) a nearly perfectly rounded, 3.5 cm diameter, basalt clast at Section 5, 8–10 cm. This clast is similar in composition to the basalt clast at Section 1, 55–57 cm; 6) a peloid wackestone clast, 5 cm across, at Section 5, 139–144 cm is highly mottled and contains clear calcite cement (PE5); 7) measurement of whole round cylinders at Section 5, 90–145 cm indicates several clast beds that have apparent dip of 35°, 28°, and 38°; 8) measurement of whole round cylinders at Section 6, 110–135 cm indicates several clast beds that have apparent dip of 35° and 9) an increase in the percentage of limestone clasts in Section 6.</p> <p>General Description: Cylinders: Section 1, 0–109 cm, Section 2, 0–151 cm, Section 3, 0–147 cm, Section 4, 0–140 cm, Section 5, 0–145 cm, Section 6, 0–150 cm. Thin sections: Section 1, 53–57 cm.</p>
2	[Graphic Lith. Pattern]	2			[Disturb. Pattern]		5G 6/1 To 5G 4/1	
3	[Graphic Lith. Pattern]	3			[Disturb. Pattern]			
4	[Graphic Lith. Pattern]	4			[Disturb. Pattern]			
5	[Graphic Lith. Pattern]	5			[Disturb. Pattern]			
6	[Graphic Lith. Pattern]	6			[Disturb. Pattern]			
7	[Graphic Lith. Pattern]				[Disturb. Pattern]			
8	[Graphic Lith. Pattern]	6			[Disturb. Pattern]			



SITE 878 HOLE A CORE 58R

CORED 530.4 – 540.1 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
								VOLCANICLASTIC LIMESTONE BRECCIA
								Major Lithology:
								Section 1, 0–150 cm; pale green (10G 6/2) carbonate packstone matrix, medium sand size, poorly sorted with rare peloids and skeletal debris. Matrix is 55% of volume; decreases to 45% at base. Basalt clasts are 35%, maximum size is 10 mm; at 141 cm is a round 20 mm basalt clast; most clasts extremely angular, broken across vesicles. Vesicles typically are 40% clast volume. Many are open; some calcite filled; some filled with matrix, mostly at the edge of the clast. A few (14 cm and 33 cm) have some vesicles lined with matrix at outer edge; empty or filled with calcite spar at center. Clast at 40 cm has crescent rim of peloid packstone, 0.5 mm thick, one side only. Olivine rich basalt at 137 cm. 20 cm clast at 142 cm is representative of about 2% of clasts: medium dark gray, N3, with small pyroxene phenocrysts, about 20% vesicles, empty (~50%) and calcite filled, are stained rusty red. Limestone clasts are mostly very pale brown (10YR 7/3) or white (10YR 8/1), rounded. Some are embayed (e.g., 20 cm, 31 cm). Some embayments are solution cavities, filled with matrix. (Basalt clasts also have reentrants in a few cases). Limestone is 10% volume at top, 20% at base, maximum size of 40 mm is usually greater than basalts, but limestones are all sizes, grading into matrix (medium sand). Composition in descending order of abundance: 1) miliolid-peloid packstone, with gastropods, bivalves (molds) (20 cm, 31 cm, 55 cm, 77 cm, 124 cm, 137 cm, 148 cm). 2) miliolid wackestone, with peloid cf. 125 cm (w/burrows), 148 cm. At 77 cm, >40 mm clast has fenestrae, laminar and tubular, pellet-filled burrows. 3) codiacean-peloid packstone (15 cm, 107 cm) 4) ooid-peloid grainstone (129 cm, with bivalve molds). No bedding or sharp contacts. Possible reverse graded interval 70–110 cm. Possible graded interval: Section 2–20 cm to 1–110 cm. May be in eyes of beholder. 118 cm: mm-size organic clast. Section 2, 0–145 cm, consists of LIMESTONE VOLCANIC BRECCIA. The matrix is gray (5Y 5/1), carbonate-rich; spar cements are few. The matrix includes isolated carbonate grains (e.g. ooids). The breccia is unsorted and featureless. Volcanic clasts are usually to 1 cm, rarely larger than 1 cm although some of them are to 5 cm (e.g. Section 2, 60–90 cm). Small clasts correspond to broken pieces of vesicular basalt. Volcanic clasts are 30% of total clasts; they include:
1		1				T		- dark yellowish green (10GY 4/2) pyroxen-vesicular basalt. Vesicles are open or filled by calcite. Some vesicles are filled by matrix, especially at the outer edge of clasts. These clasts are the dominant clasts.
2		2				T		- Pale green (10G 6/1) basalt; these clasts are few to many.
3		3						- Black (2.5 Y N2/0) to very dark gray (2.5Y N3); these clasts are rare.
4		4				T		- Weathered basalt, stained red; these clasts are rare.
5		4						Limestone clasts are 5 to 10% of total clasts. They are usually few mm to 1 cm in size. Clasts larger than 1 cm are observed in Section 2, 12–20 cm, 48–50 cm, and 72–87 cm. Limestone clasts are subrounded to subangular, few
6		5						
7		6						
8		6						
9		7				T		



Site 878 Hole A Core 58R Description continued...

are angular. Embayments in clasts are frequent. Color of limestone clasts is light gray (10YR 7/2) to white (10YR 8/2). Limestone clasts include:

- FORAMINIFER WACKESTONE displaying borings and burrows. Benthic foraminifers are mostly miliolids. These clasts are dominant.
- RUDIST FLOATSTONE (e.g. Section 2, 10–20 cm).
- ONCOID PACKSTONE with fenestrae (e.g. Section 2, 72–87 cm).
- blue gray recrystallized LIMESTONE (texture unidentified).

Section 3, 0–150 cm, is comprised of LIMESTONE VOLCANIC BRECCIA similar to Section 2. Inclined layers at 50 degrees and 40 degrees are observed respectively in Section 3, 20–30 cm and 80–90 cm. Limestone clasts larger than 1 cm occur in Section 3, 10–12 cm, 24–27 cm, 72–73 cm, 89–92 cm, and 127–146 cm. Limestone clasts are similar to those in Section 2 but also include rare clasts of FORAMINIFER SKELETAL PACKSTONE; clasts of blue-gray recrystallized limestone (texture unidentified) are more abundant than in Section 2. Large black volcanic clasts to 6 cm in size are observed in Section 3, 68–74 cm.

Section 4, 0–111 cm, consists of LIMESTONE VOLCANIC BRECCIA similar to previous sections. Inclined layers at 30 degrees are observed in Section 4, 40–50 cm. Limestone clasts larger than 1 cm occur in Section 4, 4–6 cm and 52–70 cm. PELOID-ONCOID PACKSTONE-GRAINSTONE is a common lithology of limestone clasts in this section. Limestone clasts are scarcer in Section 4, 66–100 cm. Limestone clasts are fractured in Section 4, 66 cm.

Section 5, 0–122 cm, is comprised of LIMESTONE VOLCANIC BRECCIA very similar to previous sections. Inclined layers at 30–40 degrees are observed in Section 5, 95–115 cm. Limestone clasts larger than 1 cm occur only in Section 5, 56–80 cm. The dominant lithology of limestone clasts consists of FORAMINIFER WACKESTONE with miliolids. Section 6, 0–130 cm, consists of LIMESTONE VOLCANIC BRECCIA similar to previous sections. Inclined layers at 60 degrees are observed in Section 6, 55–65 cm. Limestone clasts are white (10YR 8/2) to very pale brown (10YR 8/3) and mostly include FORAMINIFER WACKESTONE and PELOID-ONCOID PACKSTONE. Large limestone clasts occur in Section 6, 16–41 cm, 80–84 cm, and 120–127 cm. Limestone clasts display large embayments. Large volcanic clasts are observed in Section 6, 16–41 cm. Section 7, 0–150 cm, is comprised of LIMESTONE VOLCANIC BRECCIA similar to previous sections. Inclined layers at 45 degrees and 55 degrees respectively in Section 7, 10–20 cm and 80–105 cm. Limestone clasts are similar to those reported in Section 6. Large limestone clasts in Section 7, 44–52 cm, 70–82 cm, 97–99 cm, and 125–127 cm; these large clasts usually display large embayments.

General Description:

Cylinders: Section 1, Section 2, Section 3, Section 4, Section 5, Section 6, Section 7. Thin sections: Section 2, 11–15 cm, Section 3, 90–94 cm, Section 7, 47–49 cm.

878A-56R CORED 511.9-521.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian						T	10YR 7/1 To 5GY 4/1
2		2								
3		3								
4		4								
5		5								
6		6								
7		7								
8										5GY 6/1 To 5GY 4/1
9										

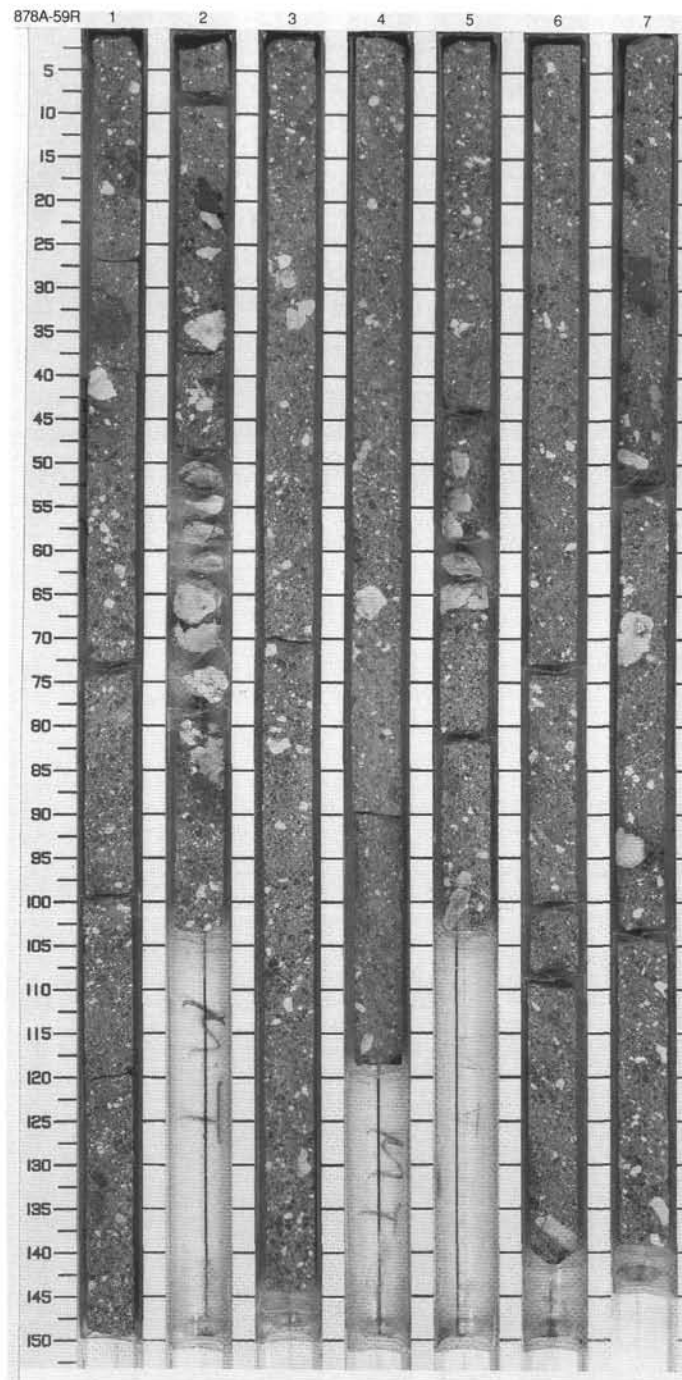
878A-57R CORED 521.2-530.4 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian						T	5G 6/1 To 5G 4/1
2		2								
3		3								
4		4								
5		5								
6		6								
7										
8				B	B					

878A-58R CORED 530.4-540.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	late Aptian						T	
2		2								
3		3								
4		4								
5										
6										
7										
8										
9				B	B	R,P				

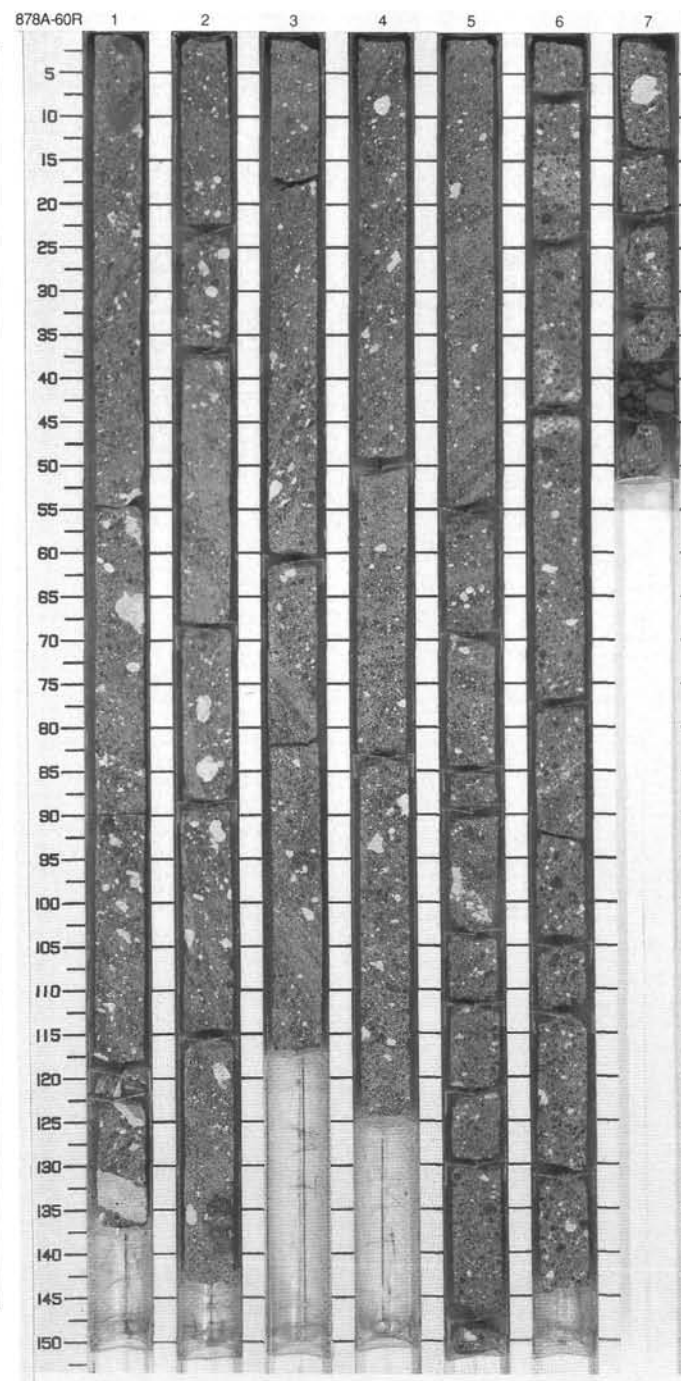
Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1	[Graphic Lithology]	1						<p>LIMESTONE VOLCANIC BRECCIA Major Lithology: Section 1: Matrix is carbonate-rich, mostly silt size particles (unidentifiable) with many sand-size grains. Finer grained matrix is light olive gray and the coarser grain matrix is white. Clasts consist of dark greenish gray (5GY 4/1) and greenish black (5G 2/1) basalt and very pale brown (10YR 7/3) and yellowish gray (5Y 8/1) limestone. The latter are peloid wackestone and rare milioid wackestone. Limestone clasts are highly recrystallized. Basalt clasts are abundant. In general there are two types of basalt clasts. Basalt clast commonly are angular with rough perimeter textures. 1) aphyric, scoriaceous completely altered; commonly to clay. Vesicles are mostly infilled; few are filled with calcite. Most vesicles are spherical (0.1–0.2 mm). A 7 cm clast occurs at Section 1, 30–37 cm. 2) Microcrystalline, nonvesicular basalt with up to 15% olivine completely altered to dark red brown (2 cm diameter at Section 1, 134–137 cm). Section 2: the percentage of carbonate clasts is greater. Limestone clasts also larger, some up to 7 cm, than in previous cores. Dominant lithology of clasts is mottled mudstone. This lithology is medium bluish gray (5G 5/1) and very pale brown (10YR 7/3) and contains pore filling, clear calcite cement (PE6). Rare mudstone clasts contain pellet-filled burrows. These mudstones have "conchoidal" fracture pattern and a few appear nodular (?). Sections 3, 4, 5, 6, and 7: same as previous sections. Other notable features in these sections include 1) limestone clasts at Section 3, 27–34 cm that contain common pellets, rare peloids, very rare cyanobacteria bushes (Cayeuxia or Orthonella), and rare oncoids; 2) clasts at Section 4, 62–66 cm have several embayments which are filled with matrix of host rock and 0.5–1 mm diameter basalt clast, cemented together by clear coarse calcite (PB56?); clast is peloid wackestone; 3) clear coarse blocky calcite PE6 cements together matrix, volcanic clasts, and 2 pinkish gray peloid wackestone clasts at Section 5, 52–55 cm; 4) clear, coarse blocky calcite PE6 completely fills pore space at Section 5, 58–62 cm; 5) peloid wackestone, mottled with vein-like stringers of medium bluish gray (5B 5/1) at Section 5, 62–65 cm; 6) pinkish gray (5Y 8/1) peloid grainstone, also possible voids and oncoids (need a thin section) at Section 5, 96–98 cm; 6) mottled, fenestral peloid wackestone at Section 5, 98–103 cm, majority of fenestrae filled with clear calcite spar (PB4); 7) limestone clast at Section 6, 136–141 cm, mottled, very pale brown, medium bluish gray peloid wackestone, clear calcite cement.; 8) limestone clast (peloid wackestone) with a very interesting and complicated cavity-fill at Section 7, 66–72 cm, pore space is filled with white needle fibrous crystals which are probably the zeolite mineral naturalite; and 9) a mottled, medium bluish gray (5 B 5/1) mudstone clast at Section 7, 134–135 cm.</p> <p>Cylinders: Section 1, Section 2, 0–50 cm, 63–72 cm,</p>
2	[Graphic Lithology]	2				T		
3	[Graphic Lithology]	3						
4	[Graphic Lithology]	4				T		
5	[Graphic Lithology]	5					5G 4/1 To 5G 2/1	
6	[Graphic Lithology]	6				T		
7	[Graphic Lithology]	7				T		
8	[Graphic Lithology]	7				T		
9	[Graphic Lithology]	7						



SITE 878 HOLE A CORE 60R

CORED 549.8 – 559.2 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
								LIMESTONE VOLCANIC BRECCIA
								Major Lithology:
								All sections are VOLCANICLASTIC LIMESTONE BRECCIA . Section 1: light gray (2.5Y7/2) with brownish tint, matrix supported, unorganized. Vesicular glassy basalt clasts 0.5–1 cm; subangular to sharp-edged, dark gray (2.5Y 4/0), form about 30% of the rock. Several clasts of dark olive gray, vesicular basalt. Also some iron oxide stained, reddish vesicular basalt clasts and grayish color microcrystalline basalt clasts at 93–95 cm. Limestone clasts are 5 mm to 4 cm, subangular, composed of peloid wackestone, one with miliolids and mold of gastropod or ammonite shell; In 65–69 cm, well-sorted, fine-grained grainstone. In 130–134 cm, there is a 4 cm-thick limestone bed, inclined 20 degrees, cutting across overlying, steeply inclined (60 degrees) beds in the breccia. Edges of the bed are fine-grained size, the middle pebbly packstone (rudstone) with mudstone clasts up to 1 cm. Probably injected soft carbonate sediment into volcanoclastics. Section 2: light gray (2.5 Y7/2), matrix supported, unorganized. Slightly coarser (1 cm) clasts at 16–36 cm; Dominant coarse sand size debris of volcanic debris is coarse sand size, 20%–25% is coarser; coarser limestone fraction is 10%. Few horizons are steeply bedded, bedding mostly by coarse sand, laminae. Limestone: larger fragments up to 2 cm between 75–120 cm, mainly mudstone. Mudstone with sponge spicules, ?algal or altered skeletal fragment with poorly visible radial structure, dense mudstone. Few elongated limestone clasts are positioned by the narrow side down. 134–140 cm broken fragment of bomb or scoria. At the outer perimeter the vesicles are elongated and aligned parallel to the surface of the clast. Matrix is fine carbonate sand with mud. Section 3, 0–12 cm: light gray (2.5Y 7/2) coarse sand-size fraction carbonate with 5% of gravel size vesicular basalt, cross bedding, sharp contact at the base. 12 cm–40 cm, gravelly bed, 20% volcanics, 5% limestone with few clasts 1 cm. Dip is increasing up to 40 degree. 40–72 cm: alternation of coarse pebbly beds (1–2 cm thick) of a basaltic glass and limestone clasts with coarse sandy laminae 1 cm thick. True dip is 52 degrees. 72–100 cm: clast supported bed, clasts 0.8–1.5 cm, 10% limestone, 60% vesicular basalt, calcite cemented, no matrix. 100–118 cm: coarse sand laminae with fine gravelly beds, dipping at 45 degrees. Limestone clasts are predominantly very pale brown mudstone and peloid mudstone. Volcanics are vesicular glassy basalt fragments, dark gray, with few reddish stained by iron oxide. Section 4: light gray (2.5 Y 7/2), matrix supported, as in Section 4. Clasts are vesicular glassy basalt 30%, mm to 1 cm size; limestone clasts are mm to 1.5 cm size, 7%. Breccia is bedded, alternation of sandy and pebbly laminae and beds several mm thick, variable dip,
1		1				T		
2		2				T		
3		3				T		
4		4					2.5Y 7/2 To 2.5Y N4/0	
5								
6		5				T		
7						T		
8		6						
		7						



Site 878 Hole A Core 60R Description continued...

decreasing from 55 degrees at the top to 10 degree at 100 cm. Limestones are mudstone, pelleted mudstone. Basalt clasts as in Section 3. Section 5: light gray (2.5 Y7/2), matrix supported; 5% limestone clasts up to 1 cm in diameter; 15%–20% glassy basalt. 0–65 cm dominated by coarse sand size fraction, with well-developed inclined bedding at 40 degree, decreasing downward to 10–20 degree at 100 cm. 18 cm: fine-grained grainstone clast. 59 cm: 1 cm clast of gray intraclast wackestone. 81 cm: 5 mm clast of dark packstone with peloids, elliptical bluish gray grains. 96 cm: peloidal grainstone, fine-grained with miliolids and biserial? foraminifers (possible *Vercosella* of subaudia). Matrix as in Section 1. Limestone clast at 100 cm may have been fractured in flow and than spread apart. Section 6: matrix supported, light gray (2.5 Y 7/2). 5% limestone clasts up to 2 cm, vesicular glassy basalt clasts 25%–30 % (mm -1.5 cm), subangular. Lighter gray (5Y 8/1) horizons at 13–18 cm, 42–46 cm. No textural difference is associated with the color change, but increase of sand size carbonate particles in the matrix. Contact at 13 cm is sharp. Breccia is disorganized, no clear bedding features are visible. Limestone clasts are mudstone and peloid wackestone. Basalt clasts are vesicular, some greenish colored, few small iron oxide stained clasts (3 mm in size). Vesicles are very small and mainly unfilled. Section 7: continuation of same lithology as in 60R/6. Single limestone clast 3 cm in size of mudstone with few small miliolids.

General Description:

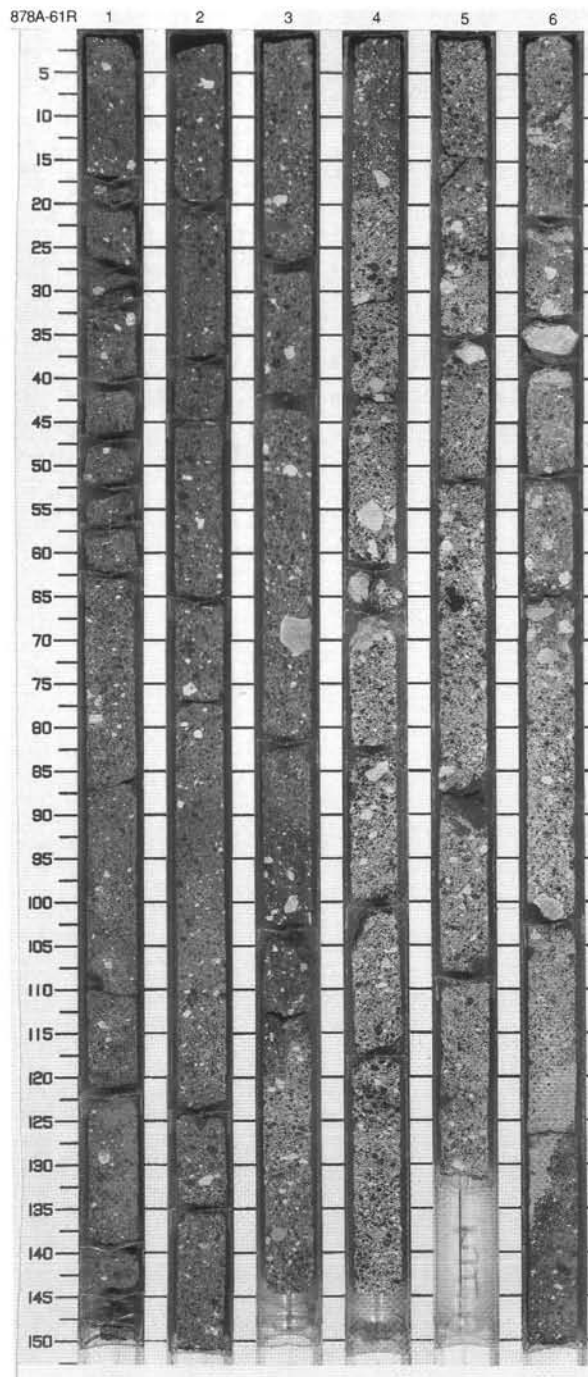
Cylinders: Section 1, Section 2, Section 3, Section 4, Section 5, 0–147 cm, Section 6, Section 7, 0–32 cm; Rollers: Section 5, 147–153 cm, Section 7, 32–38 cm, 45–52 cm; Drilling pebbles: 38–45 cm. Thin sections: Section 1, 129–132 cm; Section 2, 83–86 cm; Section 3, 36–39 cm; Section 5, 50–53 cm; Section 6, 13–16 cm.

SITE 878 HOLE A CORE 61R

CORED 559.2 – 568.7 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0-151	[Symbolic Lithology]	1						<p>LIMESTONE VOLCANIC BRECCIA</p> <p>Major Lithology: Section 1, 0–151 cm; Matrix: greenish gray (5GY 6/1), about 50%–70% of bulk rock; 75% of matrix is mud size to coarse sand carbonate, including lithoclasts and rare peloids and skeletal fragments. 25% of matrix is volcaniclastic fragments, similar to clasts described below. Volcaniclastics: angular to subangular, equant, mostly (60%–70%) highly vesicular, aphyric basalt with 50% spherical vesicles, altered to dark grayish green (5GY 4/1). 30%–40% of clasts are light gray (N&), highly altered basalt, less vesicular (20%–30%) than other type of clast. In Section 1, volcanics comprise 95% of clasts, average 2 mm–1 cm size, rarely to 1.5 cm. Limestone clasts 5%–10% of total clasts, 2 mm–1 cm average size, rare to 1.5 cm, very pale brown, white and light bluish gray (1YR 8/3–8/2, 5B 7/1), mostly wackestone and peloidal packstone, gray clasts are recrystallized. Very high moldic and vuggy porosity in 2 clasts, most filled by clear, calcite spar. Molds after mollusk fragments. Structure: bedding is extremely vague. Section 2, 0–151 cm; matrix same as section 1, except for below 110 cm, where carbonate component increases to 80%–90% of matrix; volcanic component decreases. Volcanic clasts same composition as section 1. Limestone clasts same as Section 1 in abundance, size, and lithology; 1.5 cm clast at 75 cm is peloid wackestone to packstone? with a few Subauidia and a 3 mm burrow, partly filled with breccia matrix and calcite cement. Structure: only extremely vague variations in grain size. Section 3, 0–146 cm. Matrix: 0–82 cm similar to base of Section 2. From 82 cm to 112–122 cm, carbonate drops to 25% or less, leaving a clast-supported texture of mostly volcanics. There is a nearly vertical contact in 112–122 cm between low carbonate, clast-supported breccia and high carbonate matrix supported breccia; geometry of contact is sketched. Below contact, matrix is 80% of rock decreasing to 60% by 146 cm; difference is in the abundance of sand-size volcaniclastics, they are sparse below contact and more abundant at 146 cm. The matrix below 146 cm same as Sections 1 and 2. Volcaniclastic composition same as Section 2 except for a few (e.g. 3 cm-size clast at 23 cm) iron-stained, dark gray basalt clasts with tiny iddingsitised olivines. In general, percent volcanics and size increases from 82–105 cm to maximum of 2 cm. In Section 3, below 115–122 cm, volcanic clasts are fewer relative to limestone. Limestone clasts are 5%–10% of total clasts in 0–112/122 cm, 2 mm–1.5 cm average size, one clast is 4x4 cm, lithologies similar to Sections 1 and 2, except large clast (at 67–71 cm) of peloidal packstone, extremely vuggy and recrystallised. Also, one clasts of medium sand-size, miliolid-peloid grainstone. Structures: extremely vague bedding in 0–112 cm, seems to dip 45 degree east (relative to top of working half). Section 4. In 0–19 cm, matrix is same as Sections 1 and 2, horizontal</p>
1-2	[Symbolic Lithology]	2				T		
2-3	[Symbolic Lithology]	3						
3-4	[Symbolic Lithology]	3						
4-5	[Symbolic Lithology]	4						
5-6	[Symbolic Lithology]	4				T		
6-7	[Symbolic Lithology]	5						
7-8	[Symbolic Lithology]	5						
8-151	[Symbolic Lithology]	6						

5GY
6/1
To
5GY
4/1



Site 878 Hole A Core 61R Description continued...

contact at 19 cm, matrix is then light gray, 95%–90% mud to coarse carbonate sand, with 5%–10% fine to coarse sand volcanics. Volcanics are 70%–80% of total clasts, 2 mm-1 cm average size, rarely up to 1.5 cm. Compositions same as section 1–3. Limestone clasts are mostly 2 mm- 2 cm in size, few up to 3 cm. One highly irregular mass of peloid, lithoclast, skeletal packstone in 55–70 cm, that appears to have been soft and deformed prior to or after deposition, ranges from 8–5 cm, partially mixed in places with breccia matrix. Other lithologies similar to Section 1–3 except for 3 cm piece in 61–66 cm of very coarse pelletal-skeletal packstone with intergranular and moldic cement filled by clear calcite cement. Structures: contact between lithologies at 19 cm is horizontal. Section 5. Matrix same as section 4. Volcanics: 70%–80% of total clasts are volcanics, 2 mm-1cm in size, rarely to 1.5 cm. Composition of clasts same as Sections, 1–4, except: 64–67 cm, irregular, 2x3 cm clast and a large (3x6 cm) clast, greenish gray, that looks as if parts are spalled off into the carbonate-rich matrix, presumably the composition is altered basalt. Limestone clasts are 20%–30% of total clasts, rounded to subangular, very pale brown, 2 mm-1.5 cm, lithologies similar to Sections 1–4. One 2x4 cm clast at 36 cm is a burrowed? mudstone. Structure: possible grading at about 14–26 cm, vague, but horizontal. Beds may be slightly inclined (about 10 degrees) from 40–50 cm. Horizontal beds in 94–105 cm, inclined 40 degree from 110–130 cm, roughly to the east (relative to north at top of working half. Section 6: Matrix same as Section 1 except for 0–69 cm where volcanic sand increases to 10% of matrix and below a sharp contact at 126–138 cm, where matrix is same as Sections 1, 2, and top of 3. Volcanic clasts: 70%–80% of total, same composition as previous sections, same size range. Limestone clasts: 20%–30% of total, 2 mm-2 cm average size common until 103 cm, then all clasts are less than 0.5 cm. One large "clast" between 33–41 cm is coarse carbonate sand (similar to breccia matrix without the volcanics) with a few larger lithoclasts, only rare volcanics. This sand is interlayered at edges with some of breccia matrix. There is similar material in contorted beds from 21–25 cm and 10–13 cm; in these two intervals, there is some mixing with volcanics. 1.5 cm-3 cm clasts at 78–84 cm, one is clast of the carbonate sandy from 33–41 cm, one is a foram-peloid grainstone, well cemented with clear, intergranular calcite cement. Forams are miliolids and one Vercosella or Subaudia, one is light bluish gray, recrystallized miliolid wackestone. 3 cm clast at 100 cm has a cm-size Nereinid gastropod, replaced, in extremely vuggy, uncertain matrix. Structures: aside from convolute beds discussed above, steeply inclined (almost vertical, irregular contact from 126–138 dips to the west; beds dip less above contact until horizontal at 105 cm.

General Description:

Cylinders: Section 1, 0–17 cm, 20–27 cm, 31–144 cm, Section 2, Section 3, Section 4, 0–61 cm, 66–145 cm, Section 5, Section 6, 0–32 cm; 38–151 cm; Rollers: Section 1, 17–20 cm, 27–31 cm, 144–151 cm, Section 4, 61–66 cm, Section 6, 32–38 cm. Thin sections: Section 2, 75–78 cm; Section 4, 83–86 cm; Section 6, 127–128 cm.

878A-59R CORED 540.1-549.8 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1	[Lithology]	1	early Aptian					/ / / / /	T	5G 41 To 5G 2/1
2	[Lithology]	2								
3	[Lithology]	3								
4	[Lithology]	4								
5	[Lithology]	5								
6	[Lithology]	6								
7	[Lithology]	7								
8	[Lithology]	8								
9	[Lithology]	9								

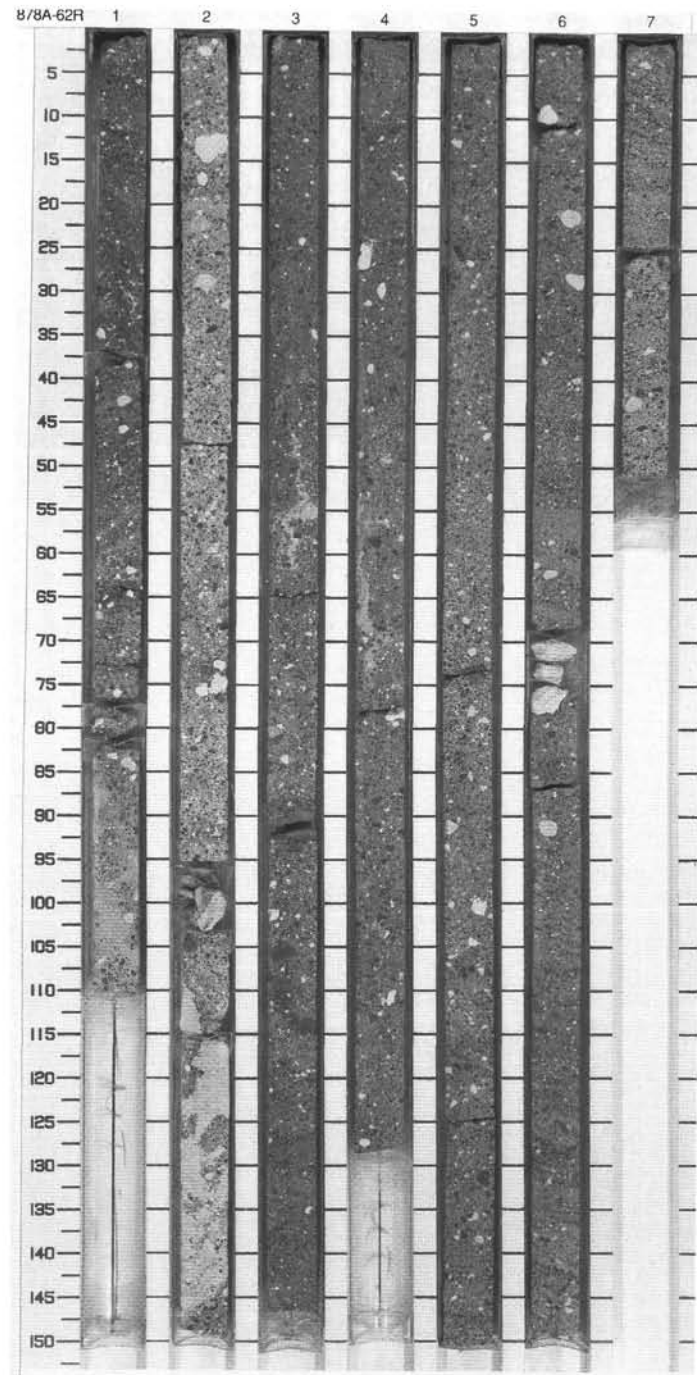
878A-60R CORED 549.8-559.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1	[Lithology]	1	early Aptian					/ / / / /	T	2.5Y 7/2 To 2.5Y N4/0
2	[Lithology]	2								
3	[Lithology]	3								
4	[Lithology]	4								
5	[Lithology]	5								
6	[Lithology]	6								
7	[Lithology]	7								
8	[Lithology]	8								
				B	B					

878A-61R CORED 559.2-568.7 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1	[Lithology]	1	early Aptian					/ / / / /	T	5GY 6/1 To 5GY 4/1
2	[Lithology]	2								
3	[Lithology]	3								
4	[Lithology]	4								
5	[Lithology]	5								
6	[Lithology]	6								
				B	B					

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1	[Pattern]	1				T	5Y 5/2	<p>LIMESTONE VOLCANIC BRECCIA</p> <p>Major Lithology: Section 1, 0–52 cm: grain supported, coarsening downward (2 mm at the top, 5 mm at the base). Clasts of 1.5 cm common in the basal part. Limestone form 10%, vesicular basalt 60%. Minor grain size variation delineates inclined bedding up to 30 degrees. Breccia is olive gray (5Y 5/2). Where clast supported, it is calcite cemented. 82–83 cm: light olive gray breccia, matrix supported, few 1 cm beds with 30 degree inclination. No sharp boundaries. 83–110 cm: white carbonate sand with 10% of clasts average 4 mm in size. Two limestone clasts are 1.5 and 2 cm. The reverse side of the core shows a vein of soft carbonate sand injected into breccia. Limestone clasts mainly dense mudstone. At 41 cm: clast of vuggy, leached, pelleted packstone with few mollusk debris and miliolids. At 100 cm: recrystallized, gray, vuggy intraclast packstone. Size of clasts 1 cm. Section 2. Matrix supported, white (5Y 8/2), unorganized with only few "sandy" laminae with 10 degree inclination. Vesicular basalt clasts are subangular, 5–8 mm, maximum 1.5 cm in size. They are mainly very fine vesicular basalt glass, dark gray. Basalt forms 20% of the breccia; coarse limestone clasts form 10%. Carbonate matrix 70%–60%. Limestone is mainly pale mudstone at 22 cm, dark bluish clasts with structureless grains. Section 2, 20 cm: Silt-size peloid packstone, bioturbated with burrows filled by peloids. 67 cm: Skeletal wackestone with mollusk shell molds and few miliolids. 69 cm: Miliolid rich peloid packstone. 100 cm: Clast of dark gray packstone with miliolids. 108–150 cm: Very pale brown crushed limestone silt with few limestone clasts injected as soft material into breccia, or the breccia material flowed (loaded in the carbonate sand) into carbonate. Section 3: olive gray (5Y 5/2), matrix supported, unorganized, fine-grained. Basalt clasts are subangular, 30%–40% of the rock, mostly 3–6 mm in size, rarely 1.5 cm and only one clast of 3 cm. Limestone clasts 7%, few mm to 1.5 cm, mostly mudstone and dense limestone. Few clasts are peloid packstone (at 35 cm). Volcanics are vesicular glassy basalt with mixture of clasts with small and "large" vesicles partially and fully infilled by zeolites; few clasts have vesicles orange stained (at 105 cm). A fluid escape structure is developed between 45–60 cm. Structure is infilled by fine sand size carbonate. Section 4: breccia in Section 3 continues into Section 4. Texture and composition is the same. Vesicles are more often orange colored than in Section 3. Fluid escape structure from 57–74 cm. Section 5: 0–150 cm, pale green (10 G 6/2) is matrix color. Maximum grain size is 30 mm; most clasts <20 mm. Slightly coarser clasts 23–31 cm; 66–79 cm; 99–150 cm; no sharp contacts, no bedding or other sedimentary structures. Matrix is carbonate, very fine sand, mostly rounded grains, no particles identified, average 55% of rock. Volcanic/basalt clasts are about 30% of volume. Maximum 30 mm; but generally <15 mm,</p>
2	[Pattern]	2				T	5Y 8/2	
3	[Pattern]	3				T	5Y 5/2	
4	[Pattern]	4				T	10G 6/1	
5	[Pattern]	5				T	10G 7/2	
6	[Pattern]	6				T		
7	[Pattern]	7				T		
8	[Pattern]	8				T		



Site 878 Hole A Core 62R Description continued...

extremely angular, scoriaceous margins, equant shapes, but a few are very elongate, almost all are vesicular, vesicles typically are 40% of clast, only a few are elongate. About 40% of vesicles are carbonate cement filled, randomly distributed within clast. Carbonate mud and sand fill some vesicles at or near clast margins. Rust-stained vesicles common in some clasts.

Carbonate cement filling are both unstained and stained within single clasts. Limestone clasts comprise ~15% of rock. Maximum size is 20 cm; size grades into matrix?

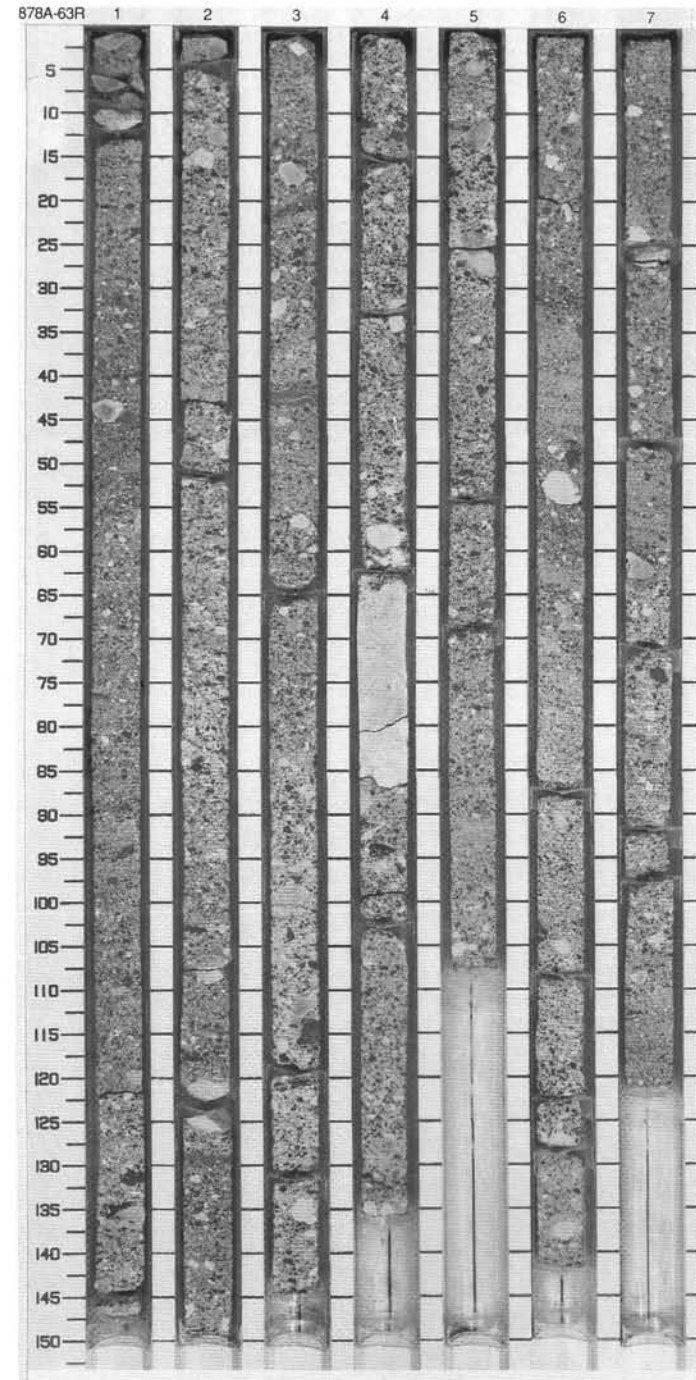
Most are rounded; a few have projections or small embayments (e.g., 12, 45, 64 cm). Clast types are: 1) 52% miliolid peloid packstone; 2) 34% peloid wackestone with some miliolids; 3) 7% mudstone with miliolids; 4) 3% fine packstone with abundant, clear, silt-sized particles (quartz or carbonate ?); some codiacean algae, peloids, mollusk mold, clast at 7 cm has encrusting squamariacean red algae; 5) 1% ooid packstone with deformed (soft) pellets. 20 cm: gray-stained peloid packstone with 2% pyrite. Section 6, 0–150 cm. Matrix is greenish gray (10G 6/1) grading down to 10G 5/1. Carbonate sand of matrix is fine sand, moderately sorted, rounded grains, about 55% of volume. Maximum grain size is 55 mm, but most clasts are <10 mm. Finer intervals with fairly sharp boundaries occur at 54–58 cm, 103–113 cm, 125–128 cm and 133–143 cm. Coarser intervals are 69–79 cm and 128–133 cm. Volcanic clasts are about 33% of volume. Most are very vesicular basalt. Maximum size 25 mm. Black, very angular, stretched vesicles are rare. Whole round used to measure all dips, i.e., true dips. Vesicle are as large as 1.5 mm. 89 cm: olivine basalt, few vesicles. 111 cm: dark gray (N3.5/1) basalt with no vesicles, very altered feldspars, one big olivine phenocryst. 121 cm: red weathered clast with very elongate, poorly oriented feldspar laths. Limestone clasts: about 11% coarser than sand size, rounded, a few embayments (vugs?). Composition: 1) peloid packstone with few miliolids (45%); 2) mudstone, white (N8/1), rare miliolids, very rare mollusk fragments (32%), mostly in top 60 cm; 3) packstone with silt grains (carbonate or quartz?) mollusk molds very rare (12%); 4) packstone with peloids, miliolids, gastropods very rare (10%); 5) grainstone (2%) (peloidal and oolitic). 18–20 cm: silty wackestone with burrows. 60 cm: peloid packstone with green algae? 61 cm: packstone with encruster, possibly sponge. 69–72 and 72–74 cm: large wackestone with peloids, miliolids, gastropod molds. Burrows with siltstone fill; also with intraclast grainstone. 2 vugs to 2.2 cm (one may be enlarged burrow), partly with silicified? volcanic/carbonate matrix and with fibrous natrolite. Section 7: Dips best seen on back of working half. 0–51 cm: Limestone-basalt breccia, carbonate matrix. Matrix pale green (10 G 7/2), 55%–65% volume. Maximum grains 20 mm. Finer layers 11–23 cm; coarser 134–142 cm. Basalt clasts more abundant (~35%) at top, 0–11 cm, less abundant (~20%) in 11–51 cm. Limestone clasts ~10% at top, 0–11 cm; 15% in 11–51 cm. ~70% peloid packstone with few miliolids, 20% mudstone, 10% miliolid wackestone. No noticeable size difference

between limestone and basalt clasts. Limestone more abundant in finer intervals.

General Description:

Cylinders: Section 1, 0–75 cm, 83–110 cm, Section 2, 0–96 cm, 103–150 cm, Section 3, Section 4, Section 5, Section 6, 0–69 cm, 74–150 cm, Section 7; Rollers: Section 1, 75–83 cm, Section 6, 69–74 cm; Drilling pebbles: 96–103 cm. Thin sections: Section 2, 145–150 cm.

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
								VOLCANICLASTIC LIMESTONE BRECCIA
								Major Lithology: Section 1, matrix light gray (N7), 70% of bulk rock, consists of mud to coarse sand-size carbonate (white) including lithoclasts (85%), 15% volcanics, glass shards? and fragments of volcanoclastics (dark grayish green-5 GY 4/1). Volcanoclastics (>1 mm), 70%-80% of total clasts, average 2 mm to 1 cm, few up to 2 cm, are mostly dark grayish green (5GY 4/1), equant, subangular to angular, highly vesicular (50% spherical) aphyric basalt. Very minor, greenish gray (5GY 6/1) weathered basalt, less vesicular (20%-30%), some vesicles filled. Limestone clasts, subangular to rounded, 20%-30% of total clasts, 2 mm-1 cm commonly, only a few in 1 cm-4 cm range. Lithologies include: very pale brown (10YR 8/3) wackestone; dark gray (N3) peloidal grainstone, well cemented with clear calcite; very pale brown peloidal grainstone, similar to gray one; very pale brown peloid-miliolid packstone to wackestone with gray (N6) mottles; and ooid wackestone, very pale brown mottled with medium light gray (N6). Gray mudstone to wackestone at 0-10 cm, 5 pieces, 3 cm each. Structures: vague variation in grain size, horizontal. Large (>1 cm) limestone clasts (and volcanics) concentrated in 129-136 cm. The limestones are mostly pale brown peloidal grainstones, wackestones, packstones (dominant). Also, roller in 145-148 cm contains several clasts, >1 cm, of lithology same as 129-136 cm. Section 2: matrix 70%-80% of bulk rock (matrix supported), very light gray (N8), 90%-95% of matrix is white carbonate (same as section 1). Only 5%-10% volcanics in matrix from about 130 to 150 cm, matrix similar to Section 1. Volcanoclastics same as Section 1, except only 60%-70% of total clasts from 1-120, then 70%-80% of total. Limestone clasts same as Section 1. Notable: 0-4 cm, light gray (N7), 2x2x3 cm clast of gray miliolid-peloid wackestone in contact with very pale brown peloid packstone; possible burrow fill. Structure: vague variation in grain size, horizontal. 1 cm-thick band of oriented grains cuts across section at 60 degree angle from 72-83 cm; possible shear structure?. Horizontal contact at 129 cm is sharp: transition from light gray-white matrix to abundant coarse sand size volcanics (grayish green). This band is 2 cm thick. Section 3: matrix from 0-80 cm similar to section 1; from 80-144 cm, similar to top of Section 2. Volcanic clasts (>2 mm) same as Sections 1 and 2; 3 cm clast at 114-117 cm. Limestone clasts similar to sections 1 and 2, very pale brown peloid packstone and wackestone most abundant, one dark gray (N3), 1.5 cm clast, mudstone to wackestone, at 84 cm. A few other smaller clasts in section with same lithology. Gastropod mold in one clast. Sedimentary structure: 1-2 cm-thick beds of concentrated sand-size volcanoclastics at 19-21 (inclined about 20 degree west - assuming working half is north) and at 42-44 cm, nearly horizontal. The 19-21 cm bed is underlain by a cm-thick light gray bed of breccia matrix. Other bedding is only vague variation in grain size with no clear preferred dip - most near horizontal. Section 4, matrix similar to top of Section 2.
							N7 To 5GY 4/1	



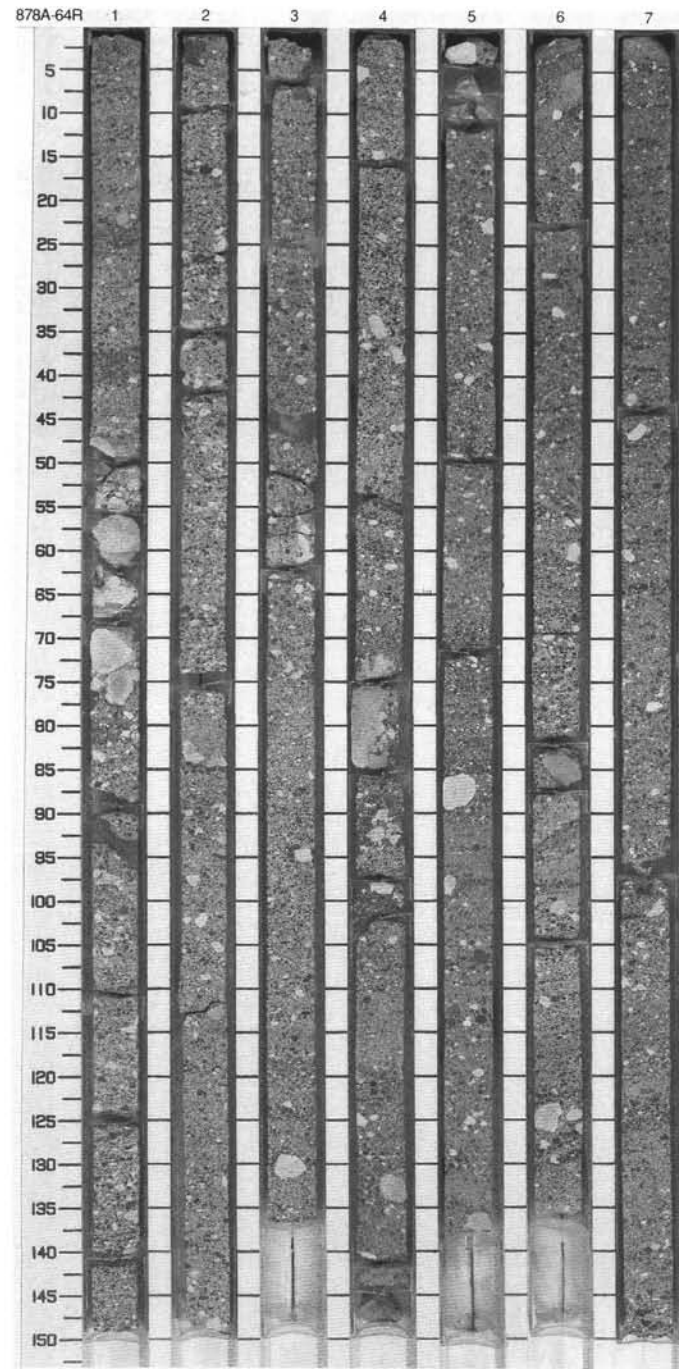
Site 878 Hole A Core 63R Description continued...

Volcanic clasts - similar to Sections 1, 2, 3. Limestone clasts same as Section 1, 2, 3 - including another dark gray clast at 12 cm. Notable feature is nodular limestone bed from 63-87 cm: very pale brown packstone of undetermined composition with anastomosing stylolites separating 1-4 cm nodules. Very irregular contact with breccia, same breccia matrix fills voids in nodular limestone. Sedimentary structures: no clear bedding in section. Section 5, matrix same as Section 2, 3, 4. Volcaniclastics (>2 mm) same as Section 1, 2, 3, 4, except 1 cm size abundant in 10-28 cm and 80-107 cm. Limestone clasts: same as section 1-4, except, generally larger in top 30 cm (up to 4 cm-size). Very few are 1 cm-size below 30 cm. Two oncolites, 1.5 cm diameter, at 5 cm and 2x3 cm at 11-13 cm. The first may have gastropod (replaced) at core, the second some algal fragment at core. Also, a large 3x5x3 cm lithoclast packstone, very pale brown, mottled gray at 23-29 cm. Sedimentary structures: overall fining trend from top to bottom. Bedding not clear until about 60 cm, where it is inclined 20 degree to west. Section 6: matrix same as Section 1. Volcaniclastics generally smaller (2 mm-6 mm) with only a few up to 2 cm. Except for a bed from 119-127 cm with most grains 5 mm-10 mm in size. Limestone clasts similar to Section 1-5, except 3-4 cm piece at 50-54 cm, peloid packstone, very pale brown on one half and mottled mottled gray on the other, some fenestral fabric. Piece of skeletal peloid grainstone with large (0.5x20 cm) mollusk fragment - clast is fractured. More peloidal packstone, 1x4 cm at 126-128 cm and 2x2 piece at 137-139 cm with a partial gastropod? mold. Sedimentary structure: no apparent-bedding until 28 cm, then inclined about 10 degrees to east from 28 to 48 cm, mostly volcanic poor, sandy except for 3 cm band which is volcanic rich. Vague bedding continues from 54-63 cm, 68-86 cm. These intervals lack the coarser (greater than 0.5 cm) clasts that obscure bedding in rest of section. Section 7: matrix same as Sections 1 and 6. Volcaniclastics (>2 mm) same as Section 6. Limestone clasts similar to previous sections. Large clasts, at 22-27 cm and 60-63 cm are very pale brown wackestone to packstone with few miliolids. Sedimentary structures. Only vague bedding, slightly inclined (5-10 degree) to east from 0-16 cm. In 15-20 cm, concentration of sand-size volcanics 5 cm thick to the east and pinches out at 1 cm thick to the west. Bedding is apparent where coarse grains are lacking in 50-59 cm (inclined 5-10 degree to west) and 110-120 cm (slightly graded, inclined 5-10 degree to the east).

General Description:

Cylinders: Section 1, 12-145 cm, Section 2, 4-150 cm, Section 3, Section 4, Section 5, Section 6, Section 7;
 Rollers: Section 1, 0-5 cm, 8-12 cm, 145-148 cm, Section 2, 0-4 cm; Drilling pebbles: Section 1, 5-8 cm. Thin sections: none.

Mete	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
								VOLCANIC LIMESTONE BRECCIA
								<p>Major Lithology: Matrix in this breccia is carbonate rich, probably ~70% carbonate. The remaining 30% is volcanoclastic grains, mostly basalt fragments. Color is light gray (N7). Basalt clasts tend to be dark greenish gray and greenish gray. Grain size of the matrix varies from silt size to coarse sand size. Carbonate particles of the matrix are white and generally are unidentifiable. Faint bedding of the matrix is rarely observed. Limestone clasts generally are of 3 types; pinkish gray miliolid wackestone, very pale brown and medium bluish gray mottled mudstone, very pale brown peloid wackestone. The latter type clast contains stylolites at Section 1, 69–74 cm. Basalt clasts generally are of 2 types; dark grayish green (5GY 4/1), subangular, scoriaceous aphyric basalt, and the less common greenish gray (5G 6/1), weathered, microcrystalline basalt. Clasts of vesiculated basalt commonly contain unfilled vesicles. Few vesicles are filled with calcite (some with orange Fe staining). Rare vesicles are filled with reddish brown zeolite? crystals. Sections 2, 3, 4, 5, 6, and 7 are same as Section 1 (i.e., VOLCANIC LIMESTONE BRECCIA); 3) greenish gray basalt clast (subangular 2–3 mm across) aligned with apparent dip of 19° degree at Section 4, 0–10 cm; 4) several subround clasts, 2–3 cm across, pinkish gray (5Y 8/1) miliolid wackestone at Section 4, 72–85 cm and 132–135 cm. Other components present include rare ooids and oncoids, very rare caprinid fragment, rare thin skeletal bivalve debris. Few clear calcite cement crystals (PB6+ PE6); 5) miliolid mudstone clasts, mottled, pinkish gray at Section 5, 0–11 cm; 6) greenish gray basalt clast (vesicular), aligned with hint of bedding and an apparent dip of 10° at Section 5, 85–87 cm. Clast size is 2–4 mm. Clasts are subangular; 7) limestone clast of peloid wackestone with few clear calcite cements PB4 at Section 5, 86–90 cm; 8) zone of fine-grained, greenish gray (5GY 6/1) "bed" with an apparent dip of 48° at Section 6, 0–20 cm; 9) limestone clast (4 cm x 2 cm), pinkish gray, peloid wackestone at Section 6, 82–87 cm; 10) basalt clast (scoriaceous) dark greenish gray (5G 4/1) at Section 6, 90–95 cm. Grains are angular and range in size from 2–3 cm. Clasts are aligned with apparent dip 34°; 11) same as 10, except apparent dip is 28°; 12) very pale brown (10YR 7/3) miliolid wackestone clast at Section 6, 126–134 cm; and 13) three "beds" of basalt clasts at Section 7, 0–43 cm. Clasts are scoriaceous, dark greenish gray, and have a grain size of 2–3 cm. Beds have apparent dip of <5°.</p> <p>General Description: Cylinders: Section 1, 0–55 cm and 61–150 cm; Section 2; Section 3; Section 4, 0–97 cm and 102–150 cm; Section 5, 11–140 cm; Section 6, 0–82 cm and 87–136 cm; and Section 7. Rollers: Section 1, 55–61 cm; Section 4, 97–102 cm; and Section 6, 82–87 cm. Drilling pebbles: Section 5, 0–11 cm. Thin sections: none.</p>
							N7 To 5G 6/1	



878A-62R CORED 568.7–578.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	early Aptian					T		5Y 5/2
2		2								5Y 8/2
3		3								5Y 5/2
4		4								10G 6/1
5		5								10G 7/2
6		6								
7		7								
8		8								
				B	B					

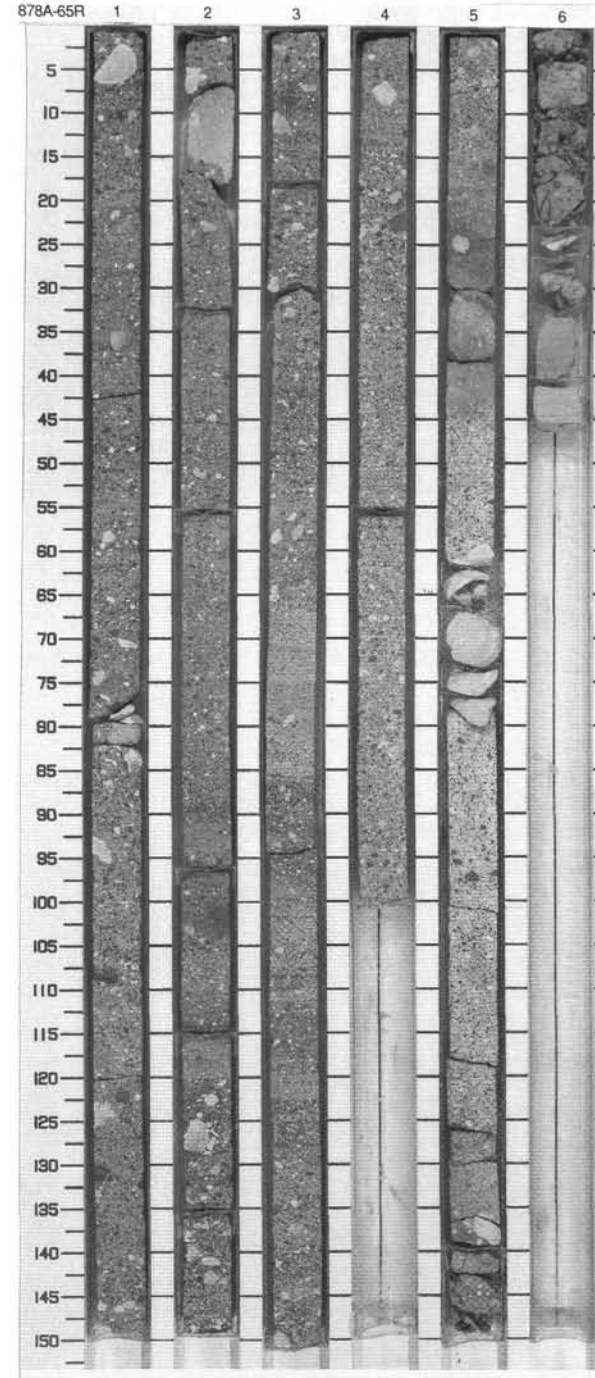
878A-63R CORED 578.1–587.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	early Aptian							N7 To 5GY 4/1
2		2								
3		3								
4		4								
5		5								
6		6								
7		7								
8		8								
9		9								
				B	B					

878A-64R CORED 587.6–597.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	early Aptian							N7 To 5G 6/1
2		2								
3		3								
4		4								
5		5								
6		6								
7		7								
8		8								
9		9								
10		10								
				B	B					

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1	[Pattern]	1					10YR 8/2 To 5GY 4/1	<p>LIMESTONE VOLCANIC BRECCIA</p> <p>Major Lithology: Section 1, Matrix consists of white (10YR 8/2) sand-size carbonate grains and light gray (N7) silt size carbonate particles along with sand-size, dark greensih gray (5GY 4/1) scoriaceous basalt fragments. Carbonate content of the matrix is estimated to be 60%–70%. Limestone clasts tend to be of two types; 1) pinkish gray (5Y 8/1) miliolid wackestone, and 2) pinkish gray (5Y 8/1) peloid wackestone. Clear, coarse (PE6) calcite cement occurs in a few of the limestone clasts. Many encrusting red algae occur in a limestone clast at Section 1, 80–83 cm. Basalt clasts are generally dark greensih gray (5GY 4/1), scoriaceous, aphyric basalt. Roughly 50% of the vesicles remain open, whereas the other 50% are filled with calcite cement. Some of the calcite cement is stained orange by Fe-oxide (?). Vesicles are less than 0.5 mm in diameter. Section 2, matrix is fine-grained, light gray (5Y 8/1) with volcanic clasts olive gray (5Y 4/2). Vesicular glassy basalt fragments are mm to 1.5 cm in size, average 5 mm-size clasts form 15%–40% of the breccia. Limestone clasts 10% of total, vary from mm size up to 10 cm in size. At 7 cm: skeletal packstone with miliolids, mollusk debris and a sponge. 128 cm: peloid grainstone to packstone with miliolids and pyritized grains. Pyrite concentrated at outer rims. 140 cm: gray (bluish) dense limestone. 142 cm: oolite grainstone. 144 cm: peloid packstone. Volcanics are glassy vesicular basalt with fine vesicles; larger vesicles infilled by orange colored minerals. Sedimentary structures: several horizons of horizontal bedding with gradational boundaries between beds. Bedding results from increased accumulation of clasts or vice versa "sand-size" layers. Section 2, 128 cm: peloid grainstone to packstone with miliolids and pyritized grains. Pyrite concentrated at outer rims. 140 cm: gray (bluish) dense limestone. 142 cm: oolite grainstone. 144 cm: peloid packstone. Volcanics are glassy vesicular basalt with fine vesicles; larger vesicles infilled by orange colored minerals. Sedimentary structures: several horizons of horizontal bedding with gradational boundaries between beds. Bedding results from increased accumulation of clasts or vice versa "sand-size" layers. Section 3, matrix is white (5Y 8/1), volcanic clasts olive gray (5Y 4/2). Breccia is medium coarse-grained with clasts 0.6–3 cm, unorganized between 0–66 cm. From 66 cm–123 cm intercalated beds 1–4 cm thick of fine to coarse sand size "breccia" with fine-grained breccia beds. Bedding is horizontal to inclined 5 degree. Limestone pebbles: at 10 cm: peloid-skeletal grainstone with algal fragments; at 30 cm: peleted wackestone with miliolids; at 65 cm: peleted packstone to grainstone with nerinid gastropod; at 137 cm: oolitic grainstone; at 144 cm: peleted packstone. Most of other limestone fragments are mudstone and dense limestone. Volcanic clasts variable vesicular glassy basalt. Vesicles are small, mostly infilled by zeolite and calcite, few are stained orange. Section 4, matrix is light gray (5Y 8/1) with volcanic clasts olive</p>
2	[Pattern]	2				T		
3	[Pattern]	3					5Y 8/1 To 5Y 4/2	
4	[Pattern]	4						
5	[Pattern]	5					10YR 7/1 To 5Y 5/2	
6	[Pattern]	6				T		
7	[Pattern]	6				T	10YR 8/3	



Site 878 Hole A Core 65 Description continued...

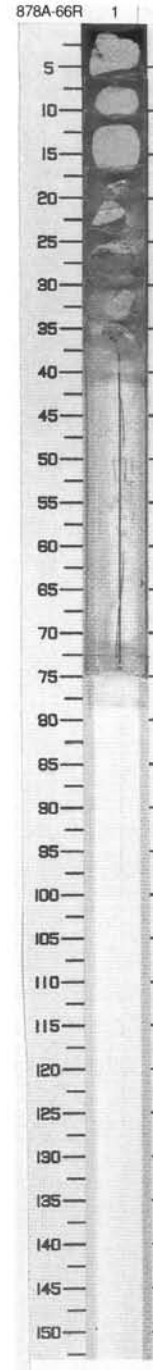
gray (5Y 4/2). Breccia is fine-grained, clasts several mm size, rare 2 cm clasts of glassy basalt (35%) and limestone (15%). 50% of rock is carbonate matrix, fine-grained fragmented limestone with micrite. Limestone clasts mainly mudstone with few miliolids. Volcanics are vesicular glassy basalt vesicles variably infilled. Few sand-size laminae 1 cm thick in upper 10 cm are dipping under 15 degrees. Section 5, 0–23 cm.

Volcanic-limestone breccia, fine-grained, light gray (10YR 7/1), unorganized. Vesicular basalt glass 15–30 mm in size, olive gray (5Y 5/2) 15%; limestone clasts few 2 cm in size: miliolid wackestone, skeletal wackestone with gastropod cast. In 24–30 cm, breccia is very fine muddy with volcanics altered into clay. At 31 cm sharp boundary along fault with yellowish stained breccia which downward becomes progressively whiter. Vesicular basalt glass clasts are olive green (5Y 4/3) up to 2 cm in size. At 32 cm: oncolites with algal or coral. In 60–80 cm: mudstone with few mollusk debris and miliolids. In 131–140 cm: breccia is very fine-grained with matrix pinkish stained; volcanics are highly altered. At 140 cm: drilling contact with brownish yellow (10R 6/4) crumbling, lightly altered fine-grained detrital limestone with clayey carbonate matrix. Clasts of vesicular glass fragments several mm in diameter completely altered. Section 6, 0–3 cm: Argillaceous, fragmented limestone, yellow (10YR 8/6). "Limestone" is soft, friable, disintegrates in water. Contains altered vesicular glass, with elongated vesicles (10% of glass). Vesicular glass is probably completely altered into clay. Few microconcretions 2 mm in diameter, dark reddish-black (10YR 2.5/1) which are either iron concentrations or fragments of scoria. In 3–22 cm, sharp boundary (probably resulting from differences in lithification) with bed comprised by sharp limestone clasts of miliolid packstone, very pale brown (10YR 8/3). Clasts are 1–1.5 cm in size, in yellowish fragmented limestone matrix. From 8–22 cm, matrix becomes dominant and limestone is softer. Few mm-thick Fe-oxide stained laminae. Vesicular, altered basalt, or glass fragments 1.5–2 mm in size are dispersed throughout and comprise about 10% of the rock. Enclosed is also a single clast of oolitic grainstone with Fe-oxide staining. Contact between brecciated limestone containing vesicular basalt clasts and the underlying carbonate platform was not recovered. In 22–26 cm, pelleted packstone, with intraclasts of more dense limestone, bioturbated, with burrows filled by limonite stained packstone. In 31–45 cm, oolitic grainstone, fine-grained (0.2 mm), well sorted, few mollusk and echinoid debris, high intergranular porosity (15%).

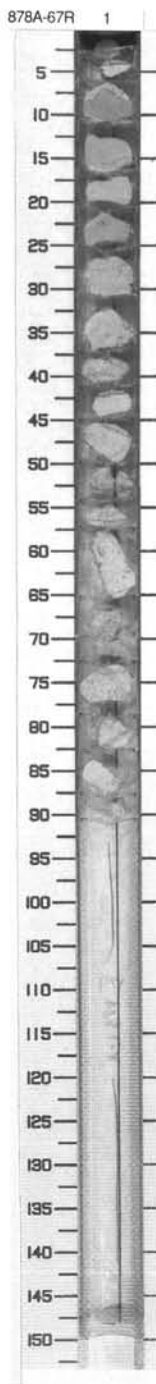
General Description:

Cylinders: Section 1, Section 2, Section 3, Section 4, Section 5, 0–61 cm and 76–140 cm; Section 6, 0–22 cm and 31–45 cm; Rollers: Section 5, 66–76 cm; Drilling pebbles: Section 5, 61–66 cm and 147–150 cm, Section 6, 26–31 cm. Thin section samples: Section 2, 11–14 cm; Section 5, 73–75 cm and 84–86 cm; Section 6, 35–37 cm and 41–45 cm.

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
		1				T	10YR 8/3	<p>DESCRIPTION</p> <p>SKELETAL GRAINSTONE and PACKSTONE</p> <p>Major Lithologies: Section 1, 0–17 cm; very pale brown (10YR 8/3) SKELETAL GRAINSTONE, average 0.2 mm grain size, abundant mollusk fragments, abundant spherical to oval coated grains, a few ooids, one large mollusk shell (entire width of core) is probably an oyster shell, borinbgs filled by peloids. Porosity 15%–25%, only a little intergranular cement. Possible algal (or some other enrustation) 3 mm thick and 2 cm long, stained orange. 17–37 cm; coarse-grained packstone, with few mollusk fragments up to 2 cm, abundant coated grains, few ooids, few miliolids, few pellets, few lithoclasts, few fragments of encrusting algae, fragment of calcisponge, possible small coral (poorly preserved). Porosity is 5%–15%, intergranular, moldic, vuggy, little visible cement. In 29–34 cm, there are 4 adjacent circular sections through small (0.5 cm) mollusks (rudist?), with white, packstone geopetal fill.</p> <p>General Description: Rollers: 0–17 cm, 23–29 cm. Drilling pebbles: 17–23 cm, 29–37 cm. Thin sections: 10–15 cm.</p>



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
		1		●			10YR 8/2	<p>LIMESTONE</p> <p>Major Lithology: 0–21 cm. PELOIDAL GRAINSTONE, very pale brown (10YR 8/3), medium sand size, well sorted. Few grains recognizable; probably mostly skeletal, but rounded with pervasive micrite coatings, about 50 microns thick. Mollusk fragments, rare, mostly molds; small forams, rare, red algal fragments rare (3–6 cm and 16–21 cm), squamariaceans? 3–6 cm. Porosity about 35%, mostly interparticle (about 28%), some moldic (about 7%). Cement very patchy; pore filled (rare) to virtually empty. Cement appears to bridge between grains and have curved (meniscate) boundaries; it's equant, medium crystalline calcite (PE45) where visible, most is probably finer. 21–54 cm. SKELETAL GRAINSTONE, very pale brown (10YR 8/3), coarse sand, variable sorted, (poor, well, mostly moderate). Peloid abundant; similar to overlying, but more components identifiable: coralline algae, mostly encrusters, few; squamariaceans rare; mollusk fragments, few; corals, very rare; echinoid spines very rare; encrusting forams very rare; calcisponge? (in 20–25 cm, 50–54 cm). Porosity about 35%, interparticle 20%, moldic 10%; vugs, patchily distributed, 5%. Cement patchy; bridges grains, curved? (meniscate)contacts. Overgrowths on echinoderms (PE4Om). There are overgrowths on echinoderms (PE4Om). Section 1, 54–79 cm. COATED GRAIN BIVALVE RUDSTONE, packstone matrix; very pale brown (10YR 8/33). Matrix coarse sand, little mud. Bivalve fragments many to abundant, thick, oyster-like at top, thin-shelled, ovoid, toward base; "oysters" encrust sponge (72–79 cm); coated grains include 1) spheres, 0.5–0.8 mm diameter, matte white, laminated coatings, probably coralline algae and 2) elongate shell fragments with thin white coating, possibly micrite or algal. Peloids common throughout. Minor skeletal components: calcisponges (57–64 cm, 72–79 cm); corals; squamariacian algae. Porosity about 30%. Interparticle about 18%, moldic about 9%, vugs 2%, intraparticle 1%. No visible cement. 79–83 cm and 88–90 cm. (drilling pebbles). SKELETAL PACKSTONE, very pale brown (10YR 8/3), fine sand, poorly sorted. Large intraclast with abundant tubular encrusters (tubes 0.25 mm diameter, short); large calcisponge, mollusk fragments with micrite coatings; red algal fragments. 83–88 cm. GASTROPOD PACKSTONE, very pale brown (10YR 8/3), coarse silt size ("matrix", coarser grains common). Gastropods and gastropod fragments many; miliolids few. Porosity moldic 5%. Calcite cement medium to coarse grained bladed and equant (PE4; PB5), in molds. Molds and patches of matrix stained brownish yellow (10YR 6/8).</p> <p>General Description: Cylinders: 57–65 cm. Rollers: 6–50 cm, 72–79 cm, 83–88 cm. Drilling pebbles: 0–6 cm, 50–57 cm, 65–72 cm, 79–83 cm, 88–90 cm. Thin sections: none.</p>
				●			10YR 8/3	



878A-65R CORED 597.1 – 606.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	early Aptian	B	B	R,P		T	10YR 8/2 To 5GY 4/1	
2		2								
3		3								
4		4								
5		5								
6		5								
7		6								
								T	5Y 8/1 To 5Y 4/2	
								T	10YR 7/1 To 5Y 5/2	
								T	10YR 8/3	

878A-66R CORED 606.6 – 616.3 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
		1	early Aptian	B	B	R,P			T	10YR 8/3

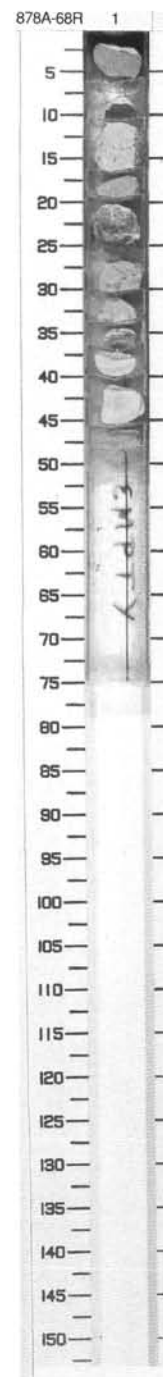
878A-67R CORED 616.3 – 625.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.5		1	early Aptian	B	B	R,P				10YR 8/3
										10YR 8/2

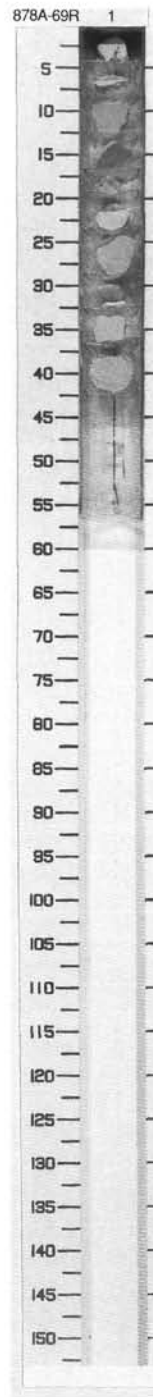
SITE 878 HOLE A CORE 68R

CORED 625.9 – 635.6 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1	W W	1	early Aptian	G		T	10YR 8/3	<p>FORAMINIFER WACKESTONE, NEREINID RUDSTONE and MILIOLID PACKSTONE</p> <p>Major Lithologies: 0–20 cm; very pale brown (10YR 8/3) FORAMINIFER WACKESTONE, common miliolids and Vercoella-type foraminifers, and pale brown fragments that may be small corals (preservation is poor). Mollusk debris is common, often molds. Chalky aspect, 5%–10% porosity moldic and vuggy, abundant visible vugs are less than 0.2 mm. Some grains and pores stained orange; similar stain common in some vugs. 20–25 cm; NEREINID RUDSTONE with PACKSTONE matrix. Two highly recrystallized nerineid gastropod pieces, one is 5 cm long, 2.5 cm wide at one end and 1.8 cm wide at the other, completely replaced with light yellow coarse, bladed calcite cement. Matrix is pale brown (stained yellow and orange in places) MILIOLID PACKSTONE. Large clasts (0.5–0.8 cm) in addition to gastropods are coral, algae?, and miliolid wackestone lithoclasts. Matrix and some lithoclasts have fractures, 0.5–1 mm wide and 0.5–1.5 cm long, as if formed by shrinkage. Some of these fractures, as well as some moldic and vuggy porosity filled by clear, bladed, and equant calcite. 25–30 cm is the same as matrix in 20–25 cm. Section 1, 30–33 cm, is comprised of FORAMINIFER (MILIOLID) WACKESTONE (or a silt-sized packstone with abundant 10–20 micron grains), with some burrowing and orange staining. This piece has a 2–4 mm rim of the packstone lithology described above cemented to its surface, along with thin (2 mm X 1 cm) mollusk shells (oyster?). Section 1, 33–36 is the same lithology as 25–30 cm with a 2x2.5 cm thin, nearly complete oyster shell. Section 1, 36–45 cm, same as a 30–33 cm (without the packstone rim), with few Vercoella-type foraminifers, iron staining in streaks, but also radiating from points that may be noncarbonate grains. Chalky: microporosity is high, absorbs water rapidly. Section 1, 45–48 cm is a highly recrystallized packstone to grainstone with no recognizable grains, yellow to orange staining common in the matrix, and a few black grains. Porosity is 1%–2%, most has been filled by clear to yellow equant and bladed cement.</p> <p>General Description: Rollers: 0–6 cm, 10–16 cm, 19–30 cm, 39–45 cm. Drilling Pebbles: 6–10 cm, 16–19 cm, 30–39 cm, 45–48 cm. Thin sections: 11–16 cm.</p>
.2	W W							
.3	W W							
.4	W W							



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION		
.1	W W	1	early Aptian	●			10YR 7/3	PELOID WACKESTONE and PELOID MILIOLID PACKSTONE		
.2	P P			●				Major Lithologies: 0-19 cm: Very pale brown (10YR 7/3), leached PELOID WACKESTONE. Most grains are unidentifiable; some are clearly peloids (0.6 to 1.2 mm diameter). Mollusk molds are few. Red algae fragments are rare, as are pellet-filled burrows. Porosity is variable, ranging from up to 30% to 10%. Porosity types include moldic and solution enlarged interparticle. 19-42 cm: Very pale brown (10YR 7/3) leached PELOID MILIOLID PACKSTONE. Dominant skeletal components are miliolid foraminifers and peloids; both are <1.0 mm in diameter. Other skeletal components are much rarer in abundance, and include few mollusk fragments, rarely up to 1.6 mm long; few red algae fragments (rarely up to 8 mm across); rare pellet-filled burrow. Yellow brown and rusty orange stains (Fe-oxides ?) occur in rare abundance. Porosity is ~ 10%, mostly interparticle (BP). Concentration of calcite cement is negligible.		
.3										
.4										
								General Description: Rollers: 0-4 cm; 4-8 cm; 8-12 cm; 12-17 cm; 23-28 cm; 37-42 cm. Drilling pebbles: 17-23 cm; 28-37 cm. Thin sections: 20-23 cm.		

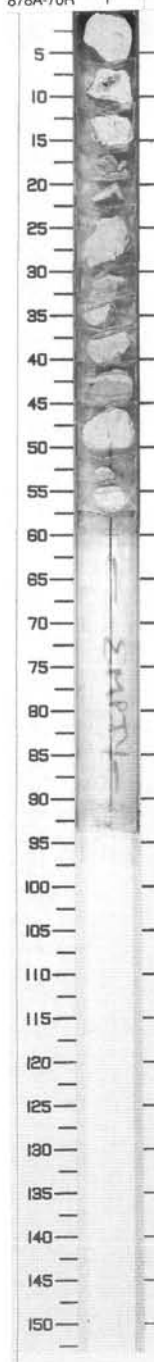


SITE 878 HOLE A CORE 70R

CORED 645.2 - 654.9 mbsf

878A-70R 1

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1 .2 .3 .4 .5		1	early Aptian			T	10YR 7/3	<p>MOLLUSK WACKESTONE, STROMATOPOROID BOUNDSTONE, SKELETAL WACKESTONE and PELOID WACKESTONE</p> <p>Major Lithologies: 0-15 cm: Very pale brown (10YR 7/3), leached MOLLUSK WACKESTONE with many mollusk fragments, especially a 3 mm long rudist? fragment at 0-6 cm and a Nerineid gastropod (3.5 cm by 1 cm) at 6-11 cm, rare red algae, rare uniserial foraminifer, and rare stromatoporoid fragments. Porosity (10%) is mostly solution enlarged interparticle. Calcite cement is very rare, mostly finely bladed crusts (PB3C). 15-22 cm: Very pale brown, encrusting STROMATOPOROID BOUNDSTONE. There is 3 cm specimen in 15-18 cm and a 2.5x4 cm specimen in 18-22 cm. Mollusk fragments occur in a small area overlying the latter stromatoporoid specimen. Porosity (20%) is mostly solution enlarged intraparticle. 22-40 cm: Very pale brown SKELETAL WACKESTONE with common peloids, common red algae, especially in 30-36 cm, few bivalves, rare gastropods, rare ooids and very rare stromatoporoid fragments. Porosity (15%) is mostly solution enlarged intraparticle. Calcite cement is few, mostly pore-filling in fenestral? voids. Fe-oxide staining in 36-40 cm is prominent; color varies from moderate red (5R 4/6) to pale yellowish orange (10YR 8/6). Some may be fenestrae. 40-44 cm: Very pale brown, coarse sand SKELETAL PACKSTONE with abundant peloids, few mollusk fragments and rare red algae fragments. Porosity (15%) is mostly solution enlarged intraparticle. Fine bladed calcite crusts (PB3C) are rare. Section 1, 40-44 cm, is comprised of very pale brown, coarse sand SKELETAL PACKSTONE, with abundant peloids, few mollusk fragments and rare red algae fragments. Porosity (15%) is mostly solution enlarged intraparticle. Fine bladed calcite crusts (PB3C) are rare. Section 1, 44-57 cm, is comprised of very pale brown PELOID WACKESTONE to MUDSTONE, with few discernable grains; these include peloids and a rare gastropod. Pale yellowish orange (10YR 8/6) staining of grains occurs in Section 1, 53-57 cm.</p>
							5YR 4/6 To 10YR 8/6	
							10YR 7/3	
							10YR 8/6	
								<p>General Description: Rollers: 0-15 cm; 22-30 cm; 36-50 cm. Drilling pebbles: 15-22 cm; 30-36 cm; 50-57 cm. Thin sections: 11-15 cm.</p>



878A-68R CORED 625.9 – 635.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	early Aptian						T	10YR 8/3
.2										
.3										
.4						B	B	F/M		

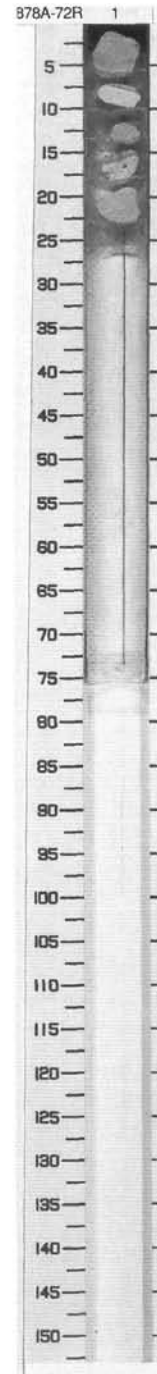
878A-69R CORED 635.6 – 645.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	early Aptian							10YR 7/3
.2						B	B	C/M		
.3										
.4										

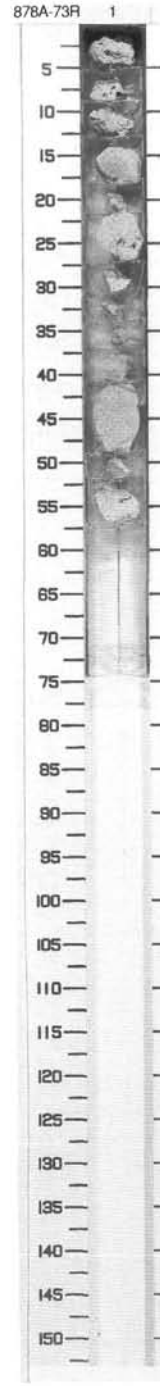
878A-70R CORED 645.2 – 654.9 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color	
.1		1	early Aptian						T	10YR 7/3	
.2											5YR 4/6 to 10YR 8/6
.3											←
.4						B	B	F/M			10YR 7/3
.5											10YR 8/6

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	early Aptian			T	10YR 7/3	<p>DESCRIPTION</p> <p>OID PELOID GRAINSTONE, FENESTRAL WACKESTONE and ALGAL STROMATOPOROID BINDSTONE</p> <p>Major Lithologies: 0–23 cm. very pale brown, fine sand-size OID PELOID GRAINSTONE. Other grains include oncoids (many) and few mollusk fragments. Most fragments are <0.5 mm in diameter. Porosity is variable, ranges from 10% to 35%, solution enlarged interparticle, small mesopore vuggy, and moldic. Cement is rare to few, mostly PB3C. Cement color is clear. 0–6 cm. FENESTRAL WACKESTONE which forms an irregular contact with ooid peloid grainstone. Skeletal components in the wackestone include a few red algae (<0.5mm) and few peloids. Many of the fenestrae are filled with clear coarse calcite (PB45C). Few of the calcite crystals have rusty orange (Fe-oxide?) coatings. 13–18 cm. 1/3 of drilling pebble are ALGAL STROMATOPOROID BINDSTONE. There are numerous generations of encrustation of the ooid peloid grainstone by red algae and stromatoporoid. On top of this apparently horizontal encrustation is a downed-slope growth of a calcisponge or another stromatoporoid. This growth is highly recrystallized and has abundant clear coarse calcite cement within. Some of the domed organism is stained moderate reddish orange (10R 6/6).</p> <p>General Description: Rollers: 0–10 cm, 13–23 cm. Drilling pebbles: 10–13 cm. Thin sections: 6–10 cm.</p>
.2								



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0-57		1	early Aptian			T	10YR 8/3	<p>CORAL RUDSTONE and GRAINSTONE</p> <p>Major Lithologies: 0–57 cm; very pale brown (10YR 8/3) CORAL RUDSTONE with GRAINSTONE matrix at the top grading to GRAINSTONE at the base (transition in 21–27 cm). Grains in the matrix are mostly spherical to ovoid, 0.2–1.0 mm, recrystallized to the point of nonrecognition. A few grains may be ooids, some rectangular grains are probably mollusk debris, few lithoclasts. Porosity 10%–20%, moldic and intergranular, both types probably solution enlarged in places. Cements are mostly clear calcite coatings on grains, some intergranular porosity filled. Occasional medium to coarse, equant and bladed, crystalline calcite in some voids; most are unlined. Some intergranular space may be filled with mud (i.e., local packstone texture), but this could be fine-grained cement; will need thin section. Most abundant large (>2 mm) grains: are molds of coral pieces (ave 0.5 to 2 cm). Mold walls commonly bored. Also, few calcisponge, few lithoclasts. Large (up to 3x3x4 cm) coral colonies in 12–18 cm and 51–57 cm (smaller pieces in 18–21 cm and 48–51 cm) have densely packed corallites (2 mm diameter), recrystallized. The colony in 12–18 cm has a rim of grainstone matrix cemented over half of the uncut surface.</p> <p>General Description: Cylinders: 41–48 cm. Rollers: 0–5 cm, 9–18 cm, 21–27 cm, and 51–57 cm. Drilling pebbles: 5–9 cm, 18–21 cm, 27–41 cm and 48–51 cm. Thin sections: 37–41 cm.</p>



878A-71R

CORED 654.9 - 664.6 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1	early Aptian	B	B	R/M	↑ T ↑ T ↑ T ↑ T	∩ ∩ ∩ ∩ ∩ ∩ ∩ ∩ ∩ ∩	T	10YR 7/4 10YR 8/4

878A-72R

CORED 664.6 - 674.2 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1 .2		1	early Aptian	B	B	F/P	⊙ ⊙		T	10YR 7/3





878A-73R

CORED 674.2 - 683.9 mbsf

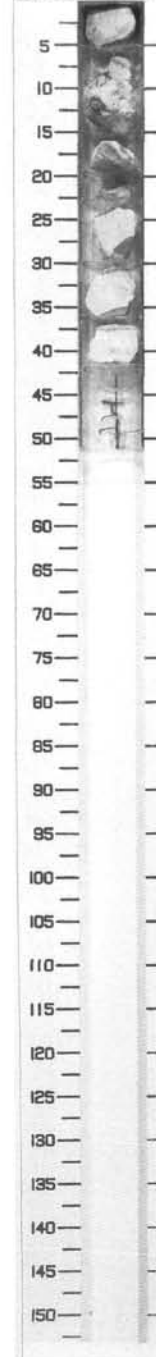
Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
5		1	early Aptian	B	B	R/P	⊙ ⊙		T	10YR 8/3

SITE 878 HOLE A CORE 74R

CORED 683.9 – 693.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
.1		1	early Aptian	β			10YR 8/3	<p>GASTROPOD RUDSTONE and PACKSTONE</p> <p>Major Lithologies: 0–8 cm. Colonial coral and micritized gastropod molds in very pale brown (10YR 8/3), chalky, very fine-grained, PELLETED PACKSTONE. 0–4 cm single fragment of colonial coral cemented by honey colored sparry calcite. Vuggy porosity 7%. 8–19 cm. GASTROPOD RUDSTONE (lumachella); 70% molds of nerineid gastropods. Gastropods 1.5 cm in diameter; filled by bladed sparry calcite. Gastropod shells extensively bored by fungi. Some of the vugs are stained reddish by iron oxide. Matrix is chalky mudstone to wackestone. 19–41cm. Fine-grained PACKSTONE, intensively chalkified, so no skeletal grains are recognizable. High chalky porosity 10%–15%. Few vugs as tubular holes 0.6 mm and one mold after small gastropod. 37 cm - completely chalkified skeletal fragment of ?coral.</p> <p>General Description: Rollers: 0–5 cm, 8–19 cm, 22–41 cm; Drilling pebbles: 5–8 cm, 19–22 cm. Thin sections: none.</p>
.2		1	early Aptian	β			10YR 8/3	
.3		1	early Aptian					
.4		1	early Aptian					

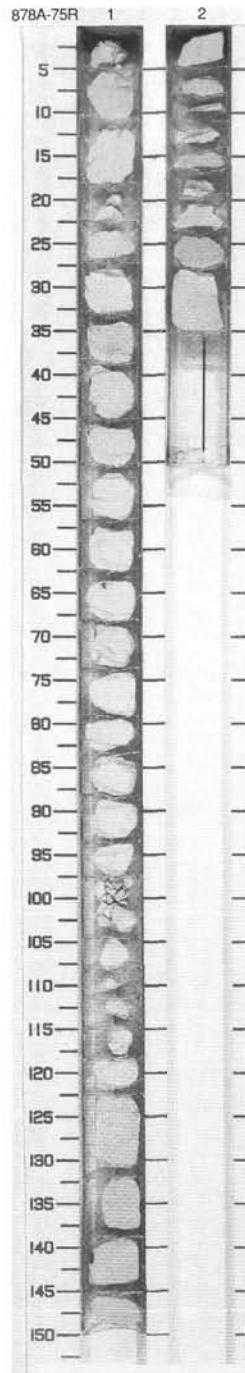
878A-74R 1



SITE 878 HOLE A CORE 75R

CORED 693.5 – 703.0 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
0-5		1	early Aptian		/ / / / / / / /	T	10YR 8/3	<p>SKELLETAL PACKSTONE and SKELLETAL GRAINSTONE WACKESTONE and PACKSTONE</p> <p>Major Lithologies: Section 1, 0–118 cm; very pale brown (10YR 8/3) WACKESTONE (or silt-sized packstone, there are abundant grains in the 10–20 micron range). Grains unidentifiable, except for a few thin mollusk shell fragments (many as molds) and rare Vercosella-type (or Subaudia) foraminifers. Also rare coral fragments, 0.5–1.0 cm size, poorly preserved. Mottles in Section 1, 68–73 cm may be filled burrows, rounded lithoclasts, or rounded encrustations, poorly preserved. Porosity (10%) is moldic and vuggy; wackestone is chalky, water is absorbed rapidly. Little visible cement, few orange stains in some pores, and a stylolite in Section 1, 32–38 cm. Section 1, 118–150 to Section 2, 35 cm; very pale brown (10YR 8/3), fine-grained (0.05–0.1 mm) PACKSTONE with slightly darker, anastomosing laminae that look like either flaser bedding or some kind of loading feature. Components are the same as in Section 1, 0–118 cm, except for larger and more common orange stains and a few black grains. No visible difference in grain type between laminae, but there may be more cement in the darker layers, although it is too fine grained to see crystals. Laminae not as obvious in Section 1, 145 to Section 2, 35 cm. Partial stylolite in Section 2, 0–5 cm. Rare gastropod molds in Section 2, 27–35 cm. No visible difference in grain type is observed between laminae, but there may be more cement in the darker layers, although it is too fine grained to see crystals. Laminae are not as obvious in Section 1, 145 cm, to Section 2, 35 cm. There is a partial stylolite in Section 2, 0–5 cm. Rare gastropod molds are noted in Section 2, 27–35 cm.</p> <p>General Description: Cylinders: Section 1, 62–68 cm, 122–145 cm; Section 2, 27–35 cm. Rollers: Section 1, 4–17 cm, 26–62 cm, 68–97 cm, 118–122 cm, 145–150 cm; Section 2, 0–5 cm, 23–27 cm. Drilling Pebbles: Section 1, 0–4 cm, 17–26 cm, 97–118 cm; Section 2, 5–23 cm. Thin sections: Section 1, 0–4 cm, 141–143 cm; Section 2, 0–4 cm.</p>
5-10		2						

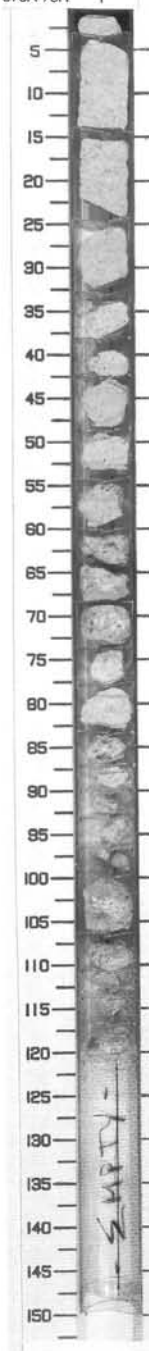


SITE 878 HOLE A CORE 76R

CORED 703.0 – 712.5 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color
1		1	early Aptian			T	10YR 7/4
<p>DESCRIPTION</p> <p>SKELETAL GRAINSTONE</p> <p>Major Lithology: 0–53 cm. SKELETAL GRAINSTONE, very pale brown (10YR 7/4). Coarse sand size; moderate sorting. Most grains are rounded and coated with a micritic band to 200 microns thick. This is probably an additive coating. Some thinner micrite peripheries may be only micrite envelopes. Few grains identified: bivalves are most common, followed by gastropods (molds), red algal fragments, codiacean algae, calcisponges, echinoderms, and corals. Intraclasts are rare. A probable vesicular basalt clast occurs at 52 cm. Porosity is uniformly 30%–35%, but distributed in detailed patches. About 2/3 of pores are primary interparticle; 1/3 are molds. Cement is very patchy; some pores are filled. Possible meniscus cement at top. A "diagenetic disconformity" at 53, marked by low relief stylolite. Beneath cementation is much more extensive; moldic porosity is greater. Section 1, 53–64 cm. SKELETAL GRAINSTONE, very pale brown (10YR 7/4). Coarse to very coarse sand. Coated grains (as above) abundant. Recognized skeletons are: bivalves, gastropods (turrillid), encrusting and fragmented red algae, a large coral fragment, possible codiacean algae. Grainstone intraclast (54–60 cm). Porosity ranges from 20%–40% (in small pieces); moldic porosity is about 20%; interparticle ranges from 0 at top to 20%. Section 1, 64–74 cm. BIVALVE CORAL RUDSTONE; matrix is coated</p> <p>skeletal grainstone, coarse sand size. Color is very pale brown (10YR 7/4). Bivalves to 4 cm; may be nearly complete shells. Coral heads to 4 cm. Coated grains common; gastropods rare, echinoid spine very rare. Porosity 35%–40%; half moldic, half interparticle. Early cement is cloudy isopachous calcite (PB?4C), in interparticle pores. Grades into clear, coarse, bladed calcite, which also occurs in molds (PB5C). Section 1, 74–100 cm. COATED SKELETAL GRAINSTONE, very pale brown (10YR 7/4); coarse to very coarse grained. Poor sorting. Coated grains abundant. Recognizable grains are corals, bivalves, gastropods, codiacean algae(?), calcisponge(?). Porosity estimates range from 20%–40%; average 33%. Interparticle is about 22%; moldic ranges from 5 to 25%, average 11%. Cloudy, medium, bladed? isopachous cement (PB?4C) lines some interparticle pores in 93–96 cm. Molds contain coarser bladed spar PB45C. Very coarse crystalline overgrowths occur on echinoderms (PE56Om, PB6Om). Section 1, 100–121 cm. CORAL RUDSTONE, very pale brown (10YR 7/3). Coral heads, extensively neomorphosed, leached and replaced, occur in every piece. They are extensively bored and filled by coated grains. Matrix is very coarse sand-sized coated skeletal grainstone. Laminated coated grains (eg. boring fills in 114–117 cm) appear to have red algal laminations rather than oolite cortices. Some corals are encrusted, e.g. by squamariacean algae (110–114 cm). Recognized skeletal grains include bivalves, gastropods, miliolids. Porosity in matrix ranges from 20%–35%, 1/2 interparticle, 1/2 moldic. Early cement visible in 114–117 cm is cloudy, bladed, fine isopachous calcite (PB3C) overlain by clear, bladed medium to coarse calcite (PB45C), which also reduces moldic pores.</p> <p>General Description: Cylinders: 3–33 cm, 100–106 cm; Rollers: 0–3 cm, 33–83 cm, 106–110 cm, 117–121 cm; Drilling pebbles: 83–100 cm, 110–117 cm. Thin sections: 12–14 cm.</p>							

878A-76R 1



878A-74R CORED 683.9 – 693.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	early Aptian							10YR 8/3
.2				B						
.3				B						
.4				R,P						

878A-75R CORED 693.5 – 703.0 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	early Aptian							10YR 8/3
.2				F,M	F,M	F,M				

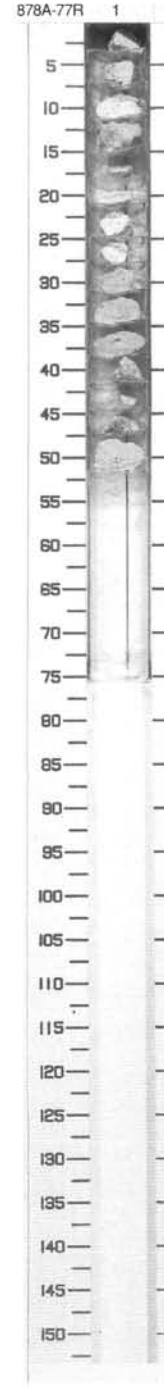
878A- 76R CORED 703.0 – 712.5 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
.1		1	early Aptian							10YR 7/4
.2				B						
.3				B						
.4				R,P						

SITE 878 HOLE A CORE 77R

CORED 712.5 - 722.1 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150		1	early Aptian				10YR 8/3	<p>DESCRIPTION</p> <p>GRAINSTONE</p> <p>Major Lithology: Coarse-grained, very pale brown (10YR 8/3) GRAINSTONE. Coarse fraction 1-2 mm in size, matrix fine fraction 0.2 mm average. Grains are oolites, minor intraclast of oolitic grainstone, molds of small gastropods. Coral fragments form few up to 60% of the grainstone (maximum at 39-47 cm). Rare are mollusk fragments and fragments of echinoids. Grainstone between 15 and 25 cm is leached, chalky. Porosity is moldic, interparticle, 7%-20%. Some of the limestone pieces show differential cementation; limestone is well cemented, but the adjacent burrows are only slightly cemented and infilled by coarser grains. In 31-35 cm grainstone is bored, with grains truncated at the edge of the hole. Cement is short, drusy sparry calcite at grain contacts. In some intraskeletal voids few large bladed sparry calcite crystals. In 47-52 cm grainstone shows low angle cross lamination 5-10°. Vugs are elongated parallel with bedding.</p> <p>General Description: Rollers: 11-15 cm, 47-52 cm. Drilling pebbles: 0-11 cm, 15-47 cm.</p>



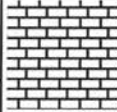



Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
1		1	early Aptian				10YR 7/3 To 5YR 6/6	<p>SKELETAL GRAINSTONE AND BASALT</p> <p>Major Lithology: 0–43 cm: Very pale brown (10YR 7/3) and reddish yellow (5YR 6/6) SKELETAL GRAINSTONE. Majority of skeletal grains are coated by red algae. Skeletal components include common peloids; common red algae fragments; few coral fragments; few thin-shelled bivalve fragments; rare ooids; very rare gastropod; and very rare lithoclast. Grainstone is poorly sorted, with grains ranging in size from <0.25 mm to > 4.0 mm. Most grains are rounded to ovoid in shape. Peloidal matrix is very pale brown with many areas stained reddish yellow (5YR 6/6), dusky red (5R 3/4), and/or red (10R 5/8). Porosity is highly variable, and ranges from 15%–30%. Calcite cement is generally few, mostly isopachous crusts (PB3C). Other notable features include 1) Section 1, 7–10 cm where a 3 cm diameter algal rhodolith with fenestrae occurs. Many of the fenestrae are coated or filled with a red (10R 5/8) lining of cement (?); 2) Section 1, 20–25 cm where coral fragments are common, stromatoporoids few, mollusk fragments few, and green algae very rare. Dusky red (5R 3/4) stains are many.; and 3) Section 1, 35–40 cm where reddish yellow (5YR 6/6) staining is especially prominent.</p> <p>General Description: Drilling pebbles: 7–10 cm; 10–13 cm; 13–16 cm; 16–20 cm. Rollers: 0–4 cm; 4–7 cm; 20–25 cm; 25–30 cm; 30–35 cm; 35–40 cm; 40–43 cm.</p>
2		2						

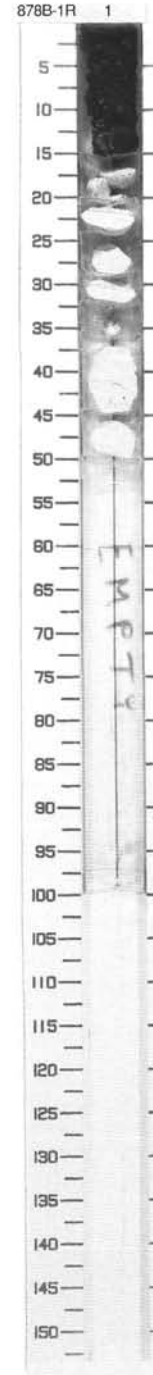
878A 79R THROUGH 98R HARD ROCKS



SITE 878 HOLE B CORE 1R

CORED 0.0 – 5.8 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION	
.1		1	early Pleistocene	(Mn)			10YR 8/2 to 5YR 6/8	<p>MANGANESE NODULES and PELOID GASTROPOD WACKESTONE</p> <p>Major Lithologies: 0–15 cm: Black (N2) MANGANESE NODULES with small patches of pelagic and neritic carbonate. Carbonate varies in color from white (10YR 8/2) to reddish yellow (5YR 6/8) to very pale brown (10YR 7/3). The reddish yellow colored sediment is probably phosphatized. Two manganese encrusted and phosphatized mollusk fragments are identifiable. Other grains not discernable. 15–50 cm: White (10YR 8/2) PELOID GASTROPOD WACKESTONE. Skeletal components include many to few gastropods, especially Nereneids; few peloids; few to rare highly altered bioclasts (mollusk fragments?), especially one 3 cm-long by 0.4 cm-wide mollusk fragment at 35–44 cm. Porosity is variable and ranges from 3%–12%. Porosity is moldic and is best developed after gastropods. Calcite cement is very rare (PB3C?).</p> <p>Drilling disturbance Drilling pebbles: 0–15 cm; 15–20 cm; 32–35 cm. Rollers: 20–24 cm; 24–28 cm; 28–32 cm; 44–50 cm. Cylinders: 35–44 cm.</p>	
.2									
.3									
.4									



878A-77R CORED 712.5 – 722.1 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.5		1	early Aptian			early Aptian				10YR 8/3
				B	B	R,P				

878A-78R CORED 722.1 – 731.7 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
1		1								
2		2	?	B	B	B				10YR 7/3 To 5YR 6/6

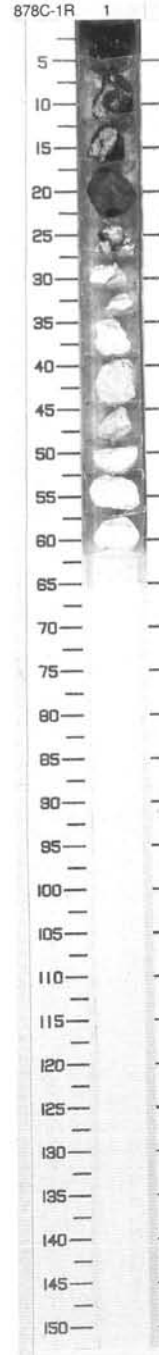
878 79R THROUGH 98R HARD ROCKS

878B- 1R CORED 0.0 – 5.8 mbsf

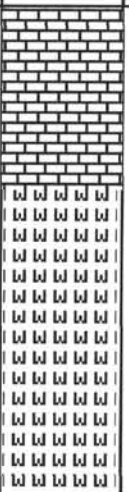
Meter	Graphic Lith.	Section	Age	Calc. nanno.	Plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.1										
0.2		1	early Pleistocene		<i>C. macintyreii</i>					
0.3				A,G	B	B				
0.4										10YR 8/2 to 5YR 6/8

SITE 878 HOLE C CORE 1R CORED 0.0-6.0 mbsf

Meter	Graphic Lith.	Section	Age	Structure	Disturb	Sample	Color	DESCRIPTION
			1 late Pliocene	 			15G 6/1 to 5YR 6/8 to 10YR 7/3 10YR 8/2	MANGANESE NODULES and PELOID GASTROPOD WACKESTONE Major Lithologies: 0-23 cm: Black (N2) MANGANESE NODULES with small patches of foraminifer limestone. This pelagic limestone contains abundant molds of pelagic foraminifers. Sediment color varies from greenish gray (5G 6/1) to reddish yellow (5YR 6/8) to very pale gray (10YR 7/3). Some of the sediments may be phosphatized. Porosity is high, roughly 25% and mostly solution enlarged moldic (especially after foraminifers). 23-61 cm: White (10YR 8/2) PELOID GASTROPOD WACKESTONE. Skeletal components include many gastropods (Cerithids and Nereneids), preserved mostly as molds; few to many peloids; few unidentifiable grains which may be recrystallized or micritized; and rare mollusk fragments, especially a 2 cm long bored fragment at 57-61 cm. Porosity is ~ 20%, mostly moldic and boring. Grain size is 0.8 mm to 4.0 mm. Grains are rounded. Drilling disturbance: Drilling pebbles: 0-5 cm; 23-27 cm; 27-30 cm; 30-34 cm. Rollers: 5-12 cm; 12-17 cm; 17-23 cm; 34-39 cm; 39-44 cm; 44-48 cm; 48-52 cm; 52-57 cm; 57-61 cm.



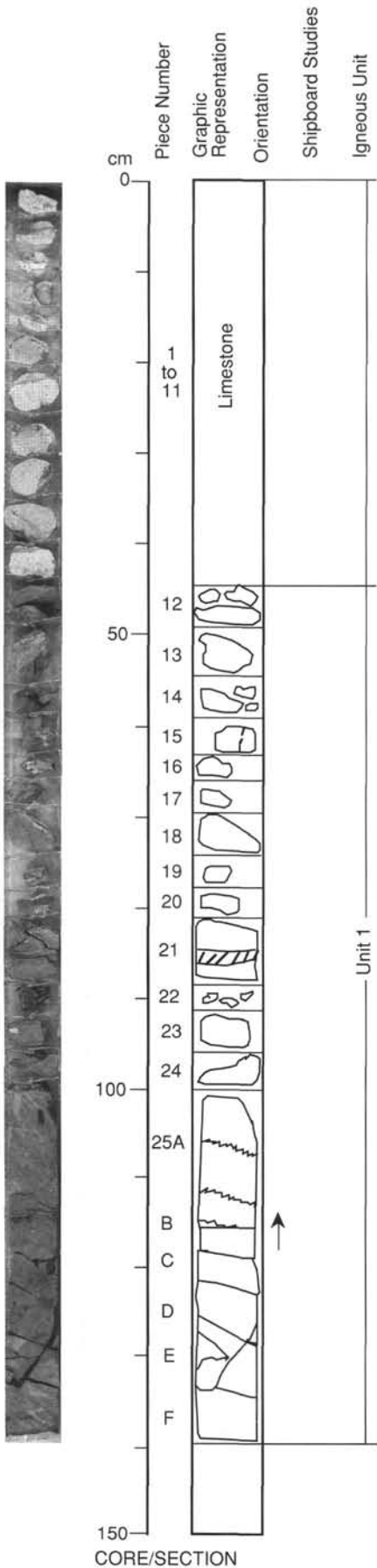
878C-1R CORED 0.0 - 6.0 mbsf

Meter	Graphic Lith.	Section	Age	Calc. nanno. plank. foram.	Larger foram.	Structure	Disturb.	Sample	Color
0.5		1	late Pliocene	CN 12a		●		10YR 8/2	15G 6/1 to 5YR 6/8 to 10YR 7/3
				C,G	B	B			

UNIT 1: CLINOPYROXENE-OLIVINE-PLAGIOCLASE BASALT

Pieces 12-25

CONTACTS: Continues into Section 78R-2.
PHENOCRYSTS: Visible in the interval 92-139 cm.
 Plagioclase - 1%; 1-3 mm; Euhedral, clear prisms which appear to be fresh.
 Olivine - 3%; 0.2-0.5 mm; Altered to dusky green (5G 3/2) clay.
 Clinopyroxene - 5%; 0.5 mm; Prisms altered to dusky green (5G 3/2) clay.
GROUNDMASS: Microcrystalline.
VESICLES: <5%; 3-10 mm; Round; Interval 92-139 cm; Filled with white (N9) to pale green (5G 7/2) clay.
COLOR: 43-55 cm, colors are grayish orange (10YR 7/4), pale yellowish brown (10YR 6/2), and yellowish gray (5Y 7/2). 55-92 cm, dusky yellow green (5GY 3/2) to greenish black (5GY 2/1) (see comments).
STRUCTURE: Massive.
ALTERATION: Interval 43-55 cm is pervasively altered as indicated by the small scale mix of colors in the interval. 55-92 cm, less altered (harder; colors closer to fresh basalt hues). 92-139 cm, relatively fresh.
VEINS/FRACTURES: 1%-5%; <0.5 mm; Irregular calcite veinlets. At 75 cm, there is a 7 mm wide vein of bright green (no appropriate Munsell color) clay. 43-55 cm, fractures are pervasive, without orientation, and are lined with brightly colored clays.
ADDITIONAL COMMENTS: Color (continued): 43-55 cm, there are <0.5 mm, anastomosing, subhorizontal, dusky red (5R 3/4) bands. 55-92 cm, there are brown or reddish brown (7.5YR 5/4 and 2.5YR 4/4) edges. 92-139 cm, dark gray (N4).



144-878A-78R-2

UNIT 1: CLINOPYROXENE-OLIVINE-PLAGIOCLASE BASALT (continued)

Pieces 1-3

CONTACTS: Continues from Section 78R-1.

PHENOCRYSTS:

Plagioclase - 1%; 1-3 mm; Euhedral, clear prisms which appear to be fresh.

Olivine - 3%; 0.2-0.5 mm; Altered to dusky green (5G 3/2) clay.

Clinopyroxene - 5%; 0.5 mm; Prisms altered to dusky green (5G 3/2) clay.

GROUNDMASS: Microcrystalline.

VESICLES: <5%; 3-10 mm; Round; Filled with white (N9) to pale green (5G 7/2) clay.



COLOR: Dark gray (N4).

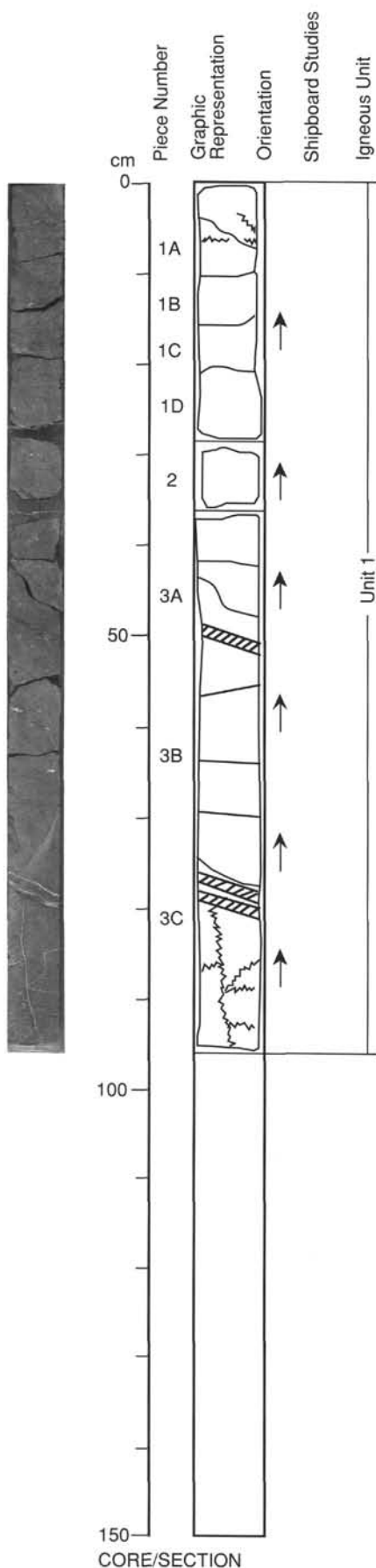
STRUCTURE: Massive.

ALTERATION: Clay and calcite additions in veins and vesicles. Presumably there has been some groundmass replacement by clays.

VEINS/FRACTURES: 1%-5%; <0.5 mm; Irregular calcite veinlets. 48-51 cm, there is a 3-5 mm wide, greenish gray (5G 6/1) clay-filled vein. 76-80 cm, there are complex, en echelon and branching calcite veins, 0.25-3 mm, associated with moderate green (5G 5/6) and dusky red (5R 3/4) clays.

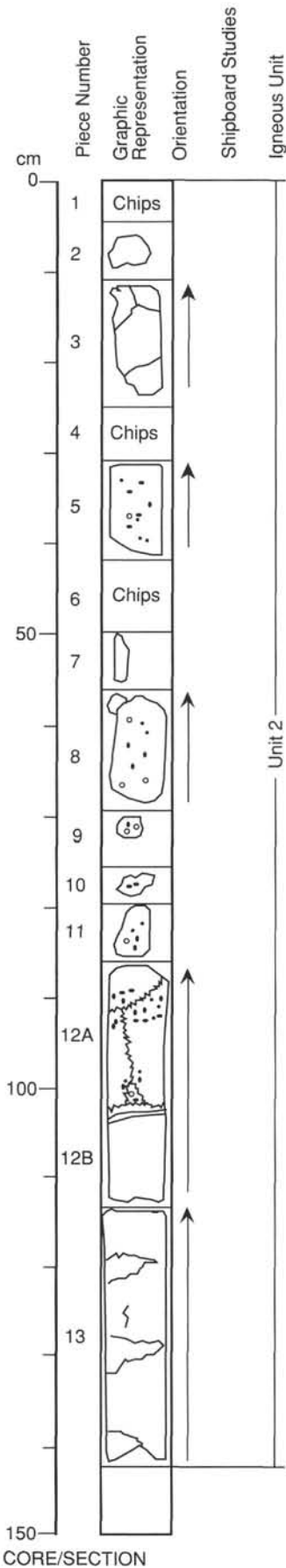
ADDITIONAL COMMENTS: None.

-  Calcite veins
-  Other veins



UNIT 2: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT

Pieces 1-13



CONTACTS: Continues into Section 79R-2.

PHENOCRYSTS: Not easily visible above 98 cm, because of alteration.

Plagioclase - <1%; 0.5-4 mm; Clear, unaltered prisms.

Olivine - 5%-15%; 0.2-1 mm; Euhedral to subhedral, iddingsitized in the oxidized alteration zones, and replaced by dusky green (5G 3/2) clay elsewhere.

Clinopyroxene - <5%; 0.5-1 mm; Prisms. Replaced by dusky green (5G 3/2) clay.

GROUNDMASS: Microcrystalline.

VESICLES: 31-98 cm, vesicles are irregular, 0.5-3 mm, vary in abundance from 10%-50%, commonly 40%, and are filled with white (N9) clay. 98-143 cm, vesicles are 0.2-2 mm, irregular, 5%-20%, and most are filled with white (N9) clay; the rest are filled with dusky green (5G 3/2) clay.

COLOR: 0-31 cm, dusky red (5R 3/4) to blackish red (5R 2/2). 31-98 cm, grades from dusky red (5R 3/4) to medium gray (N5) downhole. 98-143 cm, medium gray (N5) to light gray (N7).

STRUCTURE: None.

ALTERATION: 0-31 cm, is friable, indicating extensive clay development. Grades into less altered material downhole.

VEINS/FRACTURES: Irregular, randomly oriented fractures spaced every 5-10 cm.

ADDITIONAL COMMENTS: 98-143 cm, there are occasional moderate brown (5YR 4/4), iron-stained, 0.5-1 cm wide bands.

- ~ Calcite
- Vesicles

CORE/SECTION

144-878A-79R-2

UNIT 2: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-4

CONTACTS: Continues from Section 79R-1 and into Section 79R-3.

PHENOCRYSTS:

- Plagioclase - <1%; 0.5-4 mm; Clear, unaltered prisms.
- Olivine - 5%-15%; 0.2-1 mm; Euhedral to subhedral, iddingsitized in the oxidized alteration zones, and replaced by dusky green (5G 3/2) clay elsewhere.
- Clinopyroxene - <5%; 0.5-1 mm; Prisms. Replaced by dusky green (5G 3/2) clay.

GROUNDMASS: Microcrystalline.

VESICLES: Intervals 24-35 cm and 44-49 cm are regions of 40%-50% irregular vesicles (with calcite veining). Vesicles are 0.5-2 mm and filled with white (N9) clay.

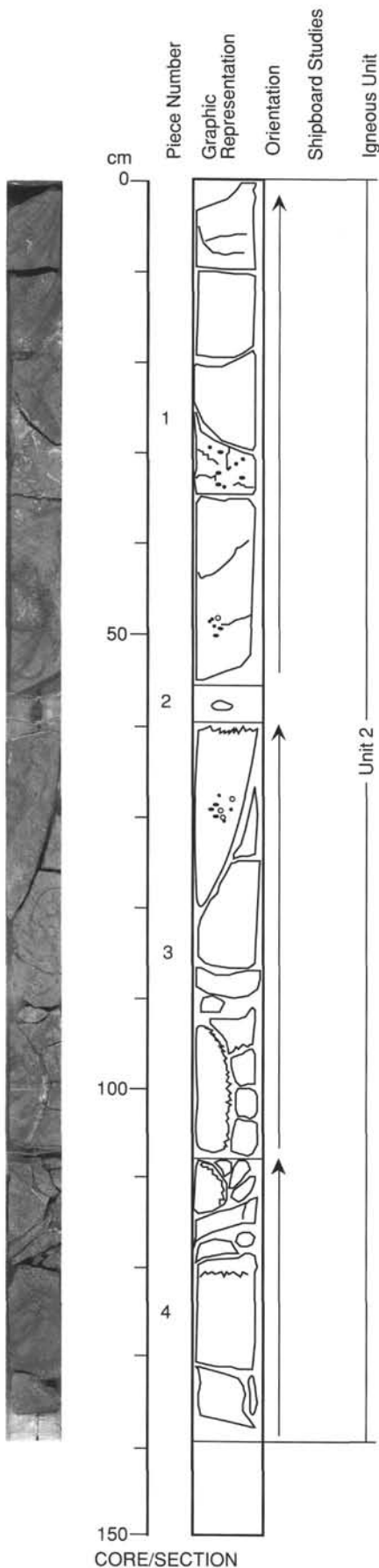
COLOR: Medium gray (N5) to light gray (N7).

STRUCTURE: None.

ALTERATION: 20%-25% of the section is 0.5-1 cm wide, moderate brown (5YR 4/4) iron-stained bands. Unit appears to have significant clay development.

VEINS/FRACTURES: <2 mm; Calcite-filled veins concentrated where there are abundances of vesicles. Irregular, randomly oriented fractures spaced every 5-10 cm.

ADDITIONAL COMMENTS: Iron-stained bands are parallel to, but commonly 1-2 cm away from, the subhorizontal fractures.



UNIT 2: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-4

CONTACTS: Continues from Section 79R-2 and into Section 79R-4.

PHENOCRYSTS:

- Plagioclase - <1%; 0.5-4 mm; Clear, unaltered prisms.
- Olivine - 5%-15%; 0.2-1 mm; Euhedral to subhedral, iddingsitized in the oxidized alteration zones, and replaced by dusky green (5G 3/2) clay elsewhere.
- Clinopyroxene - <5%; 0.5-1 mm; Prisms. Replaced by dusky green (5G 3/2) clay.

GROUNDMASS: Microcrystalline.

VESICLES: None.

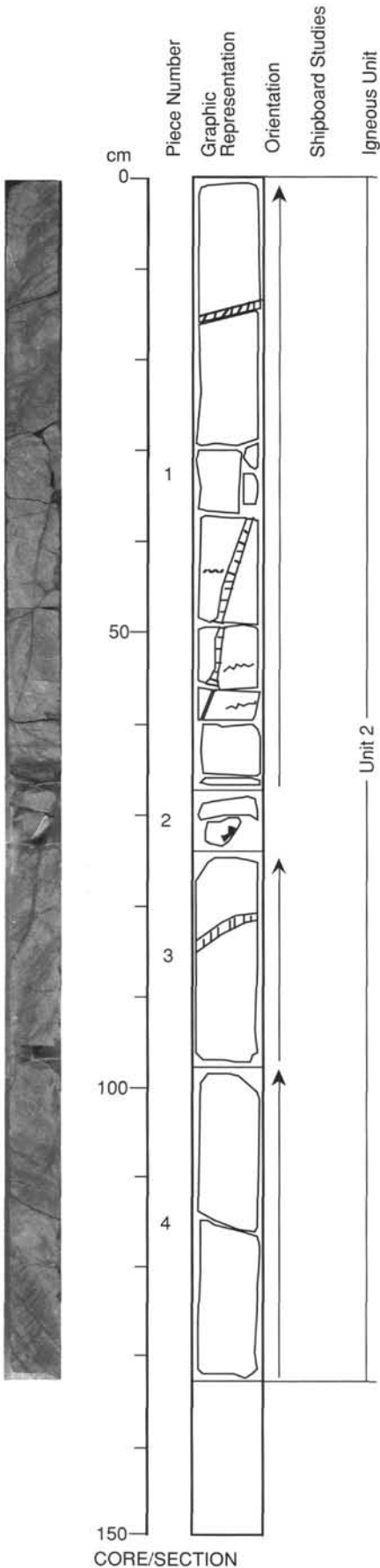
COLOR: Medium gray (N5) to light gray (N7).

STRUCTURE: None.

ALTERATION: 20%-25% of the section is 0.5-1 cm wide, moderate brown (5YR 4/4) iron-stained bands. Unit appears to have significant clay development.

VEINS/FRACTURES: <2 mm; Dark yellowish green (10GY 4/4) and dusky red (5R 3/4) clay-filled veins at 13 cm, 29 cm, 36-60 cm, 108-111 cm, and 124-130 cm.

ADDITIONAL COMMENTS: Iron-stained bands are parallel to, but commonly 1-2 cm away from, the subhorizontal fractures.



144-878A-79R-4

UNIT 2: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-3

CONTACTS: Continues from Section 79R-3.

PHENOCRYSTS:

- Plagioclase - <1%; 0.5-4 mm; Clear, unaltered prisms.
- Olivine - 5%-15%; 0.2-1 mm; Euhedral to subhedral, iddingsitized in the oxidized alteration zones, and replaced by dusky green (5G 3/2) clay elsewhere.
- Clinopyroxene - <5%; 0.5-1 mm; Prisms, replaced by dusky green (5G 3/2) clay.

GROUNDMASS: Microcrystalline.

VESICLES: None.

COLOR: Medium gray (N5) to light gray (N7).

STRUCTURE: None.

ALTERATION: 20%-25% of the section is 0.51 cm wide, moderate brown (5YR 4/4) iron-stained bands. Unit appears to have significant clay development.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Iron-stained bands are parallel to, but commonly 1-2 cm away from, the subhorizontal fractures.

UNIT 3: BASALT BRECCIA

Pieces 4-6

CONTACTS: Continues into Section 79R-5.

PHENOCRYSTS:

- Olivine - 10%; 1-2 mm; Subhedral iddingsite pseudomorphs after olivine are found in the larger clasts.
- Plagioclase - 1%-3%; <2 mm; Needles seen in Pieces 5 and 6. Appear to be altered to clay. Weak parallel alignment.

GROUNDMASS: Clasts are aphanitic, 0.5-6 cm, and subangular. The matrix is comprised of sand-sized volcanogenic grains and (authigenic?) clay.

VESICLES: 51-68 cm, irregular, 0.5-3 mm, 5%-15%, some are empty, the rest are lined with a white (N9) clay or zeolite. 68-90 cm, irregular, 1-4 mm, filled with white (N9) and light bluish gray (5B 7/1) clays or zeolites.

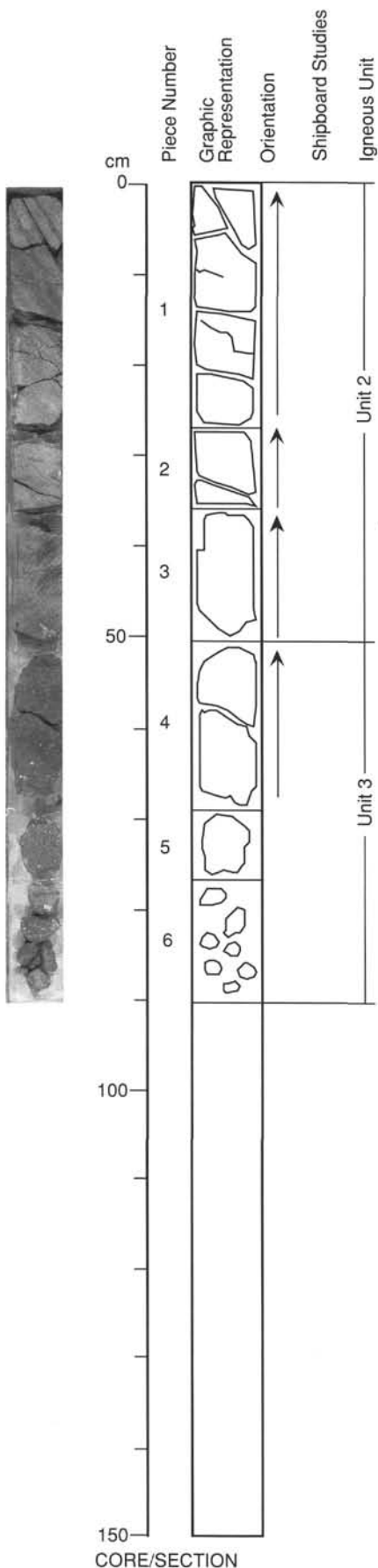
COLOR: Clasts: 51-68 cm, very dusky red (10R 2/2); 68-90 cm, medium bluish gray (5B 5/1).

STRUCTURE: Breccia.

ALTERATION: Oxidation in the upper portion. Unit is soft and has clearly undergone extensive clay development, especially in the matrix.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Pieces 5 and 6 seem to be isolated clasts of the breccia which were cleaned free of matrix by the drilling process.



CORE/SECTION

UNIT 3: BASALT BRECCIA (continued)

Pieces 1–4, upper part of 5

CONTACTS: Continues from Section 79R-4. Sharp contact, at 70 cm, with Unit 4.

PHENOCRYSTS:

Olivine - 3%–10%; 1–3 mm; Subhedral iddingsite pseudomorphs after olivine are found in the larger clasts.

GROUNDMASS: Clasts are aphanitic, 0.5–6 cm, and subangular. The matrix is comprised of sand-sized volcanogenic grains and (authigenic?) clay.

VESICLES: 0–40%; 0.5–4 mm; Irregular; Variable distribution clast-to-clast; Filled with white (N9) and light bluish gray (5B 7/1) clays or zeolites.

COLOR: Clasts: black (N1), dark gray (N3), very dark red (5R 2/6), and very dusky red (10R 2/2).

STRUCTURE: Breccia.

ALTERATION: Unit is soft and has clearly undergone extensive clay development, especially in the matrix. 48–70 cm, the material is claystone with relict texture.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

UNIT 4: LITHIC TUFF

Piece 5, lower portion

CONTACTS: Sharp contact, at 70 cm, with Unit 3. Continues into Section 79R-CC.

PHENOCRYSTS: Broken (and now altered) olivines and clinopyroxenes form some of the clasts and are in some of the lithic clasts.

GROUNDMASS: Clasts are 0.2–0.6 cm (granule-sized), subangular to subrounded, and made of basalt or olivine and clinopyroxene crystals. Matrix is made of clay.

VESICLES: None.

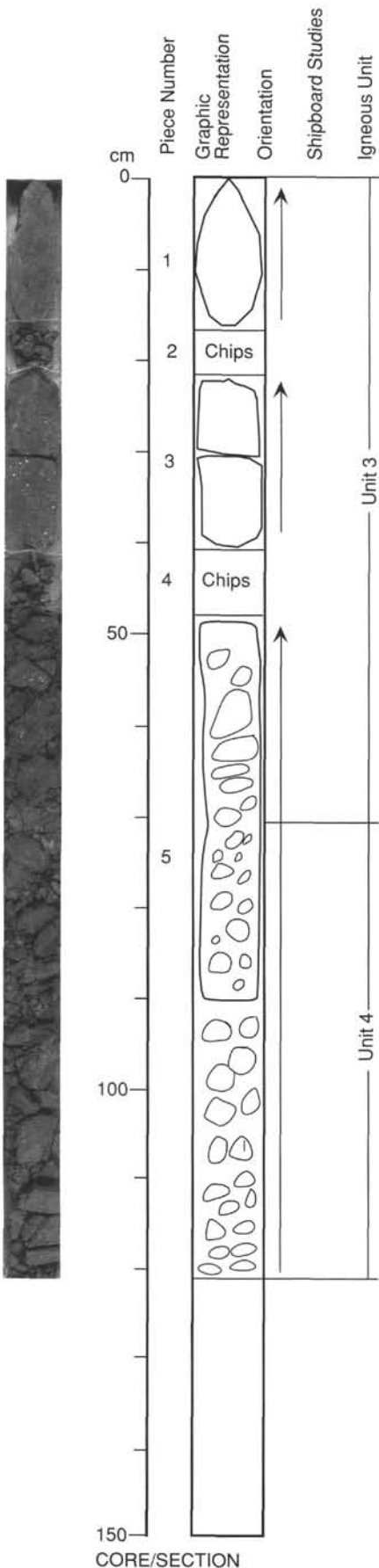
COLOR: Clasts: grayish orange (10YR 7/4), moderate yellowish brown (10YR 5/4), and pale red (10R 6/2). Matrix is dark reddish brown (10R 3/4).

STRUCTURE: Tuff with a few large, 2–3 cm, clasts of dense, dark reddish brown (10R 3/4) clay. Appears to be a tuffaceous "matrix" around some clasts of unknown origin.

ALTERATION: Crystals, lithic clasts, and matrix are all oxidized and very soft, implying extensive clay development.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

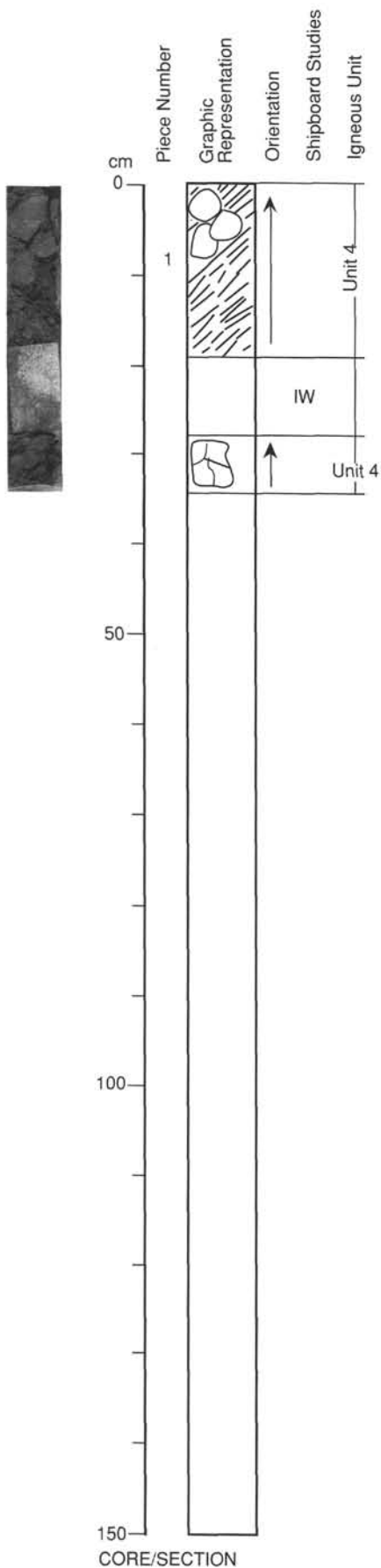


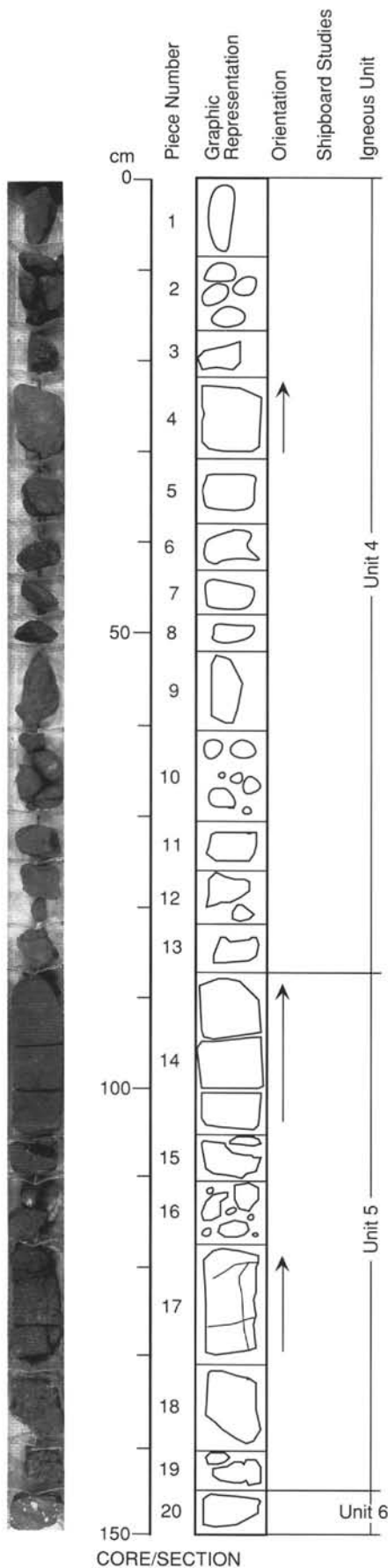
144-878A-79R-CC

UNIT 4: LITHIC TUFF (continued)

Piece 1

- CONTACTS:** Continues from Section 79R-5 and into Section 80R-1.
- PHENOCRYSTS:** Broken (and now altered) olivines and clinopyroxenes form some of the clasts and are in some of the lithic clasts.
- GROUNDMASS:** Clasts are 0.2–0.6 cm (granule-sized), subangular to subrounded, and made of basalt or olivine and clinopyroxene crystals. Matrix is made of clay.
- VESICLES:** None.
- COLOR:** Clasts: grayish orange (10YR 7/4), moderate yellowish brown (10YR 5/4), and pale red (10R 6/2). Matrix is dark reddish brown (10R 3/4).
- STRUCTURE:** Tuff with a few large, 2–3 cm, clasts of dense, dark reddish brown (10R 3/4) clay. Appears to be a tuffaceous "matrix" around some clasts of unknown origin.
- ALTERATION:** Crystals, lithic clasts, and matrix are all oxidized and very soft, implying extensive clay development.
- VEINS/FRACTURES:** None.
- ADDITIONAL COMMENTS:** None.





UNIT 4: LITHIC TUFF (continued)

Pieces 1–13

CONTACTS: Continues from Section 79R-5 and Section 79R-CC.
PHENOCRYSTS: Broken (and now altered) olivines and clinopyroxenes form some of the clasts and are in some of the lithic clasts.
GROUNDMASS: Clasts are 0.2–0.6 cm (granule-sized), subangular to subrounded, and made of basalt or olivine and clinopyroxene crystals. Matrix is made of clay.
VESICLES: None.
COLOR: Clasts: grayish orange (10YR 7/4), moderate yellowish brown (10YR 5/4), and pale red (10R 6/2). Matrix is dark reddish brown (10R 3/4).
STRUCTURE: Tuff with a few large, 2–3 cm, clasts of dense, dark reddish brown (10R 3/4) clay. Appears to be a tuffaceous "matrix" around some clasts of unknown origin.
ALTERATION: Crystals, lithic clasts, and matrix are all oxidized and very soft, implying extensive clay development.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Piece 8 is very dusky red (10R 2/2) and may be part of a single large clay clast from within the lithic tuff conglomerate.

UNIT 5: VOLCANOGENIC SANDSTONE

Pieces 14–19

CONTACTS: None.
PHENOCRYSTS: None.
GROUNDMASS: Visible grains are concentrated in horizontal bands. Grain size increases downhole, from 0.5–1 mm grains to 1–4 mm granules which are clearly very altered, angular to subrounded, lithic clasts. The matrix is abundant, clay-rich, and hard to identify. It is likely that much of the matrix has been authigenically created by weathering of lithic grains.
VESICLES: None.
COLOR: Visible grains occur in a wide range of light colors; Matrix is very dusky red (10R 2/2).
STRUCTURE: Laminated sandstone.
ALTERATION: Oxidized and probable that many lithic grains have altered into clay matrix. Soft and friable.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Probably formed during subaerial weathering.

UNIT 6: OLIVINE BASALT

Piece 20

CONTACTS: Continues into Section 80R-2.
PHENOCRYSTS: Olivine - 15%; 0.5–4 mm; Pseudomorphed by mixes of dusky green (5G 3/2), reddish yellow (7.5YR 7/8), and white (N9) clays.
GROUNDMASS: Aphanitic.
VESICLES: 20%; 1–10 mm; Round; Filled with calcite, white (N9) clay and dusky blue green (5BG 3/2) clay.
COLOR: Medium gray (N5).
STRUCTURE: None.
ALTERATION: Minerals are pseudomorphed, vesicles are filled, and the texture of the matrix suggests significant clay development.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: None.

144-878A-80R-2

UNIT 6: OLIVINE BASALT (continued)

Piece 1

CONTACTS: Continues from Section 80R-1.

PHENOCRYSTS:

Olivine - 15%; 0.5–4 mm; Pseudomorphed by mixes of dusky green (5G 3/2), reddish yellow (7.5YR 7/8), and white (N9) clays.

GROUNDMASS: Aphanitic.

VESICLES: 20%; 1–10 mm; Round; Filled with calcite, white (N9) clay and dusky blue green (5BG 3/2) clay.

COLOR: Medium gray (N5).

STRUCTURE: None.

ALTERATION: Minerals are pseudomorphed, vesicles are filled, and the texture of the matrix suggests significant clay development.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

UNIT 7: BASALT BRECCIA

Pieces 2–13

CONTACTS: None.

PHENOCRYSTS: Only in the larger clasts.

Olivine - 15%; 1–2 mm; Euhedral to subhedral, iddingsitized.

GROUNDMASS: Clasts are aphanitic.

VESICLES: 5%–40%; 0.5–3 mm; Round; Variable distribution clast-to-clast; Some are empty, some are lined with pale blue (5PB 7/2) clay, some are filled with very dusky red (10R 2/2) clay.

COLOR: Clasts: 7–42 cm, brownish black (5YR 2/1); 42–74 cm, medium bluish gray (5B 5/1).

STRUCTURE: Unit has been broken by drilling. Only a few pieces have matrix present, so clast sizes must have been >6 cm on average. Matrix, where present, is very altered. The clasts fit together well, with little matrix in between them.

ALTERATION: Some clay development in both clasts and matrix.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Piece 12 has calcite-filled vesicles.

UNIT 8: OLIVINE BASALT

Pieces 14–22

CONTACTS: Continues into Section 80R-3.

PHENOCRYSTS: Smaller, subhedral, and not so abundant in the flow-top breccia (74–90 cm).

Olivine - 10%; 0.5–2 mm; Euhedral. Altered to iddingsite with lesser pale blue green (5BG 7/2) clay.

GROUNDMASS: 74–90 cm, poorly-sorted, subrounded, 0.1–3 cm clasts in a presumably clay-rich volcanogenic matrix. 90–150 cm, microcrystalline.

VESICLES: 5%; 0.55 mm; Irregular; 90–150 cm, rarely up to 1 cm in diameter, filled with white (N9) and/or pale blue green (5BG 7/2) clay.

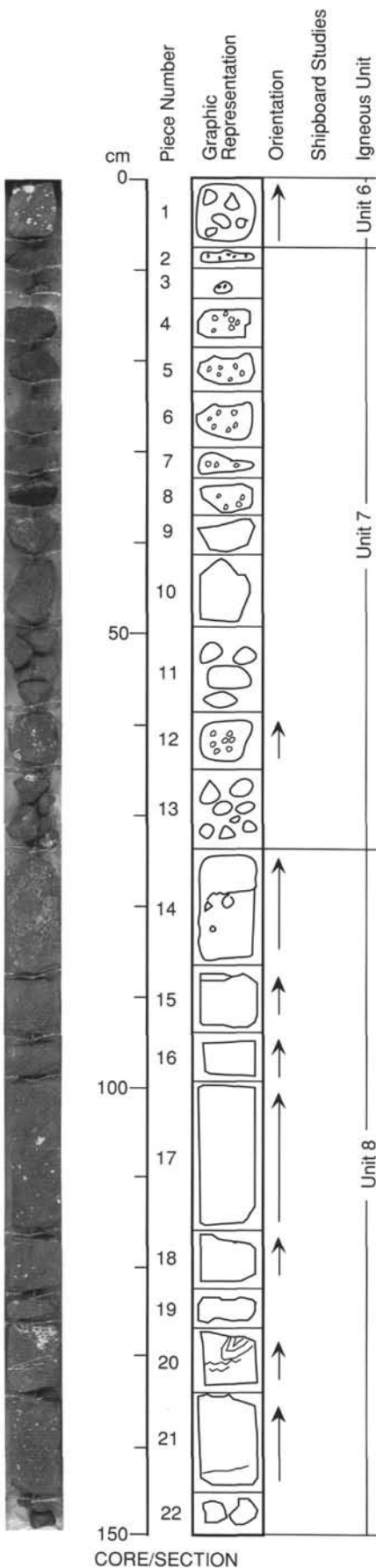
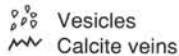
COLOR: 74–90 cm, clasts are blackish red (5R 2/2); Matrix is light olivine gray (5Y 6/1). 90–150 cm, dark gray (N3).

STRUCTURE: 74–90 cm, flow top breccia; 90–150 cm, massive.

ALTERATION: Minerals pseudomorphed, vesicle and vein fillings, and probable moderate clay development in the groundmass.

VEINS/FRACTURES: <1%; <1 mm; Subhorizontal; Filled with calcite. 126–128 cm, there is a dense network of 1–3 mm calcite veins replacing groundmass.

ADDITIONAL COMMENTS: Clear gradational contact from the flow-top breccia into the massive flow at 90 cm.



CORE/SECTION

UNIT 8: OLIVINE BASALT (continued)

Pieces 1-14

CONTACTS: Continues from Section 80R-2 and into Section 80R-4.

PHENOCRYSTS:

Olivine - 10%; 0.5-2 mm; Euhedral. Altered to iddingsite with lesser pale blue green (5BG 7/2) clay.

GROUNDMASS: Microcrystalline.

VESICLES: 5%; 0.5-5 mm; Irregular; Filled with white (N9) and/or dusky blue green (5BG 3/2) clay. 73-140 cm, 10% very large (1-15 mm), subround vesicles mostly filled with the dusky blue green (5BG 3/2) clay.

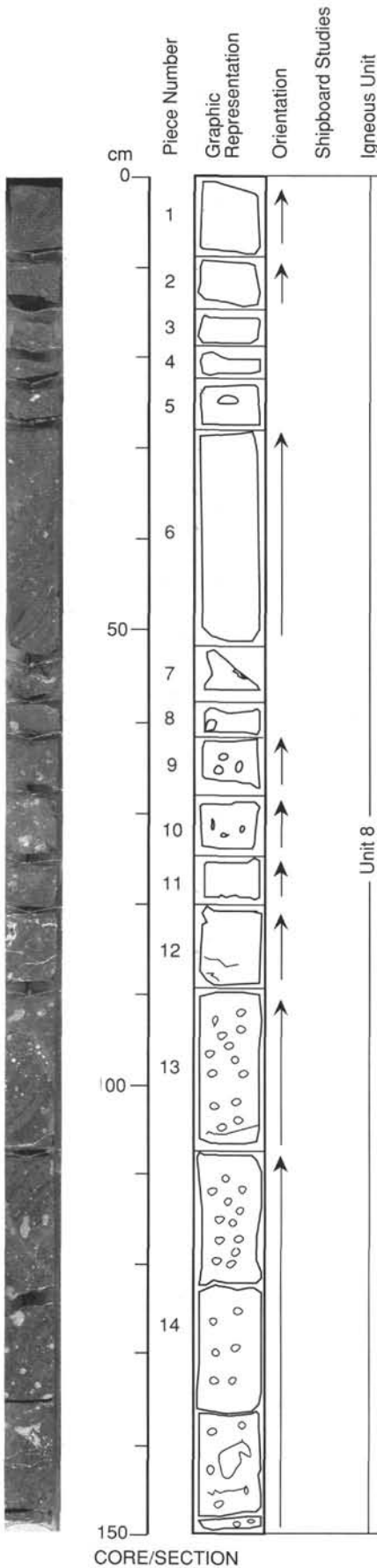
COLOR: Dark gray (N3).

STRUCTURE: Massive.

ALTERATION: Minerals pseudomorphed, vesicle and vein fillings, and probable moderate clay development in the groundmass.

VEINS/FRACTURES: <1%; 1-3 mm; Subhorizontal; Filled with calcite and dusky blue green (5BG 3/2) clay.

ADDITIONAL COMMENTS: 53-83 cm, there is a network of fine, <2 mm, fractures filled with the dusky blue green (5BG 3/2) clay which appear in most cases to initiate from a vesicle.



144-878A-80R-4

UNIT 8: OLIVINE BASALT (continued)

Pieces 1-4

CONTACTS: Continues from Section 80R-3 and into Section 80R-5.

PHENOCRYSTS:

Olivine - 15%–20%; 0.5–2 mm; Euhedral crystal structures are well preserved. Altered to translucent moderate olive brown (5Y 4/4) with iddingsite rims.

GROUNDMASS: Microcrystalline.

VESICLES: <1%–5%; 0.5–5 mm; Irregular; Filled with pale green (10G 6/2) clay and calcite.

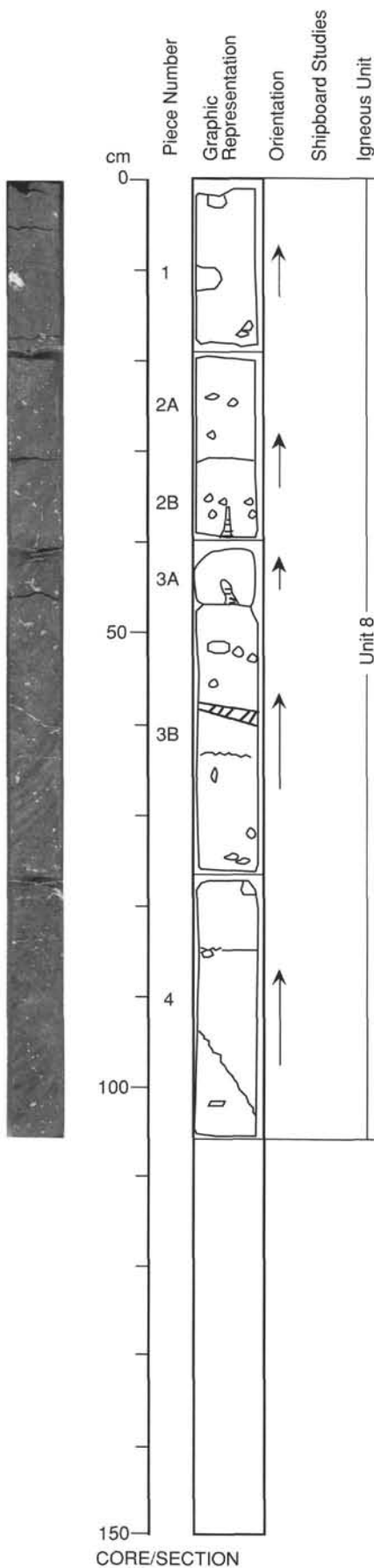
COLOR: Dark gray (N3).

STRUCTURE: Massive.

ALTERATION: Minerals pseudomorphed, vesicle and vein fillings, and probable moderate clay development in the groundmass.

VEINS/FRACTURES: <1%; 0.5–2 mm; Subhorizontal; Filled with calcite and pale green (10G 6/2) clay. Fractures are few and subhorizontal.

ADDITIONAL COMMENTS: None.



UNIT 8: OLIVINE BASALT (continued)

Pieces 1-4

CONTACTS: Continues from Section 80R-4 and into Section 80R-6.

PHENOCRYSTS:

Olivine - 20%; 0.5-3 mm; Euhedral crystal structures are well preserved. Altered to translucent moderate olive brown (5Y 4/4) with iddingsite rims. Larger crystals are commonly embayed. There are occasional glomerocrysts.

GROUNDMASS: Microcrystalline.

VESICLES: <1%-5%; 0.5-5 mm; Irregular; Filled with pale green (10G 6/2) clay and calcite.

COLOR: Dark gray (N3).

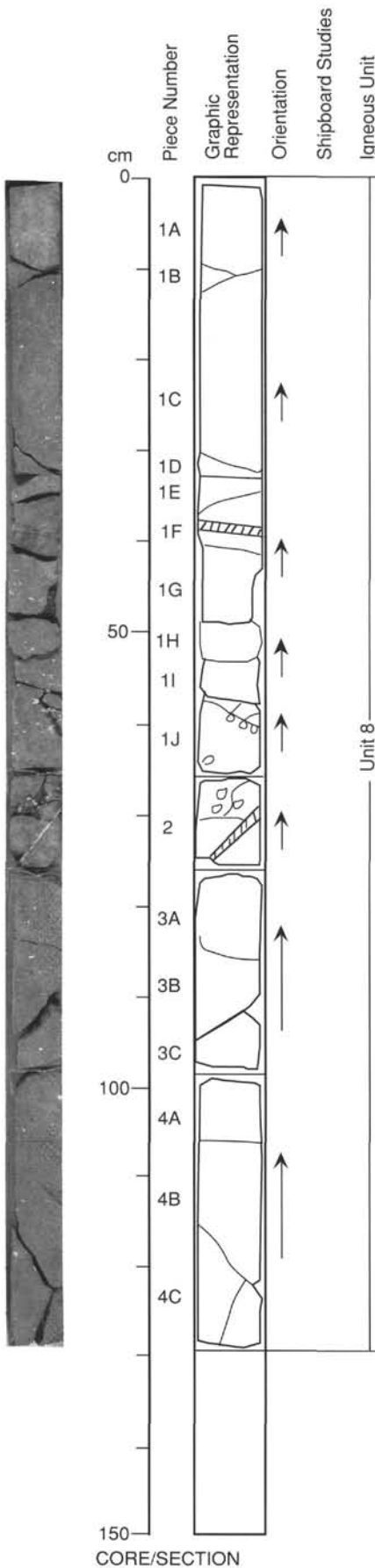
STRUCTURE: Massive.

ALTERATION: Minerals pseudomorphed, vesicle and vein fillings, and probable moderate clay development in the groundmass.

VEINS/FRACTURES: <1%; 0.5-2 mm; Subhorizontal; Filled with calcite and pale green (10G 6/2) clay. Fractures are few and subhorizontal.

ADDITIONAL COMMENTS: None.

-  Clay filled vein
-  Large vesicles



144-878A-80R-6

UNIT 8: OLIVINE BASALT (continued)

Pieces 1-4

CONTACTS: Continues from Section 80R-5.

PHENOCRYSTS:

Olivine - 20%; 0.5-3 mm; Euhedral crystal structures are well preserved. Altered to translucent moderate olive brown (5Y 4/4) with iddingsite rims. Larger crystals are commonly embayed. There are occasional glomerocrysts.

Plagioclase - <1%; 0.2-0.5 mm; Stubby prisms. Clear and unaltered, to partially replaced by white (N9) clay.

GROUNDMASS: Microcrystalline.

VESICLES: <1%-5%; 0.5-5 mm; Irregular; Filled with pale green (10G 6/2) clay and calcite.

COLOR: Dark gray (N3).

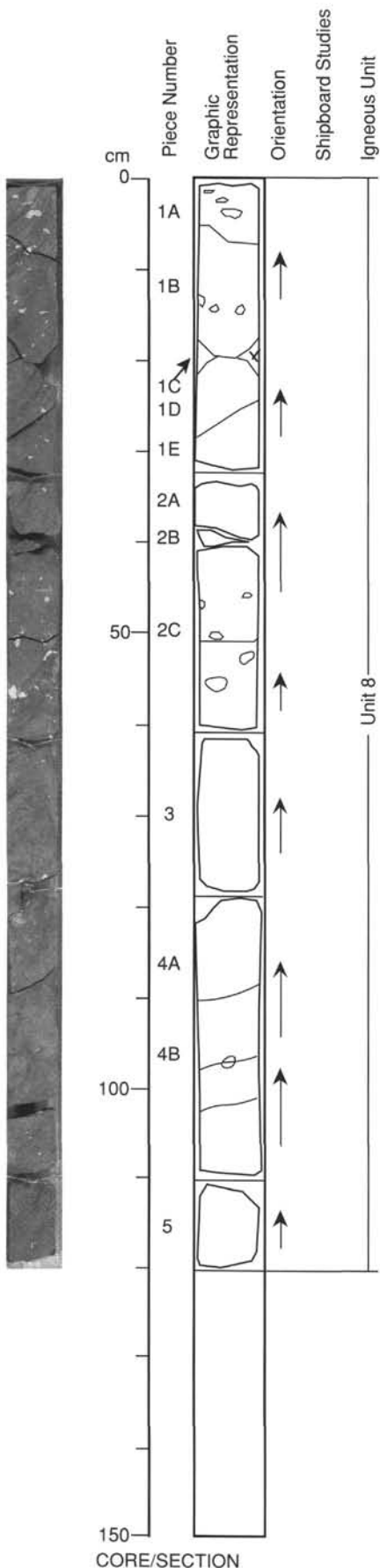
STRUCTURE: Massive.

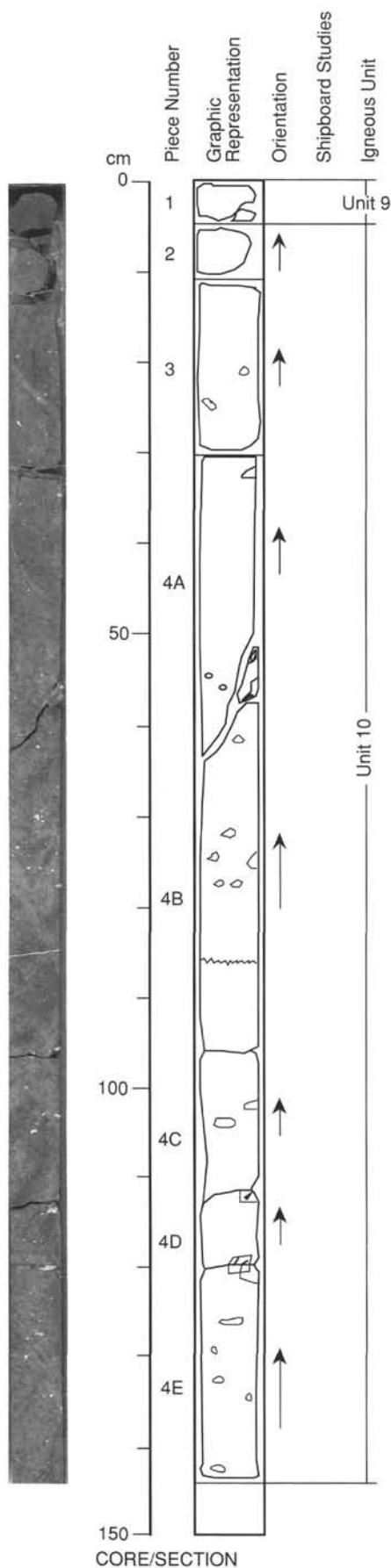
ALTERATION: Minerals pseudomorphed, vesicle and vein fillings, and probable moderate clay development in the groundmass.

VEINS/FRACTURES: <1%; 0.5-2 mm; Subhorizontal; Filled with calcite and pale green (10G 6/2) clay. Fractures are few and subhorizontal.

ADDITIONAL COMMENTS: Best samples for geochemical studies are Pieces 3 and 4.

◇ Large vesicles





UNIT 9: VITRIC TUFF

Piece 1

CONTACTS: None.
PHENOCRYSTS: None visible in the altered clasts.
GROUNDMASS: Elongate, 3 mm X 5 mm, vesicular clasts in a finer, no longer identifiable, matrix.
VESICLES: Tiny ones present in the clasts.
COLOR: Mottled grayish orange (10YR 7/4) and dusky red (5R 3/4).
STRUCTURE: Clast-supported vitric tuff.
ALTERATION: Very soft; largely weathered to claystone which retains relict texture.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Possibly downhole rubble from Unit 4, but details of texture are different and the sample is much more friable.

UNIT 10: OLIVINE BASALT

Pieces 2-4

CONTACTS: Continues into Section 81R-2.
PHENOCRYSTS:
 Olivine - 15%; 0.5-2 mm; Euhedral. Altered to translucent grayish olive (10Y 4/2) clay with iddingsite rims.
GROUNDMASS: Microcrystalline.
VESICLES: <1%; 1-5 mm; Round to irregular; Filled with calcite and minor grayish green (5G 5/2) clay.
COLOR: Dark gray (N3). Mottled in the interval 80-120 cm, where finely dispersed iron staining is visible with a microscope.
STRUCTURE: Massive.
ALTERATION: Olivines are pseudomorphed, vesicles are filled, and the texture of the groundmass suggests moderate clay replacement.
VEINS/FRACTURES: At 84-85 cm, there is a 2 mm wide, calcite-filled vein.
ADDITIONAL COMMENTS: Identical to Unit 8. Assuming that Piece 1 (Unit 9) fell down the hole, it is likely that Unit 8 and 10 are the same flow.

- Large vesicles
- ~~~~~ Calcite veins

144-878A-81R-2

UNIT 10: OLIVINE BASALT (continued)

Pieces 1-2

CONTACTS: Continues from Section 81R-1 and into Section 81R-3.

PHENOCRYSTS:

Olivine - 15%; 0.5-2 mm; Euhedral. Altered to translucent grayish olive (10Y 4/2) clay with iddingsite rims.

GROUNDMASS: Microcrystalline.

VESICLES: <1%; 0.5-5 mm; Irregular; Filled with calcite.

COLOR: 0-90 cm, matrix is mottled medium dark gray (N4) and very dusky red (10R 2/2), reflecting finely dispersed iron-staining.

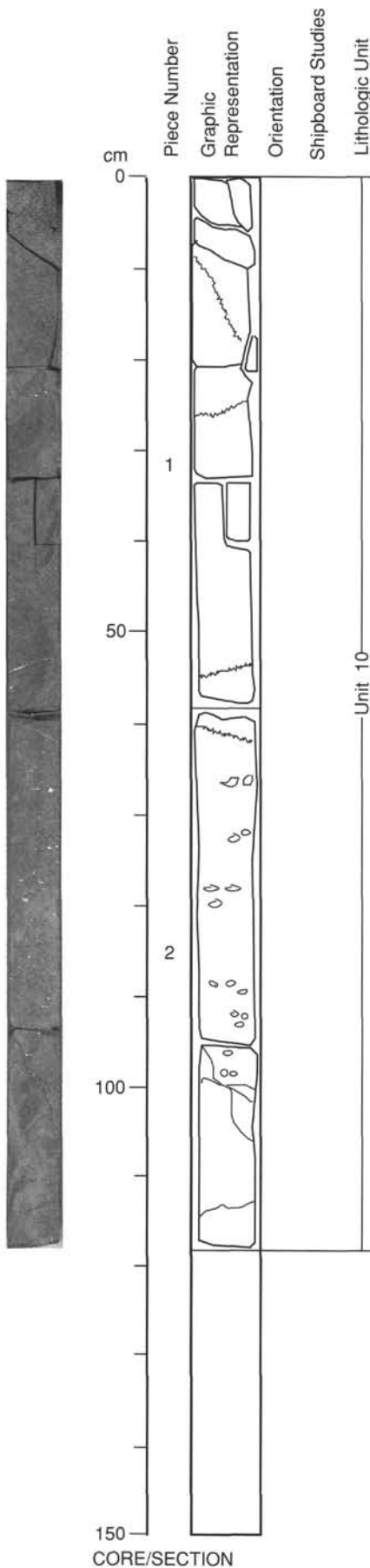
STRUCTURE: Massive.

ALTERATION: Olivines are pseudomorphed, vesicles are filled, and the texture of the groundmass suggests moderate clay replacement.

VEINS/FRACTURES: <1%; 0.5-1 mm; Filled with calcite.

ADDITIONAL COMMENTS: Identical to Unit 8. Assuming that Piece 1 (Unit 9) fell down the hole, it is likely that Unit 8 and 10 are the same flow.

- ~ Calcite veins
- o Large vesicles



UNIT 10: OLIVINE BASALT (continued)

Pieces 1, most of 2

CONTACTS: Continues from Section 81R-2. Sharp contact with Unit 11 at 103 cm.

PHENOCRYSTS:

Olivine - 15%-20%; 0.5-2 mm; Euhedral. Altered to translucent grayish olive (10Y 4/2) clay with iddingsite rims. This grades to progressively more iddingsite until 74 cm, after which there is complete replacement by iddingsite.

GROUNDMASS: Microcrystalline.

VESICLES: <1%; 0.5-5 mm; Irregular; Filled with calcite.

COLOR: 0-74 cm, medium dark gray (N4); 74-103 cm, light brownish gray (10YR 6/2).

STRUCTURE: Massive.

ALTERATION: Olivines are pseudomorphed, vesicles are filled, and the texture of the groundmass suggests moderate clay replacement. Color indicates that 74-103 cm is more altered than the rest of the Unit.

VEINS/FRACTURES: <1%; 0.5-1 mm; Filled with calcite.

ADDITIONAL COMMENTS: Identical to Unit 8. Assuming that Piece 1 (Unit 9) fell down the hole, it is likely that Unit 8 and 10 are the same flow.

UNIT 11: OLIVINE BASALT

Pieces Bottom of 2, 3-10

CONTACTS: Sharp contact with Unit 10 at 103 cm. Continues into Section 81R-4.

PHENOCRYSTS: Not present in the flow-top breccia (103-114 cm).

Olivine - 20%; 0.5-2 mm; Euhedral. Completely altered to dark reddish brown (2.5YR 3/4) clay.

GROUNDMASS: 103-114 cm, subrounded basalt clasts, 1-15 mm, aphyric. 114-149 cm, microcrystalline.

VESICLES: 40%; 1-15 mm; Irregular; Interconnected; Partially to completely filled by white (N9) clay.

COLOR: Clasts are blackish red (5R 2/2), dusky red (5R 3/4) and grayish red (10R 4/2). Massive basalt is mottled very dusky red (10R 2/2) and grayish red (10R 4/2).

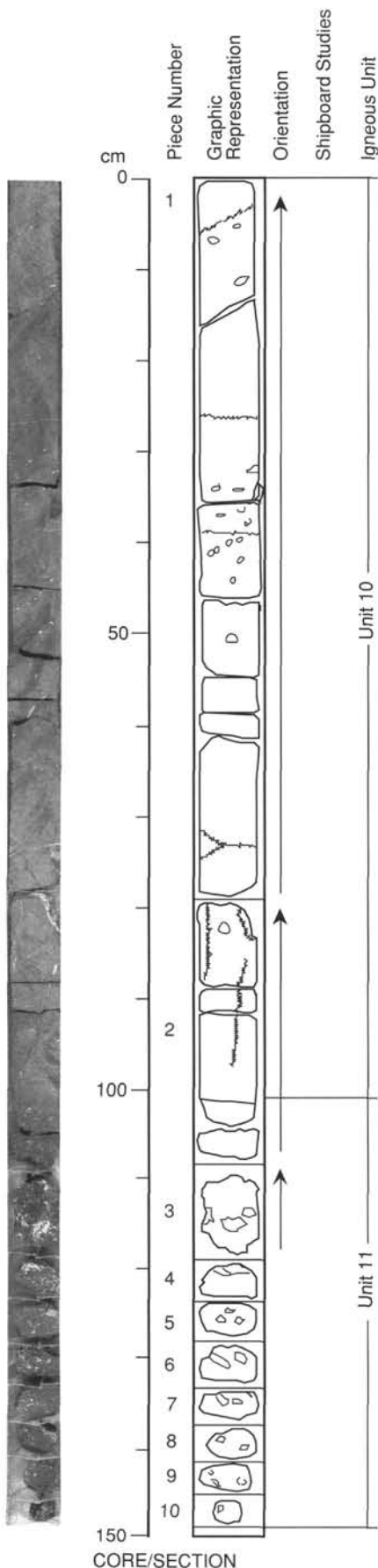
STRUCTURE: 103-114 cm, flow-top breccia; 114-149 cm, massive.

ALTERATION: Olivines are pseudomorphed, vesicles are partially filled, and the texture of the groundmass suggests moderate clay replacement.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

- Calcite veins
- Large vesicles
- ◊ Irregular vesicles



144-878A-81R-4

UNIT 11: OLIVINE BASALT (continued)

Pieces 1-12

CONTACTS: Continues from Section 81R-3 and into Section 81R-5.

PHENOCRYSTS:

Olivine - 15%; 0.5-3 mm; Euhedral. 0-15 cm, completely altered to dark reddish brown (2.5YR 3/4) clay. 15-137 cm, altered to translucent, light to moderate olive brown (5Y 5/6-4/4) clay with iddingsite rims.
Clinopyroxene - <<1%; 1-2 mm; Below 15 cm there are equant, subhedral grains.

GROUNDMASS: Microcrystalline.

VESICLES: 0-15 cm, 40%, 1-15 mm in diameter, interconnected, partially to completely filled by white (N9) clay. 15-50 cm, 10%, 2-20 mm in diameter, rounded to irregular shapes, sometimes horizontally elongate, filled with calcite and lesser amounts of grayish green (5G 5/2) clay. Below 50 cm, the vesicles become sparse (1%-2%).




COLOR: 0-15 cm, mottled very dusky red (10R 2/2) and grayish red (10R 4/2). 15-137 cm, weak red (2.5YR 5/2).

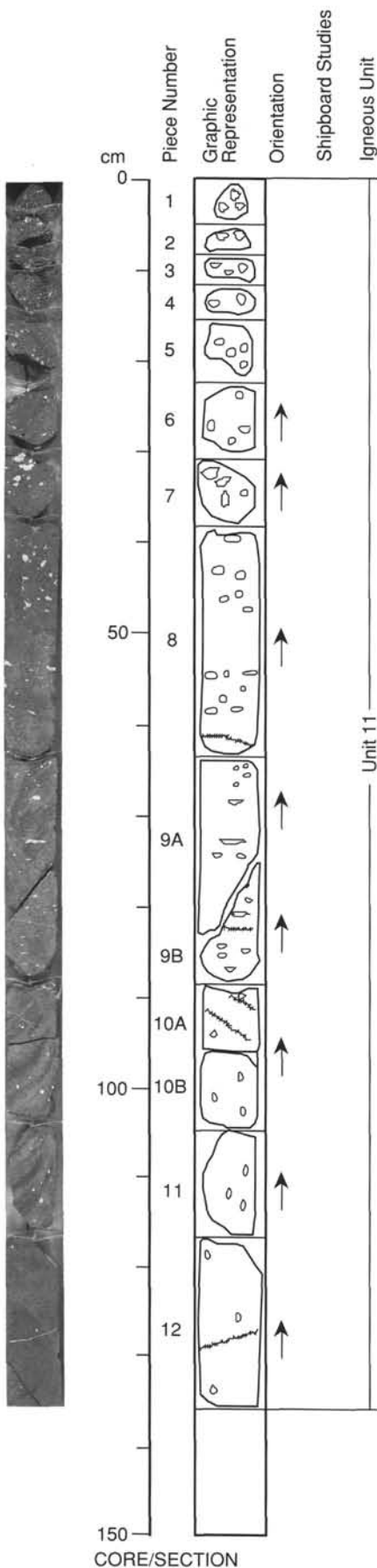
STRUCTURE: Massive.

ALTERATION: Olivines are pseudomorphed, vesicles are filled, and the texture of the groundmass suggests moderate clay replacement.

VEINS/FRACTURES: <1%; <1 mm; Filled with calcite and lesser amounts of grayish green (5G 5/2) clay.

ADDITIONAL COMMENTS: None.

-  Calcite veins
-  Large vesicles
-  Irregular vesicles



CORE/SECTION

UNIT 11: OLIVINE BASALT (continued)

Pieces 1-11

CONTACTS: Continues from Section 81R-4.

PHENOCRYSTS:

Olivine - 15%; 0.5-3 mm; Euhedral. Predominately replaced by iddingsite.
 Clinopyroxene - <<1%; 1-2 mm; Below 15 cm there are equant, subhedral grains.

GROUNDMASS: Microcrystalline.

VESICLES: 0-100 cm, <<1%, 1-10 mm in diameter, irregular, filled with calcite and grayish green (5G 5/2) clay. 100-133 cm, increase downhole from 1%-30% and from <1 mm to 3-5 mm, irregular, filled with calcite and grayish green (5G 5/2) clay. 135-149 cm, 20%, 2-15 mm, round, calcite-filled.

COLOR: 0-100 cm, medium gray (N4); 100-149 cm, weak red (2.5YR 5/2).

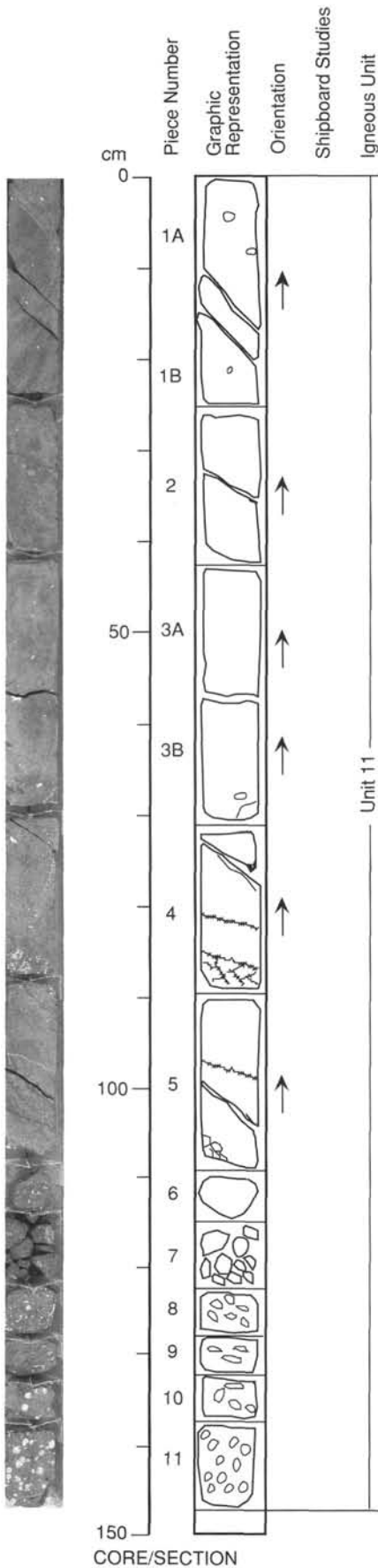
STRUCTURE: Massive.

ALTERATION: Olivines are pseudomorphed, vesicles are filled, and the texture of the groundmass suggests moderate clay replacement.

VEINS/FRACTURES: 87-90 cm, meshwork of fine veins and irregular patches of grayish green (5G 5/2) clay and minor calcite replacing 40% of the basalt. 109-110 cm, edge of similar area where most of the material was not recovered.

ADDITIONAL COMMENTS: None.

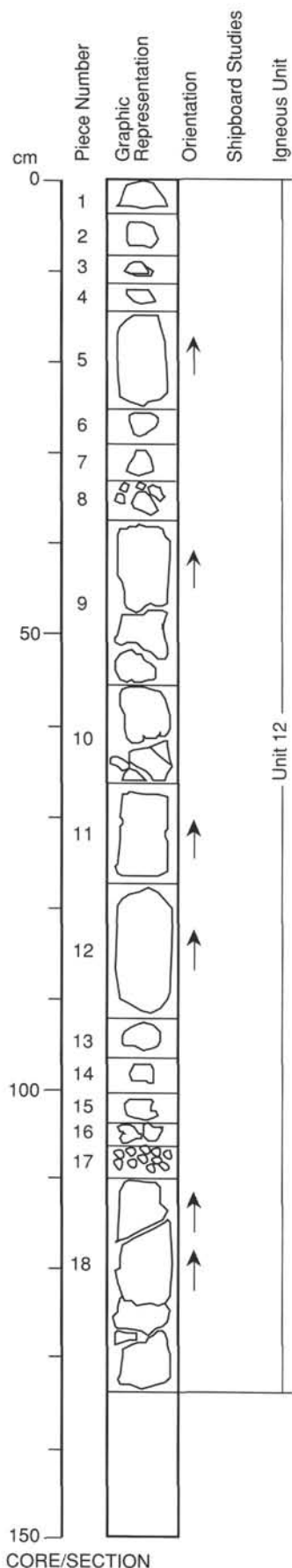
- ↔ Calcite veins
- Vesicles
- ⚡ Irregular patchy veining



144-878A-82R-1

UNIT 12: BASALT BRECCIA

Pieces 1-18



CONTACTS: Continues into Section 82R-2.

PHENOCRYSTS: Phenocrysts in the clasts.

Olivine - <3%; 0.5-2 mm; Euhedral, pseudomorphed by iddingsite.

GROUNDMASS: Clasts are subround, 5 mm to >5 cm, and aphanitic. Matrix is comprised of <1-5 mm, subangular to subround, vesicular basalt grains.

VESICLES: 20%-40%; <1-3 mm; Irregular; Variable abundances clast-to-clast; Interconnected and filled with white (N9) clay and calcite.

COLOR: Clasts are dark reddish gray (10R 4/1) to dusky red (10R 3/4).

STRUCTURE: Breccia.

ALTERATION: Clasts are oxidized and highly altered; olivines are pseudomorphed, and the matrix has interstitial white (N9) clay or zeolite and calcite.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

UNIT 12: BASALT BRECCIA (continued)

Pieces 1–8

CONTACTS: Continues from Section 82R-1.

PHENOCRYSTS: Phenocrysts in the clasts.

Olivine - <3%; 0.5–2 mm; Euhedral, pseudomorphed by iddingsite.

GROUNDMASS: Clasts are subround, 5 mm to >5 cm, and aphanitic. Matrix is comprised of <1–5 mm, subangular to subround, vesicular basalt grains.

VESICLES: 20%–40%; <1–3 mm; Irregular; Variable abundances clast-to-clast; Interconnected and filled with white (N9) clay and calcite. 0–55 cm, the vesicularity of the large clasts is about 50%.

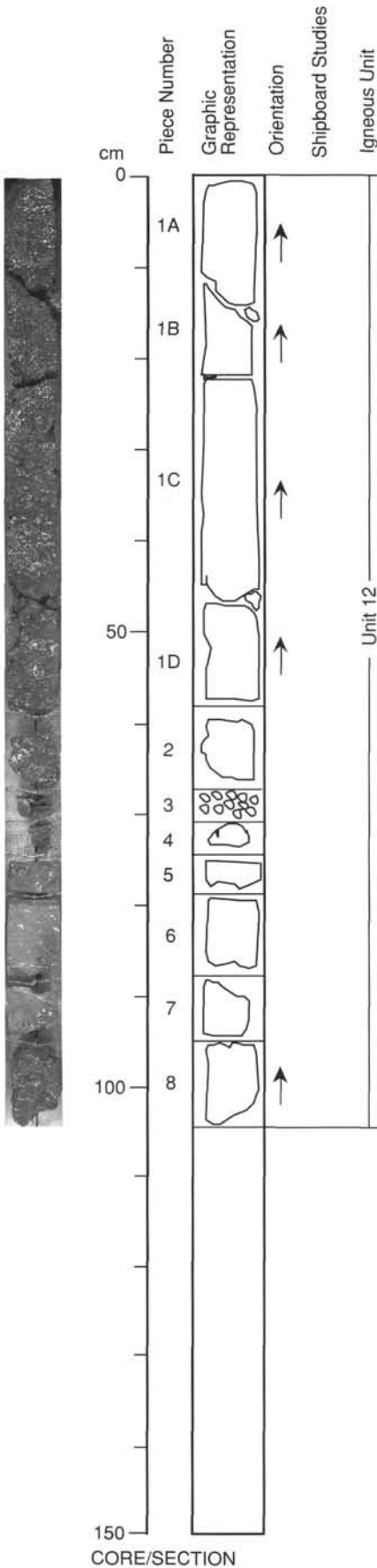
COLOR: Clasts are dark reddish gray (10R 4/1) to dusky red (10R 3/4).

STRUCTURE: Breccia.

ALTERATION: Clasts are oxidized and highly altered; olivines are pseudomorphed, and the matrix has interstitial white (N9) clay or zeolite and calcite.

VEINS/FRACTURES: None.

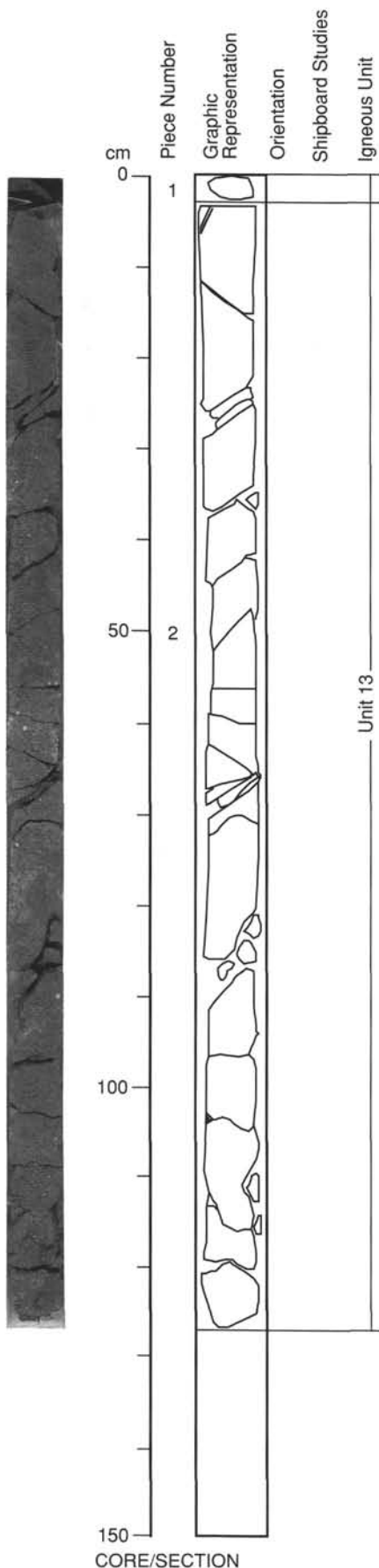
ADDITIONAL COMMENTS: 68–95 cm, there is a single basalt clast with 1%–2%, elongate (1–2 mm X 5–10 mm) vesicles, and 15%, 0.5–2 mm, euhedral, pseudomorphed by iddingsite, olivine grains. The matrix is microcrystalline and reddish gray (10R 5/1).



144-878A-83R-1

UNIT 13: OLIVINE BASALT

Pieces 1-2



CONTACTS: Continues into Section 83R-2.

PHENOCRYSTS: Unit is too altered to clearly distinguish phenocryst abundances.
Olivine - ?; 0.5-2 mm; Pseudomorphed by iddingsite.

GROUNDMASS: Microcrystalline.

VESICLES: None.

COLOR: Medium gray (N4) with 5 mm, circular patches of grayish black (N2).

STRUCTURE: None.

ALTERATION: Unit is friable, highly fractured, and soft, suggesting that it has been mostly or completely replaced by clay.

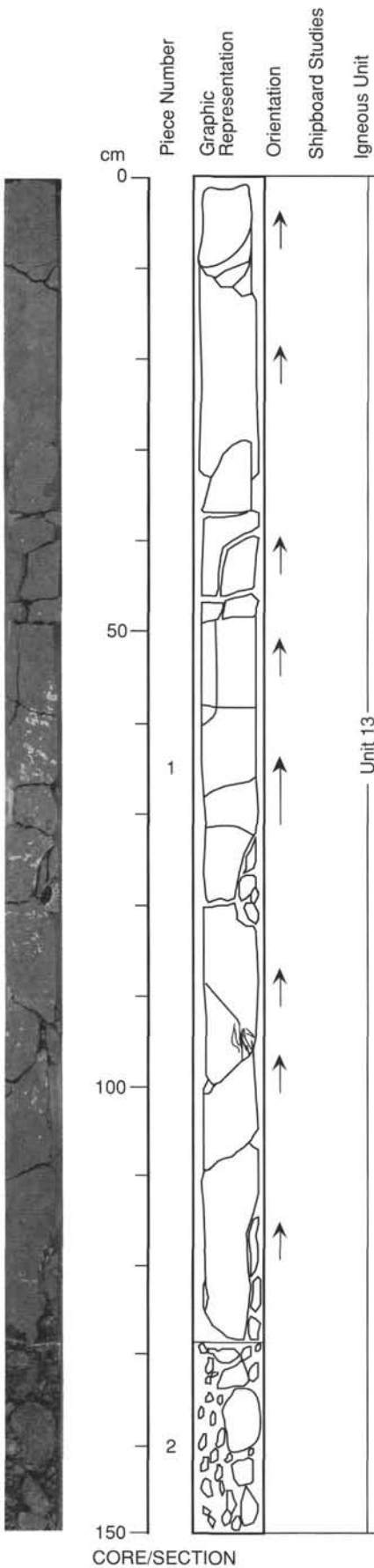
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: 110-127 cm, there are slickensides on two surfaces, one irregular and nearly vertical, the other dipping 60 degrees.

CORE/SECTION

UNIT 13: OLIVINE BASALT (continued)

Pieces 1-2



CONTACTS: Continues from Section 83R-1 and into Section 83R-3.

PHENOCRYSTS: Unit is too altered to clearly distinguish phenocryst abundances.
Olivine - ?; 0.5-2 mm; Pseudomorphed by iddingsite.

GROUNDMASS: Microcrystalline.

VESICLES: 10%-20%; 3-10 mm; Round; 56-85 cm only; Filled with very pale orange (10YR 8/2) clay.

COLOR: Medium gray (N4) with 5 mm, circular patches of grayish black (N2).

STRUCTURE: None.

ALTERATION: Unit is friable, highly fractured, and soft, suggesting that it has been mostly or completely replaced by clay.

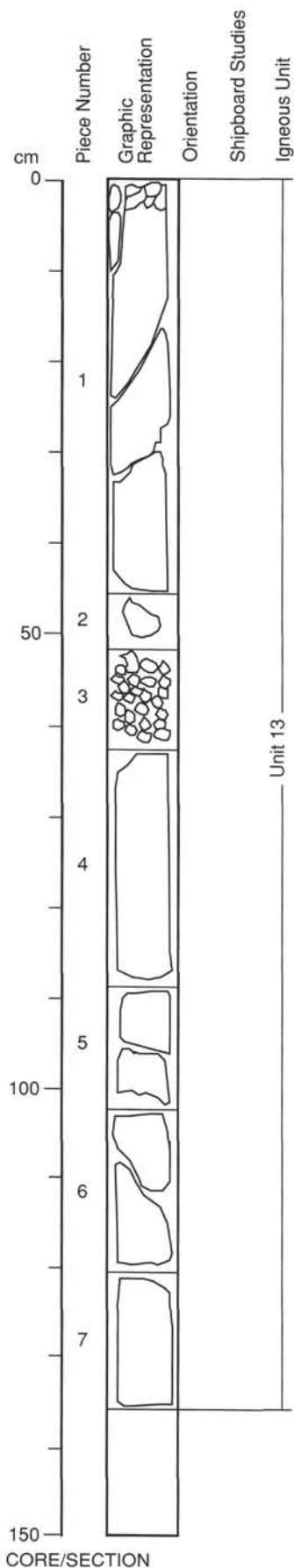
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: 128-150 cm the core has been fragmented by drilling. There are abundant slickenside surfaces.

144-878A-83R-3

UNIT 13: OLIVINE BASALT (continued)

Pieces 1-7



CONTACTS: Continues from Section 83R-2 and into Section 83R-4.

PHENOCRYSTS: Unit is too altered to clearly distinguish phenocryst abundances and sizes.
Olivine - ?; 0.5-2 mm; Pseudomorphed by iddingsite.

GROUNDMASS: Microcrystalline.

VESICLES: None.

COLOR: Medium gray (N4) with 5 mm, circular patches of grayish black (N2).

STRUCTURE: None.

ALTERATION: Unit is friable, highly fractured, and soft, suggesting that it is been mostly or completely replaced by clay.

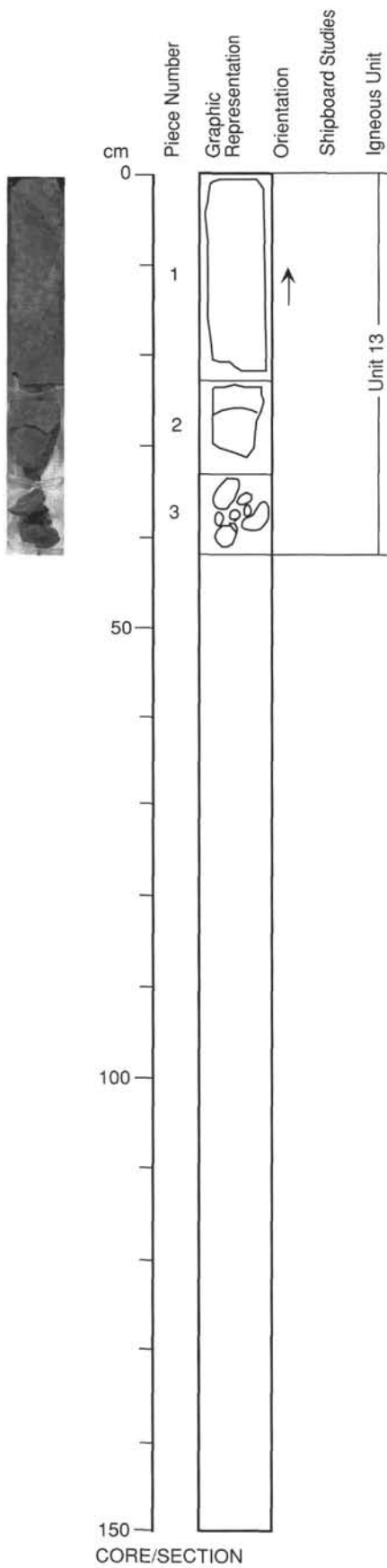
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

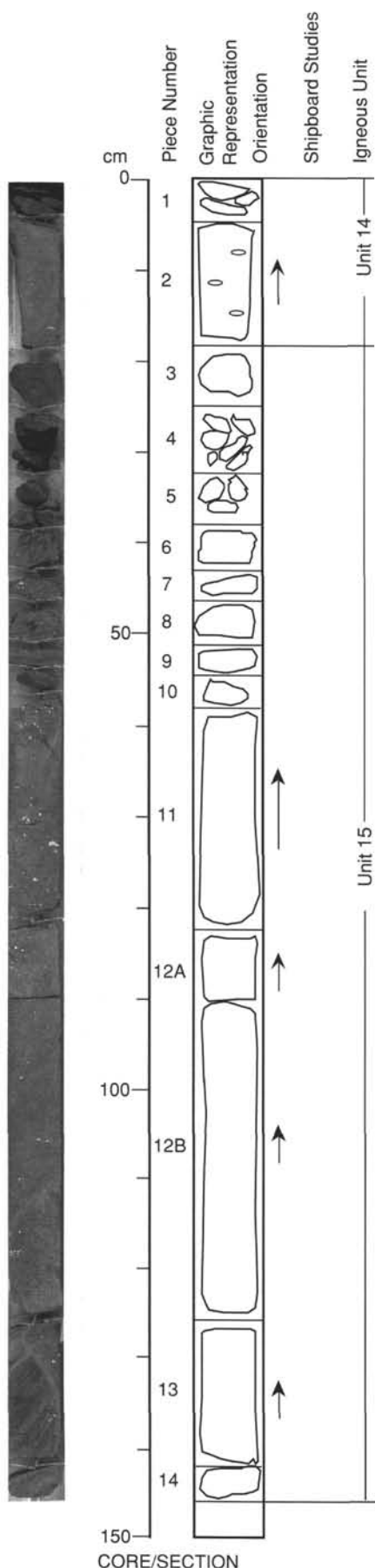
UNIT 13: OLIVINE BASALT (continued)

Pieces 1-3

CONTACTS: Continues from Section 83R-3.
PHENOCRYSTS: Unit is too altered to clearly distinguish phenocryst abundances and sizes.
 Olivine - ?; 0.5-2 mm; Pseudomorphed by iddingsite.
GROUNDMASS: Microcrystalline.
VESICLES: None.
COLOR: Medium gray (N4) with 5 mm, circular patches of grayish black (N2).
STRUCTURE: None.
ALTERATION: Unit is friable, highly fractured, and soft, suggesting that it is been mostly or completely replaced by clay.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: None.



144-878A-84R-1



UNIT 14: OLIVINE BASALT

Pieces 1-2

CONTACTS: None.

PHENOCRYSTS:

Olivine - 15%; 0.2-1 mm; Euhedral diamonds and elongate prisms, iddingsitized.

GROUNDMASS: Microcrystalline.

VESICLES: 1%; 1-2 X 5 mm; Elongate; Filled by calcite and a translucent, pale blue green (5BG 7/2) clay.

COLOR: Medium gray (N4) to dark reddish gray (10R 4/1).

STRUCTURE: None.

ALTERATION: Phenocrysts pseudomorphed by clays, vesicles filled, and the groundmass is quite soft, suggesting extensive clay development.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

UNIT 15: OLIVINE-CLINOPYROXENE BASALT

Pieces 3-14

CONTACTS: Continues into Section 84R-2.

PHENOCRYSTS: Randomly oriented plagioclase needles, 0.1-0.2 mm long, are visible in places.

Clinopyroxene - <5%; 0.1-0.5 mm; Subhedral prisms, completely replaced by dusky green (5G 3/2) clay.

Olivine - 20%; 0.2-0.5 mm; Equant, angular, broken grains altered to translucent light olive brown (5Y 5/6) clay and varying amounts of iddingsite.

GROUNDMASS: 19-32 cm, aphyric, vesicular, 1-5 cm in diameter, basalt clasts in a dense clay matrix. 32-146 cm, microcrystalline.

VESICLES: 15%; <1-5 mm; Round to irregular; Filled by grayish green (5G 5/2) clay and lesser calcite.

COLOR: 19-32 cm, clasts are very dark gray (N3) to medium dark gray (N5) in a dusky red (2.5YR 3/2) matrix. 32-146 cm, grades from reddish gray (10R 5/1) to medium gray (N4) downhole.

STRUCTURE: 19-32 cm, flow-top breccia; 32-146 cm, massive.

ALTERATION: Flow-top breccia is oxidized and much of its clay matrix is probably authigenic. Phenocrysts are pseudomorphed, vesicles are filled, and an unknown amount of groundmass has been replaced by clay.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

○ Large vesicles

UNIT 15: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-7

CONTACTS: Continues from Section 84R-1 and into Section 84R-3.

PHENOCRYSTS: Randomly oriented plagioclase needles, 0.1-0.2 mm long, are visible in places.

Clinopyroxene - <5%; 0.1-0.5 mm; Subhedral prisms, completely replaced by dusky green (5G 3/2) clay.

Olivine - 20%; 0.2-0.5 mm; Equant, angular, broken grains altered to translucent light olive brown (5Y 5/6) clay and varying amounts of iddingsite.

GROUNDMASS: Microcrystalline.

VESICLES: 0-93 cm, vesicles are 10%, 1-2 X 5 mm, elongate, round to irregular. 93-144 cm, there are sparse, <1%, large vesicles as previous, and 1%-2%, 0.1-0.2 mm, round vesicles filled with grayish green (5G 5/2) and bright red (no appropriate Munsell color) clays.

COLOR: Medium gray (N4).

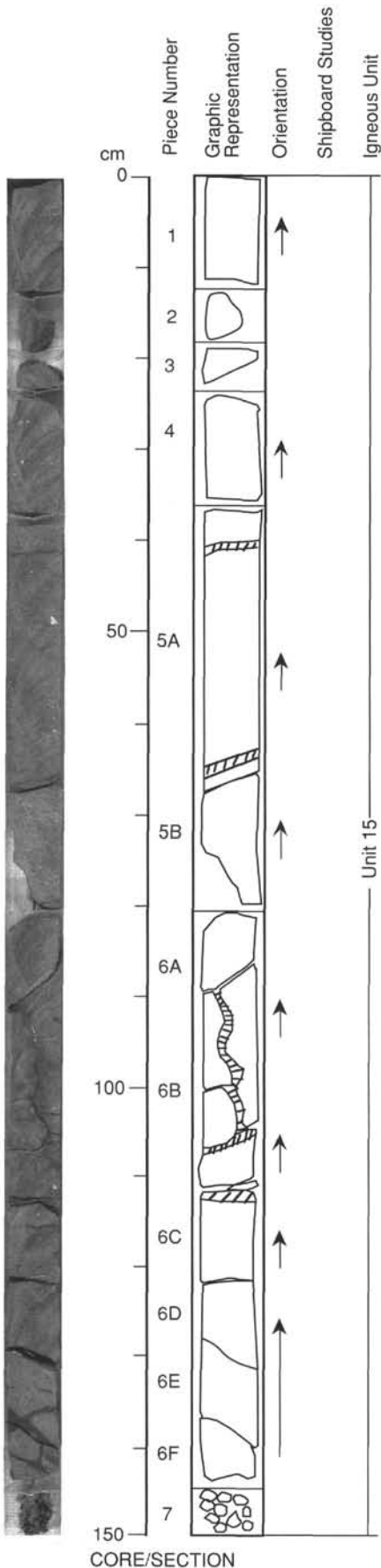
STRUCTURE: Massive.

ALTERATION: 93-144 cm, matrix contains 10% dusky green (5G 3/2) clay along narrow fractures and in irregular patches. This unit is more altered than its matrix color suggests.

VEINS/FRACTURES: 1-3 mm; Subhorizontal; At 42 cm, 67 cm, 91-107 cm, 114 cm, and 130 cm, filled by grayish green (5G 5/2) clay and lesser calcite.

ADDITIONAL COMMENTS: None.

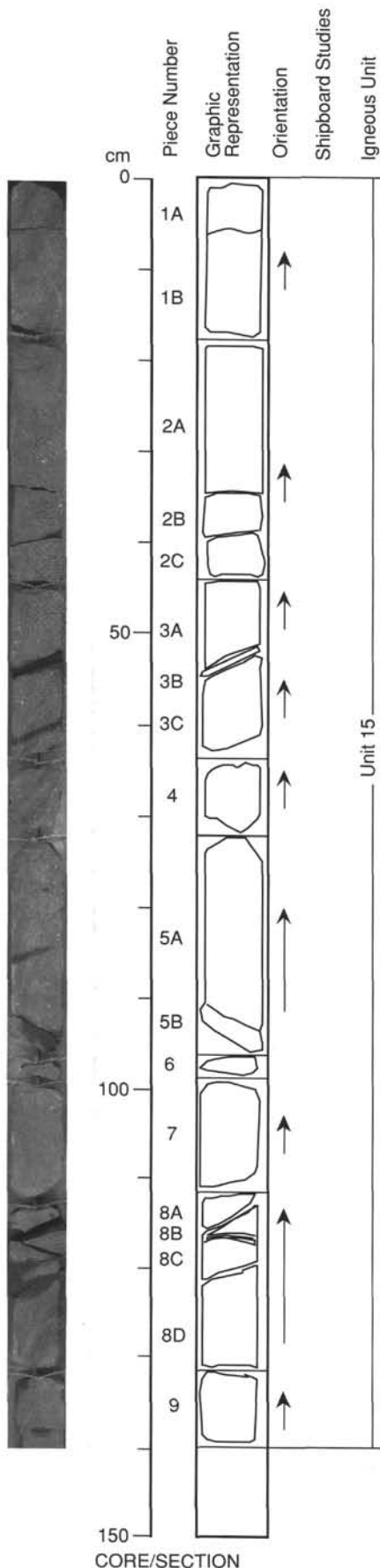
 Clay filled veins



144-878A-84R-3

UNIT 15: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-9



CONTACTS: Continues from Section 84R-2 and into Section 84R-4.

PHENOCRYSTS: Randomly oriented plagioclase needles, 0.1-0.2 mm long, are visible in places.

Clinopyroxene - 1%; 0.1-0.2 mm; Subhedral prisms, completely replaced by dusky green (5G 3/2) clay above 90 cm, but fresh below.

Olivine - 20%; 0.2-0.5 mm; Equant, angular, broken grains altered to translucent light olive brown (5Y 5/6) clay and varying amounts of iddingsite. However, below 90 cm, olivine is less abundant (10%) and fresh except near fractures.

GROUNDMASS: Microcrystalline.

VESICLES: 0-90 cm, there are sparse, <1%, <1-5 mm in diameter, vesicles filled with grayish green (5G 5/2) clay and lesser calcite and 1%-2%, 0.1-0.2 mm, round vesicles filled with grayish green (5G 5/2) and bright red (no appropriate Munsell color) clays. 90-145 cm, 3%-5%, 0.1-1 mm, round vesicles filled with light greenish gray (5G 8/1) clay and lesser calcite.

COLOR: Medium gray (N4).

STRUCTURE: Massive.

ALTERATION: 0-90 cm, matrix contains 10%, dusky green (5G 3/2) clay along narrow fractures and in irregular patches. 90-145 cm, the basalt may be less altered.

VEINS/FRACTURES: 1-3 mm; Subhorizontal; Filled by grayish green (5G 5/2) clay and lesser calcite.

ADDITIONAL COMMENTS: None.

UNIT 15: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-5

CONTACTS: Continues from Section 84R-3 and into Section 84R-5.

PHENOCRYSTS: Randomly oriented plagioclase needles, 0.1-0.2 mm long, are visible in places.

Clinopyroxene - 1%; 0.1-0.2 mm; Subhedral prisms. 40-94 cm and 128-150 cm, completely replaced by dusky green (5G 3/2) clay. 0-37 cm and 94-128 cm, unaltered.

Olivine - 15%; 0.2-0.5 mm; Equant, angular, broken grains. 40-94 cm and 128-150 cm, altered to translucent light olive brown (5Y 5/6) clay and varying amounts of iddingsite. 0-37 cm and 94-128 cm, olivine is less abundant (10%) and fresh except near fractures.

GROUNDMASS: Microcrystalline.

VESICLES: 3%-5%; 0.1-1 mm; Round; Filled with light greenish gray (5G 8/1) clay and lesser calcite.

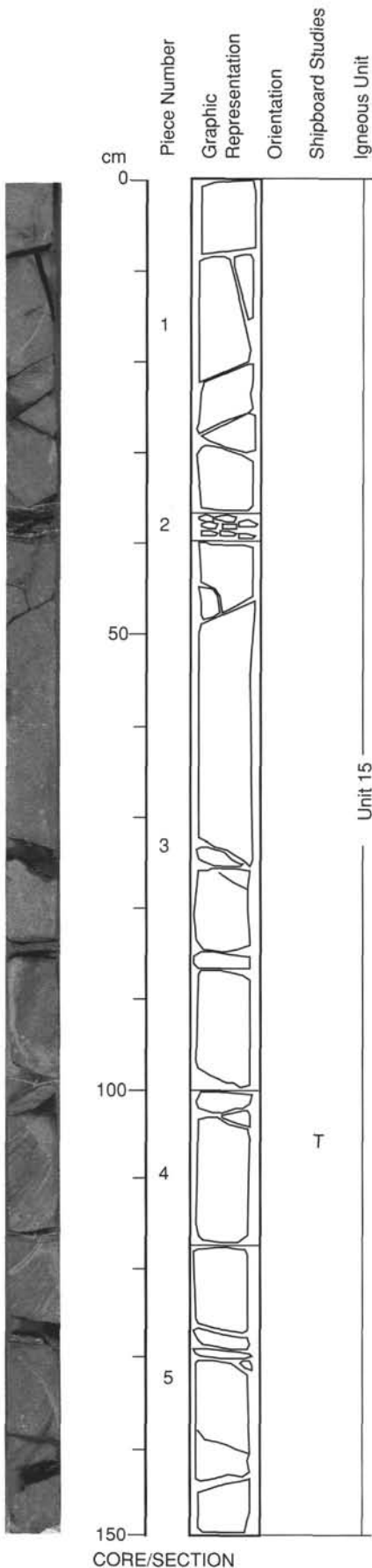
COLOR: Medium gray (N4).

STRUCTURE: Massive.

ALTERATION: Downsection there is less alteration as evidenced by the unaltered minerals, but it is likely that there is still significant clay development in the matrix.

VEINS/FRACTURES: 37-40 cm, vein fragments, 85-86 cm, 1 cm wide vein, 128-129, 6 mm wide vein. These are filled with pale green (5G 7/2) clay and minor calcite.

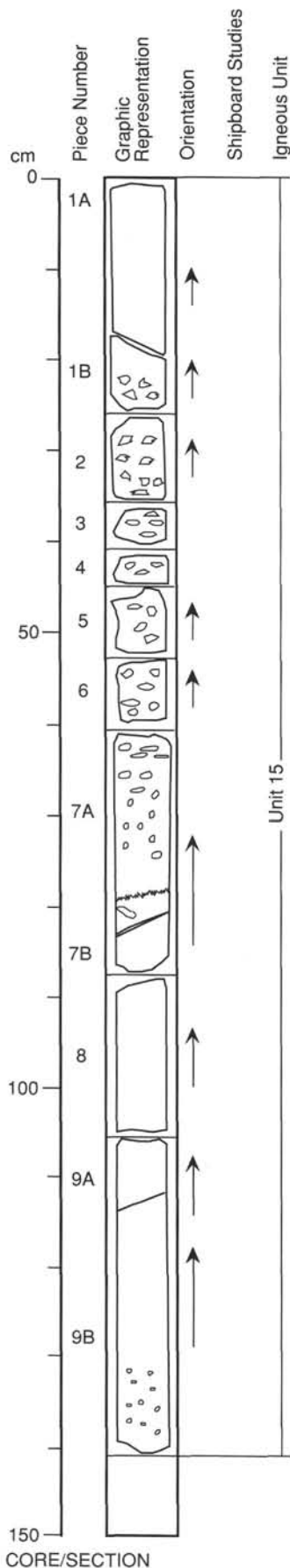
ADDITIONAL COMMENTS: None.



144-878A-84R-5

UNIT 15: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-9



CONTACTS: Continues from Section 84R-4 and into Section 84R-6.

PHENOCRYSTS: Randomly oriented plagioclase needles, 0.1-0.2 mm long, are visible in places.

Clinopyroxene - 1%; 0.1-0.2 mm; Subhedral prisms. 0-96 cm and 106-142 cm, completely replaced by dusky green (5G 3/2) clay. 96-106 cm, unaltered.

Olivine - 15%; 0.2-0.5 mm; Equant, angular, broken grains. 0-96 cm and 106-142 cm, altered to translucent light olive brown (5Y 5/6) clay and varying amounts of iddingsite. 96-106 cm, olivine is less abundant (10%) and fresh except near fractures.

GROUNDMASS: Microcrystalline.

VESICLES: 0-26 cm, vesicularity increase from <1% to 10% downsection. 26-65 cm, 20%-30%, irregular and interconnecting, <0.5-3 mm, mostly empty, but filled with pale green (10G 6/2) clay above 28 cm and in the interval 33-41 cm. 65-76 cm, abrupt transition to a region of 1-5 mm, round or subround vesicles filled with pale green (10G 6/2) clay (calcite below 74 cm). 76-142 cm, vesicles are as in Section 84R-4.

COLOR: Medium gray (N4).

STRUCTURE: Massive.

ALTERATION: Filled vesicles and pseudomorphed minerals suggest there is significant clay development in the matrix.

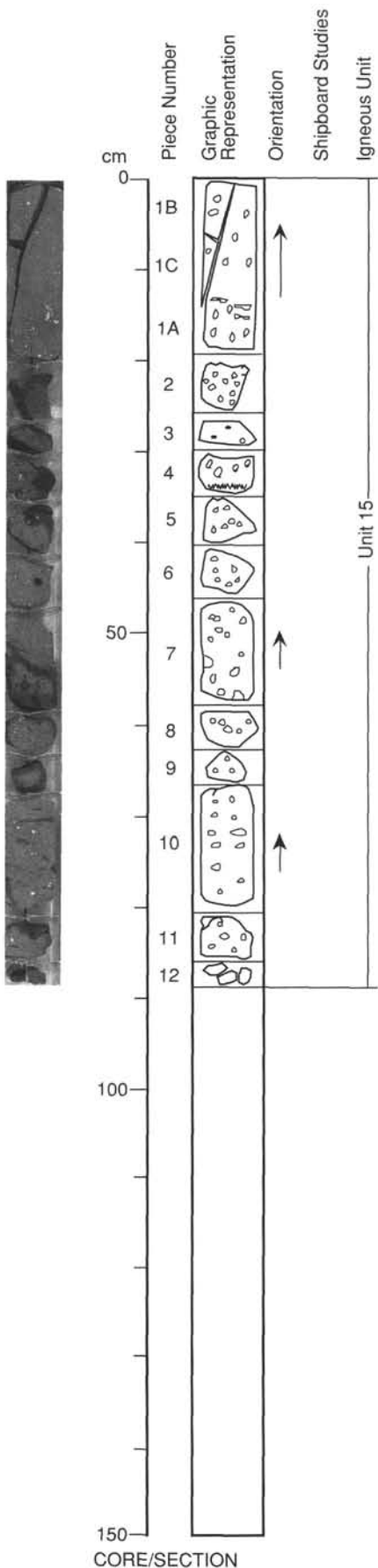
VEINS/FRACTURES: 6 mm calcite vein at 80 cm.

ADDITIONAL COMMENTS: Midflow concentration of vesicles.

- Regions of abundant irregular vesicles
- Large vesicles
- Calcite veins

UNIT 15: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-12



CONTACTS: Continues from Section 84R-5.

PHENOCRYSTS: Randomly oriented plagioclase needles, 0.1–0.2 mm long, are visible in places.
Clinopyroxene - 1%; 0.1–0.2 mm; Subhedral prisms, completely replaced by dusky green (5G 3/2) clay.

Olivine - 20%; 0.2–0.5 mm; Equant, angular, broken grains, altered to translucent light olive brown (5Y 5/6) clay and varying amounts of iddingsite.

GROUNDMASS: Microcrystalline.

VESICLES: 5%–15%; 0.5–15 mm; Round to irregular; Filled with pale green (5G 7/2) clay with lesser calcite, except for interval 30–58 cm, where the vesicles are mostly empty.

COLOR: Dark reddish gray (10R 4/1).

STRUCTURE: Massive.

ALTERATION: Redder matrix color reflects more severe alteration. Filled vesicles and pseudomorphed minerals suggest there is significant clay development in the matrix.

VEINS/FRACTURES: Piece 2, 20–26 cm, is more than 50% replaced by white (N9) and dark red (10R 3/6) clay in irregular branching veinlets.

ADDITIONAL COMMENTS: None.

144-878A-85R-1

UNIT 16: OLIVINE BASALT

Pieces 1-15

CONTACTS: Continues into Section 85R-2.

PHENOCRYSTS:

Olivine - 15%; 0.1-0.5 mm; Euhedral and broken grains, altered to iddingsite above 68 cm, to translucent moderate olive brown (5Y 4/4) clay with minor iddingsite below.

GROUNDMASS: Microcrystalline.

VESICLES: 0-29 cm, 20%, 0.2-2 mm, irregular and interconnected, variable distribution, generally empty. 29-40 cm, 10%, to 4 mm, less interconnected, filled with pale green (5G 7/2) or white (N9) clay. 40-133 cm, to 5 mm, elliptical near the top of the interval, more irregular farther down, decreasing to 2-3 mm below 120 cm, 10%, filled by pale green clay (5G 7/2) and lesser calcite.




COLOR: Grades from dark reddish gray (10R 4/1) to medium gray (N4) downsection.

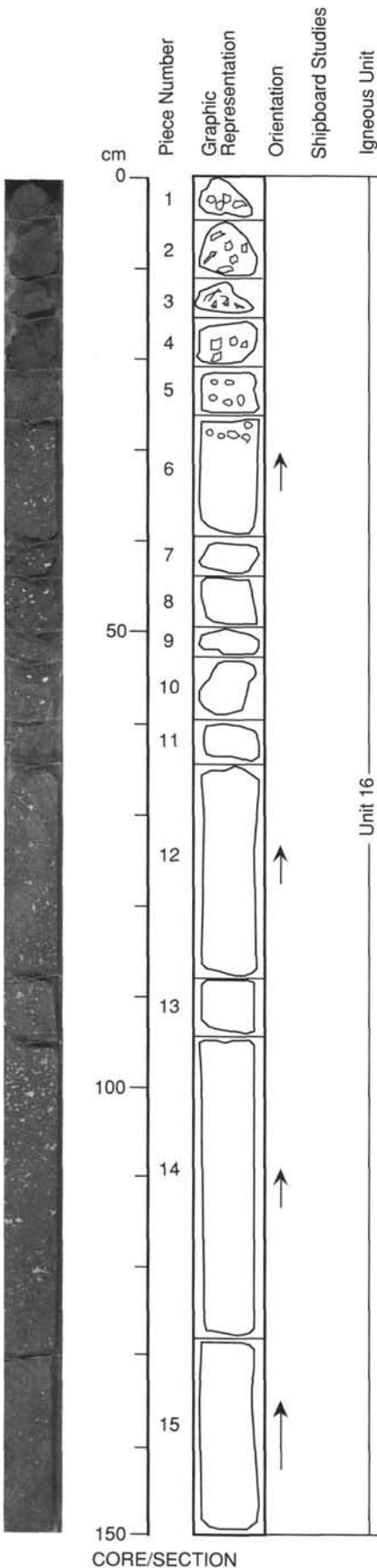
STRUCTURE: Massive.

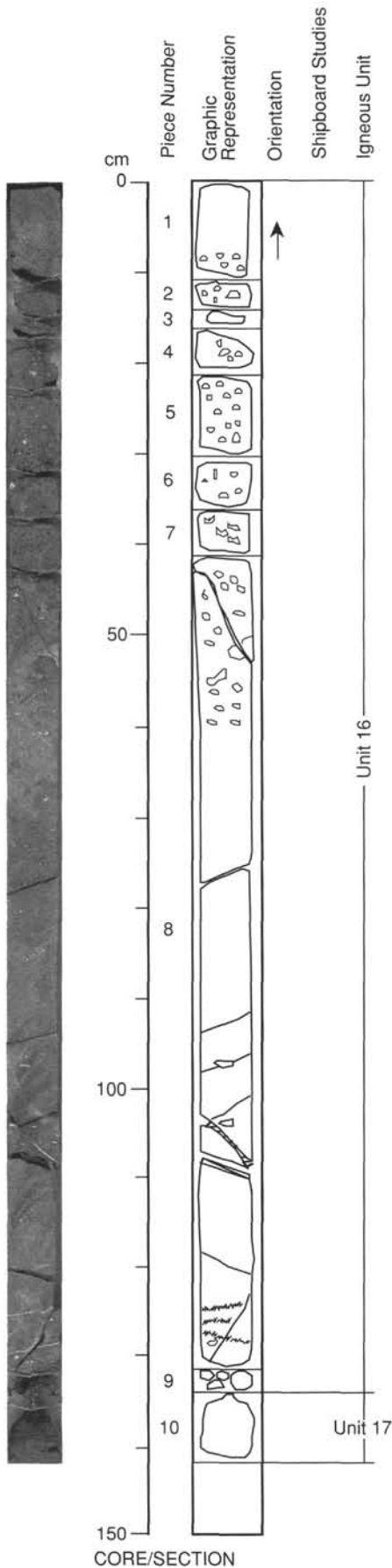
ALTERATION: Olivines are completely replaced, vesicles are filled below 29 cm, and the upper portion of the section is oxidized. Alteration appears to be extensive, but progressively less so downsection.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

-  Interconnected vesicles
-  Large vesicles
-  Calcite veins





UNIT 16: OLIVINE BASALT (continued)

Pieces 1-9

CONTACTS: Continues from Section 85R-1.

PHENOCRYSTS:

Olivine - 15%; 0.1-0.5 mm; Euhedral and broken grains, altered to iddingsite above 68 cm, to translucent moderate olive brown (5Y4/4) clay with minor iddingsite below.

GROUNDMASS: Microcrystalline.

VESICLES: 0-5 cm and 60-134 cm, there are no vesicles. 5-50 cm, 30%, 0.5-3 mm, round but becoming irregular and interconnected downsection, filled with pale green (5G 7/2) clay above 34 cm, and empty below. 50-60 cm, 20%, to 2 cm, round to horizontally elongate vesicles, filled with pale green clay (5G 7/2).

COLOR: Medium gray (N4).

STRUCTURE: Massive.

ALTERATION: Alteration appears to be extensive.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

UNIT 17: CLAYSTONE

Piece 10

CONTACTS: Continues into Section 85R-3.

PHENOCRYSTS: None.

GROUNDMASS: None.

VESICLES: None.

COLOR: Dark reddish gray (10R 4/1).

STRUCTURE: None.

ALTERATION: Severe. This unit represents a tropical weathering profile through basalts and basalt breccias.

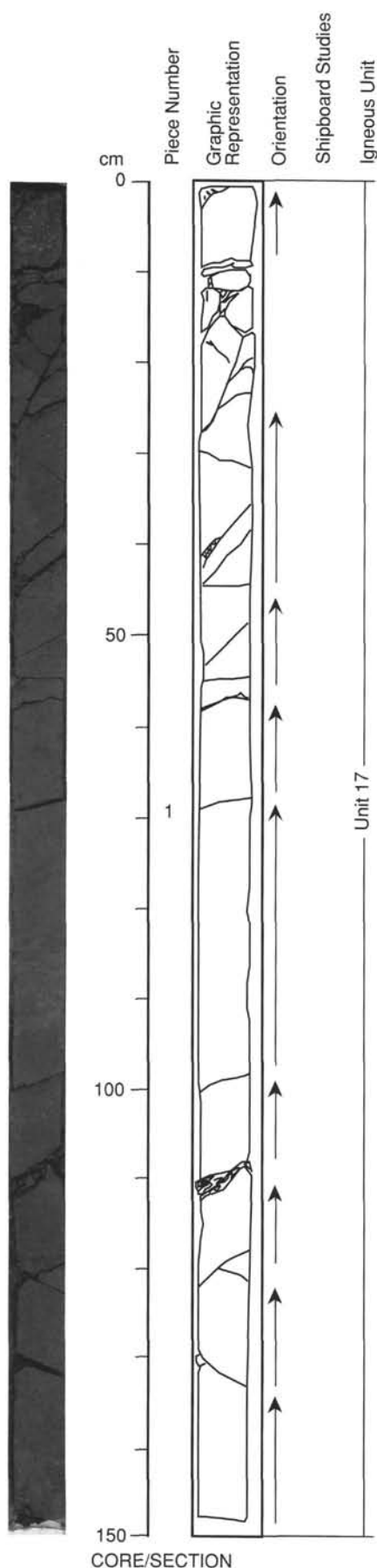
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Claystone with areas of relict igneous texture (not seen in Piece 10).

144-878A-85R-3

UNIT 17: CLAYSTONE (continued)

Piece 1



CONTACTS: Continues from Section 85R-2 and into Section 85R-4.

PHENOCRYSTS: None.

GROUNDMASS: None.

VESICLES: None.

COLOR: See Additional Comments.

STRUCTURE: None.

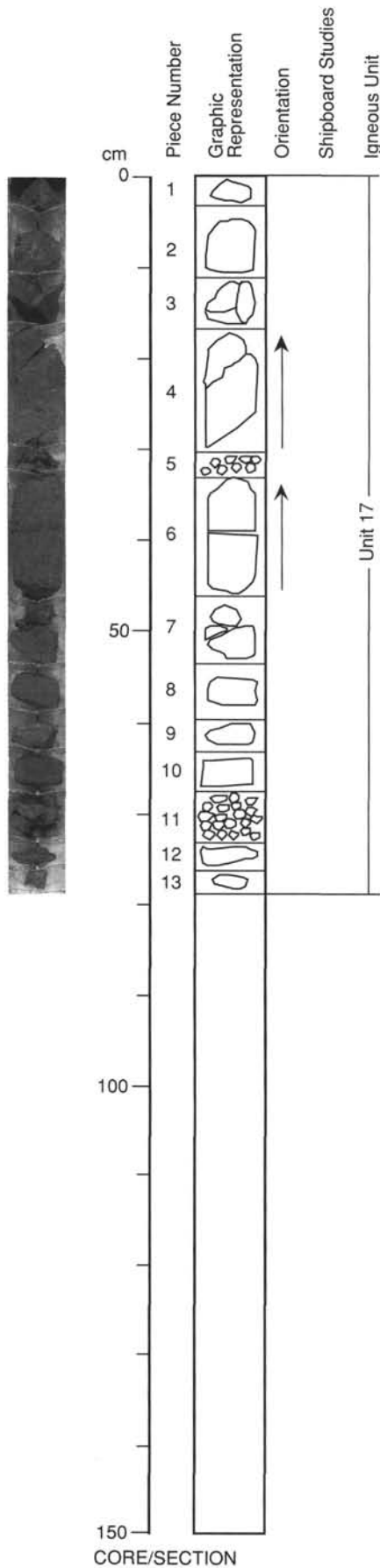
ALTERATION: Severe. This unit represents a tropical weathering profile through basalts and basalt breccias.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Claystone with areas of relict igneous texture. 0–10 cm, relict breccia with 3–15 mm, blackish red (5R 2/2) clasts in a very pale blue (5B 8/2) and moderate reddish brown (10R 4/6) clay matrix. 10–84 cm, relict massive basalt is dark reddish brown (10R 3/4) with 10% dark yellowish orange (10YR 6/6), 0.2–2 mm spots (pseudomorphs of olivine?) in the interval 45–84 cm. 84–95 cm, ghosts of subangular, 2–15 mm clasts in a dark reddish brown (10R 3/4) matrix. 95–111 cm, dusky red (5R 3/4) grading into dark gray (N3), with 25%, 0.5–3 mm, anhedral, dark yellowish orange (10YR 6/6) probable olivine pseudomorphs. This may be a large, single, less altered, clast within the breccia. 111–125 cm, featureless, blackish red (5R 2/2). 125–150 cm, ghosts of clasts in a dark reddish brown (10R 3/4) matrix.

UNIT 17: CLAYSTONE (continued)

Pieces 1–13



CONTACTS: Continues from Section 85R-3 and into Section 85R-5.

PHENOCRYSTS: None.

GROUNDMASS: None.

VESICLES: None.

COLOR: See Additional Comments.

STRUCTURE: None.

ALTERATION: Severe. This unit represents a tropical weathering profile through basalts and basalt breccias.

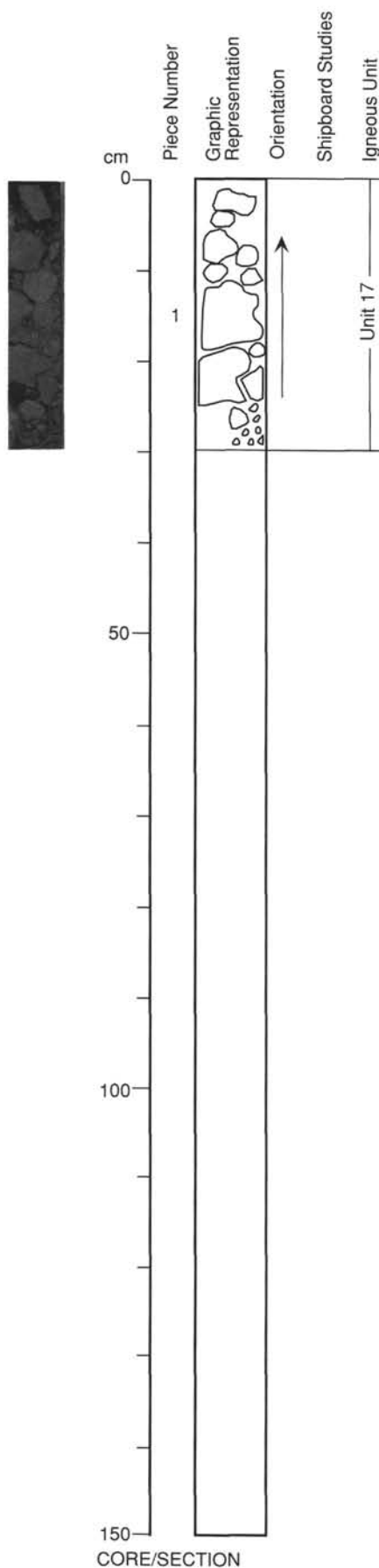
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Claystone with areas of igneous basalt texture. 0–33 cm, relict breccia with 2–15 mm ghosts of clasts in a variety of colors, in a dark reddish brown (10R 3/4) matrix. Pieces 1–3 have slickenside surfaces. 33–79 cm, appears to have been a single massive clast with variable alteration (very dark red (5R 2/6) to dark gray (N3)) and 15%, 0.5–6 mm, dark yellowish orange (10YR 6/6) probable olivine pseudomorphs.

144-878A-85R-5

UNIT 17: CLAYSTONE (continued)

Piece 1



CONTACTS: Continues from Section 85R-4 and into Section 86R-1.

PHENOCRYSTS: None.

GROUNDMASS: None.

VESICLES: None.

COLOR: See additional colors.

STRUCTURE: None.

ALTERATION: Severe. This unit represents a tropical weathering profile through basalts and basalt breccias.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Claystone with areas of relict basalt texture. Very dusky red (10R 2/2) to medium and dark gray (N5-N3), horizontally banded on 2–7 mm scale. Sparse, 2–6 mm, dark yellowish orange (10YR 6/6) probable olivine pseudomorphs. Uncertain if this is relict breccia or massive flow material.

UNIT 17: CLAYSTONE (continued)

Piece 1

CONTACTS: Continues from Section 85R-5 and into Section 86R-2.

PHENOCRYSTS: None.

GROUNDMASS: None.

VESICLES: None.

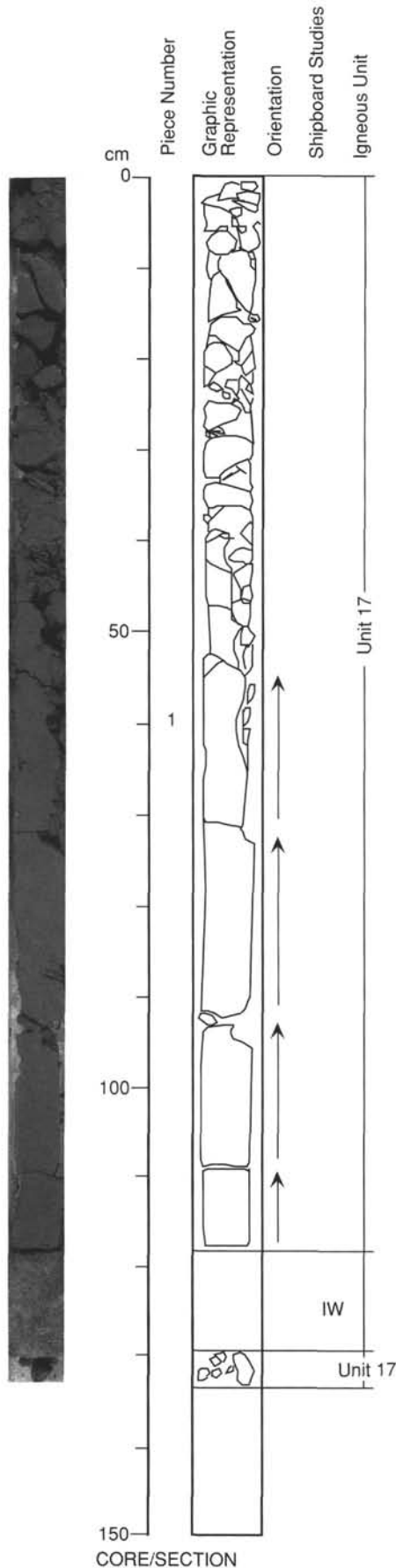
COLOR: See Additional Comments.

STRUCTURE: None.

ALTERATION: Severe. This unit represents a tropical weathering profile through basalts and basalt breccias.

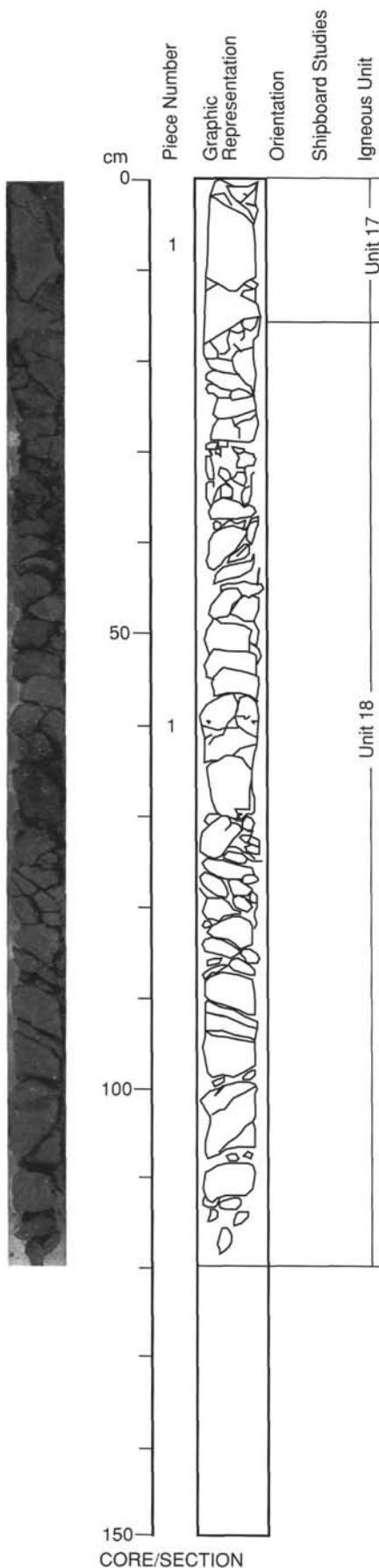
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Claystone with areas of relict basalt texture. 0–5 cm, dusky yellowish brown (10YR 2/2). 5–22 cm, relict granule-sized volcanoclastic breccia with very dusky red (10R 2/2) and dark gray (N3) clasts, dark reddish brown (10R 3/4) matrix, and <5% dark yellowish orange probable olivine pseudomorphs. 22–48 cm, relict massive basalt, dark gray (N3) with 5%, 1–3 mm, dark yellowish orange (10YR 6/6) probable olivine pseudomorphs. 48–133 cm, very dusky red (10R 2/2) claystone with no relict texture.



CORE/SECTION

144-878A-86R-2



UNIT 17: CLAYSTONE (continued)

Piece 1

CONTACTS: Continues from Section 86R-1.
PHENOCRYSTS: None.
GROUNDMASS: None.
VESICLES: None.
COLOR: Very dusky red (10R 2/2).
STRUCTURE: None.
ALTERATION: Severe. This unit represents a tropical weathering profile through basalts and basalt breccias.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: No relict texture.

UNIT 18: OLIVINE BASALT

Piece 1

CONTACTS: Continues into Section 86R-3.
PHENOCRYSTS: Some of these pseudomorphs may have been clinopyroxene. See Section 86R-3 description.
 Olivine - 30%; 1-5 mm; Euhedral to round olivine pseudomorphs altered to moderate brown (5YR 4/4), strong brown (7.5YR 5/8), and olive yellow (5Y 6/8), with the latter color becoming more prevalent downsection.
GROUNDMASS: Microcrystalline.
VESICLES: None.
COLOR: Dark gray (N3) except the interval 110-120 cm, where the matrix is grayish blue green (5BG 5/2).
STRUCTURE: None.
ALTERATION: Severely altered, very soft.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Unit is badly fragmented and some of it has been ground to soft clay.

UNIT 18: OLIVINE BASALT (continued)

Piece 1

CONTACTS: Continues from Section 86R-2.

PHENOCRYSTS: Phenocryst description applies to the interval 38–48 cm. See 86R-2 description for the interval 0–38 cm.

Olivine - 20%; 1–5 mm; Euhedral to round olivine pseudomorphs altered to strong brown (7.5YR 5/8).
Clinopyroxene - 10%; 1–4 mm; Prisms to round shapes, partially fresh.

GROUNDMASS: Microcrystalline.

VESICLES: 3%; 1–3 mm; Irregular; Interval 38–48 cm; Filled with white (N9) clay.

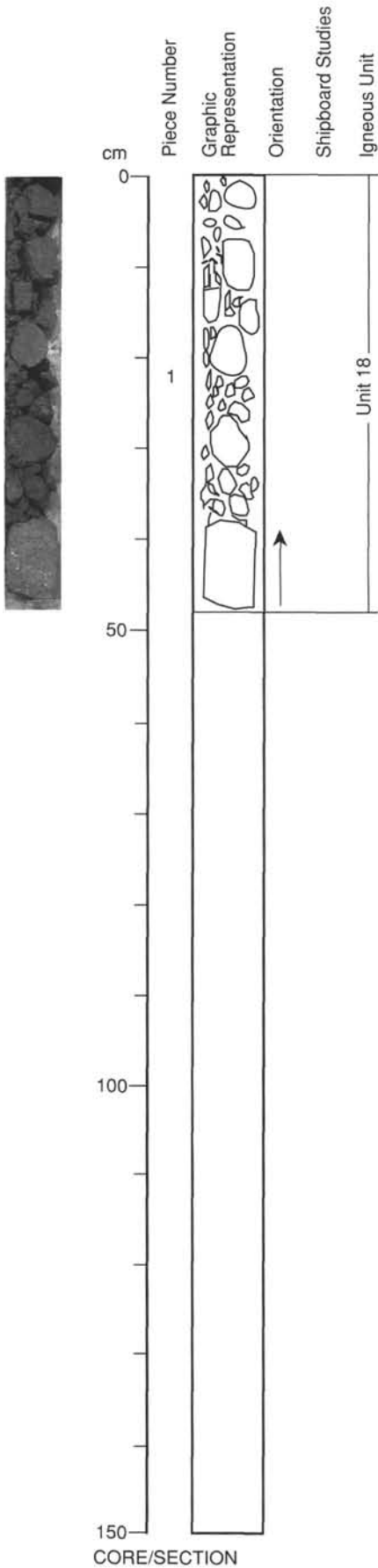
COLOR: 0–21 cm, grayish blue green (5BG 5/2); 21–38 cm, mottled blackish red (5R 2/2) and dark reddish brown (10R 3/4) on a millimeter scale. 38–48 cm, medium gray (N5).

STRUCTURE: None.

ALTERATION: Severely altered, very soft. 38–48 cm is much fresher and has some unaltered clinopyroxene.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Unit is badly fragmented and some of it has been ground to soft clay.

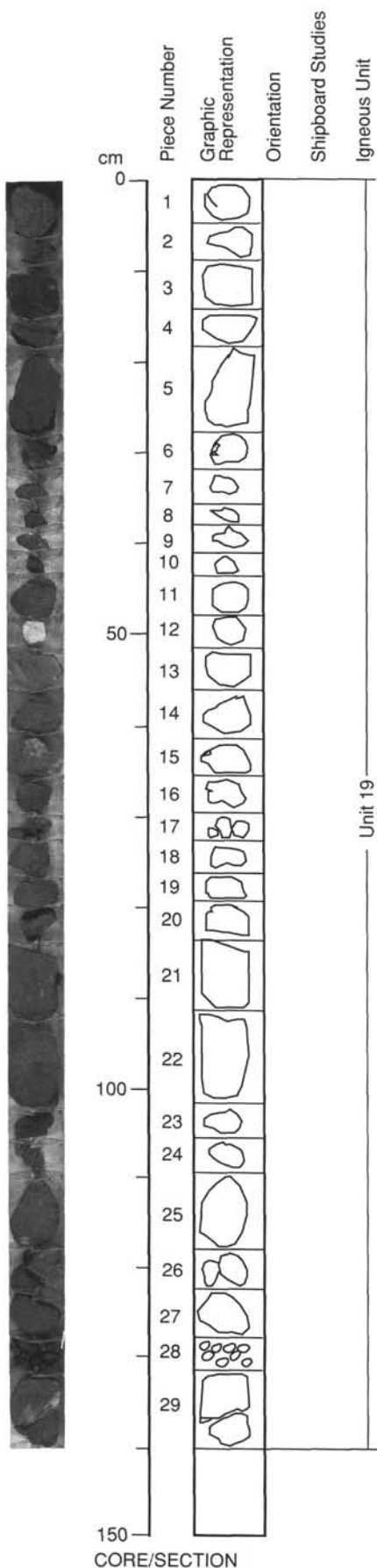


144-878A-87R-1

UNIT 19: WASH-CORE: MISCELLANEOUS PIECES FROM FURTHER UPHOLE

Pieces 1-29

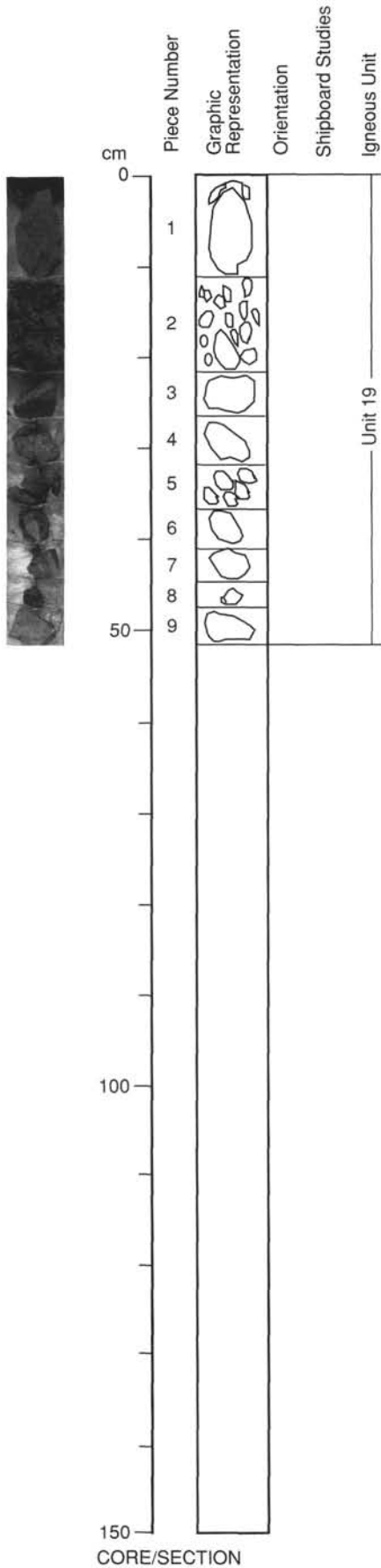
CONTACTS: None.
PHENOCRYSTS: None.
GROUNDMASS: None.
VESICLES: None.
COLOR: Not appropriate.
STRUCTURE: Miscellaneous pieces of many units uphole.
ALTERATION: Not appropriate.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Includes Lithic Tuffs, Pieces 1-11, 14-17, 21, 25, 26; Limestone, Piece 12 (milleolid wackestone); Altered Basalt, Pieces 13, 20, 24, 27-29; and Basalt Breccia, Pieces 22, 23.



UNIT 19: WASH-CORE: MISCELLANEOUS PIECES FROM FURTHER UPHOLE

Pieces 1–9

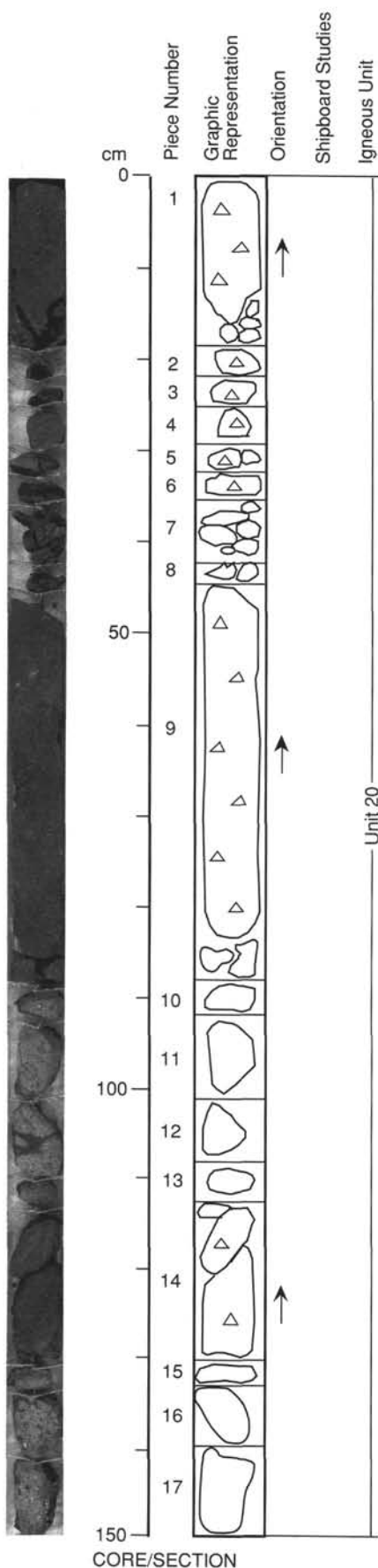
CONTACTS: None.
PHENOCRYSTS: None.
GROUNDMASS: None.
VESICLES: None.
COLOR: Not appropriate.
STRUCTURE: Miscellaneous pieces of many units uphole.
ALTERATION: Not appropriate.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Includes basalt breccia, Piece 1; claystone and weathered basalt fragments, Piece 2; and vesicular basalts with a variety of textures, Pieces 3–9.



144-878A-88R-1

UNIT 20: OLIVINE-CLINOPYROXENE BASALT

Pieces 1-17



CONTACTS: Continues into Section 88R-2.

PHENOCRYSTS: Phenocryst descriptions refer to the massive portion of the flow.

Olivine - 10%; 0.1-2 mm; Subhedral, iddingsitized.
 Clinopyroxene - 1%; 0.5-1 mm; Subhedral prisms, unaltered.

GROUNDMASS: 0-88 cm and 113-130 cm, flow-top breccia. Clasts are subrounded, 1 mm->5 cm, <5% olivines altered to friable iddingsite. Matrix consists of poorly sorted, angular basalt fragments and clay. 88-113 cm, and 130-150 cm, massive basalt which is microcrystalline with visible, randomly oriented, 1 mm plagioclase laths.

VESICLES: 10%; 0.2-2 mm; Irregular; Vesicles in the massive basalt are lined or filled with translucent, pale green (5G 7/2) zeolite and some centers are of friable white (N9) or soft, expanding, light brown (5YR 6/4) clay. Breccia clasts have 10%, irregular, 0.5-1 mm vesicles filled with white (N9) clay.

COLOR: Clasts are reddish black (10R 2.5/1). Breccia matrix clay is weak red (10R 4/4). Massive basalt matrix is reddish gray (10R 5/1).

STRUCTURE: 0-88 cm and 113-130 cm, flow top breccia. 88-113 cm, large clasts broken out of the breccia by drilling. 130-150 cm, massive portion of the flow.

ALTERATION: Flow-top breccia is oxidized, authigenic clay has formed a matrix, and presumably the groundmasses of the clasts have been partially replaced by clay. The massive basalt is somewhat altered.

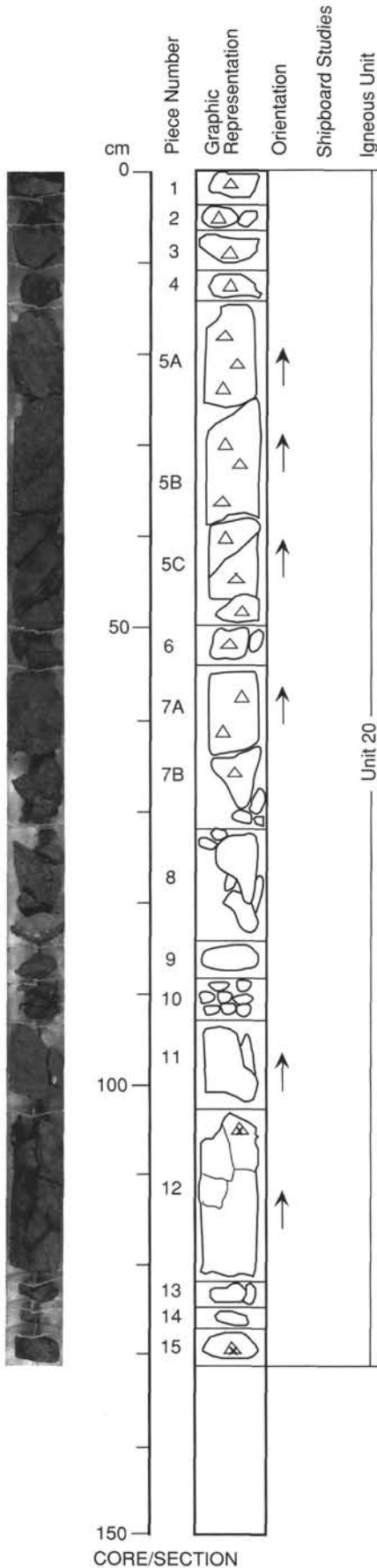
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

△ Breccia

UNIT 20: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1–15



CONTACTS: Continues from Section 88R-1 and into Section 88R-3.

PHENOCRYSTS: Phenocryst descriptions refer to the massive portion of the flow.

Olivine - 10%; 0.1–2 mm; Subhedral, iddingsitized.

Clinopyroxene - 1%; 0.5–1 mm; Subhedral prisms, unaltered.

GROUNDMASS: 0–72 cm, is flow-top breccia. Clasts are subrounded, 1 mm - >5 cm, <5% olivines altered to friable iddingsite. Matrix is poorly sorted and consists of angular basalt fragments and clay. 72–85 cm, fractured, altered basalt with steeply dipping (70 degrees) slickensides. 85–131 cm, massive basalt which is microcrystalline with visible, randomly oriented, 1 mm plagioclase laths.

VESICLES: 10%; 0.2–2 mm; Irregular; Vesicles in the massive basalt are lined or filled with translucent, pale green (5G 7/2) zeolite and some centers are of friable white (N9) or soft, expanding, light brown (5YR 6/4) clay. Breccia clasts have 10%, irregular, 0.5–1 mm vesicles filled with white (N9) clay.

COLOR: Clasts are reddish black (10R 2.5/1). Breccia matrix clay is weak red (10R 4/4). Massive basalt matrix is dark reddish gray (10R 3/1).

STRUCTURE: 0–72 cm, flow-top breccia. 72–131, massive portion of the flow.

ALTERATION: Flow-top breccia is oxidized, authigenic clay has formed a matrix, and presumably the groundmasses of the clasts have been partially replaced by clay. The massive basalt is somewhat altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

△ Breccia

⊠ X-Xenoliths

144-878A-88R-3

UNIT 20: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-7

CONTACTS: Continues from Section 88R-2.

PHENOCRYSTS:

Olivine - 3%; 0.53 mm; Euhedral and broken, iddingsitized. (xenocrysts?).

Olivine - 20%; 0.1-0.3 mm; Equant, anhedral, iddingsitized.

Clinopyroxene - <1%; 1-5 mm; Subhedral prisms, fresh except for pale green (5G 7/2) clay or calcite rims.

GROUNDMASS: Microcrystalline with some visible, randomly oriented, 1 mm plagioclase laths.

VESICLES: <1%; 0.5-3 mm; Subround; Lined or filled with translucent, pale green (5G 7/2) zeolite and some centers are of friable white (N9) clay. 16-22 cm and 62-74 cm, up to 20%, irregular, interconnecting, 2 mm patches of white (N9) clay.

COLOR: Massive basalt matrix is medium gray (N5).

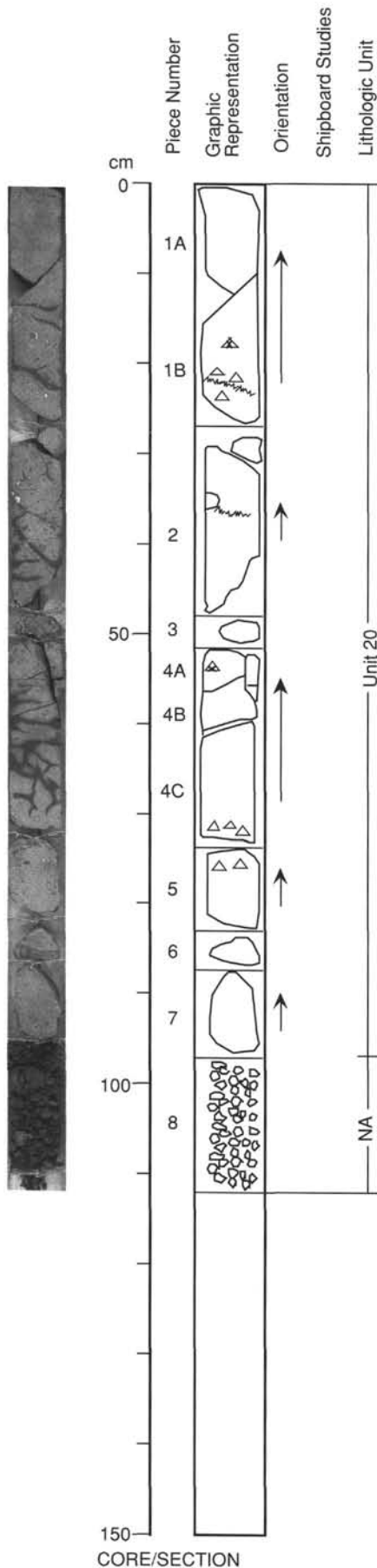
STRUCTURE: Massive.

ALTERATION: Somewhat altered, but less so than in Sections 88R-2 and 88R-3.

VEINS/FRACTURES: <<1%; <1 mm; Subhorizontal; Calcite. Random, closely (2-3 cm) spaced fractures throughout the section.

ADDITIONAL COMMENTS: Piece 8 consists of small, clay-rich fragments of weathered basalt, not part of this unit.

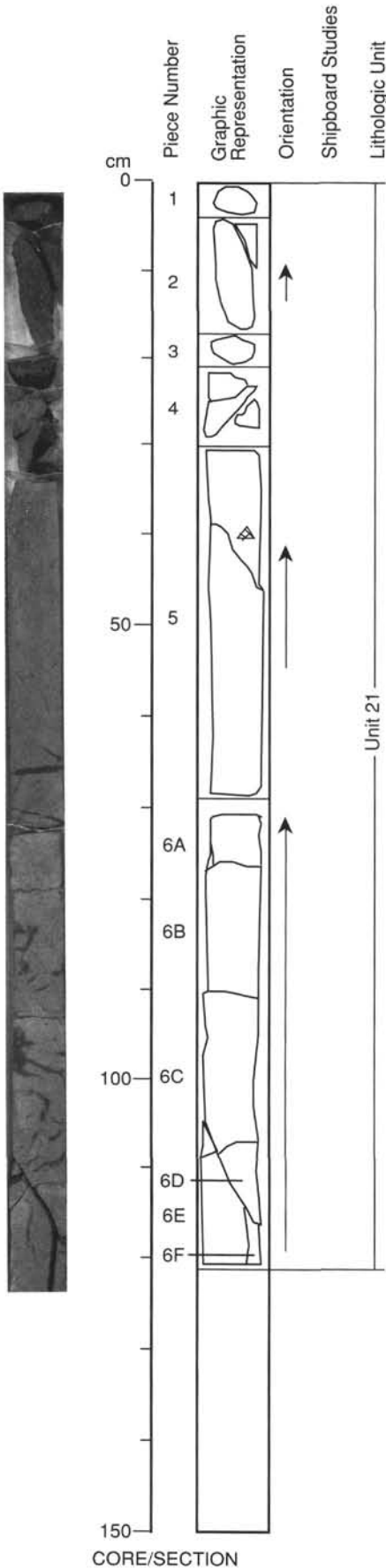
- △ Breccia
- ⊠ X-Xenoliths
- Vesicles



CORE/SECTION

UNIT 21: OLIVINE-CLINOPYROXENE BASALT

Pieces 1-6F



CONTACTS: Continues into Section 89R-2.

PHENOCRYSTS:

Olivine - 1%-5%; 1-5 mm; Subhedral, replaced by iddingsite plus translucent grayish olive (10Y 4/2) clay (xenocrysts?).

Olivine - 20%; 0.1-0.3 mm; Anhedral, iddingsitized.

Clinopyroxene - 3%-5%; 0.5-3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Above 20 cm, 15%, 2 mm, interconnected and irregular vesicles filled with white (N9) clay. Sparse to absent elsewhere.

COLOR: 0-20 cm, dark reddish gray (10R 4/1); 20-121 cm, medium gray (N5).

STRUCTURE: Massive.

ALTERATION: Color suggests some alteration, and all olivine has been pseudomorphed, but this is a relatively fresh unit.

VEINS/FRACTURES: Microfractures, about every 2 cm, dipping 70 degrees, are evident on the outside surface of the core.

ADDITIONAL COMMENTS: None.

144-878A-89R-2

UNIT 21: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-6

CONTACTS: Continues into Section 89R-2.

PHENOCRYSTS:

Olivine - 1%-5%; 1-5 mm; Subhedral, replaced by iddingsite plus translucent grayish olive (10Y 4/2) clay (xenocrysts?).

Olivine - 20%; 0.1-0.3 mm; Anhedral, iddingsitized.

Clinopyroxene - 3%-5%; 0.5-3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Sparse to absent, filled with white (N9) clay.

COLOR: Medium gray (N5).

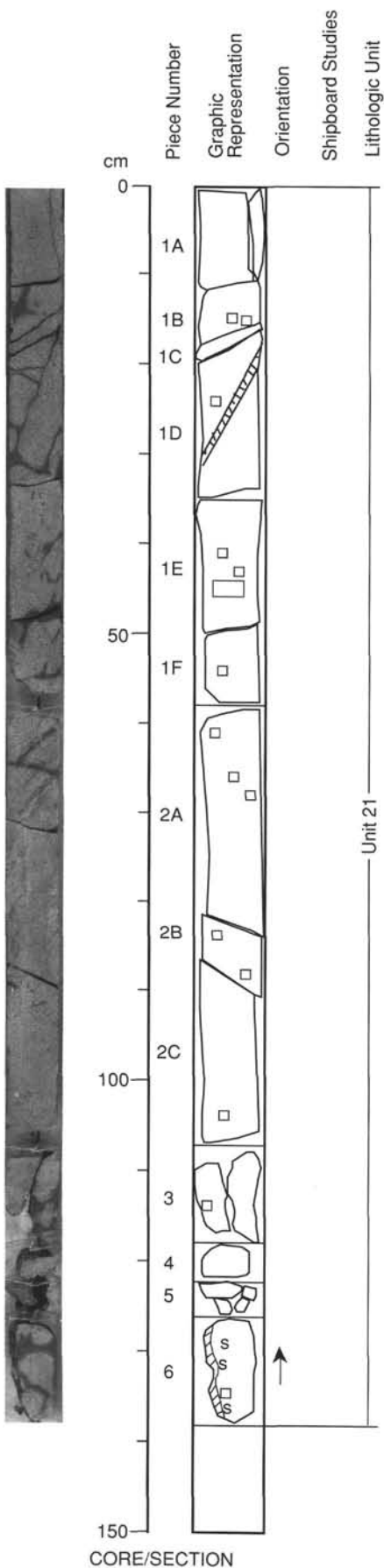
STRUCTURE: Massive.

ALTERATION: This is a relatively fresh unit. However, at 126-136 cm, slickensides occur in fractures filled with pale green (5G 7/2) serpentine.

VEINS/FRACTURES: Microfractures, about every 1 cm, dipping 70 degrees, are evident on the outside surface of the core.

ADDITIONAL COMMENTS: Only serpentine found in Leg 144 basalts. Contains about 5%, small (<1 cm) xenoliths. Dunite at 44 cm and 67 cm; The rest are gabbro.

- Xenolith
- ▨ Clay filled vein
- s Serpentine



144-878A-89R-3

UNIT 21: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-9

CONTACTS: Continues from Section 89R-2 and into Section 89R-4.

PHENOCRYSTS:

Olivine - 1%-5%; 1-5 mm; Subhedral, replaced by iddingsite plus translucent grayish olive (10Y 4/2) clay (xenocrysts?).

Olivine - 20%; 0.1-0.3 mm; Anhedral, iddingsitized.

Clinopyroxene - 3%-5%; 0.5-3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Sparse to absent, filled with white (N9) clay.

COLOR: Medium gray (N5).

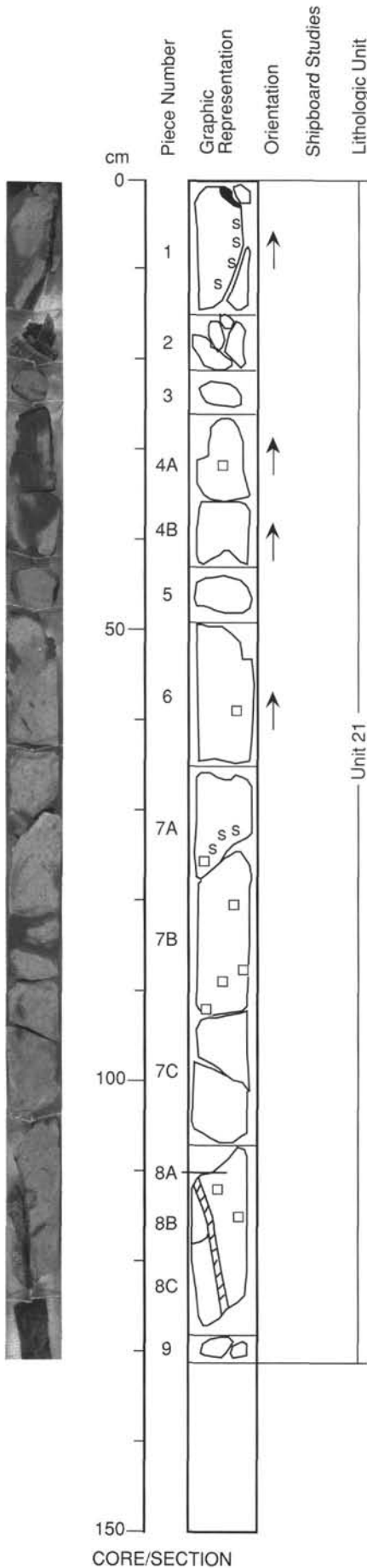
STRUCTURE: Massive.

ALTERATION: This is a relatively fresh unit. However, at 5-15 cm and 70-75 cm, slickensides occur in pale green (5G 7/2) serpentine-filled fractures.

VEINS/FRACTURES: Microfractures, about every 1 cm, near vertical, are evident on the outside surface of the core.

ADDITIONAL COMMENTS: Only serpentine found in Leg 144 basalts. Basalt contains about 5%, small (<1 cm) xenoliths. 15 mm diameter clinopyroxene oikocryst (includes plagioclase) at 30 cm.

- s Serpentine
- Larger xenoliths/xenocrysts
- ▨ Clay vein

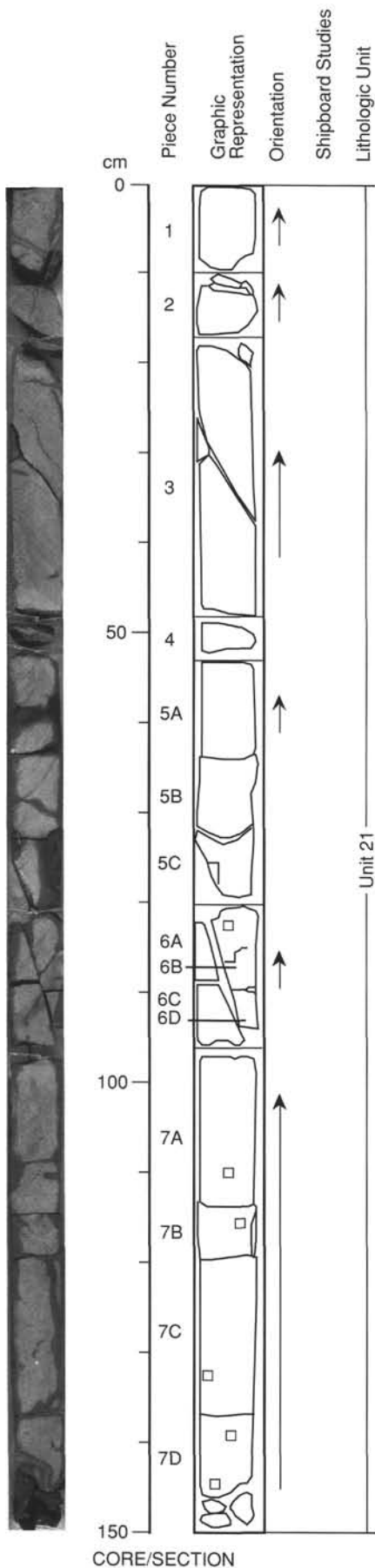


CORE/SECTION

144-878A-89R-4

UNIT 21: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-7



CONTACTS: Continues from Section 89R-3 and into Section 89R-5.

PHENOCRYSTS:

- Olivine - 1%-5%; 1-5 mm; Subhedral, replaced by iddingsite plus translucent grayish olive (10Y 4/2) clay (xenocrysts?).
- Olivine - 20%; 0.1-0.3 mm; Anhedral, iddingsitized.
- Clinopyroxene - 3%-5%; 0.5-3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Sparse to absent, filled with white (N9) clay.

COLOR: Medium gray (N5).

STRUCTURE: Massive.

ALTERATION: This is a relatively fresh unit.

VEINS/FRACTURES: 0-20 cm, microfractures, about every 1 cm, near vertical, are evident on the outside surface of the core. Below 20 cm, these fractures are sparse.

ADDITIONAL COMMENTS: 44-76 cm, basalt is fresh and xenolith/xenocryst-free. Otherwise, xenoliths comprise about 5% of the rock.

UNIT 21: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1–15

CONTACTS: Continues from Section 89R-4 and into Section 90R-1.

PHENOCRYSTS:

Olivine - 1%–5%; 1–5 mm; Subhedral, replaced by iddingsite plus translucent grayish olive (10Y 4/2) clay (xenocrysts?).

Olivine - 20%; 0.1–0.3 mm; Anhedral, iddingsitized.

Clinopyroxene - 3%–5%; 0.5–3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Sparse to absent, filled with white (N9) clay.

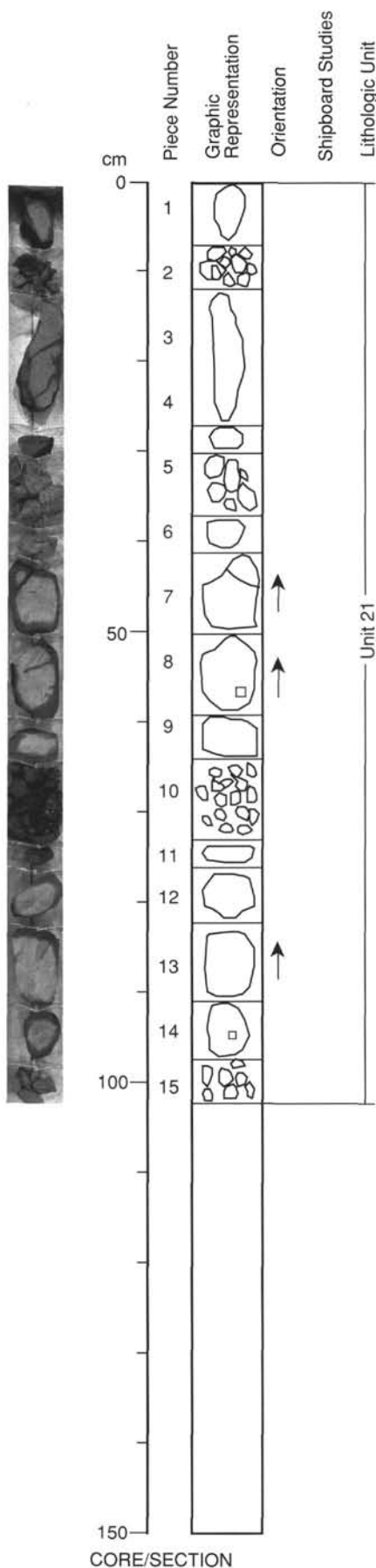
COLOR: Medium gray (N5).

STRUCTURE: Massive.

ALTERATION: This is a relatively fresh unit. Partially iron-stained below 40 cm.

VEINS/FRACTURES: Fractures are sparse.

ADDITIONAL COMMENTS: Xenoliths comprise about 5% of the rock.



144-878A-90R-1

UNIT 21: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-6

CONTACTS: Continues from Section 89R-5 and into Section 90R-2.

PHENOCRYSTS:

Olivine - 1%-5%; 1-5 mm; Subhedral, replaced by iddingsite plus translucent grayish olive (10Y 4/2) clay (xenocrysts?).

Olivine - 20%; 0.1-0.3 mm; Anhedral, iddingsitized.

Clinopyroxene - 3%-5%; 0.5-3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Sparse to absent, filled with white (N9) clay.

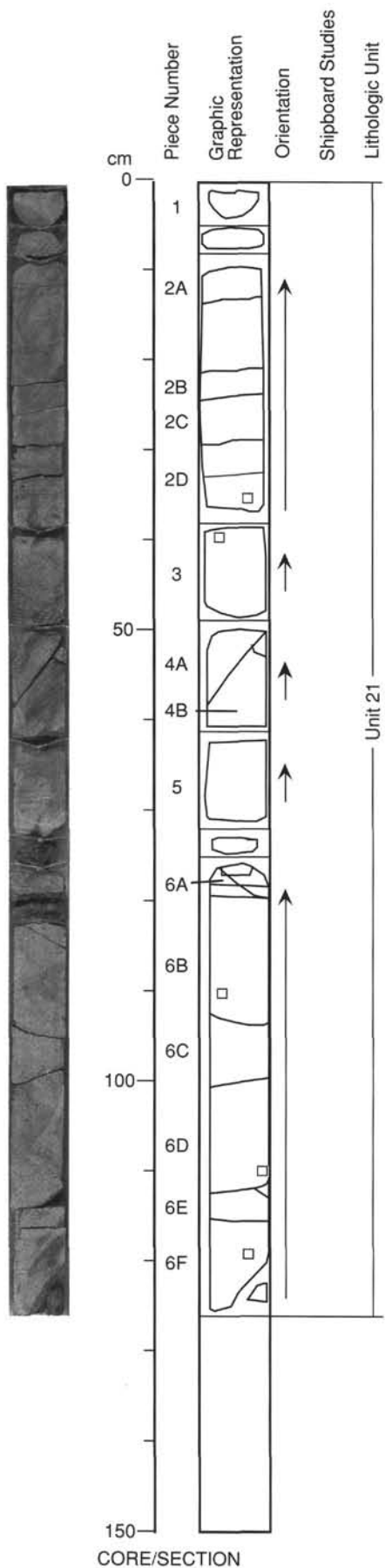
COLOR: Medium gray (N5), with 1 cm wide, iron-stained moderate yellowish brown (10YR 5/4) bands.

STRUCTURE: Massive.

ALTERATION: This is a relatively fresh unit. Partially iron-stained. 10-25 cm, 40-45 cm, and 90-100 cm appear to be unaltered. 100-115 cm, dusky green (5G 3/2), 0.2-0.5 mm clay patches in the matrix.

VEINS/FRACTURES: Fractures are sparse.

ADDITIONAL COMMENTS: Xenoliths comprise about 5% of the rock.



144-878A-90R-2

UNIT 21: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1A-2A

CONTACTS: Continues from Section 90R-1.

PHENOCRYSTS:

- Olivine - 1%-5%; 1-5 mm; Subhedral, iddingsitized.
- Olivine - 20%; 0.1-0.3 mm; Anhedral, iddingsitized.
- Clinopyroxene - 3%-5%; 0.5-3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Sparse to absent, filled with white (N9) clay, except 32-41 cm and 50-55 cm, where there are concentrations up to 40% of irregular, interconnected, 0.5-3 mm vesicles filled with white (N9) clay.

COLOR: Medium gray (N5) grading to dark reddish gray (10R 3/1) downsection.

STRUCTURE: Massive.

ALTERATION: This is a relatively fresh unit. Partially iron-stained.

VEINS/FRACTURES: Fractures are sparse.

ADDITIONAL COMMENTS: Xenoliths comprise about 5% of the rock. This zone represents alteration at the base of the flow.

UNIT 22: OLIVINE-PLAGIOCLASE-CLINOPYROXENE BASALT

Pieces 2B, 2C, 3

CONTACTS: Continues into Section 90R-3.

PHENOCRYSTS: Clinopyroxenes do not appear in the flow-top breccia.

- Plagioclase - <<1%; 1-5 mm; Laths altered to white (N9) clay or zeolite.
- Olivine - <1%; 1-3 mm; Subhedral, iddingsitized.

GROUNDMASS: Clasts are 1-50 mm, angular to subrounded and aphanitic. Matrix is sand-sized volcaniclastic grains and authigenic clay.

VESICLES: 2%; 0.5-2 mm; Irregular; Filled with white (N9) clay.

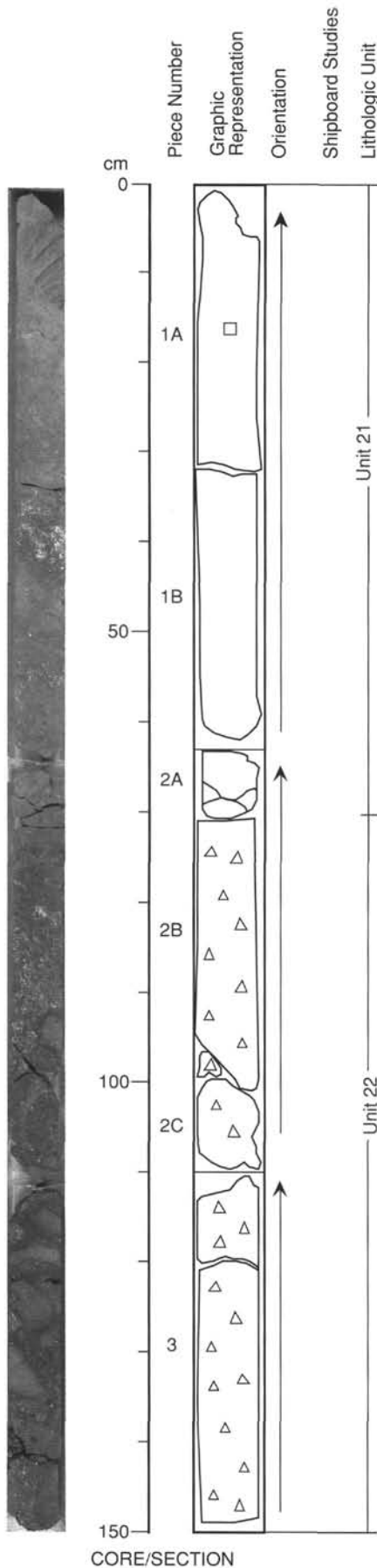
COLOR: Clasts are dark gray (N3), dusky red (5R 3/4), grayish red (10R 4/2) and moderate bluish gray (5B 6/1). Matrix clays are dusky red (5R 3/4) and white (N9).

STRUCTURE: Flow-top breccia.

ALTERATION: Clasts are oxidized and weathered. Clay replaces clasts and matrix grains. Many of the clasts have 5 mm-thick weathering rinds of darker shades.

VEINS/FRACTURES: Clasts have tiny (1-5 mm-long, <1 mm-wide), domly oriented fractures which are filled with dusky blue green (5BG 3/2) clay.

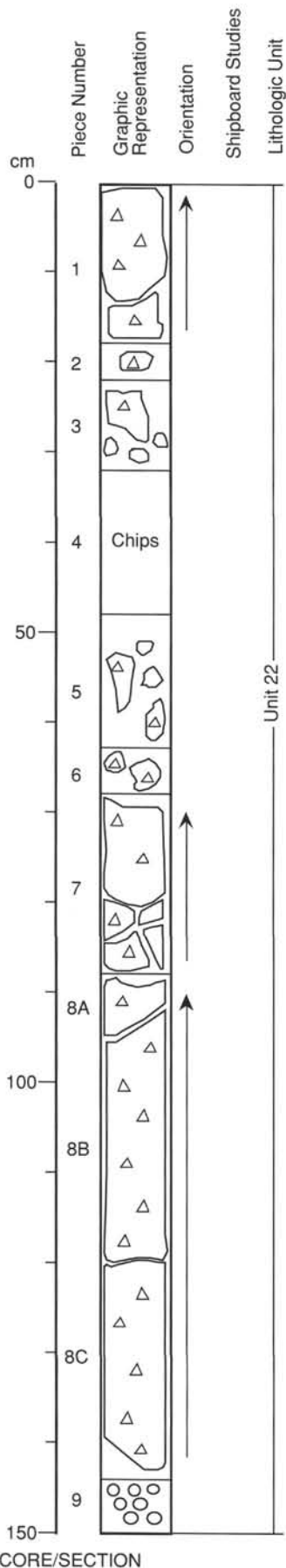
ADDITIONAL COMMENTS: A few clasts are ultramafic xenolith fragments.



144-878A-90R-3

UNIT 22: OLIVINE-PLAGIOCLASE-CLINOPYROXENE BASALT (continued)

Pieces 1-9



CONTACTS: Continues from Section 90R-2 and into Section 90R-4.

PHENOCRYSTS: Clinopyroxenes do not appear in the flow-top breccia.

Plagioclase - <<1%; 1-5 mm; Laths altered to white (N9) clay or zeolite.

Olivine - <1%; 1-3 mm; Subhedral, iddingsitized.

GROUNDMASS: Clasts are 1-70 mm, angular to subrounded and aphanitic. Matrix is sand-sized volcaniclastic grains and authigenic clay.

VESICLES: 2%; 0.5-2 mm; Irregular; Filled with white (N9) clay.

COLOR: 0-85 cm, clasts are dark gray (N3), dusky red (5R 3/4), grayish red (10R 4/2) and moderate bluish gray (5B 6/1). Matrix clays are dusky red (5R 3/4) and white (N9). See Additional Comments.

STRUCTURE: Flow-top breccia.

ALTERATION: Clasts are oxidized and weathered. Clay replaces clasts and matrix grains. Many of the clasts have 5 mm-thick weathering rinds of darker shades. Clasts have more typical unaltered basalt colors below 85 cm, suggesting that they are less altered.

VEINS/FRACTURES: Clasts have tiny (1-5 mm-long, <1 mm-wide), randomly oriented fractures which are filled with dusky blue green (5BG 3/2) clay.

ADDITIONAL COMMENTS: A few clasts are ultramafic xenolith fragments. Colors: 85-150 cm, clasts are dark gray (N3), medium gray (N5), and medium bluish gray (5B 5/1). Matrix clays are white (N9) and grayish red (5R 4/2).

144-878A-90R-4

UNIT 22: OLIVINE-PLAGIOCLASE-CLINOPYROXENE BASALT (continued)

Pieces 1-9

CONTACTS: Continues from Section 90R-3. Sharp contact with Unit 23 at 143 cm.

PHENOCRYSTS:

Plagioclase - <1%-3%; 1-7 mm; Rounded laths, partially altered to white (N9) clay or zeolite, but clear patches appear fresh.

Olivine - 5%; 0.5-3 mm; Rounded, altered to reddish yellow (5YR 6/8) clay.

Clinopyroxene - <1%; 0.5-2 mm; Rounded, altered to dark reddish brown (10R 3/4).

GROUNDMASS: Microcrystalline.

VESICLES: <1%; 1-3 mm; Irregular; Filled with white (N9) clay.

COLOR: Medium to medium dark gray (N5-N4).

STRUCTURE: Massive.

ALTERATION: Phenocrysts and xenoliths are almost entirely replaced by clays and zeolites. Unit has presumably had considerable clay development in the groundmass. 100-104 cm, irregular patches (<1 cm) of white clay with lesser calcite. May be replacing a xenolith.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: 0-12 cm is flow-top breccia; see the description for the lower portion of Section 90R-3. Ultramafic xenoliths are 3-15 mm, subangular to round, and completely altered, except for occasional fresh clinopyroxene.

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT

Piece Bottom of 9

CONTACTS: Sharp contact with Unit 22 at 145 cm. Continues into Section 90R-5.

PHENOCRYSTS: Phenocryst abundances as seen in the flow-top breccia clasts.

Olivine - 3%; 0.5-3 mm; Subhedral to round, iddingsitized.

Clinopyroxene - <<1%; <2 mm; Mostly altered.

Plagioclase - <1%; 1-4 mm; Prisms and laths altered to white (N9) clay or zeolite.

GROUNDMASS: Clasts have indistinct boundaries but appear to be 3-100 mm in diameter and subrounded. Matrix is comprised of sand-sized volcanoclastic grains and clay.

VESICLES: <1%; 0.25-2 mm; Irregular and interconnected; In clasts; Filled with white (N9) clay.

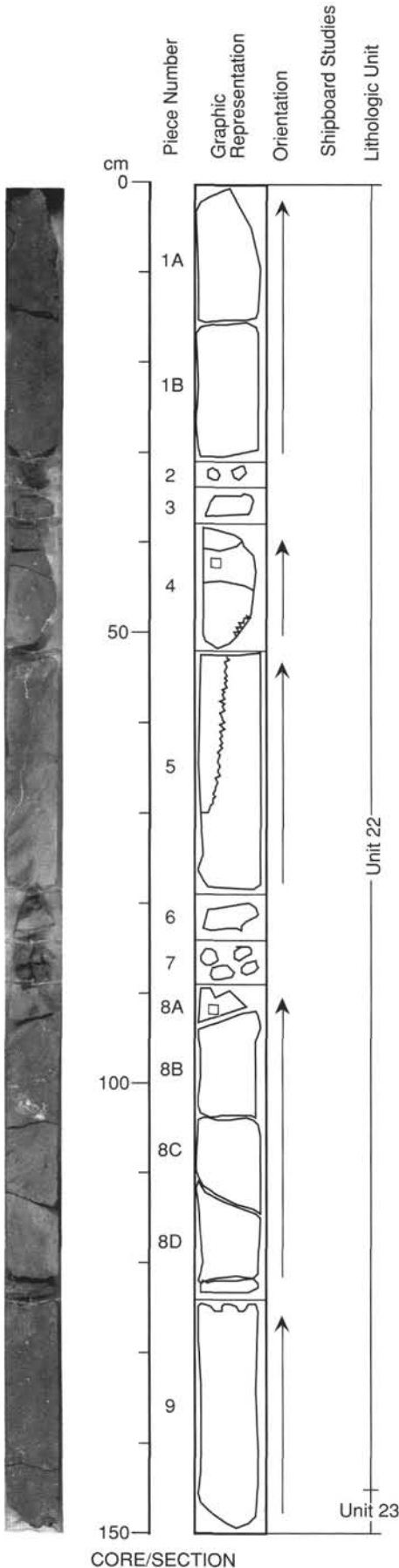
COLOR: Clasts are gray (10YR 5/1) and weak red (10R 4/2). Matrix clays are light gray (N7) and white (N9).

STRUCTURE: Flow-top breccia.

ALTERATION: Some oxidation and obvious clay development in the matrix. Almost all phenocrysts have been replaced by clay.

VEINS/FRACTURES: None.

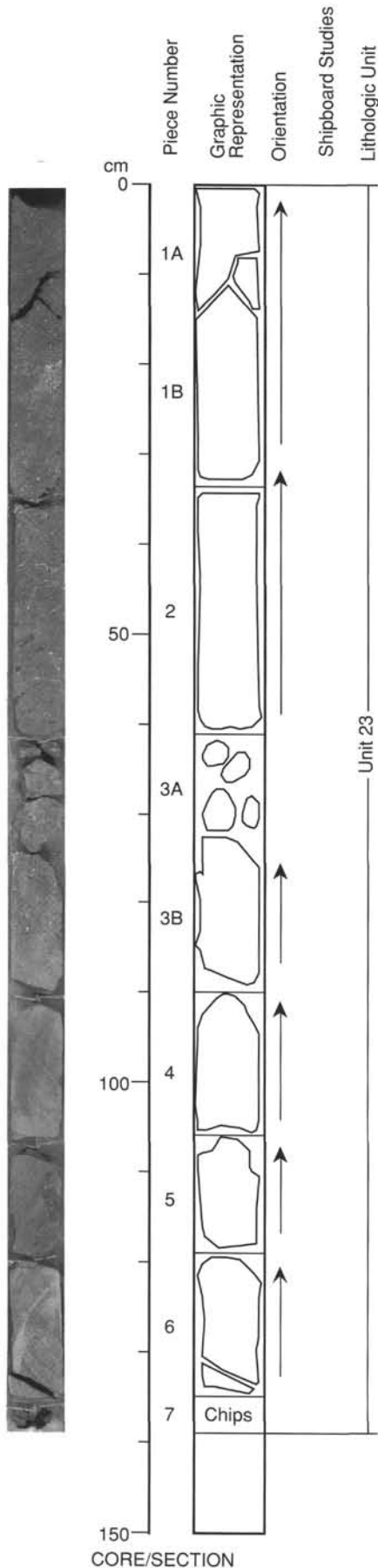
ADDITIONAL COMMENTS: None.



144-878A-90R-5

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-7



CONTACTS: Continues from Section 90R-4 and into Section 90R-6.

PHENOCRYSTS: Phenocryst abundances as seen in the massive basalt (below 25 cm). For clast phenocryst abundances see Section 90R-4.

Olivine - 20%; <0.5-3 mm; Subhedral to round, iddingsitized.

Clinopyroxene - 15%; 1-3 mm; Prisms and rounded shapes, clay alteration along fractures, but otherwise fresh.

Plagioclase - <1%; 1-3 mm; Prisms and laths, some altered to white (N9) clay or zeolite, others fresh.

GROUNDMASS: 0-25 cm, clasts have indistinct boundaries but appear to be 3-100 mm in diameter and subrounded. Matrix is comprised of sand-sized volcanoclastic grains and clay. 25-139 cm, groundmass of massive basalt is microcrystalline.

VESICLES: 0-25 cm, <1%, 0.25-2 mm, irregular and interconnected, white (N9) clay-filled vesicles. 25-59 cm, <5%, 0.5-6 mm, very irregular and interconnected, filled with white (N9) clay. Very sparse below 59 cm.

COLOR: 0-25 cm, clasts are gray (10YR 5/1) and weak red (10R 4/2). Matrix clays are light gray (N7) and white (N9). 25-139 cm, groundmass grades downsection from medium light gray (N6) to medium gray (N5).

STRUCTURE: 0-25 cm, flow-top breccia. 25-139 cm, massive.

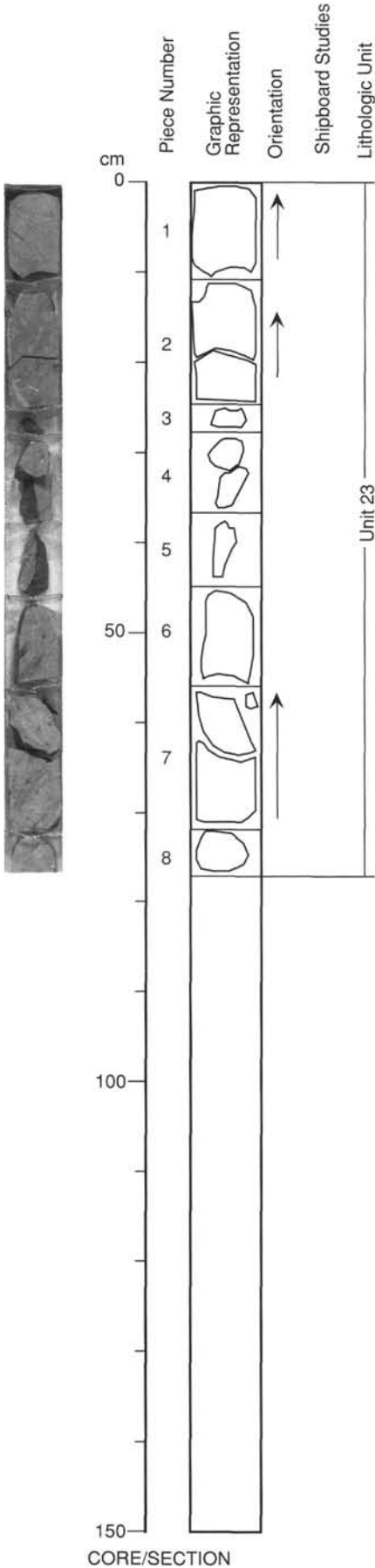
ALTERATION: Groundmass is weathered, as evidenced by the color changes downsection, and many phenocrysts have been replaced by clay.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: 4 cm long, olivine clinopyroxenite xenolith at 111-114 cm. Other, smaller, more altered xenoliths elsewhere, but sparse.

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-8



CONTACTS: Continues from Section 90R-5 and into 91R-1.

PHENOCRYSTS:

Olivine - 20%; <0.5-3 mm; Subhedral to round, iddingsitized.

Clinopyroxene - 15%; 1-3 mm; Prisms and rounded shapes, clay alteration along fractures, but otherwise fresh.

Plagioclase - <1%; 1-3 mm; Prisms and laths, some altered to white (N9) clay or zeolite, others fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Almost none.

COLOR: Medium gray (N5).

STRUCTURE: Massive.

ALTERATION: Groundmass is weathered, as evidenced by the color changes downsection, and many phenocrysts have been replaced by clay.

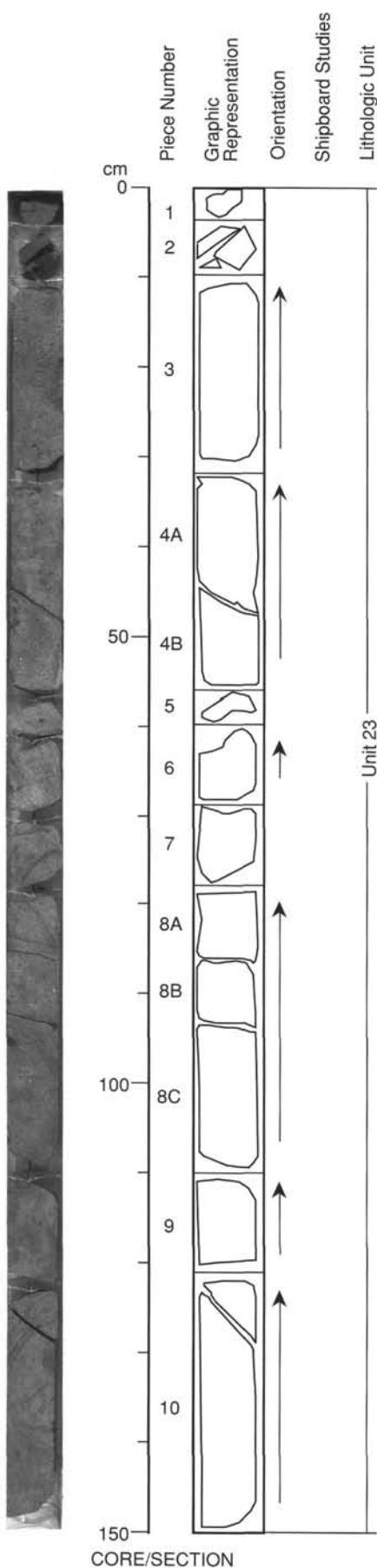
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Small (<1 cm), altered, sparse, xenoliths.

144-878A-91R-1

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-10



CONTACTS: Continues from Section 90R-6 and into 91R-2.

PHENOCRYSTS:

- Olivine - 5%; <0.5-3 mm; Subhedral to round, iddingsitized.
- Clinopyroxene - 3%; 0.5-4 mm; Prisms and rounded shapes, fresh.
- Plagioclase - <1%; 1-4 mm; Prisms and laths, mostly fresh.

GROUNDMASS: Microcrystalline.

VESICLES: 0-50 cm, 5%, 0.5-8 mm in diameter, irregular, filled with moderate yellowish green (10GY 5/4), expanding clay and lesser calcite. 50-150 cm, 3%, 0.5-2 mm in diameter, round, filled with moderate yellowish green (10GY 5/4), expanding clay.

COLOR: Greenish black (5G 2/1).

STRUCTURE: Massive.

ALTERATION: Unit is becoming less altered downsection. More unaltered phenocrysts.

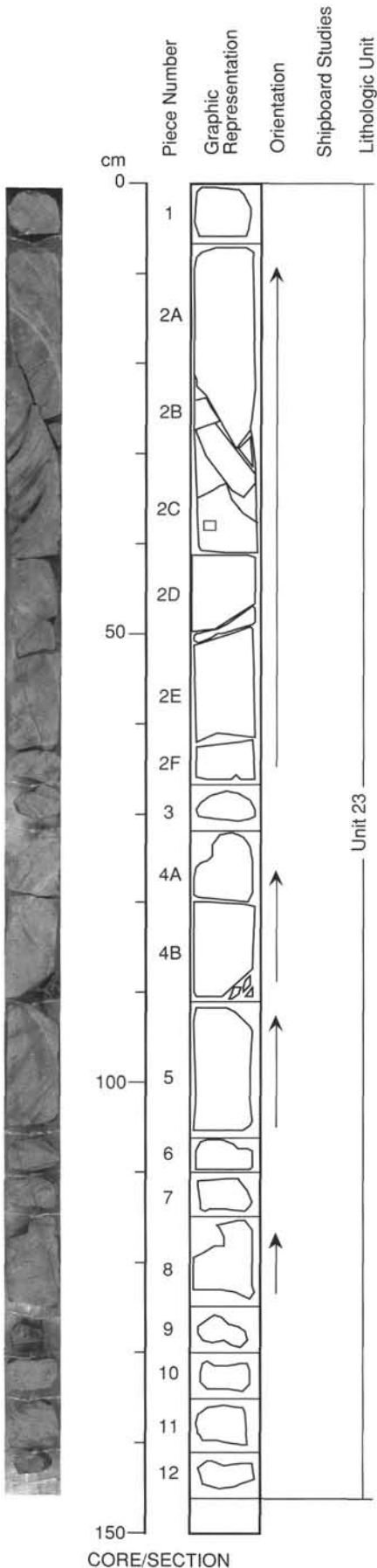
VEINS/FRACTURES: 84 cm, 1 mm-wide vein filled with dusky green (5G 3/2) clay.

ADDITIONAL COMMENTS: Small (<2.5 cm), subangular, sparse, xenoliths with iddingsitized olivine and fresh clinopyroxene.

CORE/SECTION

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1–12



CONTACTS: Continues from Section 91R-1 and into 91R-3.

PHENOCRYSTS:

- Olivine - 5%; <0.5–3 mm; Subhedral to round, iddingsitized.
- Clinopyroxene - 3%; 0.5–4 mm; Prisms and rounded shapes, fresh.
- Plagioclase - <1%; 1–4 mm; Prisms and laths, mostly fresh.

GROUNDMASS: Microcrystalline.

VESICLES: <3%, 0.5–2 mm in diameter, round, filled with moderate yellowish green (10GY 5/4), expanding clay.

COLOR: 0–80 cm, greenish black (5G 2/1); 80–144 cm, gray (7.5YR 5/0).

STRUCTURE: Massive.

ALTERATION: 0–80 cm, there are patches of iron-stained groundmass. These are pale reddish brown (10R 5/4), moderate reddish orange (10R 6/6) and grayish orange (10YR 7/4). Fractures throughout the section have 1 mm rims with strong iron-staining, moderate reddish brown (10R 4/6).

VEINS/FRACTURES: Every 5–15 cm, fractures (weathering planes) occur, dipping 60 degrees on average.

ADDITIONAL COMMENTS: Small (<2.5 cm), subangular, sparse, xenoliths with iddingsitized olivine and fresh clinopyroxene.

144-878A-91R-3

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1–8

CONTACTS: Continues from Section 91R-2 and into 91R-4.

PHENOCRYSTS:

- Olivine - 5%; <0.5–3 mm; Subhedral to round, iddingsitized where the unit is iron-stained, fresh elsewhere.
- Clinopyroxene - 3%; 0.5–4 mm; Prisms and rounded shapes, fresh.
- Plagioclase - <1%; 1–4 mm; Prisms and laths, mostly fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Trace, 0.5–5 mm in diameter, round, filled with pale olive (10Y 6/2), expanding clay.

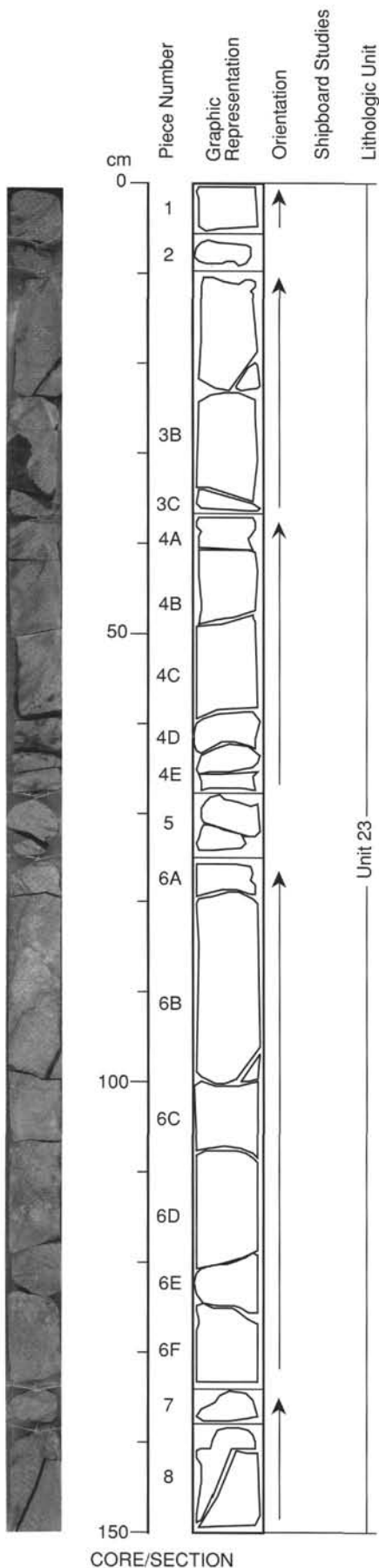
COLOR: Gray (7.5YR 5/0).

STRUCTURE: Massive.

ALTERATION: 6–30 cm and 60–67 cm, there are patches of iron-stained groundmass. These are pale reddish brown (10R 5/4), and grayish orange (10YR 7/4).

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Small (<2.5 cm), subangular, sparse, xenoliths with iddingsitized olivine and fresh clinopyroxene.



CORE/SECTION

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-13

CONTACTS: Continues from Section 91R-3 and into 91R-5.

PHENOCRYSTS:

Olivine - 5%; <0.5-3 mm; Subhedral to round; 0-22 cm, fresh; 22-144 cm, iddingsitized.
 Clinopyroxene - 3%; 0.5-4 mm; Prisms and rounded shapes, fresh. 3-7 mm glomerocrysts are becoming more common, 1% Plagioclase - <1%; 1-4 mm; Prisms and laths, mostly fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Trace, 0.5-5 mm in diameter, round, filled with pale olive (10Y 6/2), expanding clay.

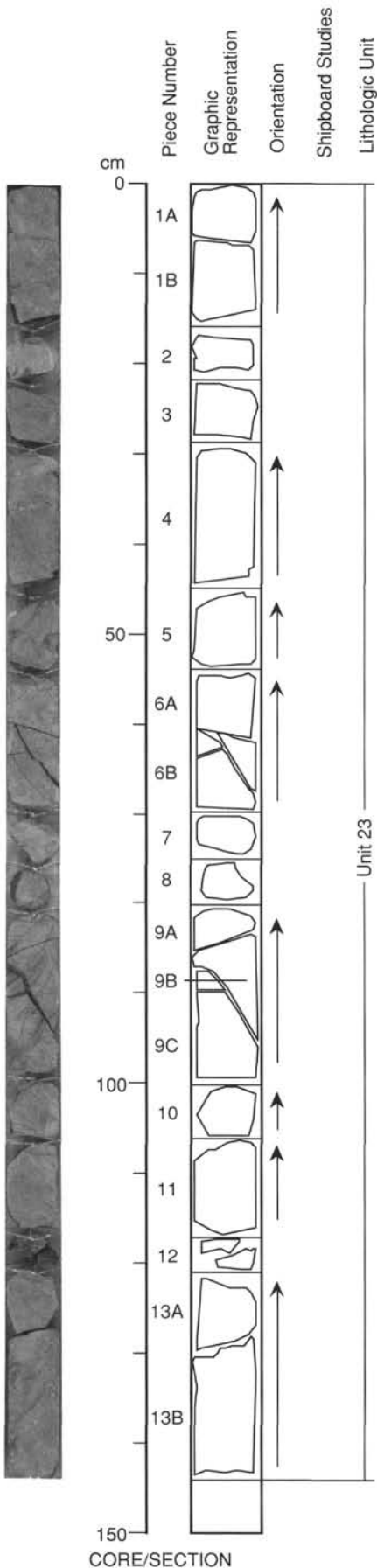
COLOR: Gray (7.5YR 5/0).

STRUCTURE: Massive.

ALTERATION: Brownish color suggests some replacement of groundmass by clay. Olivine is again pseudomorphed by clay. Not as fresh as Section 91R-2.

VEINS/FRACTURES: None.

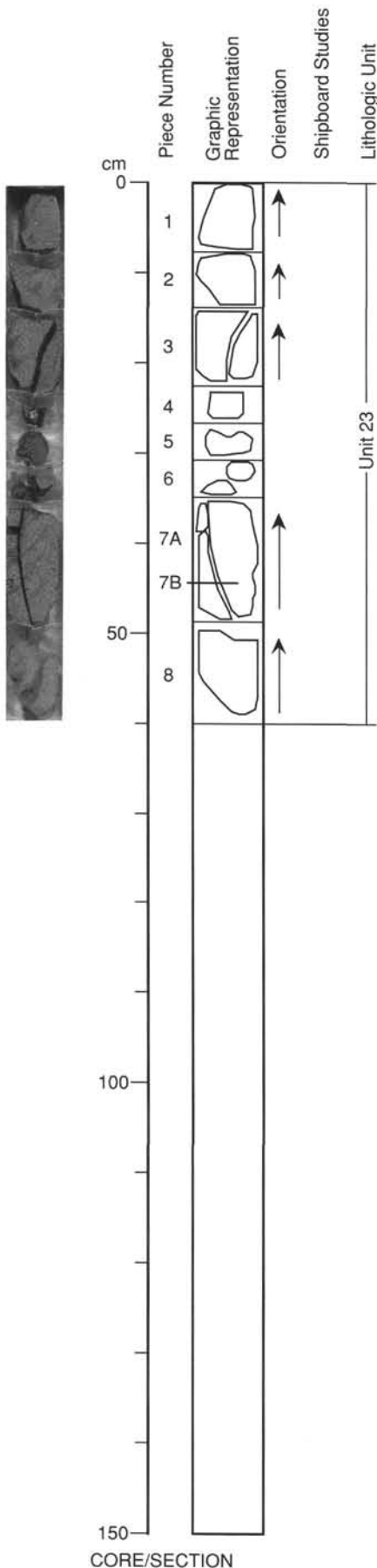
ADDITIONAL COMMENTS: Small (<2.5 cm), subangular, sparse, xenoliths with iddingsitized olivine and fresh clinopyroxene.



144-878A-91R-5

UNIT 23: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-8



CONTACTS: Continues from Section 91R-4.

PHENOCRYSTS:

- Olivine - 5%; <0.5-3 mm; Subhedral to round, iddingsitized.
- Clinopyroxene - 3%; 0.5-4 mm; Prisms and rounded shapes, fresh. 3-7 mm glomerocrysts are becoming more common, 2%.
- Plagioclase - <1%; 1-4 mm; Prisms and laths, mostly fresh.

GROUNDMASS: Microcrystalline.

VESICLES: Trace, 0.5-5 mm in diameter, round, filled with pale olive (10Y 6/2), expanding clay.

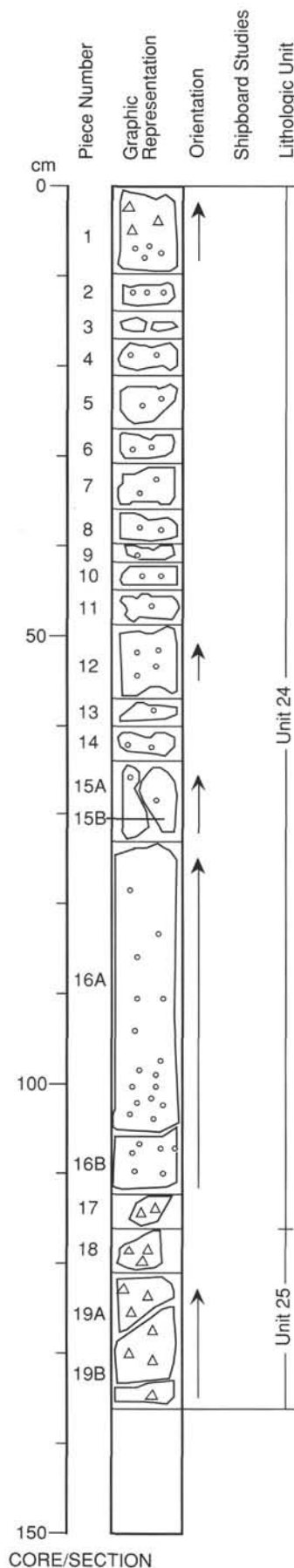
COLOR: Gray (7.5YR 5/0).

STRUCTURE: Massive.

ALTERATION: Brownish color suggests some replacement of groundmass by clay. Olivines are again pseudomorphed by clay. Not as fresh as Section 91R-2.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Small (<2.5 cm), subangular, sparse, xenoliths with iddingsitized olivine and fresh clinopyroxene.



UNIT 24: OLIVINE BASALT

Pieces 1-17

CONTACTS: None.

PHENOCRYSTS: Abundances as seen in the massive portion of the flow.

Olivine - 3%-15%; <0.5-4 mm; Euhedral to round, iddingsitized, abundance increases downsection. Clinopyroxene - <<1%; 1-4 mm; Prisms to rounded shapes, fresh.

GROUNDMASS: 0-8 cm, clasts are 8-15 mm, aphanitic, slightly vesicular, subangular; Matrix is clay. 8-116 cm, microcrystalline.

VESICLES: 8-21 cm, grades downsection from 20% to 3%, 1-5 mm, subround, white (N9) and translucent pale green (5G 7/2) clay-filled vesicles. 21-63 cm, varies from 3%-15%, 1-15 mm, round to irregular, some are vertically elongate, lined or filled with greenish gray (5G 6/1) clay. 63-116 cm, varies from 0-10%, 1-6 mm, round, filled with white (N9), greenish gray (5G 6/1), and dusky blue green (5BG 3/2) clays.

COLOR: 0-8 cm, clasts are dusky red (5R 3/4); matrix is grayish red (10R 4/2). 8-116 cm, massive basalt grades from grayish red (5R 4/2) to moderate bluish gray (5B 6/1).

STRUCTURE: 0-8 cm, flow-top breccia; 8-116 cm, massive basalt.

ALTERATION: Flow-top breccia is soft - extensive clay development. 63-116 cm, the matrix is iron-stained in small spots of pale reddish brown (10R 3/4). Vesicles are lined or filled and olivines are pseudomorphed.

VEINS/FRACTURES: Diagonal vein from 103-110 cm, filled with pale green (5G 7/2) clay and moderate yellowish brown to dark reddish brown (10YR 5/4 to 10R 3/4) material.

ADDITIONAL COMMENTS: First of a series of small (<3 m) flows which are quite altered and have recovered flow-top breccias.

UNIT 25: OLIVINE-CLINOPYROXENE BASALT

Pieces 18-19

CONTACTS: Continues into Section 92R-2.

PHENOCRYSTS: Abundances in flow-top breccia clasts.

Olivine - <<1%; 1-5 mm; Rounded or broken, iddingsitized.

GROUNDMASS: Clast boundaries are indistinct, but they appear to be angular, 2-30 mm, and aphanitic. Matrix is comprised of sand-sized volcanoclastic grains and clay.

VESICLES: 2%-15%; 1-3 mm; Irregular; filled with white (N9) clay. Description of the clasts.

COLOR: Clasts are dark reddish brown (10R 3/4) and blackish red (5R 2/2). Matrix clays are white (N9), medium bluish gray (5B 5/1), and brownish gray (5YR 4/1).

STRUCTURE: Flow-top breccia.

ALTERATION: Flow-top breccia is oxidized and abundant clay has developed in the matrix.

VEINS/FRACTURES: None.

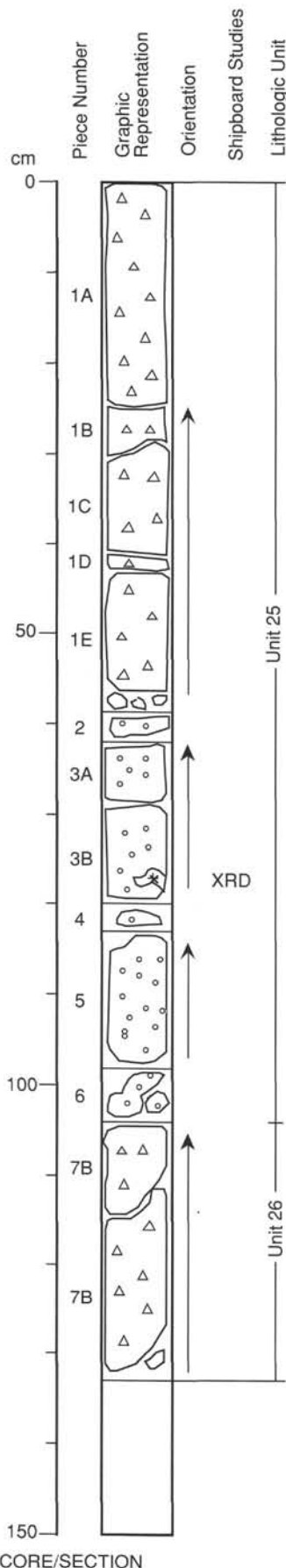
ADDITIONAL COMMENTS: Second of a series of small (<3 m) flows which are quite altered and have recovered flow-top breccias.

- Vesicle
- △ Flow-top breccia

144-878A-92R-2

UNIT 25: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-6



CONTACTS: Continues from Section 92R-1.

PHENOCRYSTS: Abundances in massive portion of the flow. See Section 92R-1 description for flow-top breccia clast abundances. Olivine - 10%; <0.5-4 mm; Euhedral to round, iddingsitized. Larger grains appear to be xenoliths. Clinopyroxene - <1%; 2-5 mm; Round, altered by clay along fractures but otherwise fresh.

GROUNDMASS: 0-44 cm, clast boundaries are indistinct, but they appear to be angular, 2-30 mm, and aphanitic. Matrix is comprised of sand-sized volcanoclastic grains and clay. 59-98 cm, massive basalt is microcrystalline.

VESICLES: 20%; 0.5-20 mm; Irregular; Some interconnectedness; Empty, lined with light bluish gray (5B 7/1) clay, filled with light bluish gray (5B 7/1) clay and pale yellow (2.5Y 8/4), clear, rhombic crystals of calcite.

COLOR: Clasts are dark reddish brown (10R 3/4) and blackish red (5R 2/2). Matrix clays are white (N9), medium bluish gray (5B 5/1), and brownish gray (5YR 4/1). Massive groundmass is medium gray (N5).

STRUCTURE: 0-44 cm, flow-top breccia. 44-59 cm, transition zone between breccia and massive flow. 59-98 cm, massive.

ALTERATION: Flow-top breccia is oxidized and abundant clay has developed in the matrix. Massive basalt has a soft-looking texture, which suggests moderate clay development.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Second of a series of small (<3 m) flows which are quite altered and have recovered flow-top breccias. 44-59 cm, transition zone has 5%, 1-2 mm, euhedral to broken, iddingsitized olivines, and 15%, irregular to interconnected, 0.5-4 mm vesicles which are filled with white (N9), light bluish gray (5B 7/1) and light red (5R 6/6) clay. The zone has a slightly mottled appearance, moderate to medium bluish gray (5B 6/1-5/1).

UNIT 26: OLIVINE BASALT

Piece 7

CONTACTS: Continues into Section 92R-3.

PHENOCRYSTS: Abundances in flow-top breccia clasts.

Olivine - 5%; 0.5-3 mm; Round, iddingsitized.

Clinopyroxene - <<1%; 0.5-1 mm; Altered prisms.

GROUNDMASS: Clasts are 0.5-10 cm, subangular to subrounded, and aphanitic. Matrix is comprised of sand-sized volcanoclastic grains and clay.

VESICLES: 1%-50%; 0.25-3 mm; Round to irregular; Variable clast-to-clast; Filled with white (N9) and light bluish gray (5B 7/1) clay.

COLOR: Clasts are brownish black (5YR 2/1), medium bluish gray (5B 5/1) and grayish red (10R 4/2). Matrix clays are medium bluish gray (5B 5/1) and reddish brown (10R 4/4).

STRUCTURE: Flow-top breccia.

ALTERATION: Flow-top breccia is oxidized and abundant clay has developed in the matrix.

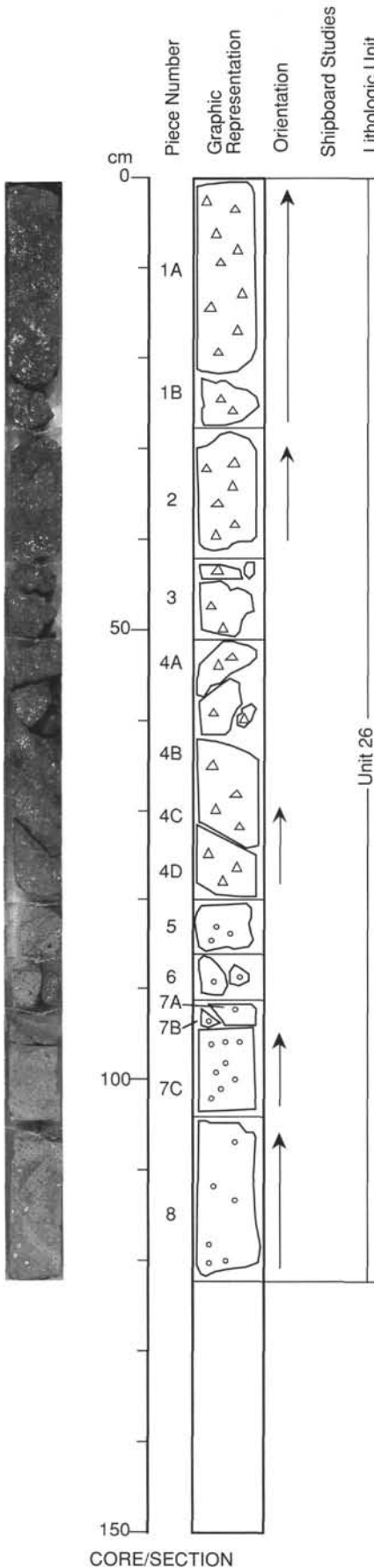
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Third of a series of small (<3 m) flows which are quite altered and have recovered flow-top breccias. At 39 cm, there is a small xenolith with altered moderate yellow green (5GY 7/4) olivines and fresh pyroxene.

- Vesicle
- △ Flow-top breccia

UNIT 26: OLIVINE BASALT (continued)

Pieces 1-8



CONTACTS: Continues from Section 92R-3 and into Section 92R-4.

PHENOCRYSTS: Abundances in massive portion of the flow. See Section 92R-2 for flow-top breccia clast abundances.

Olivine - 15%; <0.5-4 mm; Euhedral to broken and rounded, iddingsitized.

Clinopyroxene - <<1%; 1-5 mm; Rounded, fresh.

GROUNDMASS: 0-80 cm, clasts are 0.5-10 cm, subangular to subrounded, and aphanitic. Matrix is comprised of sand-sized volcanoclastic grains and clay. 80-123 cm, massive basalt is microcrystalline.

VESICLES: 3%-10%; <1-6 mm; Round to irregular; Describes massive portion; Lined with pale blue (5B 6/2) or filled with white (N9), pale blue green (5BG 7/2) and dusky blue green (5BG 3/2) clay.

COLOR: Clasts: brownish black (5YR 2/1), medium bluish gray (5B 5/1), grayish red (10R 4/2). Matrix clays: medium bluish gray (5B 5/1), reddish brown (10R 4/4). Massive basalt: medium light gray (N6).

STRUCTURE: 0-80 cm, flow-top breccia; 80-123 cm, massive basalt.

ALTERATION: Flow-top breccia is oxidized and abundant clay has developed in the matrix. Massive basalt appears to be somewhat altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Third of a series of small (<3 m) flows which are quite altered and have recovered flow-top breccias.

- o Vesicle
- Δ Flow-top breccia

144-878A-92R-4

UNIT 26: OLIVINE BASALT (continued)

Piece 1

CONTACTS: Continues from Section 92R-3.

PHENOCRYSTS:

Olivine - 15%; <0.5-4 mm; Euhedral to broken and rounded, iddingsitized.
Clinopyroxene - <<1%; 1-5 mm; Rounded, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: 1-10 mm; Round; Greenish gray (5G 6/1) and bluish white (5B 9/1) clay-filled, sparse vesicles.
At 8-13 cm, there is a half circle with 30% vesicles.

COLOR: Medium light gray (N6) with large, irregular, iron-stained (pale reddish brown (10R 5/4)) areas.

STRUCTURE: Massive.

ALTERATION: Iron-stained. Light color suggests some clay development.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Third of a series of small (<3 m) flows which are quite altered and have recovered flow-top breccias.

UNIT 27: OLIVINE-CLINOPYROXENE BASALT

Pieces 2-5

CONTACTS: Continues into Section 92R-5.

PHENOCRYSTS: Phenocryst description of clasts in flow-top breccia. See Section 92R-5 for massive basalt phenocryst description.

Olivine - 3%-10%; <0.5-2 mm; Subhedral or broken, iddingsitized.

GROUNDMASS: 101-144 cm, clasts are aphanitic, 2-6 cm, subangular, 2-6 cm, subangular. Matrix is comprised of sand-sized volcaniclastic grains and clay. 144-150 cm, massive basalt is microcrystalline.

VESICLES: <1%-15%; 0.5-2 mm; Round; Variable clast-to-clast; Filled with medium bluish gray (5B 5/1) clay.

COLOR: Clasts: Medium gray (N5), brownish black (5YR 2/1), grayish black (N2). Matrix clay: white (N9), medium bluish gray (5B 5/1), dark reddish brown (10R 3/4). Massive basalt: medium light gray (N6).

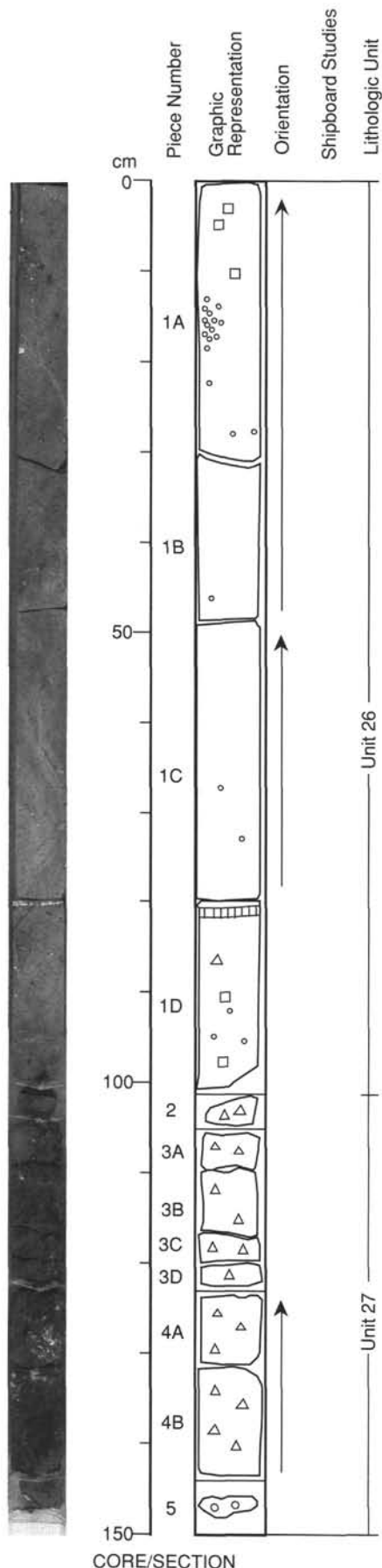
STRUCTURE: 101-144 cm, flow-top breccia; 144-150 cm, massive basalt.

ALTERATION: Much clay has developed in the breccia matrix. The massive basalt has moderate reddish orange (10R 6/6) iron-stained areas.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Fourth flow in a series of thin (<3 m), altered flows with recovered flow-top breccias.

- Vesicle
- △ Flow-top breccia
- Xenoliths
- ▤ Clay vein



UNIT 27: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1–5

CONTACTS: Continues from Section 92R-5.

PHENOCRYSTS:

Olivine - 10%; <0.5–3 mm; Euhedral to rounded, iddingsitized.
Clinopyroxene - 3%; 1–3 mm; Prisms to rounded shapes, partially altered to clay.

GROUNDMASS: Microcrystalline.

VESICLES: <1%; 1–10 mm; Round to irregular and interconnected; Filled with very pale green (10G 8/2) to grayish green (5G 5/2) clay.

COLOR: Medium light gray (N6).

STRUCTURE: Massive.

ALTERATION: The massive basalt has moderate reddish orange (10R 6/6) iron-stained areas. The light color suggests considerable clay replacement of groundmass.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Fourth flow in a series of thin (<3 m), altered flows with recovered flow-top breccias. At 82 cm, clinopyroxene-rich, 6 mm xenolith.

UNIT 28: OLIVINE-CLINOPYROXENE BASALT

Pieces 6–11

CONTACTS: Continues into Section 92R-6.

PHENOCRYSTS: Description of the breccia clasts.

Olivine - <1%; 1–3 mm; Subhedral, iddingsitized.

GROUNDMASS: Clasts are aphanitic, 2–6 cm, and subangular. Matrix is comprised of sand-sized volcanoclastic grains and clay.

VESICLES: 10%–50%; 0.5–2 mm; Round to irregular; Filled with white (N9) clay.

COLOR: Clasts: medium gray (N5), brownish black (5YR 2/1), grayish black (N2). Matrix clay: white (N9), medium bluish gray (5B 5/1), dark reddish brown (10R 3/4).

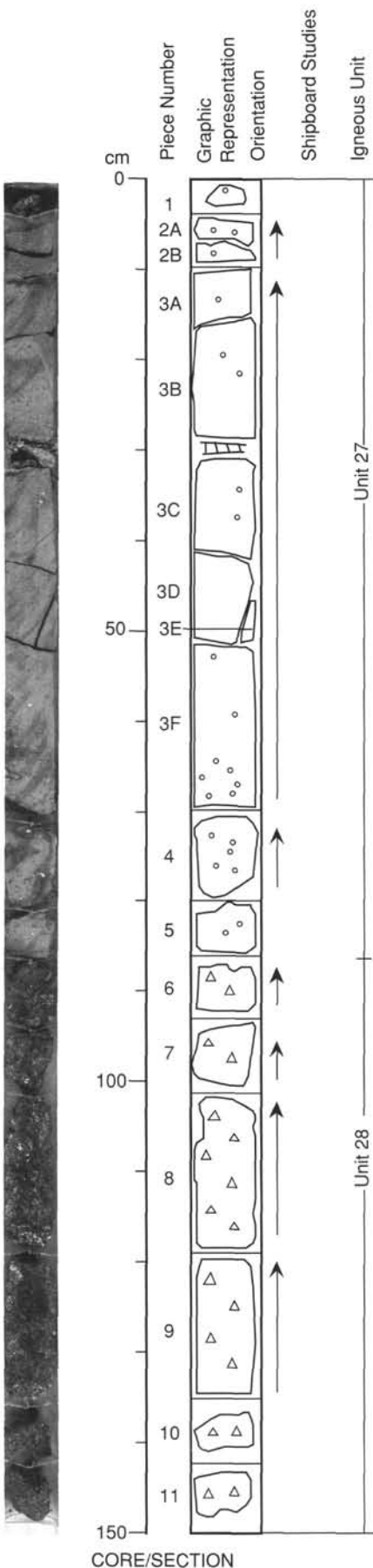
STRUCTURE: Flow-top breccia.

ALTERATION: Considerable clay has developed in the matrix. The breccia is oxidized and phenocrysts are pseudomorphed.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Fifth flow in a series of thin (<3 m), altered flows with recovered flow-top breccias.

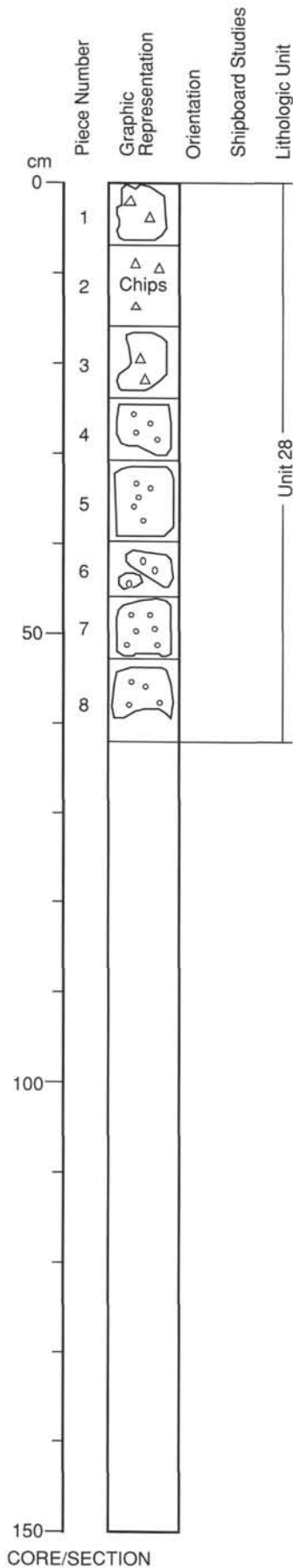
- Vesicle
- △ Flow-top breccia
- ▤ Clay vein



144-878A-92R-6

UNIT 28: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-8



CONTACTS: Continues from Section 92R-5 and into Section 93R-1.

PHENOCRYSTS: Description of the massive basalt. See Section 92R-5 for a flow-top breccia clast description

Olivine - 10%; <0.5-5 mm; Subhedral, iddingsitized. Clinopyroxene - 2%; 0.53 mm; Subhedral, partially altered to light brown (5YR 5/6) clay.

GROUNDMASS: Clasts are aphanitic, 2-6 cm, and subangular. Matrix is comprised of sand-sized volcanoclastic grains and clay. Massive basalt is microcrystalline.

VESICLES: 15%; 0.5-3 mm; Irregular; Lined and filled with pale blue (5PB 7/2) clay. Description for massive portion of the flow. See Section 92R-5 description for breccia clast vesicularity.

COLOR: Clasts: medium gray (N5), brownish black (5YR 2/1), grayish black (N2). Matrix clay: white (N9), medium bluish gray (5B 5/1), pale red (5R 6/2). Massive: moderate bluish gray (5B 6/1).

STRUCTURE: 0-24 cm, flow-top breccia; 24-62 cm, massive basalt.

ALTERATION: Considerable clay has developed in the matrix. The breccia is oxidized and phenocrysts are pseudomorphed. Color of massive basalt suggests groundmass replacement by blue or green clays.

VEINS/FRACTURES: <1 mm; Trace calcite veins.

ADDITIONAL COMMENTS: Fifth flow in a series of thin (<3 m), altered flows with recovered flow-top breccias.

- Vesicle
- △ Flow-top breccia

UNIT 28: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-3

CONTACTS: Continues from Section 92R-6.

PHENOCRYSTS: Abundances are increasing downhole. Tiny xenoliths to 8 mm. Description of the massive basalt. See Section 92R-5 for a flow-top breccia clast description.

Olivine - 15%; <0.5-5 mm; Subhedral, iddingsitized.

Clinopyroxene - 5%; 0.5-3 mm; Subhedral, partially altered to light brown (5YR 5/6) clay.

GROUNDMASS: Clasts are aphanitic, 2-6 cm, and subangular. Matrix is comprised of sand-sized volcanoclastic grains and clay. Massive basalt is microcrystalline.

VESICLES: 6-18 cm, 15%, 0.5-3 mm, irregular, filled with pale blue (5PB 7/2) clay. 18-28 cm, no vesicles. 28-42 cm, 20%, 1-6 mm, irregular and occasionally interconnected, filled with pale green (5G 7/2) clay. 42-46 cm, no vesicles. 46-60 cm, 5%, 1-10 mm, subround, filled with very pale and pale green (10G 8/2 and 5G 7/2) clay. 60-71 cm, 3%, 1-2 mm, horizontally elongate, filled with pale green (5G 7/2) clay.

COLOR: Clasts: medium gray (N5), brownish black (5YR 2/1), grayish black (N2). Matrix clay: white (N9), medium bluish gray (5B 5/1), pale red (5R 6/2). Massive: moderate bluish gray (5B 6/1).

STRUCTURE: 0-6 cm, flow-top breccia; 6-71 cm, massive basalt.

ALTERATION: Considerable clay has developed in the matrix. The breccia is oxidized and phenocrysts are pseudomorphed. Color of massive basalt suggests groundmass replacement by blue or green clays.

VEINS/FRACTURES: <1 mm; Trace calcite veins.

ADDITIONAL COMMENTS: Fifth flow in a series of thin (<3 m), altered flows with recovered flow-top breccias. 0-6 cm, flow-top breccia pieces are small and are interpreted as having fell downhole rather than representing a new flow.

UNIT 29: OLIVINE-CLINOPYROXENE BASALT

Pieces 4-16

CONTACTS: Continues into Section 93R-2.

PHENOCRYSTS: Phenocryst description of flow-top clasts from 71-86 cm and 99-125 cm. Large breccia clast, from interval 86-99 cm, contains 20%, <0.5-4 mm, anhedral olivines. Phenocrysts in the massive portion of the flow (125-150 cm) are described in Section 93R-2.

Olivine - 5%; <0.5-3 mm; Subhedral, iddingsitized.

GROUNDMASS: 71-86 cm, no distinct clast boundaries. 86-99 cm, large clast is microcrystalline. 99-125 cm, clasts are aphanitic, 2-70 cm, and subangular. Matrix is comprised of clay. 125-150 cm, massive basalt is microcrystalline.

VESICLES: 71-86 cm, 70%, 0.5-3 mm, round to interconnected, filled with white (N9) clay. 86-99 cm, 20%, 1-5 mm, round, lined or filled with pale blue (5PB 7/2) clay. 99-125 cm, 15%-70%, 0.5-2 mm, subround, filled with translucent light bluish gray (5B 7/1) and white (N9) clay. 125-150 cm, 10%, 1-5 mm, round, thickly lined or filled with light greenish-gray (5G 8/1) clay.

COLOR: 71-86 cm, olive black (5Y 2/1). 86-99 cm, medium bluish gray (5B 5/1). 99-125 cm, clasts are brownish black (5YR 2/1) and medium dark gray (N4). Matrix is pale reddish brown (10R 5/4). See Comments.

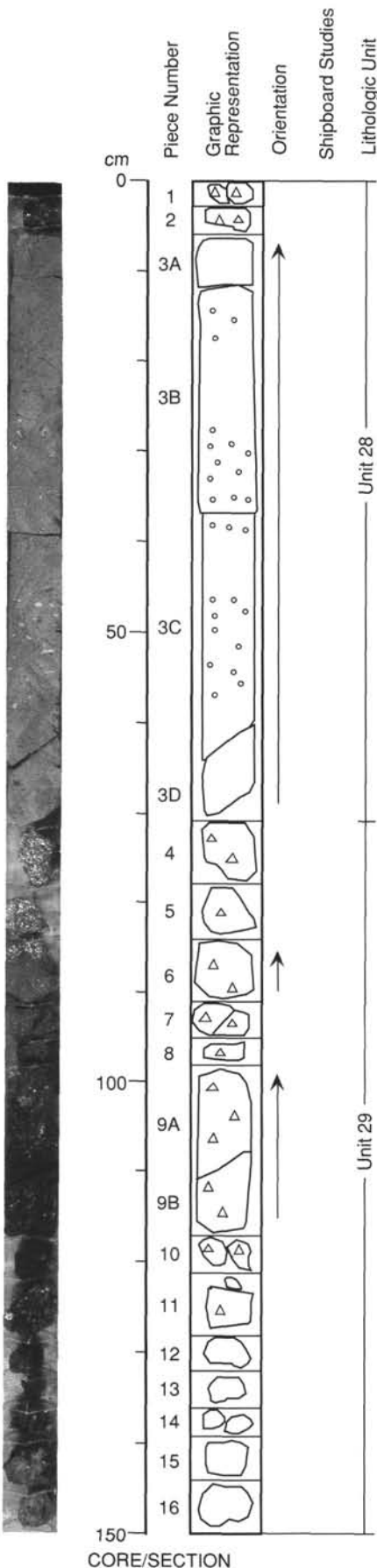
STRUCTURE: 71-86 cm and 99-125 cm, flow-top breccia. 86-99 cm, large clast within the breccia. 125-150 cm, massive portion of the flow.

ALTERATION: Considerable clay has developed in the matrix. The breccia is oxidized, phenocrysts are pseudomorphed, and clast boundaries are indistinct in the upper portion of the flow-top breccia. Massive portion of the flow has had vesicles filled and phenocrysts partially to completely altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Sixth flow in a series of thin (<3 m), altered flows with recovered flow-top breccias. Color: massive basalt is gray (10YR 5/1).

- Vesicle
- △ Flow-top breccia



144-878A-93R-2

UNIT 29: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-11

CONTACTS: Continues from Section 93R-1.

PHENOCRYSTS:

Olivine - 7%10%; <0.5-6 mm; Anhedral, iddingsitized.
Clinopyroxene - <1%; 1-4 mm; Round, altered to clay along fractures, but fresh elsewhere.

GROUNDMASS: Microcrystalline.

VESICLES: Darker areas have 20%, 0.25-2 mm, irregular vesicles. Lighter areas have 10%, round to irregular, 1-4 mm vesicles. All are lined or filled with light greenish gray (5GY 6/1) clay.

COLOR: Variable on a several centimeter scale, medium dark gray (N4) and gray (10YR 5/1).

STRUCTURE: Massive.

ALTERATION: Massive portion of the flow has had vesicles filled and phenocrysts partially to completely altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Sixth flow in a series of thin (<3 m), altered flows with recovered flow-top breccias.

UNIT 30: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT

Pieces 12-22

CONTACTS: Continues into Section 93R-3.

PHENOCRYSTS: Description of massive basalt. Flow-top breccia has 3%, 1-3 mm, broken, iddingsitized olivine and trace, 1-2 mm, clay altered along fractures, clinopyroxene.

Olivine - 15%; <0.5-3 mm; Subhedral to rounded, iddingsitized.

Clinopyroxene - 2%; 1-5 mm; Round, altered to clay along fractures, but fresh elsewhere.

Plagioclase - <1%; 1-3 mm; Altered laths, often in glomerocrysts with clinopyroxene.

GROUNDMASS: Clast boundaries are not identifiable. Clasts are presumed to have been aphanitic. Massive basalt is microcrystalline.

VESICLES: In the flow-top breccia, 0-50%, irregular to round, filled with white (N9) or lined with translucent light bluish gray (5B 7/1) clay.

Vesicularity decreases downsection, 30% to 1%, round, filled with translucent greenish gray (5G 6/1) and opaque pale green (5G 7/2) to white (N9) clay.

COLOR: 63-75 cm, flow-top breccia is olive black (5Y 2/1), medium bluish gray (5B 5/1) and moderate red (5R 5/4). 75-144 cm, massive basalt is grayish red (10R 4/2) grading downsection to medium gray (N5).

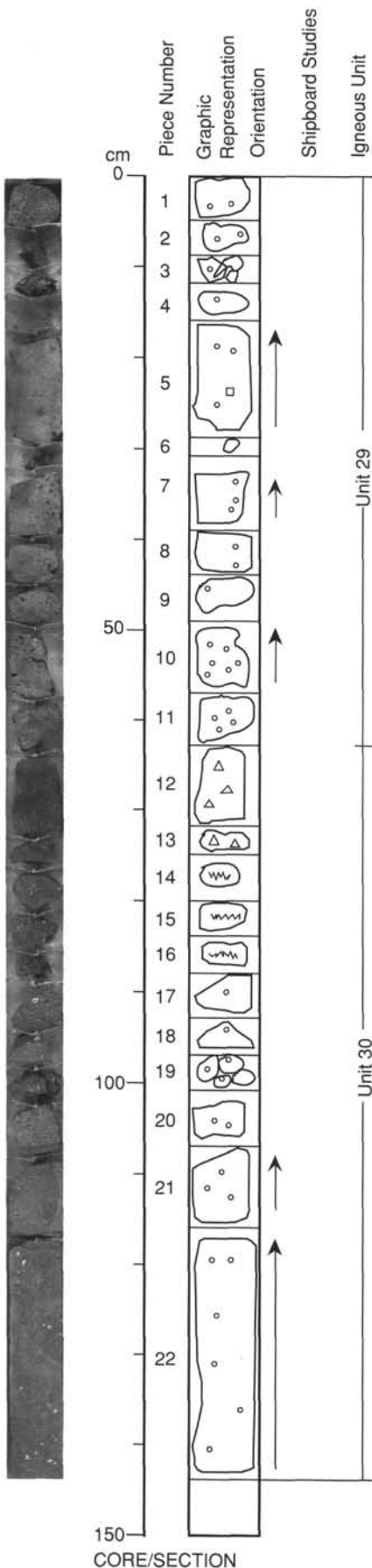
STRUCTURE: 63-75 cm, flow-top breccia. 75-144 cm, massive basalt.

ALTERATION: Breccia is extremely altered. Development of clay minerals has been so extensive as to obscure clast to matrix distinctions. Massive portion of the flow has had vesicles filled and phenocrysts partially to completely altered.

VEINS/FRACTURES: 75-93 cm, small (<2 mm), discontinuous fractures are filled with translucent greenish gray (5G 6/1) clay.

ADDITIONAL COMMENTS: Seventh flow in a series of thin (<3 m), altered flows with recovered flow-top breccias.

- Vesicle
- △ Flow-top breccia
- Xenolith



CORE/SECTION

UNIT 30: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-17

CONTACTS: Continues from Section 93R-2 and into Section 93R-4.

PHENOCRYSTS:

- Olivine - 15%; <0.53 mm; Subhedral to rounded, iddingsitized.
- Clinopyroxene - 2%; 1-5 mm; Round, altered to clay along fractures, but fresh elsewhere.
- Plagioclase - <1%; 1-3 mm; Altered laths, often in glomerocrysts with clinopyroxene.

GROUNDMASS: Microcrystalline.

VESICLES: 0-28 cm, 2%, 1-15 mm, subround to irregular. 28-38 cm, 20%, 0.5-5 mm, larger ones are subround, small ones are irregular and interconnected. 30-150 cm, very sparse. All are lined or filled with greenish gray (5G 6/1) clay.

COLOR: Medium gray (N5).

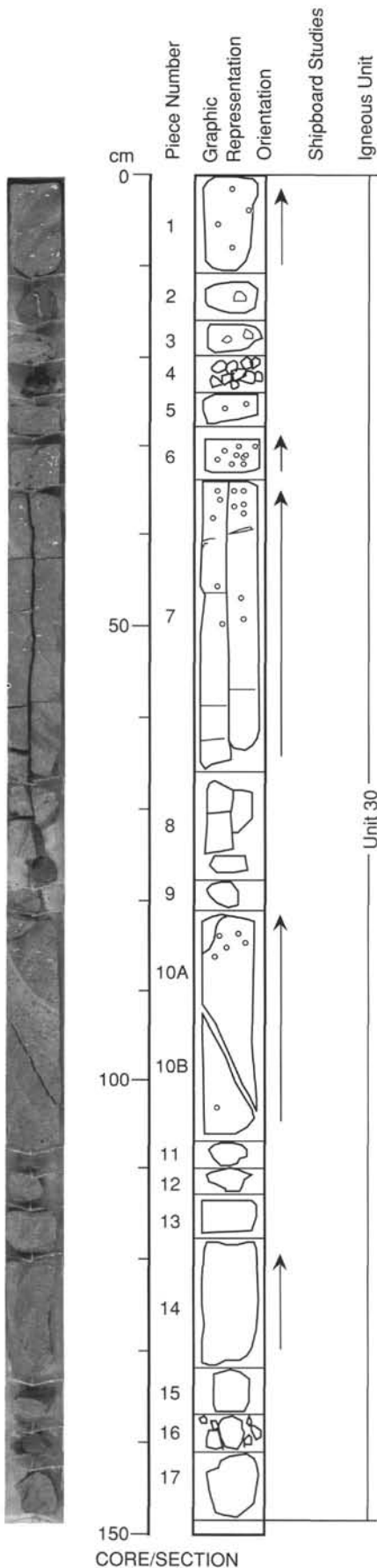
STRUCTURE: Massive.

ALTERATION: Massive portion of the flow has had vesicles filled and phenocrysts partially to completely altered.

VEINS/FRACTURES: 83-130 cm, small (<0.25 mm wide), horizontal, discontinuous fractures spaced <1 cm apart and filled with moderate blue green (5BG 4/6) clay. The whole section fractures along oxidized weathering horizons, about 10 cm apart.

ADDITIONAL COMMENTS: Seventh flow in a series of thin (<3 m), altered flows with recovered flow-top breccias.

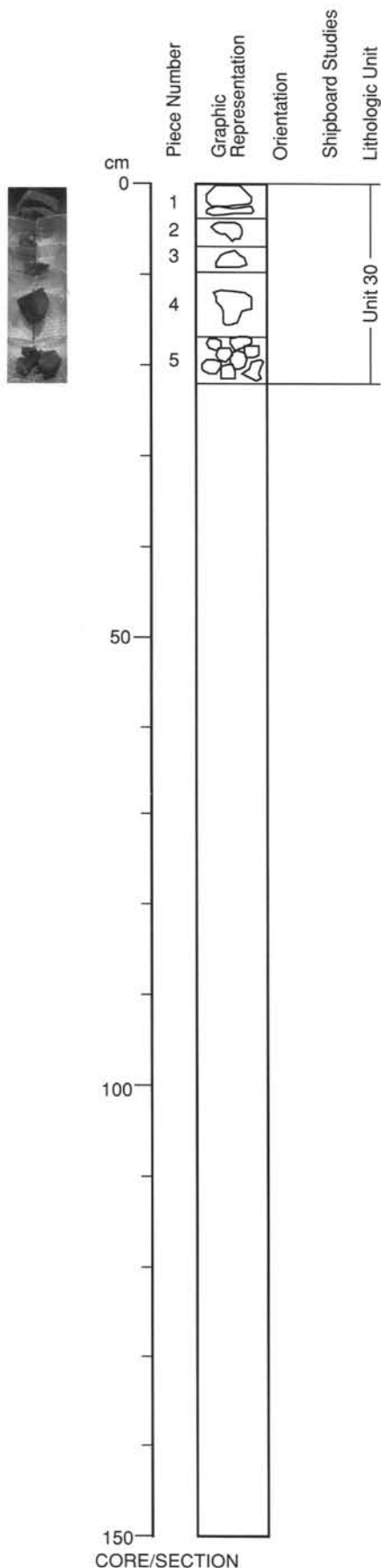
- Vesicle



144-878A-93R-4

UNIT 30: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-5



CONTACTS: Continues from Section 93R-3 and into Section 94R-1.

PHENOCRYSTS:

- Olivine - 15%; <0.5-3 mm; Subhedral to rounded, iddingsitized.
- Clinopyroxene - 2%; 1-5 mm; Round, altered to clay along fractures, but fresh elsewhere.
- Plagioclase - <1%; 1-3 mm; Altered laths, often in glomerocrysts with clinopyroxene.

GROUNDMASS: Microcrystalline.

VESICLES: Very sparse. Lined or filled with greenish gray (5G 6/1) clay.

COLOR: Medium gray (N5).

STRUCTURE: Massive.

ALTERATION: Massive portion of the flow has had vesicles filled and phenocrysts partially to completely altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Seventh flow in a series of thin (<3 m), altered flows with recovered flow-top breccias.

UNIT 30: OLIVINE-CLINOPYROXENE-PLAGIOCLASE BASALT (continued)

Pieces 1-4

CONTACTS: Continues from Section 93R-4.

PHENOCRYSTS:

- Olivine - 15%; <0.5-3 mm; Subhedral to rounded, iddingsitized.
- Clinopyroxene - 2%; 1-5 mm; Round, altered to clay along fractures, but fresh elsewhere.
- Plagioclase - <1%; 1-3 mm; Altered laths, often in glomerocrysts with clinopyroxene.

GROUNDMASS: Microcrystalline.

VESICLES: Very sparse. Lined or filled with greenish gray (5G 6/1) clay.

COLOR: Medium gray (N5).

STRUCTURE: Massive.

ALTERATION: Massive portion of the flow has had vesicles filled and phenocrysts partially to completely altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Seventh flow in a series of thin (<3 m), altered flows with recovered flow-top breccias. 28-30 cm, area which appears to have been brecciated and cemented. Dusky red (5R 3/4) clasts, 3-10 mm in diameter, in a medium dark gray (N4) matrix. May be a strange zone of alteration rather than brecciation.

UNIT 31A: HIGHLY ALTERED VOLCANIC BRECCIA

Pieces 5A-5E

CONTACTS: Continues into Section 94R-2.

PHENOCRYSTS: Lighter colored regions (95-150 cm) retain olivine microphyric texture and occasional fresh clinopyroxene phenocrysts. These are 0.5-3 mm.

GROUNDMASS: Breccia consists of irregularly shaped, highly angular to subrounded clasts, 1 mm to 3 cm.

VESICLES: Within the very pale brown (10YR 8/4) matrix, vesicles can be distinguished, up to 50% and spherical to elongate.

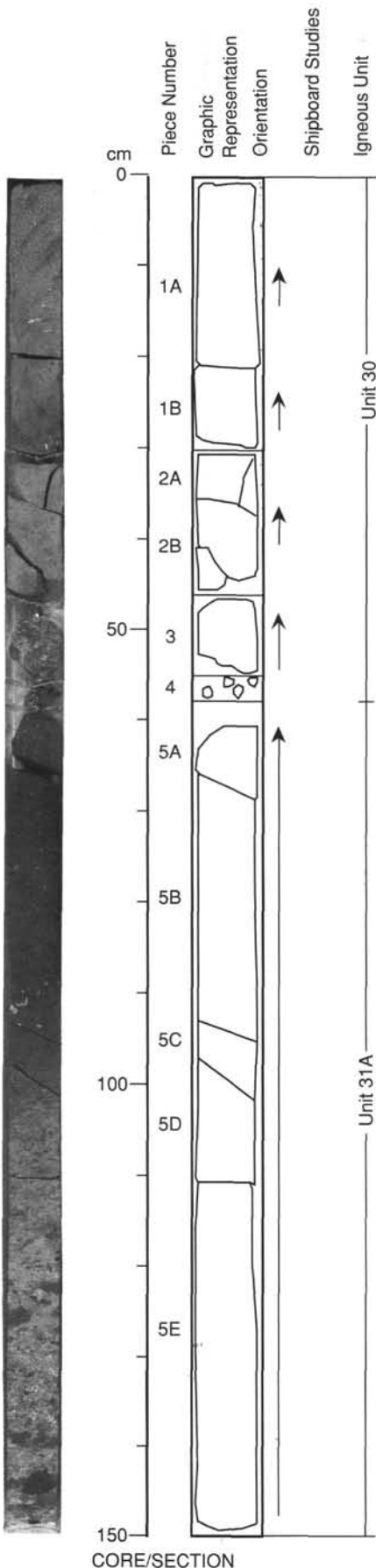
COLOR: Predominant color grades downsection from dark reddish brown (2.5YR 2.5/4) through dark red (2.5YR 3/6), weak red (10R 4/4), to very pale brown (10YR 8/4).

STRUCTURE: Volcanogenic breccia.

ALTERATION: Almost complete alteration, approaching a dense claystone. Soapy to touch, soft, expands and disintegrates in fresh water, and disintegrates as it dries.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: In darker colored regions (58-95 cm) clasts and matrix are barely distinguishable in hand specimen. Clasts commonly have diffuse outlines suggesting reaction with the matrix clay. Similar clay has replaced much of the original basalt. Severe alteration of the unit suggests hydrothermal reaction.

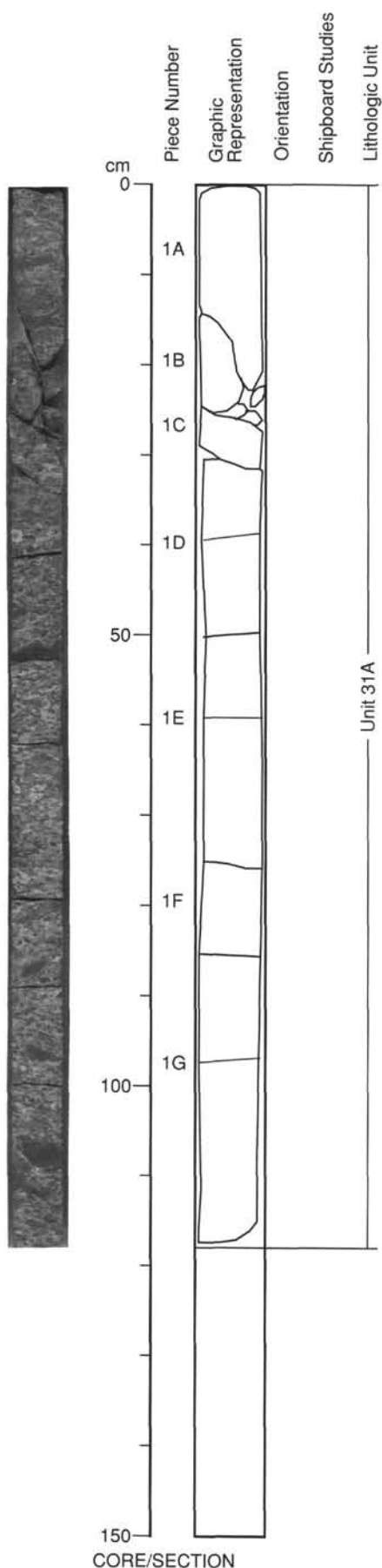


CORE/SECTION

144-878A-94R-2

UNIT 31A: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Piece 1



CONTACTS: Continues from Section 94R-1 and into Section 94R-3.

PHENOCRYSTS: Retains olivine microphyric texture and occasional fresh clinopyroxene phenocrysts. These are 0.5–3 mm.

GROUNDMASS: Breccia consists of irregularly shaped, highly angular to subrounded clasts, 1 mm to 3 cm.

VESICLES: Vesicles can be distinguished, up to 50% and spherical to elongate.

COLOR: Very pale brown (10YR 8/4) throughout; Larger clasts (1–5 cm) are dark reddish brown (5YR 3/3) and very dark gray (N3). Clasts are darker in the center of the section, lighter to the ends.

STRUCTURE: Volcanogenic breccia.

ALTERATION: Almost complete alteration, approaching a dense claystone. Soapy to touch, soft, expands and disintegrates in fresh water, and disintegrates as it dries.

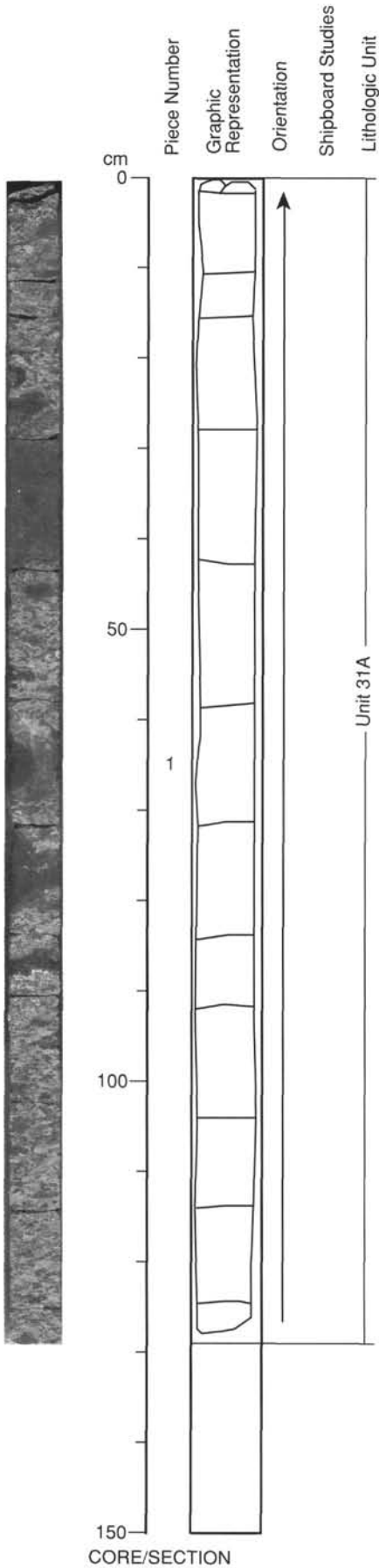
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Clasts commonly have diffuse outlines suggesting reaction with the matrix clay. Similar clay has replaced much of the original basalt. Severe alteration of the unit suggests hydrothermal reaction.

144-878A-94R-3

UNIT 31A: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Piece 1



CONTACTS: Continues from Section 94R-2 and into Section 94R-4.

PHENOCRYSTS: Lighter colored areas retain olivine microphyric texture and occasional fresh clinopyroxene phenocrysts. These are 0.5–3 mm.

GROUNDMASS: Breccia consists of irregularly shaped, highly angular to subrounded clasts, 1 mm to 5 cm.

VESICLES: In the lighter colored portions of the unit vesicles can be distinguished, up to 50% and spherical to elongate.

COLOR: Very pale brown (10YR 8/4), except 29–42 cm, where the unit is uniformly dark reddish brown (2.5YR 3/4). 2-3 cm and 21-23 cm, 3 cm in diameter clasts with dark gray (N4) cores. See Comments.

STRUCTURE: Volcanogenic breccia.

ALTERATION: Almost complete alteration, approaching a dense claystone. Soapy to touch, soft, expands and disintegrates in fresh water, and disintegrates as it dries.

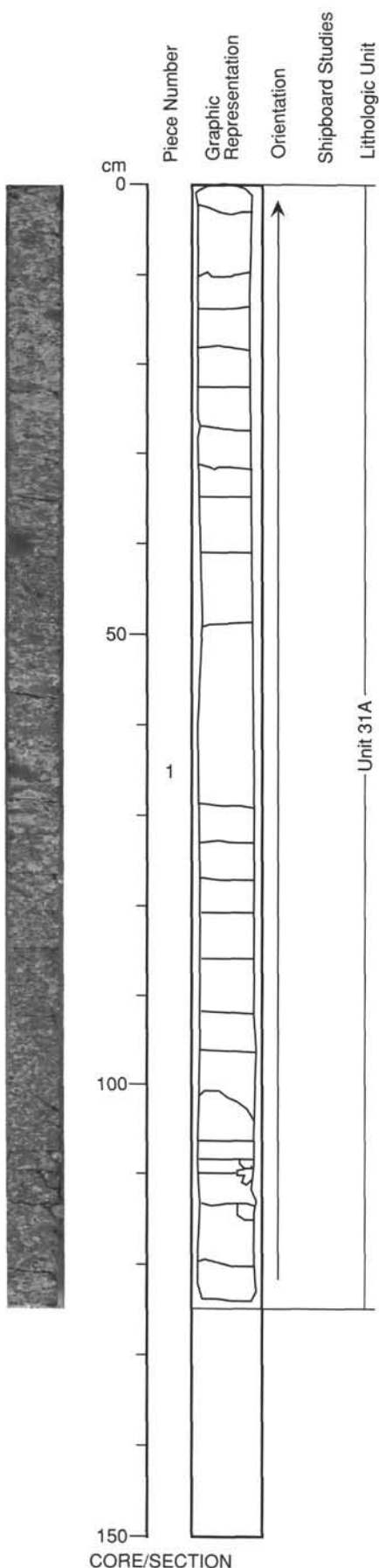
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Clasts commonly have diffuse outlines suggesting reaction with the matrix clay. Similar clay has replaced much of the original basalt. Severe alteration of the unit suggests hydrothermal reaction. Dark gray (N4) clasts appear fresh, but they are soft and soapy to the touch. Color: 61–67 cm, 73–80 cm, and 87–88 cm, large (5cm) dark reddish brown (2.5YR 3/4) clasts.

144-878A-94R-4

UNIT 31A: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Piece 1



CONTACTS: Continues from Section 94R-3 and into Section 94R-5.

PHENOCRYSTS: Lighter colored areas retain olivine microphyric texture and occasional fresh clinopyroxene phenocrysts. These are 0.5–3 mm.

GROUNDMASS: Breccia consists of irregularly shaped, highly angular to subrounded clasts, 1 mm to 5 cm.

VESICLES: In the lighter colored portions of the unit vesicles can be distinguished, up to 50% and spherical to elongate.

COLOR: Very pale brown (10YR 8/4). Some large clasts are dark reddish brown (2.5YR 3/4).

STRUCTURE: Volcanogenic breccia.

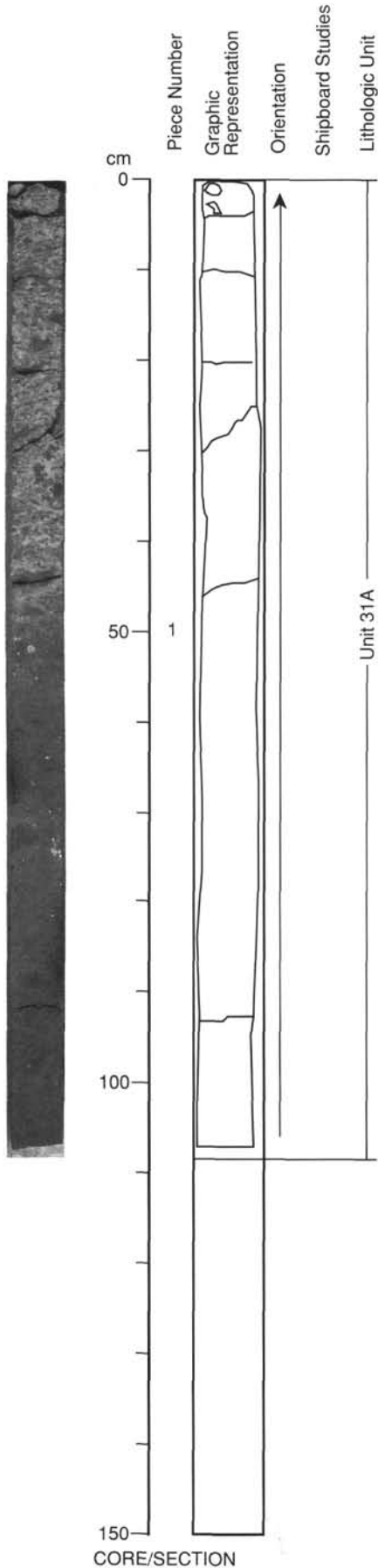
ALTERATION: Almost complete alteration, approaching a dense claystone. Soapy to touch, soft, expands and disintegrates in fresh water, and disintegrates as it dries.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Clasts commonly have diffuse outlines suggesting reaction with the matrix clay. Similar clay has replaced much of the original basalt. Severe alteration of the unit suggests hydrothermal reaction.

UNIT 31A: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Piece 1



CONTACTS: Continues from Section 94R-4 and into Section 94R-6.

PHENOCRYSTS: Lighter colored areas retain olivine microphyric texture and occasional fresh clinopyroxene phenocrysts (0.5–3 mm).

GROUNDMASS: Breccia consists of irregularly shaped, highly angular to subrounded clasts, 1 mm to 5 cm.

VESICLES: Relict vesicles, up to 50%, spherical to elongate.

COLOR: 0–48 cm, very pale brown (10YR 8/4). 48–56 cm, grades to red (2.5YR 4/6). 56–108 cm, uniform red (2.5YR 4/6).

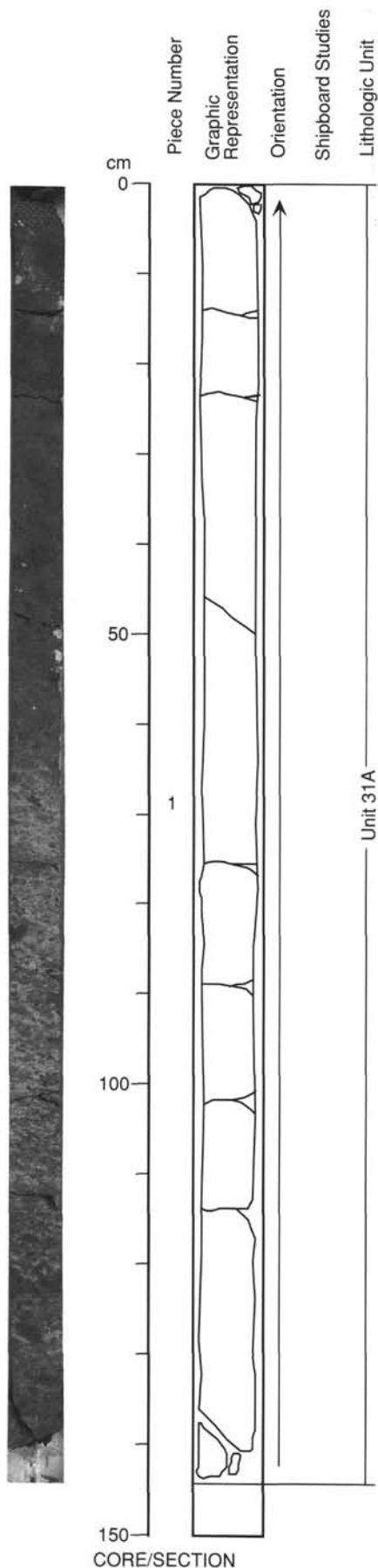
STRUCTURE: Volcanogenic breccia.

ALTERATION: Complete alteration to claystone. Soapy to touch, soft, expands and disintegrates in fresh water, and disintegrates as it dries.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Clasts commonly have diffuse outlines suggesting reaction with the matrix clay. Similar clay has replaced much of the original basalt. Clast outlines are more difficult to make out in darker portions of the unit. Severe alteration suggests hydrothermal reaction.

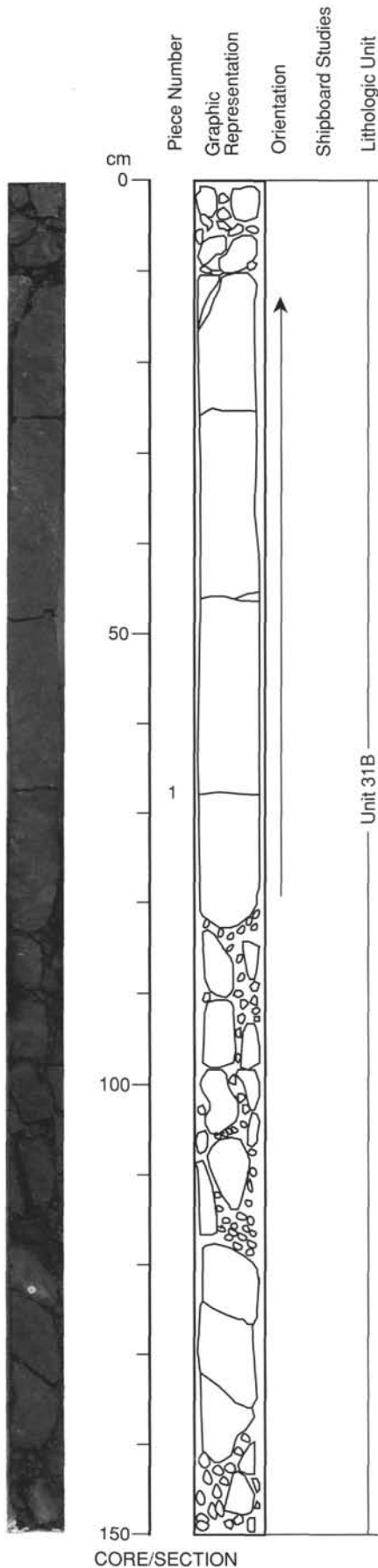
144-878A-94R-6

UNIT 31A: HIGHLY ALTERED VOLCANIC BRECCIA (continued)**Piece 1****CONTACTS:** Continues from Section 94R-5. No distinct contact with Subunit 31B was recovered.**PHENOCRYSTS:** Lighter colored areas retain olivine microphyric texture and occasional fresh clinopyroxene phenocrysts (0.5–3 mm).**GROUNDMASS:** Breccia consists of irregularly shaped, highly angular to subrounded clasts, 1 mm to 5 cm.**VESICLES:** Relict vesicles, up to 50%, spherical to elongate.**COLOR:** 0–66 cm, red (2.5YR 4/6). 66–96 cm, grades to very pale brown (10YR 8/4). 96–143 cm, very pale brown (10YR 8/4).**STRUCTURE:** Volcanogenic breccia.**ALTERATION:** Complete alteration to claystone. Soapy to touch, soft, expands and disintegrates in fresh water, and disintegrates as it dries.**VEINS/FRACTURES:** None.**ADDITIONAL COMMENTS:** Clasts commonly have diffuse outlines suggesting reaction with the matrix clay. Similar clay has replaced much of the original basalt. Clast outlines are more difficult to make out in darker portions. Severe alteration suggests hydrothermal reaction. 15–17 cm, 24–31 cm, and 49–50 cm, dark reddish gray (10R 3/1), large clasts of plagioclase-olivine microphyric basalt (now completely altered to clay).

144-878A-94R-7

UNIT 31B: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Piece 1



CONTACTS: Continues into Section 94R-8.

PHENOCRYSTS: None.

GROUNDMASS: Subunit 31B appears to be a continuation of Subunit 31A, but coloration is so strong that almost no relict texture can be distinguished.

VESICLES: Not visible.

COLOR: Variable, dark reddish gray (10R 3/1), dusky red (10R 3/4), and dark red (10R 3/6).

STRUCTURE: Volcanogenic breccia.

ALTERATION: Complete alteration to claystone. Soapy to touch, but harder, more abrasive than Subunit 31A.

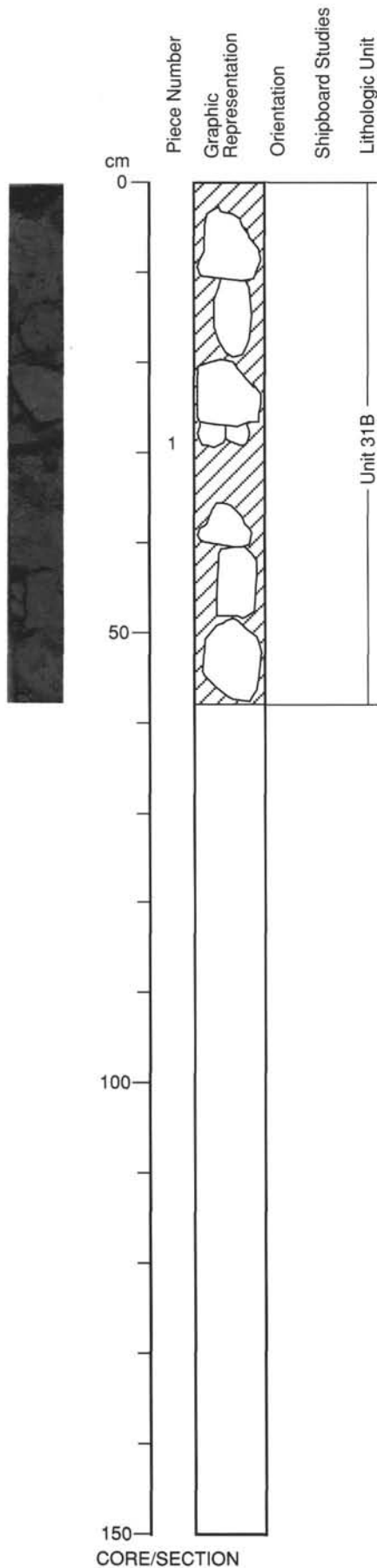
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Texture is obscured by the dark color. Severe alteration suggests hydrothermal reaction. 7-10 cm, dark gray (N4), completely altered, vesicular (20%) basalt clast.

144-878A-94R-8

UNIT 31B: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Piece 1



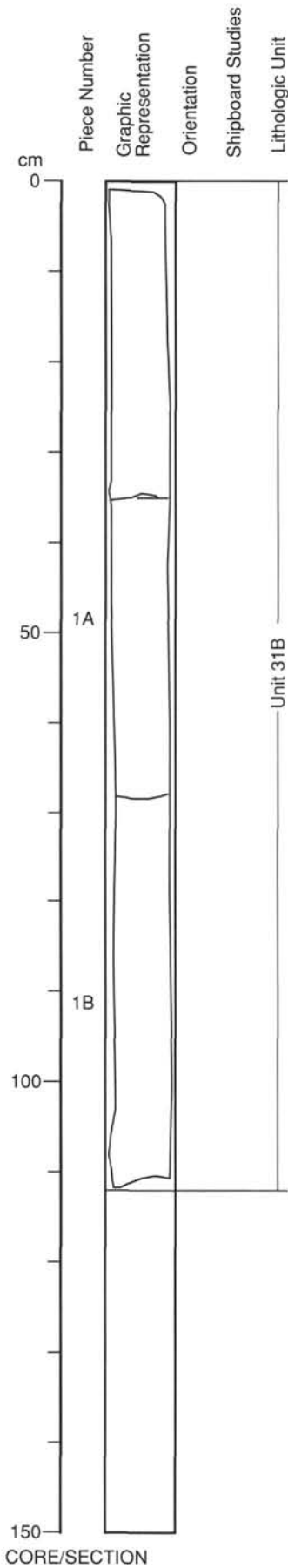
CONTACTS: Continues from Section 94R-7 and into Section 95R-1.
PHENOCRYSTS: <1%, anhedral, 1–4 mm clinopyroxene grains which appear fresh.
GROUNDMASS: Subunit 31B appears to be a continuation of Subunit 31A, but coloration is so strong that almost no relict texture can be distinguished.
VESICLES: Not visible.
COLOR: Dark red (10R 3/6).
STRUCTURE: Volcanogenic breccia.
ALTERATION: Complete alteration to claystone. Soapy to touch, but harder, more abrasive than Subunit 31A.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Texture is obscured by the dark color in this. Severe alteration suggests hydrothermal reaction. Pieces of relict breccia are surrounded by ground up (by drilling) clay.

/// Clay

144-878A-95R-1

UNIT 31B: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Piece 1



CONTACTS: Continues from Section 94R-8 and into Section 95R-2.

PHENOCRYSTS: <1%, anhedral, 1–4 mm clinopyroxene grains which appear fresh.

GROUNDMASS: Subunit 31B appears to be a continuation of Subunit 31A, but coloration is so strong that almost no relict texture can be distinguished.

VESICLES: Not visible.

COLOR: Dark reddish brown (2.5YR 3/4).

STRUCTURE: Volcanogenic breccia.

ALTERATION: Complete alteration to claystone. Soapy to touch, but harder, more abrasive than Subunit 31A.

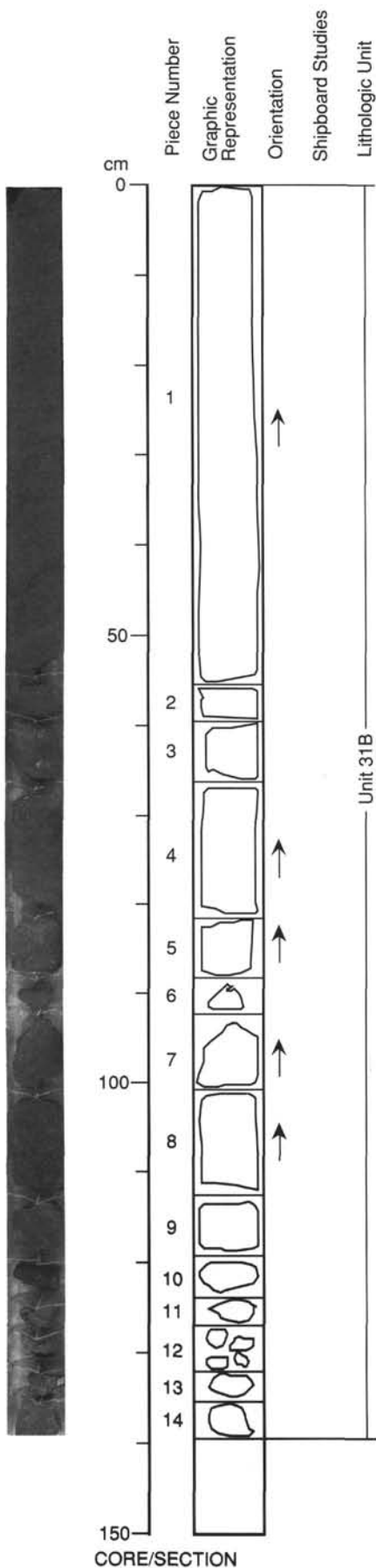
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Texture is obscured by the dark color. Severe alteration suggests hydrothermal reaction. 85–92 cm, irregular, light brown (7.5YR 6/4) areas in the matrix.

144-878A-95R-2

UNIT 31B: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Pieces 1-14



CONTACTS: Continues from Section 95R-1 and into Section 95R-3.

PHENOCRYSTS: None.

GROUNDMASS: Subunit 31B appears to be a continuation of Subunit 31A, but coloration is so strong that almost no relict texture can be distinguished.

VESICLES: Not visible.

COLOR: 0-5 cm and 97-123 cm, light brown (2.5YR 3/4); 59-97 cm and 123-139 cm, weak red (5R 4/3).

STRUCTURE: Volcanogenic breccia.

ALTERATION: Complete alteration to claystone. Soapy to touch, but harder, more abrasive than Subunit 31A.

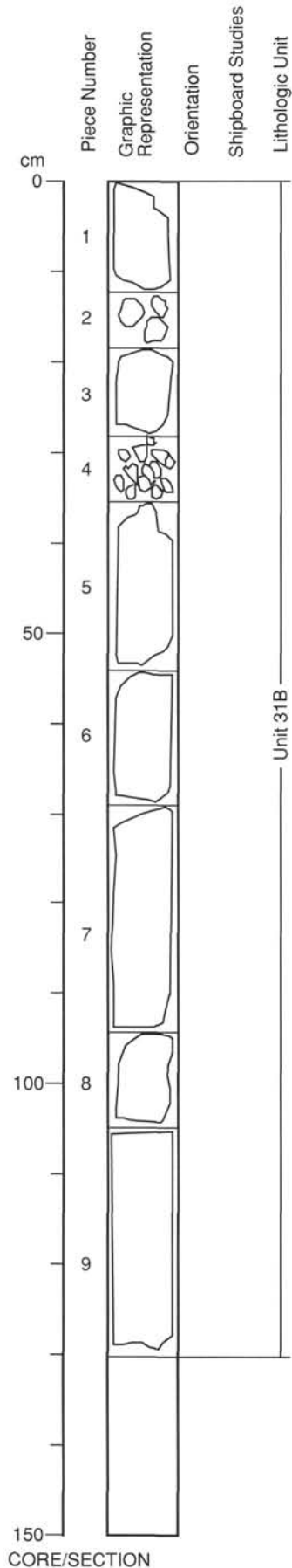
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Texture is obscured by the dark color. Severe alteration suggests hydrothermal reaction. 59-97 cm and 123-139 cm, vesicular, relict basalt clasts and basalt breccia which are harder and less altered than adjoining core.

CORE/SECTION

UNIT 31B: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Pieces 1-9



CONTACTS: Continues from Section 95R-2 and into Section 95R-4.

PHENOCRYSTS: None.

GROUNDMASS: Subunit 31B appears to be a continuation of Subunit 31A, but coloration is so strong that almost no relict texture can be distinguished.

VESICLES: Not visible.

COLOR: 0-69 cm, weak red (5R 3/4). 69-130 cm, light brown (2.5YR 3/4).

STRUCTURE: Volcanogenic breccia.

ALTERATION: Complete alteration to claystone. Soapy to touch, but harder, more abrasive than Subunit 31A. Less altered below 69 cm.

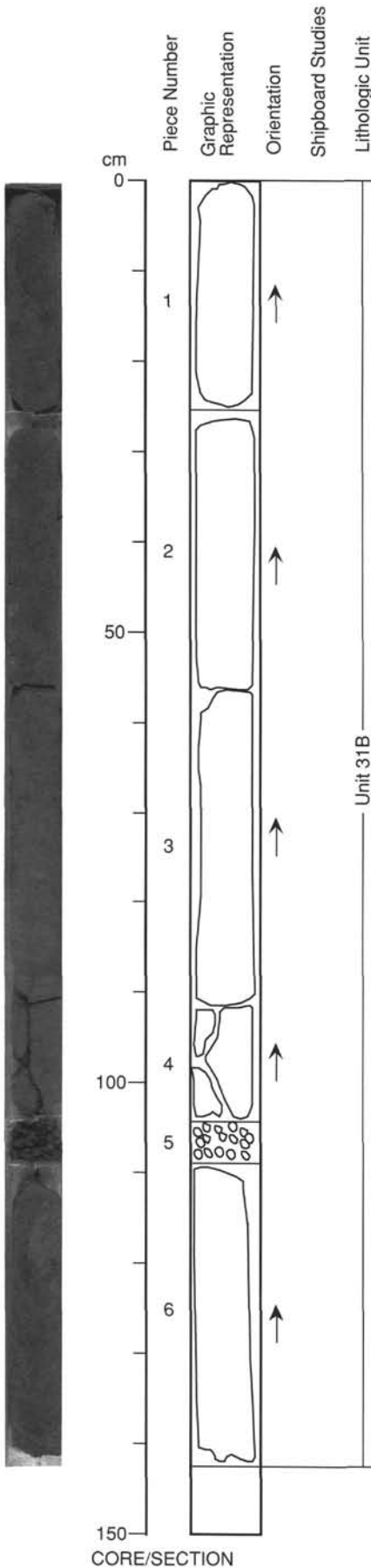
VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Texture is obscured by the dark color. Severe alteration suggests hydrothermal reaction.

144-878A-95R-4

UNIT 31B: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

Pieces 1-6



CONTACTS: Continues from Section 95R-3 and into Section 95R-5.

PHENOCRYSTS: None.

GROUNDMASS: Subunit 31B appears to be a continuation of Subunit 31A, but coloration is so strong that almost no relict texture can be distinguished.

VESICLES: Not visible.

COLOR: 0-142 cm, light brown (2.5YR 3/4), with weak red (5R 3/4) clasts at 5-14 cm, 37-40 cm, 44-50 cm, 50-52 cm, 57-62 cm, 73-77 cm, 82-86 cm, and 120-125 cm.

STRUCTURE: Volcanogenic breccia.

ALTERATION: Complete alteration to claystone. Soapy to touch, but harder, more abrasive than Subunit 31A. Weak red (5R 3/4) clasts are less altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Texture is obscured by the dark color. Severe alteration suggests hydrothermal reaction.

CORE/SECTION

UNIT 31B: HIGHLY ALTERED VOLCANIC BRECCIA (continued)

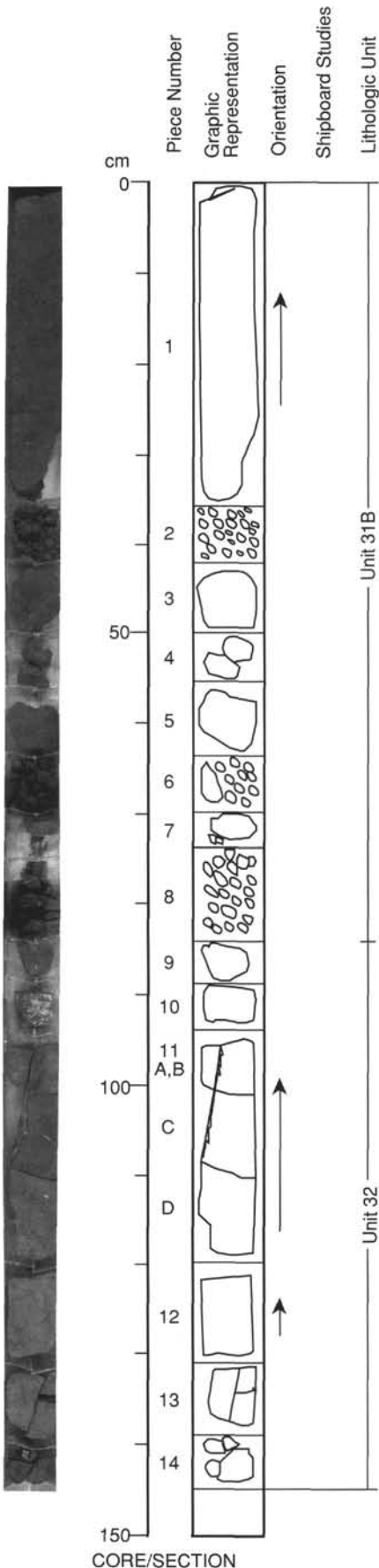
Pieces 1-8

CONTACTS: Continues from Section 95R-4.
PHENOCRYSTS: None.
GROUNDMASS: Subunit 31B appears to be a continuation of Subunit 31A, but coloration is so strong that almost no relict texture can be distinguished.
VESICLES: Not visible.
COLOR: Weak red (5R 3/4).
STRUCTURE: Volcanogenic breccia.
ALTERATION: Complete alteration to claystone. Soapy to touch, but harder, more abrasive than Subunit 31A. Less altered, similar to weak red clasts in previous section.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Texture is obscured by the dark color. Severe alteration suggests hydrothermal reaction.

UNIT 32: OLIVINE-CLINOPYROXENE BASALT

Pieces 9-14

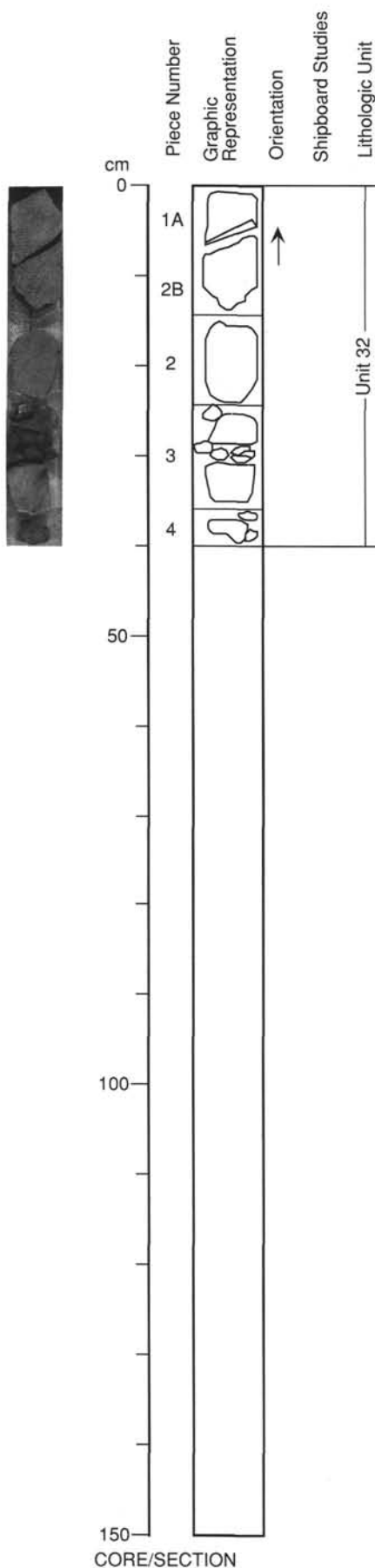
CONTACTS: Continues into Section 95R-6.
PHENOCRYSTS:
 Olivine - 1%-2%; 0.5-2 mm; Anhedral, but occasionally euhedral, iddingsitized.
 Olivine - 15%; 0.1-0.2 mm; Anhedral, iddingsitized.
 Clinopyroxene - <1%; <1 mm; Anhedral, fresh.
GROUNDMASS: Microcrystalline, with plagioclase laths showing a weak horizontal orientation in more altered areas.
VESICLES: None.
COLOR: Mottled medium gray (N5) and weak red (10R 5/2). Intensity of red mottling decreases downsection.
STRUCTURE: Massive.
ALTERATION: Partially oxidized as evidenced by the mottled matrix. Many phenocrysts and microphenocrysts are pseudomorphed.
VEINS/FRACTURES: 95-106 cm, single calcite vein, <1 mm.
ADDITIONAL COMMENTS: None.



144-878A-95R-6

UNIT 32: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-4



CONTACTS: Continues from Section 95R-5.

PHENOCRYSTS:

Olivine - 1%-2%; 0.5-2 mm; Anhedral, but occasionally euhedral, iddingsitized.

Olivine - 15%; 0.1-0.2 mm; Anhedral, iddingsitized.

Clinopyroxene - <1%; <1 mm; Anhedral, fresh.

GROUNDMASS: Microcrystalline, with plagioclase laths showing a weak horizontal orientation in more altered areas.

VESICLES: None.

COLOR: Mottled medium gray (N5) and weak red (10R 5/2). Intensity of red mottling decreases downsection.

STRUCTURE: Massive.

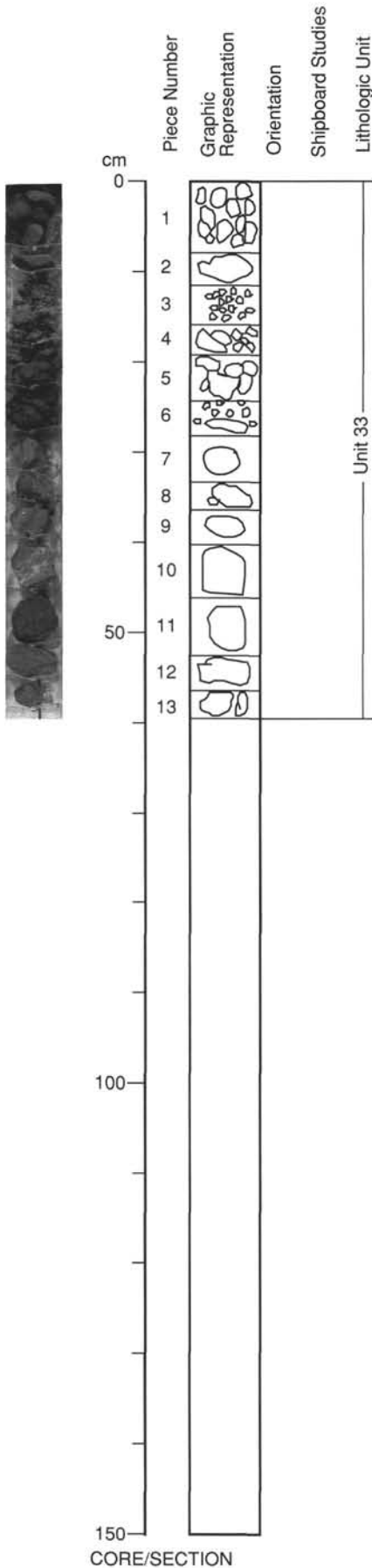
ALTERATION: Partially oxidized as evidenced by the mottled matrix. Many phenocrysts and microphenocrysts are pseudomorphed.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: None.

UNIT 33: WASH-CORE: MISCELLANEOUS PIECES FROM FURTHER UPHOLE

Pieces 1-13



CONTACTS: Continues into Section 97R-1.

PHENOCRYSTS: Not appropriate.

GROUNDMASS: Various, uphole lithologies.

VESICLES: Present in some pieces.

COLOR: Various, uphole colors.

STRUCTURE: Miscellaneous pieces.

ALTERATION: As the contributing units uphole are altered.

VEINS/FRACTURES: None.

ADDITIONAL COMMENTS: Pieces 1-9, altered basalt fragments of unclear origin. Piece 10, altered breccia of Subunit 31A. Piece 11, altered breccia of Subunit 31B. Pieces 12-13, altered basalt with 10%, altered to white (N9) clay, plagioclase microlites - may be from Unit 30 flow-top breccia.

144-878A-97R-1

UNIT 33: WASH-CORE: MISCELLANEOUS PIECES FROM FURTHER UPHOLE

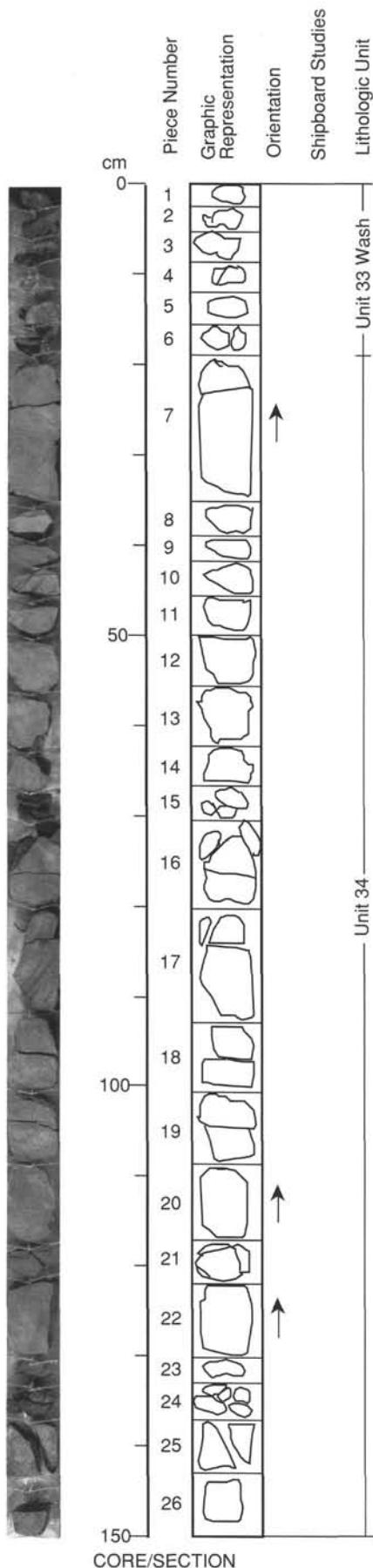
Pieces 1-6

CONTACTS: Continues from Section 96R-1.
PHENOCRYSTS: Not appropriate.
GROUNDMASS: Various, uphole lithologies.
VESICLES: Present in some pieces.
COLOR: Various, uphole colors.
STRUCTURE: Miscellaneous pieces.
ALTERATION: As the contributing units uphole are altered.
VEINS/FRACTURES: None.
ADDITIONAL COMMENTS: Pieces 1, 3-5, altered breccia of Subunit 31A. Pieces 2 and 6, altered basalt of unclear origin.

UNIT 34: CLINOPYROXENE-OLIVINE-PLAGIOCLASE BASALT

Pieces 7-26

CONTACTS: Continues into Section 97R-2.
PHENOCRYSTS:
 Plagioclase - <1%; 0.5 mm; Anhedral, commonly in glomerocrysts with clinopyroxene.
 Olivine - <1%; 0.5-2 mm; Euhedral to anhedral, fresh in certain areas, but iddingsitized where the matrix is iron-stained.
 Clinopyroxene - 1%-2%; 0.5-3 mm; Subhedral prisms, fresh.
GROUNDMASS: Microcrystalline.
VESICLES: None.
COLOR: Medium gray (N5) but iron-stained to red (2.5YR 5/6) within 1 cm of fractures.
STRUCTURE: Massive.
ALTERATION: Relatively fresh, with lots of unaltered phenocrysts. Iron-staining along fractures.
VEINS/FRACTURES: Subhorizontal and spaced every 2-5 cm. Iron-staining of the matrix out about 1 cm from each fracture.
ADDITIONAL COMMENTS: None.



CORE/SECTION

UNIT 34: CLINOPYROXENE-OLIVINE-PLAGIOCLASE BASALT (continued)

Pieces 1–14

CONTACTS: Continues from Section 97R-1 and into Section 97R-3.

PHENOCRYSTS:

Plagioclase - <1%; 0.5 mm; Anhedra, commonly in glomerocrysts with clinopyroxene.

Olivine - <1%; 0.5–2 mm; Euhedral to anhedral, fresh in certain areas, but iddingsitized where the matrix is iron-stained.

Clinopyroxene - 1%–2%; 0.5–3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: None.

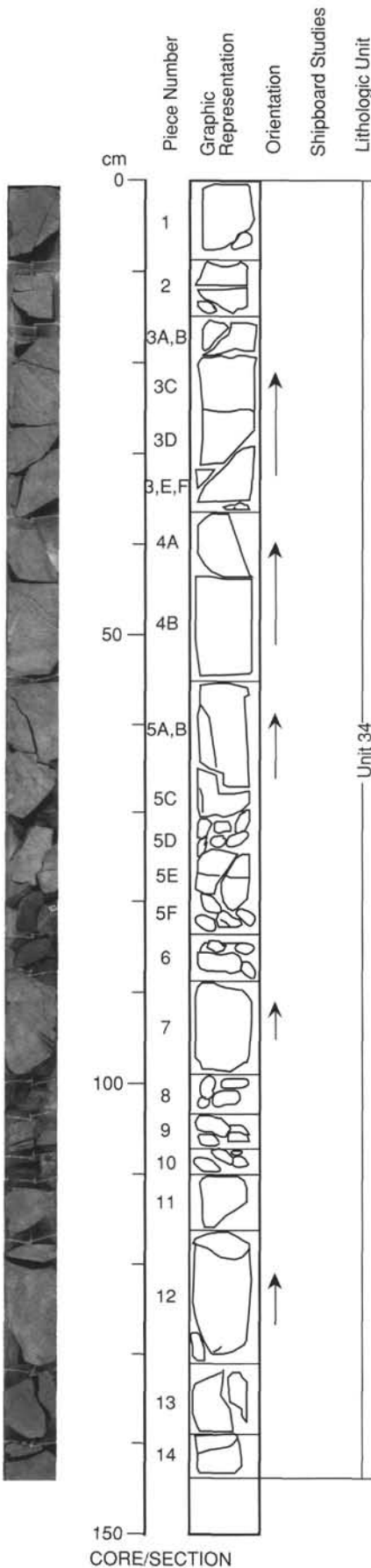
COLOR: Medium gray (N5) but iron-stained to red (2.5YR 5/6) within 1 cm of fractures.

STRUCTURE: Massive.

ALTERATION: Relatively fresh, with lots of unaltered phenocrysts. Iron-staining along fractures.

VEINS/FRACTURES: Subhorizontal and spaced every 2–5 cm. Iron-staining of the matrix out about 1 cm from each fracture.

ADDITIONAL COMMENTS: None.



144-878A-97R-3

UNIT 34: CLINOPYROXENE-OLIVINE-PLAGIOCLASE BASALT (continued)

Pieces 1-8

CONTACTS: Continues from Section 97R-2.

PHENOCRYSTS:

Plagioclase - <1%; 0.5 mm; Anhedral, commonly in glomerocrysts with clinopyroxene.

Olivine - <1%; 0.5-2 mm; Euhedral to anhedral, fresh in certain areas, but iddingsitized where the matrix is iron-stained.

Clinopyroxene - 1%-2%; 0.5-3 mm; Subhedral prisms, fresh.

GROUNDMASS: Microcrystalline.

VESICLES: None.

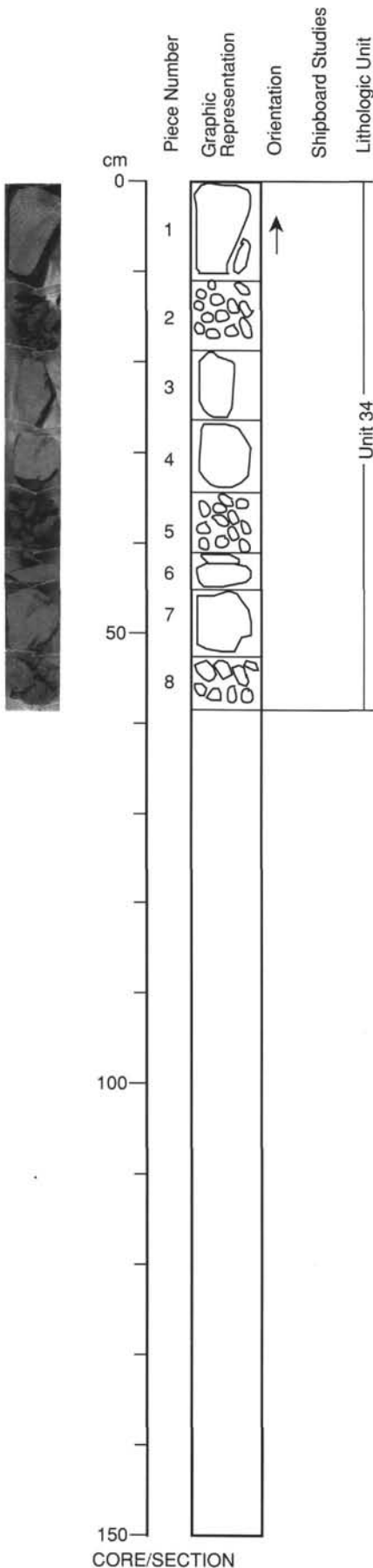
COLOR: Medium gray (N5) but iron-stained to red (2.5YR 5/6) within 1 cm of fractures.

STRUCTURE: Massive.

ALTERATION: Relatively fresh, with lots of unaltered phenocrysts. Iron-staining along fractures.

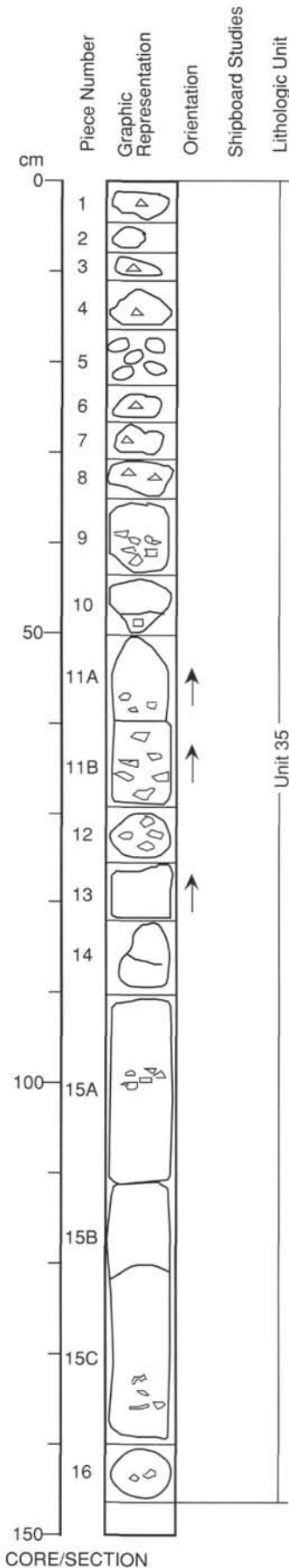
VEINS/FRACTURES: Subhorizontal and spaced every 2-5 cm. Iron-staining of the matrix out about 1 cm from each fracture.

ADDITIONAL COMMENTS: None.



UNIT 35: OLIVINE-CLINOPYROXENE BASALT

Pieces 1–16



CONTACTS: Continues into Section 98R-2.

PHENOCRYSTS: Description for massive portion of the flow. Clasts in the flow-top breccia have the same texture.
Olivine - 5%–10%; 1–5 mm; Euhedral, broken and anhedral grains. Also, glomerocrysts. Iddingsitized.
Clinopyroxene - <1%; 1–2 mm; Subhedral, intergrown with plagioclase.

GROUNDMASS: 0–31 cm, clasts are aphanitic, subrounded, and 15 cm. 31–146 cm, massive basalt is microcrystalline.

VESICLES: 0–31 cm, clasts have no vesicles, matrix has 10%, 3–10 mm, open vugs. 31–75 cm, 10%–15%, 1–10 mm, irregular and commonly horizontally elongate, filled by pale green (10G 6/2) and white (N9) clay. 76–89 cm, no vesicles. 89–146 cm, 30%, 1–3 mm, round to elliptical, filled with white (N9) or dusky green (5G 6/2) clay.

COLOR: 0–31 cm, clasts are dark reddish gray (5R 3/1). Matrix clay is grayish yellow green (5GY 7/2). 31–89 cm, medium gray (N5). 89–146 cm, dark gray (N3).

STRUCTURE: 0–31 cm, flow-top breccia. 31–146 cm, massive portion of the flow.

ALTERATION: Olivine is all pseudomorphed by iddingsite, and vesicles are filled, but the matrix of the unit is a fresh gray (N3-N5) color. Relatively unaltered unit.

VEINS/FRACTURES: None.

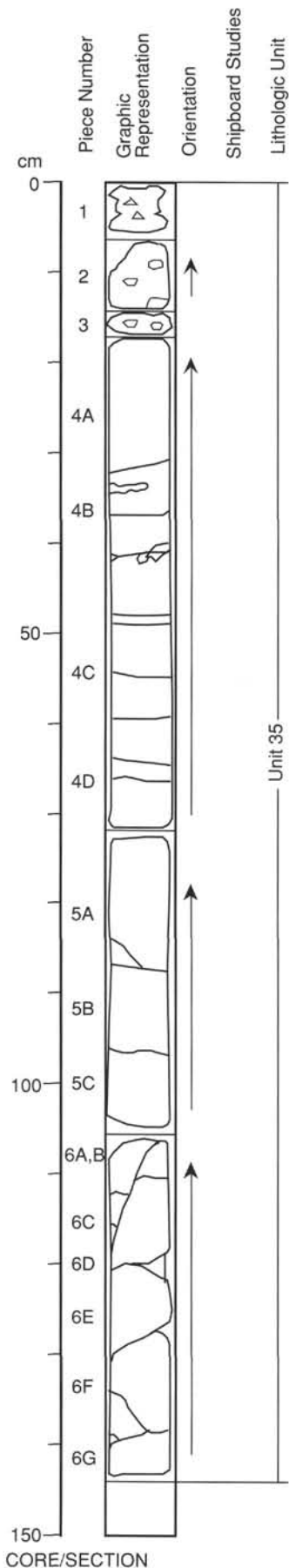
ADDITIONAL COMMENTS: None.

- △ Breccia
- ◊ Irregular vesicles
- Xenoliths

144-878A-98R-2

UNIT 35: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-6



CONTACTS: Continues from Section 98R-1 and into Section 98R-3.

PHENOCRYSTS:

Olivine - 5%-10%; 1-5 mm; Euhedral, broken and anhedral grains. Also, glomerocrysts. 0-47 cm, iddingsitized. 47-80 cm, altered to dark greenish gray (5G 4/1). 80-144 cm, altered to light olive brown (2.5Y 5/4) or iddingsite, but some is fresh.

Clinopyroxene - <1%; 1-2 mm; Subhedral, intergrown with plagioclase.

GROUNDMASS: Microcrystalline.

VESICLES: 0-17 cm, 10%, 1-2 mm, irregular, empty or filled by white (N9) and pale green (10G 6/2) clay.

No vesicles below 17 cm.

COLOR: 0-17 cm, dark gray (N3); 17-33 cm, reddish gray (10R 6/1); 33-73 cm, medium dark gray (N4);

73-144 cm, medium light gray (N6), but iron-stained light brown (5YR 5/6) in places.

STRUCTURE: Massive.

ALTERATION: Becoming, except for the iron-staining, fresher looking downsection. More phenocrysts are preserved.

VEINS/FRACTURES: Subhorizontal fractures spaced every 1-3 cm.

ADDITIONAL COMMENTS: None.

UNIT 35: OLIVINE-CLINOPYROXENE BASALT (continued)

Pieces 1-5

CONTACTS: Continues from Section 98R-2.

PHENOCRYSTS:

Olivine - 5%-10%; 1-5 mm; Euhedral, broken and anhedral grains. Also, glomerocrysts. Altered to light olive brown (2.5Y 5/4) clay or iddingsite, but some are fresh.

Clinopyroxene - <1%; 1-2 mm; Subhedral, intergrown with plagioclase.

GROUNDMASS: Microcrystalline.

VESICLES: None.

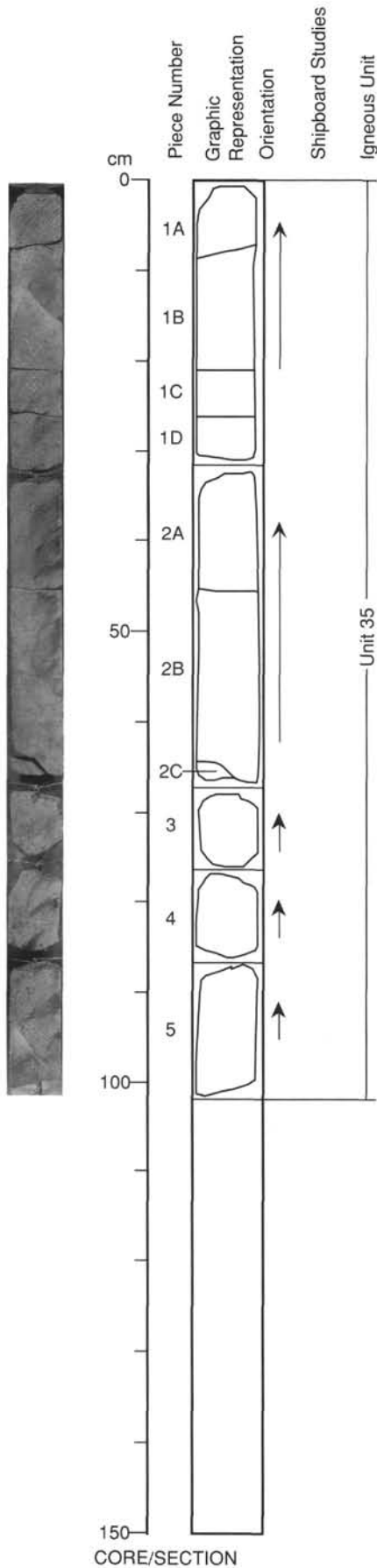
COLOR: Medium light gray (N6), but iron-stained light brown (5YR 5/6) in places.

STRUCTURE: Massive.

ALTERATION: Except for the iron-staining, the lower portion of this unit appears to be very fresh.

VEINS/FRACTURES: Subhorizontal fractures spaced every 1-3 cm.

ADDITIONAL COMMENTS: None.



CORE/SECTION