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Lithofacies and Sequence Stratigraphic Description of the Upper Part of the Avon Park Formation and the Arcadia Formation in U.S. Geological Survey G–2984 Test Corehole, Broward County, Florida

By Kevin J. Cunningham and Edward Robinson

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Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
	Mass	
ounce, avoirdupois (oz)	28.35	gram (g)

Abbreviations

bls	below land surface
Ca	calcium
DS	depositional sequence
Fe	iron
obi	optical image logger
USGS	U.S. Geological Survey
XRD	x ray diffraction

Lithofacies and Sequence Stratigraphic Description of the Upper Part of the Avon Park Formation and the Arcadia Formation in U.S. Geological Survey G–2984 Test Corehole, Broward County, Florida

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Abstract

Rock core and sediment from U.S. Geological Survey test corehole G–2984 completed in 2011 in Broward County, Florida, provide an opportunity to improve the understanding of the lithostratigraphic, sequence stratigraphic, and hydrogeologic framework of the intermediate confining unit and Floridan aquifer system in southeastern Florida. A multidisciplinary approach including characterization of sequence stratigraphy, lithofacies, ichnology, foraminiferal paleontology, depositional environments, porosity, and permeability was used to describe the geologic samples from this test corehole. This information has produced a detailed characterization of the lithofacies and sequence stratigraphy of the upper part of the middle Eocene Avon Park Formation and Oligocene to middle Miocene Arcadia Formation. This enhancement of the knowledge of the sequence stratigraphic framework is especially important, because subaerial karst unconformities at the upper boundary of depositional cycles at various hierarchical scales are commonly associated with secondary porosity and enhanced permeability in the Floridan aquifer system.

Introduction

The U.S. Geological Survey (USGS) G–2984 test corehole (Florida Geological Survey well ascension number W–17986) was completed in November 2011 by the Florida Geological Survey in Broward County, Florida (fig. 1). The main purpose for drilling the test corehole was to provide additional information to update the lithostratigraphic, sequence stratigraphic, and hydrogeologic framework of the upper part of the Upper Floridan aquifer for a cooperative investigation by the USGS and Broward County completed by Reese and Cunningham (2014). The test corehole was continuously cored from land surface to a total depth of 1,308 feet below land surface (ft bls). The corehole penetrated middle Eocene, Oligocene, Neogene, and Quaternary rocks and sediments. These strata include the surficial aquifer, intermediate confining unit, and the upper part of the Upper Floridan aquifer. The purpose of this report is to describe the sequence stratigraphy, lithofacies, ichnology, foraminiferal paleontology, depositional environments, porosity, and permeability of the upper part of the Avon Park Formation and Arcadia Formation by using data obtained from the core (fig. 2). These data can be used as multiple lines of evidence for advancing the understanding of the Eocene to Miocene

sequence stratigraphic, lithostratigraphic, and hydrogeologic framework of the southeastern Florida Platform. Notably, the sequence stratigraphic framework is important because subaerial karst unconformities at the upper boundary of depositional cycles at various hierarchical scales (Kerans and Tinker, 1997, fig. 1.11) are commonly associated with secondary porosity and enhanced permeability in the Floridan aquifer system (Cander, 1995; Reese and Cunningham, 2014) and in many oil and gas fields around the world (Budd and others, 1995).

Methods

A multidisciplinary approach was used to describe the lithofacies and sequence stratigraphy of the upper part of the Avon Park Formation and Arcadia Formation. This approach used data from analyses of slabbed core, including sequence stratigraphy, paleontology (emphasis on foraminifera), x ray diffraction (XRD), ichnology, and porosity and permeability characterization. At the time of this publication, all core samples and thin sections used in this study are temporarily stored at the U.S. Geological Survey Florida Water Science Center, Fort Lauderdale, Fla. Permanent storage of the core samples and thin sections will be at the Florida Geologic Survey Geologic Core Repository, Tallahassee, Fla.

Analyses of Slabbed Core

Numerous slabbed core samples (approximately 2-inch [in.] diameter) from an upper part of the Avon Park Formation and the entire thickness of the Arcadia Formation were analyzed. All of the core samples were first visually analyzed by using a 10x-magnification hand lens and a binocular microscope, and then compared to optical and acoustic borehole wall images acquired by a wireline logging tool. The total magnification of the hand lens is multiplied by 10, as indicated by “10x”. Standard transmitted-light petrography was used to examine 179 thin sections. The slabbed cores and thin sections were useful for determining lithofacies, vertical trends in lithofacies, sedimentary structures, ichnology, and sequence stratigraphic (cycle) boundaries. Lithofacies were identified by grain types, fabric, depositional texture, and diagenetic features by using a combination of classification schemes and terminology from Dunham (1962), Embry and Klovan (1971), and Lucia (1999). Comparison of slabbed core to a Munsell rock color chart (Geological Society of America, 1991) was used to record rock color. A semiquantitative field classification of ichnofabric (Droser and Bottjer, 1986, 1989) was used to record variations in the extent of bioturbation. Classifications of porosity were assessed by using schemes developed by Choquette and Pray (1970) and Lucia (1995, 1999). A total of 276 air-permeability measurements (Cunningham and others, 2006) and calculated lattice Boltzman permeability values of both Pleistocene and Cretaceous carbonate rocks (Cunningham and others, 2009, 2012; Cunningham and Sukop, 2011, 2012; Sukop and others, 2013; Sukop and Cunningham, 2014) were used as reference material for the purpose of visual comparison to the Avon Park and Arcadia Formation core samples from the G-2984 test corehole in order to visually estimate the permeability of these samples. The Pleistocene and Cretaceous carbonate rock samples have similar lithofacies and pore types as the core samples described herein from the G–2984 test corehole.

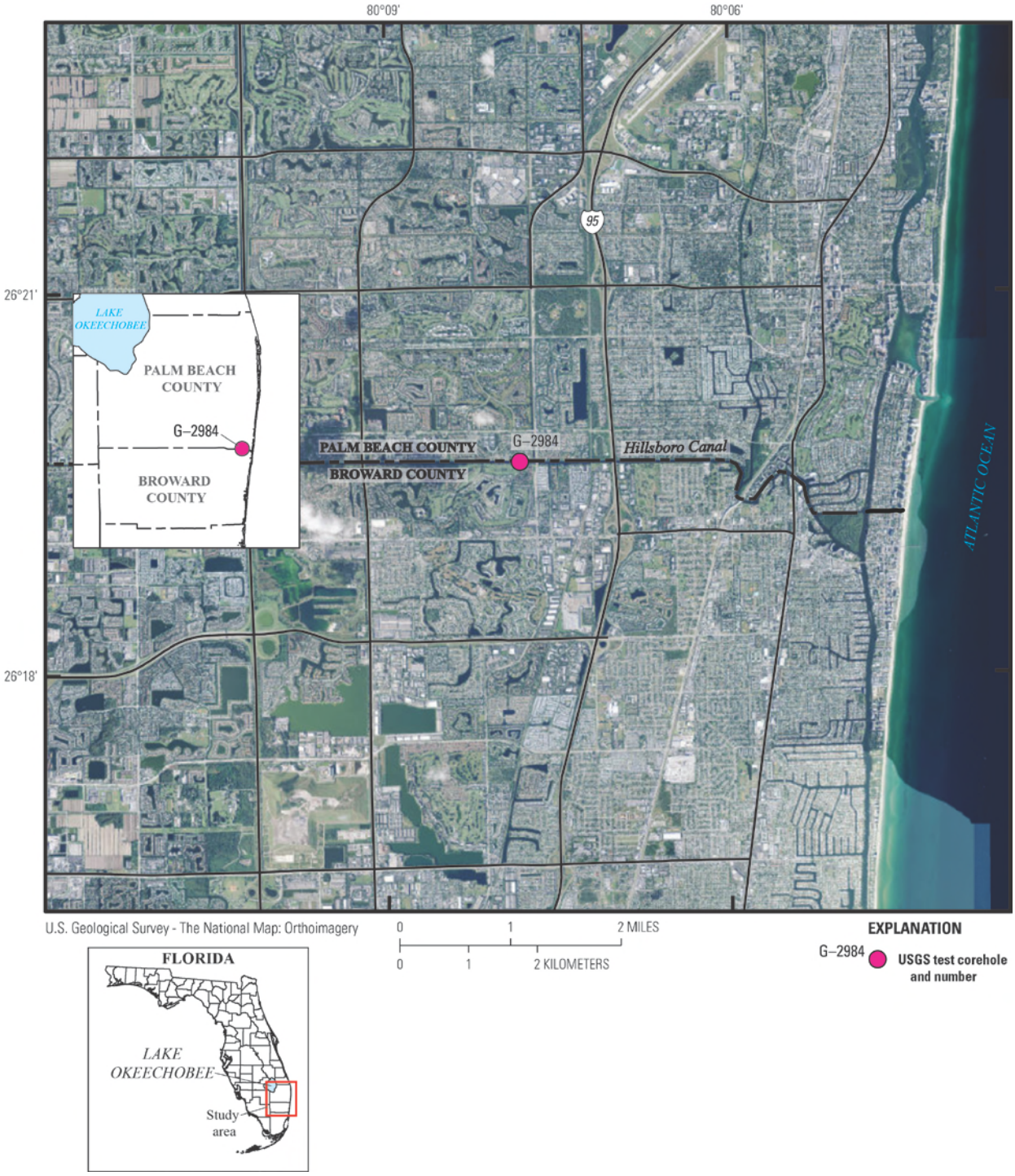

Figure 1. Map showing location of U.S. Geological Survey G–2984 test corehole in southeastern Florida.

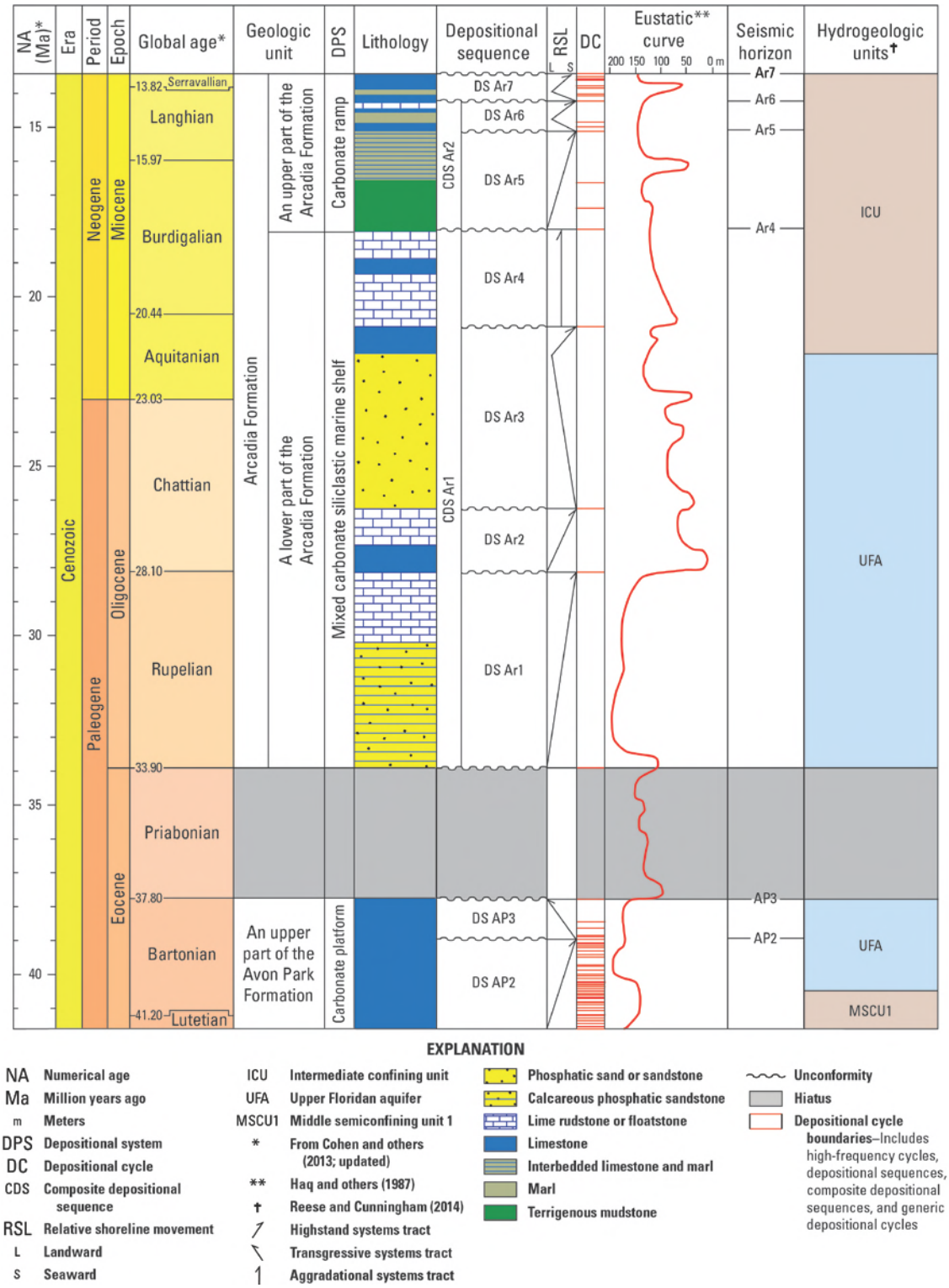

Figure 2. Stratigraphic chart showing correlation of chronostratigraphy, geologic units, lithology, sequence stratigraphy, major cycles, depositional cycles, eustatic sea-level curve, seismic horizons, and hydrogeologic units of U.S. Geological Survey G–2984 test corehole. Note that the hiatus represents an interruption in the geologic record, such as nondeposition, erosion, or both.

Foraminiferal Paleontologic Analysis

Taxonomy of benthic and planktic foraminifera from selected lithofacies was determined to assist in interpretation of depositional environments and biostratigraphy. Foraminifera were examined in 189 thin sections prepared from core samples acquired from the G–2984 test corehole (fig. 1). Thin sections were examined by transmitted light by using a Zeiss stereoscopic microscope and by counting selected taxa at magnifications ranging from 1.6x to 6.3x. Thin sections were then examined by using an AmScope 2000X LED Model SME-F8BH trinocular compound microscope for more detailed analysis and identification to the highest practicable taxonomic level. Typical examples of identified taxa were imaged by using an AmScope MU Series 10-megapixel digital camera.

X Ray Diffraction

Twenty-four rock samples were analyzed by XRD to identify the clay and carbonate content of the rock samples acquired from the Arcadia Formation in the G–2984 test corehole (fig. 1, table 1). Use of XRD provided a quantitative guide for differentiating marl and limestone, and assisted in characterizing depositional environments of the carbonate ramps that compose the Arcadia Formation. Marl is a lithology consisting of 65–35 percent carbonate and 35–65 percent clay (Pettijohn, 1957; Flügel, 2004). Samples weighed between 10.2 and 30.0 grams and were used for determination of weight percentage whole-rock and clay-fraction mineralogy by XRD analytical procedures at Core Laboratories LP in Houston, Texas. Each sample was cleaned of any observable drilling contaminants and then disaggregated with a mortar and pestle. Approximately 5 grams of each sample was transferred to isopropyl alcohol and ground in a McCrone micronizing mill. A split of the resultant powders was dried, disaggregated, and back-loaded into aluminum sample holders to produce whole-rock mounts. A separate split of each sample powder was dispersed in a dilute sodium-phosphate solution by using a sonic probe, and the suspensions were then centrifugally size-fractionated to isolate clay-size (less than 4 microns) materials. The separate clay-fraction suspensions were then vacuum deposited on silver membrane filters to produce clay-oriented mineral aggregates and attached to stainless steel slugs.

Lithofacies and Sequence Stratigraphy

The fundamental lithostratigraphic component identified in this report is the lithofacies. A lithofacies is a lateral mappable subdivision of a designated stratigraphic unit, distinguished from adjacent subdivisions on the basis of lithology, including all mineralogic and petrographic characteristics and those paleontologic characteristics that influence the appearance, composition, or texture of the rock (Neuendorf and others, 2005). Unique, vertically defined lithofacies units were identified and described in a concise abbreviated style for the Avon Park Formation and Arcadia Formation core samples from the G–2984 test corehole, and are presented in the final two sections herein. The lithofacies units stack into vertical lithofacies successions that contain a record of shallowing upward or deepening upward environments, or an amalgamation of a persistent, aggradational environment as accommodation is filled within a cycle-scale relative change in sea level (Kerans and Tinker, 1997, fig. 1.11).

In the two succeeding sections of this report that contain the core descriptions of the Avon Park and Arcadia Formations, information is presented in a two-column display that

Table 1. X ray diffraction results for rock core samples from the Arcadia Formation in U.S. Geological Survey G–2984 test corehole.

[Fe, iron; Ca, calcium]

Driller's depth (feet below land surface)	Seismic sequence	Whole-rock mineralogy (weight percentage)							Clay mineralogy (weight percentage)			
		Quartz	K-feldspar	Plagio-clase	Calcite	Dolomite and (Fe,Ca)-dolomite	Fluora-patite	Total clay miner-als	Illite/ smec-tite*	Sepi-olite	Palygor-skite	Kaoli-nite
606.76	Ar7	4.8	0.0	0.0	64.6	16.9	0.0	13.7	3.8	0.0	9.9	0.0
611.90	Ar7	9.6	1.0	1.7	57.2	16.7	0.0	13.8	4.5	0.0	9.3	0.0
619.50	Ar7	9.1	0.0	0.0	15.0	29.7	0.0	46.2	20.6	0.0	25.2	0.4
624.07	Ar7	8.0	1.3	2.3	59.7	15.1	0.0	13.6	4.4	0.0	9.2	0.0
644.87	Ar7	6.4	0.7	1.2	81.6	2.3	0.0	7.8	2.7	0.0	5.1	0.0
654.15	Ar7	5.4	0.0	0.0	68.6	3.1	0.0	22.9	10.7	0.0	12.2	0.0
662.97	Ar7	14.1	0.0	3.7	26.7	8.2	0.0	47.3	15.6	0.0	30.6	1.1
678.70	Ar7	9.9	0.0	2.0	43.9	7.1	0.0	37.1	12.4	0.0	23.8	0.9
689.90	Ar7	4.9	0.0	0.0	64.1	3.3	1.1	26.5	12.4	0.0	14.1	0.0
691.00	Ar7	4.7	0.0	0.0	70.3	2.6	0.0	22.4	7.2	0.0	15.2	0.0
696.00	Ar7	2.0	0.0	0.0	79.8	1.1	2.8	14.3	4.3	0.0	10.0	0.0
698.64	Ar7	3.8	0.0	1.1	48.2	10.6	0.0	36.3	12.3	0.0	24.0	0.0
708.00	Ar7	3.3	0.0	0.0	76.3	1.6	0.0	18.8	7.2	0.0	11.6	0.0
718.00	Ar6	2.2	0.0	0.0	87.4	0.7	0.0	9.7	3.3	0.0	6.4	0.0
767.80	Ar6	3.8	0.0	0.0	42.3	10.2	0.0	43.8	8.6	14.0	21.2	0.0
805.35	Ar6	1.7	0.0	0.7	23.8	19.0	0.0	54.9	8.1	17.6	29.2	0.0
812.10	Ar6	2.5	0.0	0.0	21.3	16.6	0.0	59.6	6.0	23.1	30.5	0.0
828.70	Ar6	2.0	0.0	0.0	28.3	26.7	0.0	43.0	7.8	20.3	14.9	0.0
841.60	Ar6	1.7	0.0	0.0	37.7	19.2	0.0	41.5	8.4	23.0	10.1	0.0
850.85	Ar6	2.1	0.0	1.0	52.1	19.8	0.0	25.0	0.0	13.9	11.1	0.0
871.40	Ar6	2.2	0.0	0.0	44.4	14.7	0.0	38.6	6.3	22.3	10.0	0.0
898.00	Ar5	1.6	0.0	0.0	26.1	14.7	0.0	57.6	8.2	23.7	25.7	0.0
914.65	Ar5	1.8	0.0	0.0	0.8	9.6	0.0	87.8	10.9	16.4	60.5	0.0
923.95	Ar5	2.4	0.0	0.0	2.7	3.8	0.0	91.0	6.9	13.0	71.1	0.0

*Mixed-layer illite/smectite contains 70–80 percent smectite layers.

provides depths in the left column and lithofacies descriptions in the right column. The tops and bottoms of lithofacies units that compose vertical lithofacies successions are separated by thin horizontal black lines, whereas bold horizontal black lines are used to mark the boundaries where a vertical lithofacies succession boundary coexists with a sequence stratigraphic (cyclostratigraphic) boundary.

The hierarchy of sequence stratigraphy applied herein is based on the terminology scheme of Kerans and Tinker (1997, fig. 1.11) and presented from the highest cycle hierarchical order to the lowest. The hierarchy includes high-frequency cycle, depositional sequence, and composite depositional sequence (fig. 2). Where the relative position of a specific cycle within this cycle hierarchy has a low level of confidence, the term "depositional cycle" is used. The hierarchical ordering of the cycle types indicates relative scale and position in the cycle hierarchy, but no particular time duration for generic depositional cycle types is inferred. Four different ideal high-frequency cycle types are defined for the Avon Park Formation. These ideal cycle types are herein named type I, type II, type III, and type IV and can be described as follows: (1) type I cycles are microbial laminite-capped grain-rich peritidal cycles; (2) type II cycles are rhizolith- and mud-capped micrite-rich peritidal cycles; (3) type III cycles are aggradational grain-rich subtidal cycles; and (4) type IV cycles are *Glossifungites*-capped subtidal cycles (figs. 3 and 4).

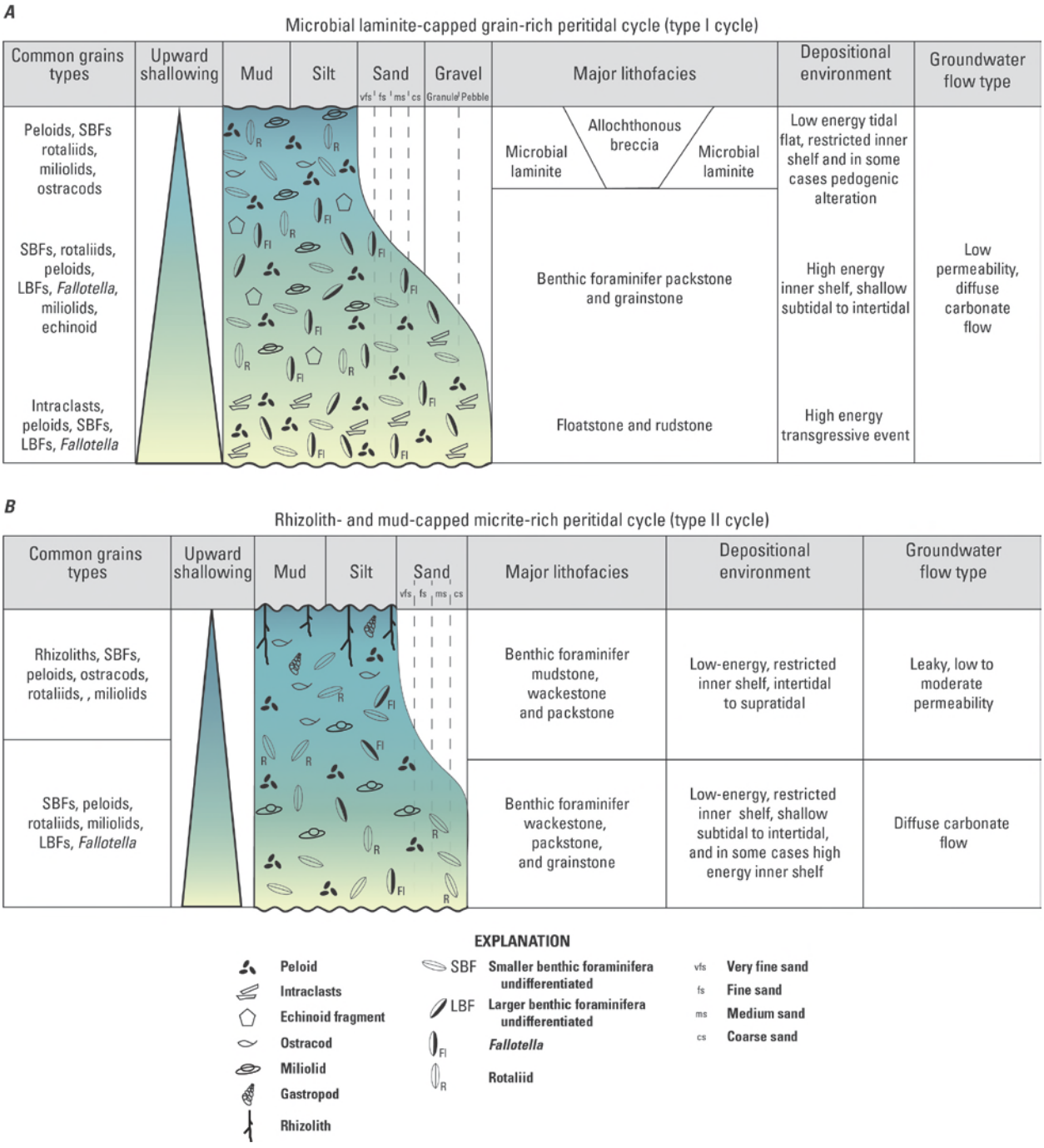

Figure 3. Diagrams showing two of three ideal high-frequency cycles defined for depositional sequence DS AP2 of the Avon Park Formation by analyzing slabbed core from U.S. Geological Survey G–2984 test corehole (figs. 1 and 2). *A*, The type I microbial laminite-capped grain-rich peritidal ideal cycle. *B*, The type II rhizolith- and mud-capped micrite-rich peritidal ideal cycle.

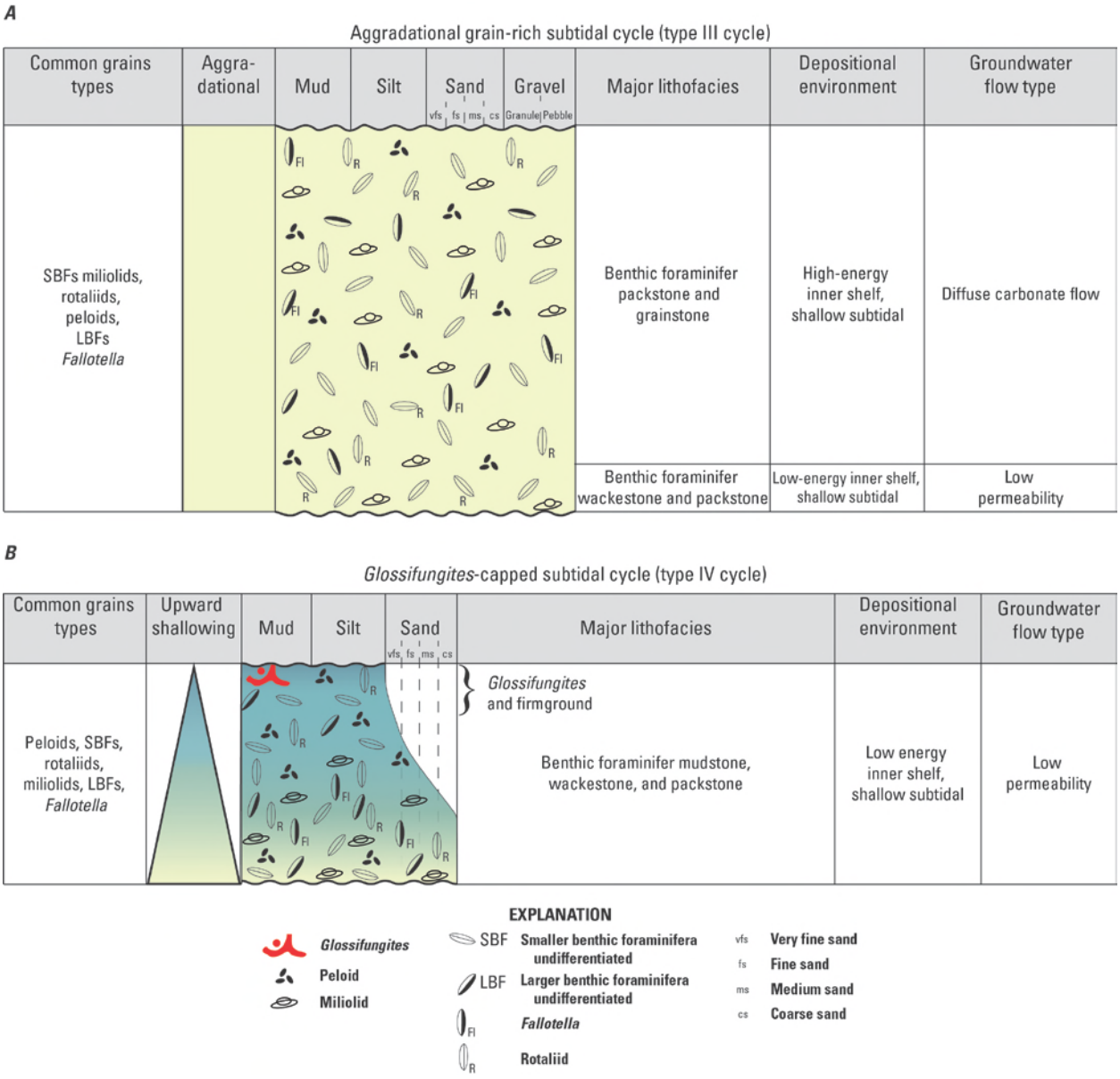

Figure 4. Diagrams showing two of four ideal high-frequency cycles defined for depositional sequence DS AP2 and DS AP3 of the Avon Park Formation by analyzing slabbed core from U.S. Geological Survey G–2984 test corehole (figs. 1 and 2). *A*, The type III aggradational grain-rich subtidal ideal cycle, which is exclusive to the depositional sequence AP3 of the Avon Park Formation. *B*, The type IV *Glossifungites*-capped ideal cycle.

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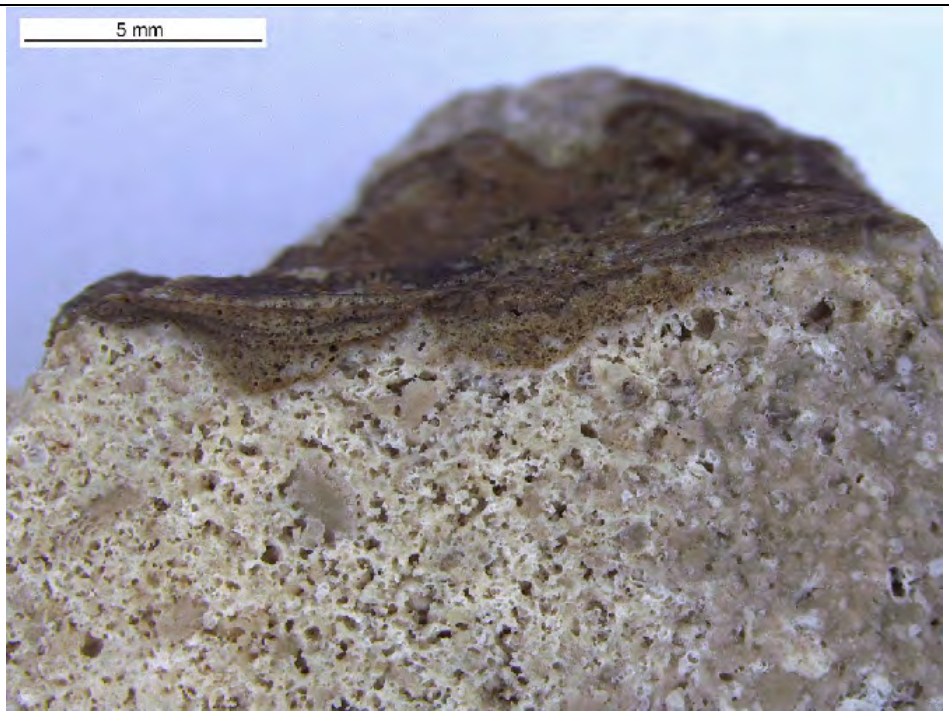
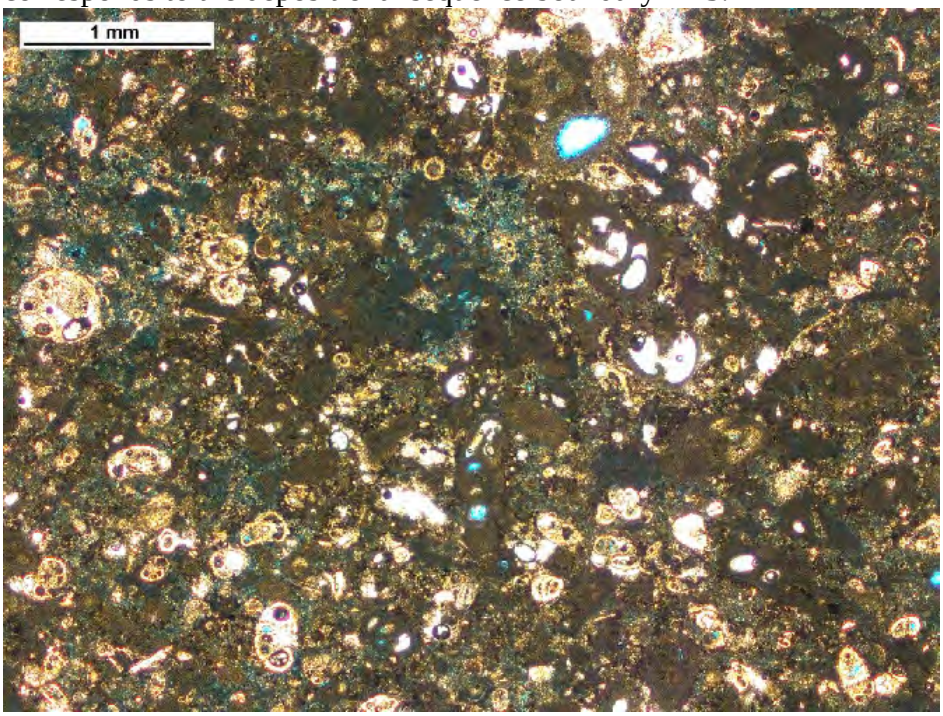
Lithofacies Description and Sequence Stratigraphy of Continuously Drilled Samples from the Avon Park Formation at U.S. Geological Survey G–2984 Test Corehole

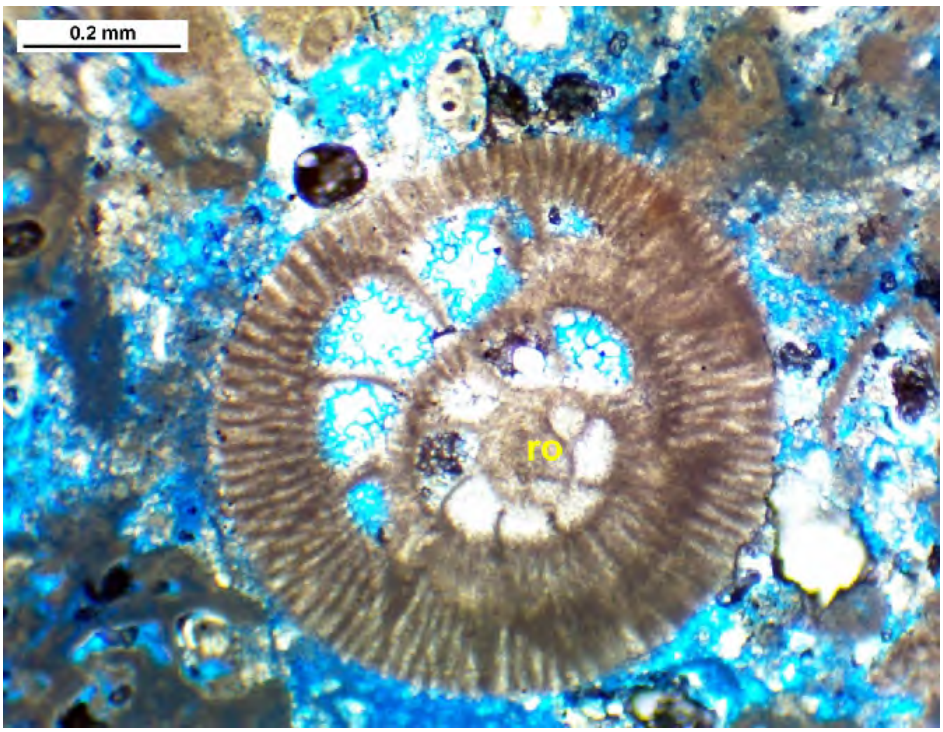
Depth interval (feet bls)	**Estimates of permeability:** Based on comparison of Avon Park Formation lithofacies and pore types to 276 Pliocene and Pleistocene eogenetic carbonate rock specimens with similar lithofacies and pore types and their air-permeability measurements (Cunningham and others, 2006) and lattice Boltzmann permeability calculations of both Pleistocene and Cretaceous carbonate rocks (Cunningham and others, 2009, 2012; Cunningham and Sukop, 2011, 2012; Sukop and others, 2013; Sukop and Cunningham, 2014) **Colors:** Colors based on comparison to Munsell rock color chart (Geological Society of America, 1991) **Ichnofabric:** Index based on Droser and Bottjer (1986, 1989) **Top of Avon Park Formation:** 1,067.60 ft bls (obi depth) and 1,066.0 ft bls (driller's depth)
obi depth: 1,067.60–1,068.30 ft bls Driller's depth: 1,066.0–1,066.7 ft bls	**Cycle type:** Top type III cycle and depositional sequence AP3 **Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifera mud- and grain-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Smaller benthic foraminifera (including smaller miliolids, rotaliids), peloids, larger benthic foraminifera (larger miliolids, *Fallotella floridana*), intraclasts, echinoid plates, ostracods, uncommon thin disarticulated bivalves. Foraminifera observed in thin section G2984–1066.05 include *Fallotella floridana*, *Pseudochrysalidina floridana*, larger valvulinids, total of 12 conical larger benthic foraminifera **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent particle moldic porosity; 6–18 percent total porosity and relatively low permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Comments:** Evidence for karstic exposure surface includes core with vugs infilled with sediment from the Arcadia Formation to a depth of 3.4 ft below the upper bounding surface. Some of the vugs are vertically oriented and circular pipe-shaped, and have an up to 2-centimeter (cm) wide inner diameter. Up to 0.3 ft of karstic microrelief on upper bounding surface, including some cracking extending downward from the upper surface (as seen on the optical borehole wall image) **Thin section:** G2984–1066.05



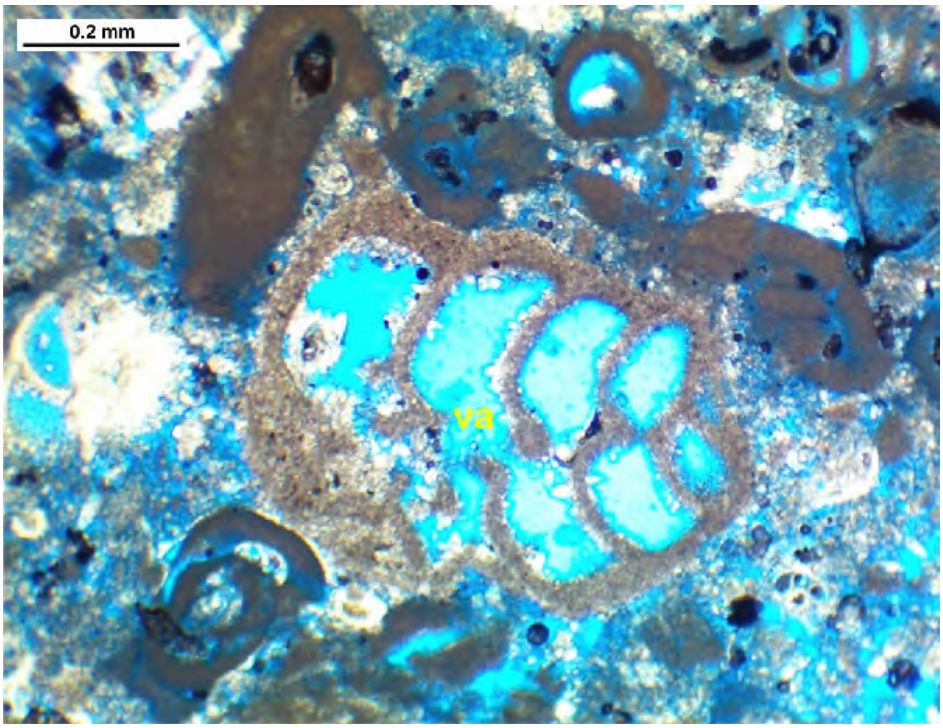
Photograph of slabbed core that shows the uppermost core sample of the Avon Park Formation with thin bands of dark coloration bounded by thin dished-shaped desiccation joint planes along the uppermost 2 millimeters (mm) and less of the Avon Park Formation. This is a depositional sequence boundary and corresponds to the depositional sequence boundary AP3.



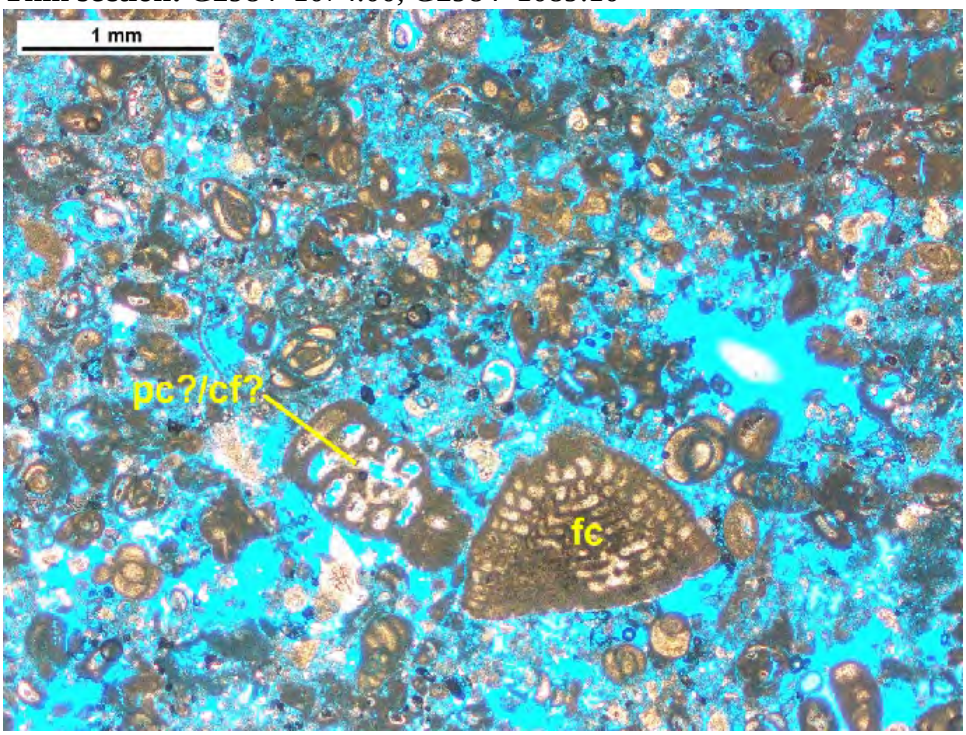
Photomicrograph from thin section G2984–1066.05 that shows smaller foraminifer and peloid mud-dominated packstone. Driller's depth of thin section is 1,066.05 ft bls.

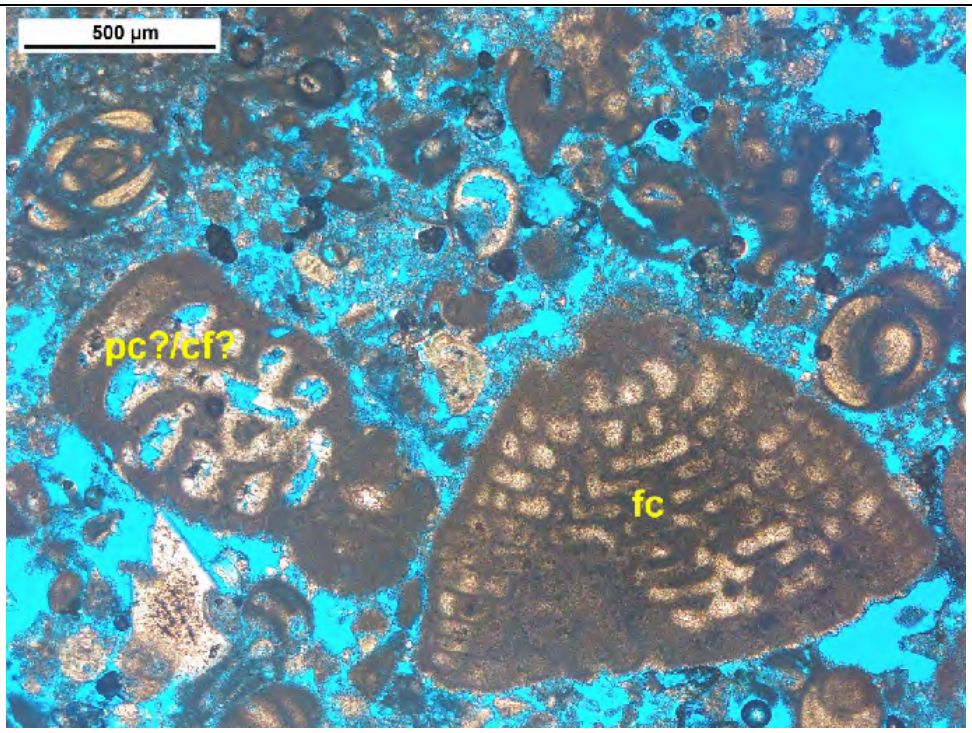


Photomicrograph from thin section G2984–1066.05 that shows a specimen of *Rotalia* (ro). Driller's depth of thin section is 1,066.05 ft bls.

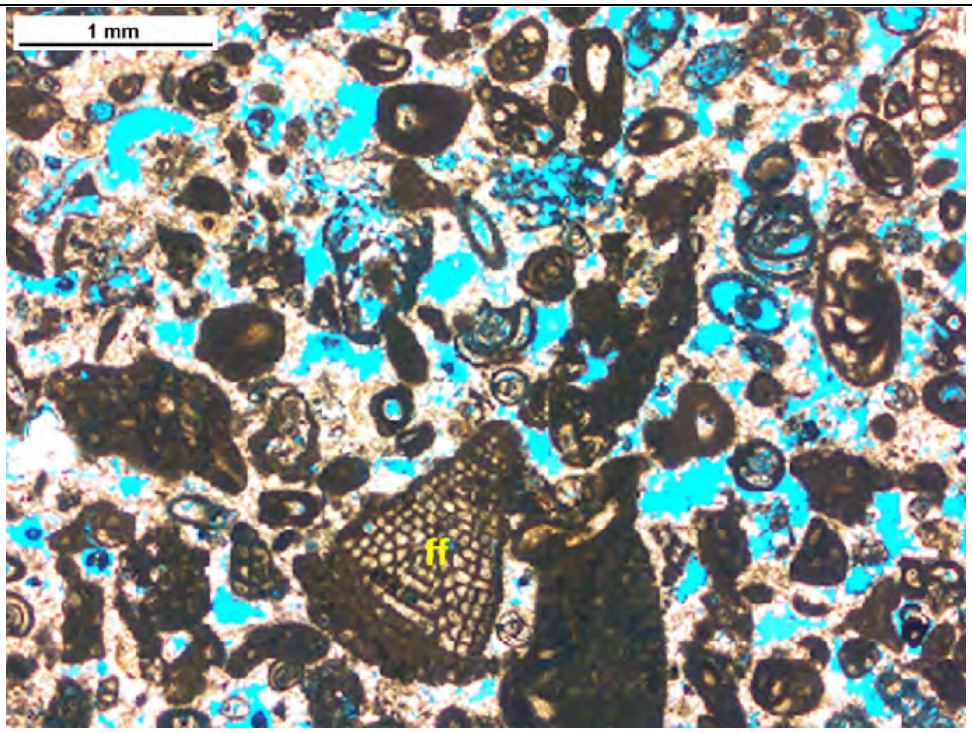


Photomicrograph from thin section G2984–1066.05 that shows a specimen of a valvulinid (va). Driller's depth of thin section is 1,066.05 ft bls.

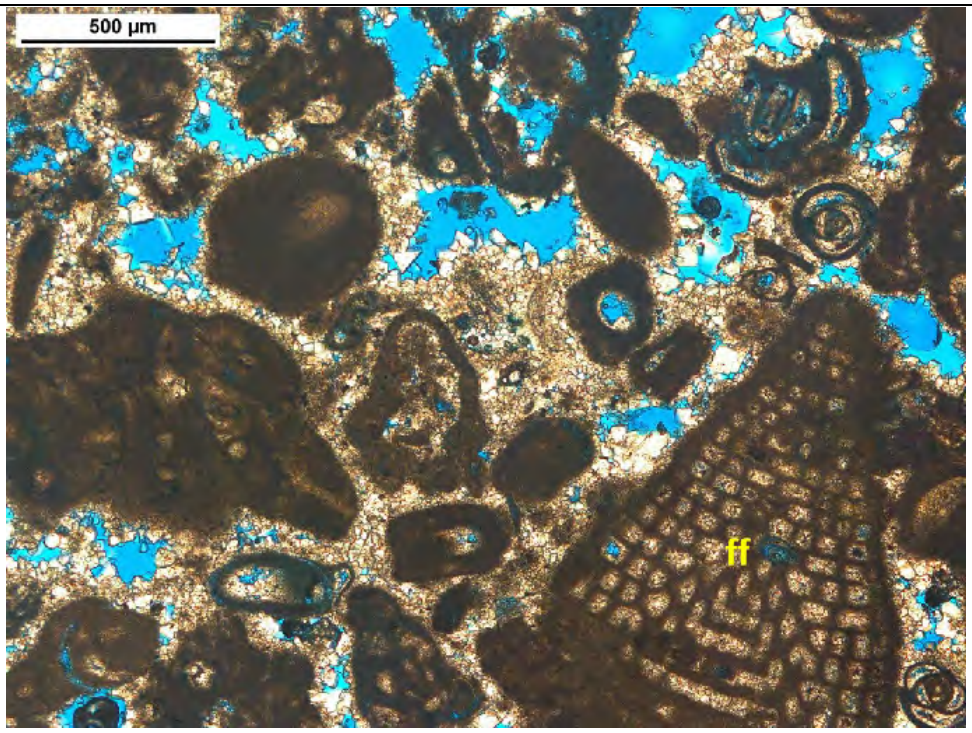
obi depth: 1,068.30– 1,103.7 ft bls Driller's depth: 1,066.7– 1,099.8 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifera grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Smaller benthic foraminifera (including smaller miliolids, rotaliids), peloids, larger benthic foraminifera (larger miliolids, *Fallotella floridana*), echinoid plates, and intraclasts. Foraminifera observed in thin section G2984–1074.00 include *Fallotella floridana*, *Pseudochrysalidina*?, *Dendritina* sp., *Gypsina*? sp., total of 13 conical larger benthic foraminifera. Foraminifera observed in thin section G2984–1089.10 include *Fallotella floridana*, *Pseudochrysalidina*?, *Dendritina* sp., total of three conical larger benthic foraminifera **Porosity and permeability:** 5–22 percent interparticle and intraparticle porosity, 1–7 percent particle-moldic porosity; 6–29 percent total porosity and relatively moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1074.00, G2984–1089.10  Photomicrograph from thin section G2984–1089.10 that shows smaller and larger benthic foraminifer grain-dominated packstone and grainstone. This interparticle-dominated pore system produces diffuse flow in part of the upper Floridan aquifer composed of the Avon Park Formation. Exemplifies rock of the Avon Park Formation that contributes to diffuse groundwater flow. The two large foraminiferal specimens near the lower center of the photomicrograph are *Pseudochrysalidina*? (pc?) or *Coskinolina floridana*? (cf?), and *Fallotella cookei* (fc). Driller's depth of thin section is 1,089.10 ft bls.



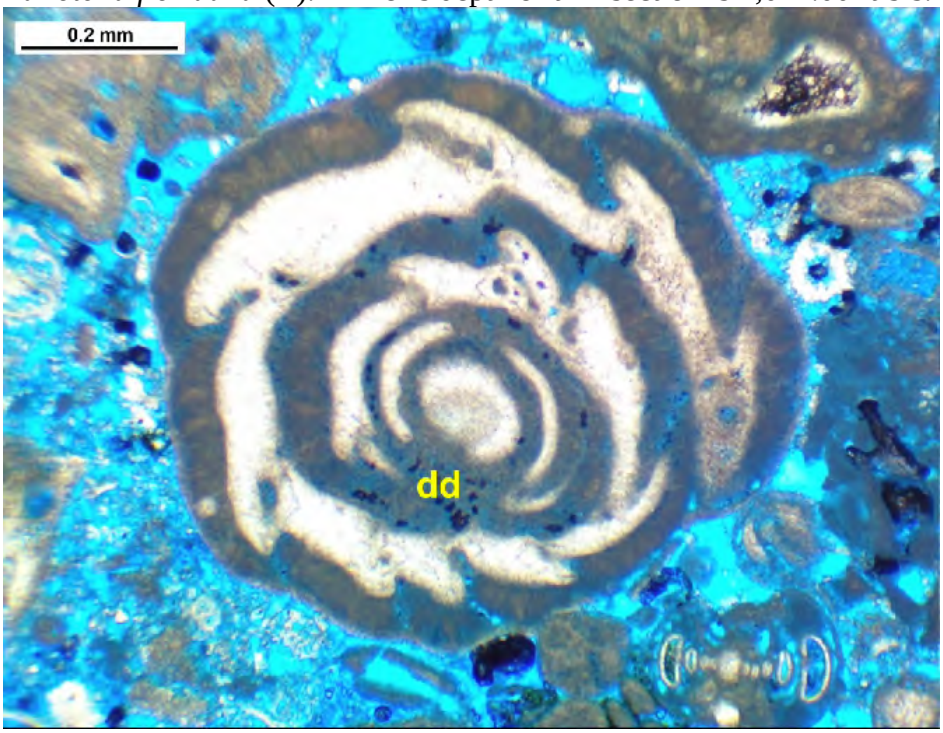
Photomicrograph from thin section G2984–1089.10 that shows smaller and larger benthic foraminifer grain-dominated packstone and grainstone. This interparticle-dominated pore system produces diffuse flow in part of the upper Floridan aquifer composed of the Avon Park Formation. The two large foraminiferal specimens in the photomicrograph are *Pseudochrysalidina*? (pc?) or *Coskinolina floridana*? (cf?), and *Fallotella cookei* (fc). Driller's depth of thin section is 1,089.10 ft bls.



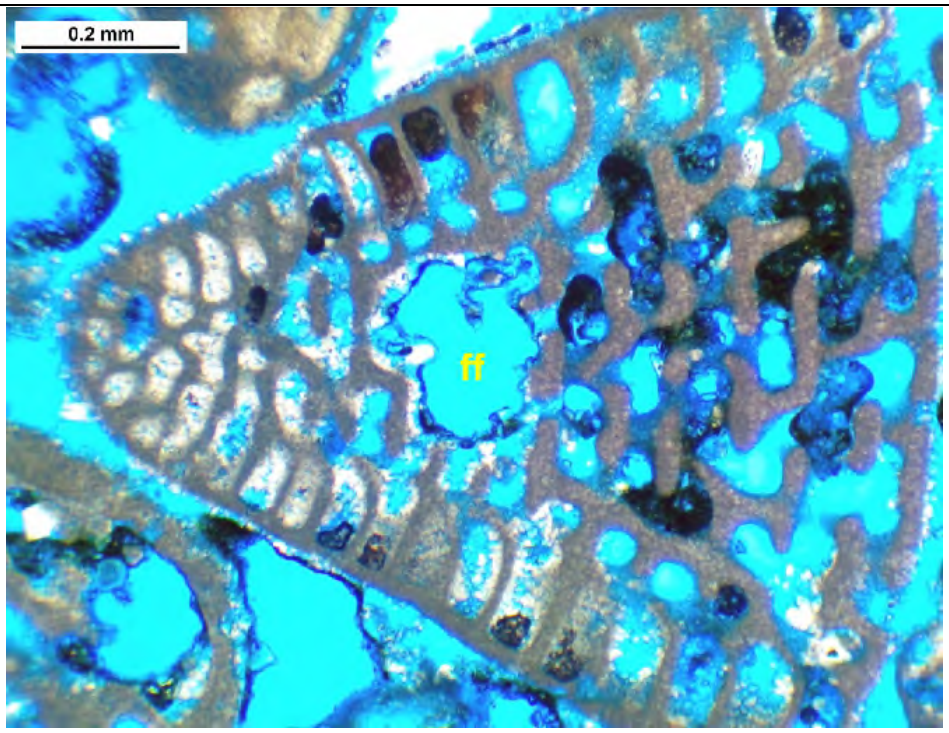
Photomicrograph from thin section G2984–1074.00 that shows smaller and larger benthic foraminifer grainstone. This interparticle-dominated pore system produces diffuse flow in part of the upper Floridan aquifer composed of the Avon Park Formation. The large foraminiferal specimen in the lower center is *Fallotella floridana* (ff). Exemplifies rock of the Avon Park Formation that contributes to diffuse groundwater flow. Driller's depth of thin section is 1,074.00 ft bls.



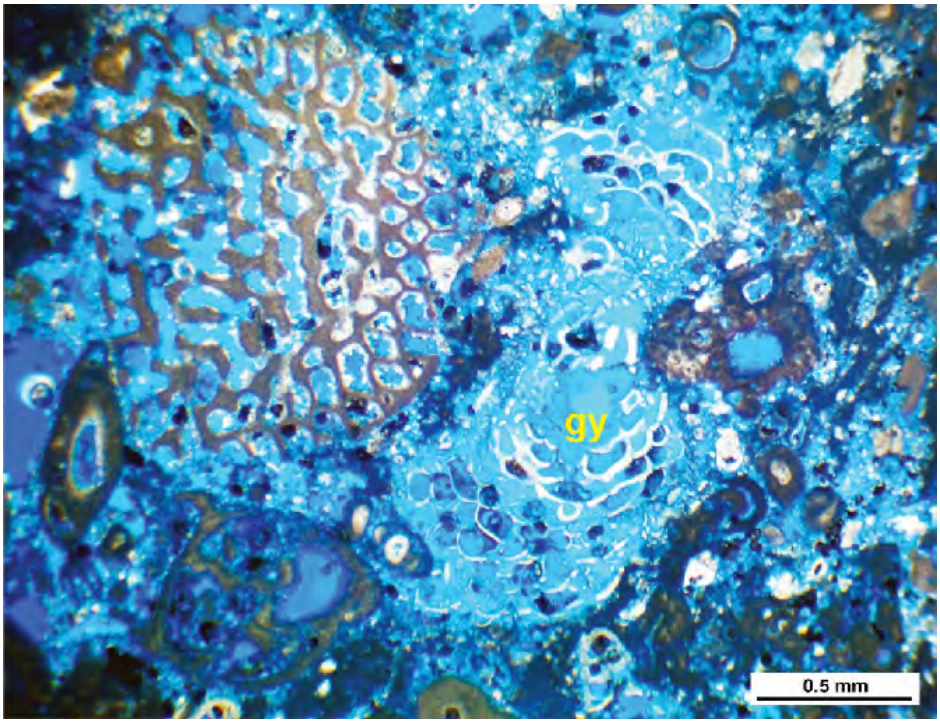
Photomicrograph from thin section G2984–1074.00 that shows smaller and larger benthic foraminifer grainstone. This interparticle-dominated pore system produces diffuse flow in part of the upper Floridan aquifer composed of the Avon Park Formation. The large foraminiferal specimen in the lower right is *Fallotella floridana* (ff). Driller's depth of thin section is 1,074.00 ft bls.



Photomicrograph from thin section G2984–1074.00 that shows a specimen of *Dendritina* sp. (dd). Driller's depth of thin section is 1,074.00 ft bls.

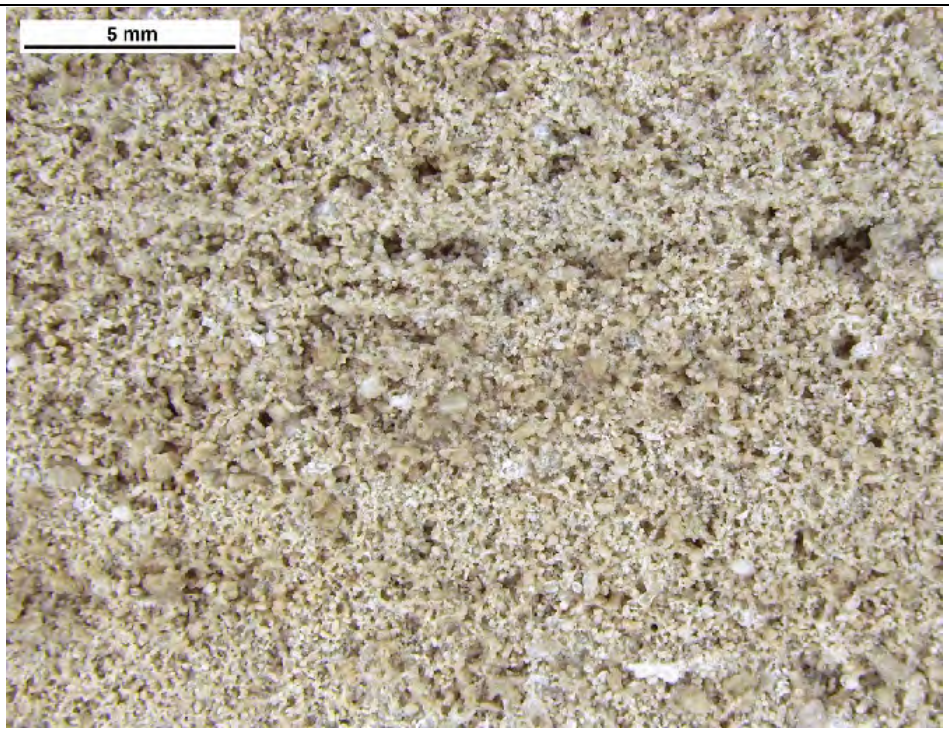


Photomicrograph from thin section G2984–1074.00 that shows a specimen of *Fallotella floridana* (ff). Driller's depth of thin section is 1,074.00 ft bls.

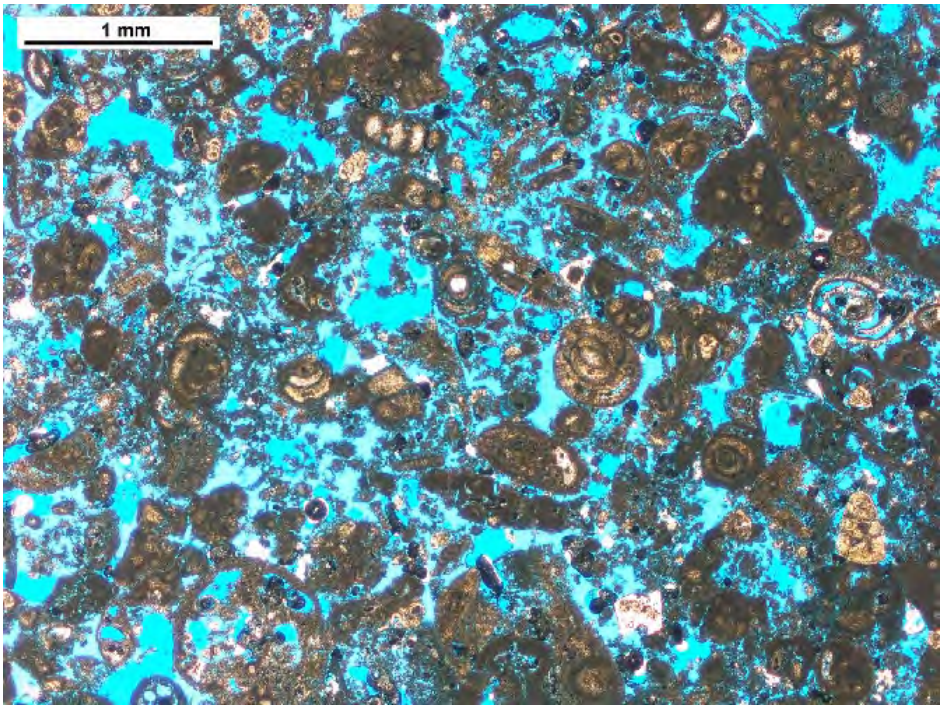


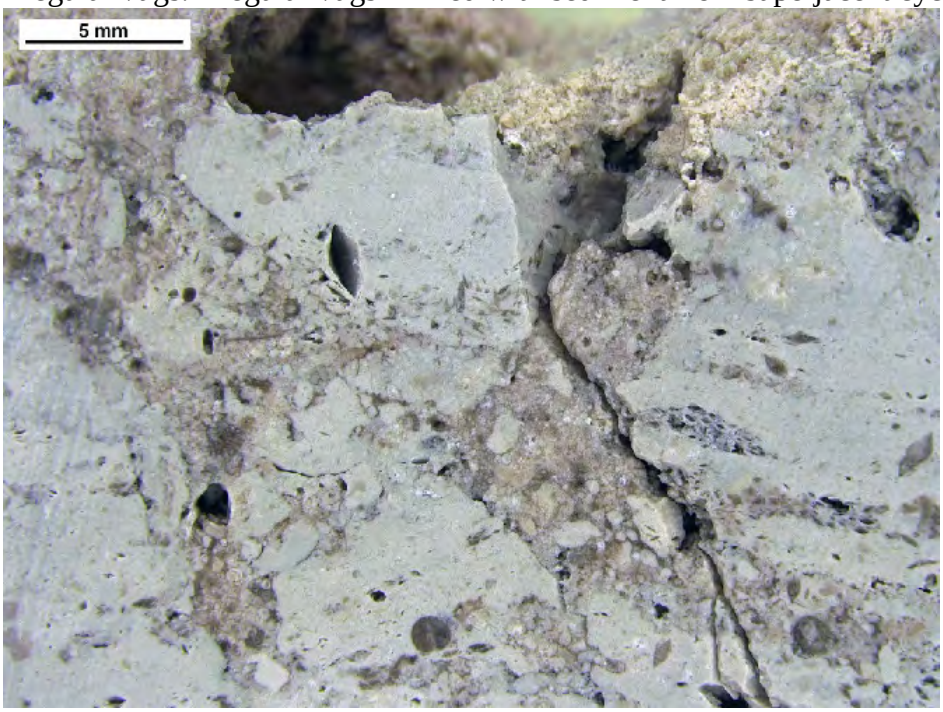
Photomicrograph from thin section G2984–1074.00 that shows a specimen of *Gypsina* sp. (gy) and a poorly preserved *Fallotella* to its left. Driller's depth of thin section is 1,074.00 ft bls.

	 Photomicrograph from thin section G2984–1074.00 that shows a specimen of a valvulinid (va). Driller's depth of thin section is 1,074.00 ft bls.
obi depth: 1,103.7–1,104.1 ft bls Driller's depth: 1,099.8–1,100.2 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifera grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thinly bedded with thin, grain-rich, horizontal laminations **Carbonate grains:** Smaller benthic foraminifera (including smaller miliolids, rotaliids), peloids, larger benthic foraminifera (larger miliolids), echinoid spines **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–7 percent particle-moldic porosity; 6–27 percent total porosity and relatively moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Comments:** Possible top of generally coarsening upward, energy increasing upward subtidal cycle at 1,103.7 ft (obi depth) and 1,099.8 ft (driller's depth). Abrupt facies shift across upper bounding surface. Possible thin hardground at upper bounding surface.

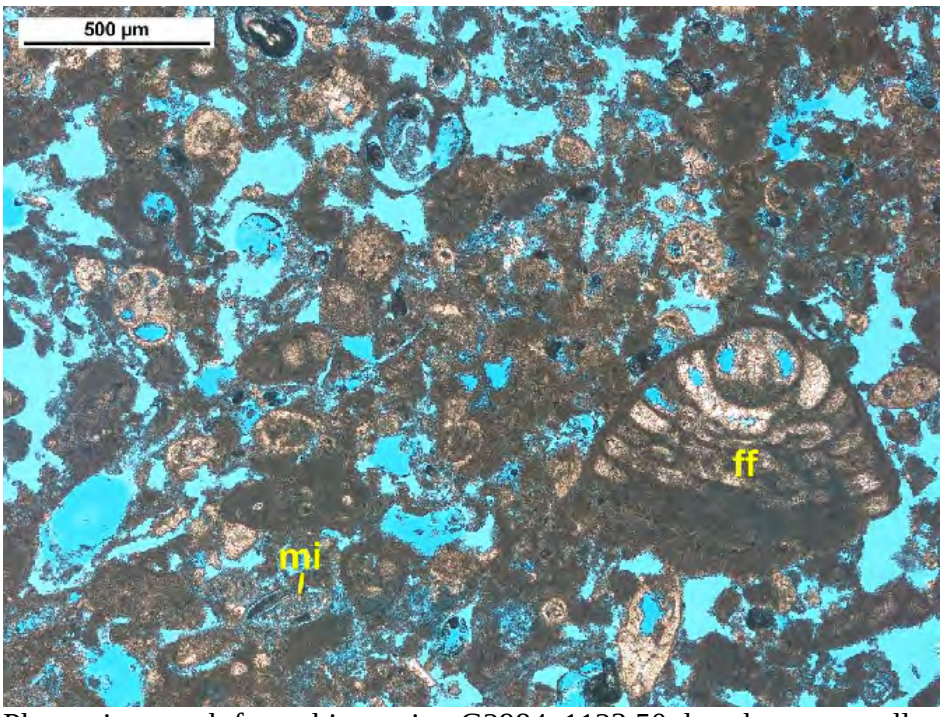
	 Photomicrograph of slabbed core that shows laminated benthic foraminifer grain-dominated packstone and grainstone. This interparticle-dominated pore system produces diffuse flow in part of the upper Floridan aquifer composed of the Avon Park Formation. Driller's depth of slabbed core is 1,100.10 ft bls.
obi depth: 1,104.1–1,108.9 ft bls Driller's depth: 1,100.2–1,106.0 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Sedimentary structures:** Very thickly bedded **Carbonate grains:** Smaller benthic foraminifera (including smaller miliolids, rotaliids), peloids, larger benthic foraminifera (*Fallotella*, larger miliolids), echinoid spines **Porosity and permeability:** 5–18 percent interparticle and intraparticle porosity, 1–3 percent particle-moldic porosity; 6–21 percent total porosity and relatively moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,108.9–1,110.9 ft bls Driller's depth: 1,106.0–	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller and larger benthic foraminifer mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Smaller benthic foraminifera (including smaller miliolids, rotaliids), peloids, larger benthic foraminifera (*Fallotella*, larger miliolids), echinoid spines **Porosity and permeability:** 5–10 percent interparticle and intraparticle porosity, 1–3

1,108.0 ft bls	percent particle-moldic porosity; 6–13 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,110.9–1,111.4 ft bls Driller's depth: 1,108.0–1,109.5 ft bls	**Cycle type:** Top type III cycle **Lithofacies:** Rhodolith and bivalve floatstone **Depositional texture:** Rhodolith and bivalve floatstone with matrix of smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Smaller benthic foraminifera (including smaller miliolids, rotaliids), peloids, larger benthic foraminifera (larger miliolids, *Fallotella floridana*), echinoid plates, disarticulated thin-shelled bivalves, rhodoliths (up to medium pebble size), *Neolaganum dalli*. Foraminifera observed in thin section G2984–1109.45 include *Fallotella floridana*, *Dendritina* sp., total of five conical larger benthic foraminifera **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–7 percent particle-moldic porosity; 6–27 percent total porosity and relatively moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal. **Comments:** Top of generally coarsening upward subtidal cycle at 1,110.9 ft bls (obi depth) and 1,108.0 ft bls (driller's depth). Abrupt facies shift across upper bounding surface **Thin section:** G2984–1109.45  Photomicrograph of slabbed core that shows rhodolith (rh) and bivalve floatstone with smaller and larger benthic foraminifer grain-dominated packstone and grainstone. Driller's depth of section is 1,108.10 ft bls.

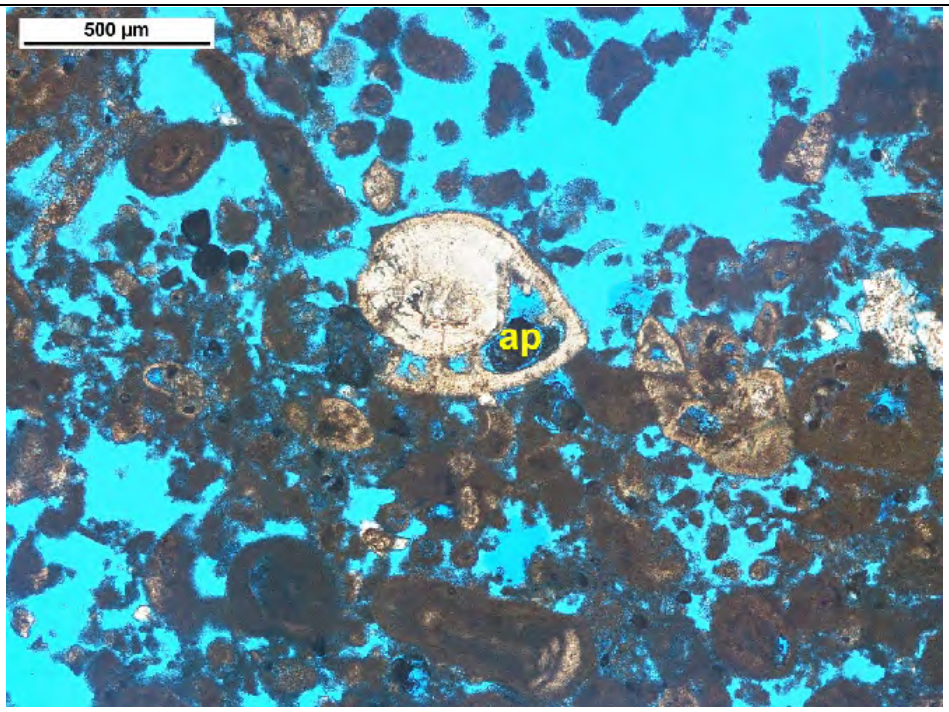
	 Photomicrograph from thin section G2984–1109.45 that shows a benthic foraminifer and peloid grainstone. Exemplifies rock of the Avon Park Formation that contributes to diffuse groundwater flow. Driller's depth of thin section is 1,109.45 ft bls.
obi depth: 1,111.4– 1,121.6 ft bls Driller's depth: 1,109.5– 1,119.8 ft bls	**Cycle type:** Intra-type III cycle **Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Smaller benthic foraminifera (including smaller miliolids, rotaliids), peloids, larger benthic foraminifera (larger miliolids, *Fallotella floridana*), echinoid plates and spines **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–7 percent particle-moldic porosity; 6–27 percent total porosity and relatively moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,121.6– 1,121.8 ft bls Driller's	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very light gray N8 **Sedimentary structures:** Thickly bedded, irregular vugs, skew-plane desiccation cracks **Trace fossils:** Rhizoliths **Carbonate grains:** Smaller benthic foraminifera (including miliolids), ostracods, minor

depth: 1,119.8–1,120.20 ft bls	peloids, gastropods, intraclasts **Porosity and permeability:** 1–2 percent intraparticle porosity, 1–2 percent particle-moldic porosity, 1–3 percent vuggy porosity, less than 1 percent irregular vugs; 3–7 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to supratidal **Comments:** Top of generally fining upward peritidal cycle at 1,121.6 ft (obi depth) and 1,119.8 ft (driller's depth). Abrupt facies shift across upper bounding surface. Subaerial exposure post deposition, as evidenced by karstic enlargement of rhizolith diameters and irregular vugs. Irregular vugs infilled with sediment from superjacent cycle  Photograph of slabbed core that shows benthic foraminifer wackestone representing a low-energy restricted inner platform, tidal flat depositional environment. Driller's depth of slabbed core is 1,119.80 ft bls.
obi depth: 1,121.8–1,127.0 ft bls Driller's depth: 1,120.2–1,126.0 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifer (including rotaliids, miliolids), peloids, larger benthic foraminifera (including *Fallotella floridana*, miliolids), minor amphisteginids (including *Amphistegina parvula*), echinoid plates and spines. Foraminifera observed in thin section G2984–1123.50 include smaller benthic foraminifera, *Fallotella floridana*, total of 10 conical larger benthic foraminifera **Porosity and permeability:** 1–22 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 2–27 percent total porosity and moderate permeability

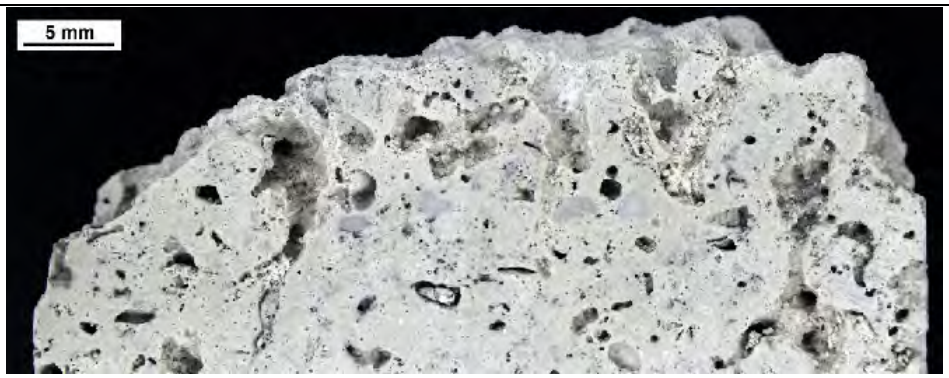
Depositional environment: High-energy inner platform, shallow subtidal
Thin section: G2984–1123.50



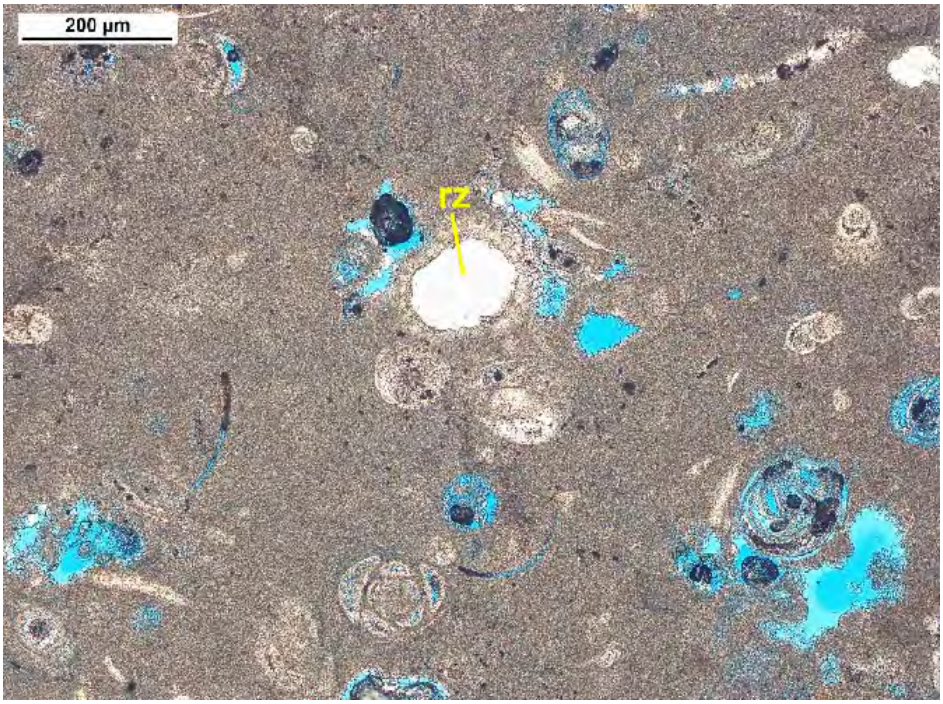
Photomicrograph from thin section G2984–1123.50 that shows a smaller and larger benthic foraminifer grain-dominated packstone and grainstone with miliolids (mi) and *Fallotella floridana* (ff). Exemplifies rock of the Avon Park Formation that contributes to diffuse groundwater flow. Driller's depth of thin section is 1,123.50 ft bls.

	 Photomicrograph from thin section G2984–1123.50 that shows *Amphistegina parvula* (ap). Exemplifies rock of the Avon Park Formation that contributes to diffuse groundwater flow. Driller's depth of thin section is 1,123.50 ft bls.
obi depth: 1,127.0–1,128.0 ft bls Driller's depth: 1,126.0–1,127.0 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very light gray N8 **Sedimentary structures:** Medium bedded, possible submarine hardground at top of interval **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, larger benthic foraminifera (including *Fallotella*, uncommon larger miliolids, rotaliids), uncommon echinoids **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 2–20 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Comments:** Possible subtidal hardground at 1,127.0 ft bls (obi depth) and 1,126.0 ft bls (driller's depth) with a higher energy cycle cap
obi depth: 1,128.0–1,132.9 ft bls Driller's depth:	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller and larger benthic foraminifer wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, larger benthic

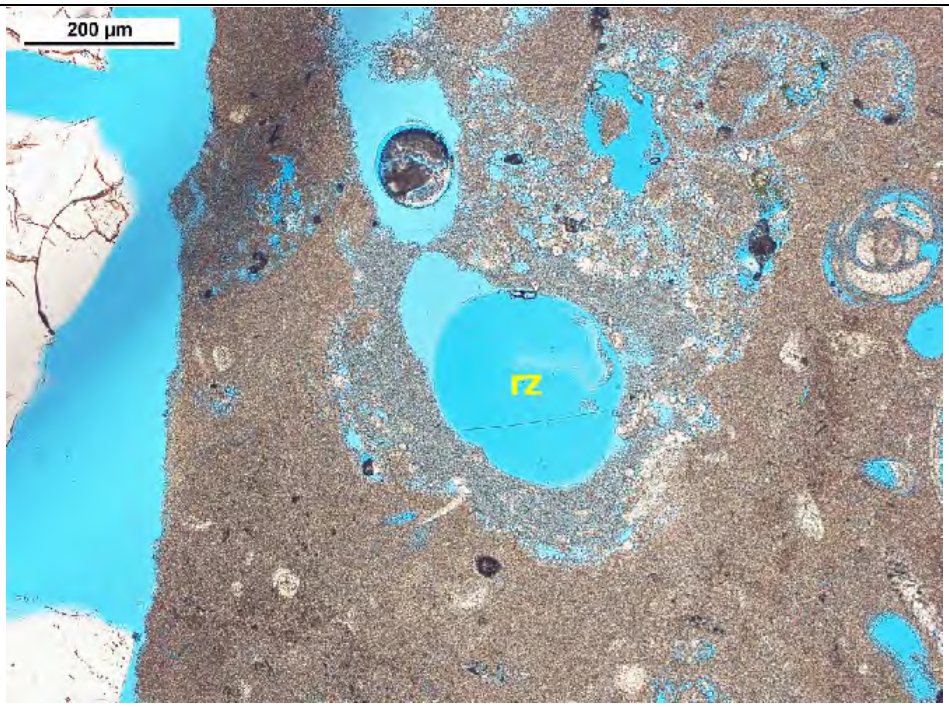
1,127.0–1,132.2 ft bls	foraminifera (including *Fallotella floridana*, uncommon larger miliolids), uncommon echinoids **Porosity and permeability:** 1–5 percent intraparticle porosity, 1–5 percent moldic porosity; 2–10 percent total porosity and low permeability **Depositional environment:** Low-energy restricted inner platform, shallow subtidal
obi depth: 1,132.9–1,134.2 ft bls Driller's depth: 1,132.2–1,133.5 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller and larger benthic foraminifer mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 3–5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, larger benthic foraminifera (including *Fallotella floridana*, uncommon larger miliolids), uncommon echinoids **Porosity and permeability:** 1–5 percent intraparticle porosity, 1–5 percent moldic porosity; 2–10 percent total porosity and low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,134.2–1,135.5 ft bls Driller's depth: 1,133.5–1,134.6 ft bls	**Cycle type:** Top type II cycle and depositional sequence AP2 **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Yellowish gray 5Y 8/1 (closest to this color when wet) **Sedimentary structures:** Thickly bedded, irregular vugs **Trace fossils:** Rhizoliths 0.5–4-mm inner tubule diameter; in some cases, root molds bifurcate and are solution enlarged, and in some cases lined with micritized grains, concentric bladed microspar, and concentric micrite **Ichnofabrics:** Ichnofabric index 2–3 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Smaller benthic foraminifera (including rotaliids, smaller miliolids), ostracods, minor peloids, uncommon echinoid spines, abraded (transported) *Microcodium*, intraclasts within the uppermost inch of the interval. Foraminifera observed in thin section G2984–1133.60 include smaller benthic foraminifera, larger valvulinids, planktic foraminifera **Porosity and permeability:** 1–2 percent intraparticle porosity, 3–10 percent root-mold porosity, 1–7 percent particle-moldic porosity, less than 1 percent irregular vugs; 4–19 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, shallow intertidal to supratidal **Comments:** Top of generally fining upward peritidal cycle at 1,134.2 ft bls (obi depth) and 1,133.5 ft bls (driller's depth). Abrupt facies shift across upper bounding surface. Subaerial exposure post deposition, as evidenced by karstic enlargement of rhizolith diameters and irregular vugs, and calcification of rhizoliths (Wright and Tucker, 1991) **Thin section:** G2984–1133.60

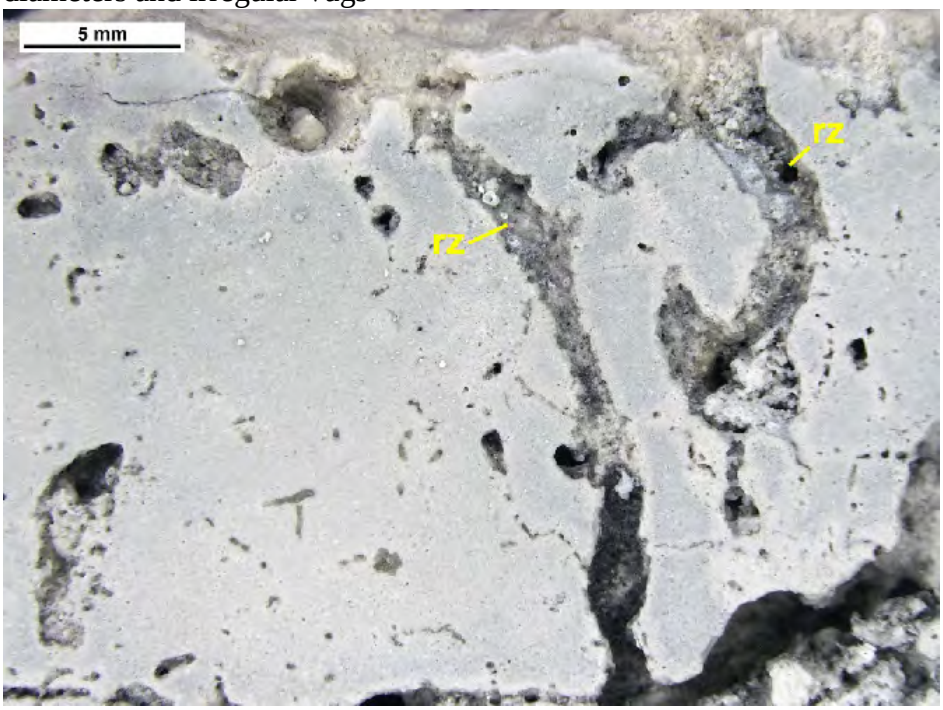


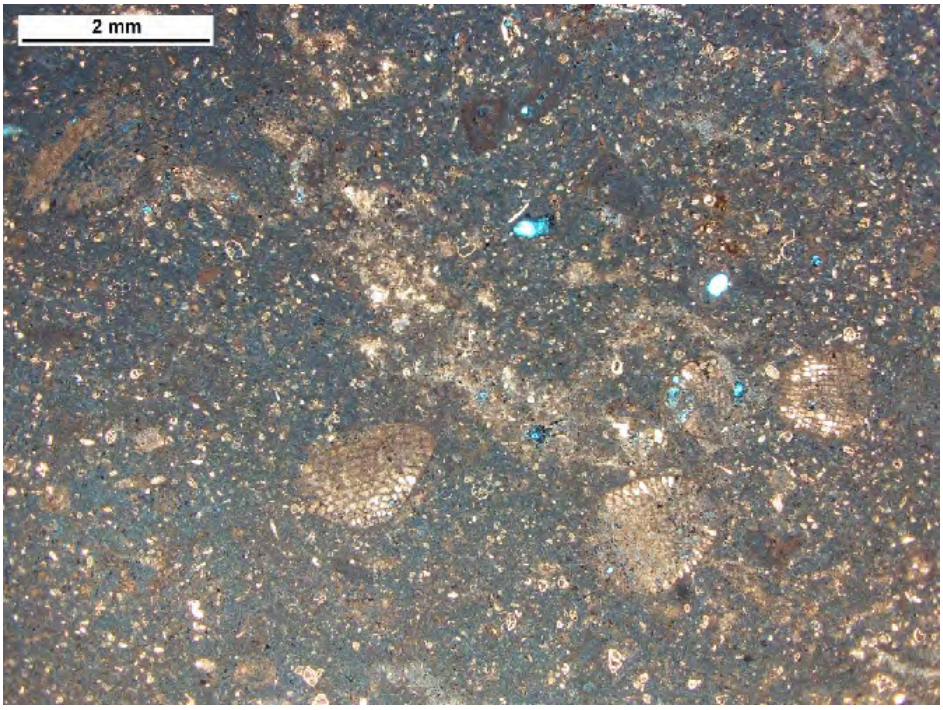
Photograph of slabbed core that shows the top of the depositional sequence AP2. Smaller benthic foraminifer wackestone deposited in an intertidal environment and top bounded by subaerial exposure surface. Driller's depth of slabbed core is 1,133.50 ft bls.



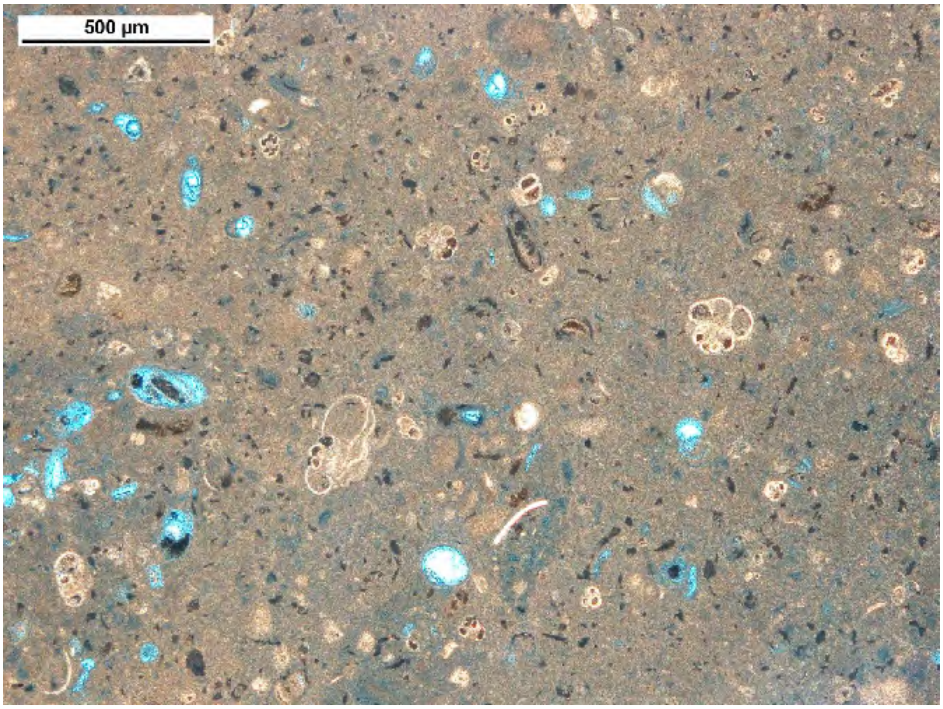
Photomicrograph from thin section G2984–1133.60 that shows a rhizolith (rz) lined with concentric bladed microspar and micritized grains. Presents evidence for subaerial exposure. Driller's depth of thin section is 1,133.60 ft bls.

	 Photomicrograph from thin section G2984–1133.60 that shows rhizolith (rz) lined with concentric micrite and minor microspar. Presents evidence for subaerial exposure. Driller's depth of thin section is 1,133.60 ft bls.
obi depth: 1,135.5–1,136.3 ft bls Driller's depth: 1,134.6–1,135.4 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, larger benthic foraminifera (including *Fallotella*), peloids **Porosity and permeability:** 1–18 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 2–23 percent total porosity and relatively moderate permeability **Depositional environment:** High-energy inner platform**,** shallow subtidal
obi depth: 1,136.3–1,136.9 ft bls Driller's depth: 1,135.4–1,136.0 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller and larger benthic foraminifer mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 4–5 **Carbonate grains:** Mainly smaller benthic foraminifera, larger benthic foraminifera (including *Fallotella*, uncommon larger miliolids), peloids **Porosity and permeability:** 1–2 percent intraparticle porosity, 1–5 percent moldic porosity; 2–7 percent total porosity and low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal

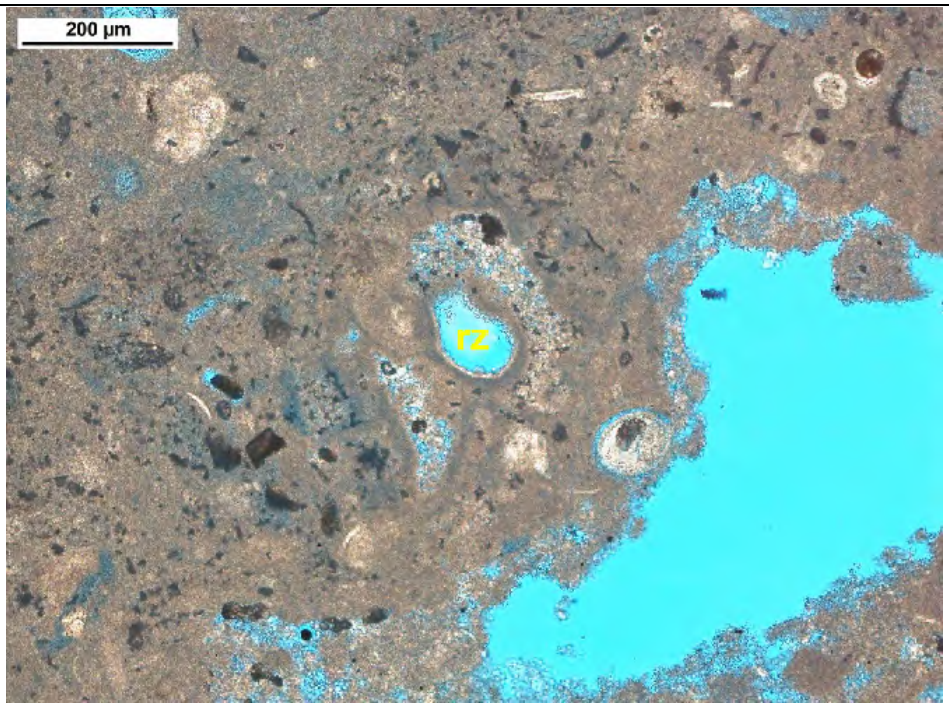
obi depth: 1,136.9–1,138.2 ft bls Driller's depth: 1,136.0–1,137.3 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thickly bedded **Trace fossils:** Rhizoliths 0.5–10-mm inner tubule diameter; in some cases, root molds bifurcate and are solution enlarged **Ichnofabrics:** Ichnofabric index 2–3 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Smaller benthic foraminifera, peloids, ostracods **Diagenesis:** Irregular vugs **Porosity and permeability:** 1–2 percent intraparticle porosity, 1–10 percent root-mold porosity, less than 1–5 percent irregular vugs; 2–17 percent total porosity and relatively moderate permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,136.9 ft bls (obi depth) and 1,136.0 ft bls (driller's depth). Abrupt facies shift across upper bounding surface. Subaerial exposure post deposition, as evidenced by karstic enlargement of rhizolith diameters and irregular vugs  Photograph of slabbed core that shows small benthic foraminifer wackestone with rhizoliths (rz) and cycle top at top of photo. Subtidal sediment from overlying cycle visible at top of photo. Driller's depth of slabbed core is 1,137.0 ft bls.
obi depth: 1,138.2–1,141.7 ft	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller and larger benthic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1

bls Driller's depth: 1,137.3–1,140.6 ft bls	**Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Smaller benthic foraminifera (including rotaliids, smaller miliolids, very uncommon *Reussella*?), larger benthic foraminifera (including *Fallotella floridana*, larger miliolids), peloids. Foraminifera observed in thin section G2984–1139.18 include smaller benthic foraminifera, *Fallotella floridana*, *Pseudochrysalidina*?, total of 14 conical larger benthic foraminifera **Porosity and permeability:** 1–5 percent intraparticle porosity, 1–3 percent moldic porosity, 1–3 percent irregular vugs; 3–11 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, shallow subtidal **Thin section:** G2984–1139.18  Photomicrograph from thin section G2984–1139.18 that shows smaller and larger conical benthic foraminifer wackestone and mud-dominated packstone. Driller's depth of thin section is 1,139.18 ft bls.
obi depth: 1,141.7–1,145.1 ft bls Driller's depth: 1,140.6–1,144.0 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thickly bedded, bird's-eye voids, curved- and skew-plane cracking produced autochthonous brecciation **Trace fossils:** Rhizoliths 0.5–2-mm inner tubule diameter; in some cases, root molds bifurcate, and in some cases, the inner diameter of the rhizoliths have a semiconcentric microspar and inner concentric micritization and microbladed calcite cement **Ichnofabrics:** Ichnofabric index 2–3

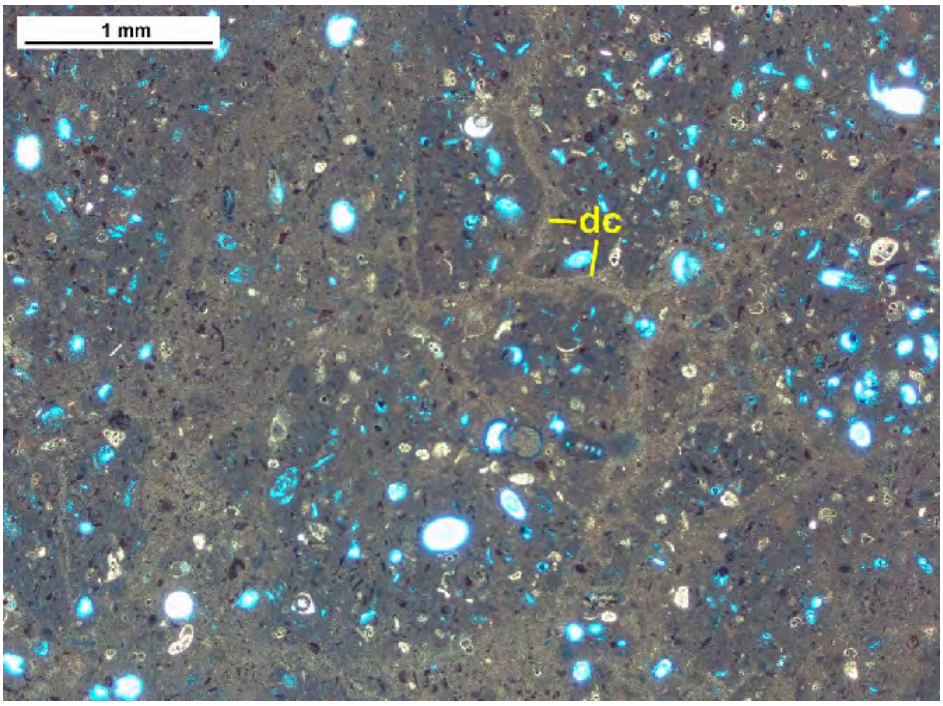
Ichnofacies: *Psilonichnus*
Carbonate grains: Smaller benthic foraminifera (including rotaliids, smaller miliolids, uncommon *Reussella*), intraclasts, ostracods, high-spired gastropods, very uncommon larger miliolids, highly abraded *Fallotella*, abraded (transported) *Microcodium*. Foraminifera observed in thin section G2984–1143.23 include smaller benthic foraminifera
Porosity and permeability: 1–2 percent intraparticle porosity, 1–7 percent root-mold porosity; 2–9 percent total porosity and relatively low permeability
Depositional environment: Low-energy restricted inner platform interior, intertidal to supratidal
Comments: Top of generally fining upward peritidal cycle at 1,141.7 ft bls (obi depth) and 1,140.6 ft bls (driller's depth). Abrupt facies shift across upper bounding surface. Subaerial exposure during and post deposition with desiccation cracking along the upper bounding surface, as seen in core. Bird's-eye voids and curved- and skew-plane desiccation cracking and autochthonous breccia provide evidence for exposure during deposition
Thin section: G2984–1143.23



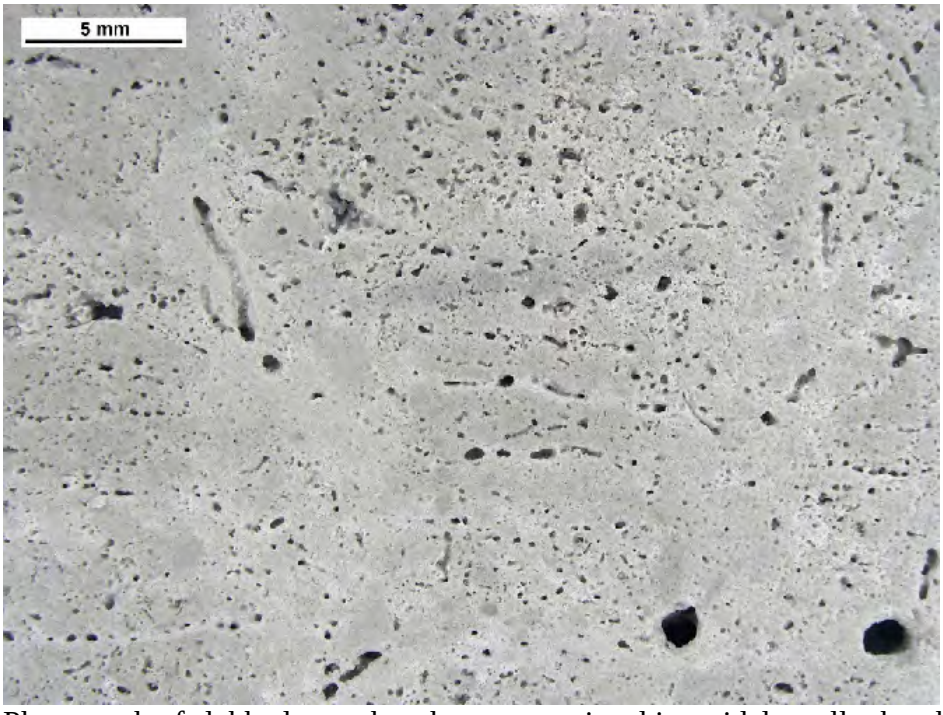
Photomicrograph from thin section G2984–1143.23 that shows a smaller benthic foraminifer wackestone. Deposition was in a restricted intertidal to supratidal environment. Driller's depth of thin section is 1,143.23 ft bls.

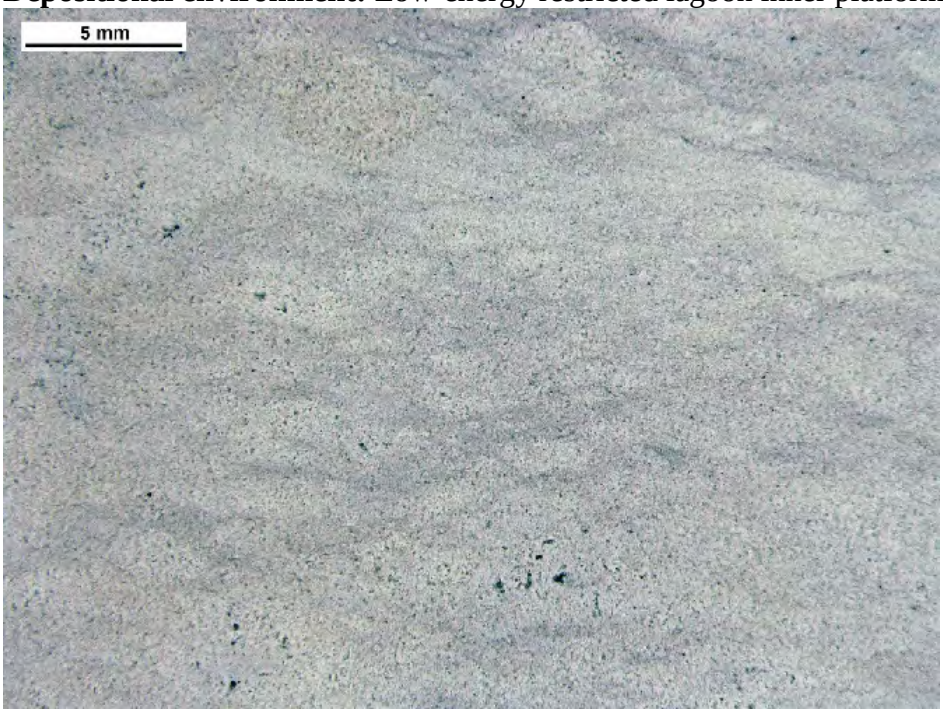


Photomicrograph from thin section G2984–1143.23 that shows rhizolith (rz) with outer semiconcentric microspar, inner concentric micritization, and microbladed calcite cement. Deposition was in a restricted intertidal to supratidal environment. Driller's depth of thin section is 1,143.23 ft bls.



Photomicrograph from thin section G2984–1143.23 that shows curved- and skew-plane desiccation cracks (dc) that provide evidence for subaerial exposure and autochthonous brecciation processes during deposition. Deposition was in a

	restricted intertidal to supratidal environment. Driller's depth of thin section is 1,143.23 ft bls.  Photograph of slabbed core that shows a restricted intertidal smaller benthic foraminifer wackestone and mud-dominated packstone with rhizoliths and bird's-eye voids. Driller's depth of slabbed core is 1,142.50 ft bls.
obi depth: 1,145.1–1,148.9 ft bls Driller's depth: 1,144.0–1,147.5 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, larger benthic foraminifera (including *Fallotella*), ostracods **Porosity and permeability:** 1–12 percent interparticle and intraparticle porosity, 1–8 percent moldic porosity; 2–20 percent total porosity and relatively low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,148.9–1,150.0 ft bls Driller's depth:	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thickly bedded, desiccation cracks **Trace fossils:** Rhizoliths 0.5–2-mm inner tubule diameter; in some cases, root molds bifurcate

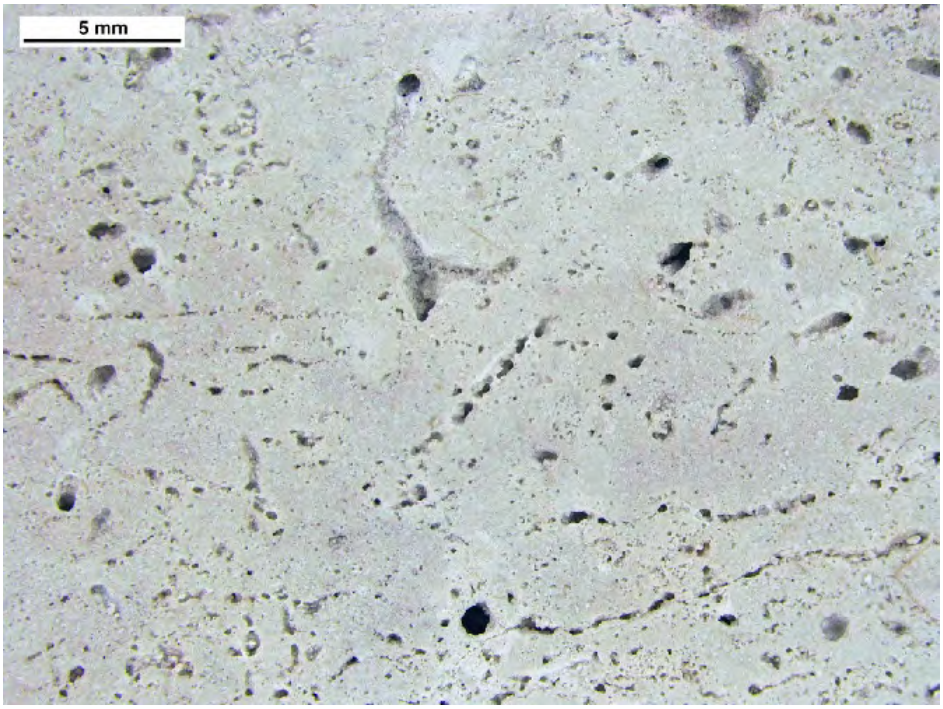
1,147.5–1,148.6 ft bls	**Ichnofabrics:** Ichnofabric index 2–3 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Smaller benthic foraminifera, peloids, ostracods, gastropods (high spired), rip-up intraclasts **Porosity and permeability:** 1–2 percent intraparticle porosity, 1–7 percent root-mold porosity; 2–9 percent total porosity and relatively low permeability **Depositional environment:** Low-energy, restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,148.9 ft bls (obi depth) and 1,147.5 ft bls (driller's depth). Abrupt facies shift across upper bounding surface
obi depth: 1,150.0–1,151.3 ft bls Driller's depth: 1,148.6–1,149.2 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thickly bedded with paper-thin wispy laminations **Trace fossils:** Bioturbated, *Planolites*?, small *Thalassinoides*? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Proximal *Planolites-Thalassinoides*-dominated *Cruziana* **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, ostracods, uncommon larger miliolids, *Fallotella* **Porosity and permeability:** 1–2 percent intraparticle porosity, 1–10 percent moldic porosity; 2–12 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted lagoon inner platform, subtidal  Photograph of slabbed core that shows a smaller foraminifer wackestone and packstone with wispy laminations. Bioturbation represents a proximal *Planolites-Thalassinoides*-dominated *Cruziana* ichnofacies and low-energy restricted lagoon. Driller's depth of section is 1,148.9 ft bls.
obi	**Cycle type:** Top type II cycle

depth: 1,151.3–1,152.4 ft bls Driller's depth: 1,149.2–1,150.3 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Medium bedded **Trace fossils:** Rhizoliths 0.5–1-mm inner tubule diameter; in some cases, root molds bifurcate **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Smaller benthic foraminifera, ostracods, uncommon larger miliolids, peloids **Porosity and permeability:** 1–2 percent intraparticle porosity, 1–5 percent root-mold porosity; 2–7 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,151.3 ft bls (obi depth) and 1,149.2 ft bls (driller's depth). Abrupt facies shift across upper bounding surface. Upper cycle cap has minor desiccation cracking and overlying intraclasts of this interval at base of superjacent cycle.
obi depth: 1,152.4–1,155.0 ft bls Driller's depth: 1,150.3–1,153.0 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller foraminifer mud- and grain-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, minor ostracods, larger benthic foraminifera (including *Fallotella*, larger miliolids) **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 2–15 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,155.0–1,155.6 ft bls Driller's depth: 1,153.0–1,153.6 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded, fenestral fabrics **Trace fossils:** Rhizoliths 0.5–3 mm inner tubule diameter; in some cases, root molds bifurcate **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Smaller benthic foraminifera (including rotaliids), intraclasts, ostracods, uncommon larger miliolids, peloids, very uncommon discoidal larger benthic foraminifera, dasycladacean algae. Foraminifera observed in thin section G2984–1153.08 include smaller benthic foraminifera, larger valvulinids **Diagenesis:** Curved-plane desiccation cracks **Porosity and permeability:** 1–2 percent intraparticle porosity; 1–2 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to

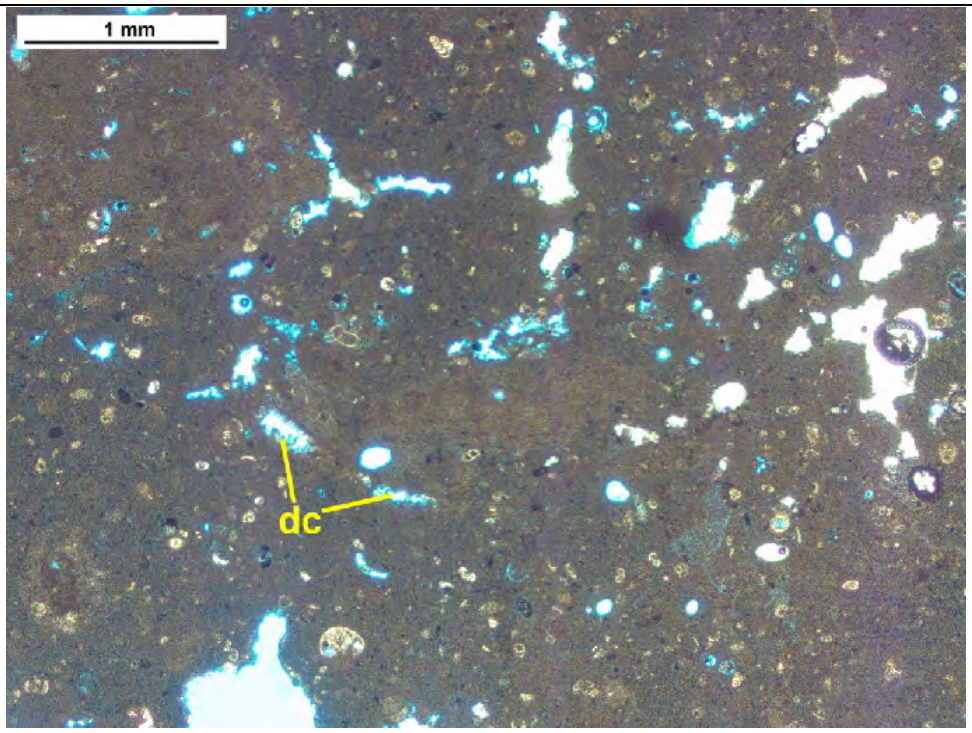
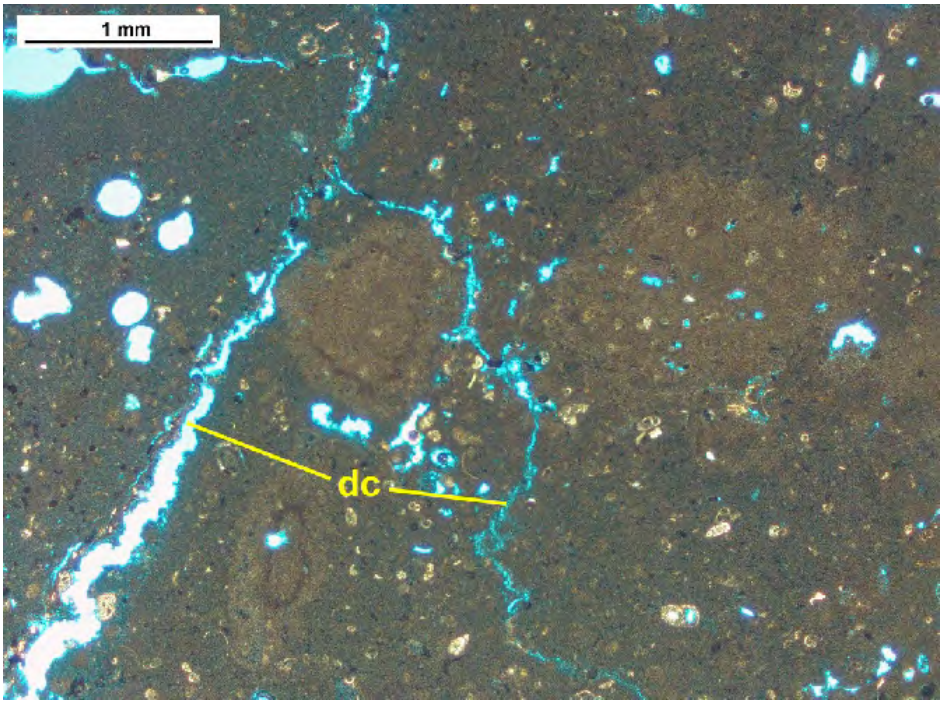
supratidal

Comments: Top of generally fining upward peritidal cycle at 1,155.0 ft bls (obi depth) and 1,153.0 ft bls (driller's depth). Abrupt facies shift across upper bounding surface. Bird's-eye voids and desiccation cracks provide evidence for subaerial exposure during deposition of this interval.

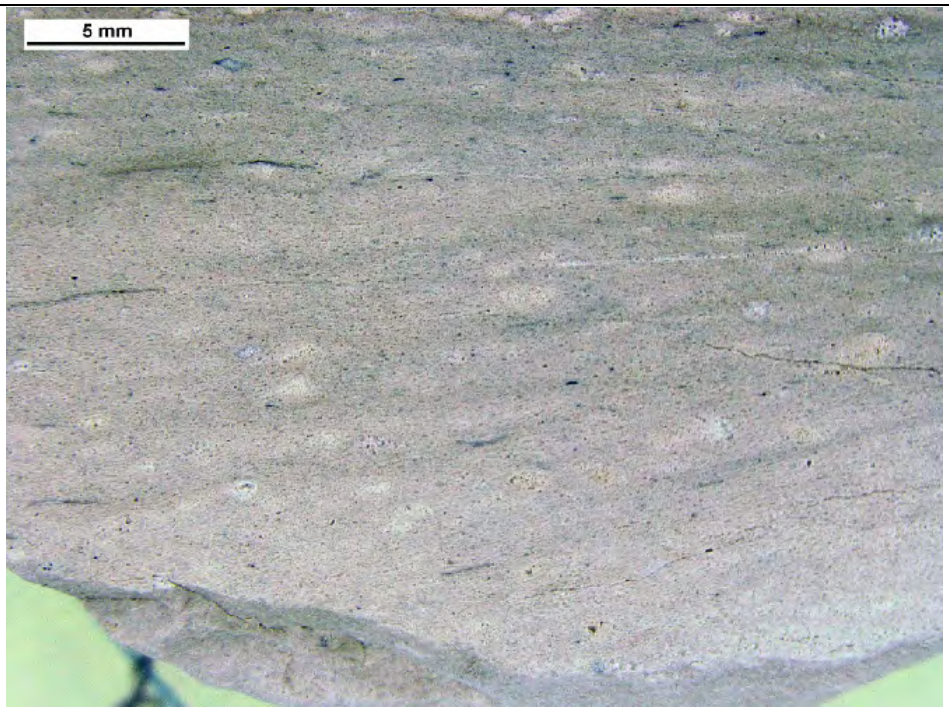
Thin section: G2984–1153.08



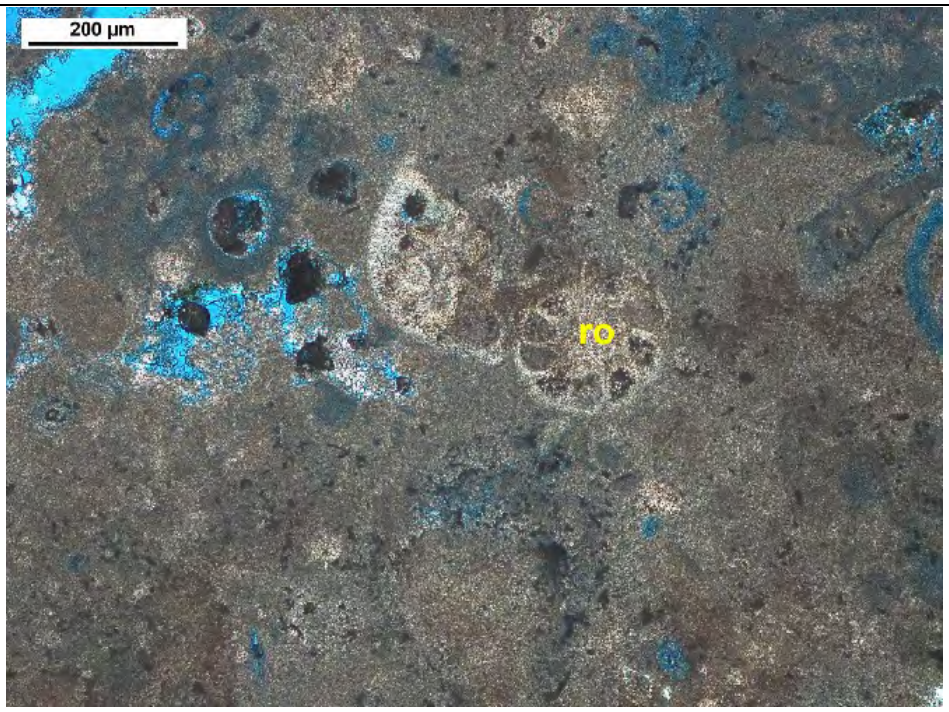
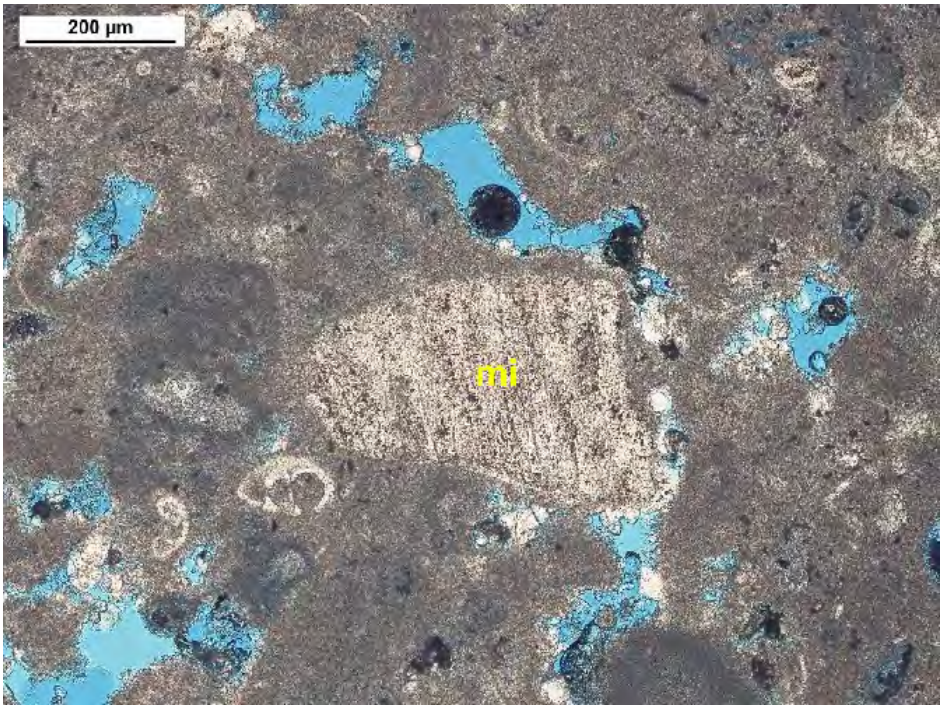
Photograph of slabbed core that shows a tidal flat wackestone with bifurcating root molds and bird's-eye voids. Driller's depth of slabbed core is 1,153.08 ft bls.

	 Photomicrograph from thin section G2984–1153.08 that shows curved-plane desiccation cracks (dc). Driller's depth of thin section is 1,153.08 ft bls.  Photomicrograph from thin section G2984–1153.08 that shows desiccation cracks (dc). Driller's depth of thin section is 1,153.08 ft bls.
obi depth: 1,155.6–	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller foraminifer mud- and grain-dominated packstone **Color:** Very pale orange 10YR 8/2

1,156.8 ft bls Driller's depth: 1,153.6–1,154.8 ft bls	**Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, minor ostracods, uncommon larger benthic foraminifera (including *Fallotella*) **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 2–15 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,156.8–1,158.1 ft bls Driller's depth: 1,154.8–1,156.1 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, and larger benthic foraminifera (including *Fallotella*), minor ostracods **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 6–20 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,158.1–1,158.4 ft bls Driller's depth: 1,156.1–1,156.4 ft bls	**Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Very thinly bedded with paper-thin laminations **Ichnofabrics:** Ichnofabric index 2–3 **Carbonate grains:** Smaller benthic foraminifera and peloids, uncommon larger benthic foraminifera **Accessory grains:** 1 percent carbonaceous fragments of plants—paper-thin discontinuous accumulations parallel to laminations **Porosity and permeability:** 1–2 percent intraparticle porosity; 1–2 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, shallow subtidal **Comments:** Transgressive base of cycle

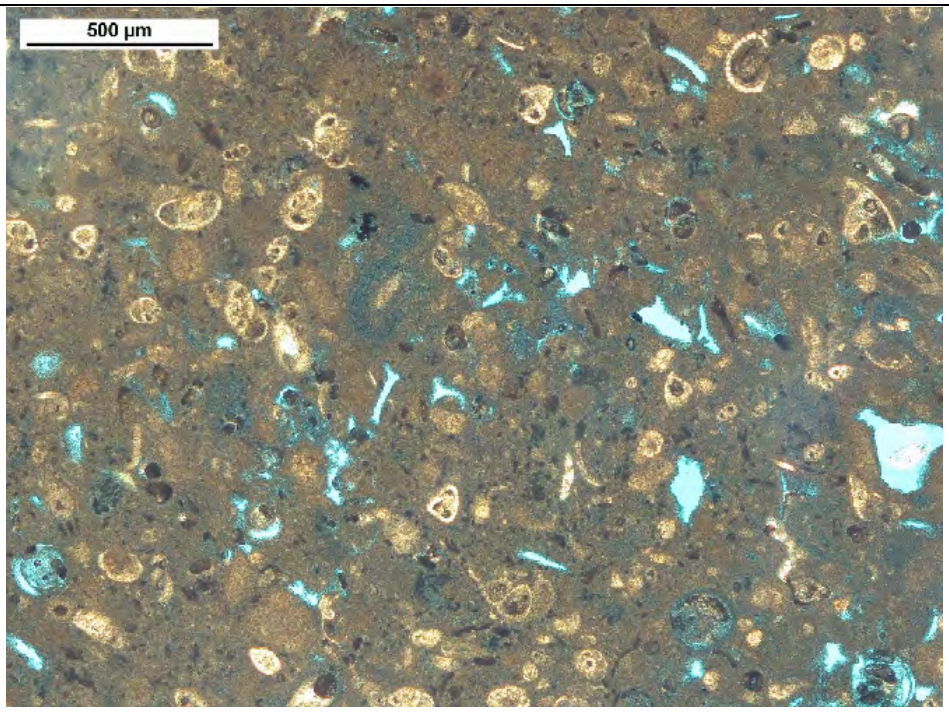
	 Photograph of slabbed core that shows a small benthic foraminifer wackestone that is the transgressive base of a high-frequency cycle. Driller's depth of slabbed core is 1,159.8 ft bls.
obi depth: 1,158.4–1,160.9 ft bls Driller's depth: 1,156.4–1,158.9 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 (wet) **Sedimentary structures:** Thickly bedded **Trace fossils:** Rhizoliths 0.5–3-mm inner tubule diameter **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, minor ostracods, high-spired gastropods, uncommon larger miliolids **Porosity and permeability:** 1 percent intraparticle porosity, 1–5 percent fossil molds, 1–5 percent root molds; 3–11 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,158.4 ft bls (obi depth) and 1,156.4 ft bls (driller's depth). Probable subaerial exposure at upper bounding surface where there is an abrupt shift in lithofacies
obi depth: 1,160.9–1,163.1 ft bls Driller's	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5

depth: 1,158.9–1,162.1 ft bls	**Carbonate grains:** Mainly smaller benthic foraminifera, peloids, and larger benthic foraminifera (including *Fallotella*), gastropods (including high-spired gastropods), minor ostracods **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 6–25 percent total porosity and low to moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,163.1–1,167.9 ft bls Driller's depth: 1,162.1–1,166.7 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very light gray N8 **Sedimentary structures:** Thickly bedded, fenestral fabric in uppermost 2 in., curved plane desiccation cracks **Trace fossils:** Rhizoliths 0.5–5-mm inner tubule diameter (in a few cases with microspar lining inner wall); in some cases, solution enlarged inner diameter **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* for the uppermost 1 ft **Carbonate grains:** Mainly smaller benthic foraminifera (including rotaliids, *Reussella*?), peloids, larger benthic foraminifera (including larger miliolids, *Fallotella floridana*), ostracods, uncommon gastropods, small bivalves, *Microcodium*. Foraminifera observed in thin section G2984–1162.82 include smaller benthic foraminifera, *Fallotella floridana*, total of nine conical larger benthic foraminifera **Porosity and permeability:** 1 percent intraparticle porosity, 1–3 percent fossil molds, 1 percent local fenestral fabric porosity, 1–5 percent irregular vugs; 4–11 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to supratidal **Comments:** Uppermost 2 in. is definitively intertidal with fenestral fabric and very restricted fauna (smaller benthic foraminifera wackestone and mud-dominated packstone, no thin section here to accurately identify particle types). Top of generally fining upward peritidal cycle at 1,163.1 ft bls (obi depth) and 1,162.1 ft bls (driller's depth). Subaerial exposure at upper bounding surface **Thin section:** G2984–1162.82

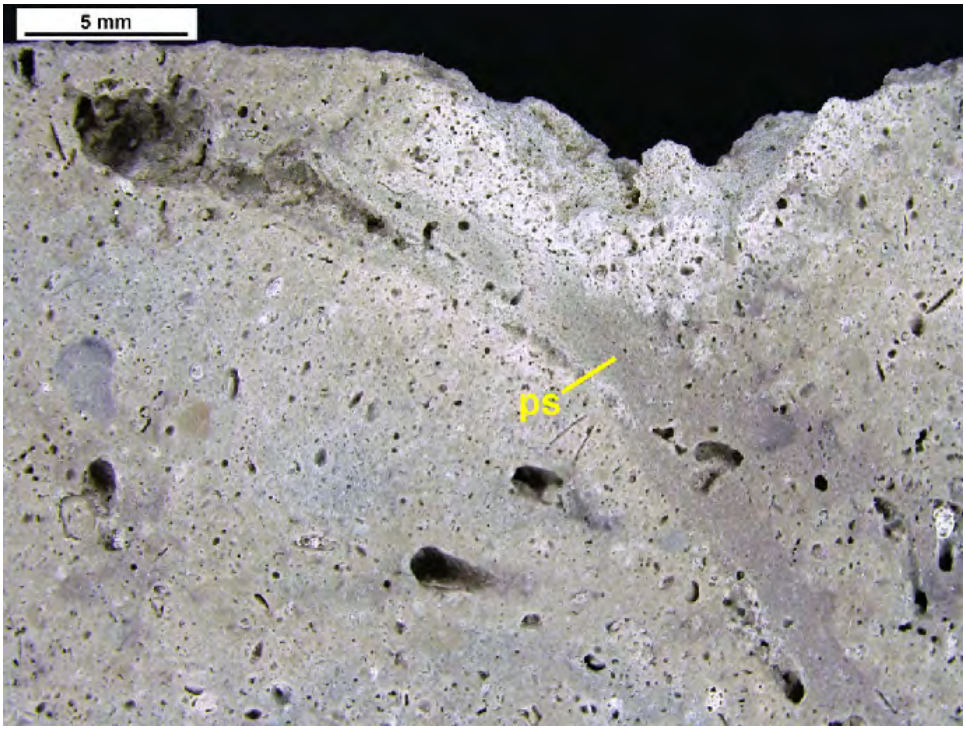
	 Photomicrograph from thin section G2984–1162.82 that shows rotaliids (ro). Driller's depth of thin section is 1,162.82 ft bls.  Photomicrograph from thin section G2984–1162.82 that shows *Microcodium* (mi) from intertidal zone. Driller's depth of thin section is 1,162.82 ft bls.
obi depth: 1,167.9–	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer mud- to grain-dominated packstone **Color:** Very pale orange 10YR 8/2

1,170.6 ft bls Driller's depth: 1,166.7–1,169.35 ft bls	**Sedimentary structures:** Thickly bedded **Trace fossils:** Burrow mottled **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera (including rotaliids), peloids, minor larger benthic foraminifera (including *Fallotella*), intraclasts, high-spired gastropods, ostracods **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,170.6–1,172.6 ft bls Driller's depth: 1,169.35–1,171.35 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and mud-dominated packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very light gray N8 **Sedimentary structures:** Thickly bedded **Trace fossils:** Rhizoliths 0.5–5-mm inner tubule diameter; in some cases, solution enlarged inner diameter **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Peloids and smaller benthic foraminifera, gastropods (high spired), uncommon bivalves **Porosity and permeability:** 1–3 percent interparticle porosity, intraparticle porosity, and fossil moldic porosity; 2–5 percent root mold porosity; 3–8 percent total porosity and relatively low to moderate permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,170.6 ft bls (obi depth) and 1,169.35 ft bls (driller's depth). Subaerial exposure at upper bounding surface
obi depth: 1,172.6–1,174.95 ft bls Driller's depth: 1,171.35–1,173.7 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Upper part of interval very light gray N8 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, unidentified grains, gastropods, thin-shelled bivalves, possible *Fallotella* **Porosity and permeability:** 1–18 percent interparticle and intraparticle porosity, 1–8 percent fossil molds; 2–26 percent total porosity and relatively low to moderate permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,174.95–1,176.25 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very light gray N8 **Sedimentary structures:** Part of a very thickly bedded unit **Trace fossils:** Rhizoliths 0.5–5-mm inner tubule diameter; in some cases, solution

Driller's depth: 1,173.7–1,175.0 ft bls	enlarged inner diameter. Horizontal lateral mangrove roots with vertical pneumatophores and geotropic roots **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Peloids and smaller benthic foraminifera, larger benthic foraminifer (larger miliolids and very uncommon *Fallotella*), gastropods (high spired) **Porosity and permeability:** 1–3 percent interparticle porosity, intraparticle porosity, and fossil moldic porosity; 2–5 percent root mold porosity; 3–8 percent total porosity and relatively low to moderate permeability **Depositional environment:** Low-energy restricted inner platform interior, tidal flat **Comments:** Thin (1–4 mm thick) microbial laminite at 1,181.4 ft bls (obi depth) and 1,174 ft bls (driller's depth). Top of generally fining upward peritidal cycle at 1,174.95 ft bls (obi depth) and 1,176.25 ft bls (driller's depth). Subaerial exposure at upper bounding surface
obi depth: 1,176.25–1,186.4 ft bls Driller's depth: 1,175.0–1,185.0 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and packstone **Color:** Upper part of interval very light gray N8 and lower part very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera (including rotaliids, smaller miliolids, *Reussella*?), peloids, minor ostracods, uncommon larger miliolids. Foraminifera observed in thin section G2984–1184.85 include smaller benthic foraminifera, planktic foraminifera **Porosity and permeability:** 1–18 percent interparticle and intraparticle porosity, 1–8 percent fossil molds; 2–26 percent total porosity and relatively low to moderate permeability **Depositional environment:** Low-energy restricted lagoon? inner platform, shallow subtidal **Thin section:** G2984–1184.85

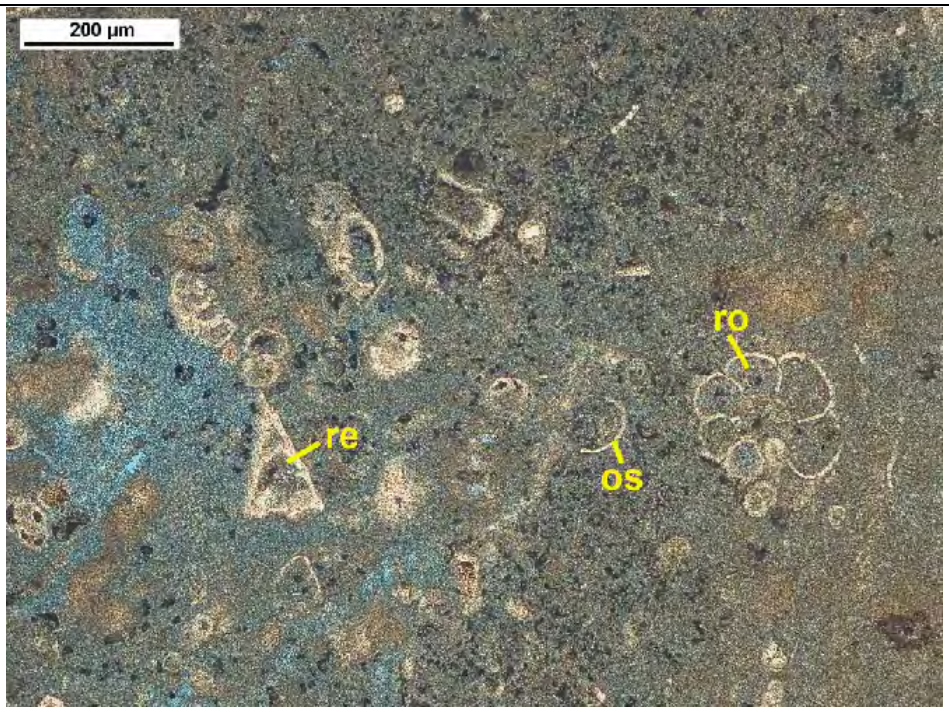


Photomicrograph from thin section G2984–1184.85 that shows a benthic foraminifer, peloid wacke-packstone, where particles are mainly smaller benthic foraminifera and peloids. Driller's depth of thin section is 1,184.85 ft bls.



Photograph of slabbed core that shows concave-upward *Psilonichnus*? (ps) at a high-frequency cycle cap. Up is to the left. Driller's depth of slabbed core is 1,180.0 ft bls.

obi depth: 1,186.4–1,189.7 ft bls Driller's depth: 1,185.0–1,188.3 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, and larger benthic foraminifera (including *Fallotella*, larger miliolids), minor ostracods, disarticulated thin bivalves, fragmented echinoids, very uncommon planktic foraminifera? **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 6–30 percent total porosity and low to moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,189.7–1,190.5 ft bls Driller's depth: 1,188.3–1,189.1 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thinly bedded **Trace fossils:** Bioturbated; rhizoliths 0.5–1.0-mm wide inner tubule diameter **Ichnofabrics:** Ichnofabric index 2–5 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Wackestone is mainly smaller benthic foraminifera (including rotaliids, *Reussella*), peloids, minor ostracods, echinoid plates, rare larger miliolids, gastropods, planktic foraminifera. Foraminifera observed in G2984–1188.73 include smaller benthic foraminifera, *Fallotella floridana*, total of two conical larger benthic foraminifera **Porosity and permeability:** 1–12 percent interparticle and intraparticle porosity, 1–2 percent root molds, 1–2 percent fossil molds; 3–16 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Cycle cap at 1,189.7 ft bls (obi depth) and 1,188.3 ft bls (driller's depth). Upper bounding surface is an exposure surface **Thin section:** G2984–1188.73

	 Photomicrograph from thin section G2984–1188.73 that shows a *Reussella* (re), rotaliid (ro), and ostracod (os). Driller's depth of section is 1,188.73 ft bls.
obi depth: 1,190.5– 1,192.5 ft bls Driller's depth: 1,189.1– 1,191 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger grain-dominated benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera, peloids, intraclasts, and larger benthic foraminifera (including very uncommon *Fallotella floridana*), minor ostracods, disarticulated thin bivalves, fragmented echinoids **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 6–30 percent total porosity and low to moderate permeability **Depositional environment:** High-energy inner platform interior, shallow subtidal
obi depth: 1,192.5– 1,198.0 ft bls Driller's depth: 1,191– 1,196.7 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated; rhizoliths in uppermost part and upper-middle part of cycle with 0.5–1.0-mm wide inner tubule diameter and deeper penetrating vertical, rhizoliths with 5-mm wide inner tubule diameter **Ichnofabrics:** Ichnofabric index 2–5 **Ichnofacies:** *Psilonichnus* in uppermost part of cycle **Carbonate grains:** Wackestone is mainly smaller benthic foraminifera (including

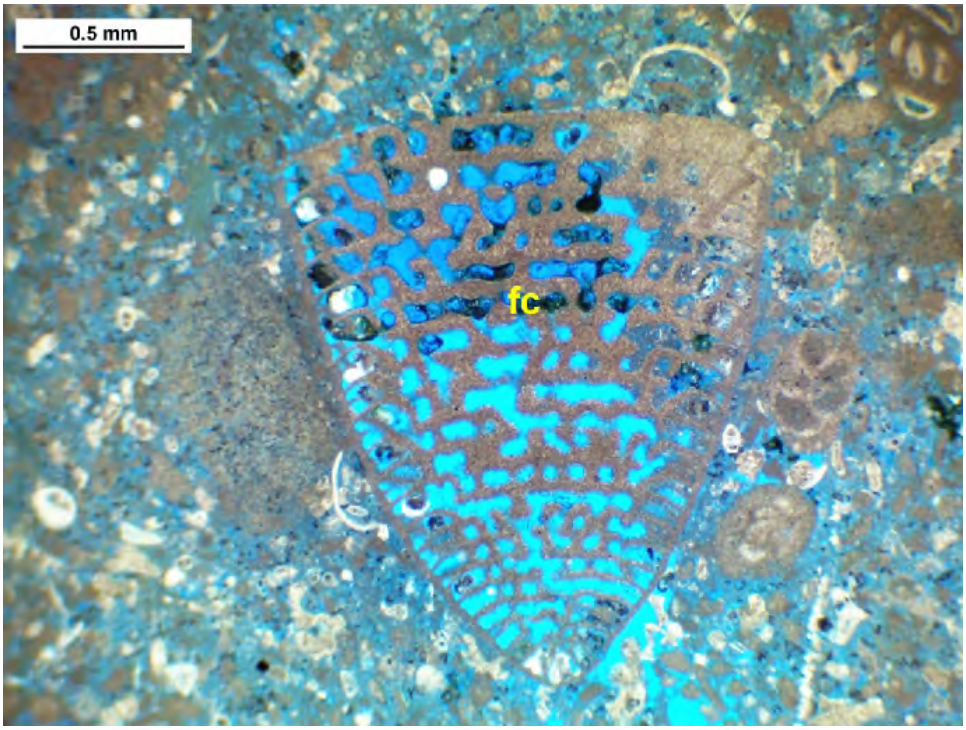
rotaliids, *Reussella*?), peloids, minor ostracods, larger miliolids, uncommon echinoid spines and plates. Packstone is mainly smaller benthic foraminifera (including rotaliids, *Reussella*), peloids, minor ostracods, larger benthic foraminifera (including *Fallotella floridana*, larger miliolids), uncommon echinoid spines and plates, ostracods. Foraminifera observed in thin section G2984–1196.05 include smaller benthic foraminifera, *Fallotella floridana*, *Pseudochrysalidina floridana*, *Fallotella cookei*, smaller *Rotalia*, total of three conical larger benthic foraminifera

Porosity and permeability: 1–12 percent interparticle and intraparticle porosity, 1–2 percent root molds, 1–2 percent fossil molds; 3–16 percent total porosity and relatively low permeability

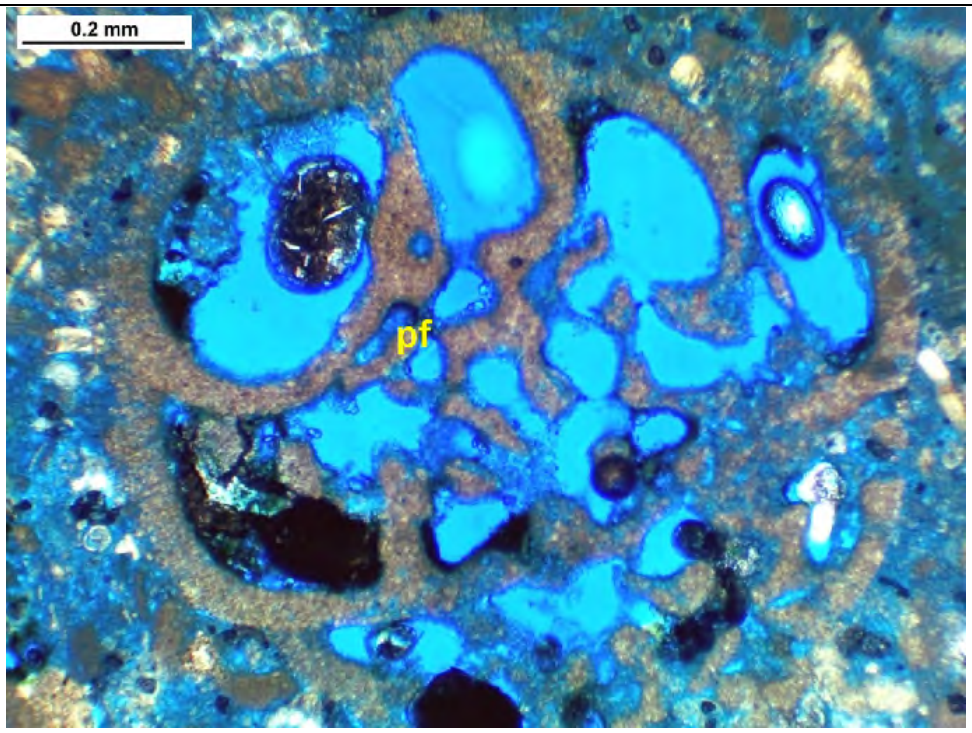
Depositional environment: Low-energy restricted inner platform, intertidal to supratidal

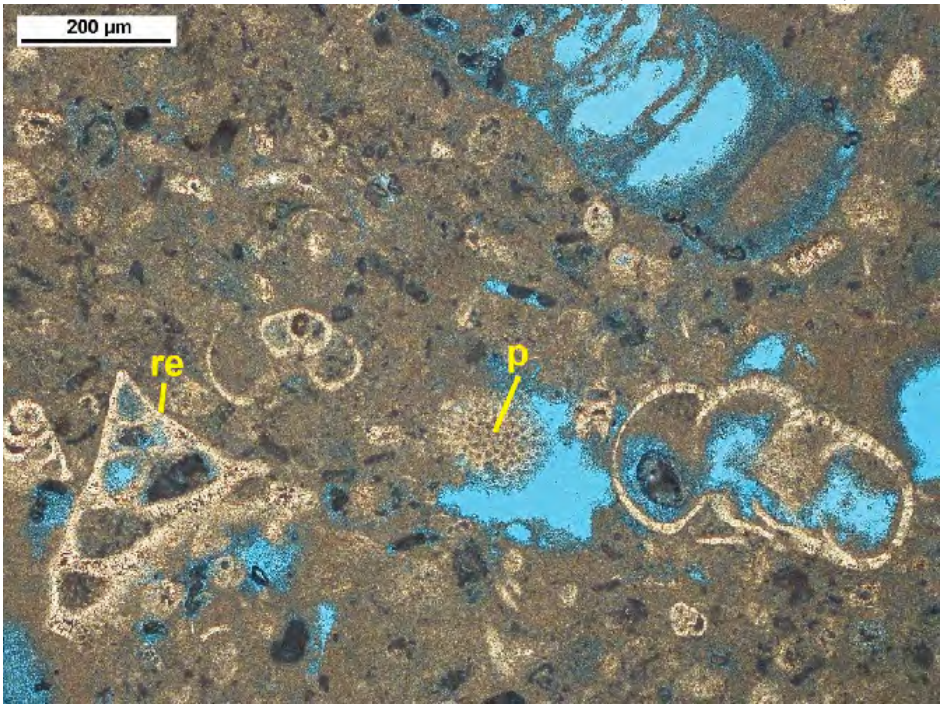
Comments: Two autochthonous breccias interbedded in the interval, likely due to desiccation and alteration by roots, very low diversity biota, high environmental stress. Cycle cap at 1,192.5 ft bls (obi depth) and 1,191 ft bls (driller's depth). Upper bounding surface is an exposure surface

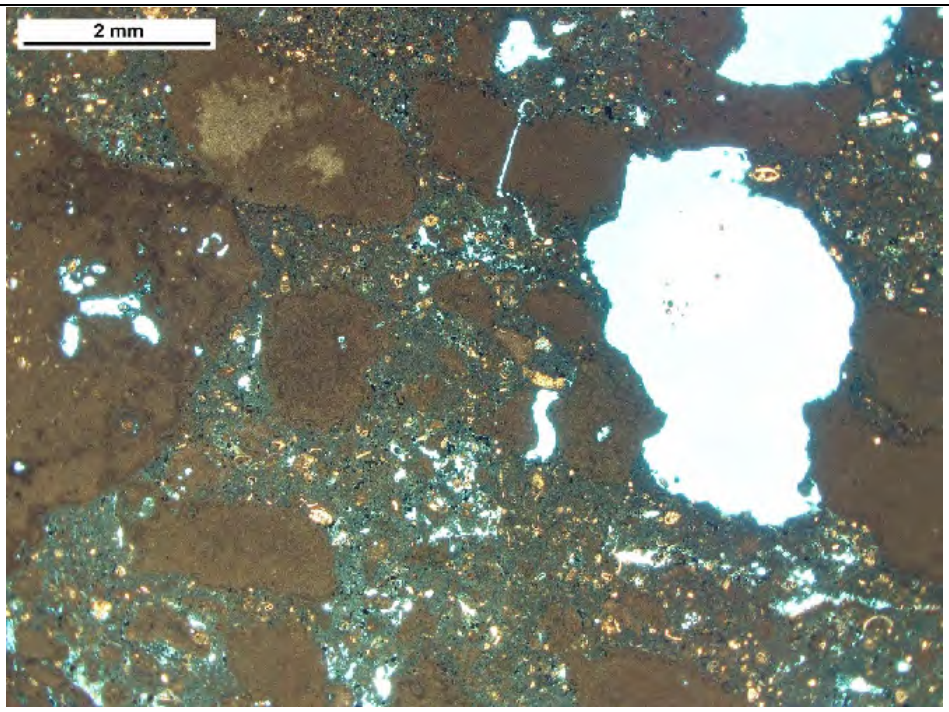
Thin section: G2984–1196.05



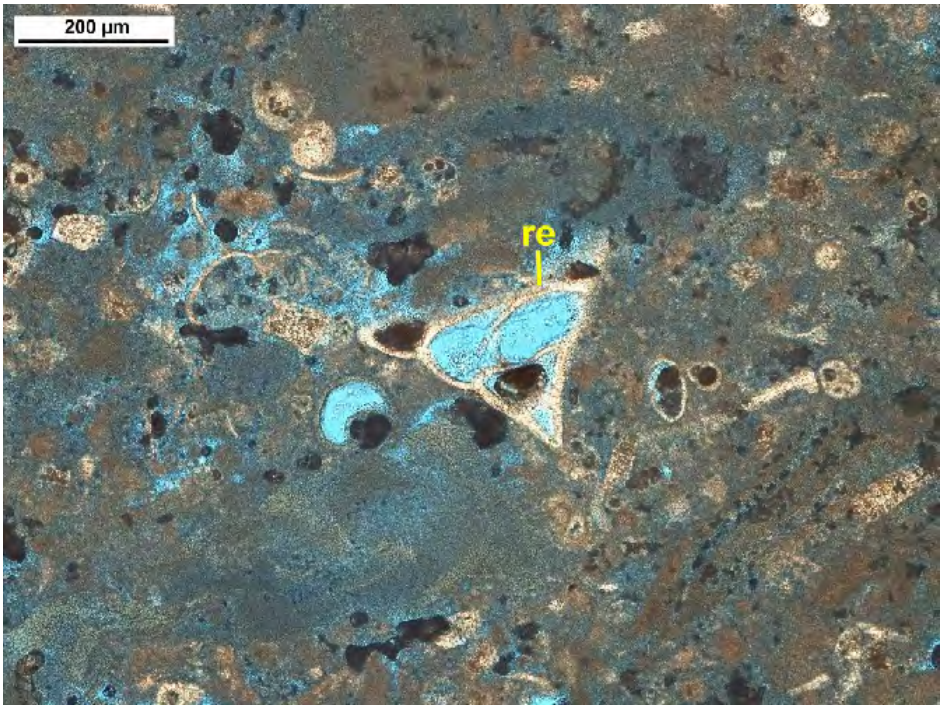
Photomicrograph from thin section G2984–1196.05 that shows a large benthic foraminiferal specimen that is *Fallotella cookei* (fc). Driller's depth of section is 1,196.05 ft bls.

	 Photomicrograph from thin section G2984–1196.05 that shows a large benthic foraminiferal specimen that is *Pseudochrysalidina floridana* (pf). Driller's depth of section is 1,196.05 ft bls.
obi depth: 1,198.0–1,199.6 ft bls Driller's depth: 1,196.7–1,198.25 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids, smaller benthic foraminifera (including rotaliids, biserials, miliolids, *Reussella*?), intraclasts, and larger benthic foraminifera (including *Fallotella cookei* and larger miliolids), minor ostracods, disarticulated thin bivalves **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 6–30 percent total porosity and low to moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,199.6–1,205.3 ft bls Driller's depth: 1,198.25–1,204.0 ft	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated; rhizoliths in uppermost part of cycle, 0.5–1.0-mm wide inner tubule diameter, deeper penetrating, vertical, rhizoliths with 5-mm wide inner tubule diameter based on acoustic borehole wall image and examples in core samples—some tubules solution enlarged

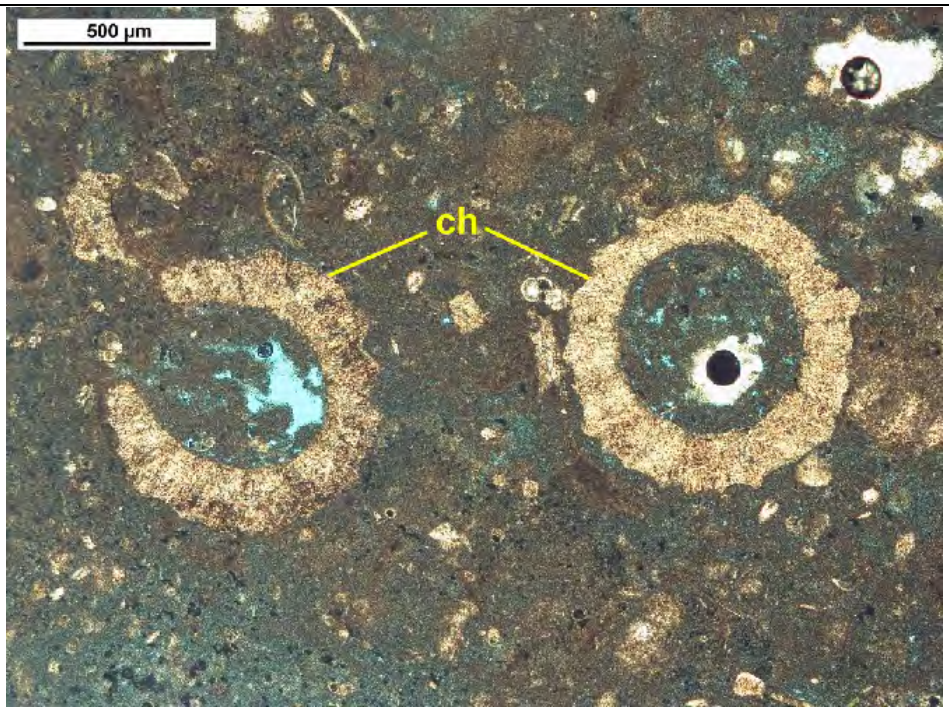
bls	**Ichnofabrics:** Ichnofabric index 2–5 **Ichnofacies:** *Psilonichnus* in uppermost part of cycle **Carbonate grains:** Wackestone is mainly smaller benthic foraminifera (including rotaliids, *Reussella*?), peloids, minor ostracods, charophytes (in intertidal wackestone), larger miliolids, uncommon echinoid spines and plates. Packstone is mainly smaller benthic foraminifera (including rotaliids, *Reussella*), peloids, minor ostracods, larger benthic foraminifera (including *Fallotella floridana*, larger miliolids), uncommon echinoid spines and plates, gastropods, planktic foraminifera, charophytes, *Microcodium*. Foraminifera observed in thin section G2984–1198.31 include smaller benthic foraminifera, smaller *Rotalia*. Foraminifera observed in thin section G2984–1200.63 include smaller benthic foraminifera, *Fallotella floridana*, *Pseudochrysalidina floridana*, larger valvulinids, total of two conical larger benthic foraminifera. Foraminifera observed in thin section G2984–1200.90 include smaller benthic foraminifera. Foraminifera observed in thin section G2984–1202.25 include smaller benthic foraminifera, planktic foraminifera **Porosity and permeability:** 1–12 percent interparticle and intraparticle porosity, 1–2 percent root molds, 1–2 percent fossil molds; 3–16 percent total porosity and relatively low permeability **Depositional environment:** Lower energy restricted inner platform, intertidal to supratidal **Comments:** Cycle cap at 1,199.6 ft bls (obi depth) and 1,198.25 ft bls (driller's depth). Solution-enlarged rhizolith tubules indicated subaerial exposure at top of cycle, as well as a thin autochthonous breccia in the uppermost 2 cm of the cycle cap **Thin section:** G2984–1198.31, G2984–1200.63, G2984–1200.90, G2984–1202.25  Photomicrograph from thin section G2984–1198.31 that shows a *Reussella* (re) and a planktic foraminifer (p). Driller's depth of section is 1,198.31 ft bls.



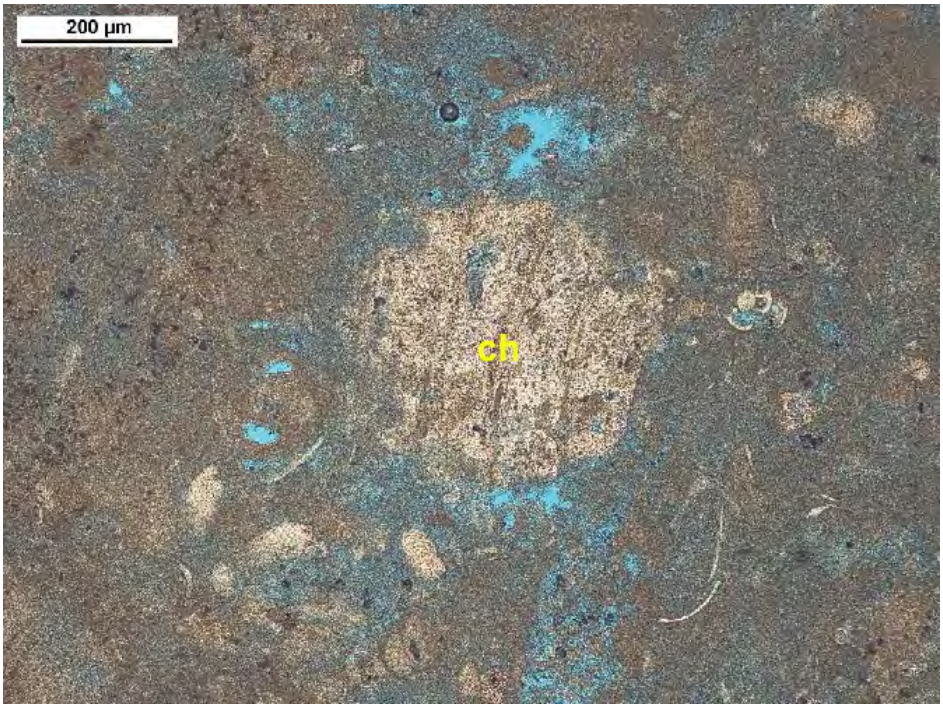
Photomicrograph from thin section G2984–1198.31 that shows autochthonous brecciated high-frequency cycle cap. Driller's depth of section is 1,198.31 ft bls.



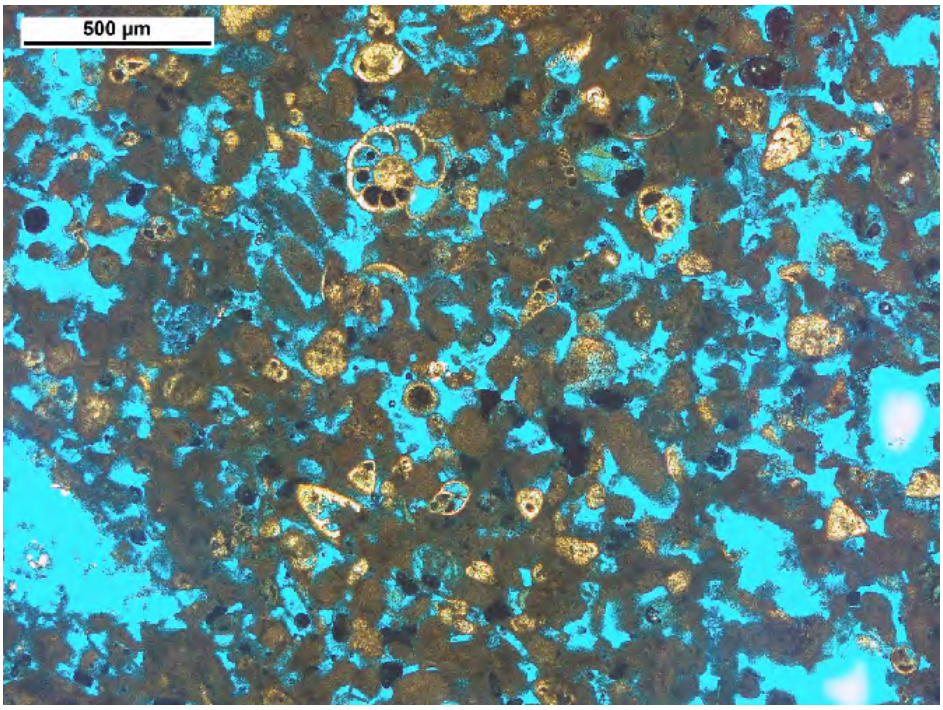
Photomicrograph from thin section G2984–1200.63 that shows *Reussella* (re). Driller's depth of section is 1,200.63 ft bls.



Photomicrograph from thin section G2984–1200.90 that shows charophytes (ch) that present evidence for subaerial exposure. Driller's depth of section is 1,200.90 ft bls.

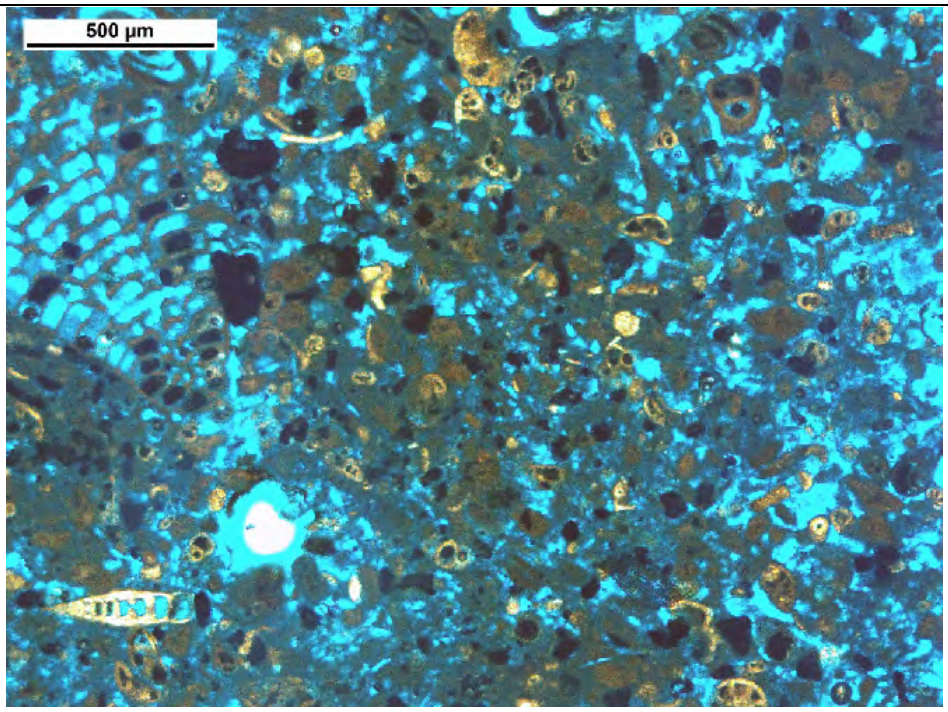


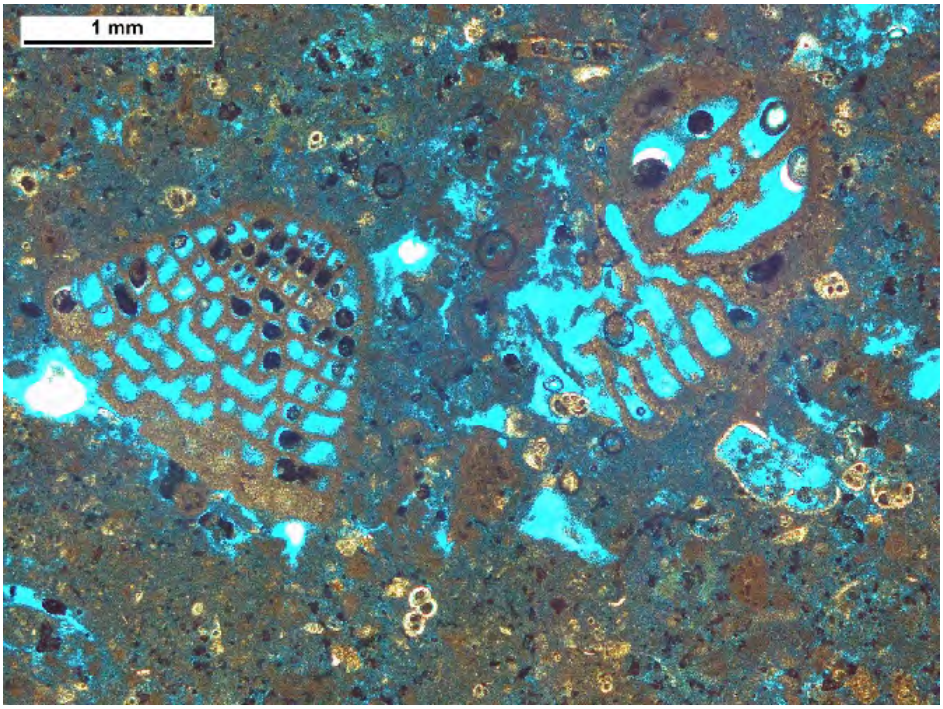
Photomicrograph from thin section G2984–1200.90 that shows a charophyte (ch) that presents evidence for subaerial exposure. Driller's depth of section is 1,200.90 ft bls.

obi depth: 1,205.3–1,206.4 ft bls Driller's depth: 1,204.0–1,205.1 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids, smaller benthic foraminifera (including rotaliids, biserials, miliolids, *Reussella*?), and larger benthic foraminifera (including *Fallotella floridana*, and larger miliolids), ostracods, disarticulated thin bivalves, intraclasts. Foraminifera observed in thin section G2984–1204.83 include smaller benthic foraminifera, *Fallotella floridana*, total of one conical larger benthic foraminifera **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–5 percent moldic porosity; 6–30 percent total porosity and low to moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1204.83  Photomicrograph from thin section G2984–1204.83 that shows a benthic foraminifer packstone and grainstone. Driller's depth of thin section 1,204.83 ft bls.
obi depth: 1,206.4–1,206.9 ft bls Driller's depth:	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic and larger foraminifer mud-dominated packstone **Color:** Very pale orange 10YR 8/2 with minor pale yellowish brown 10YR 6/2 paper-thin, wispy laminations **Sedimentary structures:** Thickly bedded **Trace fossils:** Burrow mottled **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids, smaller benthic foraminifera (including rotaliids),

1,205.1–1,205.6 ft bls	larger benthic foraminifera (including *Fallotella cookei*, *Fallotella floridana*), ostracods **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,206.9–1,207.4 ft bls Driller's depth: 1,205.6–1,206.1 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded, fenestral fabric **Trace fossils:** Rhizoliths 0.5–1.0-mm inner tubule diameter **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Peloids and smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, 2–3 percent root mold porosity, 1 percent fenestrae porosity; 1–9 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,206.9 ft bls (obi depth) and 1,205.6 ft bls (driller's depth)
obi depth: 1,207.4–1,209.0 ft bls Driller's depth: 1,206.1–1,207.8 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated, rhizoliths **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera (including miliolids), peloids, minor ostracods, larger miliolids, uncommon echinoid spines **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 1 percent root molds, 1–2 percent fossil molds; 3–13 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat
obi depth: 1,209.0–1,210.0 ft bls Driller's depth: 1,207.8–1,208.8 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera (including rotaliids, biserials, *Reussella*?), peloids, and larger benthic foraminifera (including *Fallotella floridana*, and larger miliolids), intraclasts, ostracods, fragmented bivalves **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–2 percent moldic porosity; 6–27 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Comments:** Minor rip-up intraclasts along base of interval up to medium pebble size

obi depth: 1,210.0–1,211.4 ft bls Driller's depth: 1,208.8–1,210.2 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very light gray N8 **Sedimentary structures:** Thickly bedded **Trace fossils:** Minor rhizoliths with 0.5-mm inner tubule diameter **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including miliolids, *Reussella*?), peloids, minor ostracods, larger miliolids, uncommon echinoid spines, rare charophytes? Foraminifera observed in thin section G2984–1210.42 include smaller benthic foraminifera (thin section fits into this interval) **Diagenesis:** Circumgranular curved-plane cracks and vertical joint plane cracks **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 1 root molds, 1–2 percent fossil molds; 3–13 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to supratidal **Comments:** Highly irregular paleotopography with about 1 in. of paleorelief probably related to desiccation (cracks) and karst dissolution during exposure. Top of generally fining upward peritidal cycle at 1,210.0 ft bls (obi depth) and 1,208.8 ft bls (driller's depth) **Thin section:** G2984–1210.42 (thin section fits into this interval)
obi depth: 1,211.4–1,214.9 ft bls Driller's depth: 1,210.2–1,213.7 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera (including rotaliids, biserials, *Reussella*?), peloids, and larger benthic foraminifera (including *Fallotella floridana*, and larger miliolids), ostracods, fragmented bivalves. Foraminifera observed in thin section G2984–1213.33 include smaller benthic foraminifera, *Fallotella floridana*, larger valvulinids, total of seven conical larger benthic foraminifera **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–2 percent moldic porosity; 6–27 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1213.33

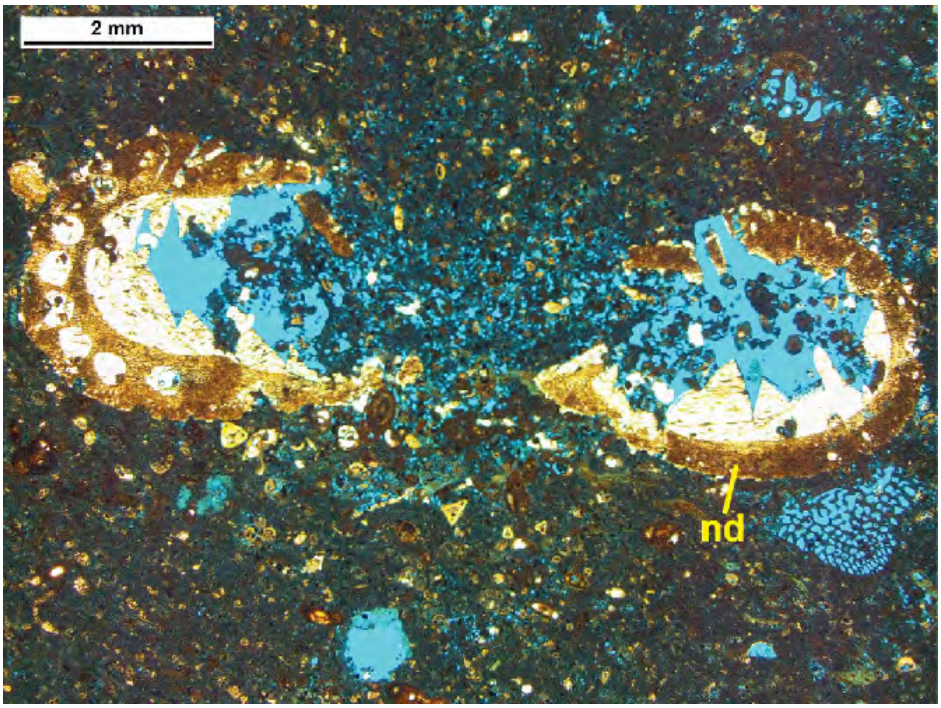
	 Photomicrograph from thin section G2984–1213.33 that shows a peloid, smaller and larger benthic foraminifer grain-dominated packstone, including *Fallotella floridana*. Driller's depth of thin section 1,213.33 ft bls.
obi depth: 1,214.9–1,215.0 ft bls Driller's depth: 1,213.7–1,213.8 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Yellow gray 5Y 8/1 (wet) **Sedimentary structures:** Thinly bedded, vertical desiccation cracks **Trace fossils:** Rhizoliths 0.5-mm inner tubule diameter **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Peloids and smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, 2–3 percent root mold porosity; 3–8 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,214.9 ft bls (obi depth) and 1,213.7 ft bls (driller's depth)
obi depth: 1,215.0–1,217.8 ft bls Driller's depth: 1,213.8–1,217.7 ft	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (most pellets), smaller benthic foraminifera (including uncommon rotaliids, *Reussella*?), larger benthic foraminifera (including *Fallotella floridana*), ostracods, *Neolaganum dalli* along base of interval, rare planktic foraminifera. Foraminifera observed in thin section G2984–1215.31 include smaller

bls	benthic foraminifera, *Fallotella floridana*, larger valvulinids, *Coskinolina floridana*?, total of 10 conical larger benthic foraminifera **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity; 1–10 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal **Thin section:** G2984–1215.31  Photomicrograph from thin section G2984–1215.31 that shows a benthic foraminifer packstone. Driller's depth of thin section 1,215.31 ft bls.
obi depth: 1,217.8–1,219.3 ft bls Driller's depth: 1,217.7–1,219.6 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 very thin laminations **Sedimentary structures:** Thinly bedded **Trace fossils:** Burrow mottled; *Thalassinoides*, *Asterosoma* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Proximal *Cruziana* **Carbonate grains:** Mainly peloids (probably many pellets), smaller benthic foraminifera (including common globular-shaped multichambered foraminifera, uncommon rotaliids, *Reussella*?), minor intraclasts, larger benthic foraminifera (including *Fallotella cookei*, *Fallotella floridana*), ostracods, rare planktic foraminifera. Foraminifera observed in thin section G2984–1218.92 include smaller benthic foraminifera, *Fallotella floridana*, larger valvulinids, *Arenagula* sp., total of four conical larger benthic foraminifera **Porosity and permeability:** 1–7 percent interparticle and intraparticle porosity; 1–7 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted lagoon or inner platform, shallow subtidal **Comments:** Abrupt lithofacies shift at top of interval at 1,217.8 ft bls (obi depth) and

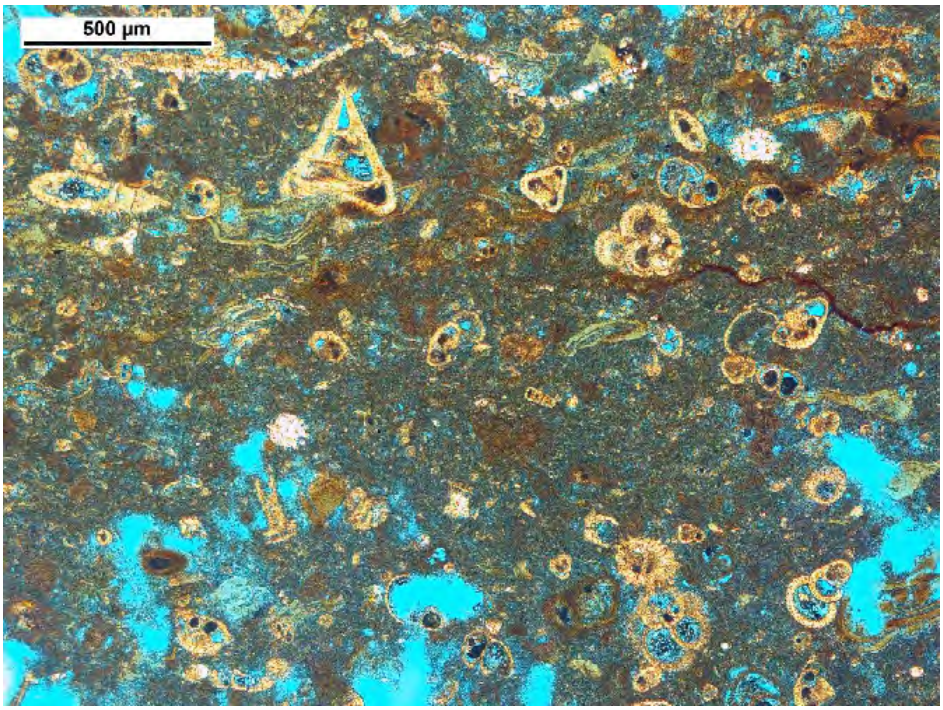
	1,217.7 ft bls (driller's depth); this area of core maybe farther offshore or lagoonal relative to underlying cycles based on muddy *Cruziana*-dominated ichnofacies underlying very thick intertidal mudstone and wackestone **Thin section:** G2984–1218.92  Photomicrograph from thin section G2984–1218.92 that shows a benthic foraminifer wackestone with *Pseudochrysalidina* (large foraminifer on right) and ostracods. Driller's depth of thin section 1,218.92 ft bls.
obi depth: 1,219.3–1,219.4 ft bls Driller's depth: 1,219.6–1,219.7 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Yellow gray 5Y 8/1 (wet) **Sedimentary structures:** Thinly bedded **Trace fossils:** Rhizoliths 0.5–1.5-mm inner tubule diameter **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Peloids and smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, 2–7 percent root mold porosity; 3–12 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,219.3 ft bls (obi depth) and 1,219.6 ft bls (driller's depth)
obi depth: 1,219.4–1,219.6 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 very thin laminations **Sedimentary structures:** Thinly bedded **Trace fossils:** Burrow mottled; *Thalassinoides*

Driller's depth: 1,219.7–1,219.9 ft bls	**Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Proximal *Cruziana* **Carbonate grains:** Mainly peloids (probably mainly pellets), smaller benthic foraminifera (including common globular-shaped multichambered foraminifera, uncommon rotaliids, *Reussella*?), minor larger benthic foraminifera (including *Fallotella cookei*, *Fallotella floridana*), ostracods, rare planktic foraminifera **Porosity and permeability:** 1–7 percent interparticle and intraparticle porosity; 1–7 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,219.6–1,219.8 ft bls Driller's depth: 1,219.9–1,220.1 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Yellow gray 5Y 8/1 (wet) **Sedimentary structures:** Thinly bedded **Trace fossils:** Rhizoliths 0.5–1.5-mm inner tubule diameter **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Peloids and smaller benthic foraminifera, minor gastropods **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, 2–7 percent root mold porosity; 3–12 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,219.6 ft bls (obi depth) and 1,219.9 ft bls (driller's depth)
obi depth: 1,219.8–1,220.1 ft bls Driller's depth: 1,220.1–1,220.4 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 very thin laminations **Sedimentary structures:** Thinly bedded **Trace fossils:** Burrow mottled; *Thalassinoides*, *Rhizocorallium?* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Proximal *Cruziana* **Carbonate grains:** Mainly peloids (probably many pellets), smaller benthic foraminifera (including common globular-shaped multichambered foraminifera, uncommon rotaliids, *Reussella*?), minor larger benthic foraminifera (including *Fallotella cookei*, *Fallotella floridana*), ostracods, rare planktic foraminifera **Porosity and permeability:** 1–7 percent interparticle and intraparticle porosity; 1–7 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,220.1–1,221.0 ft bls Driller's depth:	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer, intraclast wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal

1,220.4–1,221.3 ft bls	grains), smaller benthic foraminifera, and intraclasts **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,221.0–1,221.2 ft bls Driller's depth: 1,221.3–1,221.5 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thinly bedded **Trace fossils:** Rhizoliths 0.5–1.0-mm inner tubule diameter with some bifurcating **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Unidentified skeletal grains and peloids, minor gastropods **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 2–7 percent root mold porosity; 3–17 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,221.0 ft bls (obi depth) and 1,222.0 ft bls (driller's depth)
obi depth: 1,221.2–1,221.4 ft bls Driller's depth: 1,221.5–1,221.7 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thinly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including very minor small rotaliids), *Neolaganum dalli* **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,221.4–1,221.6 ft bls Driller's depth: 1,221.7–1,221.9 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thinly bedded, very minor fenestral fabric **Trace fossils:** Rhizoliths 0.5–1.0-mm inner tubule diameter with some bifurcating **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Unidentified skeletal grains and peloids, minor gastropods **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 2–7 percent root mold porosity; 3–17 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,221.4 ft bls (obi depth) and 1,221.7 ft bls (driller's depth)

obi depth: 1,221.6– 1,225.6 ft bls Driller's depth: 1,221.9– 1,224.1 ft bls	**Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including very minor small rotaliids), and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), *Neolaganum dalli*. Foraminifera observed in thin section G2984–1223.33 include smaller benthic foraminifera, *Fallotella floridana*, larger valvulinids, *Arenagula* sp., total of eight conical larger benthic foraminifera **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal **Thin section:** G2984–1223.33  Photomicrograph from thin section G2984–1223.33 that shows a benthic foraminifer wackestone and packstone with a *Neolaganum dalli* (nd) echinoid. Driller's depth of thin section 1,223.33 ft bls.
obi depth: 1,225.6– 1,226.5 ft bls Driller's	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5

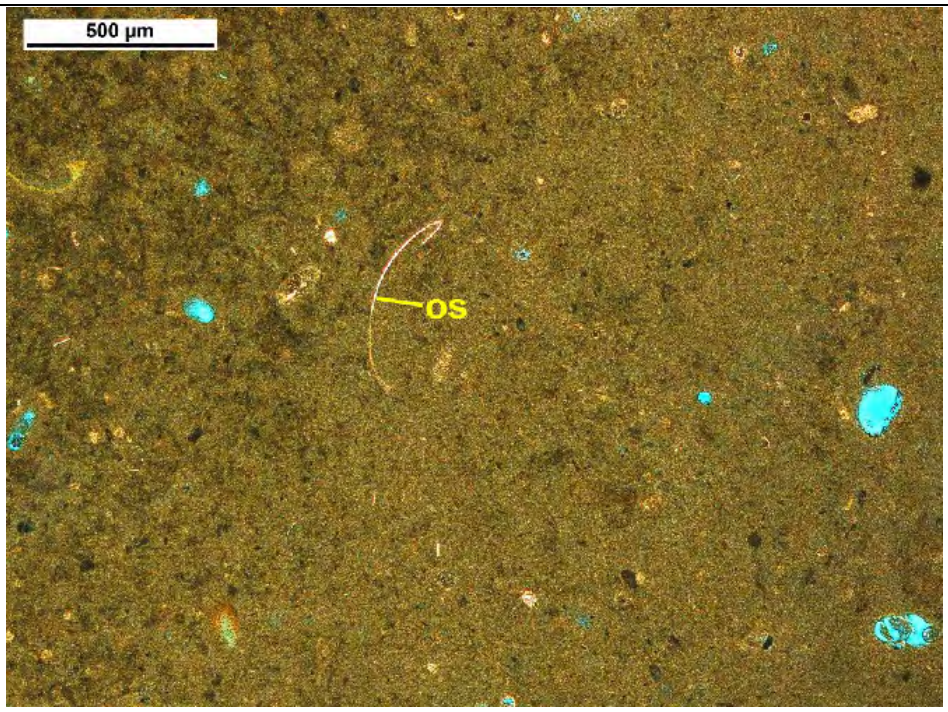
depth: 1,224.1–1,225.0 ft bls	**Carbonate grains:** Mainly unidentified small grains, smaller benthic foraminifera, intraclasts **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,226.5–1,226.55 ft bls Driller's depth: 1,225.0–1,225.05 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial-laminite packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 and dusky yellowish brown 10YR 2/2 organic laminations **Sedimentary structures:** Thinly laminated **Carbonate grains:** Mainly peloids and smaller benthic foraminifera, minor larger benthic foraminifera (including *Fallotella floridana*) **Accessory grains:** Organic paper-thin laminations **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,226.5 ft bls (obi depth) and 1,225.05 ft bls (driller's depth)
obi depth: 1,226.55–1,227.05 ft bls Driller's depth: 1,225.05–1,225.55 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly unidentified small grains, smaller benthic foraminifera, intraclasts, *Neolaganum dalli* **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi: 1,227.05–1,227.1 ft bls Driller's depth: 1,225.55–1,225.6 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly laminated **Carbonate grains:** Mainly peloids and smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,227.05 ft bls (obi depth) and 1,225.55 ft bls (driller's depth)
obi depth: 1,227.1–	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone

1,229.4 ft bls Driller's depth: 1,225.6–1,227.9 ft bls	**Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thickly laminated to medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly unidentified small grains, smaller benthic foraminifera and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), intraclasts, *Neolaganum dalli*. Foraminifera observed in thin section G2984–1226.33 include smaller benthic foraminifera **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1226.33  Photomicrograph from thin section G2984–1226.33 that shows a benthic foraminifer packstone and grainstone. Driller's depth of thin section 1,226.33 ft bls.
obi depth: 1,229.4–1,230.5 ft bls Driller's depth: 1,227.9–1,229.0 ft bls	**Lithofacies:** Rip-up clast floatstone **Depositional texture:** Intraclast floatstone with a smaller benthic foraminifer grain-dominated packstone and grainstone matrix **Color:** Matrix is very pale orange 10YR 8/2 and contains monocolored intraclasts either very pale orange 10YR 8/2, pale yellowish brown 10YR 6/2, light gray N7, or medium light gray N6 **Sedimentary structures:** Medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including rotaliids), and probably intraclasts are rip-up clasts (up to small cobble-sized clasts that are mainly composed of smaller benthic

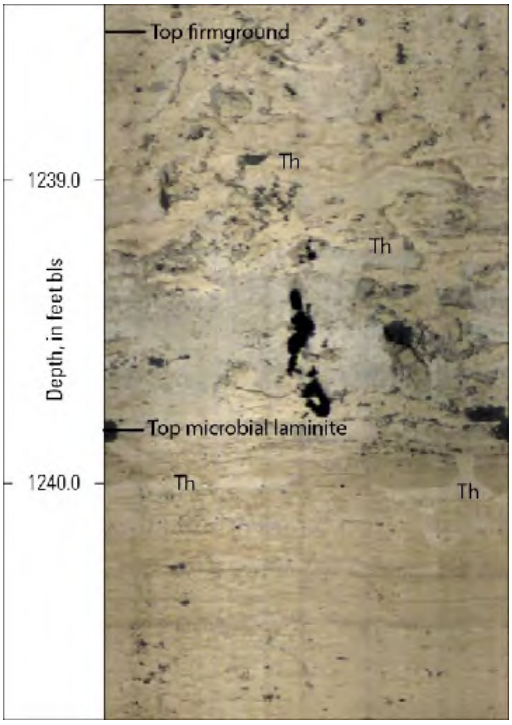
	foraminifera wackestone and minor benthic foraminifera grainstone) **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity; 1–15 percent total porosity and relatively low permeability **Depositional environment:** High-energy event, marine subtidal
obi depth: 1,230.5–1,230.8 ft bls Driller's depth: 1,229.0–1,229.3 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminate—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 and dark yellowish brown 10YR 4/2 organic laminations **Sedimentary structures:** Thinly laminated to very thinly bedded **Trace fossils:** *Planolites* **Ichnofabrics:** Ichnofabric index 1–3 **Ichnofacies:** *Skolithos* **Carbonate grains:** Mainly peloids and smaller benthic foraminifera (including rotaliids and smaller miliolids), larger miliolids, ostracods, very minor *Neolaganum dalli* **Accessory grains:** Organic paper-thin laminations **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,230.5 ft bls (obi depth) and 1,229.0 ft bls (driller's depth)
obi depth: 1,230.8–1,231.5 ft bls Driller's depth: 1,229.3–1,230.0 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Thinly laminated to medium bedded **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 1–5 **Ichnofacies:** Distal *Skolithos* **Carbonate grains:** Mainly unidentified small grains, smaller benthic foraminifera, and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), echinoid spines **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–8 percent moldic porosity; 6–33 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,231.5–1,234.4 ft bls Driller's depth: 1,230.0–1,232.9 ft bls	**Lithofacies:** Skeletal floatstone and rudstone **Depositional texture:** Bivalve, echinoid floatstone with peloid, benthic foraminifer mud- and grain-dominated packstone matrix **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** Minor rhizoliths that are probably from marine plants **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), mollusks (articulated and disarticulated bivalves and gastropods), *Neolaganum dalli*, smaller benthic foraminifera and larger benthic foraminifera (including *Fallotella floridana*), dasycladacean algae, intraclasts, very uncommon possible stick-shaped small

	coral **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–10 percent moldic porosity; 6–30 percent total porosity and low to moderate permeability **Depositional environment:** Low-energy inner platform, shallow subtidal
obi depth: 1,234.4–1,235.4 ft bls Driller's depth: 1,232.9–1,233.9 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Autochthonous breccia **Depositional texture:** Breccia **Color:** Very pale orange 10YR 8/2, pale yellowish brown 10YR 6/2, local very light gray N8 to medium gray N5 irregular coloring of wackestone clasts possibly due to local concentration of organic material **Sedimentary structures:** Medium bedded, irregular dissolution voids and interparticle voids infilled with sediment from superjacent unit **Trace fossils:** Uncommon semivertical rhizoliths with about 0.5–1.0-mm inner tubule diameter **Carbonate grains:** Mainly rounded intraclasts that contain smaller benthic foraminifera and unidentified skeletal grains **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 1 percent root-mold porosity; 2–11 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, supratidal **Comments:** Autochthonous breccia that underwent pedogenetic alteration. Probably several phases of alteration by desiccation and root growth. Top of generally fining upward peritidal cycle at 1,234.4 ft bls (obi depth) and 1,233.9 ft bls (driller's depth) with evidence for karst dissolution during subaerial exposure
obi depth: 1,235.4–1,235.8 ft bls Driller's depth: 1,233.9–1,234.3 ft bls	**Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminate—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 and dark yellowish brown 10YR 4/2 organic laminations **Sedimentary structures:** Thinly laminated to very thinly bedded **Trace fossils:** *Thalassinoides*? **Ichnofabrics:** Ichnofabric index 1–2 **Carbonate grains:** Mainly peloids and smaller benthic foraminifera (including rotaliids and smaller miliolids), larger miliolids, ostracods, very minor *Neolaganum dalli* **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat
obi depth: 1,235.8–1,238.5 ft bls Driller's depth: 1,234.3–1,237.1 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), very minor *Neolaganum dalli* **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3

	percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,238.5–1,239.3 ft bls Driller's depth: 1,237.1–1,237.9 ft bls	**Cycle type:** Top type IV cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Very light gray N8 to light gray N7 **Sedimentary structures:** Medium bedded **Trace fossils:** *Thalassinoides*, *Psilonichnus* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Thalassinoides*-dominated *Glossifungites* **Carbonate grains:** Unidentified skeletal grains; uncommon, very small gastropods **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity; 1–10 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, inner tidal flat **Comments:** Top of a firmground and *Thalassinoides*-dominated *Glossifungites* ichnofacies cap at 1,238.5 ft bls (obi depth) and 1,237.1 ft bls (driller's depth). Infill in *Thalassinoides* burrow from superjacent benthic foraminifer grain-dominated packstone and grainstone interval from 1,238.5 to 1,239.3 ft bls (obi depth) and 1,237.1 to 1,237.9 ft bls (driller's depth). Burrows and *Glossifungites* ichnofacies continue downward into subjacent ostracod mudstone and microbial laminite
obi depth: 1,239.3–1,239.8 ft bls Driller's depth: 1,237.9–1,238.4 ft bls	**Lithofacies:** Ostracod mudstone **Depositional texture:** Ostracod and smaller benthic foraminifer mudstone **Color:** Very light gray N8 to light gray N7 **Sedimentary structures:** Thickly bedded, skew-plane and curved-plane desiccation cracks **Trace fossils:** *Thalassinoides*, rhizoliths with 0.5–1.0-mm inner diameter and in some cases have bifurcating tubules, *Psilonichnus* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Thalassinoides*-dominated *Glossifungites* **Carbonate grains:** Minor ostracods and unidentified smaller benthic foraminifera. Foraminifera observed in thin section G2984–1238.25 include smaller benthic foraminifera **Porosity and permeability:** 1–3 percent root-mold porosity, 1 percent desiccation-crack porosity; 2–4 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, inner tidal flat **Comments:** *Thalassinoides*-dominated *Glossifungites* ichnofacies associated with superjacent and subjacent *Glossifungites* ichnofacies. Infill in *Thalassinoides* burrow from overlying interval from 1,238.5 to 1,239.3 ft bls (obi depth) and 1,237.1 to 1,237.9 ft bls (driller's depth) **Thin section:** G2984–1238.25



Photomicrograph from thin section G2984–1238.25 that shows an ostracod (os) mudstone. Driller's depth of thin section is 1,238.25 ft bls.



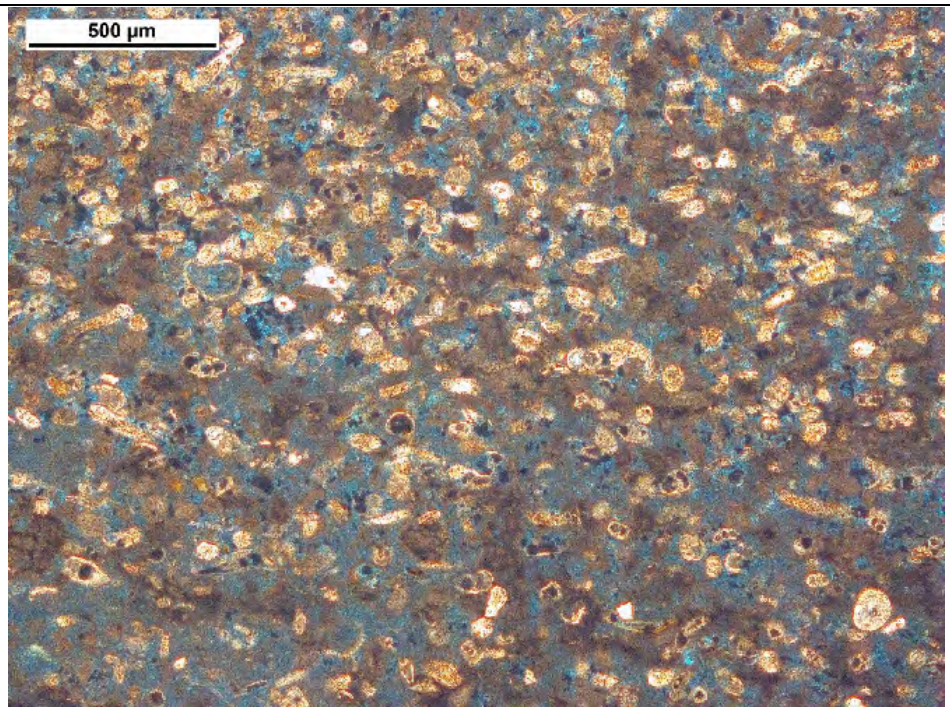
Optical borehole image that shows a firmground composed of underlying microbial laminite outer tidal flat and an overlying benthic foraminifer wackestone and packstone lithofacies inner tidal flat. Both lithofacies were transformed to a firmground and burrowed by crustaceans to form

	Thalassinoides (*Glossifungites* ichnofacies) extending downward from the cycle top and backfilled with sediment from the overlying cycle. Th is abbreviation for *Thalassinoides*.
obi depth: 1,239.8–1,240.5 ft bls Driller's depth: 1,238.4–1,239.1 ft bls	**Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly laminated to very thinly bedded **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 1–2 **Ichnofacies:** *Thalassinoides*-dominated *Glossifungites* **Carbonate grains:** Mainly peloids and smaller benthic foraminifera (including rotaliids and smaller miliolids), larger miliolids, ostracods **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, outer tidal flat **Comments:** *Glossifungites* ichnofacies in uppermost part of unit is associated with superjacent *Glossifungites* ichnofacies intervals. The uppermost part of this microbial laminite is a firmground. Infill in *Thalassinoides* burrow from overlying interval from 1,238.5 to 1,239.3 ft bls (obi depth) and 1,237.1 to 1,237.9 ft bls (driller's depth).
obi depth: 1,240.5–1,243.1 ft bls Driller's depth: 1,239.1–1,241.8 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** *Ophiomorpha* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Skolithos* **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera and larger benthic foraminifera (including *Fallotella floridana*, and larger miliolids), very minor *Neolaganum dalli* **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,243.1–1,243.7 ft bls Driller's depth: 1,241.8–1,242.4 ft bls	**Cycle type:** Type IV cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone **Color:** Very pale orange 10YR 8/2 matrix, light gray N7 to medium light gray N8 rip-up intraclasts **Sedimentary structures:** Burrow mottled, medium bedded **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Thalassinoides*-dominated *Glossifungites* **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), rip-up intraclasts up to small pebble size (rip-

	ups of benthic foraminifer wackestone—possibly total erosion of a pre-existing underlying benthic foraminifer wackestone) **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal **Comments:** *Thalassinoides*-dominated *Glossifungites* ichnofacies with burrows infilled with superjacent benthic foraminifer grain-dominated packstone and grainstone **Comments:** Top of a firmground-capped subtidal cycle at 1,243.1 ft bls (obi depth) and 1,241.8 ft bls (driller's depth)
obi depth: 1,243.7–1,244.0 ft bls Driller's depth: 1,242.4–1,242.7 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2, dark yellowish brown 10YR 4/2 organic laminations **Sedimentary structures:** Thinly to thickly laminated, horizontal to wavy laminations **Trace fossils:** Minor small burrows, *Planolites*? **Ichnofabrics:** Ichnofabric index 2 **Carbonate grains:** Mainly peloids and smaller benthic foraminifera (including rotaliids and smaller miliolids), larger miliolids, ostracods **Accessory grains:** Very minor paper-thin organic laminations **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Cycle top at 1,243.7 ft bls (obi depth) and 1,242.4 ft bls (driller's depth)
obi depth: 1,244.0–1,245.3 ft bls Driller's depth: 1,242.7–1,243.7 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, medium bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera, and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids) **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,245.3–1,246.15 ft bls Driller's depth:	**Lithofacies:** Rip-up clast floatstone **Depositional texture:** Intraclast floatstone with matrix of smaller and larger benthic foraminifer mud- and grain-dominated packstone **Color:** Very pale orange 10YR 8/2 matrix, light gray N7 to medium light gray N8 rip-up intraclasts **Sedimentary structures:** Burrow mottled, medium bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5

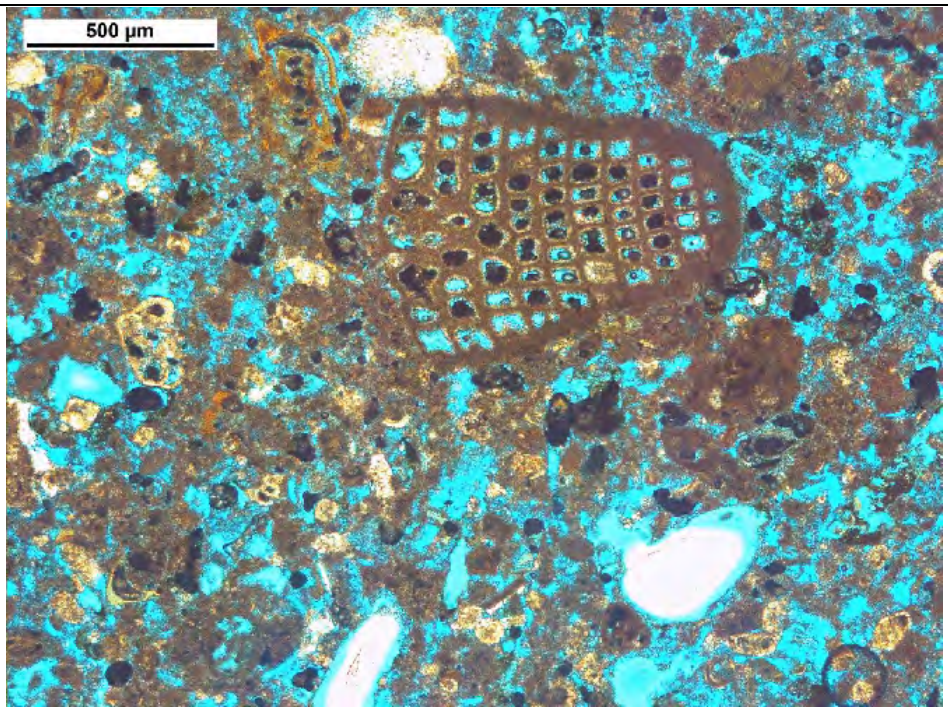
1,243.7–1,244.8 ft bls	**Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera and larger benthic foraminifera (including *Fallotella floridana*, and larger miliolids), rip-up intraclasts up to medium pebble size (rip-ups of benthic foraminifer wackestone—possibly total erosion of a pre-existing micrite-rich intertidal to supratidal lithofacies), very minor *Neolaganum dalli* **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** High-energy event, marine subtidal **Comment:** Marine erosion of intertidal to supratidal sediments
obi depth: 1,246.15–1,246.4 ft bls Driller's depth: 1,244.8–1,245.0 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly to thickly laminated, horizontal laminations **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 2–3 **Ichnofacies:** Distal *Cruziana* **Carbonate grains:** Mainly peloids and smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,246.15 ft bls (obi depth) and 1,244.8 ft bls (driller's depth)
Obi depth: 1,246.4–1,249.3 ft bls Driller's depth: 1,245.0–1,248.7 ft bls	**Cycle type:** Intra-type I cycle **Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** *Planolites* (deposit feeder), *Thalassinoides* in uppermost 0.3 ft of unit **Ichnofabrics:** Ichnofabric index 5 in general, 2 in uppermost 0.3 ft of unit **Ichnofacies:** Proximal *Cruziana* **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera, and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids) **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,249.3–1,251.2 ft bls Driller's	**Cycle type:** Top type IV cycle **Lithofacies:** Benthic foraminifer mudstone and wackestone **Depositional texture:** Smaller benthic foraminifer mudstone and wackestone **Color:** Very light gray N8, very minor light gray N7 to medium light gray N6 **Sedimentary structures:** Thickly bedded **Trace fossils:** *Thalassinoides* (suspension feeder) **Ichnofabrics:** Ichnofabric index 5

depth: 1,248.7–1,250.6 ft bls	**Ichnofacies:** *Glossifungites* **Carbonate grains:** Mainly smaller benthic foraminifera (including very minor small rotaliids, smaller miliolids) and ostracods, unidentified skeletal grains, minor dasycladacean algae. Foraminifera observed in thin section G2984–1249.58 include smaller benthic foraminifera **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity; 3–17 percent total porosity and relatively low permeability **Depositional environment:** Low-energy inner platform, shallow subtidal **Comments:** Cycle top at top of interval, interval is a firmground and *Thalassinoides*-dominated *Glossifungites* ichnofacies with a top at 1,249.3 ft bls (obi depth) and 1,248.7 ft bls (driller's depth). *Thalassinoides* burrows infilled with superjacent benthic foraminifer packstone and grainstone
obi depth: 1,251.2–1,251.7 ft bls Driller's depth: 1,250.6–1,251.0 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—wackestone to packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly to thickly laminated, topography-draping laminations **Trace fossils:** Semivertical rhizolith tubules **Ichnofabrics:** Ichnofabric index 1 **Ichnofacies:** *Psilonichnus*? **Carbonate grains:** Mainly peloids, *Microcodium* prisms, and smaller benthic foraminifera (including rotaliids), minor larger miliolids, ostracods, very uncommon globular planktic foraminifera. Foraminifera observed in thin section G2984–1250.77 include smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,251.5 ft bls (obi depth) and 1,250.8 ft bls (driller's depth) **Thin section:** G2984–1250.77

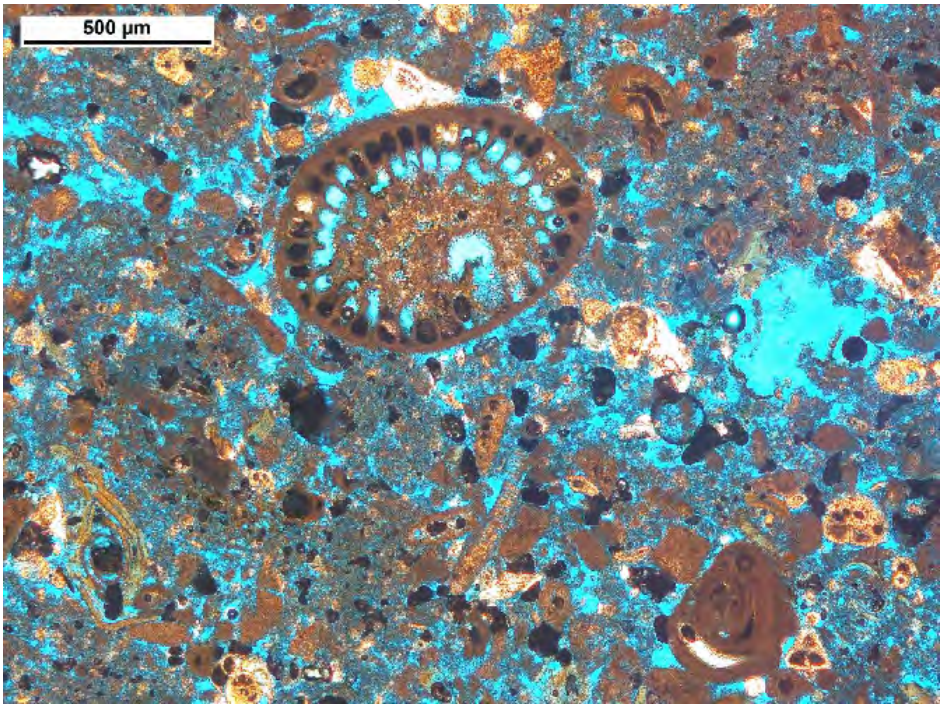
	 Photomicrograph from thin section G2984–1250.77 from a microbial laminite where accumulation of isolated *Microcodium* prisms that have been transported and deposited into a restricted marine packstone sediment with abundant smaller benthic foraminifera and peloids. Top of this high-frequency cycle could be conformable with a superjacent benthic foraminifer mudstone and wackestone. Driller's depth of thin section is 1,250.77 ft bls.
obi depth: 1,251.7– 1,259.0 ft bls Driller's depth: 1,251.0– 1,257.5 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, very thickly bedded **Trace fossils:** Rhizoliths throughout much of cycle, probably seagrass root molds **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), and larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), uncommon ostracods, echinoid plates **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,259.0– 1,259.8 ft bls Driller's	**Cycle type:** Top type IV cycle **Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Larger and smaller benthic foraminifer mud- to grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Medium bedded **Trace fossils:** Very small *Thalassinoides*-like burrow? at top of interval (identification

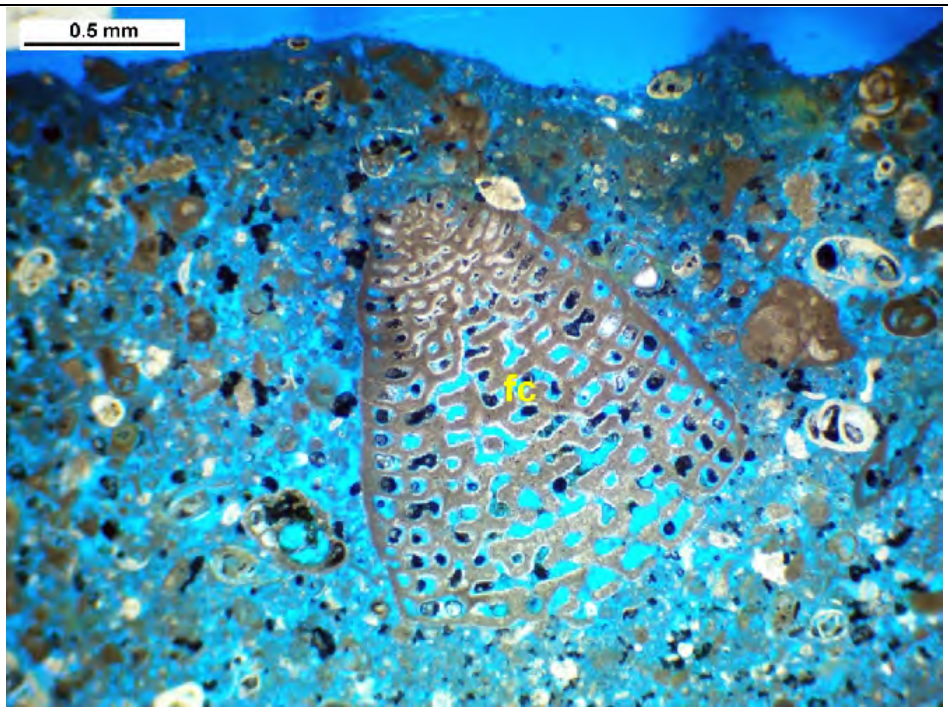
depth: 1,257.5–1,258.3 ft bls	based on obi borehole wall image only) **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Glossifungites* at uppermost 0.25 ft of interval **Carbonate grains:** Mainly larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), smaller benthic foraminifera, echinoid plates **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–23 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Comments:** Cycle top at top of interval, interval is a firmground and *Glossifungites* ichnofacies with a top at 1,259.0 ft bls (obi depth) and 1,258.3 ft bls (driller's depth). Very small *Thalassinoides*-like burrows maybe infilled with superjacent benthic foraminifer packstone and grainstone. Base of interval appears to be conformable with subjacent microbial laminite
obi depth: 1,259.8–1,260.0 ft bls Driller's depth: 1,258.3–1,258.5 ft bls	**Cycle top:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly to thickly laminated, topography draping laminations, minor vertical desiccation cracks **Trace fossils:** *Planolites*? **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus*? **Carbonate grains:** Mainly peloids and smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,259.8 ft bls (obi depth) and 1,258.3 ft bls (driller's depth)
obi depth: 1,260.0–1,262.5 ft bls Driller's depth: 1,258.5–1,261.1 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), uncommon ostracods, echinoid plates **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–23 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,262.5–1,263.6 ft	**Lithofacies:** Rip-up clast floatstone **Depositional texture:** Intraclast floatstone with matrix of smaller and larger benthic foraminifer mud- and grain-dominated packstone **Color:** Very pale orange 10YR 8/2

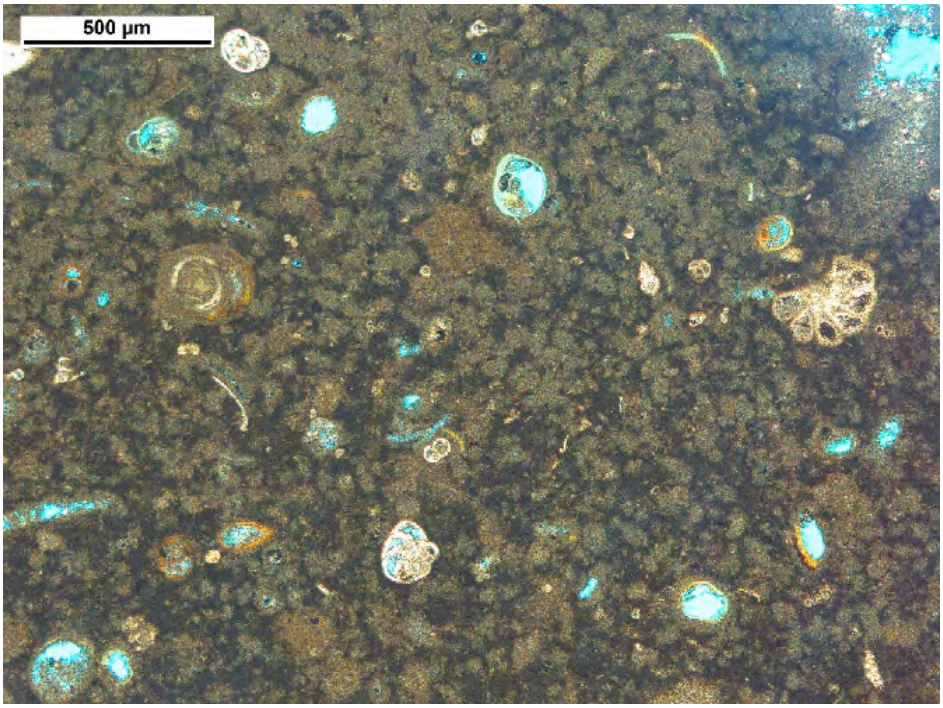
bls Driller's depth: 1,261.1–1,262.2 ft bls	**Sedimentary structures:** Burrow mottled matrix and intraclasts, medium bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana*, and larger miliolids), rip-up intraclasts up to small cobble size (rip-up intraclasts of wackestone and packstone) **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** High-energy event, marine subtidal **Comments:** Intraclasts from transgressive total erosion of micrite-rich cycle cap associated with subjacent cycle top
obi depth: 1,263.6–1,264.3 ft bls Driller's depth: 1,262.2–1,262.9 ft bls	**Cycle type:** Top type I cycle with erosionally removed micrite-rich cycle cap **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly laminated, topography-draping laminations and slight buildup topography near upper part of unit **Trace fossils:** *Planolites* **Ichnofabrics:** Ichnofabric index 2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly peloids and smaller benthic foraminifera (including rotaliids and smaller miliolids), larger miliolids, ostracods **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,263.6 ft bls (obi depth) and 1,262.2 ft bls (driller's depth)
obi depth: 1,264.3–1,268.5 ft bls Driller's depth: 1,262.9–1,267.3 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, very thinly bedded **Trace fossils:** *Skolithos* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Distal *Skolithos* **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), *Neolaganum dalli*, uncommon ostracods, echinoid plates. Foraminifera observed in thin section G2984–1266.19 include smaller benthic foraminifera, *Fallotella floridana*, *Fallotella cookei*, total of two conical larger benthic foraminifera **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–23 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1266.19

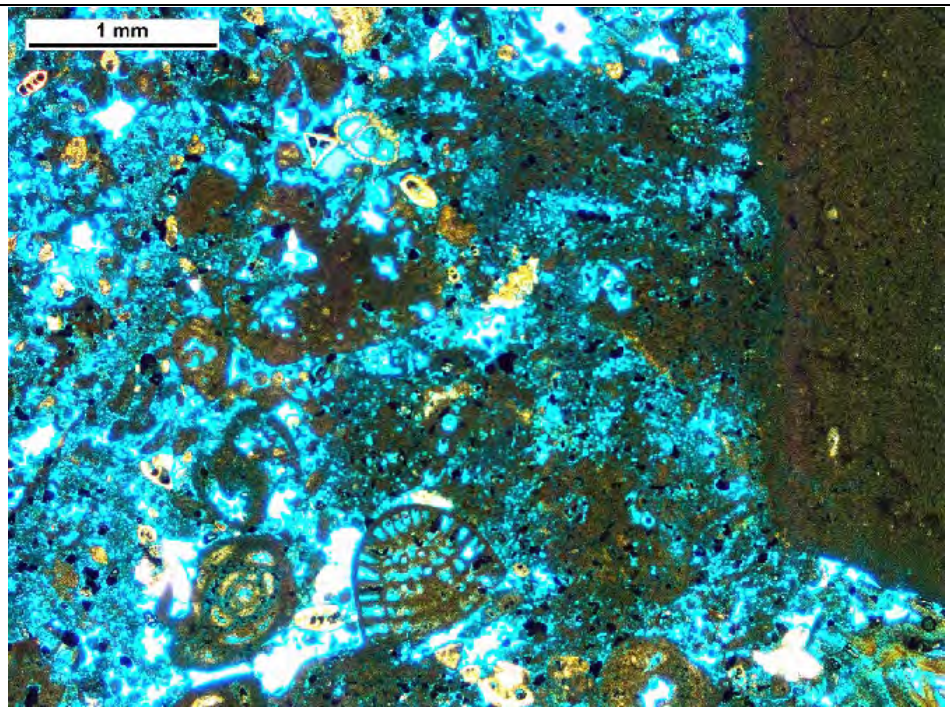
	 Photomicrograph from thin section G2984–1266.19 that shows a benthic foraminifer packstone and grainstone. Driller's depth of thin section is 1,266.19 ft bls.
obi depth: 1,268.5–1,269.7 ft bls Driller's depth: 1,267.3–1,268.5 ft bls	**Lithofacies:** Rip-up clast floatstone **Depositional texture:** Intraclast floatstone with matrix of smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), rip-up intraclasts up to medium pebble size (rip-up clasts of underlying benthic foraminifer mudstone and wackestone—intertidal to supratidal sediment) **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** High-energy event, marine subtidal. Probably shallow subtidal transgression
obi depth: 1,269.7–1,270.3 ft bls Driller's depth:	**Cycle type:** Top-type I cycle **Lithofacies:** Autochthonous breccia **Depositional texture:** Breccia with clasts of smaller benthic foraminifer mudstone and wackestone with a matrix of transgressive subtidal marine sediment—smaller and larger benthic foraminifer, *Microcodium*-prism mud-dominated packstone **Color:** Very light gray N8, very minor light gray N7 to medium light gray N6 **Sedimentary structures:** Very thinly bedded, common desiccation cracks, fenestrae, autochthonous breccia clasts up to small cobble size

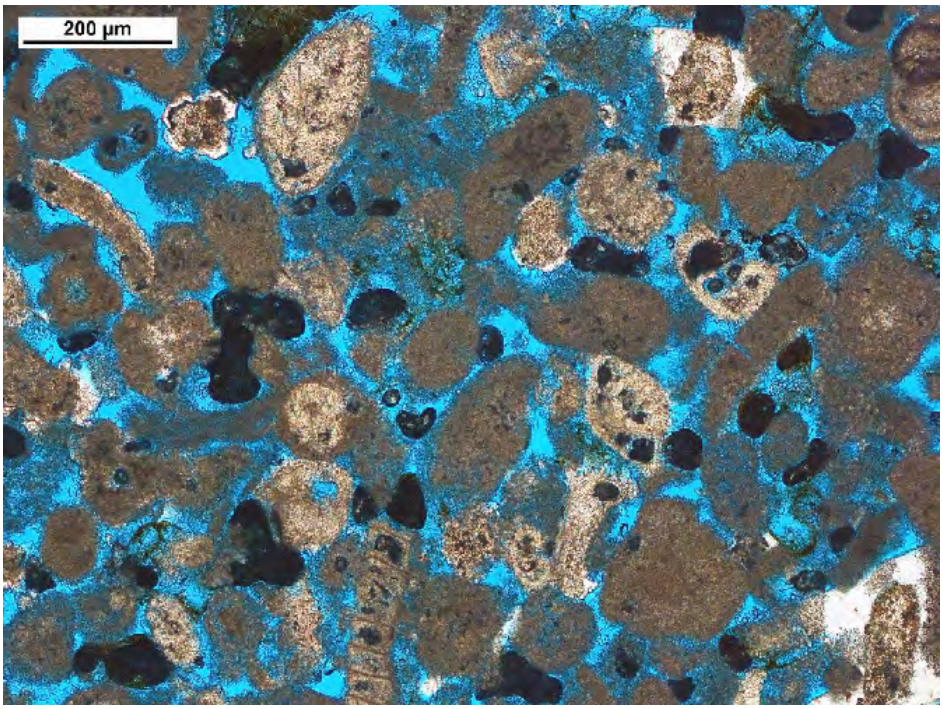
1,268.5–1,268.9 ft bls	**Trace fossils:** Rhizoliths as evidenced by 0.5–0.1-mm inner diameter tubules and presence of *Microcodium* and *Microcodium*-filled voids (root molds?) up to 1.5 cm in diameter **Ichnofabrics:** Ichnofabric index 1–2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including very minor small rotaliids, smaller miliolids) and ostracods, unidentified skeletal grains, minor larger benthic foraminifera (including *Fallotella floridana*), *Microcodium*. Foraminifera observed in thin section G2984–1268.83 include smaller benthic foraminifera, *Fallotella floridana*, larger valvulinids, total of one conical larger benthic foraminifera **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, 1–3 percent root-mold porosity, 1–4 percent fenestrae porosity; 3–17 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, supratidal **Comments:** Top of generally fining upward peritidal cycle at 1,269.7 ft bls (obi depth) and 1,268.5 ft bls (driller's depth). Autochthonous breccia resulting from desiccation and root stresses **Thin section:** G2984–1268.83
obi depth: 1,270.3–1,270.9 ft bls Driller's depth: 1,268.9–1,269.5 ft bls	**Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly laminated, topography-draping laminations, interlaminations of organic-rich laminations, and wackestone and mud-dominated packstone **Carbonate grains:** Mainly peloids and smaller benthic foraminifera (including rotaliids and smaller miliolids), larger miliolids, ostracods, *Microcodium*. Foraminifera observed in thin section G2984–1269.04 include smaller benthic foraminifera. Foraminifera observed in thin section G2984–1269.17 include smaller benthic foraminifera, planktic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Thin section:** G2984–1269.04, G2984–1269.17
obi depth: 1,270.9–1,274.7 ft bls Driller's depth: 1,269.5–1,273.2 ft bls	**Lithofacies:** Benthic foraminifer grain-dominated packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled in lower and middle part of unit, very thickly bedded at base and middle part of unit and thickly laminated and very thinly bedded in upper part of unit **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 1–5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), minor intraclasts up to small pebble size, *Neolaganum dalli*, uncommon ostracods, thin-shelled

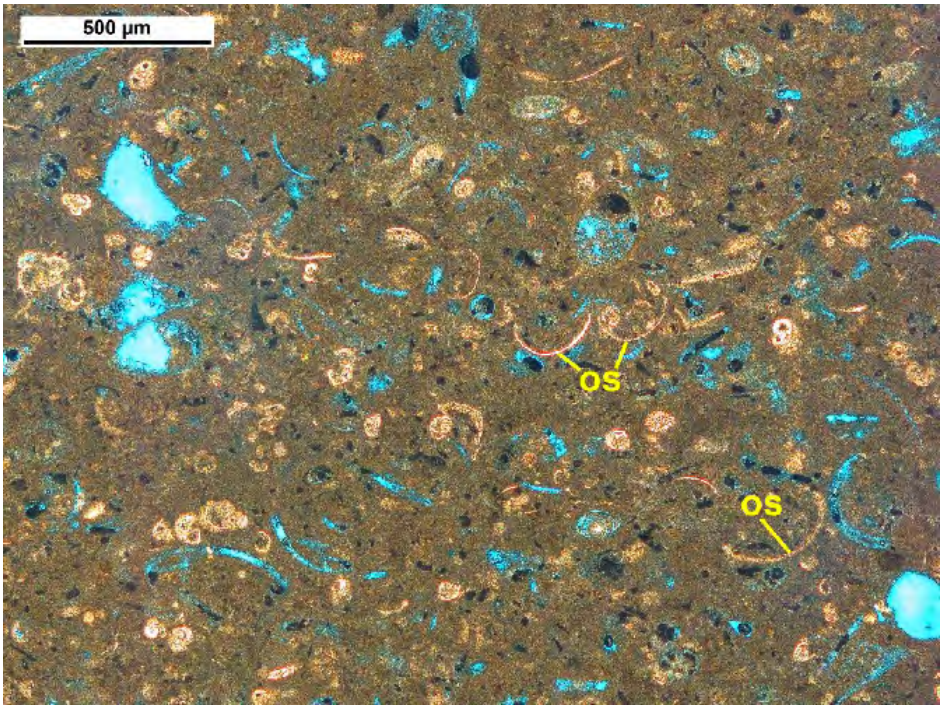
	disarticulated bivalves. Foraminifera observed in thin section G2984–1269.58 include *Fallotella floridana*?, ostracods, conical larger benthic foraminifera, smaller benthic foraminifera. Foraminifera observed in thin section G2984–1270.60 include smaller benthic foraminifera, larger valvulinids, total of 28 conical larger benthic foraminifera. Foraminifera observed in thin section G2984–1272.96 include smaller benthic foraminifera, total of six conical larger benthic foraminifera **Porosity and permeability:** 5–30 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–33 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1270.60, G2984–1272.96  Photomicrograph from thin section G2984–1272.96 that shows a benthic foraminifer grain-dominated packstone and grainstone. Driller's depth of thin section is 1,272.96 ft bls.

	 Photomicrograph from thin section G2984–1270.60 that shows a specimen of *Fallotella cookei* (fc). Driller's depth of thin section is 1,270.60 ft bls.  Photomicrograph from thin section G2984–1270.60 that shows a specimen of *Fallotella floridana* (ff). Driller's depth of thin section is 1,270.60 ft bls.
obi depth: 1,274.7–	**Cycle type:** Top type I cycle **Lithofacies:** Autochthonous breccia **Depositional texture:** Breccia with clasts of smaller benthic foraminifer mudstone and

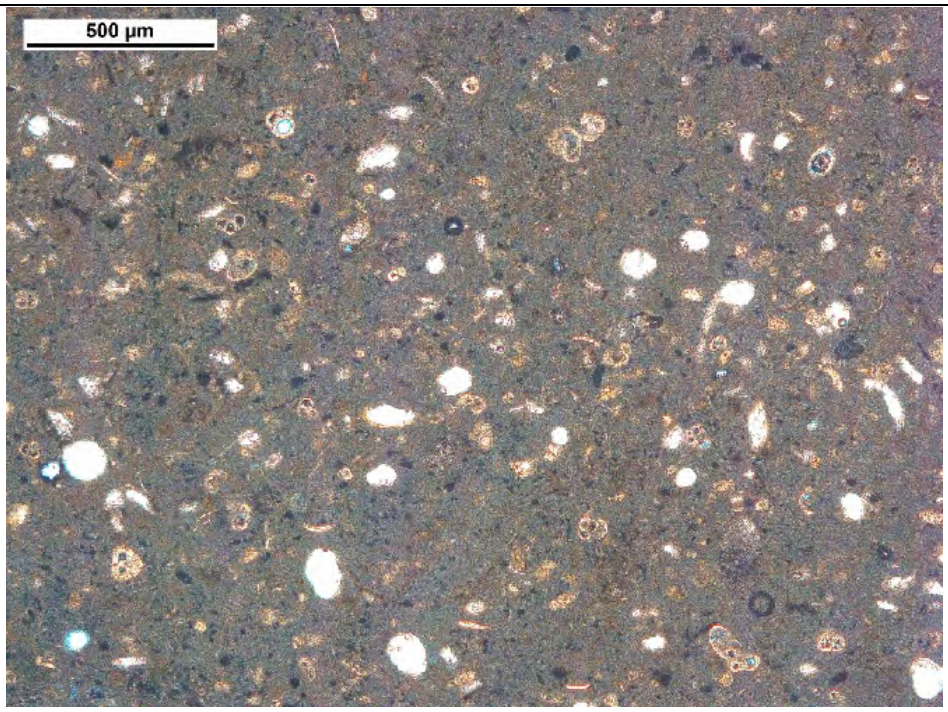
1,277.0 ft bls Driller's depth: 1,273.2–1,275.6 ft bls	wackestone with a matrix of superjacent subtidal marine benthic foraminifer grain-dominated packstone and grainstone **Color:** Very light gray N8, very minor light gray N7 to medium light gray N6 **Sedimentary structures:** Very thinly bedded, common desiccation cracks, fenestrae, breccia **Trace fossils:** Semivertical rhizoliths with some lined with organic coating **Ichnofabrics:** Ichnofabric index 1–2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including very minor small rotaliids, smaller miliolids) and ostracods, unidentified skeletal grains. Foraminifera observed in thin section G2984–1273.73 include smaller benthic foraminifera, total of 19 conical larger benthic foraminifera **Porosity and permeability:** 1–4 percent interparticle and intraparticle porosity, 1–3 root-mold porosity, 1–4 percent fenestrae porosity; 3–10 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, supratidal **Comments:** Top of generally fining upward peritidal cycle at 1,274.7 ft (obi depth) and 1,273.2 ft (driller's depth). Autochthonous breccia resulting from desiccation and root stresses **Thin section:** G2984–1273.73  Photomicrograph from thin section G2984–1273.73 that shows a benthic foraminifer mudstone and wackestone with rotaliids, smaller miliolids, peloids, and ostracods. Driller's depth of thin section is 1,273.73 ft bls.

	 Photomicrograph from thin section G2984–1273.73 that shows a karsted benthic foraminifer mudstone and wackestone cycle cap (karst void ceiling on right side of photo) with infill of karst void with a benthic foraminifer grain-dominated packstone and grainstone. Driller's depth of thin section is 1,273.73 ft bls.
obi depth: 1,277.0–1,277.1 ft bls Driller's depth: 1,275.6–1,275.7 ft bls	**Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly to thickly laminated, topography-draping laminations **Carbonate grains:** Mainly peloids and smaller benthic foraminifera **Porosity and permeability:** 1–10 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat
obi depth: 1,277.1–1,282.6 ft bls obi depth Driller's depth: 1,275.7–1,281.2 ft	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone with minor smaller and larger benthic foraminifer mud-dominated packstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly to very thickly bedded **Trace fossils:** *Thalassinoides* in mud-dominated packstone **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Distal *Skolithos* **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids),

bls	larger benthic foraminifera (including *Fallotella floridana*, *Coskinolina floridana*, and larger miliolids), minor intraclasts, echinoid plates, uncommon ostracods. Foraminifera observed in thin section G2984–1281.17 include smaller benthic foraminifera, *Coskinolina floridana*, *Thomasella*? sp., total of nine conical larger benthic foraminifera **Accessory grains:** Less than 1 percent carbonaceous fragments of plants **Porosity and permeability:** 5–30 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–33 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1281.17  Photomicrograph from thin section G2984–1281.17 that shows a peloid and benthic foraminifer grain-dominated packstone and grainstone. Driller's depth of thin section is 1,281.17 ft bls.
obi depth: 1,282.6–1,282.8 ft bls Driller's depth: 1,281.2–1,281.4 ft bls	**Lithofacies:** Rip-up clast floatstone **Depositional texture:** Intraclast floatstone with matrix of smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thinly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including larger miliolids), minor rip-up intraclasts up to medium pebble size (rip-ups of underlying benthic foraminifer wackestone—intertidal to supratidal sediment) **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** High-energy event, marine subtidal. Probably shallow

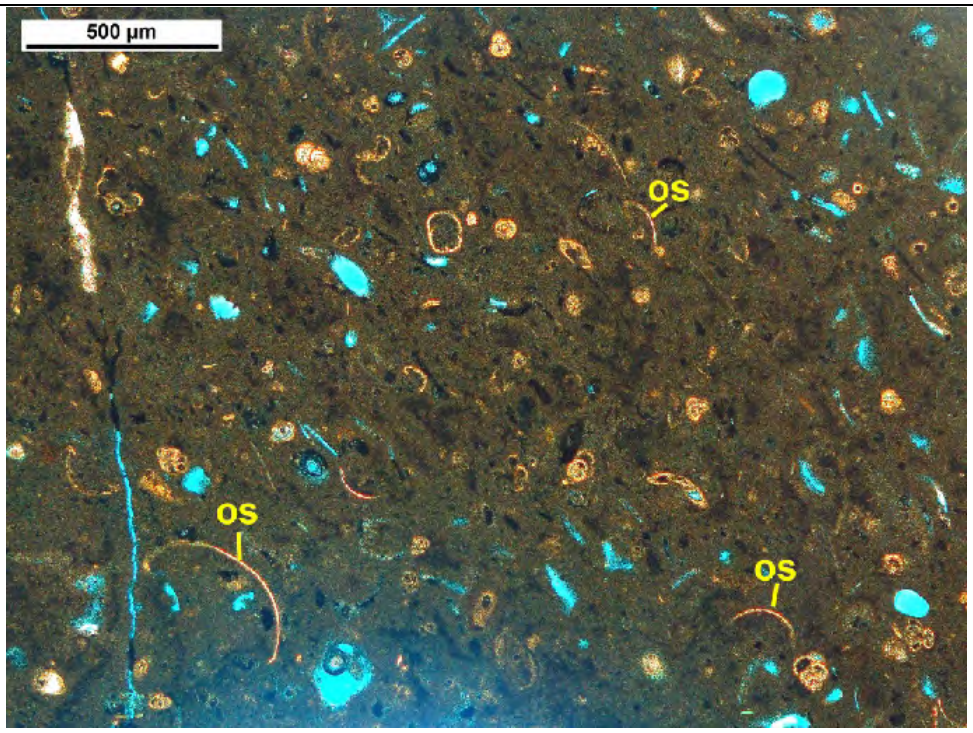
	marine transgression **Comment:** Marine erosion of underlying substrate
obi depth: 1,282.8–1,283.1 ft bls Driller's depth: 1,281.4–1,281.7 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very light gray N8 **Sedimentary structures:** Very thinly bedded, common desiccation cracks, fenestrae **Trace fossils:** Semivertical rhizoliths? **Ichnofabrics:** Ichnofabric index 1–2? **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including very minor small rotaliids) and ostracods, minor peloids. Foraminifera observed in thin section G2984–1281.46 include smaller benthic foraminifera, total of four conical larger benthic foraminifera **Porosity and permeability:** 1–4 percent interparticle and intraparticle porosity, 1–3 percent root-mold porosity, 1–4 percent fenestrae porosity; 3–10 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to supratidal **Comments:** Top of generally fining upward peritidal cycle at 1,282.8 ft bls (obi depth) and 1,281.4 ft bls (driller's depth) **Thin section:** G2984–1281.46  Photomicrograph from thin section G2984–1281.46 that shows a benthic foraminifer wackestone with abundant ostracods (os). Driller's depth of thin section is 1,281.46 ft bls.
obi depth:	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone

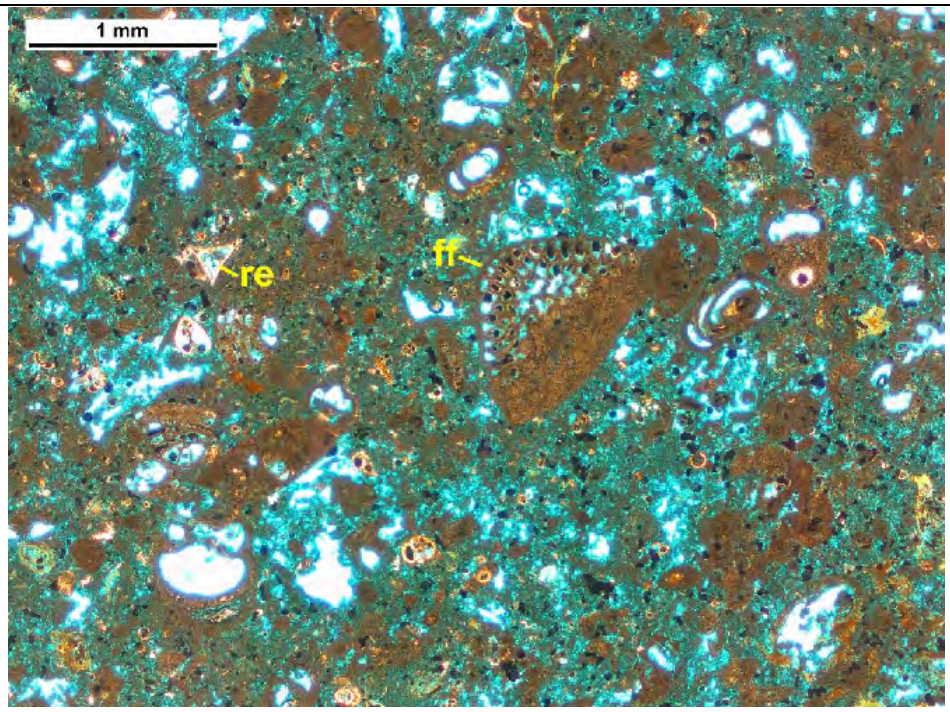
1,283.1–1,283.8 ft bls Driller's depth: 1,281.7–1,282.4 ft bls	and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thinly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains) and smaller benthic foraminifera (including small rotaliids and smaller miliolids), minor larger benthic foraminifera (including *Fallotella floridana*, larger miliolids), gastropods, uncommon disarticulated bivalves, intraclasts **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,283.8–1,284.6 ft bls Driller's depth: 1,282.4–1,283.3 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very light gray N8 **Sedimentary structures:** Burrow mottled in part, semivertical mudcracks, thickly laminated to very thinly bedded in part **Trace fossils:** Semivertical rhizoliths (some tapering downward and bifurcating downward) and possible minor worm tubes, both 0.5–1-mm inner diameter of tubes **Ichnofabrics:** Ichnofabric index 1–5 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including small rotaliids and a few small miliolids and biserial foraminifera), minor ostracods, intraclasts. Foraminifera observed in thin section G2984–1282.50 include smaller benthic foraminifera **Accessory grains:** 1–3 percent small pieces (silt-sized to 1-mm diameter or long roundish, angular, or bladed grains) of black N1 organic material, probably plant debris **Porosity and permeability:** 1–4 percent interparticle and intraparticle porosity, 1–3 percent root-mold porosity; 2–7 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to supratidal **Comments:** Lowermost 0.5 cm of unit is an organic-rich microbial mat overlain by a very thinly bedded autochthonous breccia, likely due to desiccation and alteration by roots, very low diversity biota, high environmental stress. Top of generally fining upward peritidal cycle at 1,283.8 ft bls (obi depth) and 1,282.4 ft bls (driller's depth) **Thin section:** G2984–1282.50

	 Photomicrograph from thin section G2984–1282.50 from a smaller foraminifer wackestone intertidal high-frequency cycle cap. Driller's depth of thin section 1,282.50 ft bls.
obi depth: 1,284.6–1,284.7 ft bls Driller's depth: 1,283.3–1,283.4 ft bls	**Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Interlaminated very pale orange 10YR 8/2 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly to thickly laminated, topography-draping laminations **Carbonate grains:** Mainly peloids and smaller benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat
obi depth: 1,284.7–1,289.0 ft bls Driller's depth: 1,283.4–1,287.1 ft bls	**Lithofacies:** Benthic foraminifer grain-dominated packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, very thickly bedded **Trace fossils:** *Ophiomorpha*? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Skolithos*? **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), minor *Neolaganum dalli*, uncommon disarticulated bivalves **Accessory grains:** Less than 1 percent carbonaceous fragments

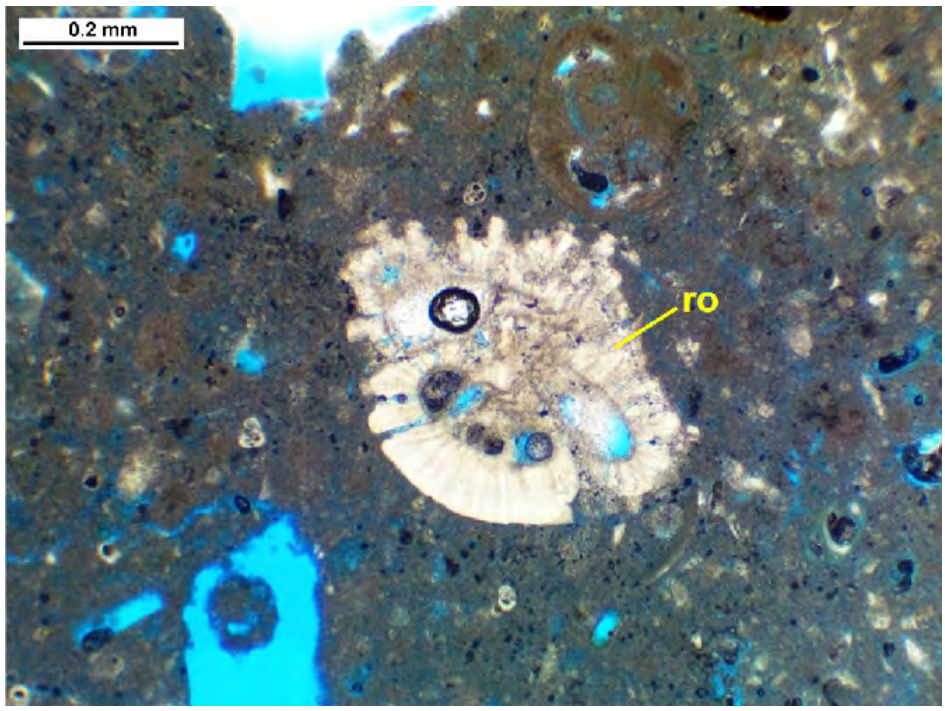
	Porosity and permeability: 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,289.0–1,293.2 ft bls Driller's depth: 1,287.1–1,291.9 ft bls	**Cycle type:** Top type IV cycle **Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone with smaller and larger benthic foraminifer mud-dominated packstone in uppermost 1 ft of interval **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, very thickly bedded **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Distal *Skolithos*? **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), minor *Neolaganum dalli*, uncommon disarticulated bivalves **Accessory grains:** Less than 1 percent carbonaceous fragments **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Comments:** Minor mud-dominated packstone with a subtidal cycle top and top of a firmground with an associated underlying *Thalassinoides*-dominated *Glossifungites* ichnofacies at 1,289.0 ft bls (obi depth) and 1,287.1 ft bls (driller's depth)
obi depth: 1,293.2–1,293.35 ft bls Driller's depth: 1,291.9–1,292.05 ft bls	**Cycle type:** Top type I cycle **Lithofacies:** Microbial laminite **Depositional texture:** Microbial laminite—packstone **Color:** Pale yellowish brown 10YR 6/2 **Sedimentary structures:** Thinly to thickly laminated, topography-draping laminations **Carbonate grains:** Mainly peloids and smaller benthic foraminifera **Porosity and permeability:** 1–15 percent interparticle and intraparticle porosity, and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,293.2 ft bls (obi depth) and 1,291.9 ft bls (driller's depth)
obi depth: 1,293.35–1,295.5 ft bls Driller's depth: 1,292.05–1,296.0 ft	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, very thickly bedded **Trace fossils:** Small *Ophiomorpha* **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), minor

bls	*Neolaganum dalli*, uncommon disarticulated bivalves, intraclasts (rip-up clasts of tidal-flat sediment up to large pebble size) **Accessory grains:** Less than 1 percent carbonaceous fragments **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,295.5–1,296.6 ft bls Driller's depth: 1,296.0–1,297.3 ft bls	**Lithofacies:** Skeletal packstone and grainstone **Depositional texture:** Skeletal grain-dominated packstone-grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), pellets, benthic foraminifera, dasycladacean algae, small mollusks (disarticulated and articulated bivalves and gastropods), intraclasts (rip-up clasts of micrite-dominated tidal-flat sediment), and small centimeter-scale stick-shaped corals **Porosity and permeability:** 5–20 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–23 percent total porosity and low permeability **Depositional environment:** High-energy inner platform, shallow subtidal
obi depth: 1,296.6–1,296.9 ft bls Driller's depth: 1,297.3–1,297.6 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Very light gray N8 **Sedimentary structures:** Thickly laminated, vertical desiccation cracks, fenestral fabric **Trace fossils:** Semivertical rhizoliths (some bifurcation of rhizolith tubes foraminifera observed) **Ichnofabrics:** Ichnofabric index 1–2? **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including small rotaliids and a few small miliolids and biserial foraminifera) and peloids, minor ostracods, intraclasts, uncommon larger miliolids. Foraminifera observed in thin section G2984–1297.35 include smaller benthic foraminifera **Porosity and permeability:** 1–4 percent interparticle and intraparticle porosity, 1–3 percent root-mold porosity, 1 percent fenestral fabric; 2–7 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to supratidal **Comments:** Top of generally fining upward peritidal cycle at 1,296.6 ft bls (obi depth) and 1,297.3 ft bls (driller's depth) **Thin section:** G2984–1297.35

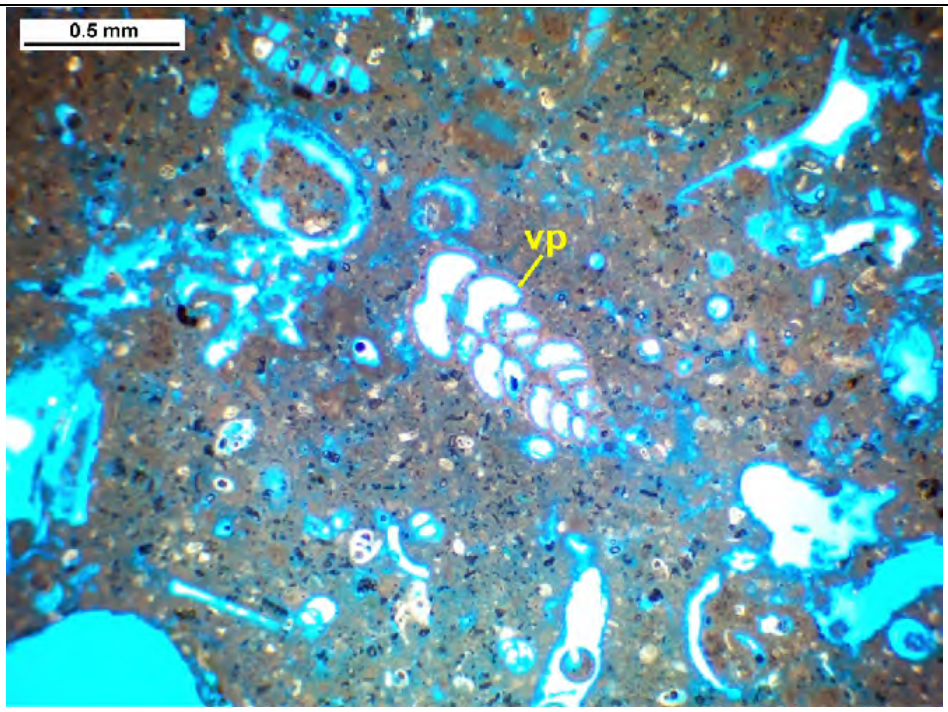
	 Photomicrograph from thin section G2984–1297.35 that shows a benthic foraminifer wackestone with abundant ostracods (os). Driller's depth of thin section 1,297.35 ft bls.
obi depth: 1,296.9 ft bls (no obi data below) Driller's depth: 1,297.6–1,302.9 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, very thickly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 1–5 **Carbonate grains:** Mainly smaller benthic foraminifera (including small rotaliids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), minor *Neolaganum dalli*, unidentified skeletal fragments, peloids, intraclasts up to large pebble size—rip-up clasts of tidal-flat sediment. Foraminifera observed in thin section G2984–1302.23 include smaller benthic foraminifera, larger valvulinids, total of 15 conical larger benthic foraminifera **Accessory grains:** Less than 1 percent carbonaceous plant material **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Comments:** Top of generally fining upward peritidal cycle at 1,296.6 ft bls (obi depth) and 1,297.3 ft bls (driller's depth)

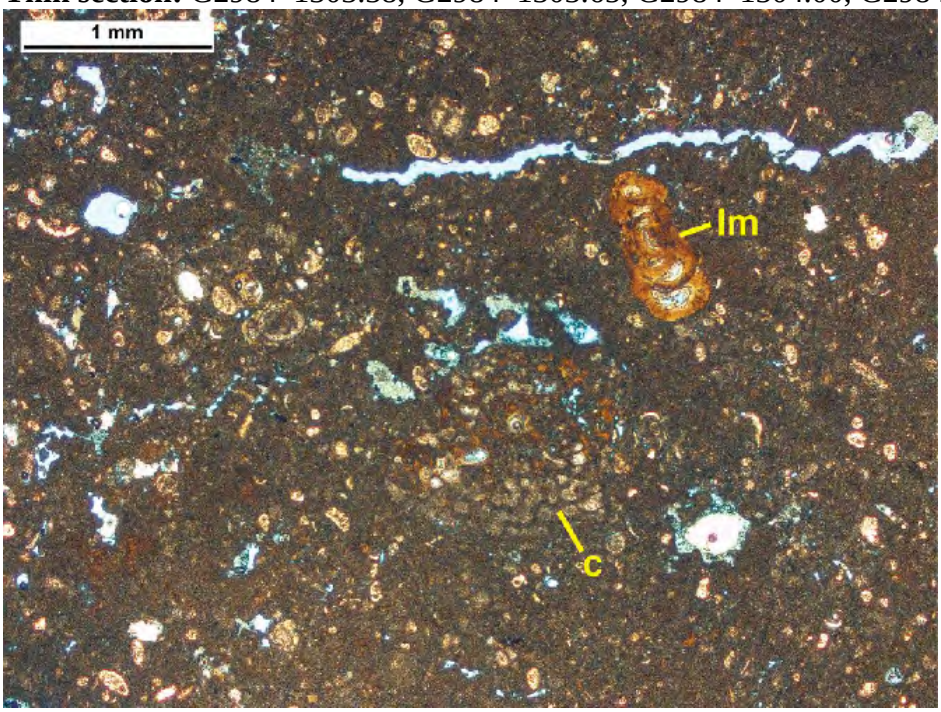


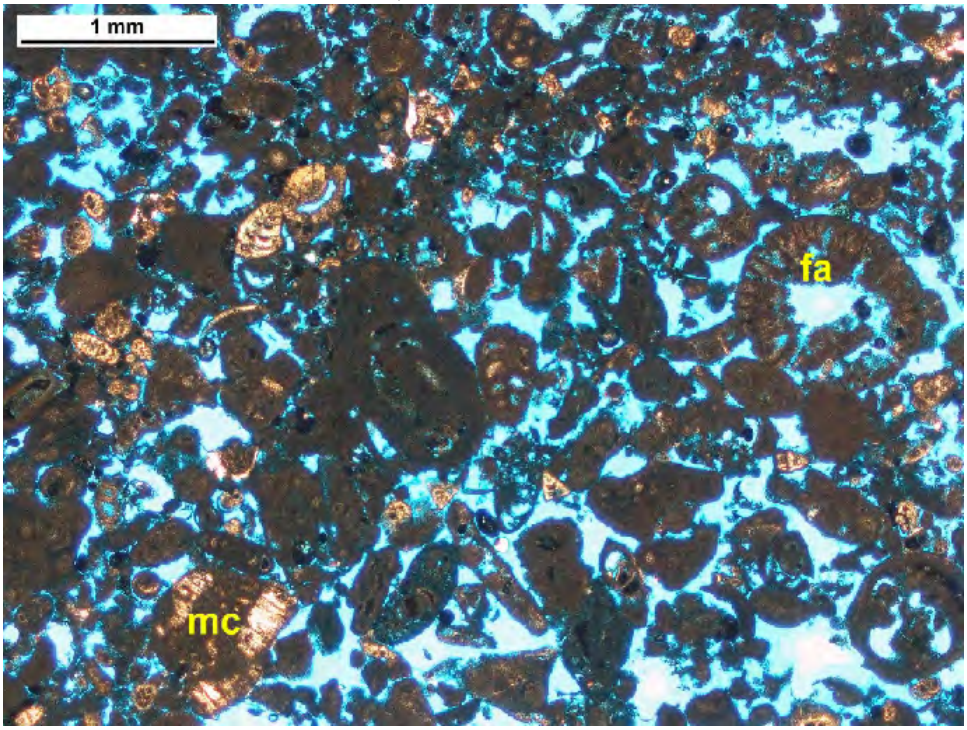
Photomicrograph from thin section G2984–1302.23 that shows a benthic foraminifer packstone and grainstone with *Reussella* (re) and *Fallotella floridana*? (ff). Driller's depth of thin section is 1,302.23 ft bls.

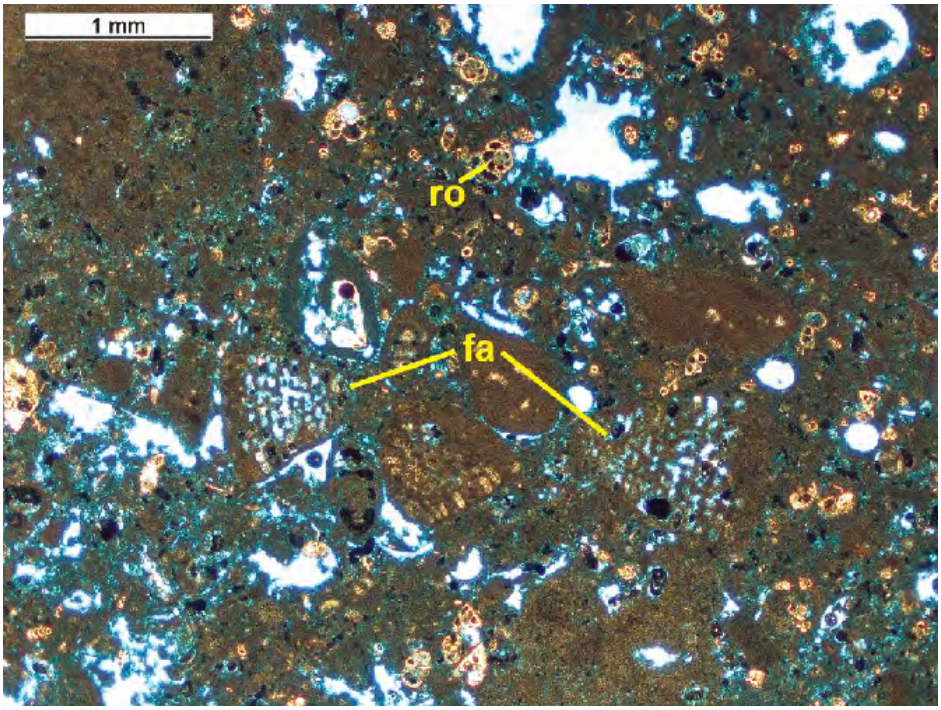


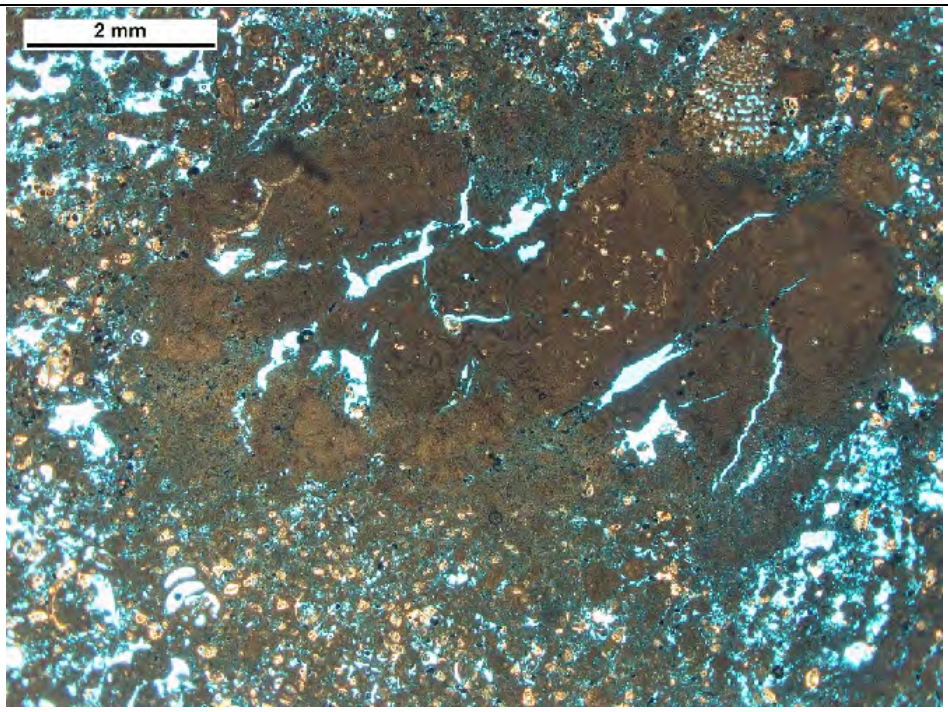
Photomicrograph from thin section G2984–1302.23 that shows a specimen of *Rotalia* (ro). Driller's depth of thin section 1,302.23 ft bls.

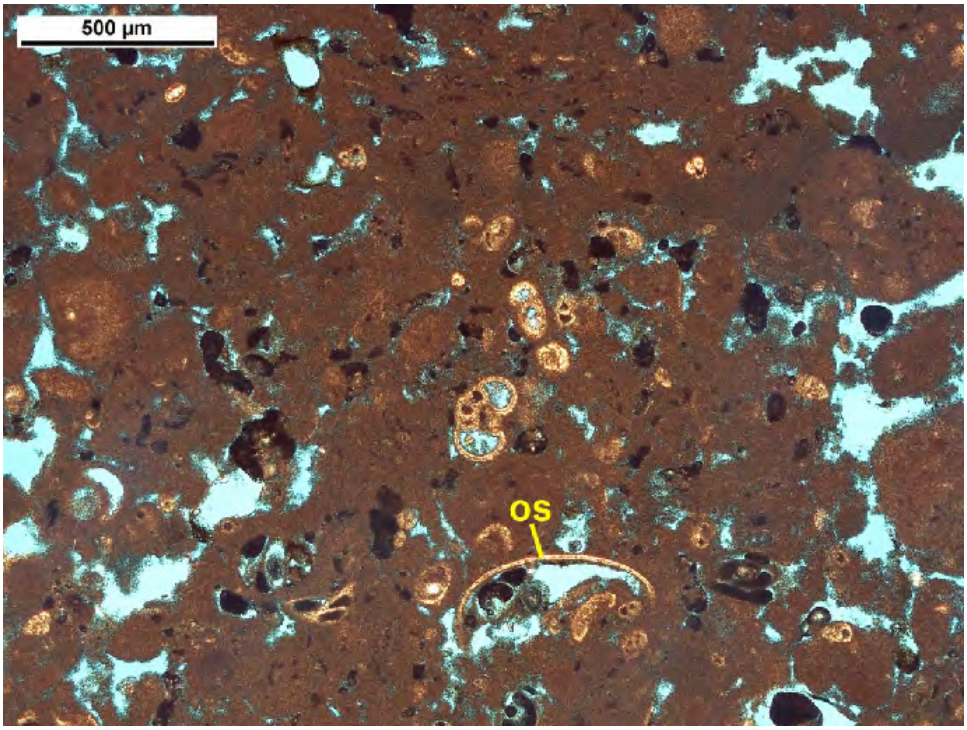
	 Photomicrograph from thin section G2984–1302.23 that shows a specimen of *Valvulina avon-parkensis* (vp). Driller's depth of thin section 1,302.23 ft bls.
Driller's depth: 1,302.9–1,303.2 ft bls	**Lithofacies:** Rip-up clast floatstone **Depositional texture:** Intraclast floatstone with matrix of smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thinly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana*, *Coskinolina floridana*, and larger miliolids), minor rip-up intraclasts up to medium pebble size (rip-ups of underlying benthic foraminifer wackestone—tidal-flat sediment). Foraminifera observed in thin section G2984–1303.13 include smaller benthic foraminifera, *Coskinolina floridana*, total of seven conical larger benthic foraminifera **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** High-energy event, marine subtidal. Marine erosion of tidal-flat sediments **Comment:** Marine erosion of underlying tidal-flat substrate **Thin section:** G2984–1303.13
Driller's depth: 1,303.2–1,304.7 ft bls	**Cycle type:** Top type II cycle **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very light gray N8 to light gray N7 **Sedimentary structures:** Thinly bedded to medium bedded. Uncommon very thinly (1–

	2 mm thick) laminated organic-rich algal mats approximately in middle of interval **Trace fossils:** Semivertical to minor semihorizontal rhizoliths (some bifurcation of rhizolith tubes) **Ichnofabrics:** Ichnofabric index 1–2 **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including small rotaliids and a few small miliolids and biserial foraminifera) and peloids, minor ostracods, intraclasts, uncommon larger miliolids and conical larger benthic foraminifera. Foraminifera observed in thin section G2984–1303.38 include smaller benthic foraminifera. Foraminifera observed in thin section G2984–1303.65 include smaller benthic foraminifera. Foraminifera observed in thin section G2984–1304.00 include *Fallotella floridana*, smaller benthic foraminifera, total of three conical larger benthic foraminifera. Foraminifera observed in thin section G2984–1304.42 include *Dendritina* sp., larger valvulinids, *Coskinolina floridana*, total of 12 conical larger benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, 1–3 percent root-mold porosity, 1–3 percent irregular vugs; 3–11 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, tidal flat **Comments:** Top of generally fining upward peritidal cycle at 1,303.0 ft bls (driller's depth). Conical benthic foraminifera are concentrated at the base of the unit and may be mixed upward by bioturbation from conical benthic foraminifera-rich grainstones underlying the unit **Thin section:** G2984–1303.38, G2984–1303.65, G2984–1304.00, G2984–1304.42  Photomicrograph from thin section G2984–1304.42 that shows a smaller benthic foraminifer wackestone that contains a conical larger benthic foraminifer (c) and larger miliolid (lm). Driller's depth of thin section is 1,304.42 ft bls.

Driller's depth: 1,304.7–1,307.0 ft bls	**Lithofacies:** Benthic foraminifer packstone and grainstone **Depositional texture:** Smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2 **Sedimentary structures:** Burrow mottled, thickly bedded **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly smaller benthic foraminifera (including small rotaliids), larger benthic foraminifera (including *Fallotella floridana*, *Coskinolina floridana*, and larger miliolids), minor *Neolaganum dalli*, unidentified skeletal fragments, peloids, intraclasts up to small pebble size, ostracods, thin disarticulated bivalves, one stick-shaped coral, *Microcodium*. Foraminifera observed in thin section G2984–1305.16 include *Dendritina* sp. Foraminifera observed in thin section G2984–1306.10 include smaller benthic foraminifera, larger valvulinids, *Coskinolina floridana*, *Arenagula* sp., total of 12 conical larger benthic foraminifera **Porosity and permeability:** 5–25 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–28 percent total porosity and moderate permeability **Depositional environment:** High-energy inner platform, shallow subtidal **Thin section:** G2984–1305.16, G2984–1306.10  Photomicrograph from thin section G2984–1306.10 that shows a smaller benthic foraminifer grainstone with *Microcodium* (mc) and *Fallotella*? (fa). Driller's depth of thin section is 1,306.10 ft bls.
Driller's depth: 1,307.0–1,307.3 ft	**Lithofacies:** Rip-up clast floatstone **Depositional texture:** Intraclast floatstone with matrix of smaller and larger benthic foraminifer grain-dominated packstone and grainstone **Color:** Very pale orange 10YR 8/2

bls	**Sedimentary structures:** Burrow mottled, medium bedded **Trace fossils:** Bioturbated **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly peloids (probably many micritized unidentified skeletal grains), smaller benthic foraminifera (including small rotaliids and smaller miliolids), larger benthic foraminifera (including *Fallotella floridana* and larger miliolids), minor intraclasts up to medium pebble size (rip-up clasts of underlying benthic foraminifer wackestone—intertidal to supratidal sediment), ostracods. Foraminifera observed in thin section G2984–1307.13 include smaller benthic foraminifera, *Dendritina* sp., larger valvulinids, *Coskinolina floridana*, total of 15 conical larger benthic foraminifera **Porosity and permeability:** 5–15 percent interparticle and intraparticle porosity, 1–3 percent moldic porosity; 6–18 percent total porosity and low permeability **Depositional environment:** High-energy event, marine subtidal. Marine erosion of tidal-flat sediments **Comment:** Marine erosion of underlying tidal-flat substrate **Thin section:** G2984–1307.13  Photomicrograph from thin section G2984–1307.13 that shows intraclast floatstone with *Fallotella* (fa) and rotaliids (ro). Driller's depth of thin section is 1,307.13 ft bls.

	 Photomicrograph from thin section G2984–1307.13 that shows a rip-up intraclast with curved- and skew-plane desiccation cracks, which presents evidence for subaerial exposure. Driller's depth of thin section is 1,307.13 ft bls.
Driller's depth: 1,307.3–1,307.7 ft bls (total depth)	**Cycle type:** Top-type II cycle? **Lithofacies:** Benthic foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer wackestone **Color:** Very light gray N8 **Sedimentary structures:** Thinly bedded, fenestrae, desiccation cracks (mainly craze plane and skew plane) **Trace fossils:** Rhizoliths **Ichnofabrics:** Ichnofabric index uncertain **Ichnofacies:** *Psilonichnus* **Carbonate grains:** Mainly smaller benthic foraminifera (including small rotaliids and a few small miliolids and biserial foraminifera) and peloids, minor ostracods, intraclasts, uncommon larger miliolids, and other larger benthic foraminifera (larger miliolids, *Fallotella floridana*). Foraminifera observed in thin section G2984–1307.50 include total of two conical larger benthic foraminifera **Porosity and permeability:** 1–5 percent interparticle and intraparticle porosity, 1–5 percent fenestrae porosity, 1–3 percent root-mold porosity, 1–2 percent desiccation crack porosity; 4–15 percent total porosity and relatively low permeability **Depositional environment:** Low-energy restricted inner platform, intertidal to supratidal **Comments:** Top of generally fining upward peritidal cycle at 1,307.3 ft bls (driller's depth). Conical benthic foraminifera are concentrated at the top of the unit and may be mixed downward by bioturbation from conical benthic foraminifera-rich grainstones overlying the unit

	Thin section: G2984–1307.50  Photomicrograph from thin section G2984–1307.50 that shows a benthic foraminifer wackestone with minor ostracods (os) deposited in an intertidal to supratidal depositional environment. Driller's depth of thin section is 1,307.50 ft bls.

Lithofacies Description and Sequence Stratigraphy of Continuously Drilled Samples from the Arcadia Formation at U.S. Geological Survey G–2984 Test Corehole

Depth interval (using obi log depth and driller's depth, in feet bls)	**Estimates of permeability:** Based on comparison of Arcadia Formation to lithofacies and pore types to 276 Pliocene and Pleistocene eogenetic carbonate rock specimens with similar lithofacies and pore types and their air-permeability measurements (Cunningham and others, 2006) and lattice Boltzmann permeability calculations of both Pleistocene and Cretaceous carbonate rocks (Cunningham and others, 2009, 2012; Cunningham and Sukop, 2011, 2012; Sukop and others, 2013; Sukop and Cunningham, 2014) **Colors:** Colors based on comparison to Munsell rock color chart (Geological Society of America, 1991) **Ichnofabric:** Index based on Droser and Bottjer (1986, 1989) **Top of Arcadia Formation:** 596.25 ft bls (obi depth) and 592.25 ft bls (driller's depth) **Base of Arcadia Formation:** 1,067.60 ft bls (obi depth) and 1,067.60 ft bls (driller's depth)
obi depth: 596.25–597 ft bls Driller's depth: 592.25–593 ft bls	**Lithofacies:** Phosphorite **Depositional texture:** Phosphorite **Color:** Black N1 and pale yellowish brown 10YR 6/2 **Sedimentary structures:** Burrow mottled **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Glossifungites* **Accessory grains:** Foraminifera observed in thin section G2984–592.82 include *Globigerinoides* gr. *trilobus*, bolivinids, total of 10 planktic foraminifera, total of 3 smaller benthic foraminifera **Porosity and permeability:** 3 percent interparticle porosity, 1 percent intraparticle porosity, 3 percent moldic porosity; 7 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** *Thalassinoides*-dominated *Glossifungites* extends downward from top of cycle 3.5 ft and contains fill dominated by globular planktic foraminifera. Uppermost part of cycle is a firmground that was later transformed to a hardground by phosphatization. Top of depositional sequence (fig. 2) at 592.25 ft (driller's depth) **Thin section**: G2984–592.82
obi depth: 597–605 ft bls Driller's depth: 593–605 ft bls	**Lithofacies:** Foraminifer wackestone to packstone **Depositional texture:** Smaller benthic and globular planktic foraminifer wackestone to mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides*, *Rhizocorallium*? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* and *Thalassinoides*-dominated *Glossifungites* at top of unit **Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, globular planktic foraminifera, smaller benthic foraminifera (including rotaliids), and minor ostracods. Foraminifera observed in thin section G2984–593.00 include *Orbulina*

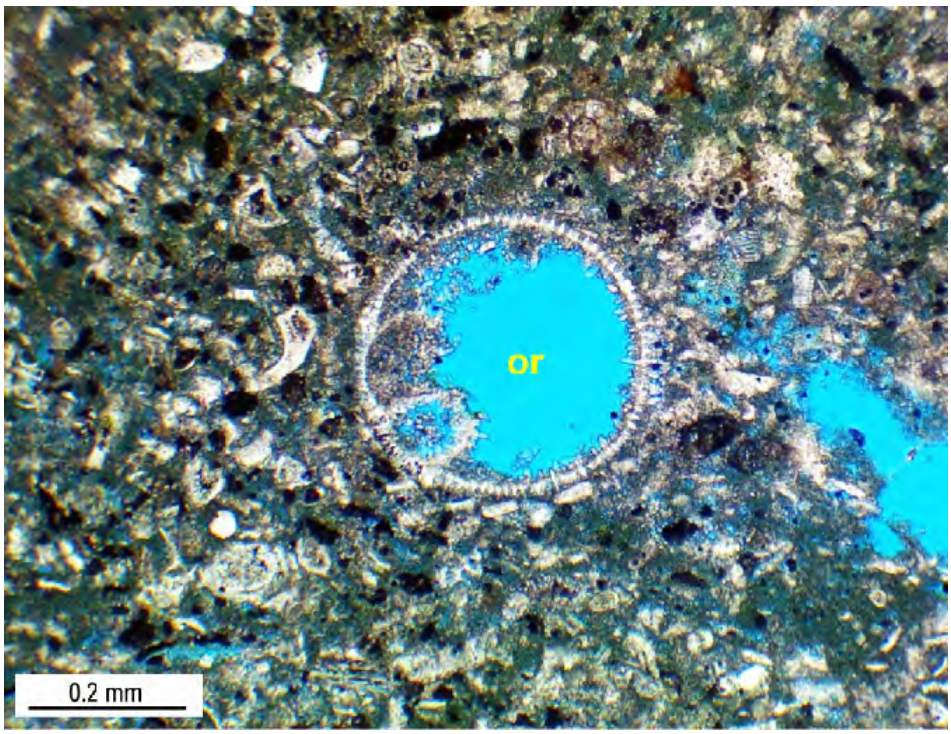
	suturalis?, *Globigerinoides* gr. *trilobus*, rotaliids (rare), planktic foraminifera (dominant), smaller benthic foraminifera with bolivinids (dominant). Foraminifera observed in thin section G2984–599.13 include *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, bolivinids, planktic foraminifera, smaller benthic foraminifera. Mud to coarse sand-sized carbonate grains **Accessory grains:** 1–5 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine to coarse sand-sized phosphorite grains; 1–3 percent very fine sand-sized dolomite rhombs **Porosity and permeability:** 4 percent interparticle porosity, 1 percent intraparticle porosity, 3 percent moldic porosity; 8 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** *Thalassinoides*-dominated *Glossifungites* extends downward 3.5 ft from top of cycle at 592.25 ft bls (driller's depth) and contains fill dominated by globular planktic foraminifera. **Thin section**: G2984–593.00, G2984–599.13
obi depth: 605–605.5 ft bls Driller's depth: 605–605.5 ft bls	**Lithofacies:** Foraminifer packstone **Depositional texture:** Smaller benthic and globular planktic foraminifer mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, smaller benthic foraminifera, globular planktic foraminifera, and minor ostracods, bivalve fragments. Foraminifera observed in thin section G2984–605.25 include *Praeorbulina sicanus*?, *Globoquadrina* sp., *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, bolivinids, lenticulinids, planktic foraminifera (dominant), smaller benthic foraminifera **Accessory grains:** 1–3 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to very fine to small pebble-sized phosphorite grains decreasing upward **Porosity and permeability:** 4 percent interparticle porosity, 1 percent intraparticle porosity; 5 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of fining upward cycle at 605.5 ft bls (driller's depth) that fines upward to top of cycle at 592.25 ft bls (driller's depth) **Thin section:** G2984–605.25
obi depth: 605.5–616 ft bls Driller's depth:	**Lithofacies:** Foraminifer wackestone to packstone **Depositional texture:** Smaller benthic and globular planktic foraminifer wackestone to mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides, Rhizocorallium?* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* with a *Glossifungites* ichnofacies capping the cycle

605.5–616 ft bls	**Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, smaller benthic foraminifera, globular planktic foraminifera, and minor ostracods, bivalve fragments. Foraminifera observed in thin section G2984–606.76 include *Praeorbulina glomerosa* s.l., unidentified planktic foraminifera, bolivinids (dominant), planktic foraminifera, smaller benthic foraminifera (dominant). Foraminifera observed in thin section G2984–611.90 include *Praeorbulina glomerosa* s.l., unidentified planktic foraminifera, bolivinids (dominant), lenticulinids, planktic foraminifera, smaller benthic foraminifera (dominant) **Accessory grains:** 1–7 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to very fine to coarse sand-sized phosphorite grains over lower 0.5 ft of cycle and overlying part of cycle contains 1 percent silt to fine sand-sized black phosphorite grains; 1–3 percent very fine sand-sized dolomite rhombs **XRD mineralogy:** At 606.76 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 4.8 percent, calcite 64.6 percent, dolomite and [Iron (Fe),Calcium (Ca)]-dolomite 16.9 percent, total clay minerals 13.7 percent); clay mineralogy in weight percentage (illite/smectite* 3.8 percent, palygorskite 9.9 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **XRD mineralogy:** At 611.90 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 9.6 percent, k-feldspar 1.0 percent, plagioclase 1.7 percent, calcite 57.2 percent, dolomite and [Fe,Ca]-dolomite 16.7 percent, total clay minerals 13.8 percent); clay mineralogy in weight percentage (illite/smectite* 4.5 percent, palygorskite 9.3 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 2 percent interparticle porosity, 1 percent intraparticle porosity; 3 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of fining upward cycle at 616 ft (driller's depth) that fines upward to top of cycle at 605.6 ft (driller's depth) and 1 ft thick *Thalassinoides*-dominated *Glossifungites* ichnofacies **Thin section:** G606.76, G2984–611.90
obi depth: 616–620.7 ft bls Driller's depth: 616–620.8 ft bls	**Lithofacies:** Foraminifer mudstone to packstone **Depositional texture:** Smaller benthic and globular planktic foraminifer mudstone to mud-dominated packstone **Color:** Yellowish gray 5Y 7/2 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides*, *Rosselia*? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* with a *Glossifungites* ichnofacies capping the cycle **Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, smaller benthic foraminifera, globular planktic foraminifera, and minor ostracods **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine to medium sand-sized black phosphorite grains **XRD mineralogy:** At 619.50 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 9.1 percent, calcite 15.0 percent, dolomite and [Fe,Ca]-dolomite 29.7 percent, total clay minerals 46.2 percent); clay mineralogy in weight percentage (illite/smectite* 20.6 percent, palygorskite 25.2 percent, kaolinite 0.4 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers

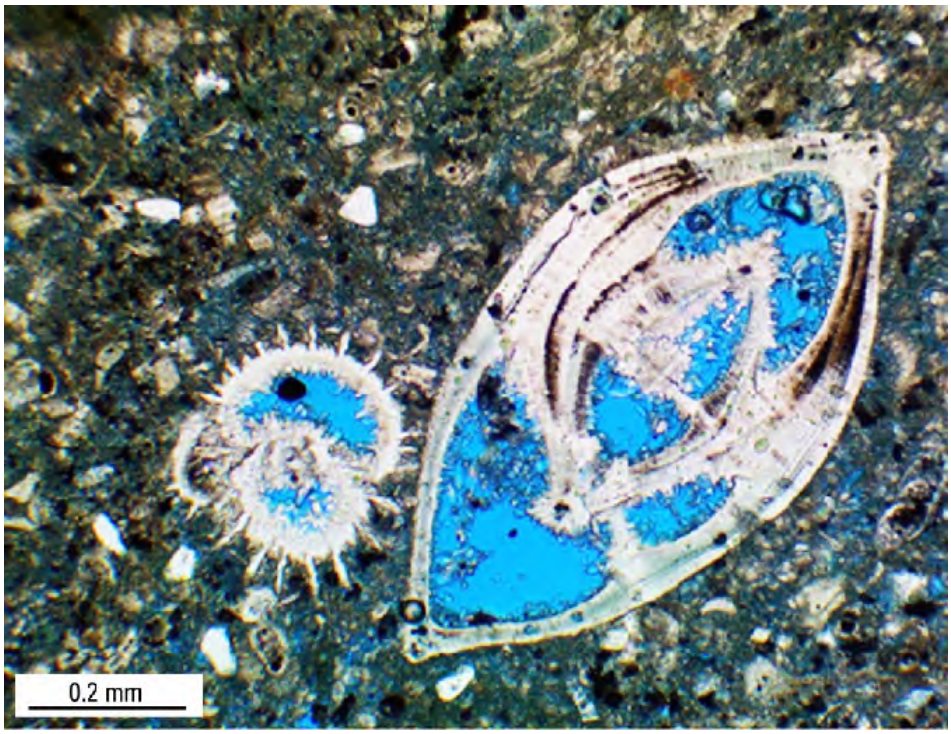
	Porosity and permeability: 2 percent interparticle porosity, 1 percent intraparticle porosity; 3 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Top of fining upward cycle at 616 ft bls (driller's depth) that is capped by a 1 ft thick *Thalassinoides*-dominated *Glossifungites* ichnofacies. Upper surface of cycle is a firmground
obi depth: 620.7–621.5 ft bls Driller's depth: 620.8–621.6 ft bls	**Lithofacies:** Foraminifer wackestone and packstone **Depositional texture:** Smaller benthic and globular planktic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 7/2 **Sedimentary structures:** Burrow mottled **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, smaller benthic foraminifera, globular planktic foraminifera, and minor ostracods, echinoid spines, bivalve fragments **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to very fine to coarse sand-sized black phosphorite grains **Porosity and permeability:** 2 percent interparticle porosity, 1 percent intraparticle porosity; 3 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of fining upward cycle at 621.6 ft bls (driller's depth) that fines upward to top of cycle at 616 ft obi depth and capped by a 1 ft thick *Thalassinoides*-dominated *Glossifungites* ichnofacies. Upper surface of cycle is a firmground
obi depth: 621.5–622.0 ft bls Driller's depth: 621.6–622.1 ft bls	**Lithofacies:** Coral floatstone **Depositional texture:** Coral floatstone with a skeletal and globular planktic foraminifer wackestone matrix **Color:** Yellowish gray 5Y 8/1 **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Glossifungites* ichnofacies capping the cycle **Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, globular planktic foraminifera, small (3-mm diameter) solitary corals, smaller benthic foraminifera (including rotaliids), and echinoid spines. Foraminifera observed in thin section G2984–621.75 include *Orbulina suturalis*?, *Praeorbulina glomerosa* s.l., unidentified planktic foraminifera, bolivinids, lenticulinids, rotaliids, planktic foraminifera (dominant), smaller benthic foraminifera **Accessory grains:** Less than 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to medium sand-sized black phosphorite grains above through to top of cycle **Porosity and permeability:** 1 percent interparticle porosity, 3 percent intraparticle porosity, 6 percent fossil moldic porosity, 2 percent vuggy porosity; 12 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Top of cycle at 621.6 ft bls (driller's depth) and capped by a firmground

characterized by a *Thalassinoides*-dominated *Glossifungites* ichnofacies with *Thalassinoides* burrows filled with overlying lithofacies

Thin section: G2984–621.75



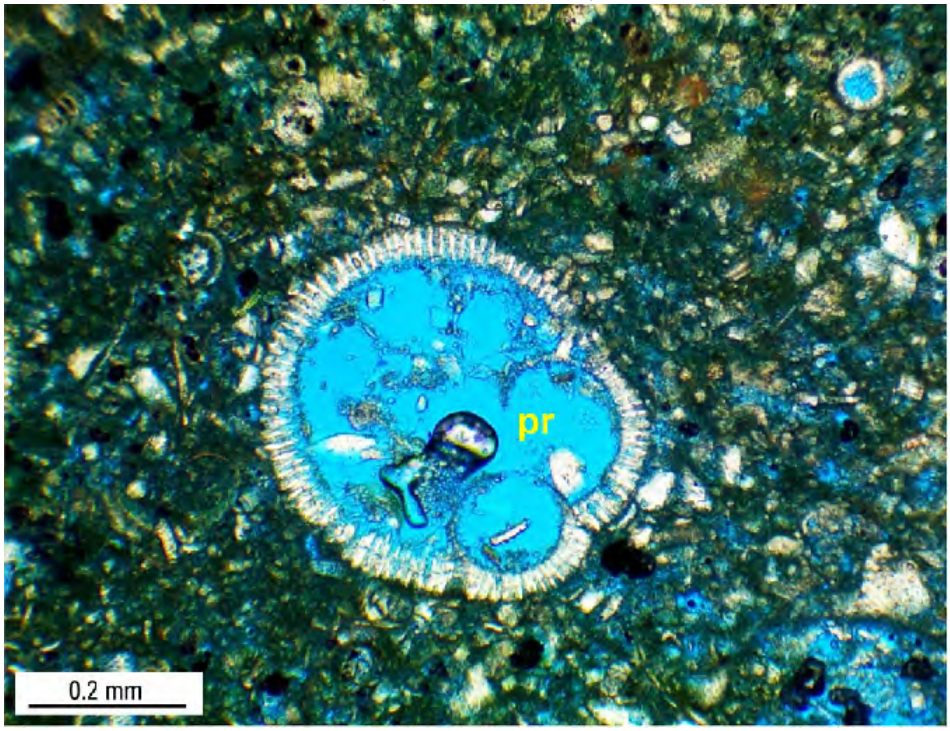
Photomicrograph from thin section G2984–621.75 that shows a specimen of *Orbulina* (or). Driller's depth of thin section is 621.75 ft bls.



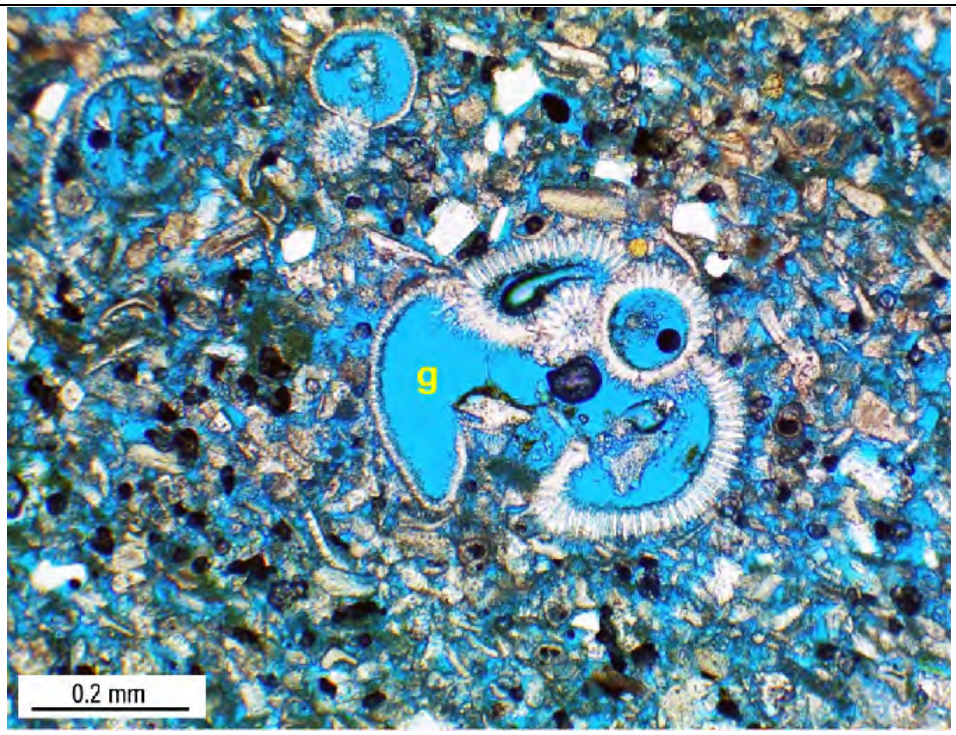
Photomicrograph from thin section G2984–621.75 that shows a specimen of lenticulinid

	(large specimen on right side) and a spinose planktic foraminifer to the left. Driller's depth of thin section is 621.75 ft bls.
obi depth: 622.0–623.15 ft bls Driller's depth: 622.1–623.24 ft bls	**Lithofacies:** Foraminifer mudstone to packstone **Depositional texture:** Smaller benthic and globular planktic foraminifer mudstone to mud- to grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** None identified **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, smaller benthic foraminifera, globular planktic foraminifera and minor ostracods, echinoid spines, bivalve fragments. Foraminifera observed in thin section G2984–622.85 include *Orbulina suturalis*?, *Praeorbulina glomerosa* s.l., *Globoquadrina* sp., unidentified planktic foraminifera, bolivinids, lenticulinids, planktic foraminifera (dominant), smaller benthic foraminifera **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to very fine to very coarse sand-sized phosphorite grains **Porosity and permeability:** 1–10 percent interparticle porosity, 1–3 percent intraparticle porosity, less than 1 percent fossil moldic porosity; 2–12 percent total porosity and low permeability **Depositional environment:** Outer ramp **Thin section:** G2984–622.85
obi depth: 623.15–650.5 ft bls Driller's depth: 623.24–650.5 ft bls	**Lithofacies:** Foraminifer wackestone and packstone **Depositional texture:** Smaller benthic and globular planktic foraminifer wackestone and mud- and grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides*, *Asterosoma*, *Ophiomorpha nodosa* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* and a thin *Glossifungites* ichnofacies capping the cycle **Carbonate grains:** Mainly silt to very fine sand-sized angular skeletal fragments, smaller benthic foraminifera, globular planktic foraminifera and minor ostracods, echinoid spines, bivalve fragments. Foraminifera observed in thin section G2984–624.07 include *Praeorbulina glomerosa* s.l.?, *Globoquadrina* sp., *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, bolivinids, smaller benthic foraminifera (dominant). Foraminifera observed in thin section G2984–632.68 include *Praeorbulina glomerosa* s.l., *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, bolivinids, planktic foraminifera, smaller benthic foraminifera (dominant). Foraminifera observed in thin section G2984–644.87 include *Globoquadrina* sp., *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, bolivinids, lenticulinids, planktic foraminifera, smaller benthic foraminifera (dominant) **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to very fine to very coarse sand-sized phosphorite grains over lower 1.5 ft of cycle; 1–2 percent silt to medium sand-sized black phosphorite grains

above through to top of cycle
XRD mineralogy: At 624.07 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 8.0 percent, k-feldspar 1.3 percent, plagioclase 2.3 percent, calcite 59.7 percent, dolomite and [Fe,Ca]-dolomite 15.1 percent, total clay minerals 13.6 percent); clay mineralogy in weight percentage (illite/smectite* 4.4 percent, palygorskite 9.2 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers
XRD mineralogy: At 644.87 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 6.4 percent, k-feldspar 0.7 percent, plagioclase 1.2 percent, calcite 81.6 percent, dolomite and [Fe,Ca]-dolomite 2.3 percent, total clay minerals 7.8 percent); clay mineralogy in weight percentage (illite/smectite* 2.7 percent, palygorskite 5.1 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers
Porosity and permeability: 1–10 percent interparticle porosity, 1–3 percent intraparticle porosity, less than 1percent fossil moldic porosity; 2–12 percent total porosity and low permeability
Depositional environment: Outer ramp
Comments: Base of fining upward cycle at 650.5 ft bls (driller's depth) that fines upward to top of cycle at 623.24 ft bls (driller's depth) and capped by a firmground characterized by a *Thalassinoides*-dominated *Glossifungites* ichnofacies with *Thalassinoides* burrows filled with overlying lithofacies
Thin section: G2984–624.07, G2984–632.68, G2984–644.87



Photomicrograph from thin section G2984–624.07 that shows a specimen of *Praeorbulina* (pr). Driller's depth of thin section is 624.07 ft bls.

	 Photomicrograph from thin section G2984–644.87 that shows a specimen of *Globoquadrina* (g). Driller's depth of thin section is 644.87 ft bls.
obi depth: 650.5–658.2 ft bls Driller's depth: 650.5–658.2 ft bls	**Lithofacies:** Foraminifer wackestone **Depositional texture:** Smaller benthic foraminifer and globular planktic foraminifer mudstone to wackestone **Color:** Yellowish gray 5Y 7/2 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides*, *Zoophycos*, *Rhizocorallium*?, *Asterosoma*?, *Terebellina* (*Schaubcylindrichnus*)? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* or *Zoophycos* with a *Glossifungites* ichnofacies cap **Carbonate grains:** Mainly silt-sized and very fine sand-sized carbonate skeletal fragments, smaller benthic foraminifera, globular planktic foraminifera, ostracods, bivalve fragments. Foraminifera observed in thin section G2984–658.07 include *Praeorbulina glomerosa* s.l., *Globoquadrina* sp., *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, bolivinids (rare), rotaliids, planktic foraminifera (dominant), smaller benthic foraminifera present with lenticulinids (dominant) **Accessory grains:** Less than 1 percent silt to fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (mainly phosphorite) **XRD mineralogy:** At 654.15 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 5.4 percent, calcite 68.6 percent, dolomite and [Fe,Ca]-dolomite 3.1 percent, total clay minerals 22.9 percent); clay mineralogy in weight percentage (illite/smectite* 10.7 percent, palygorskite 12.2 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 1–5 percent interparticle porosity, 3 percent intraparticle porosity; 4–7 percent total porosity and low permeability

	Depositional environment: Outer ramp **Comments:** Top of a fining upward cycle with a top at 650.5 ft bls (driller's depth). Upper 2 ft of cycle is a *Thalassinoides*-dominated *Glossifungites* ichnofacies, and major lithofacies shift across cycle top. The *Glossifungites* ichnofacies associates with a firmground capping the cycle **Thin section:** G2984–658.07
obi depth: 658.2–659.1 ft bls Driller's depth: 658.2–659.1 ft bls	**Lithofacies:** Foraminifer wackestone to packstone **Depositional texture:** Smaller benthic foraminifer and globular planktic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides*, *Asterosoma* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* **Carbonate grains:** Mainly smaller benthic foraminifera (including lenticulinids [dominant], rotaliids), globular planktic foraminifera, and silt to very fine sand-sized angular skeletal fragments; minor ostracods, echinoid spines, bivalve fragments **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to small pebble-sized black phosphorite grains **Porosity and permeability:** 1 percent interparticle porosity, 1 percent intraparticle porosity; 2 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of fining upward cycle at 659.1 ft bls (driller's depth) that fines upward to top of cycle at 650.5 ft bls (driller's depth) and capped by a *Thalassinoides*-dominated *Glossifungites* ichnofacies. Upper surface of cycle is a firmground
obi depth: 659.1–659.9 ft bls Driller's depth: 659.1–659.9 ft bls	**Lithofacies:** Quartz sand (caved from above in borehole) **Depositional texture:** Quartz sand sourced from the Peace River Formation **Color:** Light gray N7 **Accessory grains:** 90 percent silt to very fine sand-sized, angular, well sorted quartz grains; 10 percent silt to fine sand-sized black grains (mainly phosphorite) **Porosity and permeability:** 20 percent interparticle and total porosity; moderate permeability **Depositional environment:** Outer ramp **Comments:** Regressive quartz sand(?). Observations weigh towards this quartz sand sourced from the Peace River Formation above. No quartz sand was observed on OBI-40 image log data of good quality at or near this depth interval and was not observed on the ABI image log data. No increase in borehole diameter to indicate washout of quartz sand across this interval—quartz sand recovered was "poured" into core box from core barrel with no evidence of in situ firmness. The well as cased to a driller's depth about 468 ft bls at the time this interval was cored, so there was ample very fine quartz sand of the Peace River Formation exposed along the borehole wall at the time this interval was drilled. The quartz sand in this interval occurs at the top of a core run, where caved sand can be recovered, if present at the bottom of a corehole. Also, composition of this quartz sand is identical to quartz sand of the Peace River Formation that was exposed along the borehole wall during coring of this interval

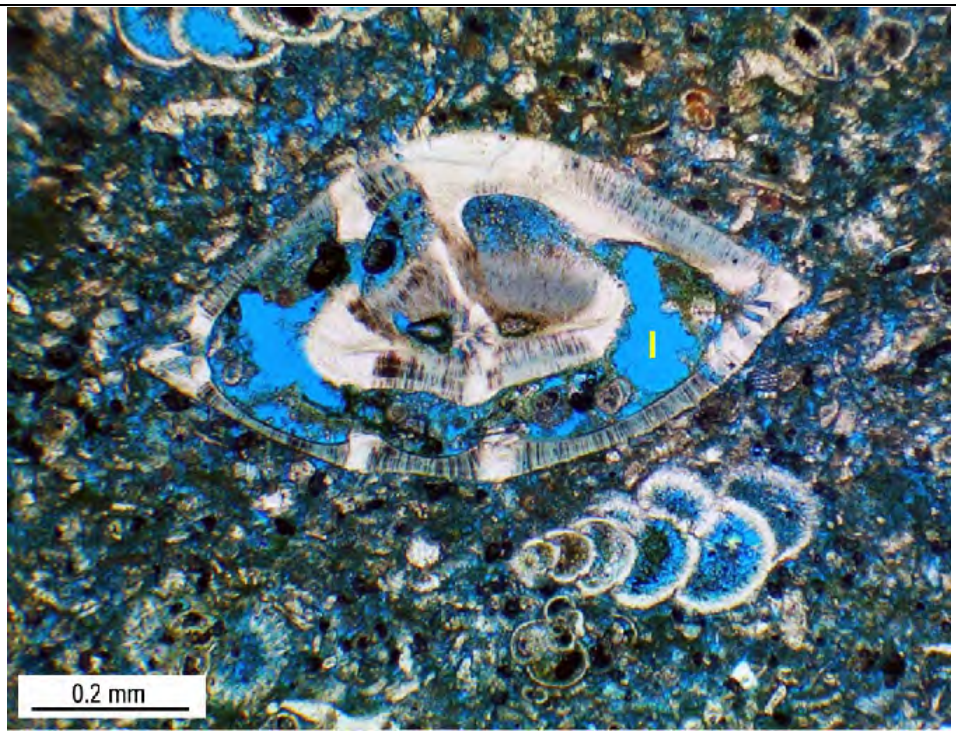
obi depth: 659.9– 663.3 ft bls Driller's depth: 659.9– 668 ft bls	**Lithofacies:** Marl **Depositional texture:** Marl **Color:** Yellowish gray 5Y 7/2 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Chondrites*?, *Cylindrichnus*?, *Zoophycos*? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* or *Zoophycos* with a *Glossifungites* cap **Carbonate grains:** Mainly silt-sized carbonate skeletal fragments, minor smaller benthic foraminifera, globular planktic foraminifera, ostracods. Foraminifera observed in thin section G2984–662.97 include *Globoquadrina* sp., *Globigerinatella insueta*, unidentified planktic foraminifera, bolivinids, lenticulinids, planktic foraminifera (rare), smaller benthic foraminifera (rare) **Accessory grains:** Less than 10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to fine sand-sized black grains (mainly phosphorite) **XRD mineralogy:** At 662.97 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 14.1 percent, plagioclase 3.7 percent, calcite 26.7 percent, dolomite and [Fe,Ca]-dolomite 8.2 percent, total clay minerals 47.3 percent); clay mineralogy in weight percentage (illite/smectite* 15.6 percent, palygorskite 30.6 percent, kaolinite 1.1 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 1 percent crack (vuggy) porosity; 1 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Major shift in lithology across top of this interval at 659.9 ft bls (driller's depth). Cycle top is at 659.9 ft bls (driller's depth). Uppermost 4 in. is a firmground characterized by a *Thalassinoides*-dominated *Glossifungites* Ichnofacies **Thin section:** G2984–662.97
obi depth: 663.3– 684 ft bls Driller's depth: 668–684 ft bls	**Lithofacies:** Marl and planktic foraminifer wackestone **Depositional texture:** Marl and globular planktic and smaller benthic foraminifer wackestone **Color:** Yellowish gray 5Y 8/1 to yellowish gray 5Y 7/2 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides*, *Zoophycos*, *Rhizocorallium*?, *Ophiomorpha*, *Asterosoma*, *Chondrites*, *Terebellina*, *Palaeophycus* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* **Carbonate grains:** Mainly silt-sized carbonate skeletal fragments, globular planktic foraminifera, smaller benthic foraminifera, ostracods. Foraminifera observed in thin section G2984–670.30 include *Globoquadrina* sp., *Globigerinatella insueta*?, unidentified planktic foraminifera, bolivinids, lenticulinids, planktic foraminifera, smaller benthic foraminifera. Foraminifera observed in thin section G2984–678.70 include *Praeorbulina sicanus*?, *Globigerinatella insueta*?, *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, bolivinids, lenticulinids, planktic foraminifera, smaller benthic foraminifer **Accessory grains:** Less than 1 percent silt to fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (mainly phosphorite) **XRD mineralogy:** At 678.70 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 9.9 percent, plagioclase 2.0 percent, calcite 43.9 percent, dolomite and

	[Fe,Ca]-dolomite 7.1 percent, total clay minerals 37.1 percent); clay mineralogy in weight percentage (illite/smectite* 12.4 percent, palygorskite 23.8 percent, kaolinite 0.9 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 1 percent interparticle porosity, 1 percent intraparticle porosity; 2 percent total porosity and low permeability **Depositional environment:** Outer ramp **Thin section:** G2984–670.30, G2984–678.70
obi depth: 684– 688.25 ft bls Driller's depth: 684– 688.25 ft bls	**Lithofacies:** Planktic foraminifer wackestone and packstone **Depositional texture:** Globular planktic and smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides, Taenidium, Rhizocorallium* (at 687.5 ft bls driller's depth) **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* or *Zoophycos* **Carbonate grains:** Mainly globular planktic foraminifera, smaller benthic foraminifera (including rotaliids), silt to very fine sand-sized angular skeletal fragments and minor ostracods, echinoid spines and plates. Foraminifera observed in thin section G2984–686.70 include *Praeorbulina glomerosa* s.l., *Globoquadrina* sp., *Globigerinatella insueta*?, unidentified planktic foraminifera, bolivinids, lenticulinids, rotaliids, planktic foraminifera, smaller benthic foraminifera **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5 percent silt to small pebble-sized black phosphorite grains **Porosity and permeability:** 3 percent interparticle porosity, 3 percent intraparticle porosity; 6 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of fining upward cycle at 688.25 ft bls (driller's depth) that fines upward to top of cycle at 659.9 ft bls (driller's depth) **Thin section:** G2984–686.70
obi depth: 688.25– 693.45 ft bls Driller's depth: 688.25– 694.25 ft bls	**Lithofacies:** Planktic foraminifer wackestone **Depositional texture:** Globular planktic and smaller benthic foraminifer wackestone **Color:** Yellowish gray 5Y 8/1 to yellowish gray 5Y 7/2 **Sedimentary structures:** Mainly burrow mottled, minor thinly laminated to very thinly bedded **Trace fossils:** *Thalassinoides*, *Zoophycos*, *Taenidium*?, *Rhizocoralliium?* (694 ft bls driller's depth) **Ichnofabrics:** Ichnofabric index 1–5, mostly 5 **Ichnofacies:** *Cruziana* or *Zoophycos* with a *Glossifungites* ichnofacies capping the cycle **Carbonate grains:** Mainly silt-sized carbonate skeletal fragments, globular planktic foraminifera, smaller benthic foraminifera **Accessory grains:** Less than 1 percent silt to fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (mainly phosphorite) **XRD mineralogy:** At 689.90 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 4.9 percent, calcite 64.1 percent, dolomite and [Fe,Ca]-dolomite 3.3 percent, fluorapatite 1.1 percent, total clay minerals 26.5 percent); clay mineralogy in weight percentage (illite/smectite* 12.4 percent, palygorskite 14.1 percent). *Mixed-layer

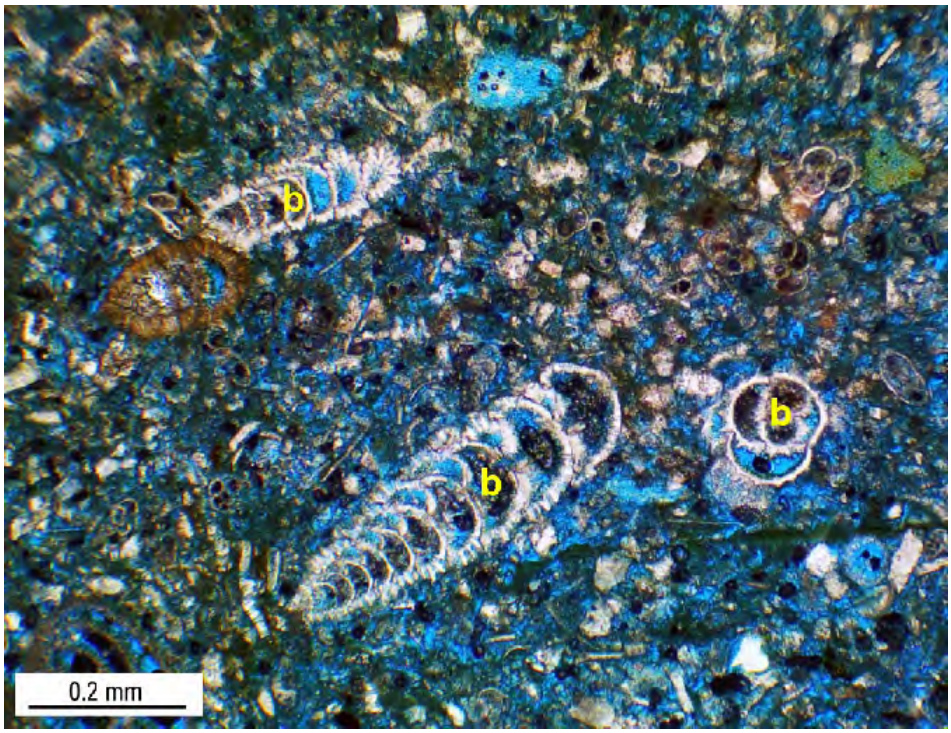
	illite/smectite that contains 70–80 percent smectite layers **XRD mineralogy:** At 691.00 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 4.7 percent, calcite 70.3 percent, dolomite and [Fe,Ca]-dolomite 2.6 percent, total clay minerals 22.4 percent); clay mineralogy in weight percentage (illite/smectite* 7.2 percent, palygorskite 15.2 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 3 percent interparticle porosity, 3 percent intraparticle porosity; 6 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Uppermost part of cycle is a *Thalassinoides*-dominated *Glossifungites* ichnofacies with sediment from overlying cycle piping down into *Thalassinoides* burrows. Uppermost part of cycle is a firmground. Cycle top is at 688.25 ft bls (driller's depth). *Glossifungites* ichnofacies extends downward about 2 ft from cycle top. Upper surface of cycle is a firmground
obi depth: 693.45–696.5 ft bls Driller's depth: 694.25–697.3 ft bls	**Lithofacies:** Planktic foraminifer wackestone and packstone **Depositional texture:** Globular planktic and smaller benthic foraminifer wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides, Taenidium* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* or *Zoophycos* **Carbonate grains:** Mainly globular planktic foraminifera, smaller benthic foraminifera, silt to very fine sand-sized angular skeletal fragments and minor ostracods, echinoid spines and plates **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to small pebble-sized black phosphorite grains **XRD mineralogy:** At 696.00 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 2.0 percent, calcite 79.8 percent, dolomite and [Fe,Ca]-dolomite 1.1 percent, fluorapatite 2.8 percent, total clay minerals 14.3 percent); clay mineralogy in weight percentage (illite/smectite* 4.3 percent, palygorskite 10.0 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 3 percent interparticle porosity, 3 percent intraparticle porosity; 6 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of fining upward cycle at 697.3 ft bls (driller's depth) that fines upward to top of cycle at 688.25 ft bls (driller's depth)
obi depth: 696.5–698.8 ft bls Driller's depth: 697.3–	**Lithofacies:** Marl **Depositional texture:** Marl **Color:** Yellowish gray 5Y 8/1 to yellowish gray 5Y 7/2 **Sedimentary structures:** Mainly burrow mottled, minor thinly laminated to thickly laminated **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 1–5, mostly 5 **Ichnofacies:** *Cruziana* or *Zoophycos* with a *Glossifungites* ichnofacies capping the cycle **Carbonate grains:** Mainly silt-sized carbonate skeletal fragments, globular planktic

699.6 ft bls	foraminifera, smaller benthic foraminifera. Foraminifera observed in thin section G2984–698.64 include *Praeorbulina glomerosa* s.l.?, *Globigerinoides* gr. *trilobus*, bolivinids, planktic foraminifera (rare), smaller benthic foraminifera (rare) **Accessory grains:** Less than 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to fine sand-sized black grains (mainly phosphorite) **XRD mineralogy:** At 698.64 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 3.8 percent, plagioclase 1.1 percent, calcite 48.2 percent, dolomite and [Fe,Ca]-dolomite 10.6 percent, total clay minerals 36.3 percent); clay mineralogy in weight percentage (illite/smectite* 12.3 percent, palygorskite 24.0 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 1 percent interparticle porosity, 1 percent intraparticle porosity; 2 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Uppermost part of cycle is a *Thalassinoides*-dominated *Glossifungites* ichnofacies with sediment from overlying cycle piping down into *Thalassinoides* burrows. Uppermost part of cycle is a firmground. Cycle top is at 697.3 ft bls (driller's depth). *Glossifungites* ichnofacies extends downward about 2 ft from cycle top. Upper surface of cycle is a firmground **Thin section:** G2984–698.64
obi depth: 698.8– 710 ft bls Driller's depth: 699.6– 712 ft bls	**Lithofacies:** Planktic foraminifer mudstone and wackestone **Depositional texture:** Globular planktic and smaller benthic foraminifer mudstone and wackestone **Color:** Yellowish gray 5Y 8/1 to yellowish gray 5Y 7/2 **Sedimentary structures:** Mainly burrow mottled, minor thinly laminated to very thinly bedded **Trace fossils:** *Thalassinoides*, *Zoophycos* (708 ft bls [driller's depth]), *Taenidium*? **Ichnofabrics:** Ichnofabric index 1–5, mostly 5 **Ichnofacies:** *Cruziana* or *Zoophycos* **Carbonate grains:** Mainly silt-sized carbonate skeletal fragments, globular planktic foraminifera, smaller benthic foraminifera. Foraminifera observed in thin section G2984–708.68 include planktic foraminifera (including *Globoquadrina* sp., *Globigerinoides* gr. *trilobus*), smaller benthic foraminifera (including bolivinids, lenticulinids) **Accessory grains:** Less than 1 percent silt to fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (mainly phosphorite); sponge spicules **XRD mineralogy:** At 708.00 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 3.3 percent, calcite 76.3 percent, dolomite and [Fe,Ca]-dolomite 1.6 percent, total clay minerals 18.8 percent); clay mineralogy in weight percentage (illite/smectite* 7.2 percent, palygorskite 11.6 percent) .*Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 1–8 percent interparticle porosity, 1–3 percent intraparticle porosity; 2–11 percent total porosity and low permeability **Depositional environment:** Outer ramp **Thin section:** G2984–708.68
obi depth:	**Lithofacies:** Planktic foraminifer wackestone and packstone **Depositional texture:** Globular planktic and smaller benthic foraminifer wackestone and

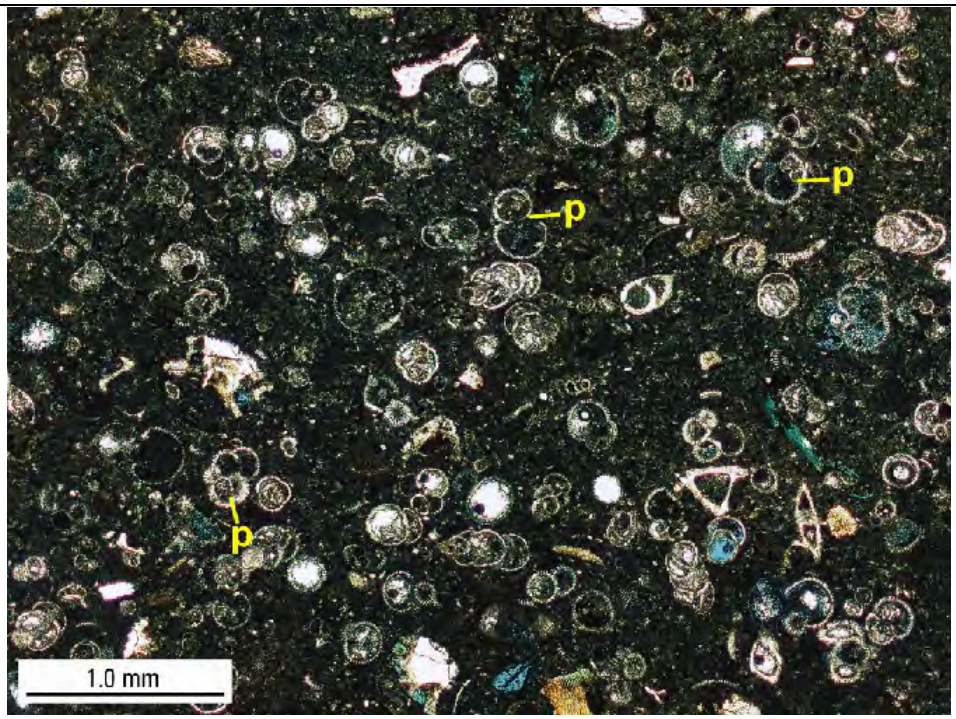
710–720 ft bls Driller's depth: 712–722 ft bls	mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** *Thalassinoides*, other unidentified trace fossils **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana* or *Zoophycos* **Carbonate grains:** Mainly globular planktic foraminifera, smaller benthic foraminifera (including rotaliids), and minor ostracods, echinoid spines, bivalve fragments; upward increase in silt to very fine sand-sized, angular skeletal fragments to where these are a dominant grain type. Foraminifera observed in thin section G2984–717.31 include planktic foraminifera (including *Orbulina suturalis*?, *Praeorbulina glomerosa* s.l., *Praeorbulina sicanus*?, *Globoquadrina* sp., *Globigerinoides bisphericus*, *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera), smaller benthic foraminifera (including lenticulinids [dominant], bolivinids, rotaliids). Foraminifera observed in thin section G2984–721.13 include *Praeorbulina glomerosa* s.l., *Praeorbulina sicanus*?, *Globoquadrina* sp., *Globigerinatella insueta*?, *Globigerinoides bisphericus*, *Globigerinoides* gr. *trilobus*, unidentified planktic foraminifera, lenticulinids (dominant), planktic foraminifera (dominant), smaller benthic foraminifera **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 5–7 percent silt to small pebble-sized black phosphorite grains (based complete extinction under crossed nicols and relatively high gamma-ray log response **XRD mineralogy:** At 718.00 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 2.2 percent, calcite 87.4 percent, dolomite and [Fe,Ca]-dolomite 0.7 percent, total clay minerals 9.7 percent); clay mineralogy in weight percentage (illite/smectite* 3.3 percent, palygorskite 6.4 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 3 percent interparticle porosity, 3 percent intraparticle porosity; 6 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of deepening and fining upward cycle at 722 ft bls (driller's depth) that fines upward to top of cycle at 697.3 ft bls (driller's depth) **Thin section:** G2984–717.31, G2984–721.13



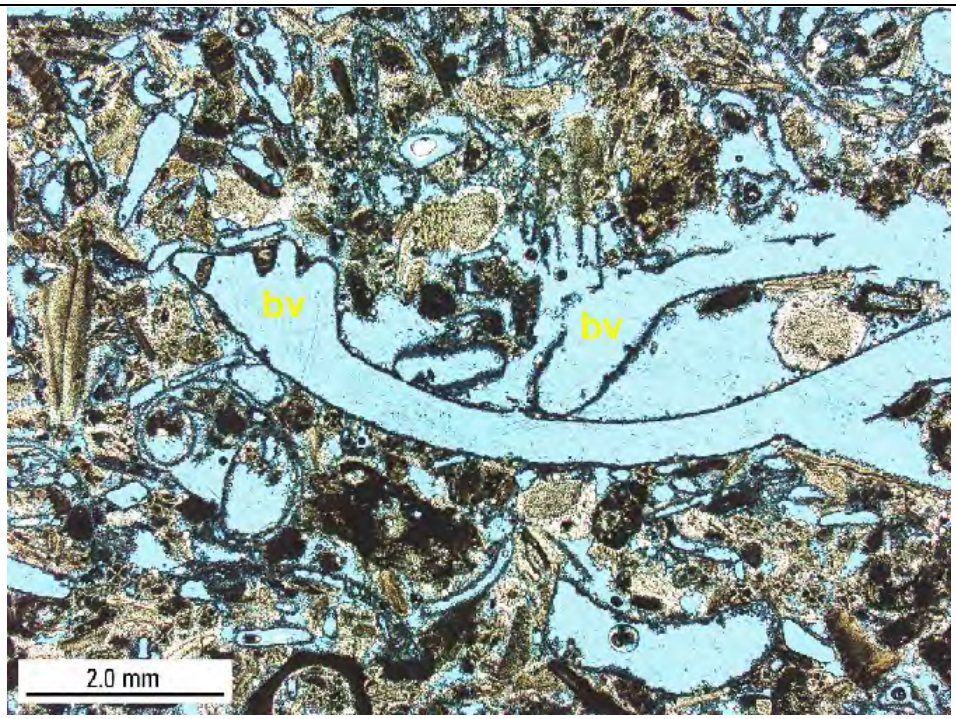
Photomicrograph from thin section G2984–717.31 that shows a specimen of linticulinid (l). Driller's depth of thin section is 717.31 ft bls.

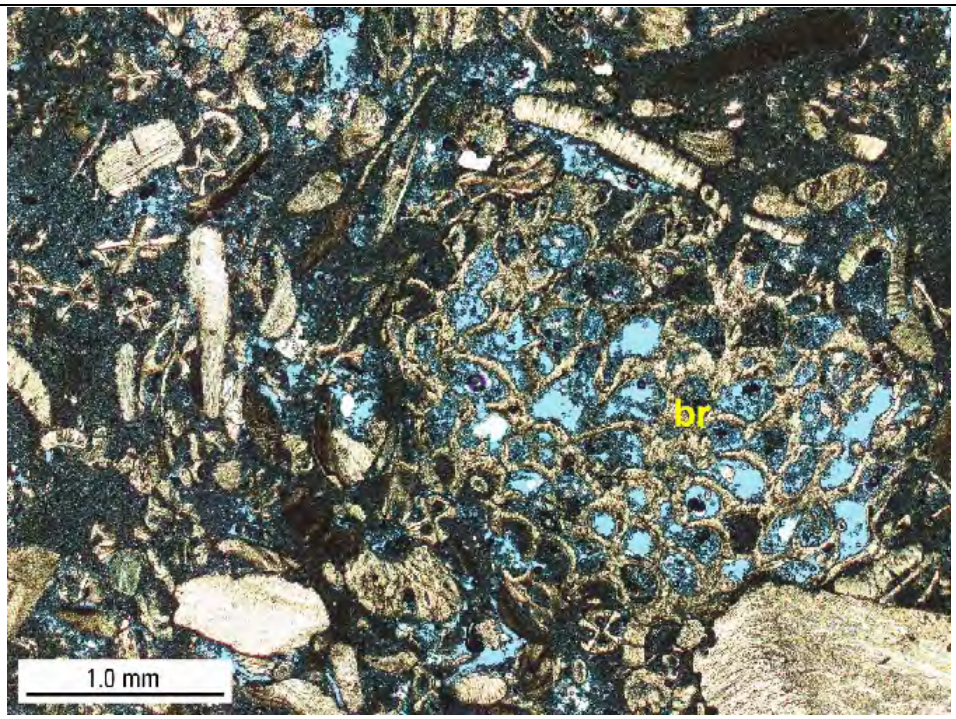


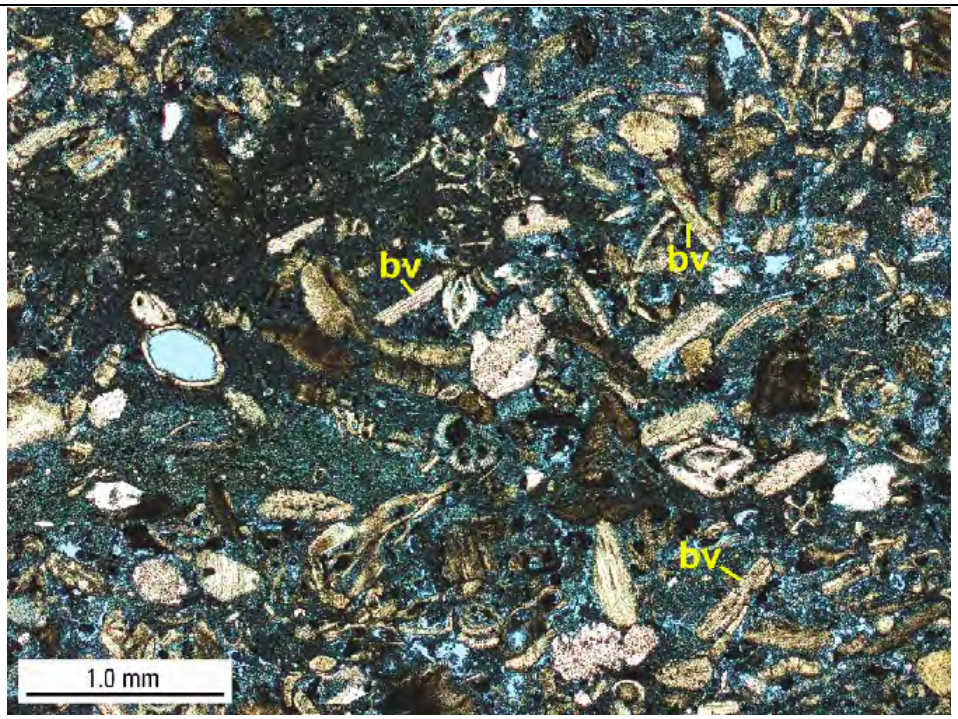
Photomicrograph from thin section G2984–717.31 that shows specimens of bolivinids (b). Driller's depth of thin section is 717.31 ft bls.

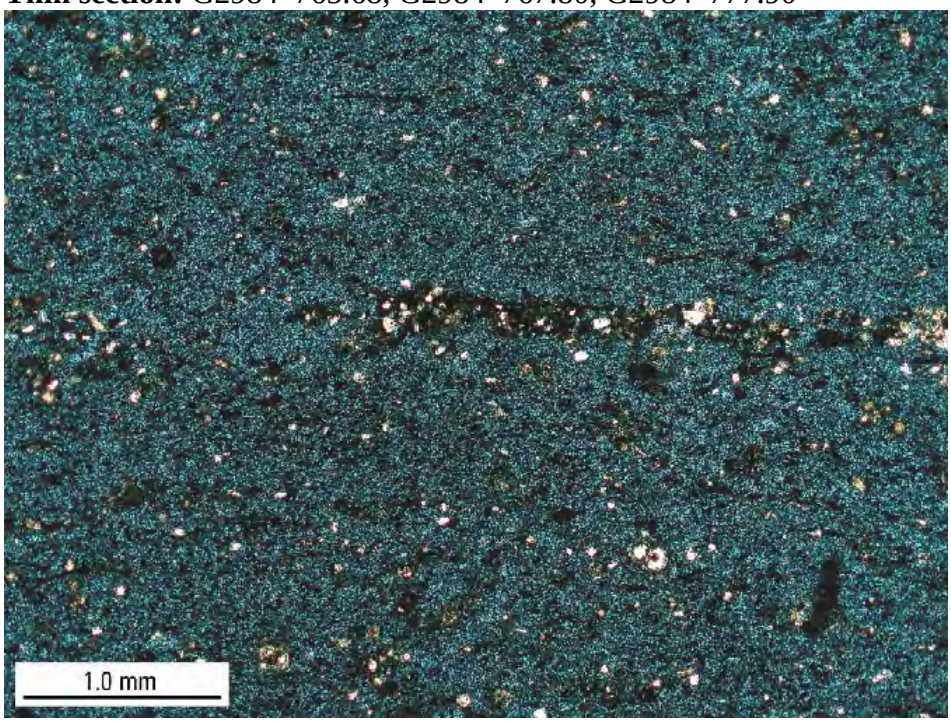
	 Photomicrograph from thin section G2984–721.13 that shows a planktic foraminifera (p) wackestone and packstone lithofacies. Driller's depth of thin section is 721.13 ft bls.
obi depth: 720– 720.02 ft bls Driller's depth: 722– 722.02 ft bls	**Lithofacies:** Phosphorite **Color:** Black N1 **Comments:** Both composite depositional sequence Ar2 and depositional sequence Ar6 at 722.02 ft bls (driller's depth). Marked by irregular dissolution along the surface and down through the rock to a depth of about 1 ft below the upper bounding surface at 722.02 ft bls (driller's depth). Upper surface and irregular vugs coated with black phosphorite, as indicated by an increase in gamma-ray counts at the depth of 722.02 ft bls (drillller's depth). Possibly a vuggy emersion surface with karst dissolution, followed by phosphatization associated with a later stage drowning unconformity
obi depth: 720.02– 721 ft bls Driller's depth: 722.02– 723 ft bls	**Lithofacies:** Bivalve floatstone and rudstone **Depositional texture:** Bivalve floatstone and rudstone with wackestone and mud- and grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Carbonate grains:** Mainly very fine sand to medium pebble-sized bivalve fragments, minor commonly abraded amphisteginids, stick-shaped bryozoans, echinoderm spines and plates **Accessory grains:** 1–3 percent silt to fine sand-sized, angular, well sorted quartz grains; 1–5 percent silt to very fine sand-sized black phosphorite grains **Porosity and permeability:** 1–5 percent interparticle porosity, 1 percent intraparticle porosity, 2–5 percent moldic porosity; 3–11 percent total porosity and low permeability

	Depositional environment: Inner ramp
obi depth: 721–723 ft bls Driller's depth: 723–727 ft bls	**Lithofacies:** Bivalve wackestone and packstone **Depositional texture:** Bivalve wackestone and mud- and grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly very fine sand to medium pebble-sized bivalve fragments, minor commonly abraded amphisteginids, stick-shaped bryozoans, echinoderm spines and plates, miliolids. Foraminifera observed in thin section G2984–726.51 include larger benthic foraminifera (dominant including *Amphistegina* sp., bolivinids), unidentified planktic foraminifera (including a total of four planktic foraminifera) **Accessory grains:** 1–3 percent silt to fine sand-sized, angular, well sorted quartz grains; 1–5 percent silt to very fine sand-sized black phosphorite grains **Porosity and permeability:** 3–10 percent interparticle porosity, 3 percent intraparticle porosity, 3–15 percent fossil moldic porosity; 9–28 percent total porosity and low to moderate permeability **Depositional environment:** Inner ramp **Thin section:** G2984–726.51
obi depth: 723.0– 742.4 ft bls Driller's depth: 727–747 ft bls	**Lithofacies:** Bivalve floatstone and rudstone **Depositional texture:** Bivalve floatstone and rudstone with bivalve fragment mud- and grain-dominated packstone and grainstone matrix **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Present **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly very fine sand to medium pebble-sized bivalve fragments, minor commonly abraded amphisteginids, stick-shaped bryozoans, echinoderm spines and plates, abraded serpulid tubes and various types of bryozoans, miliolids. Foraminifera observed in thin section G2984–735.30 include *Amphistegina* sp., miliolids, total of one planktic foraminifera. Foraminifera observed in thin section G2984–743.30 include *Amphistegina* sp., one miliolid **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1 percent silt to very fine sand-sized black phosphorite grains **Porosity and permeability:** 5–15 percent interparticle porosity, 1–4 percent intraparticle porosity, 2–5 percent moldic porosity; 8–24 percent total porosity and relatively low to moderate permeability **Depositional environment:** Inner ramp **Thin section:** G2984–735.30, G2984–743.30

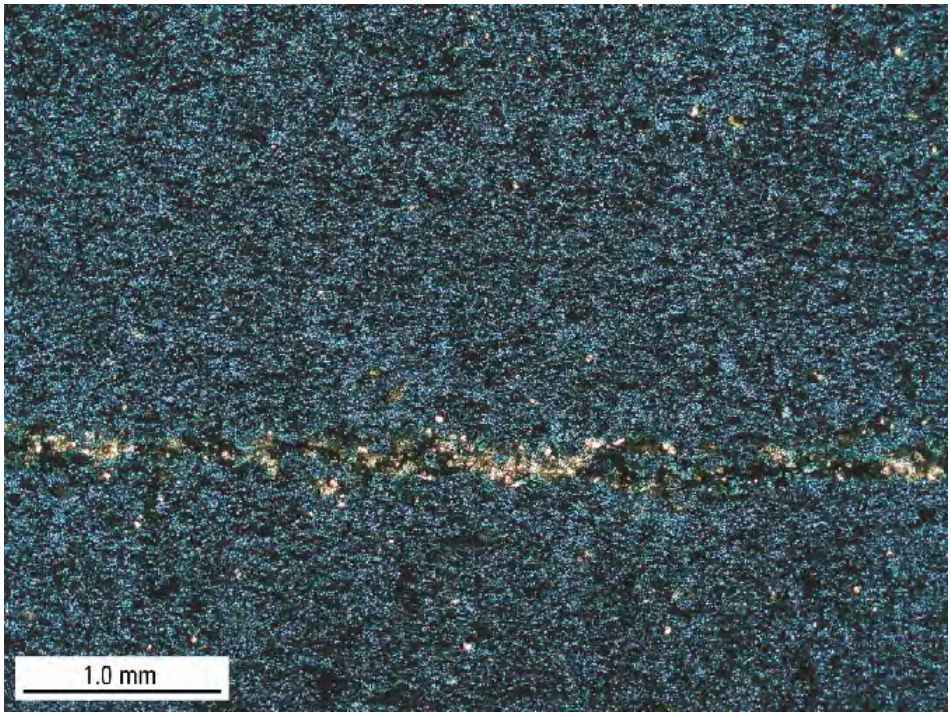
	 Photomicrograph from thin section G2984–735.30 that shows a bivalve (bv) floatstone and rudstone lithofacies. Driller's depth of thin section is 735.30 ft bls.
obi depth: 742.4– 751.4 ft bls Driller's depth: 747–756 ft bls	**Lithofacies:** Bryozoan floatstone **Depositional texture:** Bryozoan floatstone with fragment grain-dominated packstone matrix **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Present **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly very fine to very coarse sand-sized bivalve fragments, minor larger and smaller benthic foraminifera (including nummulitids?, *Elphidium*?), stick-shaped and branching bryozoans, echinoderm spines and plates, ostracods; globular planktic foraminifera. Foraminifera observed in thin section G2984–750.15 include *Amphistegina* sp., *Nummulites panamensis*?, total of two planktic foraminifera **Accessory grains:** 1–3 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–3 percent silt to very fine sand-sized black phosphorite grains **Porosity and permeability:** 2–5 percent interparticle porosity, 1–3 percent intraparticle porosity, 2 percent moldic porosity, 1–5 percent vuggy porosity; 6–15 percent total porosity and low permeability **Depositional environment:** Inner ramp **Thin section:** G2984–750.15

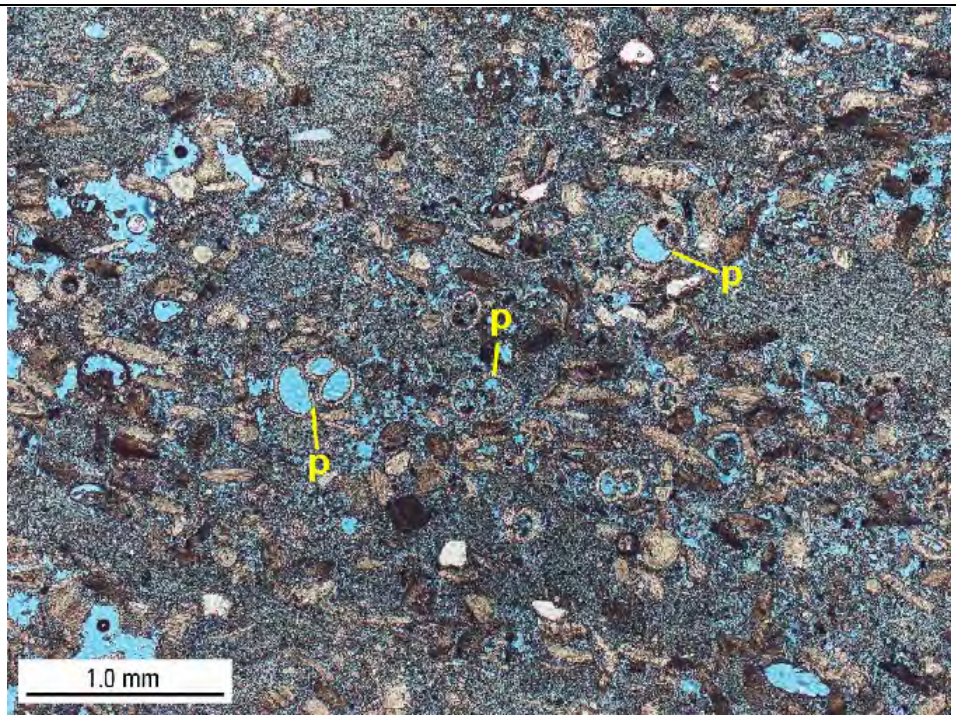
	 Photomicrograph from thin section G2984–750.15 that shows a bryozoan (br) floatstone lithofacies. Driller's depth of thin section is 750.15 ft bls.
obi depth: 751.4–760.7 ft bls Driller's depth: 756–765.5 ft bls	**Lithofacies:** Bivalve wackestone and packstone **Depositional texture:** Bivalve wackestone and mud-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** *Thalassinoides* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly very fine to fine sand-sized bivalve fragments, minor amphisteginids, stick-shaped bryozoans, globular planktic foraminifera, echinoderm spines and plates, ostracods, miliolids. Foraminifera observed in thin section G2984–756.70 include *Amphistegina* sp., total of two planktic foraminifera (*Globigerinoides* gr. *trilobus*). Foraminifera observed in thin section G2984–762.00 include smaller benthic foraminifera (including bolivinids, lenticulinids), larger benthic foraminifera (including valvulinids, abraded amphisteginid), planktic foraminifera (rare) **Accessory grains:** 1–3 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–3 percent silt to very fine sand-sized black phosphorite grains; trace feldspar; minor terrigenous mudstone matrix **Porosity and permeability:** 1–2 percent interparticle porosity, 1–2 percent intraparticle porosity, 1–2 percent moldic porosity, 0–2 percent vuggy porosity; 3–8 percent total porosity and low permeability **Depositional environment:** Middle ramp **Thin section:** G2984–756.70, G2984–762.00

	 Photomicrograph from thin section G2984–756.70 that shows a bivalve (bv) wackestone and packstone lithofacies. Driller's depth of thin section is 756.70 ft bls.
obi depth: 760.7– 782.3 ft bls Driller's depth: 765.5– 787 ft bls	**Lithofacies:** Marl **Depositional texture:** Marl and interbedded with skeletal, fragment-bearing mudstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thinly laminated to thinly bedded **Trace fossils:** *Zoophycos*, *Planolites*, *Thalassinoides*, *Diplocraterion habichi*? or *Cylindrichnus*? **Ichnofabrics:** Ichnofabric index mainly 1–5, generally low ichnofabric index **Ichnofacies:** *Cruziana*? or *Zoophycos*? **Carbonate grains:** Mainly silt to very fine sand-sized unidentified skeletal fragments, minor smaller benthic foraminifera and planktic foraminifera, ostracods. Foraminifera observed in thin section G2984–765.68 include bolivinids**,** planktic foraminifera (rare). Foraminifera observed in thin section G2984–767.80 include bolivinids, planktic foraminifera (rare), smaller benthic foraminifera. Foraminifera observed in thin section G2984–777.90 include bolivinids**,** planktic foraminifera (rare), smaller benthic foraminifera **Accessory grains:** 1–3 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1 percent silt to very fine sand-sized black grains (probably mainly phosphorite); diatom bearing; minor to common sponge spicules **XRD mineralogy:** At 767.80 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 3.8 percent, calcite 42.3 percent, dolomite and [Fe,Ca]-dolomite 10.2 percent, total clay minerals 43.8 percent); clay mineralogy in weight percentage (illite/smectite* 8.6 percent, sepiolite 14.0 percent, palygorskite 21.2 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** Less than 1 percent visible porosity (intraparticle) and low

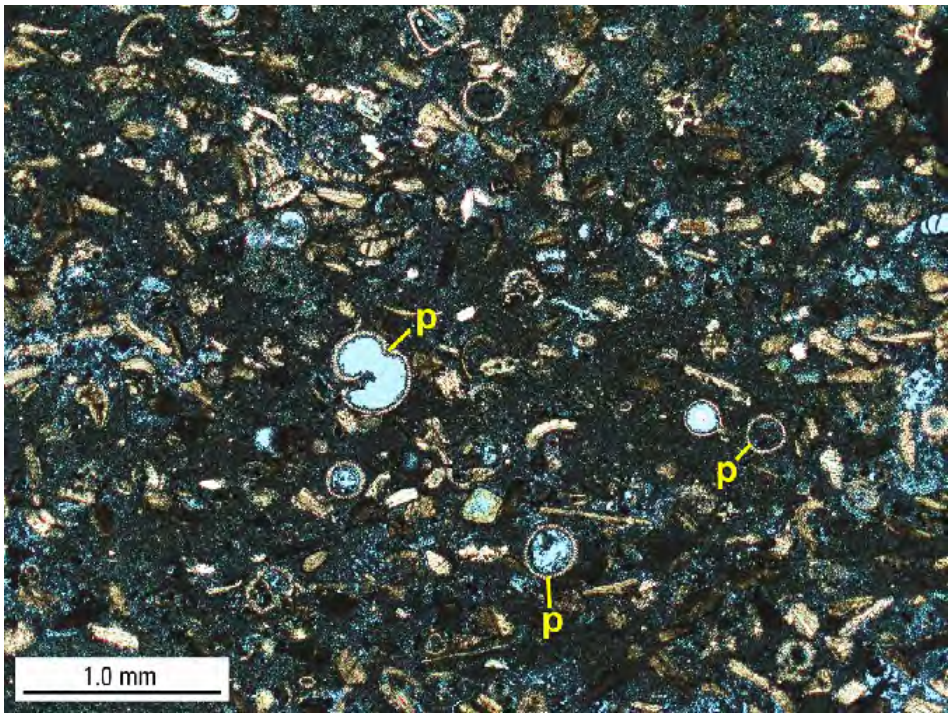
	permeability **Depositional environment:** Outer ramp **Thin section:** G2984–765.68, G2984–767.80, G2984–777.90  Photograph from thin section G2984–777.90 that shows a marl lithofacies. Driller's depth of thin section is 777.90 ft bls.
obi depth: 782.3–802.7 ft bls Driller's depth: 787–802.5 ft bls	**Lithofacies:** Diatom-bearing marl **Depositional texture:** Diatom-bearing marl interlaminated and interbedded with smaller benthic foraminifer and globular planktic foraminifer bearing marl **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thinly laminated to thinly bedded **Trace fossils:** Minor traces, one possible *Zoophycos* **Ichnofabrics:** Ichnofabric index mainly 1–3 **Ichnofacies:** Not determined **Carbonate grains:** Mainly silt to very fine sand-sized unidentified skeletal fragments, very minor smaller benthic foraminifera and planktic foraminifera. Foraminifera observed in thin section G2984–789.86 planktic foraminifera (rare), smaller benthic foraminifera **Accessory grains:** 1 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1 percent silt to very fine sand-sized black grains (probably mainly phosphorite); diatom bearing; minor sponge spicules **Porosity and permeability:** Less than 1 percent visible porosity (intraparticle) and low permeability **Depositional environment:** Outer ramp **Thin section:** G2984–789.86
obi depth: 802.7–804.2 ft	**Lithofacies:** Marl interlaminated with wackestone and packstone **Depositional texture:** Marl interlaminated with skeletal, globular planktic and smaller benthic foraminifer wackestone and mud- to grain-dominated packstone **Color:** Yellowish gray 5Y 8/1

bls Driller's depth: 802.5–808.9 ft bls	**Sedimentary structures:** Burrow mottled, fining upward laminations with wackestones and packstones at base and marl at top of centimeter-scale cyclic laminations **Trace fossils:** Abundant trace fossils with homogeneous texture throughout **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Not determined **Carbonate grains:** Mainly small fragments of bivalves, globular planktic foraminifera, smaller benthic foraminifera, and silt to medium sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines. Foraminifera observed in thin section G2984–805.35 include smaller benthic foraminifera. Foraminifera observed in thin section G2984–807.95 include planktic foraminifera **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite) **XRD mineralogy:** At 805.35 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 1.7 percent, plagioclase 0.7 percent, calcite 23.8 percent, dolomite and [Fe,Ca]-dolomite 19.0 percent, total clay minerals 54.9 percent); clay mineralogy in weight percentage (illite/smectite* 8.1 percent, sepiolite 17.6 percent, palygorskite 29.2 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** 1 percent intraparticle porosity, 0–1 percent fossil moldic porosity, 0–2 percent vuggy porosity; 1–4 percent total porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Base of deepening upward succession at 808.9 ft bls (driller's depth) **Thin section:** G2984–805.35, G2984–807.95
obi depth: 804.2–811.8 ft bls Driller's depth: 808.9–816.35 ft bls	**Lithofacies:** Diatom-bearing marl **Depositional texture:** Diatom-bearing marl interlaminated and interbedded with smaller benthic foraminifer and globular planktic foraminifer wackestone and mud- to grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thinly laminated to thinly bedded **Trace fossils:** Sparse traces, but no taxa identified **Ichnofabrics:** Ichnofabric index mainly 1–2 **Ichnofacies:** Not determined **Carbonate grains:** Mainly smaller benthic foraminifera, globular planktic foraminifera, and silt to very fine sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines. Foraminifera observed in thin section G2984–815.42 include planktic foraminifera, smaller benthic foraminifera **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite); diatoms **XRD mineralogy:** At 812.10 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 2.5 percent, calcite 21.3 percent, dolomite and [Fe,Ca]-dolomite 16.6 percent, total clay minerals 59.6 percent); clay mineralogy in weight percentage (illite/smectite* 6.0 percent, sepiolite 23.1 percent, palygorskite 30.5 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** Less than 1 percent visible porosity (intraparticle) and low permeability **Depositional environment:** Outer ramp

	Thin section: G2984–815.42  Photomicrograph from thin section G2984–815.42 that shows a diatom-bearing marl lithofacies. Driller's depth of thin section is 815.42 ft bls.
obi depth: 811.8– 820.8 ft bls Driller's depth: 816.35– 825.35 ft bls	**Lithofacies:** Skeletal and foraminifer wackestone and packstone **Depositional texture:** Skeletal, globular planktic and smaller benthic foraminifer wackestone and mud- to grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** Abundant trace fossils with homogeneous texture throughout **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Not determined **Carbonate grains:** Mainly small fragments of bivalves, globular planktic foraminifera, smaller benthic foraminifera, and silt to medium sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines. Foraminifera observed in thin section G2984–817.57 include planktic foraminifera**.** Foraminifera observed in thin section G2984–818.60 include bryozoans, planktic foraminifera, smaller benthic foraminifera. Foraminifera observed in thin section G2984–824.54 include planktic foraminifera, smaller benthic foraminifera **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite) **Porosity and permeability:** Less than 1 percent visible porosity (interparticle and intraparticle) and low permeability **Depositional environment:** Outer ramp **Comments:** Base of deepening upward cycle at 825.35 ft bls (driller's depth)—lower interval is burrowed wackestone and packstone part of a deepening upward cycle **Thin section:** G2984–817.57, G2984–818.60, G2984–824.54



Photomicrograph from thin section G2984–817.57 that shows a skeletal and foraminifer wackestone and packstone lithofacies with planktic foraminifera (p). Driller's depth of thin section is 817.57 ft bls.



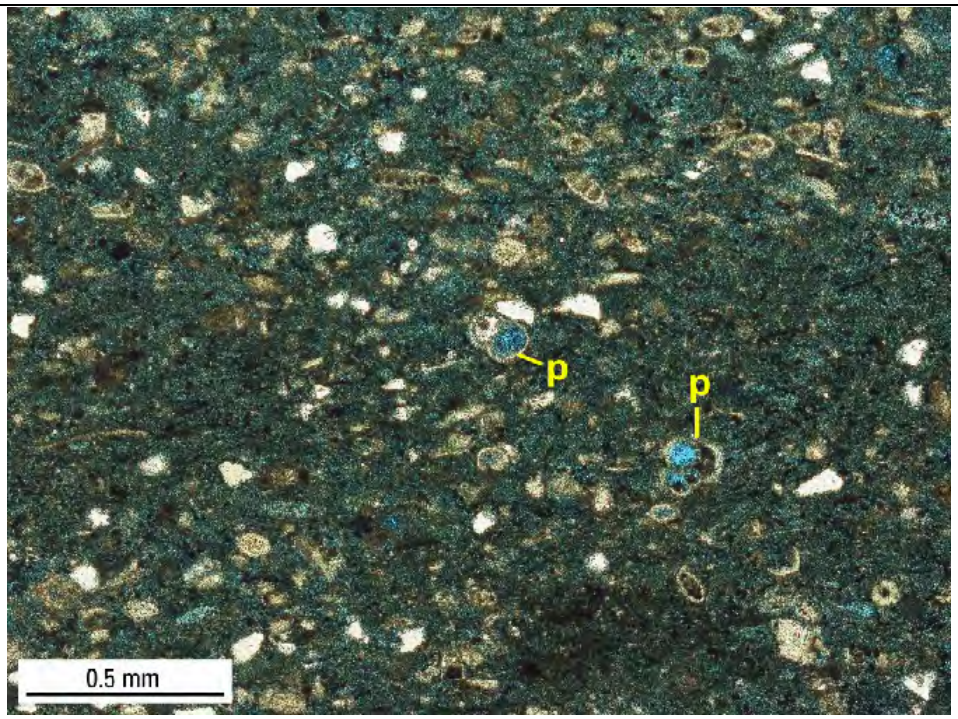
Photomicrograph from thin section G2984–818.60 that shows a skeletal foraminifer wackestone and packstone lithofacies with planktic foraminifera (p) included. Driller's depth of thin section is 818.60 ft bls.

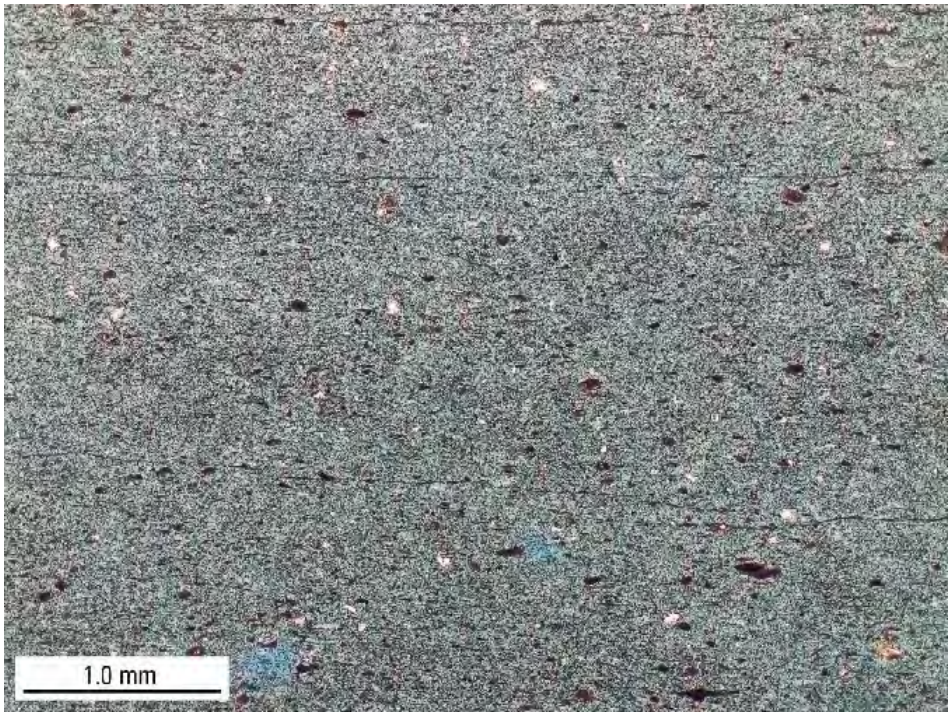
obi depth: 820.8–834.1 ft bls Driller's depth: 825.35–838.65 ft bls	**Lithofacies:** Diatom-bearing marl **Depositional texture:** Diatom-bearing marl interlaminated and interbedded with smaller benthic foraminifer and globular planktic foraminifer wackestone and mud- to grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thinly laminated to thinly bedded **Trace fossils:** Sparse traces, but no taxa identified **Ichnofabrics:** Ichnofabric index mainly 1–2 **Ichnofacies:** Not determined **Carbonate grains:** Mainly smaller benthic foraminifera, globular planktic foraminifera, and silt to very fine sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines. Foraminifera observed in thin section G2984–828.70 include smaller benthic foraminifera **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite); diatoms **XRD mineralogy:** At 828.70 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 2.0 percent, calcite 28.3 percent, dolomite and [Fe,Ca]-dolomite 26.7 percent, total clay minerals 43.0 percent); clay mineralogy in weight percentage (illite/smectite* 7.8 percent, sepiolite 20.3 percent, palygorskite 14.9 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** Less than 1 percent visible porosity (intraparticle) and low permeability **Depositional environment:** Outer ramp **Comments:** Cycle top at 825.35 ft bls (driller's depth), which is a surface of marine erosion. Upper part of the lithofacies succession of a deepening upward cycle **Thin section:** G2984–828.70
obi depth: 834.1–836.1 ft bls Driller's depth: 838.65–840.65 ft bls	**Lithofacies:** Foraminifer wackestone and packstone **Depositional texture:** Smaller benthic foraminifer and globular planktic foraminifer wackestone and mud- to grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled **Trace fossils:** Abundant trace fossils with homogeneous texture throughout **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Not determined **Carbonate grains:** Mainly smaller benthic foraminifera, globular planktic foraminifera, and silt to very fine sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite) **Porosity and permeability:** Less than 1 percent visible porosity (interparticle and intraparticle) and low permeability **Depositional environment:** Outer ramp

obi depth: 836.1– 836.5 ft bls Driller's depth: 840.65– 841.05 ft bls	**Lithofacies:** Intraclast rudstone **Depositional texture:** Intraclast rudstone with a skeletal grainstone matrix **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** No burrowing or bedding structures **Carbonate grains:** Mainly intraclasts of wackestone, small thin bivalve fragments composing the matrix, and intraclasts of chert; minor globular planktic foraminifera **Porosity and permeability:** 11 percent interparticle porosity, 4 percent intraparticle porosity; 6 percent total porosity and moderate permeability **Depositional environment:** Outer ramp **Comments:** Lower part of a deepening upward cycle that is part of a cycle set that composes depositional sequence Ar6 bounded at its base at 841.05 ft bls (driller's depth). The ideal meter-scale cycle here is (1) intraclast rudstone base, (2) about 1 m thick lower part of cycle, and (3) overlain by 1 to several meters of thick laminated mudstone—deepening upward, fining upward cycle. About 1 cm of erosional relief on upper bounding surface of underlying cycle top at 841.05 ft bls (driller's depth). Discontinuity is a surface of marine erosion
obi depth: 836.5– 873.5 ft bls Driller's depth: 841.05– 878.05 ft bls	**Lithofacies:** Interlaminated-interbedded foraminifer mudstone and wackestone **Depositional texture:** Interlaminated-interbedded smaller benthic foraminifer and globular planktic foraminifer mudstone and wackestone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thinly laminated to thinly bedded **Trace fossils:** Sparse traces, but no taxa identified **Ichnofabrics:** Ichnofabric index 1–5 **Ichnofacies:** Not determined **Carbonate grains:** Mainly smaller benthic foraminifera, globular planktic foraminifera, and silt to very fine sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines. Foraminifera observed in thin section G2984–850.85 include *Globigerinoides* gr. *trilobus*, total of 30 planktic foraminifera**,** total of 13 include smaller benthic foraminifera. Foraminifera observed in thin section G2984–861.55 include *Globigerinoides* gr. *trilobus*, total of 26 planktic foraminifera, total of 28 smaller benthic foraminifera **Accessory grains:** 1–10 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite) **XRD mineralogy:** At 841.60 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 1.7 percent, calcite 37.7 percent, dolomite and [Fe,Ca]-dolomite 19.2 percent, total clay minerals 41.5 percent); clay mineralogy in weight percentage (illite/smectite* 8.4 percent, sepiolite 23.0 percent, palygorskite 10.1 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **XRD mineralogy:** At 850.85 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 2.1 percent, plagioclase 1.0 percent, calcite 52.1 percent, dolomite and [Fe,Ca]-dolomite 19.8 percent, total clay minerals 25.0 percent); clay mineralogy in weight percentage (sepiolite 13.9 percent, palygorskite 11.1 percent) **XRD mineralogy:** At 871.40 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 2.2 percent, calcite 44.4 percent, dolomite and [Fe,Ca]-dolomite 14.7 percent, total clay minerals 38.6 percent); clay mineralogy in weight percentage (illite/smectite* 6.3 percent, sepiolite 22.3 percent, palygorskite 10.0 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers

	Porosity and permeability: Less than 1 percent visible porosity (intraparticle) and low permeability **Depositional environment:** Lowstand wedge at ramp margin **Comments:** Possible cycle top at 841.05ft bls (driller's depth). About 1 cm of erosional relief on upper bounding surface of marine erosion at 841.05 ft bls (driller's depth). **Thin section:** G2984–850.85, G2984–861.40
obi depth: 873.5–878.2 ft bls Driller's depth: 878.05–882.75 ft bls	**Lithofacies:** Interlaminated-interbedded foraminifer lime mudstone, wackestone, and packstone **Depositional texture:** Interlaminated-interbedded smaller benthic foraminifer and globular planktic foraminifer mudstone and wackestone, and mud-dominated packstone with minor very clay-rich wackestone thick laminations and very thin beds **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thinly laminated to thinly bedded **Trace fossils:** Sparse traces, but no taxa identified **Ichnofabrics:** Ichnofabric index 1–2 **Ichnofacies:** Not determined **Carbonate grains:** Mainly smaller benthic foraminifera, globular planktic foraminifera, and silt to very fine sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines **Accessory grains:** 1–15 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite); minor very clay-rich thick laminae and very thin beds **Porosity and permeability:** Less than 1 percent visible porosity (intraparticle) and low permeability **Depositional environment:** Lowstand wedge at ramp margin
obi depth: 878.2–881.0 ft bls Driller's depth: 882.75–885.75 ft bls	**Lithofacies:** Foraminiferal packstone and grainstone **Depositional texture:** Smaller benthic foraminifer and globular planktic foraminifer mud- and grain-dominated packstone and grainstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Very thickly bedded **Trace fossils:** Generally biomottled texture, but no trace fossil taxonomy identified **Ichnofabrics:** Ichnofabric index 1 and 5 **Ichnofacies:** None identified **Carbonate grains:** Mainly smaller benthic foraminifera, globular planktic foraminifera, and medium to coarse sand-sized bivalve fragments; minor fine-medium sand-sized unidentified skeletal fragments, ostracods, echinoid spines **Accessory grains:** 5 percent very fine to fine sand-sized, subangular to angular, well sorted quartz grains; 5–7 percent fine sand-sized black phosphorite grains **Porosity and permeability:** 3–7 percent interparticle porosity, 1–3 percent intraparticle porosity; 4–10 percent total porosity and low permeability **Depositional environments:** Lowstand wedge at ramp margin **Comments:** A few silicified areas forming chert nodules
obi depth: 881.0–902.85	**Lithofacies:** Interlaminated marl and foraminifer wackestone **Depositional texture:** Interlaminated marl and smaller benthic foraminifer and globular planktic foraminifer wackestone **Color:** Yellowish gray 5Y 8/1

ft bls Driller's depth: 885.75–907.1 ft bls	**Sedimentary structures:** Thinly laminated to thinly bedded to completely burrow mottled **Trace fossils:** Scarce to abundant unidentified trace fossils, minor *Zoophycos* **Ichnofabrics:** Ichnofabric index 1–5 **Ichnofacies:** *Cruziana* or *Zoophycos* with a *Glossifungites* ichnofacies capping the cycle **Carbonate grains:** Mainly smaller benthic foraminifera, globular planktic foraminifera, and silt to very fine sand-sized unidentified skeletal fragments; minor ostracods, echinoid spines. Foraminifera observed in thin section G2984–898.00 include *Globigerinoides* gr. *trilobus*, total of 27 planktic foraminifera, total of 50 smaller benthic foraminifera. Foraminifera observed in thin section G2984–899.98 include bolivinids (dominant), rotaliids, planktic foraminifera, smaller benthic foraminifera (dominant). Foraminifera observed in thin section G2984–903.40 include bolivinids, rotaliids, planktic foraminifera, smaller benthic foraminifera (dominant) **Accessory grains:** 1–15 percent silt to very fine sand-sized, angular, well sorted quartz grains; 1–3 percent silt to very fine sand-sized black grains (probably mainly phosphorite); common very clay-rich thick laminae and very thin beds **XRD mineralogy:** At 898.00 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 1.6 percent, calcite 26.1 percent, dolomite and [Fe,Ca]-dolomite 14.7 percent, total clay minerals 57.6 percent); clay mineralogy in weight percentage (illite/smectite* 8.2 percent, sepiolite 23.7 percent, palygorskite 25.7 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** Less than 1 percent visible porosity (intraparticle) and low permeability **Depositional environment:** Outer ramp **Comments:** Discontinuity and top of depositional sequence Ar5 at 885.75ft bls (driller's depth) is a surface of marine erosion with *Thalassinoides*-dominated *Glossifungites* ichnofacies developed for about 5 in. below the upper bounding surface of erosion. Upper several inches of cycle are a firmground. Major shift in grain size at 885.75 ft bls (driller's depth)—coarse overlying fine. Cycle fines upward and grainstones thin upward **Thin section:** G2984–898.00, G2984–899.98, G2984–903.40

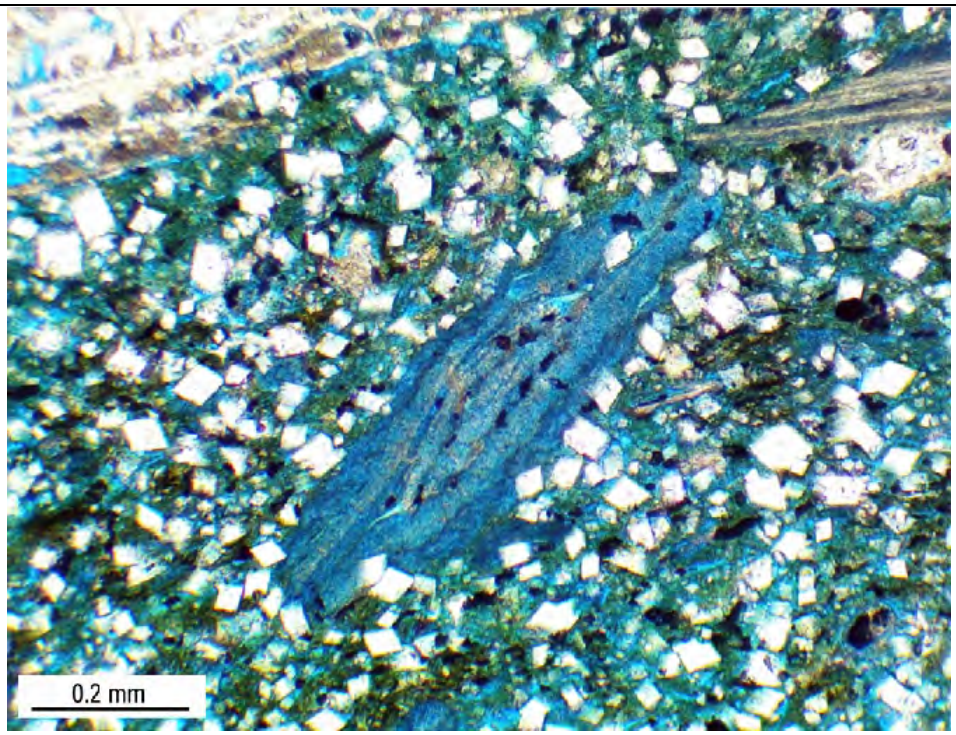
	 Photomicrograph from thin section G2984–903.40 that shows a foraminifer wackestone, with planktic foraminifera (p). Driller's depth of thin section is 903.40 ft bls.
obi depth: 902.85– 907.0 ft bls Driller's depth: 907.1– 910.9 ft bls	**Lithofacies:** Terrigenous mudstone **Depositional texture:** Terrigenous mudstone **Color:** Yellowish gray 5Y 8/1 **Trace fossils:** *Thalassinoides*, one possible *Terebellina* (*Schaubcylindrichnus*) at 907.8 ft bls 9(driller's depth) **Ichnofabrics:** Ichnofabric index 1–5 **Ichnofacies:** *Cruziana* or *Zoophycos* with a *Glossifungites* cap **Carbonate grains:** Small benthic and globular planktic foraminifera and unidentified grains **Accessory grains:** Very fine sand to medium sand-sized phosphorite grains filling *Thalassinoides* burrows at cycle top **Porosity and permeability:** Less than 1 percent visible intraparticle porosity and low permeability **Depositional environment:** Outer ramp **Comments:** Major shift in lithology across top of this interval at 907.1 ft bls (driller's depth). Cycle top is at 908.5 ft bls (driller's depth). Uppermost 3 in. is a firmground characterized by a *Thalassinoides*-dominated *Glossifungites* ichnofacies. Uppermost 3 in. is silicified as chert—all is part of the upper capping *Glossifungites* ichnofacies
obi depth: 907.0– 920.6 ft bls	**Lithofacies:** Terrigenous mudstone **Depositional texture:** Terrigenous mudstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Thinly laminated to thinly bedded to completely burrowed mottled

Driller's depth: 910.9–924.5 ft bls	**Trace fossils:** Scarce to abundant unidentified trace fossils, common *Zoophycos* **Ichnofabrics:** Ichnofabric index 1–5 **Ichnofacies:** *Cruziana* or *Zoophycos* **Carbonate grains:** 1–2 percent very fine sand-sized unidentified skeletal fragments. Foraminifera observed in thin section G2984–923.95 are a total of two smaller benthic foraminifera **Accessory grains:** 1–2 percent silt to very fine sand-sized quartz grains; 1–2 percent silt to very fine sand-sized black grains (probably mainly phosphorite) **XRD mineralogy:** At 914.65 ft bls (driller's depth), whole rock mineralogy in weight percentage (quartz 1.8 percent, calcite 0.8 percent, dolomite and [Fe,Ca]-dolomite 9.6 percent, total clay minerals 87.8 percent); clay mineralogy in weight percentage (illite/smectite* 10.9 percent, sepiolite 16.4 percent, palygorskite 60.5 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **XRD mineralogy:** At 923.95 ft bls (driller's depth), whole rock mineralogy in weight percentage is quartz 2.4 percent, calcite 2.7 percent, dolomite and [Fe,Ca]-dolomite 3.8 percent, total clay minerals 91.0 percent); clay mineralogy in weight percentage (illite/smectite* 6.9 percent, sepiolite 13.0 percent, palygorskite 71.1 percent). *Mixed-layer illite/smectite that contains 70–80 percent smectite layers **Porosity and permeability:** Less than 1 percent visible intraparticle porosity and low permeability **Depositional environment:** Outer ramp **Thin section:** G2984–923.95  Photomicrograph from thin section G2984–923.95 that shows an outer ramp terrigenous mudstone. Driller's depth of thin section is 923.95 ft bls.
obi depth: 920.6–	**Lithofacies:** Dolomitic *Hyotissa* sp. aff. *H. haitensis* rudstone **Depositional texture:** Dolomitic *Hyotissa* sp. aff. *H. haitensis* rudstone with dolomitized bivalve wackestone matrix

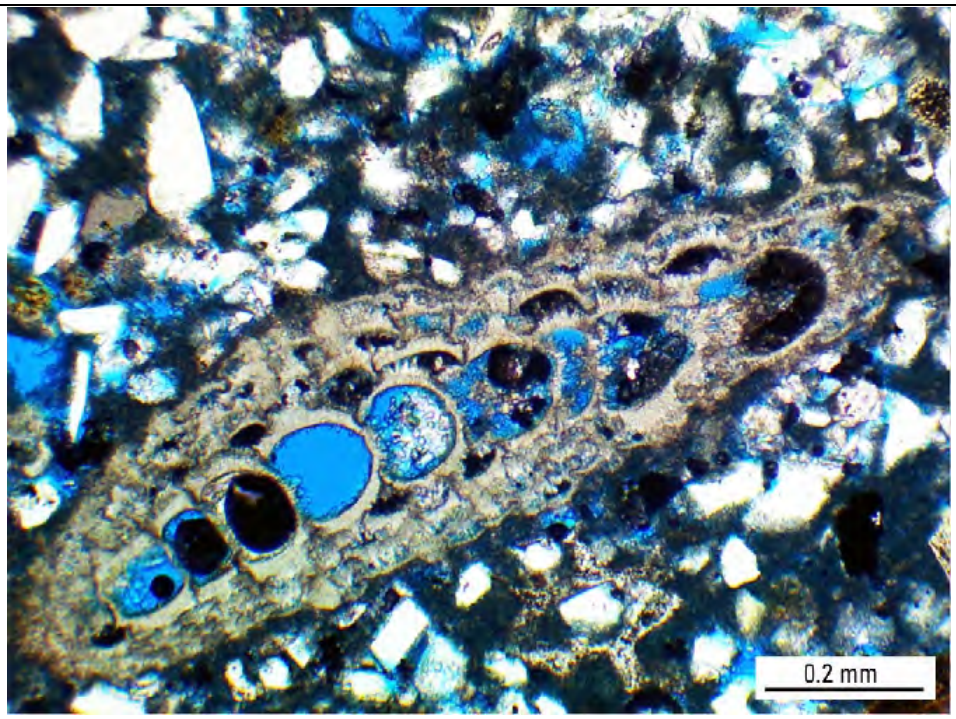
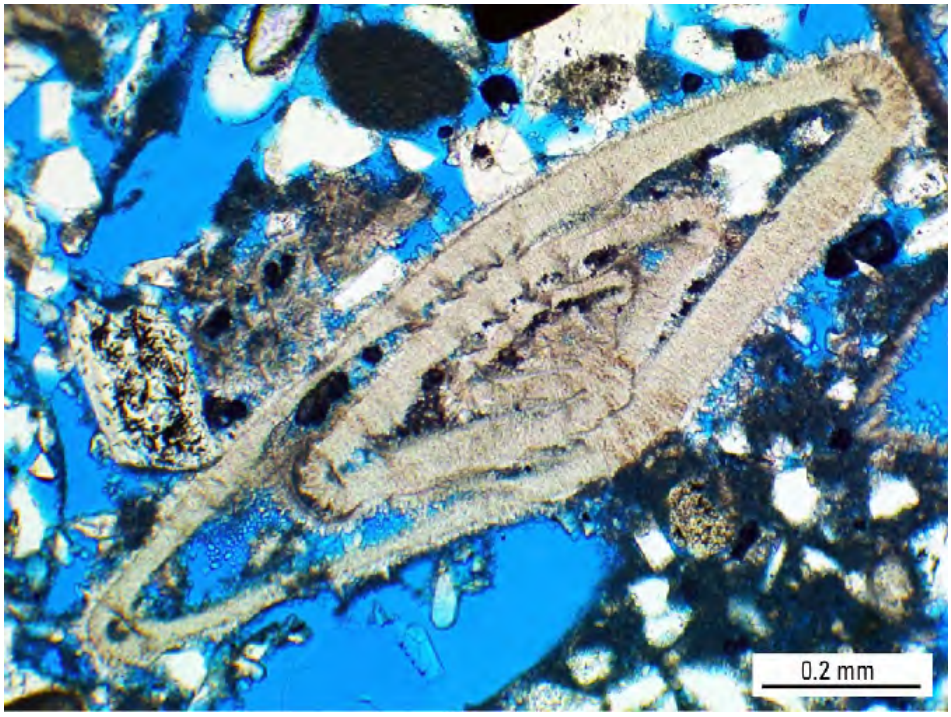
924.8 ft bls Driller's depth: 924.5–928.7 ft bls	**Color:** Yellowish gray 5Y 7/2 with white N9 *Hyotissa* sp. aff. *H. haitensis* **Ichnofabrics:** Ichnofabric index 5? **Carbonate grains:** Bivalves (commonly disarticulated), benthic and larger foraminifera (including amphisteginids), echinoid plates and spines. Foraminifera observed in thin section G2984–924.75 include *Globoquadrina* sp., *Globigerinoides bisphericus*?, *Globigerinoides* gr. *trilobus*, miliolids, lenticulinids, rotaliids, planktic foraminifera, smaller benthic foraminifera. Foraminifera observed in thin section G2984–926.45 include bryozoans, smaller benthic foraminifera **Accessory grains:** 1–2 percent very fine-sized, angular, well-sorted quartz grains; 3–10 percent fine sand size to small pebble size, angular to well-rounded phosphorite grains **Porosity and permeability:** 2 percent bored porosity, 1 percent interparticle porosity, 1 percent intraparticle porosity, 5 percent vuggy porosity; 9 percent total porosity and low permeability **Depositional environment:** Low energy lagoon or marine bay **Comments:** At the top of composite depositional sequence Ar1 and depositional sequence Ar4 phosphatization and formation of a hardground is evident along this uppermost part of the interval at 924.5 ft bls (driller's depth), irregular vugs extend downward from the upper surface for about 1 ft with their walls phosphatized, possibly a drowning unconformity with dissolution along the surface and below, and phosphatization during a long period of submersion without sediment accumulation; globular planktic foraminifera within the phosphatized internal fill of the vugs is suggestive of infill during relative higher sea-level conditions. Drowning unconformity **Thin section:** G2984–924.75, G2984–926.45
obi depth: 924.8–926.1 ft bls Driller's depth: 928.7–930.5 ft bls	**Lithofacies:** Sucrosic dolomite **Depositional texture:** Sucrosic dolomite **Color:** Yellowish gray 5Y 7/2 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** *Thalassinoides, Zoophycos?*, *Planolites?* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** None determined **Accessory grains:** 40 percent sucrosic dolomite **Porosity and permeability:** 3 percent vuggy porosity; 3 percent total porosity and low permeability **Depositional environment:** Low-energy restricted lagoon or marine bay on inner shelf, subtidal to intertidal
obi depth: 926.1–934 ft bls Driller's depth: 930.5–938.0 ft	**Lithofacies:** Dolomitic *Hyotissa* sp. aff. *H. haitensis* rudstone **Depositional texture:** Dolomitic *Hyotissa* sp. aff. *H. haitensis* rudstone with dolomitic bivalve wackestone matrix **Color:** Yellowish gray 5Y 7/2 with white N9 *Hyotissa* sp. aff. *H. haitensis* **Ichnofabrics:** Ichnofabric index 5? **Carbonate grains:** Bivalves (commonly disarticulated), benthic and larger foraminifera (including amphisteginids), echinoid plates and spines. Foraminifera observed in thin section G2984–936.00 total of two *Nummulites panamensis*. **Accessory grains:** 1–2 percent medium sand to coarse-sized (mostly coarse sand size), subrounded, moderately sorted quartz grains; 3–7 percent fine sand size to small pebble

bls	size, angular to well-rounded phosphorite grains **Porosity and permeability:** 2 percent bored porosity, 1 percent interparticle porosity, 1 percent intraparticle porosity, 5 percent vuggy porosity; 9 percent total porosity and low permeability **Depositional environment:** Low-energy lagoon or marine bay on inner shelf, shallow subtidal **Thin section:** G2984–936.00  Photograph from core that shows *Hyotissa* sp. aff. *H. haitensis* from a driller's depth of 935.3 ft bls. Photograph by G. Lynn Wingard, U.S. Geological Survey.

Photograph from core that shows *Hyotissa* sp. aff. *H. haitensis* from a driller's depth of 935.3 ft bls. Note the "honeycomb" or "vesicular" ultrastructure of the interior of the shell and thin parallel lamellae, which is typical of Gryphaeidae oysters, either *Hyotissa* sp. or *Pycnodonte* sp. (Stenzel, 1971). Other than *Hyotissa* sp. or *Pycnodonte* sp., no other Gryphaeidae oysters of Miocene age have this "vesicular" ultrastructure. Also, there are abundant listings in the literature to *Hyotissa* sp. in the Miocene of Florida and the east coast of the United States but very rare mention of *Pycnodonte* sp. (Olsson and Petit, 1964; Woodring, 1982; Ward, 1992); thus, the specimens found in the lower Arcadia Formation of the G–2984 test corehole are assigned to *Hyotissa* sp. aff. *H. haitensis*. Photograph by G. Lynn Wingard, U.S. Geological Survey.

	 Photomicrograph from thin section G2984–936.00 that shows a specimen of *Nummulites* (center of photo). Driller's depth of thin section is 936.00 ft bls.
obi depth: 934–939 ft bls Driller's depth: 938–943.2 ft bls	**Lithofacies:** Sandy, phosphatic skeletal packstone **Depositional texture:** Sandy, phosphatic, bivalve floatstone with skeletal mud-dominated packstone matrix **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Ichnofabrics:** Ichnofabric index 5 **Carbonate grains:** Mainly bivalves (commonly disarticulated) and unidentified skeletal fragments, smaller and larger benthic foraminifera. Foraminifera observed in thin section G2984–942.10 include *Amphistegina* sp., total of two *Nummulites panamensis*, total of 10 *Miogypsina* gr. *gunteri*, smaller benthic foraminifera **Accessory grains:** 15–20 percent very fine to medium sand-sized (mostly very fine sand size), angular to subrounded (mainly angular), well-sorted quartz grains; 10–20 percent very fine to fine sand size, well-rounded phosphorite grains; 1 percent plagioclase **Porosity and permeability:** 2 percent moldic porosity, 1 percent interparticle porosity, 1 percent intraparticle porosity; 4 percent total porosity and low permeability **Depositional environment:** Marine offshore or lower shoreface to upper shoreface at uppermost part of cycle **Comments:** Upper phosphatized surface is at top of depositional sequence Ar3 at 938 ft bls (driller's depth). Karstic dissolution with downward solution piping from upper surface. Dissolution cavities and upper surface encrusted with black phosphorite. Drowning unconformity **Thin section:** G2984–942.10
obi depth:	**Lithofacies:** Sandy, phosphatic skeletal packstone **Depositional texture:** Sandy, phosphatic, bivalve floatstone with skeletal mud-dominated

939– 944.5 ft bls Driller's depth: 943.2– 948.5 ft bls	packstone matrix **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** *Rhizocorallium*? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Carbonate grains:** Mainly bivalves (commonly disarticulated), smaller and larger benthic foraminifera (including abraded amphisteginids), echinoids, ostracods. Foraminifera observed in thin section G2984–945.15 include total of one *Miogypsina* gr. *gunteri*, smaller benthic foraminifera. Foraminifera observed in thin section G2984–948.06 include *Amphistegina* sp., total of two *Nummulites panamensis*, total of one *Miogypsina* gr. *gunteri*, smaller benthic foraminifera **Accessory grains:** 15–20 percent very fine to medium sand-sized (mostly very fine sand size), angular to subrounded (mainly angular), well-sorted quartz grains; 10–20 percent very fine to fine sand-sized, well-rounded phosphorite grains; 1 percent plagioclase **Porosity and permeability:** 2–5 percent moldic porosity, 1 percent interparticle porosity, 1 percent intraparticle porosity; 4–7 percent total porosity and low permeability **Depositional environment:** Lower shoreface to upper shoreface, shallow subtidal **Thin section:** G2984–945.15, G2984–948.06
obi depth: 944.5– 963.4 ft bls Driller's depth: 948.5– 966.9 ft bls	**Lithofacies:** Phosphatic, calcareous sandstone **Depositional texture:** Phosphatic, calcareous quartz sandstone **Color:** Yellowish gray 5Y 7/2 **Sedimentary structures:** Burrow mottled throughout interval **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Quartz grains:** 55 percent very fine to medium sand size (mostly very fine sand size), angular to subrounded (mostly angular), well sorted quartz grains **Carbonate grains:** Mainly smaller benthic foraminifera, fragmented bivalves, larger benthic foraminifera (including highly abraded amphisteginids), echinoid plates and spines, minor globular planktic foraminifera, fragmented branching red algae, ostracods. Foraminifera observed in thin section G2948–966.08 include *Amphistegina* sp., total of 19 *Nummulites panamensis*, total of five *Miogypsina* gr. *gunteri* **Accessory grains:** 15–25 percent very fine to medium sand-sized, well-rounded phosphorite grains; black N1 to dark gray N3 and grayish orange 10YR 7/4; 1 percent plagioclase **Porosity and permeability:** 5–10 percent moldic porosity, 5 percent interparticle porosity; 10–15 percent total porosity and low permeability **Depositional environment:** Marine offshore or lower shoreface **Thin section:** G2984–966.08

	 Photomicrograph from thin section G2984–966.08 that shows a specimen of *Miogypsina*. Driller's depth of thin section is 966.08 ft bls.  Photomicrograph from thin section G2984–966.08 that shows a specimen of *Nummulites* cf. *panamensis*. Driller's depth of thin section is 966.08 ft bls.
obi depth: 963.4–	**Lithofacies:** Phosphatic, calcareous sandstone **Depositional texture:** Phosphatic, calcareous quartz sandstone **Color:** Light gray N7

968.7 ft bls Driller's depth: 966.9–973 ft bls	**Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** *Rhizocorallium*? **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** *Cruziana*? **Quartz grains:** 55 percent very fine to medium sand size (mostly very fine sand size), angular to subrounded (mostly angular), well sorted quartz grains **Carbonate grains:** Mainly fragmented bivalves, larger benthic foraminifera (including nummulitids, amphisteginids), echinoid plates and spines, minor globular planktic foraminifera. **Accessory grains:** 15–25 percent very fine to fine sand-sized, well-rounded phosphorite grains; black N1 to dark gray N3 and grayish orange 10YR 7/4; 1 percent plagioclase **Porosity and permeability:** 5–10 percent moldic porosity, 5 percent interparticle porosity; 10–15 percent total porosity and low permeability **Depositional environment:** Marine offshore or lower shoreface **Comments:** Coarsens upward with a centimeter-scale thick red algal? floatstone cap
obi depth: 968.7 – 972.7 ft bls Driller's depth: 973–977.0 ft bls	**Lithofacies:** Phosphatic, calcareous sand **Depositional texture:** Phosphatic, skeletal fragment quartz sand **Color:** Light gray N7 **Sedimentary structures:** Burrow mottled throughout interval **Ichnofabrics:** Ichnofabric index 5 **Quartz grains:** 65 percent very fine to fine sand size (mostly very fine sand size), angular to subrounded (mostly angular), well sorted quartz grains **Carbonate grains:** Mainly small unidentified skeletal fragments, fragmented bivalves, smaller benthic foraminifera **Accessory grains:** 15–25 percent very fine to fine sand-sized, well-rounded phosphorite grains; black N1 to dark gray N3 and grayish orange 10YR 7/4; 1 percent plagioclase **Porosity and permeability:** 25 percent interparticle porosity; 25 percent total porosity and low permeability **Depositional environment:** Possibly lower shoreface to upper shoreface or marine offshore **Comments:** Slightly consolidated sand grains
obi depth: 972.7–983.0 ft bls Driller's depth: 977.0–983.0 ft bls	No recovery
obi depth: 983.0–984.3 ft	**Lithofacies:** Phosphatic, calcareous sandstone **Depositional texture:** Phosphatic, skeletal fragment quartz sandstone **Color:** Grades from dark yellowish brown 10YR 4/2 to medium light gray N6 quartz sandstone and very pale orange 10YR 8/2 carbonate grains and trace fossil walls

bls Driller's depth: 983.0–984.3 ft bls	**Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Common *Ophiomorpha* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Distal *Skolithos*? **Quartz grains:** 40 percent very fine to medium sand size (mostly fine sand size), angular to subrounded, moderately sorted quartz grains **Carbonate grains:** Mainly bivalve fragments, echinoid plates, benthic foraminifera (including nummulitids and amphisteginid? larger benthic foraminifera. Foraminifera observed in thin section G2984–984.23 include *Amphistegina* sp. **Accessory grains:** 25–35 percent very fine to medium sand-sized (mostly fine sand-sized grains), well-rounded phosphorite grains; black N1 to dark gray N3 and grayish orange 10YR 7/4 **Porosity and permeability:** 1 percent interparticle porosity, 1 percent intraparticle porosity, 1–5 percent moldic porosity; 4–7 percent total porosity and low permeability **Depositional environment:** Possibly lower shoreface to upper shoreface, shallow subtidal **Comments:** Coarsens upward **Thin section:** G2984–984.23
obi depth: 984.3–986.3 ft bls Driller's depth: 984.3–986.3 ft bls	**Lithofacies:** Phosphatic, calcareous sand **Depositional texture:** Phosphatic, skeletal fragment quartz sand **Color:** Dark yellowish brown 10YR 4/2 **Trace fossils:** Burrow mottled throughout interval **Ichnofabrics:** Ichnofabric index 5 **Quartz grains:** 40 percent very fine to fine sand size, angular to subrounded, well sorted quartz grains **Carbonate grains:** Mainly fragmented bivalve fragments, abraded echinoid plates, highly abraded benthic foraminifera **Accessory grains:** 25–35 percent very fine to fine sand-sized, well-rounded phosphorite grains; black N1 to dark gray N3 and grayish orange 10YR 7/4; 1 percent plagioclase **Porosity and permeability:** 10–30 percent interparticle porosity, 1 percent intraparticle porosity, 1–10 percent moldic porosity; 12–32 percent total porosity and relatively low to moderate permeability **Depositional environment:** Marine offshore or lower shoreface **Comments:** Mostly slightly consolidated or entirely unconsolidated sand grains
obi depth: 986.3–992.0 ft bls Driller's depth: 986.3–993.0 ft bls	**Lithofacies:** Phosphatic, calcareous sandstone **Depositional texture:** Phosphatic, skeletal fragment quartz sandstone **Color:** Grades from dark yellowish brown 10YR 4/2 to medium light gray N6 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Common *Ophiomorpha nodosa*, minor local *Phycosiphon* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Distal *Skolithos* **Quartz grains:** 40 percent quartz grains, very fine to medium sand size (mostly fine sand size), angular to subrounded, moderately sorted **Carbonate grains:** Mainly bivalve fragments, echinoid plates and spines, benthic foraminifera (including nummulitid and amphisteginid larger benthic foraminifera),

ostracods. Foraminifera observed in thin section G2984–986.50 include a total of one *Nummulites panamensis*, *Neorotalia mexicana*. Foraminifera observed in thin section G2984–990.28 include *Amphistegina* sp., total of 53 *Nummulites panamensis*, *Neorotalia mexicana*, *Heterostegina* sp. fragments

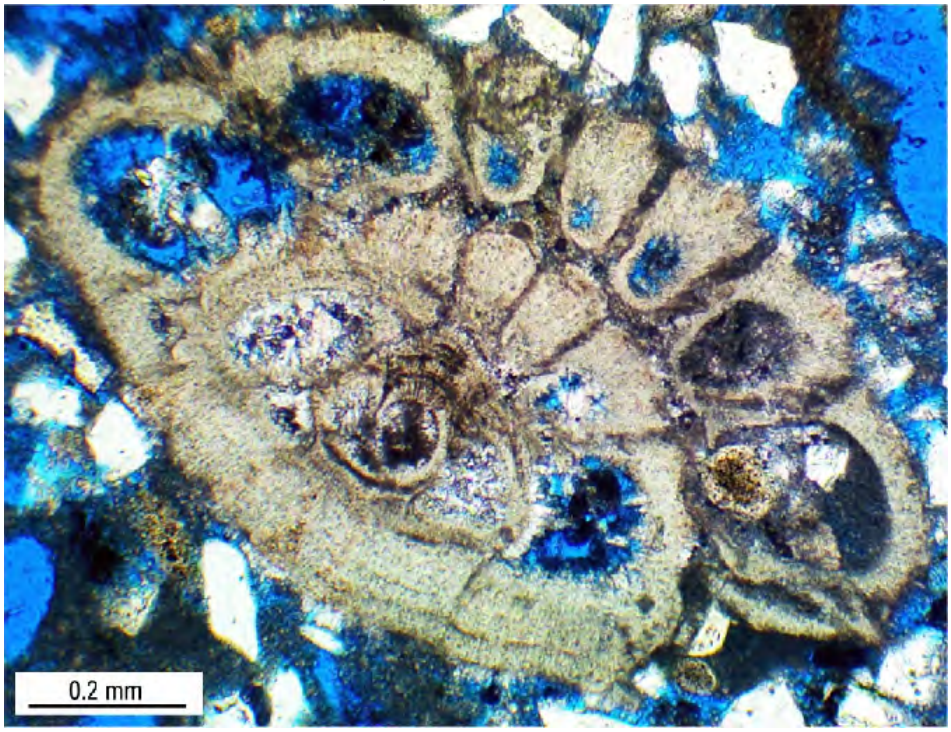
Accessory grains: 25–35 percent very fine to medium sand-sized (mostly fine sand size grains), well-rounded phosphorite grains; black N1 to dark gray N3 and grayish orange 10YR 7/4; 1 percent plagioclase

Porosity and permeability: 10–30 percent interparticle porosity, 1 percent intraparticle porosity, 1–10 percent moldic porosity; 12–32 percent total porosity and relatively low to moderate permeability

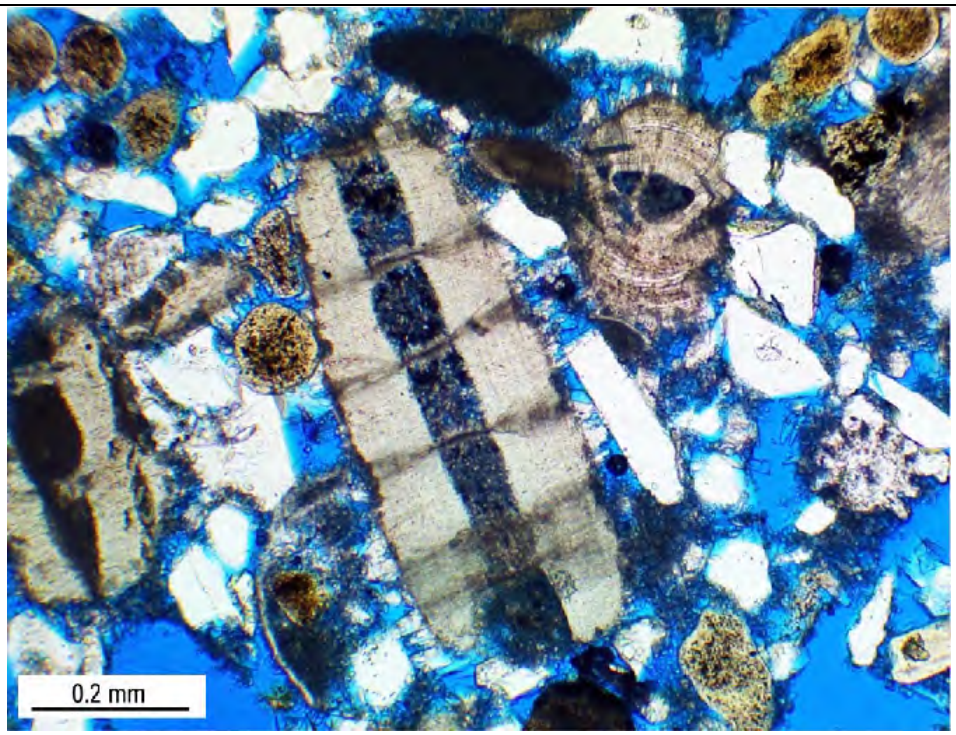
Depositional environment: Marine offshore or lower shoreface

Comments: Micrite mud commonly occludes interparticle space locally; abrupt shift in lithofacies at 986.3 ft bls (driller's depth) possibly indicating a high frequency cycle top at 986.3 ft bls (driller's depth); quantity of micrite increases upward to top of cycle

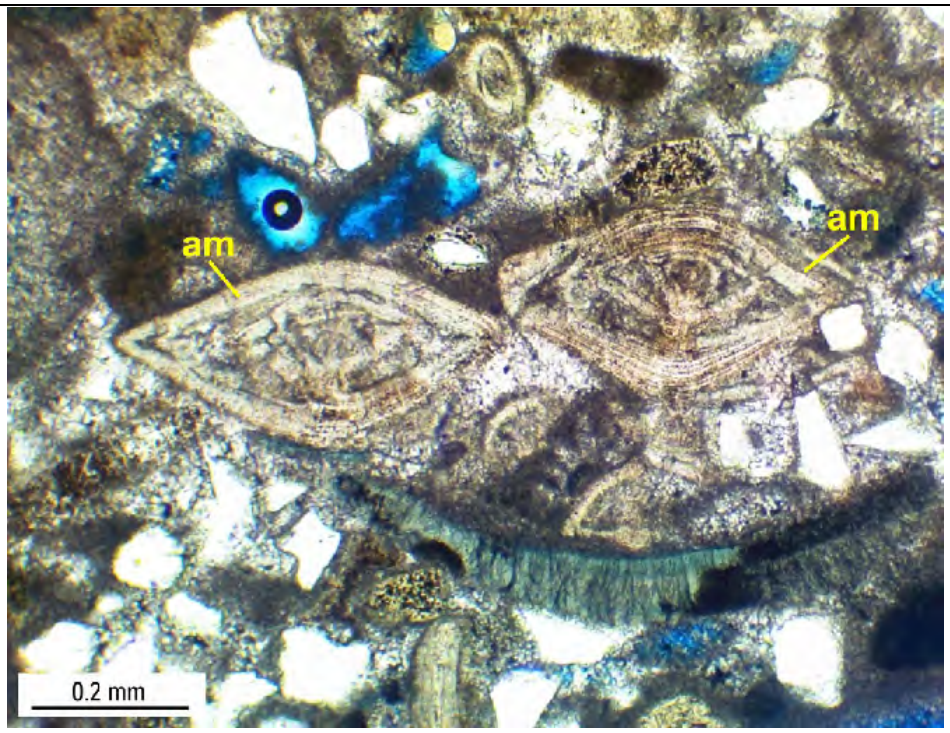
Thin section: G2984–986.50, G2984–990.28

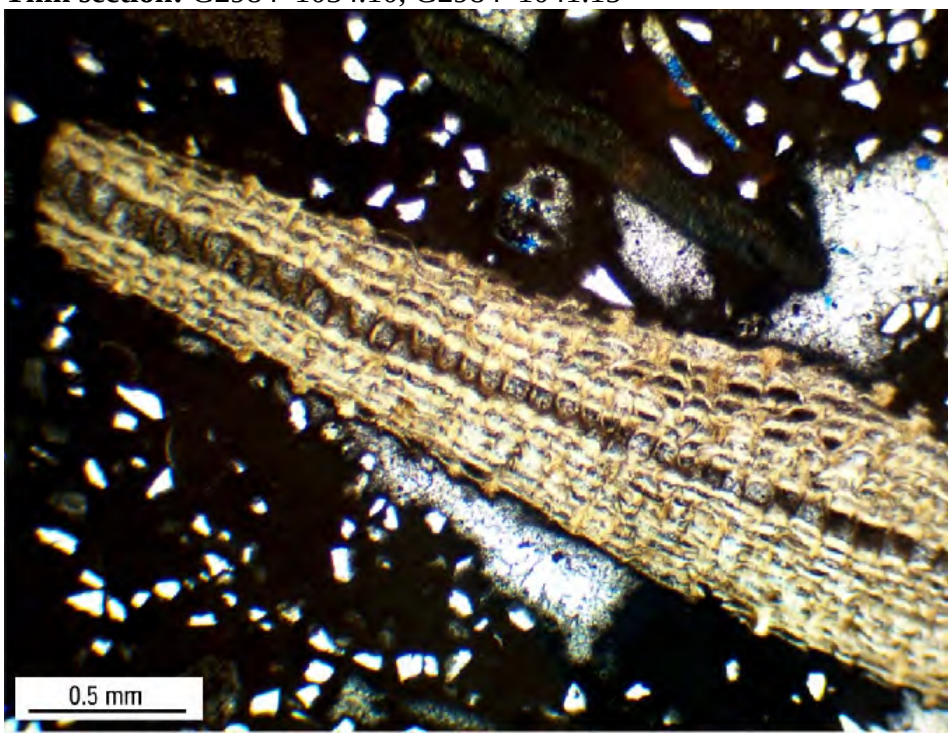


Photomicrograph from thin section G2984–986.50 that shows a specimen of *Neorotalia*. Driller's depth of thin section is 986.50 ft bls.

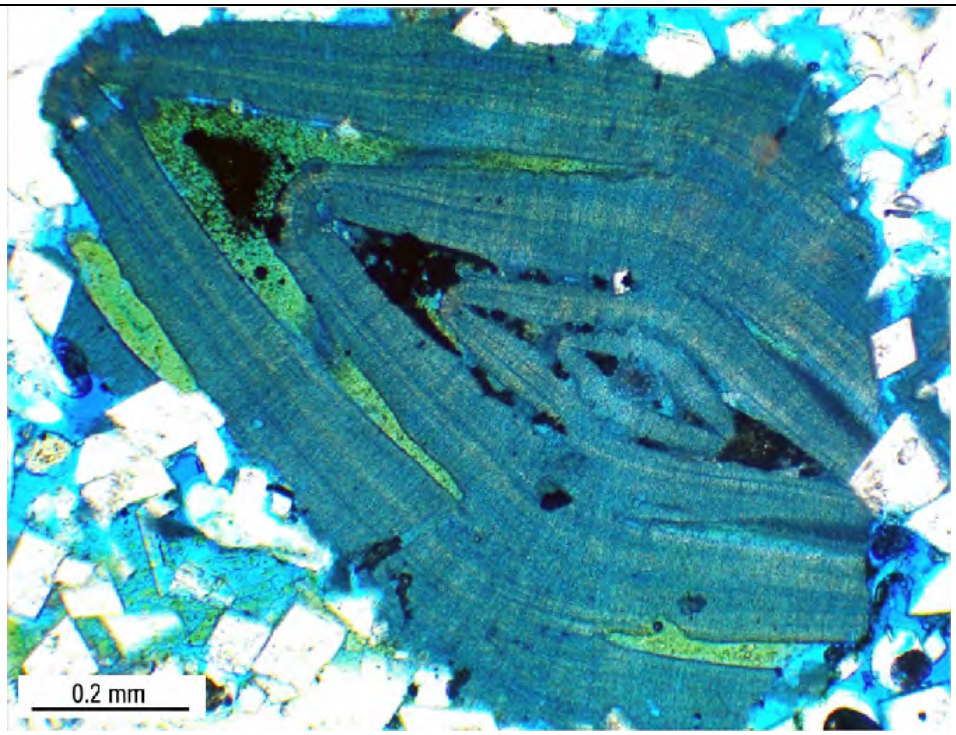
	 Photomicrograph from thin section G2984–990.28 that shows a fragment of *Heterostegina* (center of photograph). Driller's depth of thin section is 990.28 ft bls.
obi depth: 992.0–998.0 ft bls Driller's depth: 993.0–999.0 ft bls	No recovery
obi depth: 998.0–1,003.8 ft bls Driller's depth: 999.0–1,003.8 ft bls	**Lithofacies:** Phosphatic, calcareous sandstone **Depositional texture:** Phosphatic, skeletal fragment quartz sandstone **Color:** Grades from dark yellowish brown 10YR 4/2 to medium light gray N6 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Common *Ophiomorpha nodosa*, minor local *Phycosiphon* **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Distal *Skolithos* **Quartz grains:** 40 percent quartz grains, very fine to medium sand size (mostly fine sand size), angular to subrounded, moderately sorted **Carbonate grains:** Mainly bivalve fragments, echinoid plates and spines, benthic foraminifera (including nummulitid and amphisteginid larger benthic foraminifera, ostracods. Foraminifera observed in thin section G2984–999.23 *Amphistegina* sp.,

	Neorotalia mexicana? **Accessory grains:** 25–35 percent very fine to medium sand-sized (mostly fine sand-sized grains), well-rounded phosphorite grains; black N1 to dark gray N3 and grayish orange 10YR 7/4; 1 percent plagioclase **Porosity and permeability:** 10–20 percent interparticle porosity, 1 percent intraparticle porosity, 1–10 percent moldic porosity; 12–31 percent total porosity and relatively low to moderate permeability **Depositional environment:** Marine offshore or lower shoreface **Comments:** Micrite mud commonly occludes interparticle space locally **Thin section:** G2984–999.23
obi depth: 1,003.8– 1,019.6 ft bls Driller's depth: 1,003.8– 1,019.6 ft bls	**Lithofacies:** Bivalve rudstone **Depositional texture:** Bivalve rudstone and floatstone with sandy skeletal wackestone to skeletal mud- and grain-dominated packstone matrix and sandy skeletal grainstone matrix in uppermost part of interval **Color:** Very light gray N8 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Not determined **Ichnofabrics:** Ichnofabric index 4–5 **Ichnofacies:** Not determined **Carbonate grains:** Mainly large gastropods and bivalves (commonly disarticulated), benthic forams (common rotaliids), echinoids, fragmented branching red algae in uppermost part of interval. Foraminifera observed in thin section G2984–1003.53 include *Amphistegina* sp., total of one *Nummulites panamensis*, *Neorotalia Mexicana*. Foraminifera observed in thin section G2984–1015.90 include *Amphistegina* sp., *Neorotalia mexicana*, smaller benthic foraminifera **Accessory grains:** 15–20 percent matrix of very fine to fine sand-sized, angular to subrounded, well-sorted quartz grains; 1–4 percent very fine to fine sand-sized, well-rounded phosphorite grains; 1 percent plagioclase **Porosity and permeability:** 5–18 percent moldic porosity, 1 percent interparticle porosity, 1 percent intraparticle porosity; 7–20 percent total porosity and relatively low to moderate permeability **Depositional environment:** Marine offshore or lower shoreface to upper shoreface at uppermost part of depositional sequence Ar2 **Comments:** Top of depositional sequence Ar2 at 1,003.8 ft bls (driller's depth). Sediment from base of cycle above penetrates downward through dissolutional pore system of Ar2 cycle a distance of about 1.3 ft from the top of depositional sequence Ar2. Interval becomes more grain rich toward the top, indicating increasing environmental energy conditions upward or shoaling upward **Thin section:** G2984–1003.53, G2984–1015.90

	 Photomicrograph from thin section G2984–1003.53 that shows specimens of *Amphistegina* (am). Driller's depth of thin section is 1,003.53 ft bls.
obi depth: 1,019.6–1,034.0 ft bls Driller's depth: 1,019.6–1,034.0 ft bls	**Lithofacies:** Sandy, skeletal fragment, benthic foraminifer packstone **Depositional texture:** Sandy, skeletal fragment, benthic foraminifer grain-dominated packstone **Color:** Yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Not determined **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Not determined **Carbonate grains:** Mainly unidentified skeletal fragments, benthic foraminifera (including rotaliids), bivalve fragments, echinoids, globular planktic foraminifera. Foraminifera observed in thin section G2984–1025.75 include *Amphistegina* sp., smaller benthic foraminifera. Foraminifera observed in thin section G2984–1026.15 include *Amphistegina* sp., *Neorotalia mexicana*, smaller benthic foraminifera **Accessory grains:** 35–45 percent very fine to fine sand-sized, angular to subrounded, well-sorted quartz grains; 1 percent very fine to fine sand-sized well-rounded phosphorite grains; minor dolomite rhombs; 1 percent plagioclase **Porosity and permeability:** 10 percent interparticle porosity, 1 percent intraparticle porosity, 1 percent moldic porosity; 12 percent total porosity and low permeability **Depositional environment:** Marine offshore **Comments:** Grades upward into bivalve rudstone above. Coarsens upward and dolomite rhombs increase in numbers upward **Thin section:** G2984–1025.75, G2984–1026.15
obi depth:	**Lithofacies:** Molluscan rudstone **Depositional texture:** Gastropod and bivalve rudstone with sandy skeletal wackestone to

1,034.0–1,046.3 ft bls Driller's depth: 1,034.0–1,046.3 ft bls	skeletal mud- and grain-dominated packstone matrix **Color:** Very light gray N8 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Not determined **Ichnofabrics:** Ichnofabric index 4–5 **Ichnofacies:** Not determined **Carbonate grains:** Mainly large gastropods and bivalves (commonly disarticulated), larger and smaller benthic forams, echinoids, encrusting bryozoans, rhodoliths (up to 2.5 cm in diameter), lepidocyclinid. Foraminifera observed in thin section G2984–1034.10 include *Amphistegina* sp., total of one *Nummulites panamensis*, *Neorotalia mexicana*, smaller benthic foraminifera. Foraminifera observed in thin section G2984–1041.15 include *Amphistegina* sp., *Lepidocyclina vaughani*?, smaller benthic foraminifera **Accessory grains:** 2–20 percent very fine to fine sand-sized, angular to subrounded, well-sorted quartz grains; minor dolomite rhombs (sucrosic) **Porosity and permeability:** 17 percent moldic porosity, 1 percent interparticle porosity, 1 percent intraparticle porosity; 19 percent total porosity and relatively low to moderate permeability **Depositional environment:** Marine lower shoreface to offshore. **Comments:** Top of depositional sequence Ar1 at 1,034 ft bls (driller's depth). Phosphatized karstic cap with irregular dissolution downward about 1 ft from the depositional sequence top. Coarsens upward and dolomite rhombs increase in numbers upward **Thin section:** G2984–1034.10, G2984–1041.15  Photomicrograph from thin section G2984–1041.15 that shows a specimen of *Lepidocyclina vaughani*?. Driller's depth of thin section is 1,041.15 ft bls.
obi	**Lithofacies:** Calcareous sandstone

depth: 1,046.3–1,050.3 ft bls Driller's depth: 1,046.3–1,050.0 ft bls	**Depositional texture:** Skeletal fragment quartz sandstone **Color:** Yellowish gray 5Y 8/1 to very light gray N8 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Not determined **Ichnofabrics:** Ichnofabric index 4–5 **Ichnofacies:** Not determined **Quartz grains:** 50–55 percent very fine to fine sand size (coarsens upward to very fine to medium sand-sized grains), angular to subrounded, well sorted quartz grains **Carbonate grains:** Mainly benthic foraminifera (minor nummulitids), bivalve, fragments, echinoids, ostracods, rhodoliths (up to 2.5 cm in diameter) **Accessory grains:** 5–7 percent very fine to fine sand-sized (coarsens upward to very fine to medium sand-sized grains), well-rounded phosphorite grains; minor dolomite rhombs (sucrosic); 1 percent plagioclase **Porosity and permeability:** 5–20 percent interparticle porosity, 1 percent intraparticle porosity, 1 percent moldic porosity; 7–22 percent total porosity and relatively low to moderate permeability **Depositional environment:** Marine offshore to lower shoreface **Comments:** Grades upward into interval above composed of a mollucan rudstone lithofacies. Coarsens upward and dolomite rhombs increase in numbers upward
obi depth: 1,050.3–1,067.6 ft bls Driller's depth: 1,050.0–1,067.6 ft bls (total depth)	**Lithofacies:** Calcareous sandstone **Depositional texture:** Skeletal fragment quartz sandstone **Color:** Yellowish gray 5Y 7/2, light olive gray 5Y 5/2, yellowish gray 5Y 8/1 **Sedimentary structures:** Burrow mottled throughout interval **Trace fossils:** Not determined **Ichnofabrics:** Ichnofabric index 5 **Ichnofacies:** Not determined **Quartz grains:** 50–75 percent very fine to fine sand-sized (coarsens upward to very fine to medium sand-sized grains), angular to subrounded, well-sorted quartz grains **Carbonate grains:** Mainly benthic foraminifera (minor nummulitids, very minor *Reussella*). Foraminifera observed in thin section G2984–1050.23 include a total of 14 *Nummulites panamensis*. Foraminifera observed in thin section G2984–1056.34 include a total of four *Nummulites panamensis*. Foraminifera observed in thin section G2984–1060.90 includes smaller benthic foraminifera **Accessory grains:** 5–7 percent very fine to fine sand-sized (coarsens upward to very fine to medium sand-sized grains), well-rounded phosphorite grains; dolomite rhombs in uppermost part of interval; 1 percent plagioclase **Porosity and permeability:** 10–35 percent interparticle porosity, 1 percent intraparticle porosity, 1 percent moldic porosity; 12–37 percent total porosity and relatively low to moderate permeability **Depositional environment:** Marine offshore to lower shoreface **Comments:** Coarsens upward and dolomite rhombs increase in numbers upward **Thin section:** G2984–1050.23, G2984–1056.34, G2984–1060.90



Photomicrograph from thin section G2984–1050.23 that shows a specimen of *Nummulites dius*. Driller's depth of thin section is 1,050.23 ft bls.

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