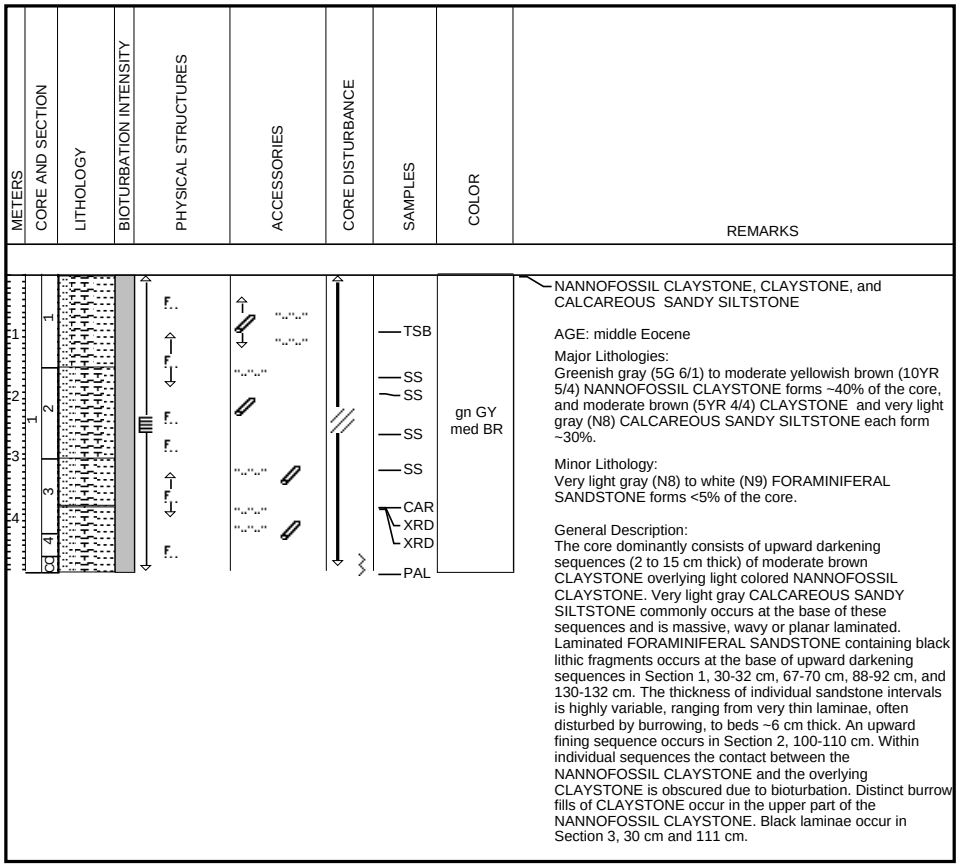
SITE 1069 HOLE A CORE 1R **CORED 718.8-728.4 mbsf**



NANNOFOSSIL CLAYSTONE, CLAYSTONE, and CALCAREOUS SANDY SILTSTONE

AGE: middle Eocene

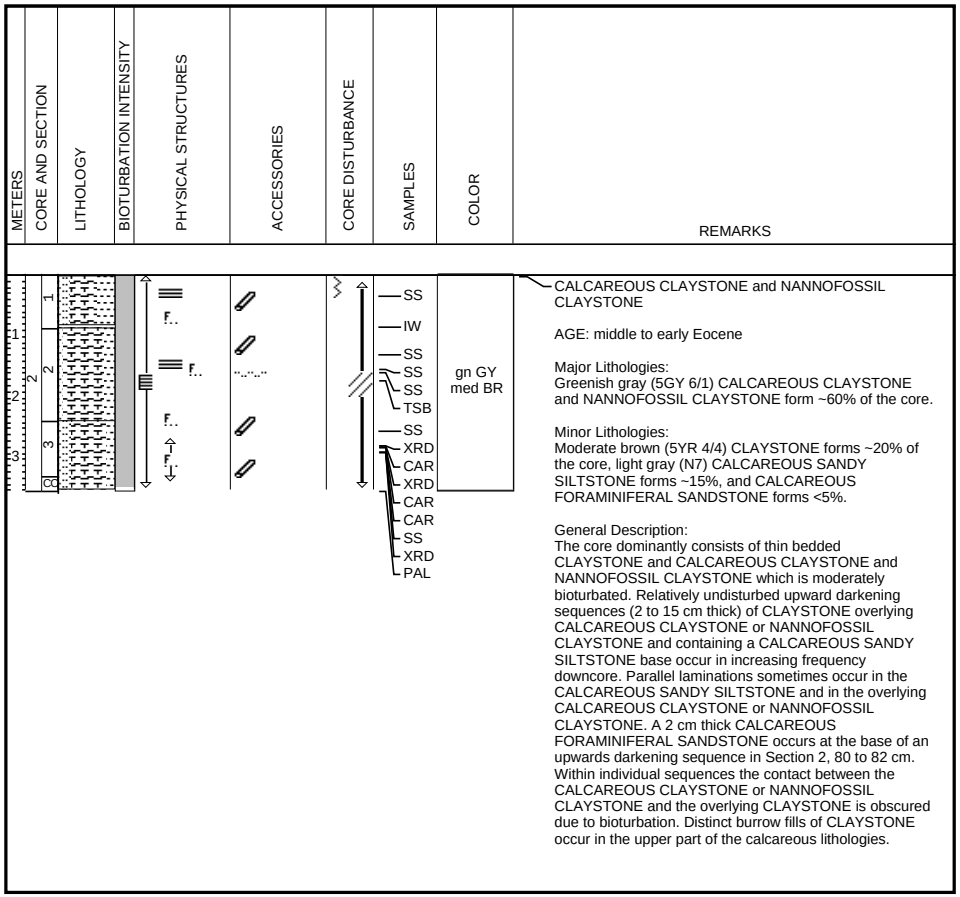
Major Lithologies:
Greenish gray (5G 6/1) to moderate yellowish brown (10YR 5/4) NANNOFOSSIL CLAYSTONE forms ~40% of the core, and moderate brown (5YR 4/4) CLAYSTONE and very light gray (N8) CALCAREOUS SANDY SILTSTONE each form ~30%.

Minor Lithology:
Very light gray (N8) to white (N9) FORAMINIFERAL SANDSTONE forms <5% of the core.

General Description:
The core dominantly consists of upward darkening sequences (2 to 15 cm thick) of moderate brown CLAYSTONE overlying light colored NANNOFOSSIL CLAYSTONE. Very light gray CALCAREOUS SANDY SILTSTONE commonly occurs at the base of these sequences and is massive, wavy or planar laminated. Laminated FORAMINIFERAL SANDSTONE containing black lithic fragments occurs at the base of upward darkening sequences in Section 1, 30-32 cm, 67-70 cm, 88-92 cm, and 130-132 cm. The thickness of individual sandstone intervals is highly variable, ranging from very thin laminae, often disturbed by burrowing, to beds ~6 cm thick. An upward fining sequence occurs in Section 2, 100-110 cm. Within individual sequences the contact between the NANNOFOSSIL CLAYSTONE and the overlying CLAYSTONE is obscured due to bioturbation. Distinct burrow fills of CLAYSTONE occur in the upper part of the NANNOFOSSIL CLAYSTONE. Black laminae occur in Section 3, 30 cm and 111 cm.

SITE 1069 HOLE A CORE 2R **CORED 728.4-738.1 mbsf**

1069A-2R



CALCAREOUS CLAYSTONE and NANNOFOSSIL CLAYSTONE

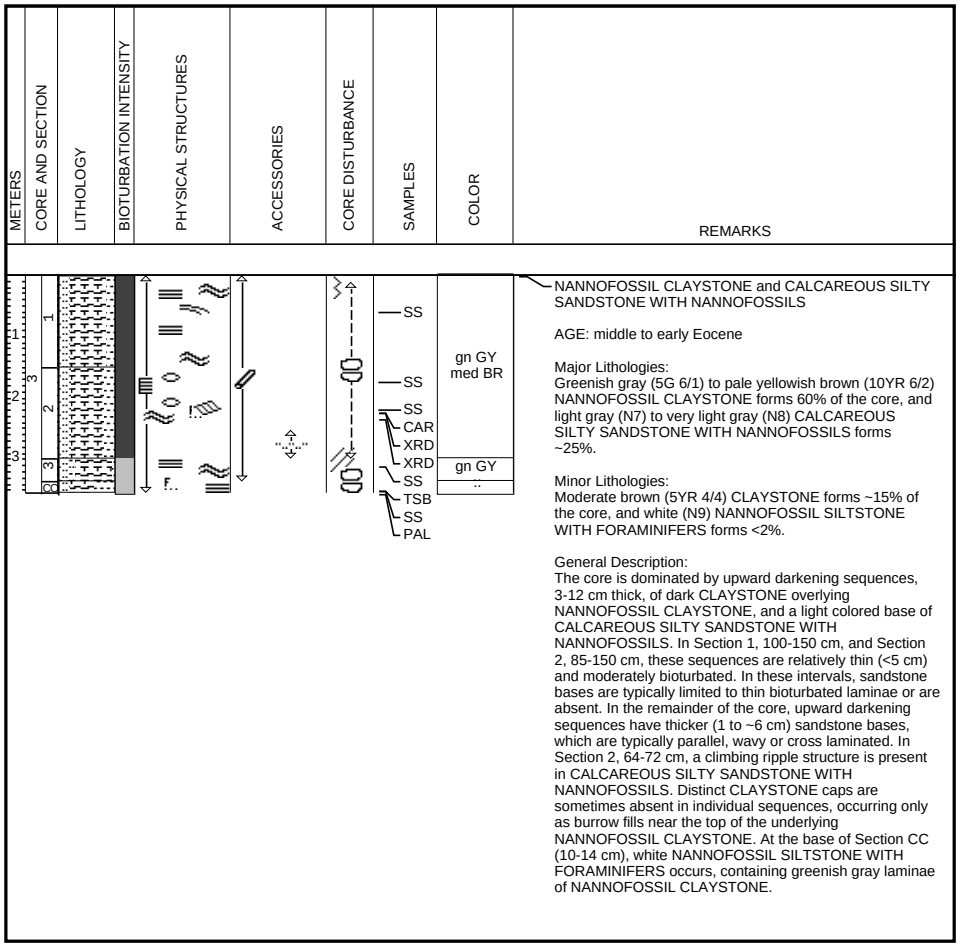
AGE: middle to early Eocene

Major Lithologies:
Greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE and NANNOFOSSIL CLAYSTONE form ~60% of the core.

Minor Lithologies:
Moderate brown (5YR 4/4) CLAYSTONE forms ~20% of the core, light gray (N7) CALCAREOUS SANDY SILTSTONE forms ~15%, and CALCAREOUS FORAMINIFERAL SANDSTONE forms <5%.

General Description:
The core dominantly consists of thin bedded CLAYSTONE and CALCAREOUS CLAYSTONE and NANNOFOSSIL CLAYSTONE which is moderately bioturbated. Relatively undisturbed upward darkening sequences (2 to 15 cm thick) of CLAYSTONE overlying CALCAREOUS CLAYSTONE or NANNOFOSSIL CLAYSTONE and containing a CALCAREOUS SANDY SILTSTONE base occur in increasing frequency downcore. Parallel laminations sometimes occur in the CALCAREOUS SANDY SILTSTONE and in the overlying CALCAREOUS CLAYSTONE or NANNOFOSSIL CLAYSTONE. A 2 cm thick CALCAREOUS FORAMINIFERAL SANDSTONE occurs at the base of an upwards darkening sequence in Section 2, 80 to 82 cm. Within individual sequences the contact between the CALCAREOUS CLAYSTONE or NANNOFOSSIL CLAYSTONE and the overlying CLAYSTONE is obscured due to bioturbation. Distinct burrow fills of CLAYSTONE occur in the upper part of the calcareous lithologies.

SITE 1069 HOLE A CORE 3R **CORED 738.1-747.7 mbsf**



NANNOFOSSIL CLAYSTONE and CALCAREOUS SILTY SANDSTONE WITH NANNOFOSSILS

AGE: middle to early Eocene

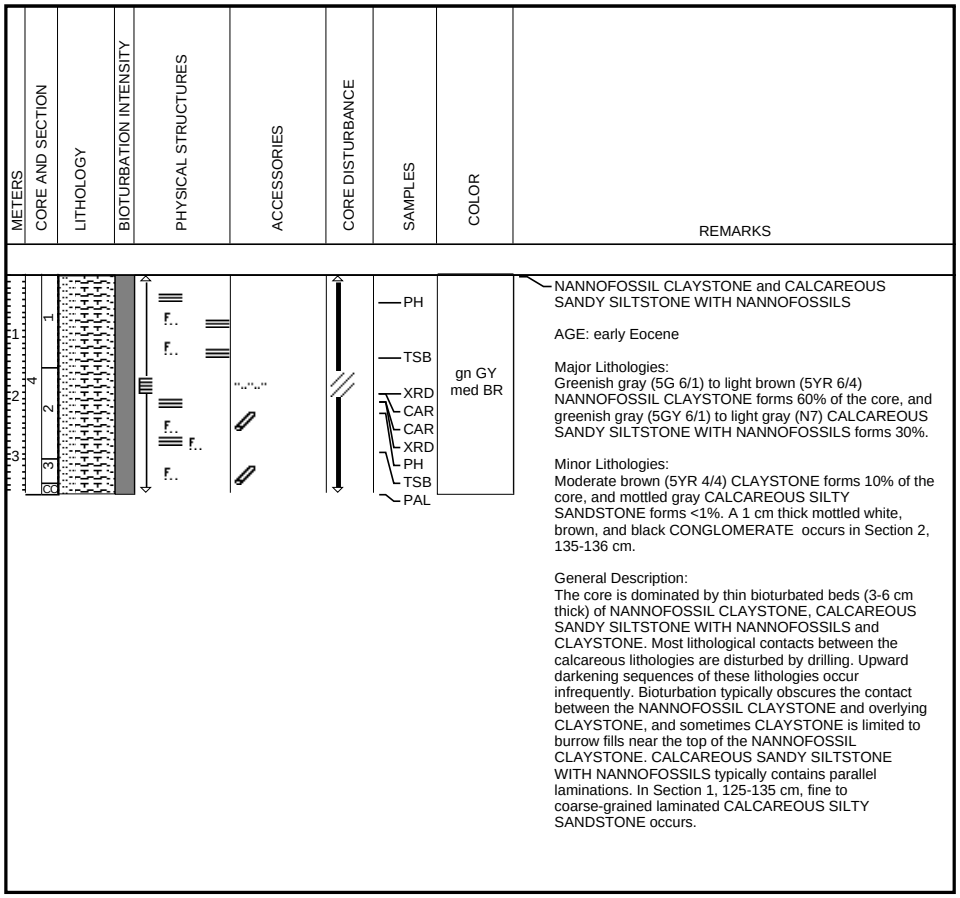
Major Lithologies:
Greenish gray (5G 6/1) to pale yellowish brown (10YR 6/2) NANNOFOSSIL CLAYSTONE forms 60% of the core, and light gray (N7) to very light gray (N8) CALCAREOUS SILTY SANDSTONE WITH NANNOFOSSILS forms ~25%.

Minor Lithologies:
Moderate brown (5YR 4/4) CLAYSTONE forms ~15% of the core, and white (N9) NANNOFOSSIL SILTSTONE WITH FORAMINIFERS forms <2%.

General Description:
The core is dominated by upward darkening sequences, 3-12 cm thick, of dark CLAYSTONE overlying NANNOFOSSIL CLAYSTONE, and a light colored base of CALCAREOUS SILTY SANDSTONE WITH NANNOFOSSILS. In Section 1, 100-150 cm, and Section 2, 85-150 cm, these sequences are relatively thin (<5 cm) and moderately bioturbated. In these intervals, sandstone bases are typically limited to thin bioturbated laminae or are absent. In the remainder of the core, upward darkening sequences have thicker (1 to ~6 cm) sandstone bases, which are typically parallel, wavy or cross laminated. In Section 2, 64-72 cm, a climbing ripple structure is present in CALCAREOUS SILTY SANDSTONE WITH NANNOFOSSILS. Distinct CLAYSTONE caps are sometimes absent in individual sequences, occurring only as burrow fills near the top of the underlying NANNOFOSSIL CLAYSTONE. At the base of Section CC (10-14 cm), white NANNOFOSSIL SILTSTONE WITH FORAMINIFERS occurs, containing greenish gray laminae of NANNOFOSSIL CLAYSTONE.

SITE 1069 HOLE A CORE 4R CORED 747.7-757.4 mbsf

1069A-4R



NANNOFOSSIL CLAYSTONE and CALCAREOUS SANDY SILTSTONE WITH NANNOFOSSILS

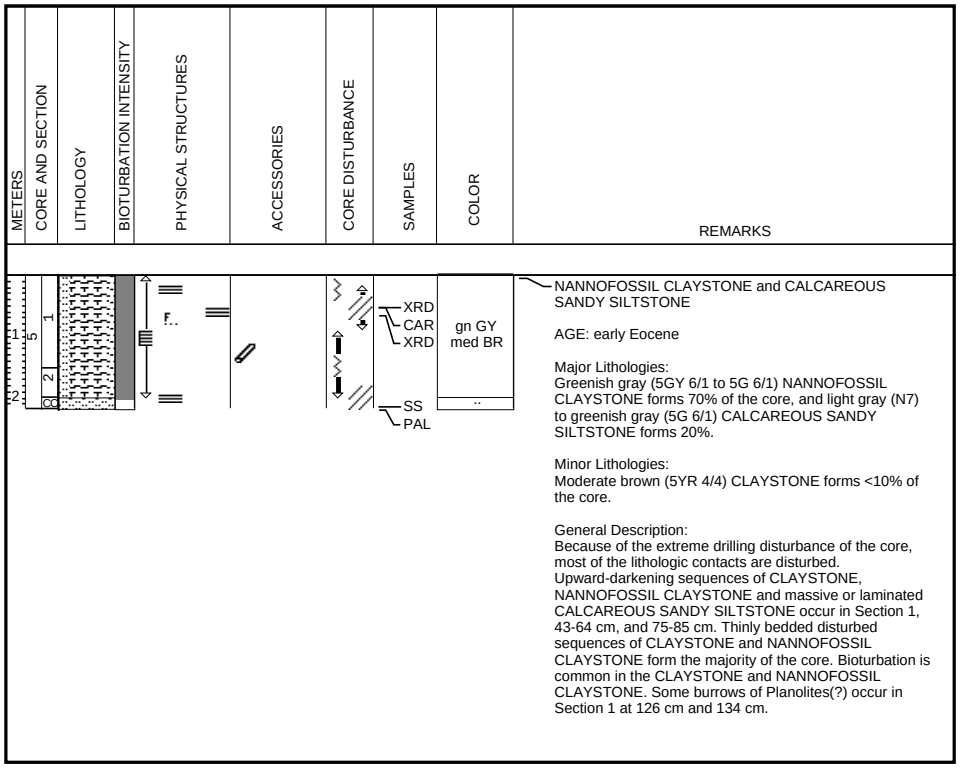
AGE: early Eocene

Major Lithologies:
Greenish gray (5G 6/1) to light brown (5YR 6/4) NANNOFOSSIL CLAYSTONE forms 60% of the core, and greenish gray (5GY 6/1) to light gray (N7) CALCAREOUS SANDY SILTSTONE WITH NANNOFOSSILS forms 30%.

Minor Lithologies:
Moderate brown (5YR 4/4) CLAYSTONE forms 10% of the core, and mottled gray CALCAREOUS SILTY SANDSTONE forms <1%. A 1 cm thick mottled white, brown, and black CONGLOMERATE occurs in Section 2, 135-136 cm.

General Description:
The core is dominated by thin bioturbated beds (3-6 cm thick) of NANNOFOSSIL CLAYSTONE, CALCAREOUS SANDY SILTSTONE WITH NANNOFOSSILS and CLAYSTONE. Most lithological contacts between the calcareous lithologies are disturbed by drilling. Upward darkening sequences of these lithologies occur infrequently. Bioturbation typically obscures the contact between the NANNOFOSSIL CLAYSTONE and overlying CLAYSTONE, and sometimes CLAYSTONE is limited to burrow fills near the top of the NANNOFOSSIL CLAYSTONE. CALCAREOUS SANDY SILTSTONE WITH NANNOFOSSILS typically contains parallel laminations. In Section 1, 125-135 cm, fine to coarse-grained laminated CALCAREOUS SILTY SANDSTONE occurs.

SITE 1069 HOLE A CORE 5R **CORED 757.4-767.1 mbsf**



NANNOFOSSIL CLAYSTONE and CALCAREOUS SANDY SILTSTONE

AGE: early Eocene

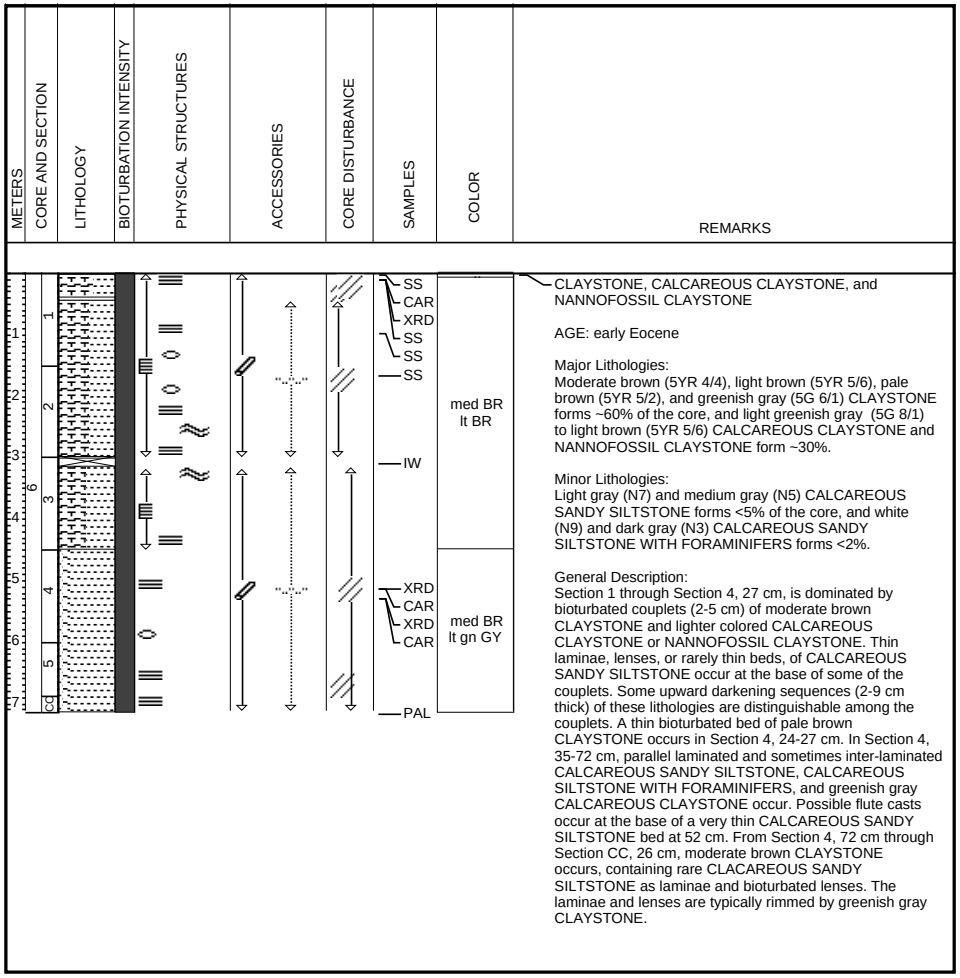
Major Lithologies:
Greenish gray (5GY 6/1 to 5G 6/1) NANNOFOSSIL CLAYSTONE forms 70% of the core, and light gray (N7) to greenish gray (5G 6/1) CALCAREOUS SANDY SILTSTONE forms 20%.

Minor Lithologies:
Moderate brown (5YR 4/4) CLAYSTONE forms <10% of the core.

General Description:
Because of the extreme drilling disturbance of the core, most of the lithologic contacts are disturbed. Upward-darkening sequences of CLAYSTONE, NANNOFOSSIL CLAYSTONE and massive or laminated CALCAREOUS SANDY SILTSTONE occur in Section 1, 43-64 cm, and 75-85 cm. Thinly bedded disturbed sequences of CLAYSTONE and NANNOFOSSIL CLAYSTONE form the majority of the core. Bioturbation is common in the CLAYSTONE and NANNOFOSSIL CLAYSTONE. Some burrows of Planolites(?) occur in Section 1 at 126 cm and 134 cm.

SITE 1069 HOLE A CORE 6R CORED 767.1-776.8 mbsf

1069A-6R



CLAYSTONE, CALCAREOUS CLAYSTONE, and NANNOFOSSIL CLAYSTONE

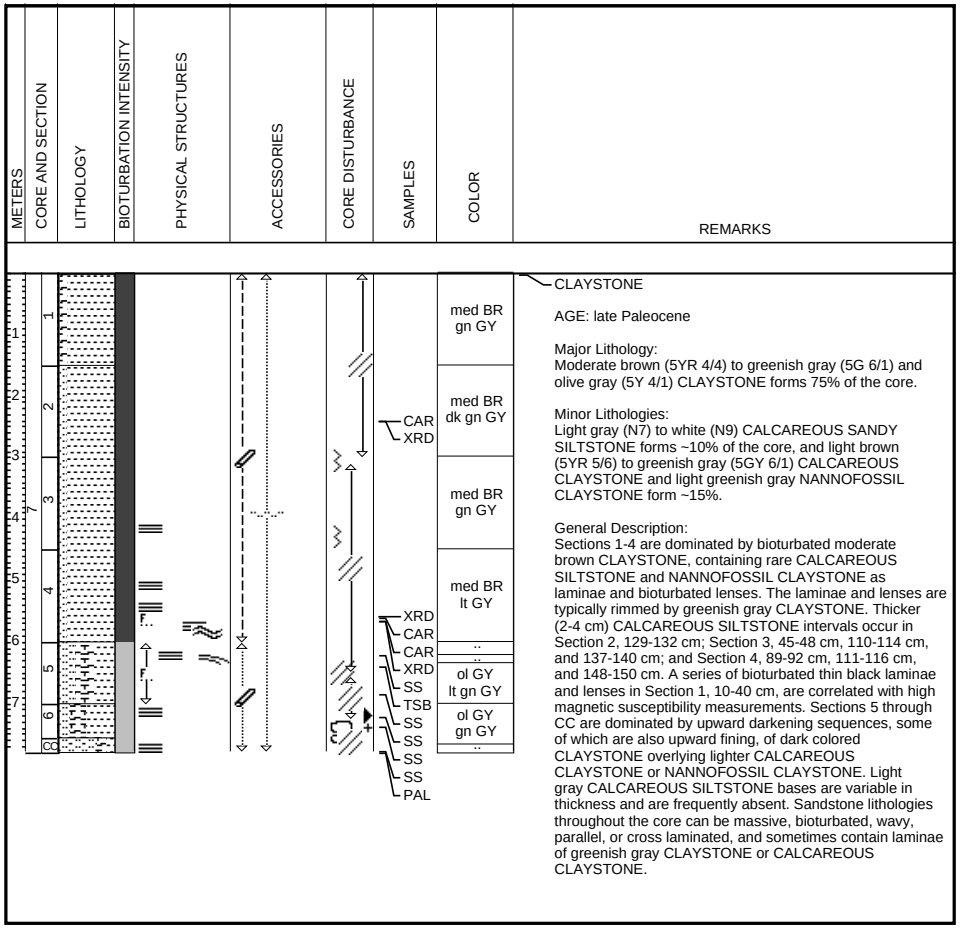
AGE: early Eocene

Major Lithologies:
Moderate brown (5YR 4/4), light brown (5YR 5/6), pale brown (5YR 5/2), and greenish gray (5G 6/1) CLAYSTONE forms ~60% of the core, and light greenish gray (5G 8/1) to light brown (5YR 5/6) CALCAREOUS CLAYSTONE and NANNOFOSSIL CLAYSTONE form ~30%.

Minor Lithologies:
Light gray (N7) and medium gray (N5) CALCAREOUS SANDY SILTSTONE forms <5% of the core, and white (N9) and dark gray (N3) CALCAREOUS SANDY SILTSTONE WITH FORAMINIFERS forms <2%.

General Description:
Section 1 through Section 4, 27 cm, is dominated by bioturbated couplets (2-5 cm) of moderate brown CLAYSTONE and lighter colored CALCAREOUS CLAYSTONE or NANNOFOSSIL CLAYSTONE. Thin laminae, lenses, or rarely thin beds, of CALCAREOUS SANDY SILTSTONE occur at the base of some of the couplets. Some upward darkening sequences (2-9 cm thick) of these lithologies are distinguishable among the couplets. A thin bioturbated bed of pale brown CLAYSTONE occurs in Section 4, 24-27 cm. In Section 4, 35-72 cm, parallel laminated and sometimes inter-laminated CALCAREOUS SANDY SILTSTONE, CALCAREOUS SILTSTONE WITH FORAMINIFERS, and greenish gray CALCAREOUS CLAYSTONE occur. Possible flute casts occur at the base of a very thin CALCAREOUS SANDY SILTSTONE bed at 52 cm. From Section 4, 72 cm through Section CC, 26 cm, moderate brown CLAYSTONE occurs, containing rare CLACAREOUS SANDY SILTSTONE as laminae and bioturbated lenses. The laminae and lenses are typically rimmed by greenish gray CLAYSTONE.

SITE 1069 HOLE A CORE 7R **CORED 776.8-786.4 mbsf**



CLAYSTONE

AGE: late Paleocene

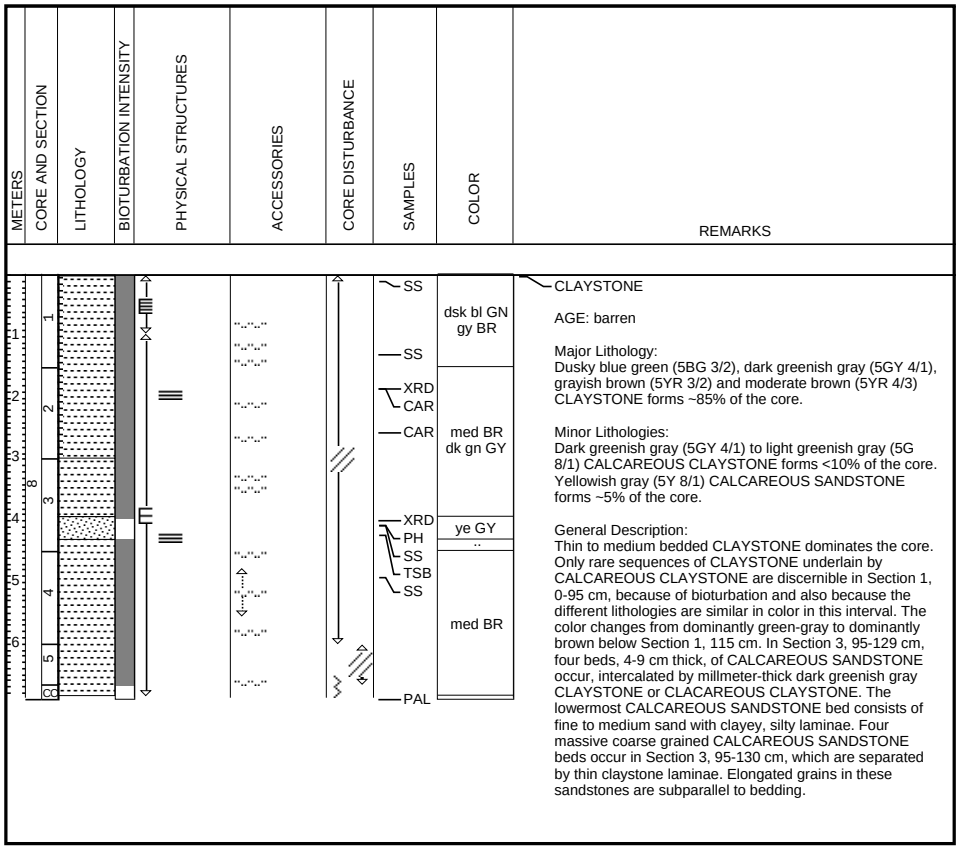
Major Lithology:
Moderate brown (5YR 4/4) to greenish gray (5G 6/1) and olive gray (5Y 4/1) CLAYSTONE forms 75% of the core.

Minor Lithologies:
Light gray (N7) to white (N9) CALCAREOUS SANDY SILTSTONE forms ~10% of the core, and light brown (5YR 5/6) to greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE and light greenish gray NANNOFOSSIL CLAYSTONE form ~15%.

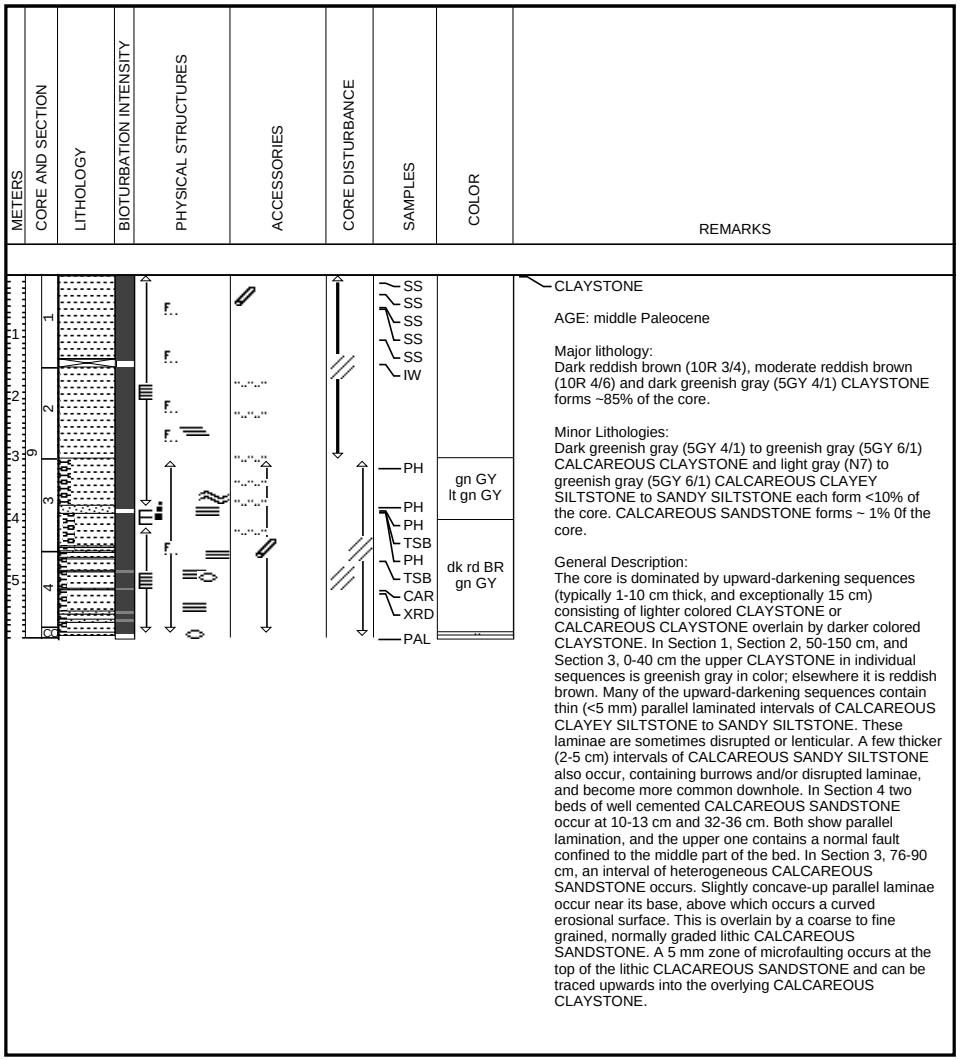
General Description:
Sections 1-4 are dominated by bioturbated moderate brown CLAYSTONE, containing rare CALCAREOUS SILTSTONE and NANNOFOSSIL CLAYSTONE as laminae and bioturbated lenses. The laminae and lenses are typically rimmed by greenish gray CLAYSTONE. Thicker (2-4 cm) CALCAREOUS SILTSTONE intervals occur in Section 2, 129-132 cm; Section 3, 45-48 cm, 110-114 cm, and 137-140 cm; and Section 4, 89-92 cm, 111-116 cm, and 148-150 cm. A series of bioturbated thin black laminae and lenses in Section 1, 10-40 cm, are correlated with high magnetic susceptibility measurements. Sections 5 through CC are dominated by upward darkening sequences, some of which are also upward fining, of dark colored CLAYSTONE overlying lighter CALCAREOUS CLAYSTONE or NANNOFOSSIL CLAYSTONE. Light gray CALCAREOUS SILTSTONE bases are variable in thickness and are frequently absent. Sandstone lithologies throughout the core can be massive, bioturbated, wavy, parallel, or cross laminated, and sometimes contain laminae of greenish gray CLAYSTONE or CALCAREOUS CLAYSTONE.

SITE 1069 HOLE A CORE 8R **CORED 786.4-796.0 mbsf**

1069A-8R



SITE 1069 HOLE A CORE 9R **CORED 796.0-805.6 mbsf**



CLAYSTONE

AGE: middle Paleocene

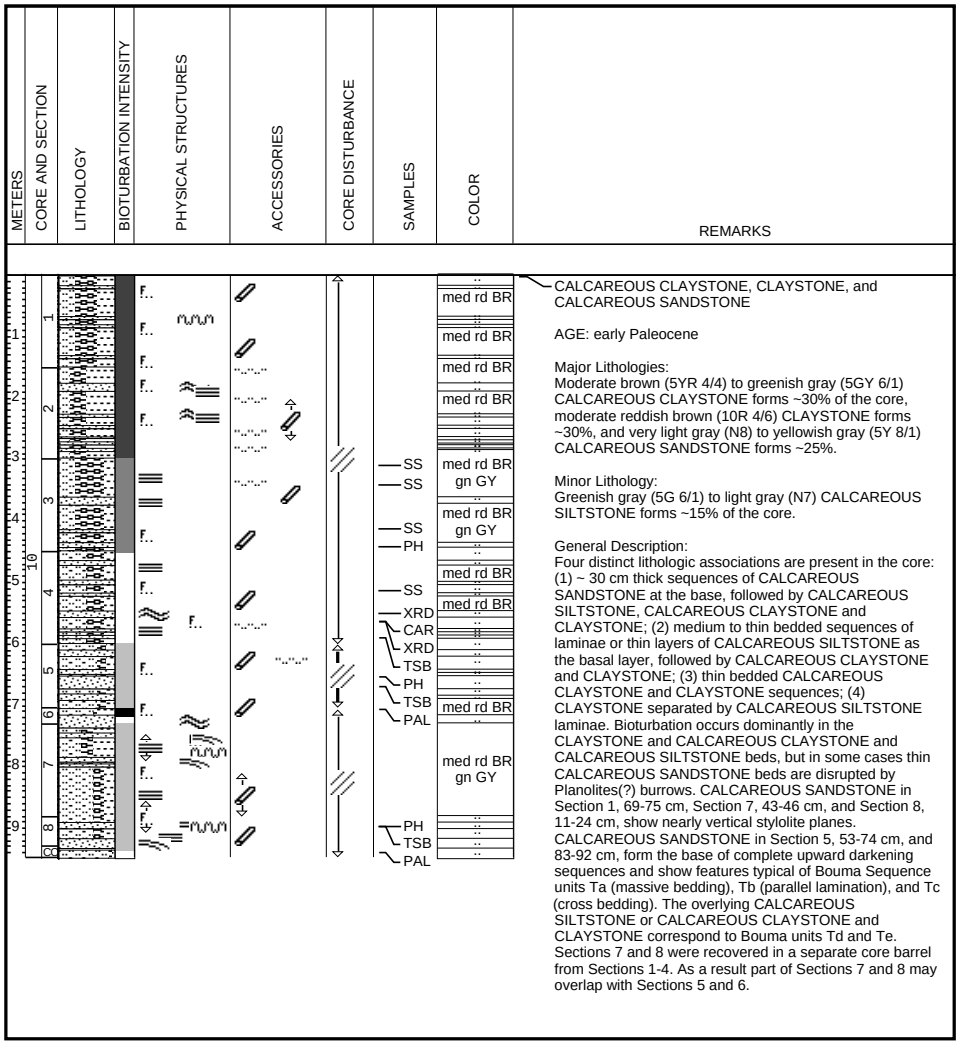
Major lithology:
Dark reddish brown (10R 3/4), moderate reddish brown (10R 4/6) and dark greenish gray (5GY 4/1) CLAYSTONE forms ~85% of the core.

Minor Lithologies:
Dark greenish gray (5GY 4/1) to greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE and light gray (N7) to greenish gray (5GY 6/1) CALCAREOUS CLAYEY SILTSTONE to SANDY SILTSTONE each form <10% of the core. CALCAREOUS SANDSTONE forms ~ 1% 0f the core.

General Description:
The core is dominated by upward-darkening sequences (typically 1-10 cm thick, and exceptionally 15 cm) consisting of lighter colored CLAYSTONE or CALCAREOUS CLAYSTONE overlain by darker colored CLAYSTONE. In Section 1, Section 2, 50-150 cm, and Section 3, 0-40 cm the upper CLAYSTONE in individual sequences is greenish gray in color; elsewhere it is reddish brown. Many of the upward-darkening sequences contain thin (<5 mm) parallel laminated intervals of CALCAREOUS CLAYEY SILTSTONE to SANDY SILTSTONE. These laminae are sometimes disrupted or lenticular. A few thicker (2-5 cm) intervals of CALCAREOUS SANDY SILTSTONE also occur, containing burrows and/or disrupted laminae, and become more common downhole. In Section 4 two beds of well cemented CALCAREOUS SANDSTONE occur at 10-13 cm and 32-36 cm. Both show parallel lamination, and the upper one contains a normal fault confined to the middle part of the bed. In Section 3, 76-90 cm, an interval of heterogeneous CALCAREOUS SANDSTONE occurs. Slightly concave-up parallel laminae occur near its base, above which occurs a curved erosional surface. This is overlain by a coarse to fine grained, normally graded lithic CALCAREOUS SANDSTONE. A 5 mm zone of microfaulting occurs at the top of the lithic CLACAREOUS SANDSTONE and can be traced upwards into the overlying CALCAREOUS CLAYSTONE.

SITE 1069 HOLE A CORE 10R CORED 805.6-815.3 mbsf

1069A-10R



CALCAREOUS CLAYSTONE, CLAYSTONE, and CALCAREOUS SANDSTONE

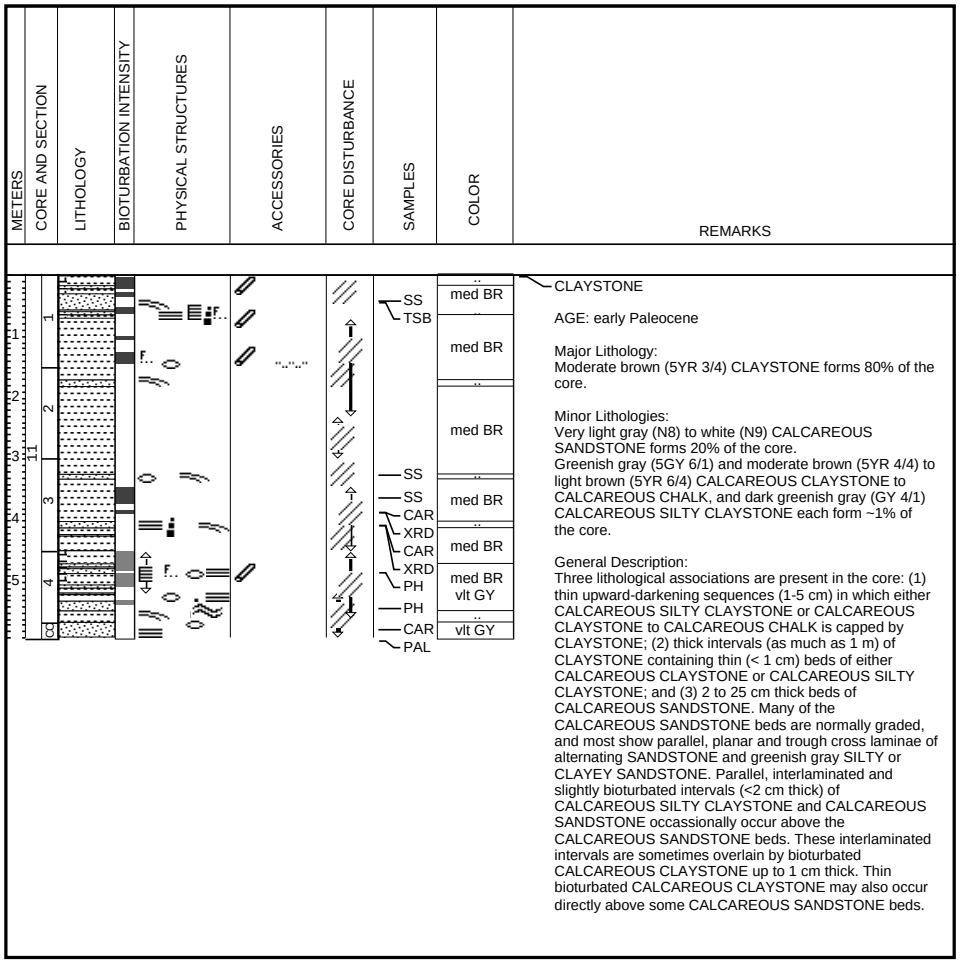
AGE: early Paleocene

Major Lithologies:
Moderate brown (5YR 4/4) to greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE forms ~30% of the core, moderate reddish brown (10R 4/6) CLAYSTONE forms ~30%, and very light gray (N8) to yellowish gray (5Y 8/1) CALCAREOUS SANDSTONE forms ~25%.

Minor Lithology:
Greenish gray (5G 6/1) to light gray (N7) CALCAREOUS SILTSTONE forms ~15% of the core.

General Description:
Four distinct lithologic associations are present in the core: (1) ~ 30 cm thick sequences of CALCAREOUS SANDSTONE at the base, followed by CALCAREOUS SILTSTONE, CALCAREOUS CLAYSTONE and CLAYSTONE; (2) medium to thin bedded sequences of laminae or thin layers of CALCAREOUS SILTSTONE as the basal layer, followed by CALCAREOUS CLAYSTONE and CLAYSTONE; (3) thin bedded CALCAREOUS CLAYSTONE and CLAYSTONE sequences; (4) CLAYSTONE separated by CALCAREOUS SILTSTONE laminae. Bioturbation occurs dominantly in the CLAYSTONE and CALCAREOUS CLAYSTONE and CALCAREOUS SILTSTONE beds, but in some cases thin CALCAREOUS SANDSTONE beds are disrupted by Planolites(?) burrows. CALCAREOUS SANDSTONE in Section 1, 69-75 cm, Section 7, 43-46 cm, and Section 8, 11-24 cm, show nearly vertical stylolite planes. CALCAREOUS SANDSTONE in Section 5, 53-74 cm, and 83-92 cm, form the base of complete upward darkening sequences and show features typical of Bouma Sequence units Ta (massive bedding), Tb (parallel lamination), and Tc (cross bedding). The overlying CALCAREOUS SILTSTONE or CALCAREOUS CLAYSTONE and CLAYSTONE correspond to Bouma units Td and Te. Sections 7 and 8 were recovered in a separate core barrel from Sections 1-4. As a result part of Sections 7 and 8 may overlap with Sections 5 and 6.

SITE 1069 HOLE A CORE 11R **CORED 815.3-825.0 mbsf**



CLAYSTONE

AGE: early Paleocene

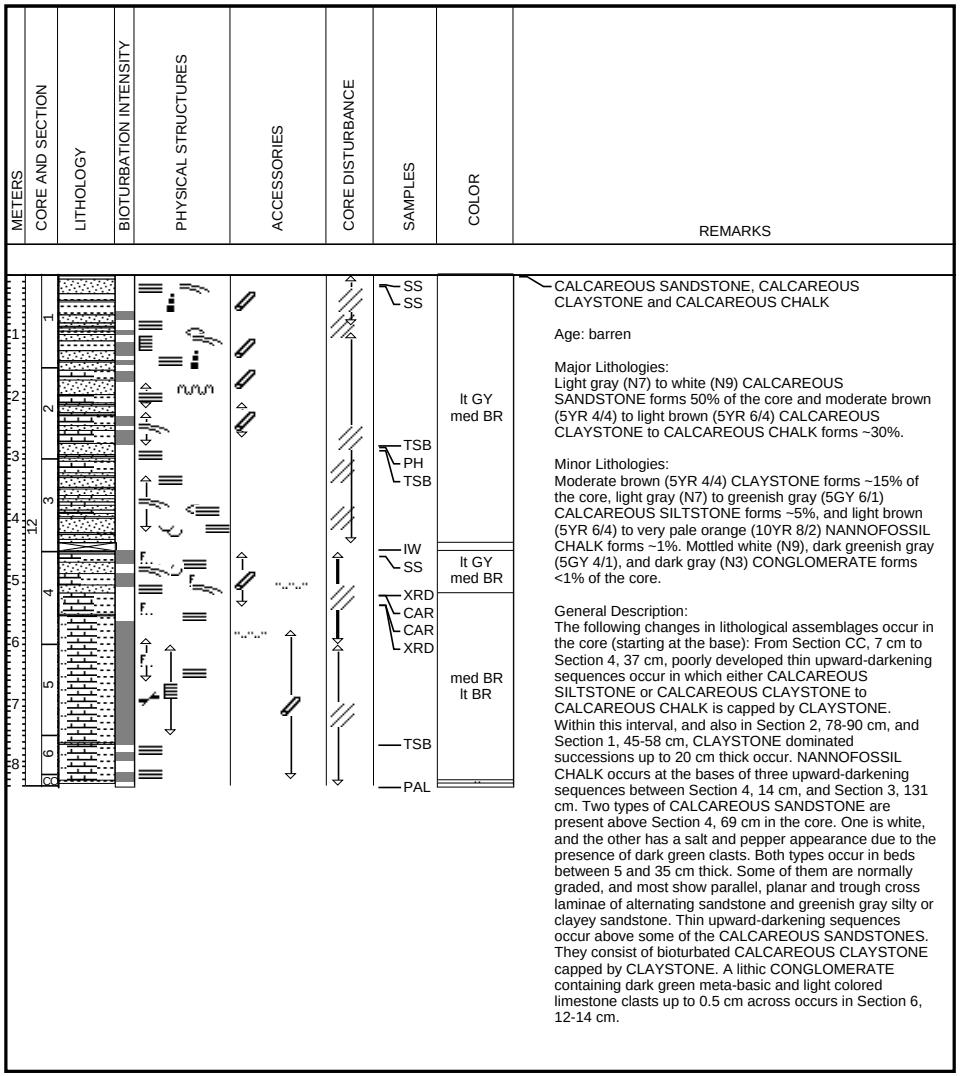
Major Lithology:
Moderate brown (5YR 3/4) CLAYSTONE forms 80% of the core.

Minor Lithologies:
Very light gray (N8) to white (N9) CALCAREOUS SANDSTONE forms 20% of the core.
Greenish gray (5GY 6/1) and moderate brown (5YR 4/4) to light brown (5YR 6/4) CALCAREOUS CLAYSTONE to CALCAREOUS CHALK, and dark greenish gray (GY 4/1) CALCAREOUS SILTY CLAYSTONE each form ~1% of the core.

General Description:
Three lithological associations are present in the core: (1) thin upward-darkening sequences (1-5 cm) in which either CALCAREOUS SILTY CLAYSTONE or CALCAREOUS CLAYSTONE to CALCAREOUS CHALK is capped by CLAYSTONE; (2) thick intervals (as much as 1 m) of CLAYSTONE containing thin (< 1 cm) beds of either CALCAREOUS CLAYSTONE or CALCAREOUS SILTY CLAYSTONE; and (3) 2 to 25 cm thick beds of CALCAREOUS SANDSTONE. Many of the CALCAREOUS SANDSTONE beds are normally graded, and most show parallel, planar and trough cross laminae of alternating SANDSTONE and greenish gray SILTY or CLAYEY SANDSTONE. Parallel, interlaminated and slightly bioturbated intervals (<2 cm thick) of CALCAREOUS SILTY CLAYSTONE and CALCAREOUS SANDSTONE occassionally occur above the CALCAREOUS SANDSTONE beds. These interlaminated intervals are sometimes overlain by bioturbated CALCAREOUS CLAYSTONE up to 1 cm thick. Thin bioturbated CALCAREOUS CLAYSTONE may also occur directly above some CALCAREOUS SANDSTONE beds.

SITE 1069 HOLE A CORE 12R CORED 825.0-834.7 mbsf

1069A-12R



CALCAREOUS SANDSTONE, CALCAREOUS CLAYSTONE and CALCAREOUS CHALK

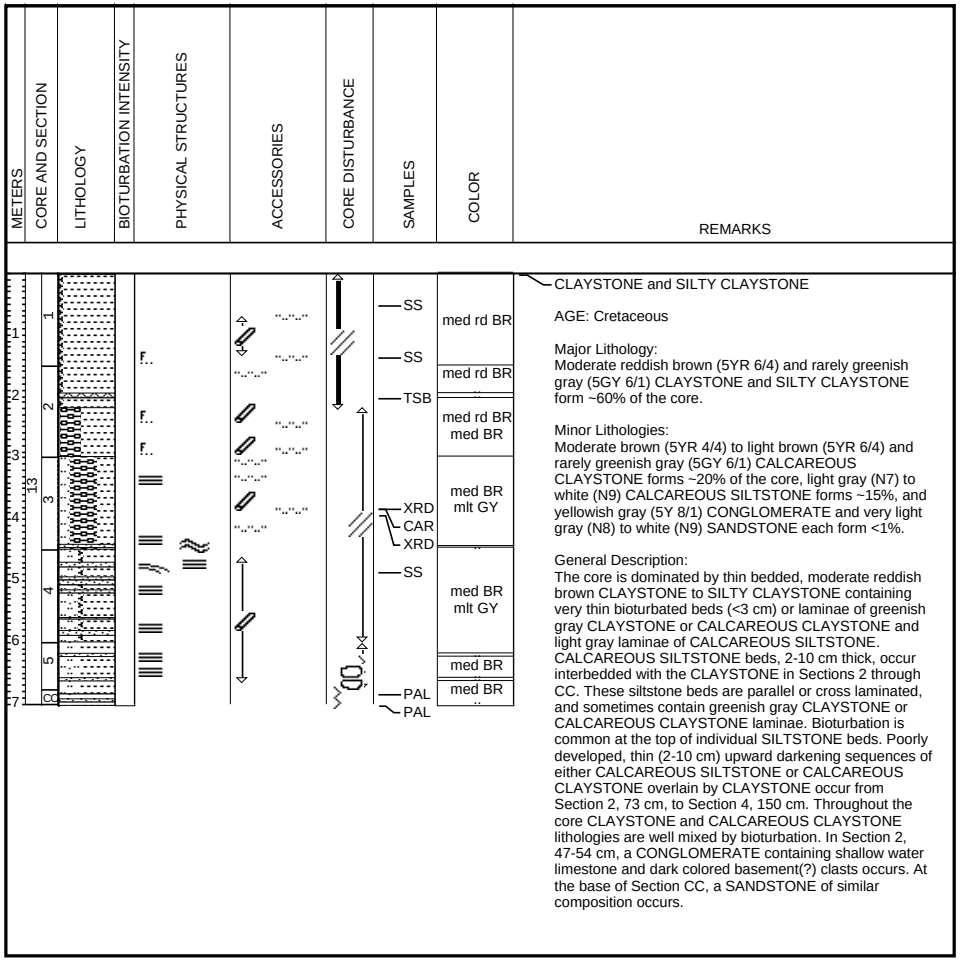
Age: barren

Major Lithologies:
Light gray (N7) to white (N9) CALCAREOUS SANDSTONE forms 50% of the core and moderate brown (5YR 4/4) to light brown (5YR 6/4) CALCAREOUS CLAYSTONE to CALCAREOUS CHALK forms ~30%.

Minor Lithologies:
Moderate brown (5YR 4/4) CLAYSTONE forms ~15% of the core, light gray (N7) to greenish gray (5GY 6/1) CALCAREOUS SILTSTONE forms ~5%, and light brown (5YR 6/4) to very pale orange (10YR 8/2) NANNOFOSSIL CHALK forms ~1%. Mottled white (N9), dark greenish gray (5GY 4/1), and dark gray (N3) CONGLOMERATE forms <1% of the core.

General Description:
The following changes in lithological assemblages occur in the core (starting at the base): From Section CC, 7 cm to Section 4, 37 cm, poorly developed thin upward-darkening sequences occur in which either CALCAREOUS SILTSTONE or CALCAREOUS CLAYSTONE to CALCAREOUS CHALK is capped by CLAYSTONE. Within this interval, and also in Section 2, 78-90 cm, and Section 1, 45-58 cm, CLAYSTONE dominated successions up to 20 cm thick occur. NANNOFOSSIL CHALK occurs at the bases of three upward-darkening sequences between Section 4, 14 cm, and Section 3, 131 cm. Two types of CALCAREOUS SANDSTONE are present above Section 4, 69 cm in the core. One is white, and the other has a salt and pepper appearance due to the presence of dark green clasts. Both types occur in beds between 5 and 35 cm thick. Some of them are normally graded, and most show parallel, planar and trough cross laminae of alternating sandstone and greenish gray silty or clayey sandstone. Thin upward-darkening sequences occur above some of the CALCAREOUS SANDSTONES. They consist of bioturbated CALCAREOUS CLAYSTONE capped by CLAYSTONE. A lithic CONGLOMERATE containing dark green meta-basic and light colored limestone clasts up to 0.5 cm across occurs in Section 6, 12-14 cm.

SITE 1069 HOLE A CORE 13R **CORED 834.7-844.4 mbsf**



CLAYSTONE and SILTY CLAYSTONE

AGE: Cretaceous

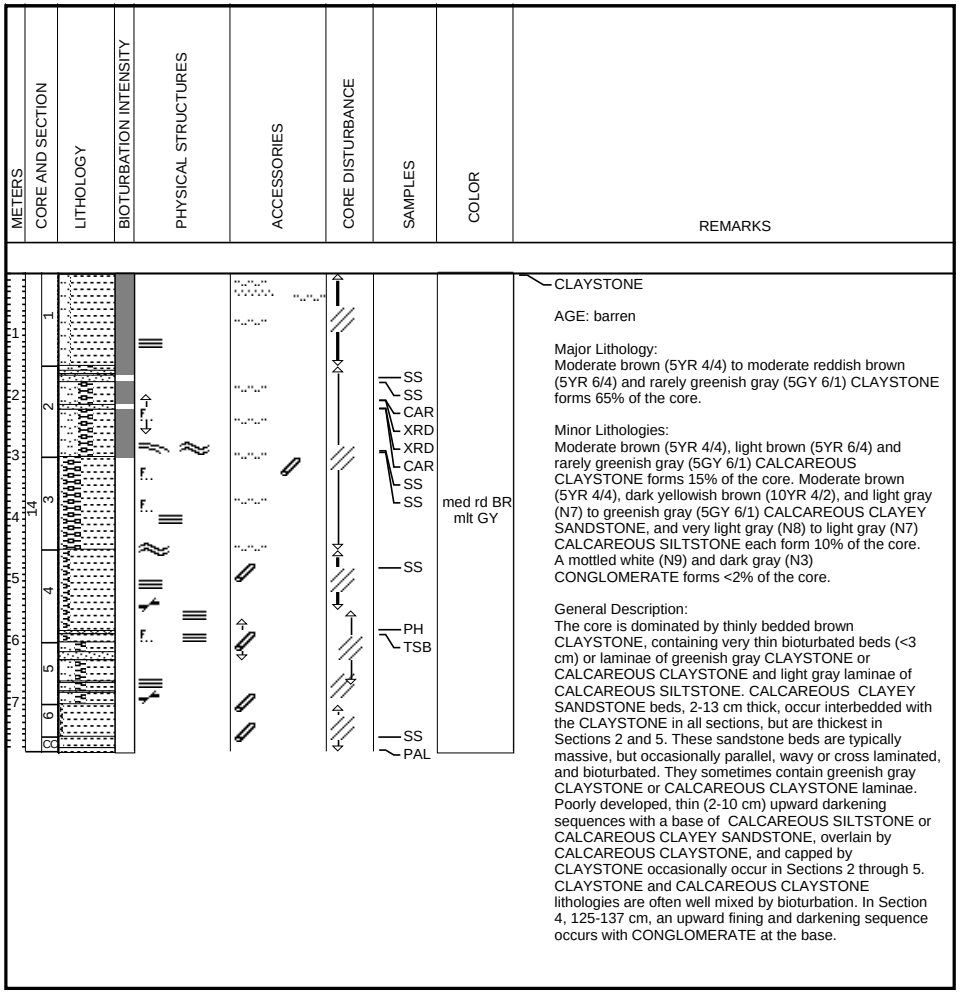
Major Lithology:
Moderate reddish brown (5YR 6/4) and rarely greenish gray (5GY 6/1) CLAYSTONE and SILTY CLAYSTONE form ~60% of the core.

Minor Lithologies:
Moderate brown (5YR 4/4) to light brown (5YR 6/4) and rarely greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE forms ~20% of the core, light gray (N7) to white (N9) CALCAREOUS SILTSTONE forms ~15%, and yellowish gray (5Y 8/1) CONGLOMERATE and very light gray (N8) to white (N9) SANDSTONE each form <1%.

General Description:
The core is dominated by thin bedded, moderate reddish brown CLAYSTONE to SILTY CLAYSTONE containing very thin bioturbated beds (<3 cm) or laminae of greenish gray CLAYSTONE or CALCAREOUS CLAYSTONE and light gray laminae of CALCAREOUS SILTSTONE. CALCAREOUS SILTSTONE beds, 2-10 cm thick, occur interbedded with the CLAYSTONE in Sections 2 through CC. These siltstone beds are parallel or cross laminated, and sometimes contain greenish gray CLAYSTONE or CALCAREOUS CLAYSTONE laminae. Bioturbation is common at the top of individual SILTSTONE beds. Poorly developed, thin (2-10 cm) upward darkening sequences of either CALCAREOUS SILTSTONE or CALCAREOUS CLAYSTONE overlain by CLAYSTONE occur from Section 2, 73 cm, to Section 4, 150 cm. Throughout the core CLAYSTONE and CALCAREOUS CLAYSTONE lithologies are well mixed by bioturbation. In Section 2, 47-54 cm, a CONGLOMERATE containing shallow water limestone and dark colored basement(?) clasts occurs. At the base of Section CC, a SANDSTONE of similar composition occurs.

SITE 1069 HOLE A CORE 14R CORED 844.4-854.0 mbsf

1069A-14R



CLAYSTONE

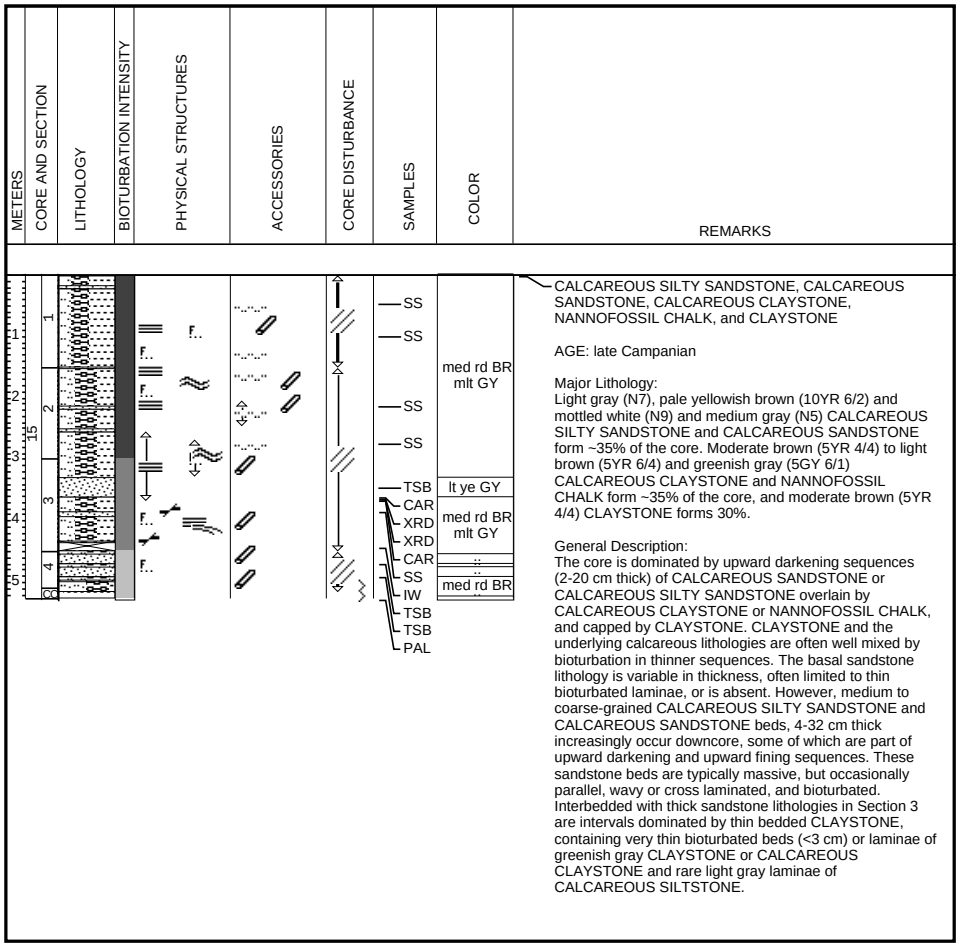
AGE: barren

Major Lithology:
Moderate brown (5YR 4/4) to moderate reddish brown (5YR 6/4) and rarely greenish gray (5GY 6/1) CLAYSTONE forms 65% of the core.

Minor Lithologies:
Moderate brown (5YR 4/4), light brown (5YR 6/4) and rarely greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE forms 15% of the core. Moderate brown (5YR 4/4), dark yellowish brown (10YR 4/2), and light gray (N7) to greenish gray (5GY 6/1) CALCAREOUS CLAYEY SANDSTONE, and very light gray (N8) to light gray (N7) CALCAREOUS SILTSTONE each form 10% of the core. A mottled white (N9) and dark gray (N3) CONGLOMERATE forms <2% of the core.

General Description:
The core is dominated by thinly bedded brown CLAYSTONE, containing very thin bioturbated beds (<3 cm) or laminae of greenish gray CLAYSTONE or CALCAREOUS CLAYSTONE and light gray laminae of CALCAREOUS SILTSTONE. CALCAREOUS CLAYEY SANDSTONE beds, 2-13 cm thick, occur interbedded with the CLAYSTONE in all sections, but are thickest in Sections 2 and 5. These sandstone beds are typically massive, but occasionally parallel, wavy or cross laminated, and bioturbated. They sometimes contain greenish gray CLAYSTONE or CALCAREOUS CLAYSTONE laminae. Poorly developed, thin (2-10 cm) upward darkening sequences with a base of CALCAREOUS SILTSTONE or CALCAREOUS CLAYEY SANDSTONE, overlain by CALCAREOUS CLAYSTONE, and capped by CLAYSTONE occasionally occur in Sections 2 through 5. CLAYSTONE and CALCAREOUS CLAYSTONE lithologies are often well mixed by bioturbation. In Section 4, 125-137 cm, an upward fining and darkening sequence occurs with CONGLOMERATE at the base.

SITE 1069 HOLE A CORE 15R **CORED 854.0-863.6 mbsf**



CALCAREOUS SILTY SANDSTONE, CALCAREOUS SANDSTONE, CALCAREOUS CLAYSTONE, NANNOFOSSIL CHALK, and CLAYSTONE

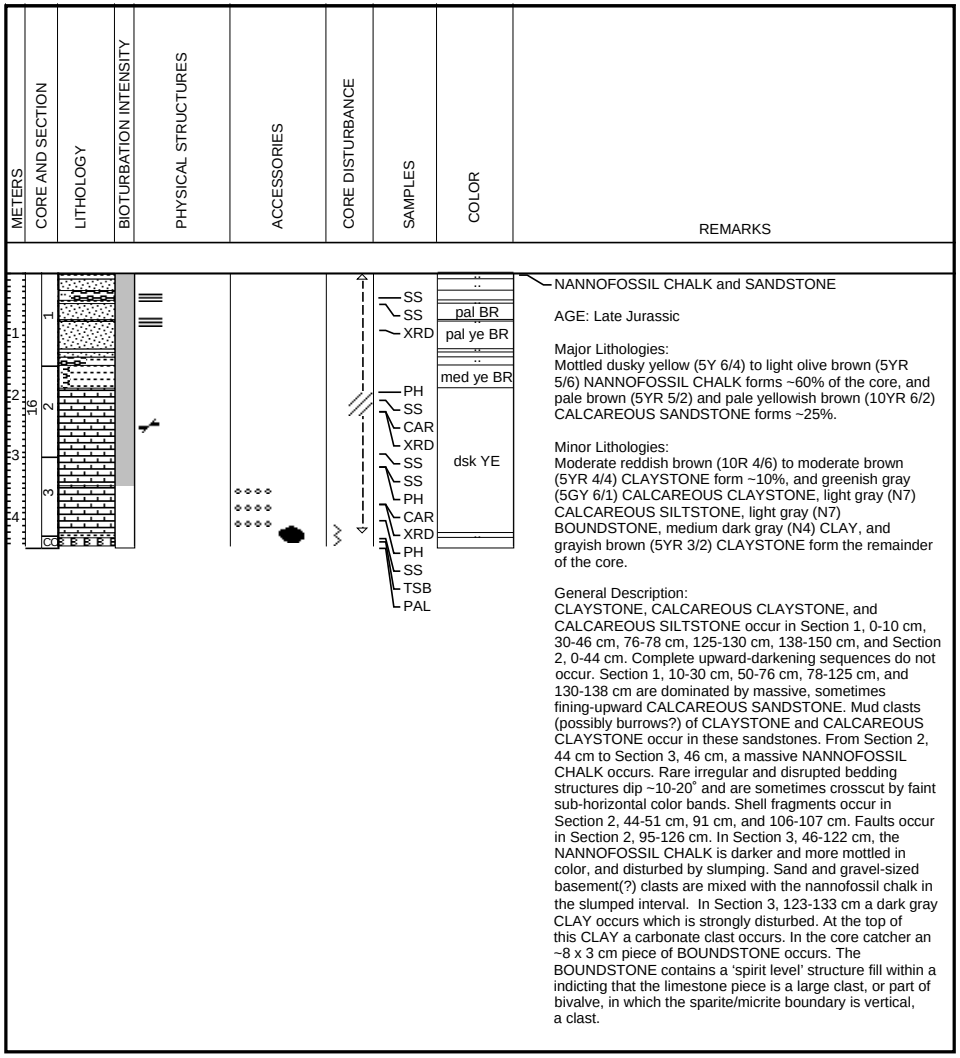
AGE: late Campanian

Major Lithology:
Light gray (N7), pale yellowish brown (10YR 6/2) and mottled white (N9) and medium gray (N5) CALCAREOUS SILTY SANDSTONE and CALCAREOUS SANDSTONE form ~35% of the core. Moderate brown (5YR 4/4) to light brown (5YR 6/4) and greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE and NANNOFOSSIL CHALK form ~35% of the core, and moderate brown (5YR 4/4) CLAYSTONE forms 30%.

General Description:
The core is dominated by upward darkening sequences (2-20 cm thick) of CALCAREOUS SANDSTONE or CALCAREOUS SILTY SANDSTONE overlain by CALCAREOUS CLAYSTONE or NANNOFOSSIL CHALK, and capped by CLAYSTONE. CLAYSTONE and the underlying calcareous lithologies are often well mixed by bioturbation in thinner sequences. The basal sandstone lithology is variable in thickness, often limited to thin bioturbated laminae, or is absent. However, medium to coarse-grained CALCAREOUS SILTY SANDSTONE and CALCAREOUS SANDSTONE beds, 4-32 cm thick increasingly occur downcore, some of which are part of upward darkening and upward fining sequences. These sandstone beds are typically massive, but occasionally parallel, wavy or cross laminated, and bioturbated. Interbedded with thick sandstone lithologies in Section 3 are intervals dominated by thin bedded CLAYSTONE, containing very thin bioturbated beds (<3 cm) or laminae of greenish gray CLAYSTONE or CALCAREOUS CLAYSTONE and rare light gray laminae of CALCAREOUS SILTSTONE.

SITE 1069 HOLE A CORE 16R CORED 863.6-873.3 mbsf

1069A-16R



NANNOFOSSIL CHALK and SANDSTONE

AGE: Late Jurassic

Major Lithologies:
Mottled dusky yellow (5Y 6/4) to light olive brown (5YR 5/6) NANNOFOSSIL CHALK forms ~60% of the core, and pale brown (5YR 5/2) and pale yellowish brown (10YR 6/2) CALCAREOUS SANDSTONE forms ~25%.

Minor Lithologies:
Moderate reddish brown (10R 4/6) to moderate brown (5YR 4/4) CLAYSTONE form ~10%, and greenish gray (5GY 6/1) CALCAREOUS CLAYSTONE, light gray (N7) CALCAREOUS SILTSTONE, light gray (N7) BOUNDSTONE, medium dark gray (N4) CLAY, and grayish brown (5YR 3/2) CLAYSTONE form the remainder of the core.

General Description:
CLAYSTONE, CALCAREOUS CLAYSTONE, and CALCAREOUS SILTSTONE occur in Section 1, 0-10 cm, 30-46 cm, 76-78 cm, 125-130 cm, 138-150 cm, and Section 2, 0-44 cm. Complete upward-darkening sequences do not occur. Section 1, 10-30 cm, 50-76 cm, 78-125 cm, and 130-138 cm are dominated by massive, sometimes fining-upward CALCAREOUS SANDSTONE. Mud clasts (possibly burrows?) of CLAYSTONE and CALCAREOUS CLAYSTONE occur in these sandstones. From Section 2, 44 cm to Section 3, 46 cm, a massive NANNOFOSSIL CHALK occurs. Rare irregular and disrupted bedding structures dip ~10-20° and are sometimes crosscut by faint sub-horizontal color bands. Shell fragments occur in Section 2, 44-51 cm, 91 cm, and 106-107 cm. Faults occur in Section 2, 95-126 cm. In Section 3, 46-122 cm, the NANNOFOSSIL CHALK is darker and more mottled in color, and disturbed by slumping. Sand and gravel-sized basement(?) clasts are mixed with the nannofossil chalk in the slumped interval. In Section 3, 123-133 cm a dark gray CLAY occurs which is strongly disturbed. At the top of this CLAY a carbonate clast occurs. In the core catcher an ~8 x 3 cm piece of BOUNDSTONE occurs. The BOUNDSTONE contains a 'spirit level' structure fill within a indicting that the limestone piece is a large clast, or part of bivalve, in which the sparite/micrite boundary is vertical, a clast.

SITE 1069 HOLE A CORE 17R **CORED 873.3-882.9 mbsf**

METERS	CORE AND SECTION	LITHOLOGY	BIOTURBATION INTENSITY	PHYSICAL STRUCTURES	ACCESSORIES	CORE DISTURBANCE	SAMPLES	COLOR	REMARKS
1	17R 1						TSB TSB PAL PAL	vlt GY vlt gy GY gn BK	GRAINSTONE, RUDSTONE, BOUNDSTONE AND METASEDIMENT

AGE: barren

Major Lithologies:
The core consists of pieces of very light gray (N8) to very pale orange (10YR 8/2) GRAINSTONE, RUDSTONE, and BOUNDSTONE, and pieces of dark greenish gray (5G 4/1) to greenish black (5GY 2/1) METASEDIMENT.

General Description:
Pieces 1-8 (Section 1, 0-44 cm) and 10 (which may be a small 'roller' out of sequence in the core) all consist of the limestone lithologies which contain clasts that vary in size from medium sand to large pebbles. The clasts are predominantly allochems and carbonate lithoclasts (coated grains, oncoids, skeletal debris, cryptalgal fragments, Chaetitid sponges, coral and other frame building organisms, plus occasional clasts of peloid grainstone), with scattered metasediment clasts up to 5 mm across.

Piece 18 is a breccia containing subrounded to subangular clasts (up to 1.5 cm) of metasedimentary rocks and boundstone set in a carbonate (possibly calcite and dolomite) matrix which contains fine sand to granule-sized angular metasediment clasts and pyrite grains.

Pieces 9-21 (with the exception of 10 and 18 described above), and similar ones in Cores 1069A-18R through -25R, are metasiltstone, meta-arkose wacke amd dolomitic meta-arkose, showing lower greenschist facies metamorphism. Bedding (including cross bedding) is defined by darker and lighter gray layers. Foliation is oblique to the layers, and pyrite grains are aligned parallel to the foliation. The rocks contain quartz, plagioclase, muscovite and chlorite, and some are carbonate-rich. Pieces 12 and 13 look like pebble sized clasts. They have rounded outer smooth surfaces that do not show any percussion marks, which would suggest that the smooth surfaces were not created by drilling.

SITE 1069 HOLE A CORE 26G CORED 767.0-959.3 mbsf

1069A-26G

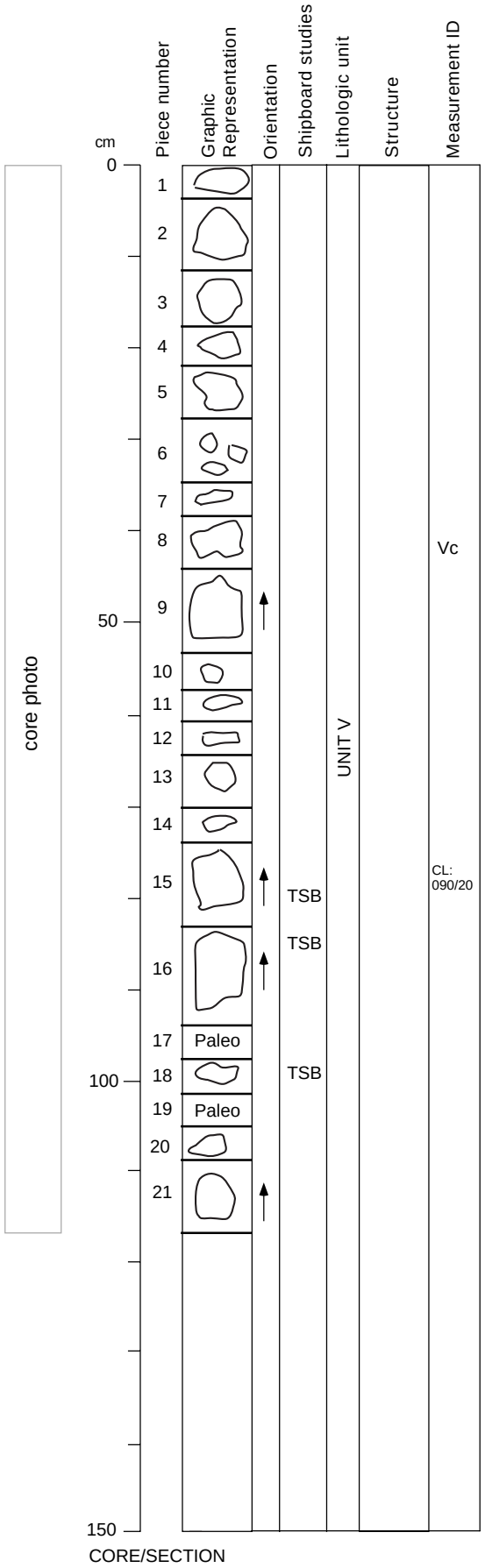
METERS	CORE AND SECTION	LITHOLOGY	BIOTURBATION INTENSITY	PHYSICAL STRUCTURES	ACCESSORIES	CORE DISTURBANCE	SAMPLES	COLOR	REMARKS
1	26 1						SS	dk gn GY	LITHIC SAND

AGE: not applicable

Major Lithology:
Dark greenish gray (5G 4/1) to grayish yellow (5Y 8/4) LITHIC SAND

Minor Lithology:
Yellowish gray (5Y 8/1)NANNOFOSSIL OOZE

General Description:
The medium to coarse grained LITHIC SAND consists of poorly sorted subangular to subrounded clasts of quartz and dark greenish gray meta-sediment basement clasts. The sand grains are mixed with a yellowish gray NANNOFOSSIL OOZE.



173-1069A-17R-1

UNIT V: META-ARKOSIC WACKE

Pieces 9, 11-16, 20, and 21

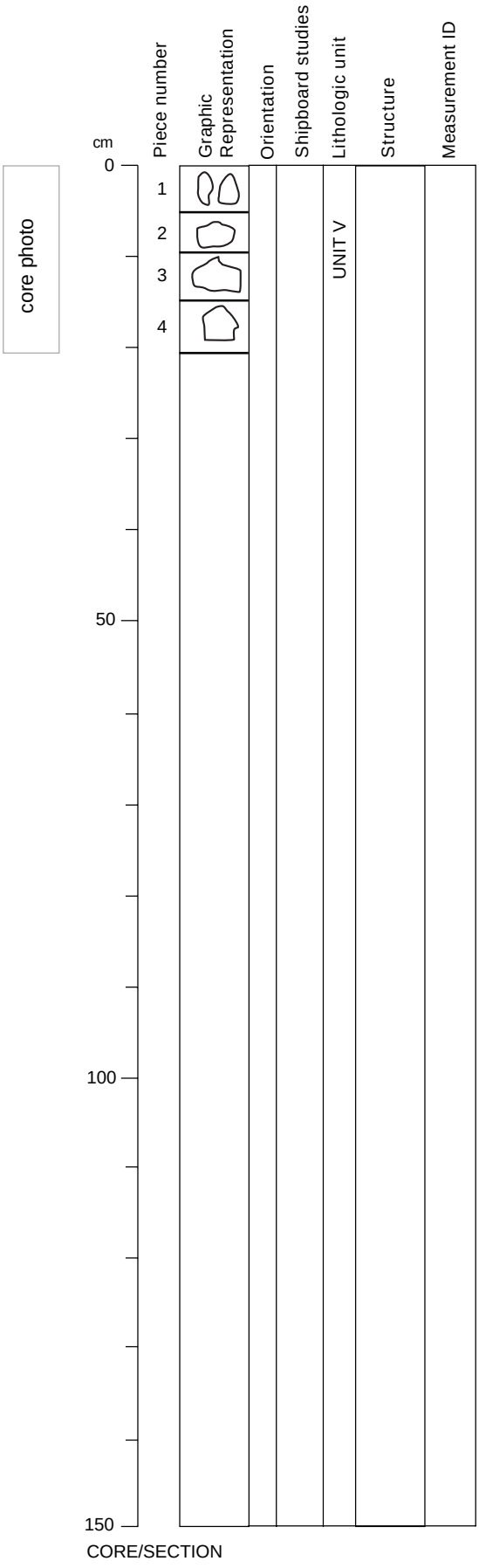
COLOR: Grayish black (N2), medium dark gray (N4) and dark greenish gray (5GY 4/1).
METAMORPHIC STRUCTURES: Slightly foliated.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
quartz	55-80	<1	anhedral	detrital
plagioclase	10-30	<1	anhedral	detrital
muscovite	5-10	<0.2	anhedral	platy, metamorphic
chlorite	5	<0.2	anhedral	platy, metamorphic

VEINS: <1%, pyrite and quartz.

ADDITIONAL COMMENTS: Piece 12 very fine-grained with coarser grained cross beds. Piece 15 void space (after pyrite?). Piece 16 is relatively coarse-grained. Piece 21 contains (reduction?) rings around pyrite(?)



173-1069A-18R-1

UNIT V: META-ARKOSIC WACKE

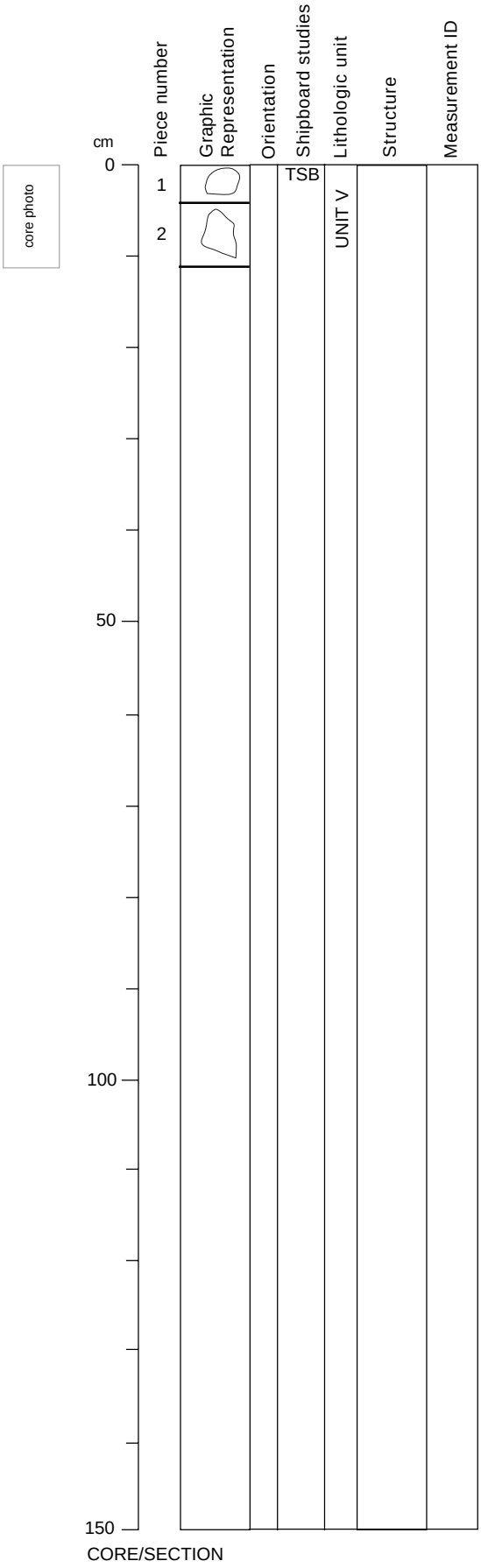
Pieces 1-4

COLOR: Dark gray (N3) to medium dark gray (N4).
METAMORPHIC STRUCTURES: Slightly foliated.
MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
quartz	70-85	<1	anhedral	detrital
plagioclase	5-15	<1	anhedral	detrital
muscovite	5-10	<0.2	anhedral	platy, metamorphic
chlorite	5	<0.2	anhedral	platy, metamorphic
pyrite	<1	<0.5	euhedral	

VEINS: <1%, pyrite and quartz. Veins parallel to foliation.

ADDITIONAL COMMENTS: Ovoid structures contain pyrite and/or quartz in pieces 1 and 3. Pyrite appears oxidized in Piece 1.



173-1069A-19R-1

UNIT V: METASILTSTONE AND META-ARKOSIC WACKE

Pieces 1 and 2

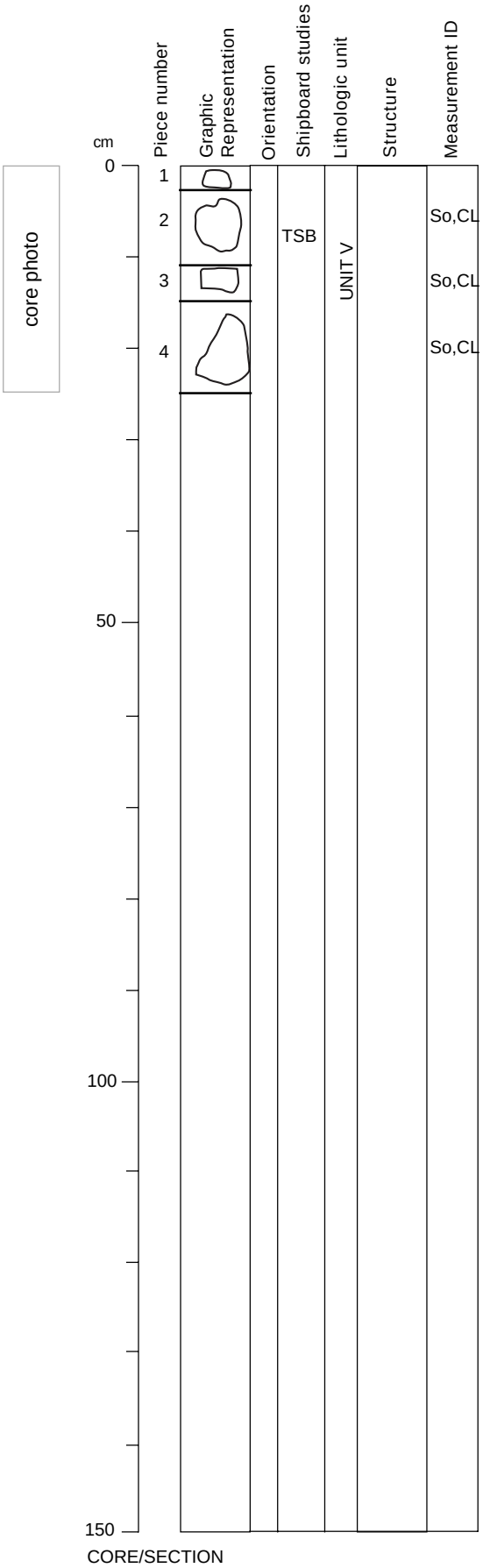
COLOR: Grayish black (N2) to medium dark gray (N4).
METAMORPHIC STRUCTURES: Slightly foliated. Foliation intersects relict bedding in Piece 2.

MINERALOGY:

Mineral Name	Mode (%)		Orig. Size (mm)	Shape	Comments
quartz	70	<1	anhedral	detrital	
plagioclase	13	<1	anhedral	detrital	
muscovite	10	<0.2	anhedral	platy, metamorphic	
chlorite	5	<0.2	anhedral	platy, metamorphic	
opaque mineral?	2	<0.2	euhedral		

VEINS:

ADDITIONAL COMMENTS: Piece 1 is a metasiltstone, and Piece 2 is a very fine-grained meta-arkosic wacke. Pyrite absent?



173-1069A-20R-1

UNIT V: META-ARKOSIC WACKE

Pieces 1-4

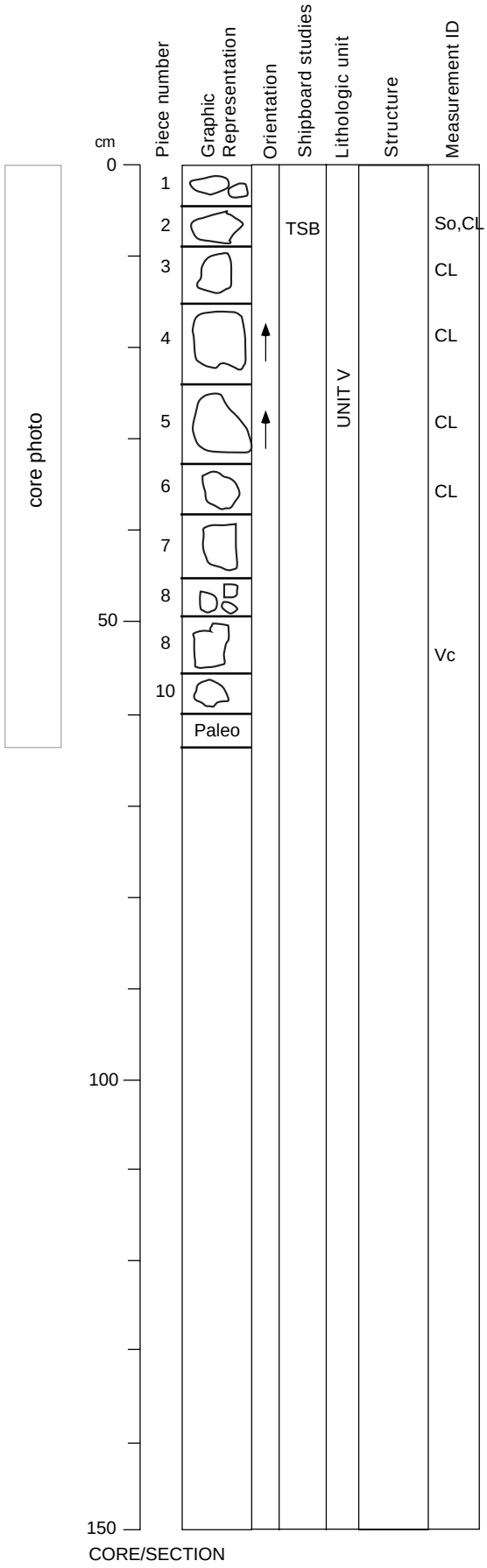
COLOR: Grayish black (N2) to medium dark gray (N4).
METAMORPHIC STRUCTURES: Slightly foliated. Foliation intersects relict bedding in Piece 2.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
quartz	60-70	<1	anhedral	detrital
plagioclase	10-30	<1	anhedral	detrital
muscovite	5-15	<0.2	anhedral	platy, metamorphic
chlorite	5	<0.2	anhedral	platy, metamorphic

VEINS: <1%, pyrite and quartz. Veins cut foliation.
Comments: Pyrite also occurs in isolated masses and with felsic minerals in ovoid pods (deformed burrows?).

ADDITIONAL COMMENTS: Relict bedding in Piece 3. Ovoid structures contain pyrite and/or quartz. Some hollow and lined with euhedral crystals.



173-1069A-21R-1

UNIT V: META-ARKOSIC WACKE

Pieces 1-10

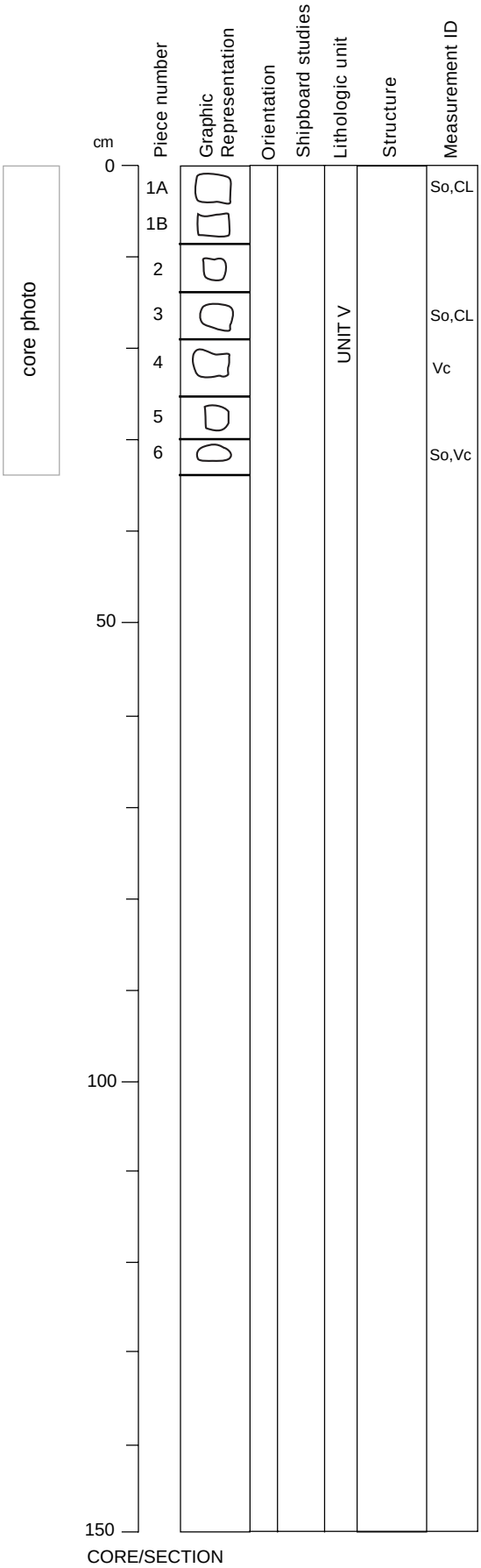
COLOR: Grayish black (N2) to medium dark gray (N4)
METAMORPHIC STRUCTURES: Slightly foliated. Foliation intersects relict bedding in Pieces 2 and 3.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Commens
quartz	50-70	<1	anhedral	detrital
plagioclase	10-30	<1	anhedral	detrital
muscovite	15	<0.2	anhedral	platy, metamorphic
chlorite	5	<0.2	anhedral	platy, metamorphic

VEINS: <1%, pyrite and quartz. Veins cut foliation.
Comments: Pyrite also occurs with felsic minerals in ovoid pods (deformed burrows?).

ADDITIONAL COMMENTS: Relict bedding in Piece 2. Drilling disturbance in Piece 8. Ovoid structures contain pyrite and/or quartz. Some ovoid structures are hollow and lined with euhedral crystals.



173-1069A-22R-1

UNIT V: META-ARKOSIC WACKE

Pieces 1-6

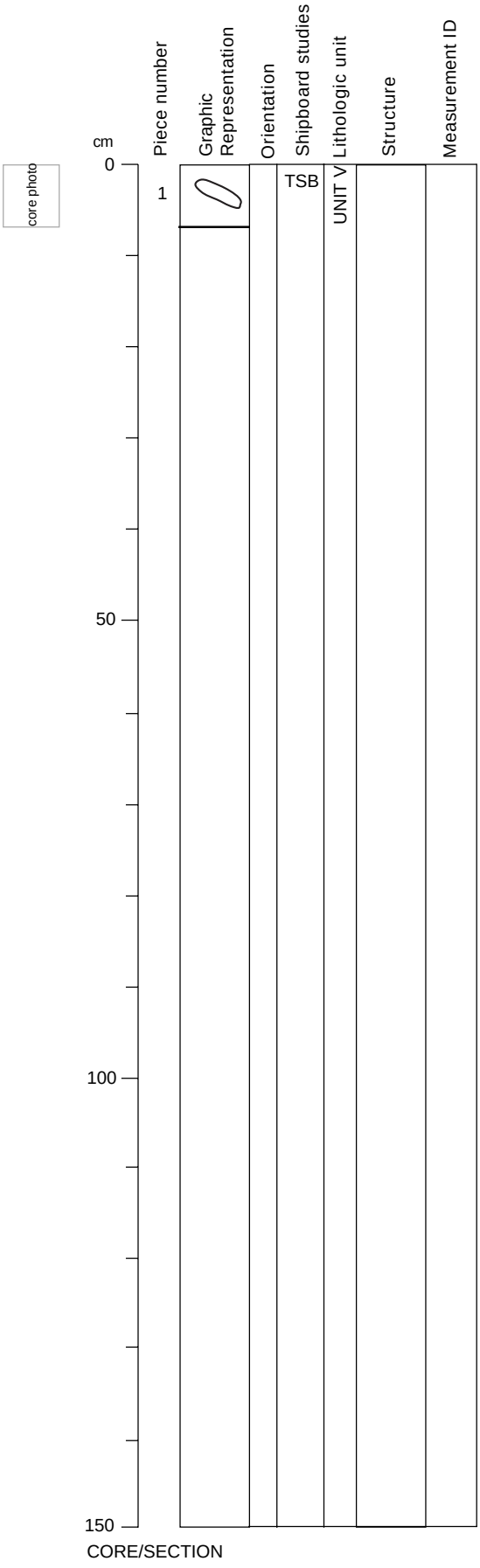
COLOR: Grayish black (N2) to medium dark gray (N4).
METAMORPHIC STRUCTURES: Slightly foliated.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
quartz	50-70	<1	anhedral	detrital
plagioclase	10-30	<1	anhedral	detrital
muscovite	15	<0.2	anhedral	platy, metamorphic
chlorite	5	<0.2	anhedral	platy, metamorphic

VEINS: <2%, pyrite and quartz. Veins cut foliation.
Comments: Pyrite more abundant than in Sections 20R-1 and 21R-1. Pyrite also occurs with felsic minerals in ovoid pods (deformed burrows?).

ADDITIONAL COMMENTS: Ovoid structures contain pyrite and/or quartz. Some ovoid structures are hollow and lined with euhedral crystals.



173-1069A-23R-1

UNIT V: DOLOMITIC METASILTSTONE

Pieces 1

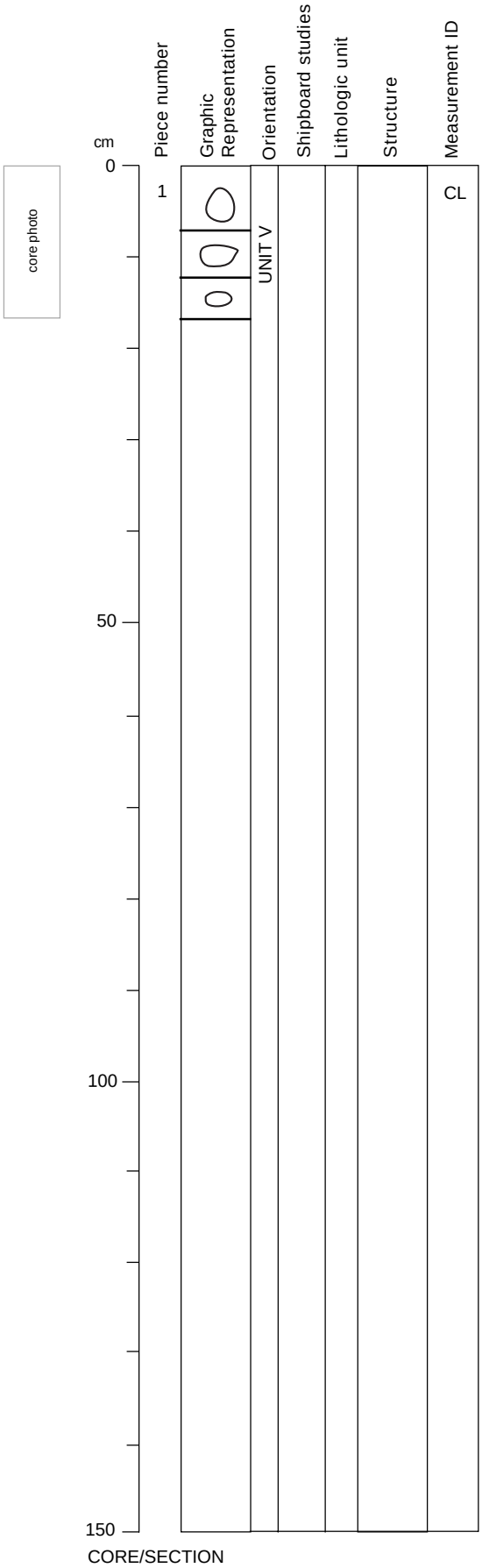
COLOR: Greenish black (5G 2/1).
METAMORPHIC STRUCTURES: Slightly foliated.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
quartz	60	<1	anhedral	detrital
plagioclase	10	<1	anhedral	detrital
muscovite	15	<0.2	anhedral	platy, metamorphic
dolomite	10	<0.2	euhedral	small, elongate grains
chlorite	5	<0.2	anhedral	platy, metamorphic

VEINS: No veins.

ADDITIONAL COMMENTS: Pyrite occurs in a few isolated masses. Relict lamination. Ovoid structures absent.



173-1069A-24R-1

UNIT V: META-ARKOSIC WACKE

Pieces 1-3

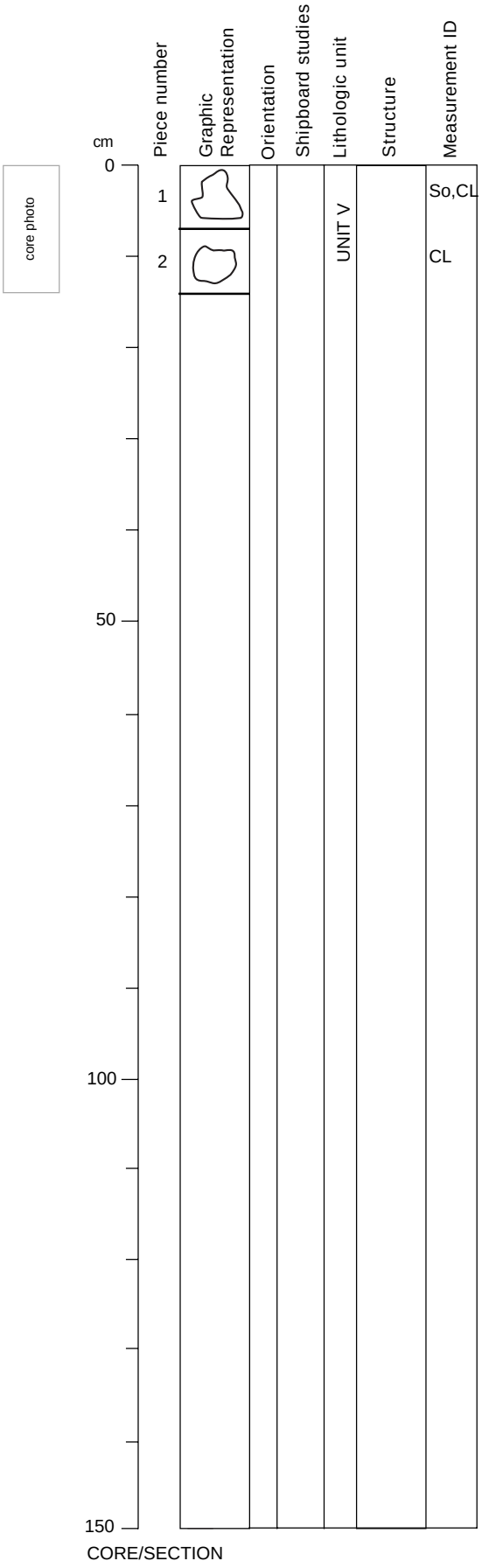
COLOR: Grayish black (N2) to medium dark gray (N4).
METAMORPHIC STRUCTURES: Slightly foliated.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
quartz	50-70	<1	anhedral	detrital
plagioclase	10-30	<1	anhedral	detrital
muscovite	15	<0.2	anhedral	platy, metamorphic
chlorite	5	<0.2	anhedral	platy, metamorphic

VEINS: <1%, Pyrite and quartz veins.
Comments: Pyrite also occurs in ovoid structures with felsic minerals (deformed burrows?).

ADDITIONAL COMMENTS: Relict lamination. Drilling disturbance in Piece 3. Ovoid structures contain pyrite and/or quartz. Some ovoid structures are hollow and lined with euhedral crystals.



173-1069A-25R-1

UNIT V: META-ARKOSIC WACKE

Pieces 1 and 2

COLOR: Grayish black (N2) to medium dark gray (N4).
METAMORPHIC STRUCTURES: Slightly foliated.

MINERALOGY:

Mineral Name	Mode (%)	Orig. Size (mm)	Shape	Comments
quartz	50-70	<1	anhedral	detrital
plagioclase	10-30	<1	anhedral	detrital
muscovite	15	<0.2	anhedral	platy, metamorphic
chlorite	5	<0.2	anhedral	platy, metamorphic

VEINS: No veins.

ADDITIONAL COMMENTS: Pyrite occurs in ovoid structures with felsic mineral(s). Some structures hollow and lined with euhedral pyrite and quartz. Relict bedding and cross-bedding in Piece 1.