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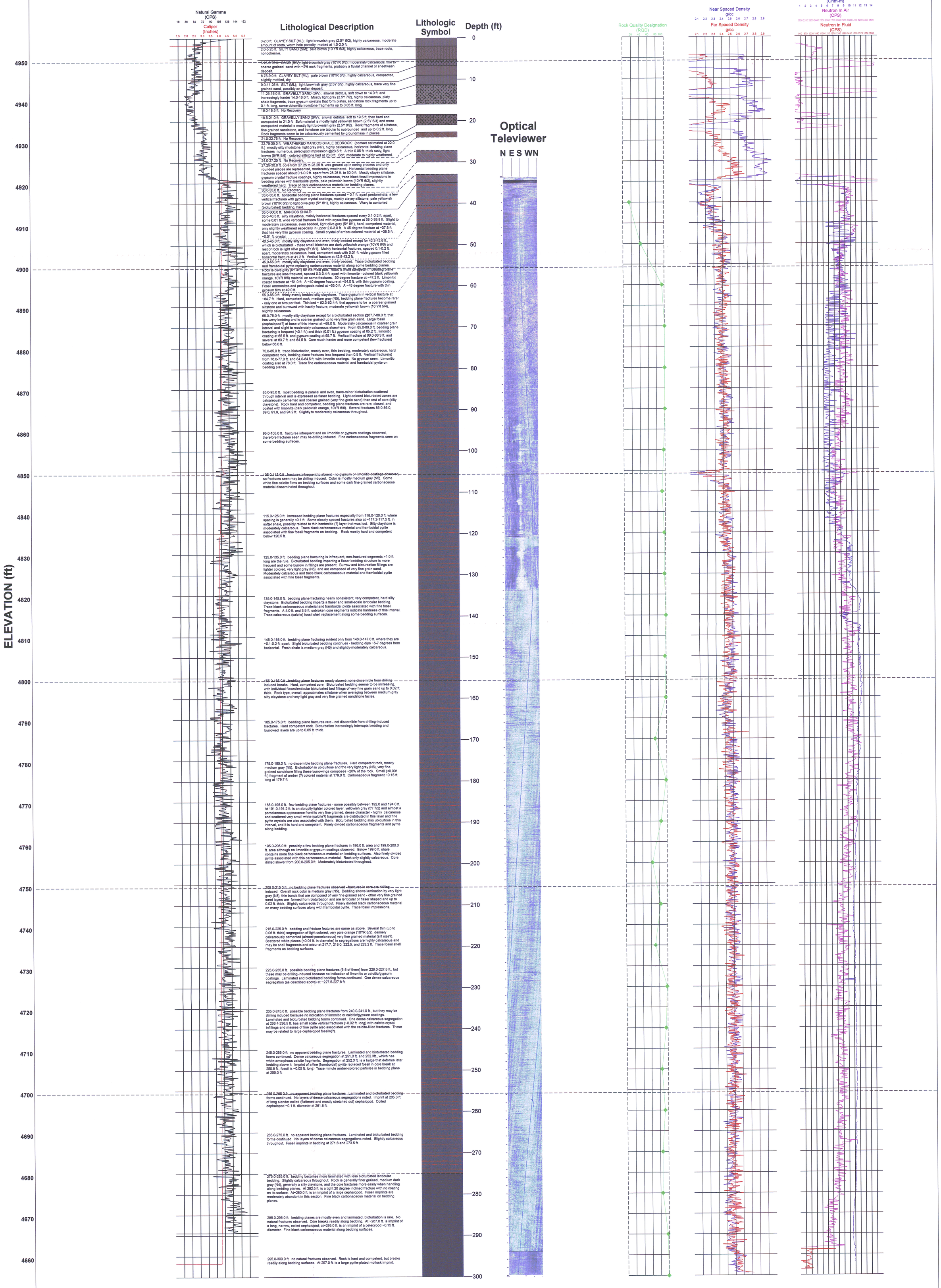

0-2.0 ft. CLAYEY SILT (ML); light brownish gray (2.5Y 6/2), highly calcareous, moderate amount of roots, worm hole porosity, mottled at 1.0-2.0 ft.

2.0-5.25 ft. SILTY SAND (SM); pale brown (10 YR 6/3), highly calcareous, trace roots, noncohesive.

5.25-6.75 ft. SAND (SW); light brownish gray (10YR 6/2), moderately calcareous, fine to coarse grained sand with ~2% rock fragments, probably a fluvial channel or sheetwash deposit.

6.75-9.0 ft. CLAYEY SILT (ML); pale brown (10YR 6/3), highly calcareous, compacted, slightly mottled, dry.

9.0-11.25 ft. SILT (ML); light brownish gray (2.5Y 6/2), highly calcareous, trace very fine grained sand, possibly an eolian deposit.

11.25-18.0 ft. GRAVELLY SAND (SW); alluvial detritus, soft down to 14.0 ft. and increasingly harder 14.0-18.0 ft. Mostly light gray (2.5Y 7/2), highly calcareous, platy shale fragments, trace gypsum crystals that form plates, sandstone rock fragments up to 0.1 ft. long, some dolomitic ironstone fragments up to 0.05 ft. long.

18.0-18.5 ft. No Recovery

18.5-21.0 ft. GRAVELLY SAND (SW); alluvial detritus, soft to 19.5 ft, then hard and compacted to 21.0 ft. Soft material is mostly light yellowish brown (2.5Y 6/4) and more compacted material is mostly light brownish gray (2.5Y 6/2). Rock fragments of siltstone, fine grained sandstone, and ironstone are tabular to subrounded and up to 0.2 ft. long. Rock fragments seem to be calcareously cemented by groundmass in places.

21.0-22.75 ft. No Recovery.

22.75-35.0 ft. WEATHERED MANCOS SHALE BEDROCK: (contact estimated at 22.0 ft.) mostly silty mudstone, light gray (N7), highly calcareous, horizontal bedding plane fractures numerous, pelecypod impression @23.5 ft. A thin 0.05 ft. thick rusty, light brown (5YR 5/6) - colored siltstone bed at 23.0 ft. Soft, moderate to highly weathered.

24.0-27.25 ft. No Recovery.

27.25-30.0 ft. core from 27.25 to 28.25 ft. was ground up in coring process and only rounded pieces are represented, moderately weathered. Horizontal bedding plane fractures spaced about 0.1-0.2 ft. apart from 28.25 ft. to 30.0 ft. Mostly clayey siltstone, gypsum crystal fracture coatings, highly calcareous, trace black fossil impressions in bedding planes with framboidal pyrite, pale yellowish brown (10YR 6/2), slightly weathered hard. Trace of dark carbonaceous material on bedding planes.

30.0-33.0 ft. No Recovery.

33.0-35.0 ft. horizontal bedding plane fractures spaced ~ 0.1 ft. apart predominate, a few vertical fractures with gypsum crystal coatings, mostly clayey siltstone, pale yellowish brown (10YR 6/2) to light olive gray (5Y 6/1), highly calcareous. Wavy to contorted (bioturbated) bedding, hard.

35.0-300.0 ft. MANCOS SHALE:

35.0-40.5 ft. silty claystone, mainly horizontal fractures spaced every 0.1-0.2 ft. apart, some 0.01 ft. wide vertical fractures filled with crystalline gypsum at 38.0-39.8 ft. Slight to moderately calcareous, even bedded, light olive gray (5Y 6/1), hard, competent material, only slightly weathered especially in upper 2.0-3.0 ft. A 45 degree fracture at ~37.8 ft. that has very thin gypsum coating. Small crystal of amber-colored material at ~38.5 ft., ~0.01 ft. crystal.

40.5-45.0 ft. mostly silty claystone and even, thinly bedded except for 42.3-42.6 ft., which is bioturbated - these small blotches are dark yellowish orange (10YR 6/6) and rest of rock is light olive gray (5Y 6/1). Mainly horizontal fractures, spaced 0.1-0.2 ft. apart, moderately calcareous, hard, competent rock with 0.01 ft. wide gypsum filled horizontal fracture at 41.2 ft. Vertical fracture at 42.8-43.2 ft.

45.0-55.0 ft. mostly silty claystone and even, thinly bedded. Trace bioturbated bedding and framboidal pyrite replacing carbonaceous material along some bedding planes. Rock is olive gray (5Y 4/1) for the most part. Rock is more competent - bedding plane fractures are less frequent, spaced 0.3-0.4 ft. apart with limonite - colored (dark yellowish orange, 10YR 6/6) material on some fractures. 30 degree fracture at ~47.2 ft. Limonitic coated fracture at ~51.0 ft. A ~40 degree fracture at ~54.0 ft. with thin gypsum coating. Fossil ammonites and pelecypods noted at ~53.0 ft. A ~45 degree fracture with thin gypsum film at 49.0 ft.

55.0-65.0 ft. thinly-evenly bedded silty claystone. Trace gypsum in vertical fracture at ~64.7 ft. Hard, competent rock, medium gray (N5), bedding plane fractures become rarer - only one or two per foot. Thin bed ~ 62.3-62.4 ft. that appears to be a coarser grained siltstone and burrowed with hackly fracture, moderate yellowish brown (10 YR 5/4), slightly calcareous.

65.0-75.0 ft. mostly silty claystone except for a bioturbated section @67.7-68.0 ft. that has wavy bedding and is coarser grained up to very fine grain sand. Large fossil (cephalopod?) at base of this interval at ~68.0 ft. Moderately calcareous in coarser grain interval and slight to moderately calcareous elsewhere. From 65.0-68.0 ft. bedding plane fracturing is frequent (<0.1 ft.) and thick (0.01 ft.) gypsum coating at 65.2 ft., limonitic coating at 65.5 ft. and gypsum coating at 65.7 ft. Vertical fracture at 68.0-68.3 ft. and several at 63.7 ft. and 64.5 ft. Core much harder and more competent (few fractures) below 66.0 ft.

75.0-85.0 ft. trace bioturbation, mostly even, thin bedding, moderately calcareous, hard competent rock, bedding plane fractures less frequent than 0.5 ft. Vertical fracture(s) from 76.0-77.0 ft. and 84.0-84.5 ft. with limonite coatings. No gypsum seen. Limonitic coating also at 78.0 ft. Trace fine carbonaceous material and framboidal pyrite on bedding planes.

85.0-95.0 ft. most bedding is parallel and even, trace-minor bioturbation scattered through interval and is expressed as flaser bedding. Light-colored bioturbated zones are calcareously cemented and coarser grained (very fine grain sand) than rest of core (silty claystone). Rock hard and competent, bedding plane fractures are rare, closed, and coated with limonite (dark yellowish orange, 10YR 6/6). Several fractures 85.0-86.0, 89.0, 91.9, and 94.2 ft. Slightly to moderately calcareous throughout.

95.0-105.0 ft. fractures infrequent and no limonitic or gypsum coatings observed, therefore fractures seen may be drilling induced. Fine carbonaceous fragments seen on some bedding surfaces.

105.0-115.0 ft. fractures infrequent to absent - no gypsum or limonitic coatings observed, so fractures seen may be drilling induced. Color is mostly medium gray (N5). Some white fine calcite films on bedding surfaces and some dark fine grained carbonaceous material disseminated throughout.

115.0-125.0 ft. increased bedding plane fractures especially from 118.0-120.0 ft. where spacing is generally <0.1 ft. Some closely spaced fractures also at ~117.2-117.5 ft. in softer shale, possibly related to thin bentonitic (?) layer that was lost. Silty claystone is moderately calcareous. Trace black carbonaceous material and framboidal pyrite associated with fine fossil fragments on bedding. Rock mostly hard and competent below 120.5 ft.

125.0-135.0 ft. bedding plane fracturing is infrequent, non-fractured segments >1.0 ft. long are the rule. Bioturbated bedding imparting a flaser bedding structure is more frequent and some burrow in fillings are present. Burrow and bioturbation fillings are lighter colored, very light gray (N8), and are composed of very fine grain sand. Moderately calcareous and trace black carbonaceous material and framboidal pyrite associated with fine fossil fragments.

135.0-145.0 ft. bedding plane fracturing nearly nonexistent, very competent, hard silty claystone. Bioturbated bedding imparts a flaser and small-scale lenticular bedding. Trace black carbonaceous material and framboidal pyrite associated with fine fossil fragments. A 4.0 ft. and 3.5 ft. unbroken core segments indicate hardness of this interval. Trace calcareous (calcite) fossil shell replacement along some bedding surfaces.

145.0-155.0 ft. bedding plane fracturing evident only from 146.0-147.0 ft. where they are ~0.1-0.2 ft. apart. Slight bioturbated bedding continues - bedding dips ~5-7 degrees from horizontal. Fresh shale is medium gray (N5) and slightly-moderately calcareous.

155.0-165.0 ft. bedding plane fractures nearly absent - none discernible from drilling induced breaks. Hard, competent core. Bioturbated bedding seems to be increasing, with individual flaser/lenticular bioturbated bed fillings of very fine grain sand up to 0.02 ft. thick. Rock type, overall, approximates siltstone when averaging between medium gray silty claystone and very light gray and very fine grained sandstone facies.

165.0-175.0 ft. bedding plane fractures rare - not discernible from drilling-induced fractures. Hard competent rock. Bioturbation increasingly interrupts bedding and burrowed layers are up to 0.05 ft. thick.

175.0-185.0 ft. no discernible bedding plane fractures. Hard competent rock, mostly medium gray (N5). Bioturbation is ubiquitous and the very light gray (N8), very fine grained sandstone filling these burrowings composes ~20% of the rock. Small (<0.001 ft.) fragment of amber (?) colored material at 179.0 ft. Carbonaceous fragment ~0.15 ft. long at 179.7 ft.

185.0-195.0 ft. few bedding plane fractures - some possibly between 192.0 and 194.0 ft. At 191.0-191.2 ft. is an abruptly lighter colored layer, yellowish gray (5Y 7/2) and almost a porcelaneous appearance from its very fine grained, dense character - highly calcareous and scattered very small white (calcite?) fragments are distributed in this layer and fine pyrite crystals are also associated with them. Bioturbated bedding also ubiquitous in this interval, and it is hard and competent. Finely divided carbonaceous fragments and pyrite along bedding.

195.0-205.0 ft. possibly a few bedding plane fractures in 198.0 ft. area and 199.0-200.0 ft. area although no limonitic or gypsum coatings observed. Below 199.0 ft. shale contains more fine black carbonaceous material on bedding surfaces. Also finely divided pyrite associated with this carbonaceous material. Rock only slightly calcareous. Core drilled slower from 200.0-205.0 ft. Moderately bioturbated throughout.

205.0-215.0 ft. no bedding plane fractures observed - fractures in core are drilling induced. Overall rock color is medium gray (N5). Bedding shows lamination by very light gray (N8), thin bands that are composed of very fine grained sand - other very fine grained sand layers are formed from bioturbation and are lenticular or flaser shaped and up to 0.02 ft. thick. Slightly calcareous throughout. Finely divided black carbonaceous material on many bedding surfaces along with framboidal pyrite. Trace fossil impressions.

215.0-225.0 ft. bedding and fracture features are same as above. Several thin (up to 0.06 ft. thick) segregation of light-colored, very pale orange (10YR 8/2), densely calcareously cemented (almost porcelaneous) very fine grained material (silt size?). Scattered white pieces (<0.01 ft. in diameter) in segregations are highly calcareous and may be shell fragments and occur at 217.7, 218.0, 222.5, and 223.2 ft. Trace fossil shell fragments on bedding surfaces.

225.0-235.0 ft. possible bedding plane fractures (6-8 of them) from 226.0-227.5 ft., but these may be drilling-induced because no indication of limonitic or calcitic/gypsum coatings. Laminated and bioturbated bedding forms continued. One dense calcareous segregation (as described above) at ~227.5-227.6 ft.

235.0-245.0 ft. possible bedding plane fractures from 240.0-241.0 ft., but they may be drilling induced because no indication of limonitic or calcitic/gypsum coatings. Laminated and bioturbated bedding forms continued. One dense calcareous segregation at 238.4-238.5 ft. has small scale vertical fractures (~0.02 ft. long) with calcite crystal infillings and masses of fine pyrite also associated with the calcite-filled fractures. These may be related to large cephalopod fossils(?).

245.0-255.0 ft. no apparent bedding plane fractures. Laminated and bioturbated bedding forms continued. Dense calcareous segregation at 251.0 ft. and 252.3ft., which has white amorphous calcite fragments. Segregation at 252.3 ft. is a bulge that deforms later bedding above it. Imprint of a fine (framboidal) pyrite replaced fossil in core break at 250.8 ft., fossil is ~0.05 ft. long. Trace minute amber-colored particles in bedding plane at 255.0 ft.

255.0-265.0 ft. no apparent bedding plane fractures. Laminated and bioturbated bedding forms continued. No layers of dense calcareous segregations noted. Imprint at 265.3 ft. of long slender coiled (flattened and mostly stretched out) cephalopod. Coiled cephalopod ~0.1 ft. diameter at 261.8 ft.

265.0-275.0 ft. no apparent bedding plane fractures. Laminated and bioturbated bedding forms continued. No layers of dense calcareous segregations noted. Slightly calcareous throughout. Fossil imprints in bedding at 271.6 and 273.5 ft.

275.0-285.0 ft. bedding becomes more laminated with less bioturbated lenticular bedding. Slightly calcareous throughout. Rock is generally finer grained, medium dark gray (N4), generally a silty claystone, and the core fractures more easily when handling along bedding planes. At 282.5 ft. is a tight 20 degree inclined fracture with no coating on its surface. At~280.0 ft. is an imprint of a large cephalopod. Fossil imprints are moderately abundant in this section. Fine black carbonaceous material on bedding planes.

285.0-295.0 ft. bedding planes are mostly even and laminated, bioturbation is rare. No natural fractures observed. Core breaks readily along bedding. At ~287.0 ft. is imprint of a long, narrow, coiled cephalopod; at~295.0 ft. is an imprint of a pelecypod ~0.15 ft. diameter. Fine black carbonaceous material along bedding surfaces.

295.0-300.0 ft. no natural fractures observed. Rock is hard and competent, but breaks readily along bedding surfaces. At 297.0 ft. is a large pyrite-plated mollusk imprint.

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