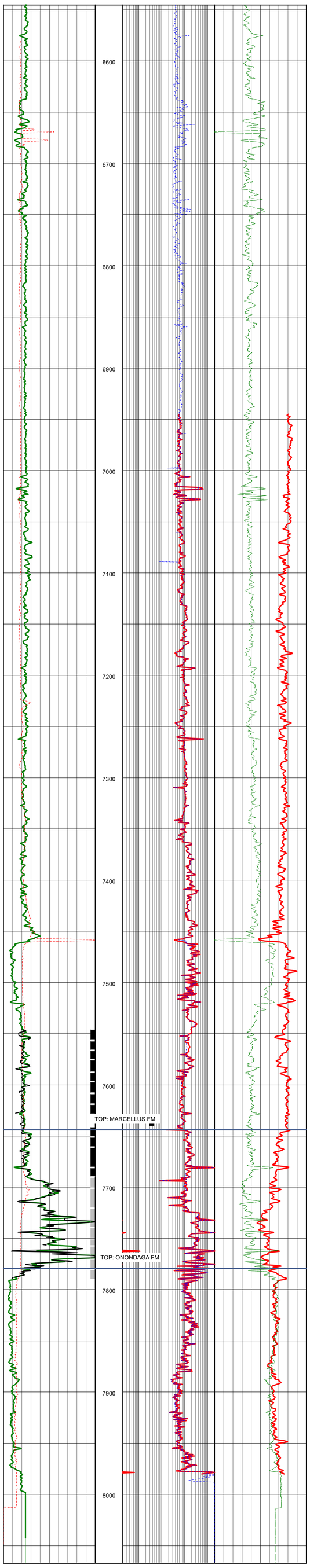
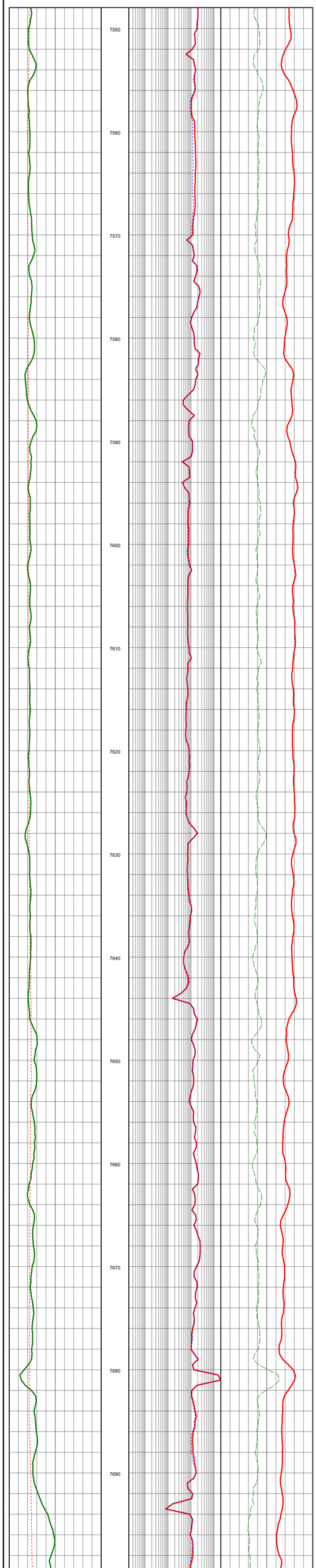
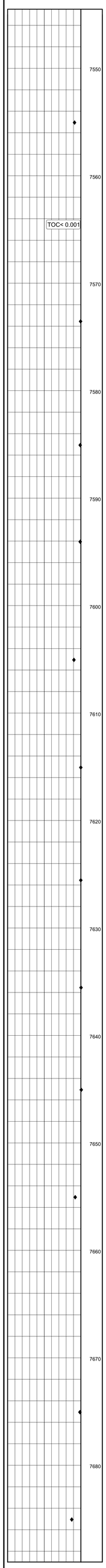
GR 0 GAPI 600 | CALI 6 IN 16 | COREDS 20 0 | DEPTH FT | RT 0.2 OHMM 2000 | RM 0.2 2000 | RHOB 1.95 2.95 | NPHI 0.45 CFCF -0.15



GR 0 GAPI 600 | CALI 6 IN 16 | DEPTH FT | RT 0.2 OHMM 2000 | RM 0.2 2000 | RHOB 1.95 2.95 | NPHI 0.45 CFCF -0.15



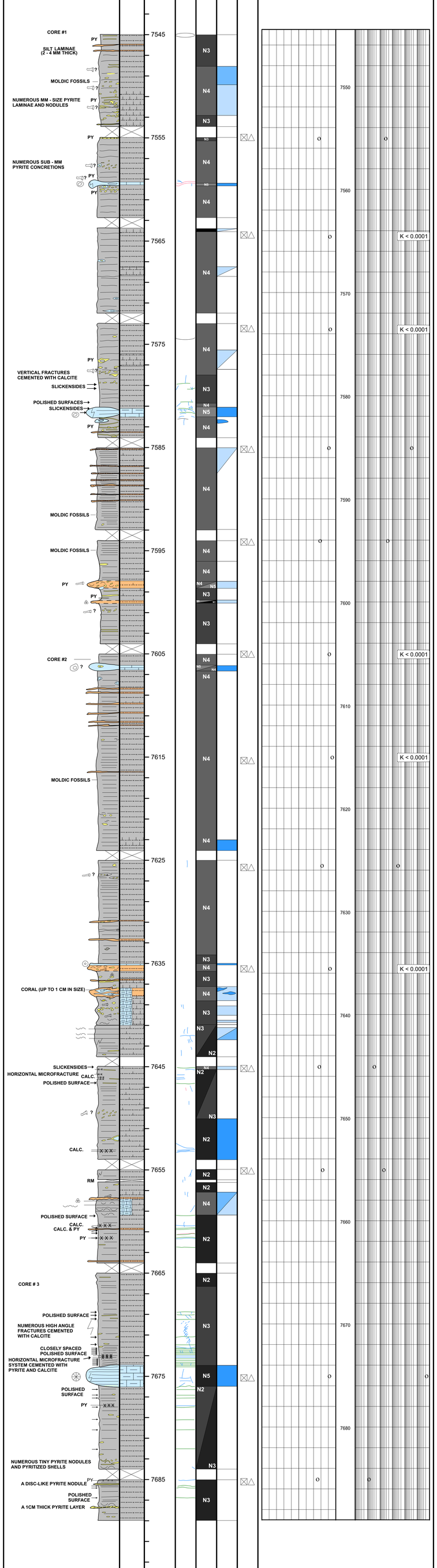
TOC 20 WT % 0 | DEPTH FT



GRAVEL / CONGLOMERATE | COARSE GRAINED SANDSTONE | MEDIUM GRAINED SANDSTONE | FINE GRAINED SANDSTONE | VERY FINE GRAINED SANDSTONE | SILTSTONE | SILTY SHALE | SHALE | SILICICLASTIC | CARBONATE | LITHOLOGY | BOUNDSTONE | GRAINSTONE | PACKSTONE | WACKESTONE | MUDSTONE | SHALE

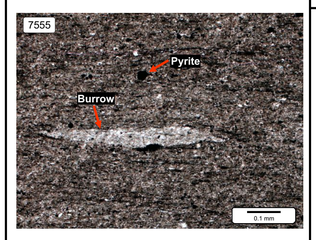
CORE DEPTH (FEET) | FRACTURES | COLOR | CaCO3 REACTION | SAMPLE LOCATION

COREPORE 20 % | DEPTH FT | COREPERM 100 nd 0.0001

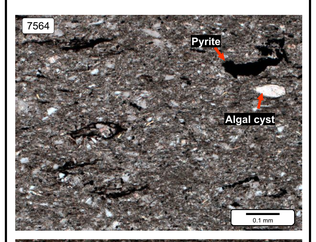


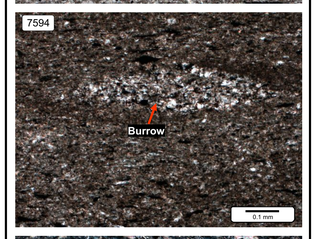
DESCRIPTION AND REMARKS

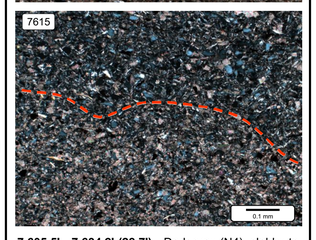
Log Depth = Core Depth + 5.0 Feet



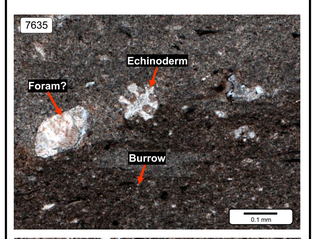
7,545.0' - 7,605.5' (60.5') - Interbedded dark gray (N4), slabby to locally flaggy, very faintly laminated, very slightly calcareous (including dolomitic), (slightly) pyritic, organic-poor, silty shale and dark gray (N3), slabby to locally flaggy, very faintly laminated, non-calcareous, pyritic, moderately organic-rich, slightly silty shale. Silt laminae (or layers) are sparse and prominent at 7598.9 to 7599.6 feet. Bioturbation is visible at 7557.0 to 7558.0 feet and 7598.9 to 7599.6 feet. Carbonate concretions are sparse (i.e., 7559.5 feet, 7581.5 feet, and 7582.2 feet) but relatively large (2 to 8 inches in diameter). Pyrite concretions, ranging from millimeter to centimeter in size, are relatively sparse. Fractures are not common and closely associated with a large carbonate concretion (7580.5 to 7582.4 feet); a 6 mm wide, calcite-cemented, vertical fracture exists at 7580.6 to 7580.8 feet.

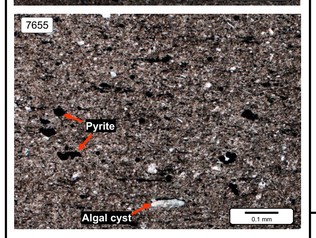






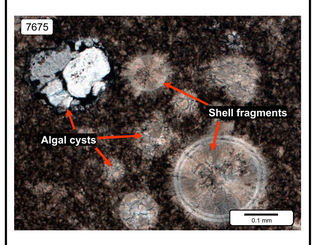
7,605.5' - 7,634.2' (28.7') - Dark gray (N4), slabby to locally flaggy, very faintly laminated to mottled (bioturbated), slightly dolomitic, organic-poor, silty shale with very sparse silt laminae. Calcareous fossils are very sparse. Centimeter-sized (up to 2.5 cm thick) disc-like pyrite concretions are common. A carbonate concretion occurs at 7606.1 to 7606.6 feet. A vertical calcite-cemented fracture exists at 7625 to 7625.55 feet.

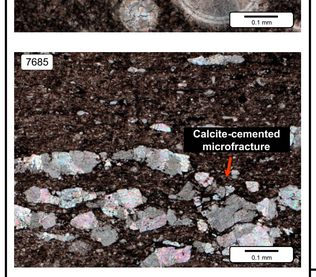




7,634.2' - 7,641.0' (6.8') - Interbedded dark gray (N3), slabby to locally flaggy, very faintly laminated, silty shale and medium dark gray (N4), slabby to locally flaggy, very faintly laminated to mottled (bioturbated), very slightly calcareous, organic-poor, silty shale and silt layers. Compared to the shale, the silty sections tend to have more calcareous shell fragments, carbonate concretions (see two carbonate concretions at 7637.7 to 7638.1 feet), and burrows. Vertical calcite-cemented fractures occur at 7639.0 to 7639.35 feet.

7,641.0' - 7,689.0' (48.0') - Dark gray to black (N2 - N3), slabby to locally flaggy and platy, faintly laminated, non-calcareous to slightly calcareous, pyritic, moderately organic-rich, silty shale. A large septarian carbonate concretion with faintly laminated to massive internal structure and calcite-cemented fractures exists at 7674.1 to 7676.0 feet. Calcareous skeletal debris accumulate in faint lamination between 7641.0 and 7643.0 feet as well as between 7657.5 and 7659.5 feet. Silt laminae are very sparse. Slickensides are common through the interval and particularly abundant at 7672.0 to 7674.1 feet; Calcite-cemented fractures are also common and a complex vertical fracture system occurs between 7690.15 and 7691.9 feet.





DEPOSITIONAL ENVIRONMENTS: SLOPE / BASIN

FORMATION: MAHANTANGO FORMATION / MARCELLUS FORMATION

AGE: MIDDLE DEVONIAN

Core Lab
RESERVOIR OPTIMIZATION

GEOLOGY BY:
Jie Zhou

COMPUTER DRAFTING BY:
J. Followell

VERTICAL SCALE
1 : 48

Job No. 090180
MSS 25

CORE LEGEND

LITHOLOGY

- SANDSTONE
- MUDDY SANDSTONE
- SILTSTONE
- SHALE
- SILTY SHALE
- LIMESTONE
- DOLOSTONE
- CALCITIC / DOLOMITIC
- FRACTURE
- CARBONATE GRAINS
- SHELL/SKELETAL FRAGMENTS
- BEDDED CHERT
- CHERT NODULES
- CHERT LAYERS
- PYRITE NODULES
- BURROWS
- SOFT SEDIMENT DEFORMATION
- CARBONACEOUS DETRITUS
- WAVY DISCONTINUOUS BEDDING
- HARDGROUND
- CONCRETIONS
- EROSIONAL CONTACT
- GRADATIONAL CONTACT
- SEPTARIAN NODULES
- AMMONOIDS
- BRACHIOPODS
- FLUORAPATITE
- ENCHINODERMS
- FINING UP BED
- CORING INDUCED FRACTURE
- OPEN/CLOSED NATURAL FRACTURE
- MINERALIZED FRACTURE
- FINING UPWARD
- COARSENING UPWARD

$CaCO_3$ REACTION

- PROFUSE
- MODERATE
- MINOR
- NONE

SSD - SOFT SEDIMENT DEFORMATION
CARB. - CARBONACEOUS
PY - PYRITE
CALC. - CALCAREOUS
GLAUC. - GLAUCONITIC
SID. - SIDERITE

SAMPLE LOCATION

- □ - THIN SECTION
- X - XRAY
- △ - SCAL (MAY INCLUDE ROCK MECHANICS, PROPPANT EMBEDMENT, ACOUSTIC ANISOTROPY, GEOCHEMISTRY, GRI, FRACTURE CONDUCTIVITY, AND/OR FLUID SENSITIVITY)

CORE DESCRIPTION PANEL

PETROLEUM DEV CORP

ARMSTRONG #1

COURT HOUSE FIELD

TAYLOR COUNTY, WEST VIRGINIA

PANEL 1 OF 2