**SUPPLEMENTAL MATERIAL**

**SUPPLEMENTAL FIGURE CAPTIONS**

**Supplemental Figure 1.** Well-log interpretation compilation for 29 of the 34 deep-penetrating wells in the BCT. gamma-ray log data is shaded so that the lowest values are white (assuming low gamma-ray=quartz sand) and the highest values are black (assuming high gamma-ray=mud/mudstone), to indicate the assumed lithology and aid in the visualization of stacking patterns (Miller et al., 2018). Circles indicating biostratigraphic analyses are color coded by approximate age (yellow=Cenomanian; green=Aptian, orange=Barremian) and numbered by species (1 = *Rotalipora cushmani*; 2 = *T. greenhornensis*; 3 = *Cyclonephelium tabulatum*; 4 = *Muderongia simplex*). Sequence boundaries derived from well-log stacking patterns are represented by red lines. Dashed red lines represent well-log sequence boundaries that are uncertain. Triangles next to the gamma-ray log show coarsening (yellow) and fining (blue) upward patterns. Blue lines indicate a transgressive surface; green lines indicate a maximum flooding surface (MFS). Units are logging units (feet below kelly bushing), but a scale is given in m.

**Supplemental Table 1.** Well-log compilation showing the location, depth, and biostratigraphy report reference for 29 of the 34 wells in the BCT.

**BACKGROUND**

We focus on potential reservoirs in the Logan Canyon Formation (Aptian-lower Cenomanian; Table 1). Based on lithostratigraphy, Libby-French (1984) originally divided the Logan Canyon sandstones into lower and upper Logan Canyon sandstone units separated by the Sable Shale equivalent. Miller et al. (2018) reinterpreted the well-log correlations with biostratigraphy using a sequence stratigraphic approach and found three distinct Logan Canyon highstand sandstones associated with three Aptian to lower Cenomanian stratigraphic sequences, the LC3, LC2, and LC1, respectively. In addition, Miller et al. (2018) found that the Sable Shale Formation identified by Libby-French (1984) was placed above and below the LC1 basal sequence boundary in some wells, highlighting issues with correlating units based only on lithology. The Upper Cretaceous strata in the BCT are termed the Dawson Canyon Equivalent Formation (Libby-French, 1984), correlate to the DCx composite sequence (Schmelz et al., 2020), and cap the Logan Canyon sequences below (Table 1) made up of a very thick, calcareous mudstone, divided by a single, thick, laterally continuous Coniacian to Campanian sandstone called the Middle Sandstone (Libby-French, 1984; Seker et al., 2012).

The BCT is an elongate, asymmetric offshore basin that parallels the coastline from New Jersey to North Carolina. The landward edge of the BCT is defined by the hinge zone, an abrupt increase in depth to basement observed on seismic reflection profiles, while the seaward edge is defined by the East Coast Magnetic Anomaly (ECMA), a feature that marks the landward edge of oceanic crust. The basin is widest offshore New Jersey (~200 km) and has accumulated 2-16 km of Jurassic and younger sedimentary rocks, the thickest along the U.S Atlantic continental margin (Grow et al., 1988). The BCT initially formed in the Late Triassic (~230-198 Ma; e.g., Withjack et al., 1998) in response to extensional rifting between North America and Africa. Rifting ended with the onset of Atlantic Ocean seafloor spreading in the early Middle Jurassic (e.g., Klitgord and Schouten, 1986) and was followed by thermal subsidence, sediment loading, and flexure of the basin (Watts and Steckler, 1979; Grow and Sheridan, 1988; Reynolds et al., 1991).

Of the 2-16 km-thick post rift Mesozoic and Cenozoic sediments in the BCT, approximately 70 percent are Jurassic (Grow et al., 1988). Rapid lithospheric subsidence caused by asthenospheric cooling dominated the first ~40-60 Myr of postrift development of the BCT (e.g., Steckler and Watts, 1978; Watts and Steckler, 1979). Early postrift Middle Jurassic sedimentation of interbedded terrestrial sandstones, marine shelf limestones, and evaporates was inferred from geophysical data correlated to sediments in the Georges Bank Basin (GBB) (Schlee, 1981). Deposition of shallow-water limestones, sandstones, and mudstones followed this initial deposition and were trapped by an early Jurassic carbonate shelf-edge reef that prograded seaward into the Barremian, interfingering with Upper Jurassic and Lower Cretaceous siliciclastic sediments (Poag, 1985; Mountain and Tucholke, 1985).

Beginning in the Tithonian, basin subsidence and sediment accumulation decreased significantly coincident with a major regressive period, allowing early Cretaceous siliciclastics to eventually overstep and bury the carbonate reef (Poag, 1985). The reef was buried across the majority of the BCT by the Barremian, as evidenced by seismic reflection β beneath the modern continental rise (Mountain and Tucholke, 1985). Sediments deposited during this interval (Berriasian to Barremian) are equivalent to the Missisauga Formation (Miss) defined by Libby-French (1984; Table 1). Onshore in Maryland, this unit correlates to the Waste Gate Formation (Miller et al., 2017; Schmelz et al., 2020). The Waste Gate Formation was correlated using logs to the Anchor Gas Dickinson #1 well in southernmost New Jersey (Olsson et al., 1988; Miller et al., 2017), however it could not be correlated north of this location. The Missisauga is typically heterolithic and sandstone-prone, and likely represents a predominantly nonmarine fluvial depositional environment based on onshore wells and the COST B-2 well (Fig. 4) that becomes progressively more marine down dip (e.g., at the COST B-3 well; Poag, 1985).

A transition from predominantly fluvial to deltaic sedimentation during the Aptian is evidenced by a change from heterolithic terrestrial sandstones of the Missisauga sequence below to thick, blocky sandstones of the Logan Canyon sequences above (Figs. 2a, 2b). Based on lithostratigraphy, Libby-French (1984) originally divided the Logan Canyon sandstonesinto lower and upper Logan Canyon sandstone units separated by the Sable Shale equivalent. Miller et al. (2018) reinterpreted the well-log correlations with biostratigraphy using a sequence stratigraphic approach and found three distinct Logan Canyon highstand sandstones associated with three Aptian to lower Cenomanian stratigraphic sequences, the LC3, LC2, and LC1, respectively. In addition, Miller et al. (2018) found that the Sable Shale Formation identified by Libby-French (1984) was placed above and below the LC1 basal sequence boundary in some wells, highlighting issues with correlating units based only on lithology.

The offshore, mid-Cretaceous deltaic LC3, LC2, and LC1 sequences correlate to the onshore mid-Cretaceous Potomac I, II, and III sequences, respectively (Miller et al., 2018; Table 1). The Potomac sequences were deposited predominately by an anastomosed river environment in the upper delta plain with possible marginal marine or delta front sources (Browning et al., 2008; Miller et al., 2017). Potomac I sandstones are generally thick, widespread, and continuous throughout New Jersey, and thicken to the south towards Maryland; Potomac II sandstones are discontinuous on the New Jersey coastal plain; and Potomac III sandstones are generally thick across New Jersey, thickening towards the north (Miller et al., 2017).

The Upper Cretaceous strata in the BCT are termed the Dawson Canyon Equivalent Formation (Libby-French, 1984), correlate to the DCx composite sequence (Schmelz et al., 2020), and cap the Logan Canyon sequences below (Table 1). Determining higher order sequences within the DCx composite sequence (where x = a number to be named when additional data are available to subdivide this megasequence) proved difficult using the available data. Much of this formation is comprised of a very thick, calcareous mudstone, divided by a single, thick, laterally continuous Coniacian to Campanian sandstone called the Middle Sandstone (Libby-French, 1984; Seker et al., 2012). In contrast to the homogeneous strata offshore, the upper Cretaceous of the mid-Atlantic coastal plain has been subdivided into ~ 15 sequences, deposited predominantly in marine environments (Miller et al., 2004; Browning et al., 2008). The beginning of upper Cretaceous onshore sedimentation marks a shift from predominantly terrestrial (Potomac sequences) to predominantly marine (Raritan to Bass River sequences) deposition (Browning et al., 2008; Miller et al., 2017). Similarly, offshore deposition during the upper Cretaceous transitions from deltaic to prodelta/slope. Both onshore and offshore transitions are coincident with a major transgression across the margin, with highest Cretaceous global sea levels occurring during the late Cenomanian to mid Turonian (Miller et al., 2005). Onshore, a major mid-Turonian eustatic lowering at the sequence boundary between the Bass River and Magothy sequences is indicated by a transition from mid-neritic to deltaic depositional environments (Browning et al., 2008). This onshore transition may coincide with the offshore shift from the Dawson Canyon Shale to the Coniacian to Campanian Middle Sandstone. However, it is also possible that this sandstone correlates to the onshore Mt. Laurel sequence. The Dawson Canyon Equivalent resumes deposition above the Middle Sandstone and may be correlated to the onshore Composite Confining Unit (Table 1; Zapecza 1989).

Deformation of Upper Jurassic and Cretaceous sediments in the northern BCT is in part due to the GSD (GSD), the largest post-rift igneous structure along the U.S. Atlantic Margin landward of the ECMA (Grow, 1980). The dome was originally identified from marine and aeromagnetic profiles over the BCT that showed a circular, large positive magnetic anomaly approximately 20 km in diameter in the middle of the continental shelf offshore New Jersey (Drake et al., 1963; Taylor et al., 1968; Schlee et al., 1976). In 1973, the U.S. Geological Survey (USGS) collected an MCS line over the anomaly, indicating the anomaly was likely a large mafic intrusion that uplifted Upper Jurassic and Lower Cretaceous (lower Barremian) strata (Schlee et al., 1976). Additional seismic profiles collected by industry (Fig. 1), and subsequent drilling showed that the GSD likely formed by an intrusive igneous dike swarm composed of lamprophyres intercalated within late-Jurassic to early-Cretaceous sedimentary strata (Jansa and Pe-Piper, 1988). Isotopic ages for the lamprophyres place the timing of the intrusion between the Barremian and Aptian (Jansa and Pe-Piper, 1988), whereas stratal relationships (this study) suggest a middle Barremian emplacement.

**SUPPLEMENTORY REFERENCES**

Bielak, L.E., Steinkraus, W.E., Cousminer, H.L., and Giordano, A.C., 1986, Biostratigraphy and Depositional Environments, IN: Bielak, L.E., editor, Tenneco Hudson Canyon 642-2 Well Geological and Operational Summary Report MMS 86-0077, p. 14-20.

Campbell, T.W., and Dunlap, J.B. Jr., 1978, Paleo-data Inc. Paleontology Report, OCS-A-0059, Gulf Energy & Minerals, Hudson Canyon, Baltimore Canyon Area, Block 857 #1.

Cousminer, H. L., Steinkraus, W.E., and Adinolfi, F., 1986, Biostratigraphy and Depositional Environments IN: Adinolfi, F., Murphy Wilmington Canyon 106-1 Well Geological and Operational Summary, OCS Report MMS 86-0117.

Cousminer, H.L., Steinkraus, W.E., and Hall, R., 1978, Paleontology: unpublished Mobil OCS-A 0015, Block 544-1, 5 p.

Crane, M.J., and Stough, J.B., 1978, Paleontological section of the Exxon OCS-A-0046 Block 684 #1 IN: Exxon Exploratory Well Summary

Crane, M.J., and Stough, J.B., 1979a, Paleontological section of the Exxon OCS-A-0046 Block 684 #2 IN: Exxon Exploratory Well Summary.

Crane, M.J., Stough, J.B, 1979b, Paleontological Section of the Exxon OCS-A-009 Block 500 #1 IN: Exxon Exploratory Well Summary

Crane, M. J., and Stough, J., 1981, Paleontologic Section, OCS-A-0055 Block 816 No.1 Well, API 61105 000200.

Crane, M., Stough, J., Zingula, R., 1979, Paleontology Section for Exxon OCS-0065 #1, Block 902 API 61105 00013 IN: Exxon offshore Alaska division exploratory well summary OCS-A-0065 Block 902 Hudson Canyon Well #1.

Hall, R., Steinkraus, W., and Cousminer, H.L., 1985, Paleontology: unpublished Gulf OCS-A 0048, Block 718-1, 6 p.

International Biostratigraphers Incorporated, 1978a, Biostratigraphy of the Continental Oil OCS-A-0024 Block 590 Hudson Canyon Well #1.

International Biostratigraphers Incorporated, 1978b, Biostratigraphy of the Houston Oil & Minerals OCS-A-0042 Block 676 No. 1 Well with appendices, 12 p.

International Biostratigraphers Incorporated, 1979a, Biostratigraphy of the Houston Oil & Minerals OCS-A-0057 Block 855 No.1 Well.

International Biostratigraphers Incorporated, 1979b, Biostratigraphy of the Tenneco OCS A-0131 Block 495 No.1 Well.

Lehmann, E. P., 1979, Biostratigraphy IN: Gibson, W., Leamer, R. J., 1979, Preliminary Biostratigraphy and Vitrinite reflectance data of the Mobil 544-1A, Baltimore Canyon, Offshore, New Jersey.

Olsson, R.K., Gibson, T.G., Hansen, H.J., and Owens, J.P., 1988, Geology of the northern Atlantic coastal plain: Long Island to Virginia, in Sheridan, R. E., and Grow, J. A., eds., The Atlantic Continental Margin, U.S.: Boulder, Colorado, Geological Society of America, Geology of North America, v. I-2, 87-105.

Poag, C. W., 1980, Foraminiferal Stratigraphy, Paleoenvironments, and depositional cycles in the outer Baltimore Canyon Trough IN: Scholle, P. A., 1980, Geological Studies of the COST No. B-3 Well, United States Mid-Atlantic Continental Slope Area, Geological Survey Circular 833.

Poag, C.W. and W.D. Sevon, 1989, A Record of Appalachian Denudation in Postrift Mesozoic and Cenozoic Sedimentary Deposits of the U.S. Middle Atlantic Continental Margin, Geomorphology, 2 (1989) 119-157.

Smith, M.A., Amato, R.V., Furbush, M.A., Pert, D.M., Nelson, M.E., Hendrix, J.S., Tamm, L.C., Wood, G., Jr., and Shaw, D.R., 1976, Geological and Operational Summary, COST No. B-2 Well, Baltimore Canyon Trough Area, Mid-Atlantic OCS: US Department of the Interior Geological Survey Open-File Report 76-774, 79 p.

Steinkraus, W.E., 1979a, Biostratigraphy IN: Amato, R. V. and Simonis, E. K., 1979, Geological and Operational Summary, COST No. B-3 Well, Baltimore Canyon Trough Area, Mid-Atlantic OCS Open File Report 79-1159.

Steinkraus, W.E., 1979b, Paleontology Report: unpublished Exxon OCS-A-0046 #1 Baltimore Canyon Trough Block 684.

Steinkraus, W.E., 1981, Preliminary Biostratigraphy Report Exploratory OCS-A-0075 Block 12 No.2 Well.

Steinkraus, W.E., and Bebout, J., 1982, Biostratigraphic Report: Texaco OCS-A-00028 Block 598-1, 6 p.

Steinkraus, W.E., and Bielak, L., 1981, Biostratigraphic Report OCS-A-0065 Baltimore Canyon Trough Block 902.

Steinkraus, W.E., Cousminer, H.L., and Bielak, L., 1986, Paleontology Report for Exxon OCS-0065 #1, Block 902 IN: Unpublished, In-house MMS Report OCS-A-0065 Block 902 Hudson Canyon Well #1.

Steinkraus, W.E., Cousminer, H.L., and Hall, R., 1978, unpublished Conoco OCS-A 0024 #1, Block 590, Paleontology Report, 8 p.

Steinkraus, W.E., Fry, C., and Bielak, L., 1985, Biostratigraphic Report Shell OCS-A 0096 #1 Baltimore Canyon, Block 272.

Steinkraus, W.E., Cousminer, H.L., Giordano, A., and Hall, R., 1979, Paleontology Report: unpublished Exxon OCS-A 009 #1, Block 500, 8 p.

Stough, J., 1981, Paleontology Report IN: Exploratory Well Summary OCS-A-0052 Block 728 No.1 Well, API 61105 00022.

Valentine, P. C., 1980, Calcareous nannofossil biostratigraphy, paleoenvironments, and post-Jurassic continental margin development IN: Scholle, P. A., 1980, Geological Studies of the COST No. B-3 Well, United States Mid-Atlantic Continental Slope Area, Geological Survey Circular 833.