BOEM 2012-016

Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Atlantic Outer Continental Shelf 2011 as of January 1, 2009

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Introduction

This report summarizes the results of the Bureau of Ocean Energy Management (BOEM) 2011 assessment of the undiscovered oil and gas resources for the U.S. Atlantic Outer Continental Shelf (OCS) (Figure 1). The area assessed comprises the portion of the submerged seabed whose mineral estate is subject to Federal jurisdiction. The 2011 assessment represents a comprehensive appraisal that considered relevant data and information available as of January 1, 2009. The assessment incorporated and applied modern exploration concepts and key new learnings from NE-adjacent offshore Nova Scotia, conjugate NW Africa, and the African Transform Margin.

Existing BOEM Atlantic OCS data sets were enhanced and made workstation compatible; e.g., seismic data were vectorized and/or reprocessed, and all wireline logs were digitized. New gravity and magnetic data were acquired, processed, and interpreted.

The methodology used by BOEM staff in the Atlantic OCS was updated and modified from those previously used (Lore et al., 2001). Previously used play and prospect level risk were replaced in the new methodology. The dual layer of risking (petroleum system and prospect) for conceptual plays was retained for conceptual plays. However, to avoid potential double risking of a single risk element, new forms and verbiage with a higher level overview were implemented for petroleum system elements (source, reservoir, seal, and overburden rocks) and processes (trap formation, generation-expulsion-migration-accumulation of petroleum, and preservation). Prospect risk forms were also revised to address hydrocarbon fill, reservoir, and trap components. The new methodology retained the major strengths of a comprehensive play-based approach; i.e., the strong relationship between information derived from oil and gas exploration activities and the geologic play models developed by the inventory team.

Conceptual plays were developed based on geophysical data, regional geologic data and knowledge of the region, consideration of productive analogs in similar tectonic/structural location, the style of analog oil and gas traps, reservoir depositional environment and lithology, reservoir age, and petroleum system analysis of existing drilling in the analog. Established plays were defined by Lore et al., (2001) as being plays in which hydrocarbons had been discovered in one or more pools and typically one for which reserves have been estimated. However, in the Atlantic OCS assessment, a play with no petroleum system risk; i.e., one in which a petroleum system is documented and therefore has no risk is considered an established play whether or not any reserves are assigned to it. This is similar to reserve estimate guidance in Society of Petroleum Engineers *Petroleum Resources Management System* (2007).

Consequently, within the Atlantic OCS, nine conceptual plays and one established high-risk play were identified and their resources inventoried.

The Atlantic Region

Planning Areas of the U.S. Atlantic Region share many of the same characteristics; e.g., Geologic Setting, Exploration and Discovery status, Engineering, Technology, Transportation, and Plays.

Location

The Atlantic Region OCS is located on the eastern margin of the U.S. It extends from the Canadian province of Nova Scotia (northeast) to The Bahamas (southwest), a distance of approximately 1,150 miles. The Atlantic Region is divided into the North, Mid- and South Atlantic and Straits of Florida Planning Areas. Some Gulf of Mexico plays extend into the Straits of Florida Planning Area; this is discussed as part of the Gulf of Mexico Assessment. Water depths range from less than 30 ft to greater than 15,000 ft.

Geological Setting

The development of the U.S. Atlantic Region began during the Late Triassic breakup of western Pangea, which was characterized by region-wide continental rifting (Iturralde-Vinent, 2003; Withjack & Schlische, 2005). Subsequent drifting apart of the North American and African conjugate margins resulted in sea floor spreading and therefore the opening of the current Atlantic Ocean. The geology and resource assessment of the region reflect the geometry and transition from the early, complex rift system to the present-day passive margin (Withjack & Schlische, 2005; Sheridan, 1987). A series of five post-rift sedimentary depocenters of Early Jurassic–recent age developed linearly along the margin. From northeast to southwest these are; the Georges Bank basin, the Baltimore Canyon Trough, the Carolina Trough, the Southeast Georgia Embayment, and the Blake Plateau basin (Sheridan, 1987). These depocenters and their sedimentary sections vary in size, shape, and thickness (Divins, 2012).

Within the region, nine conceptual plays and one established high-risk play have been identified and their resources inventoried. Water and drilling depths in these plays range from less than 100 ft to greater than 10,000 ft and from 7,000 ft to more than 30,000 ft, respectively.

Exploration and Discovery Status

There are currently no reserves and no production in the U.S. Atlantic Region. A single phase of oil and gas exploration was conducted from the late 1960s to the mid-late 1980s. Approximately 240,000 line miles of 2D seismic was acquired, processed, and interpreted between 1966 and 1988. In 1982, an early “3D” survey was acquired, consisting of 95 “inlines” with 1,000 ft spacing over a four-block area, centered on Hudson Canyon 598 in the Baltimore Canyon Trough.

The BOEM seismic data set in the Atlantic OCS consists of approximately 170,000 line miles of 2D data. To facilitate seismic interpretation and use of well data on workstations, the 2D data and “early-3D” survey noted above were digitized, vectorized, and migrated (where necessary). In addition, approximately 185,000 line miles of depth-converted, time-migrated data in SEG-Y format was licensed from Fugro Robertson (GeoSpec). The majority of the latter data set has been reviewed and integrated into this assessment.

In the U.S. Atlantic Region, nine lease sales were held from 1976–1983, resulting in 433 leases being acquired on 2,466,678 acres. Fifty-one (51) wells were drilled. These consist of: five Continental Offshore Stratigraphic Tests (COST wells) drilled between 1975 and 1979, and 46 industry wells drilled between 1978–1984 (39 of which were considered new field wildcat (NFW) wells; the remaining seven were classified as outpost/delineation/or extension wells in the four-block Hudson Canyon (HC) 598 area.

The HC 598 area is the only area where a “discovery” was made during this exploration phase. HC 598 is a listric fault-bounded structure with an associated crestal graben, located in an average water depth of approximately 450 ft. All eight wells drilled on this feature had gas shows, and gas was successfully drillstem tested in five of the wells. Apparent reservoir compartmentalization indicated by detailed cross sections incorporating wireline log correlations, mud log shows, calculations using the wireline log data, tests, etc., could not be resolved with the seismic data available at the time, including the "early-3D" survey. Distance from shore (approximately 100 miles) and lack of infrastructure in the onshore and offshore parts of the area may have contributed to plans for the development of and subsequent production from the area being abandoned.

Region Level Engineering, Technology, and Transportation

There are no engineering or technology issues that would limit exploration and production in the region because current drillship capabilities allow drilling in 12,000 ft of water to depths of 40,000 ft. Currently, the Perdido Spar, moored in approximately 8,000 ft of water, is the deepest production facility in the world. Production from wells in three fields within a (30-mile) radius, including currently the deepest water subsea completion in the world (in 9,627 ft of water), are gathered, processed, and exported from the Perdido Spar facility. The value of existing infrastructure cannot be underestimated. Instead of building a new 237 mile pipeline system to shore, or using a more costly floating-production-storage-offloading system (FPSO), production from the Perdido Spar flows into an oil pipeline approximately 77 miles away and a natural gas pipeline 107 miles away (Shell, Perdido Project Website, undated).

The first floating liquefied natural gas (FLNG) facility is scheduled to begin operating for Shell at their Prelude project offshore Western Australia in 2017. The facility will be moored in approximately 800 ft of water for the 25-year life of the project whose recoverable reserves are estimated to be ~3 trillion cubic ft of gas and 120 million barrels of condensate.

Because there is no hydrocarbon production in the coastal regions adjoining the Atlantic OCS Region, it is not possible to expand existing oil and/or gas pipeline transportation systems into the OCS, as none currently exists. Consequently, depending on the water depths and reserves of potential discoveries in the Atlantic Region, subsea completions connected to spar facilities (like Perdido Spar), or an FPSO (the deepest of which will be at Cascade-Chinook in the Gulf of Mexico in approximately 8,500 ft of water), or a FLNG facility are likely to represent the most viable production methods.

Plays in Planning Areas

Planning Area	**North Atlantic**
Play	Triassic–Jurassic Rift Basin
	Cretaceous & Jurassic Hydrothermal Dolomite
	Cretaceous & Jurassic Interior Shelf Structure
	Jurassic Shelf Stratigraphic
	Late Jurassic–Early Cretaceous Carbonate Margin
	Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core & Extension

Planning Area	**Mid-Atlantic**
Play	Cretaceous & Jurassic Interior Shelf Structure
	Jurassic Shelf Stratigraphic
	Cretaceous & Jurassic Marginal Fault Belt
	Cenozoic–Cretaceous & Jurassic Carolina Trough Salt Basin
	Cretaceous & Jurassic Blake Plateau Basin
	Late Jurassic–Early Cretaceous Carbonate Margin
	Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core & Extension

Planning Area	**South Atlantic**
Play	Cretaceous & Jurassic Blake Plateau Basin
	Late Jurassic–Early Cretaceous Carbonate Margin
	Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Extension

Play Discussions

Figure 1 shows the composite extent of all geological play areas in the U.S. Atlantic Region. Descriptions/discussions of each play follow.

Late Jurassic–Early Cretaceous Carbonate Margin Play

The conceptual Late Jurassic–Early Cretaceous Carbonate Margin Play covers an area of ~12,000 mi^2, extending as a narrow band from the U.S.–Canadian border through the North, Mid-, and South Atlantic Planning Areas to The Bahamas (Figure 2) in water depths ranging from ~3,500–6,500 ft.

Reservoir lithologies are anticipated to be limestones and/or dolomites. The most probable hydrocarbon source rocks are interpreted to be Jurassic and predate the reservoir age. Overlying impermeable carbonates or shales are the most likely seals. Deep Panuke, a 1999 discovery on the shallow water shelf offshore Nova Scotia, is the analog (Kidston et al., 2005; Wierzbicki et al., 2006; Eliuk, 2010).

In the Atlantic OCS Region, Shell (operator) drilled three wells during 1983–1984 in water depths ranging from 5,838 to 6,952 ft to test this play in the Baltimore Canyon Trough (North Atlantic Planning Area). Despite areally large structural closures with significant vertical relief and porous limestone reservoir intervals, no significant hydrocarbon shows were encountered in any of the wells (Prather, 1991); all were abandoned as dry holes.

Depending on location within this region-spanning play; any or all of the petroleum system elements (source, reservoir, seal, and potentially overburden sufficient to mature

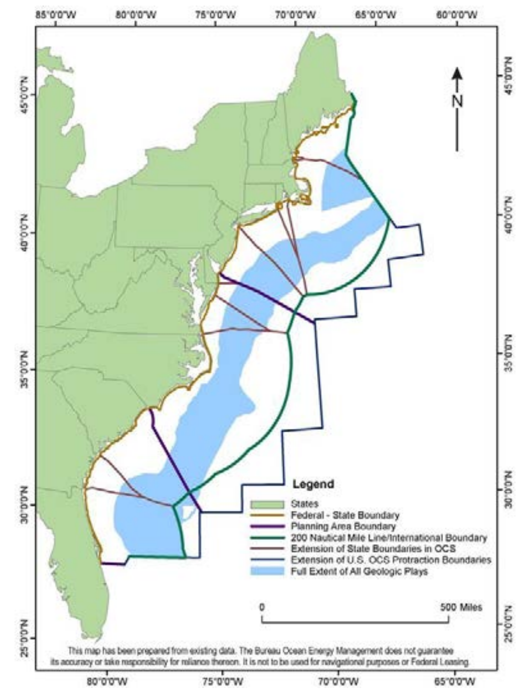

Figure 1. Extent of all geologic play outlines for the Atlantic OCS (blue). Click here for larger image.

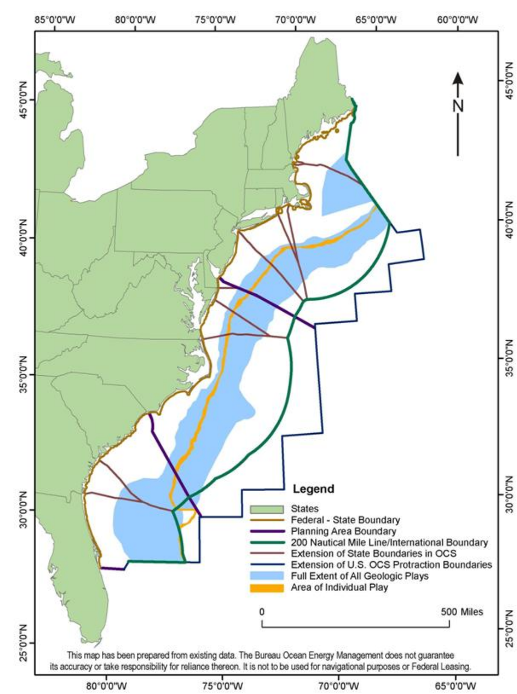

Figure 2. The Late Jurassic–Early Cretaceous Carbonate Margin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

source rocks) may be risks. Petroleum system processes of generation-expulsion-migration-accumulation (and the associated vertical cross-stratal migration conduits likely to be necessary between the mature source rocks and the reservoir) are possible risks. Preservation of trapped hydrocarbons (a combination of seal presence, lithification, and integrity due to possible post-hydrocarbon charge structural adjustments related to basinward sliding of younger, overlying units, etc.) may also be a risk factor.

Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core & Extension Plays

The Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core and Extension Plays are both conceptual. The division is because the “core” area is closer to the carbonate margin and the “extension” is more distal (Figure 3 and Figure 4 respectively). These are the most basinward plays assessed. Their water depths range from approximately 4,500–8,000 ft (core) to approximately 8,500–10,500 ft (extension). Coarse-grained lithofacies of siliciclastic turbidites and mass flow deposits on the paleo-slope and basin floor could constitute reservoirs.

In the core area of the play, closest to the Late Jurassic–Early Cretaceous Carbonate Margin, rollover structures; perhaps related to large-scale, down-slope sediment movement over the carbonate margin, can be interpreted on seismic data. The core area of the play comprises approximately 20,000 mi^2. Several analogs are considered applicable for the core area. Most

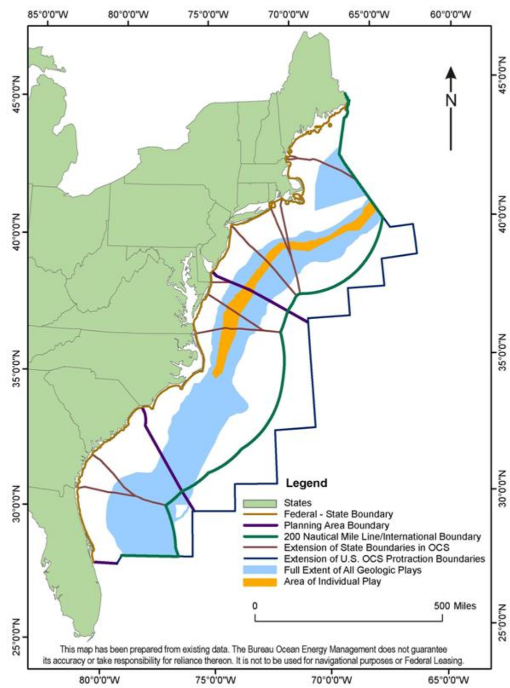

Figure 3. The Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

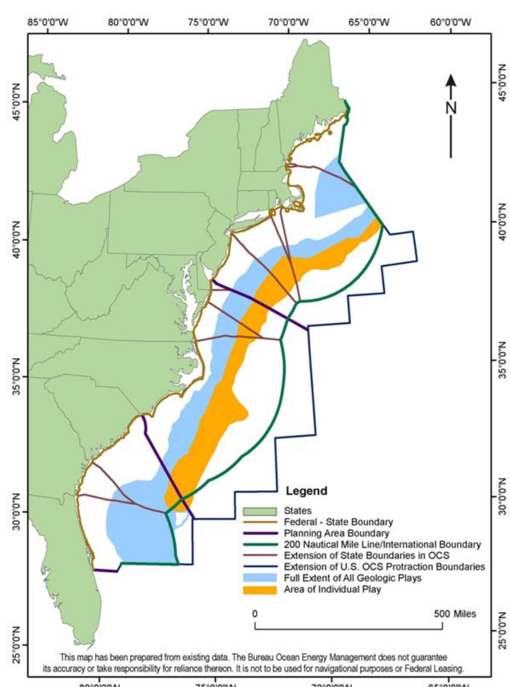

Figure 4. The Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Extension Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

appropriate for these combination structural-stratigraphic rollover traps are the Jurassic-age siliciclastic reservoirs of the South Viking Graben of the UK North Sea (Branter, 2003; Brehm, 2003; Fletcher, 2003a & b; Gambaro & Donagemma, 2003; Hook et al., 2003; Wright, 2003). Analogs for stratigraphic traps in the core area are the recently discovered fields of the Tano basin (offshore Ghana & Côte d'Ivoire), the Sierra Leone-Liberian basin (offshore Sierra Leone & Liberia) of the African Transform Margin (Jewell, 2011) and the earlier discovered Cretaceous (Woodbine) fields of the southern East Texas basin.

Farther basinward, in the extension play, hydrocarbon traps are interpreted to be entirely stratigraphic. This play area is estimated to encompass approximately 59,000 mi^2. Consequently, with the exception of one field from the South Viking Graben (Fletcher, 2003b), only the African Transform Margin discoveries (Jewell, 2011) and the Woodbine analogs are appropriate.

A single well, the Shell Baltimore Rise (BR) 93-1, drilled in the Baltimore Canyon Trough (Mid-Atlantic Planning Area) on a large, faulted structure that is part of the 'Gemini Fault System' has been interpreted to be a test of the updip shelf-margin delta system (sediment delivery system) of the play (Poag et al., 1990). A forensic petroleum system analysis of the dry hole indicates no reservoirs or hydrocarbon shows were encountered (Prather, 1991). However, several Early Cretaceous zones had total organic carbon content exceeding 1% with Type III (gas-prone) kerogen predominating. The deepest section in the well approached or was in the early oil maturity window (Amato [ed], 1987).

Petroleum system elements in both play areas that are considered risk factors are the presence of reservoir and source rocks. For reservoir units, these risks would be related to the lithology of the rocks eroded to become the potential reservoirs (if the lithology is not quartz-rich, then mudstones rather than sandstones would be the result of erosion and transport into the play area). The sediment volume transported across the paleo-shelf, and the width and dip angle of the paleo-shelf may also be factors worth considering. Too low a sediment volume would result in an insufficient amount of coarse-grained facies (potential reservoirs) reaching the depositonal slope and basin floor. The presence and maturity of organically rich source rocks, and possibly migration conduits between mature source rocks and reservoirs may also be risk factors. Trap sealing lithologies should be abundant in the play areas as fine-grained sediments predominate in both. Petroleum system processes; e.g., timing of maturation, generation, and expulsion of hydrocarbons from any source rocks may also be a risk. However, the reward size, based on the analogs, may exceed several hundred million barrels of oil or trillions of cubic ft of natural gas.

The Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core area is interpreted to occur in the North and Mid-Atlantic Planning Area, with the more distal Extension area believed to occur in the North, Mid- and South Atlantic Planning Areas.

Cretaceous & Jurassic Marginal Fault Belt Play

The Cretaceous & Jurassic Marginal Fault Belt conceptual play is confined to an area of ~8,500 mi^2 in the updip region of the undrilled Carolina Trough (Figure 5), where water depths range from approximately 1,000–4,000 ft (Dillon et al., 1982). The play is undrilled.

As in the onshore Gulf of Mexico analog, downdip salt movement created the marginal fault belt (Hughes, 1968). Although source rocks have yet to be identified in the Carolina Trough, indirect hydrocarbon indicators associated with faulting can be interpreted on seismic data. Rollover structures or fault traps with either carbonate or siliciclastic reservoirs are considered prospective. This play is confined to the Mid-Atlantic Planning Area.

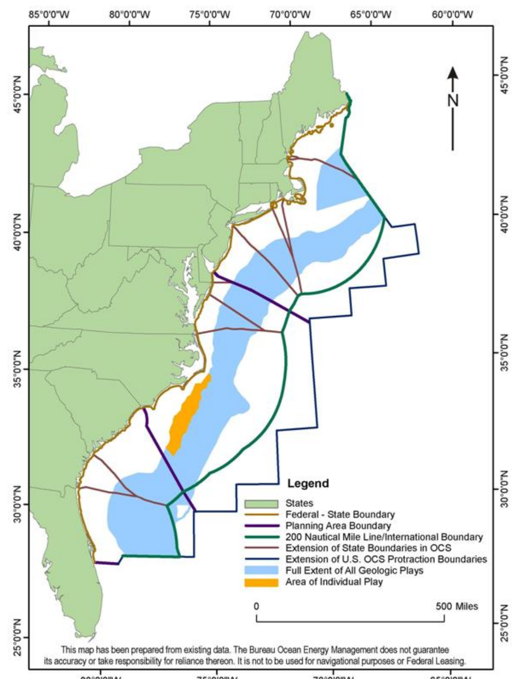

Figure 5. The Cretaceous & Jurassic Marginal Fault Belt Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

Cenozoic–Cretaceous & Jurassic Carolina Trough Salt Basin Play

The conceptual Cenozoic–Cretaceous & Jurassic Carolina Trough Salt Basin Play occurs downdip from the Cretaceous & Jurassic Marginal Fault Belt play. The play covers an area of approximately 5,700 mi^2 (Figure 6) in present-day water depths ranging from approximately 8,000 to greater than 9,000 ft (Dillon et al., 1982). Siliciclastic reservoirs are interpreted to be the targets. Resources associated with the Late Jurassic–Early Cretaceous Carbonate Margin play that bisects the area are evaluated separately.

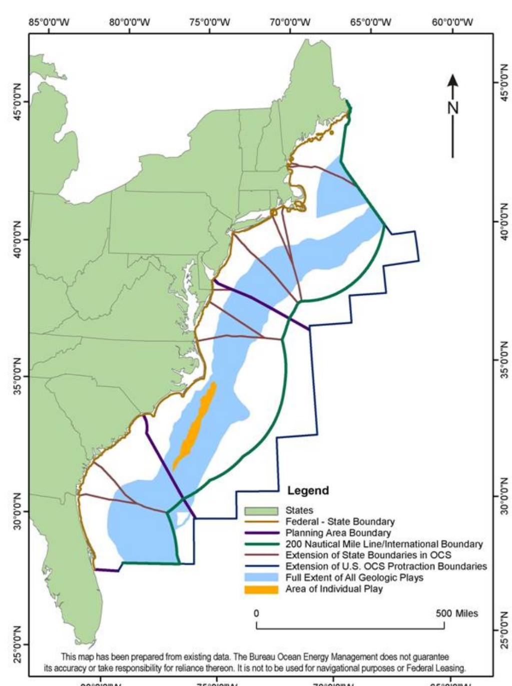

Figure 6. The Cenozoic–Cretaceous & Jurassic Carolina Trough Salt Basin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

The reservoir element of the petroleum system has not been confirmed and therefore is a risk factor. Although source rocks have yet to be identified in this play, they can be inferred by satellite identified sea-surface slicks (A. Williams, Fugro NPA Limited, pers. comm.) and chemosynthetic communities (Ruppel, 2008). Vertical salt movement is interpreted to provide cross-stratal migration conduits connecting deeper, mature oil and gas source rocks with younger reservoirs.

The play analog, the Northwest African conjugate margin Mauritania–Senegal–The Gambia–Guinea Bissau–Conarky basin, contains similar salt-related structures (e.g., diapirs, toe thrusts, detached salt bodies, etc.) which are productive and prospective (Maier, 2006). This play is undrilled in the U.S. Atlantic Region, and is entirely within the Mid-Atlantic Planning Area.

Jurassic Shelf Stratigraphic Play

Updip from the Late Jurassic–Early Cretaceous Carbonate Margin Play, the conceptual Jurassic Shelf Stratigraphic Play covers an area of approximately 10,000 mi² (Figure 7) in current water depths of between approximately 200 – 2,600 ft. As defined, no wells have been drilled in the play area targeting these objectives.

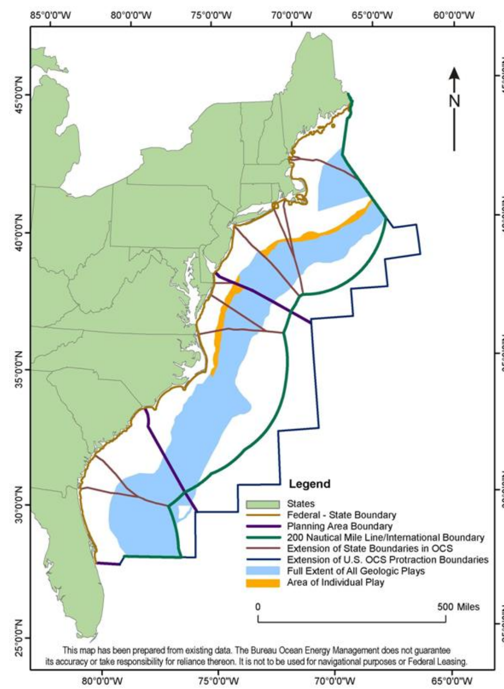

Figure 7. The Jurassic Shelf Stratigraphic Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

The reservoir element of the petroleum system is anticipated to consist of limestones and/or dolomites, as in the onshore Gulf of Mexico analog. Although some minor faulting may occur, the play is considered primarily stratigraphic because reservoir facies define and control the hydrocarbon trap. The source component is considered probable, but is unproven as wells drilled along trend often lack hydrocarbon shows. Deeper carbonate formations are the most probable source rocks (Sassen & Post, 2008: Sassen, 2010). Trap seals are interpreted to be non-porous carbonate units, possibly with minor evaporite intervals overlying and laterally adjacent to the reservoirs.

The vintage (1966 through 1988) seismic data available to assess this play was not acquired with a frequency content sufficient to identify these stratigraphic traps. Modern seismic data will provide better imaging, and may identify prospects.

The play is divided into two areas separated by the structures of the Cretaceous & Jurassic Interior Shelf Structure Play, and is interpreted to occur in the North and Mid-Atlantic Planning Areas.

Cretaceous & Jurassic Interior Shelf Structure Play

The Cretaceous & Jurassic Interior Shelf Structure Play occurs over an area of approximately 3,400 mi^2 (Figure 8) in the Baltimore Canyon Trough. This is the only established play in the U.S. Atlantic Region. It is confined to an area where listric, down-to-the-basin faulting and associated compensating faults form structures and provide migration conduits between mature older Jurassic age source rocks and siliciclastic reservoirs of younger Jurassic and Cretaceous age (Prather, 1991; Sassen & Post, 2008; Sassen, 2010). The play was targeted by 14 NFWs drilled from 1978–1981. This exploration effort resulted in a single gas-condensate discovery in the Hudson Canyon (HC) 598 area. Following the discovery, seven delineation wells were drilled in the four-block unit area. However, commerciality is currently considered questionable for a variety of reasons; e.g., reservoir continuity/flow baffles, production rates, costs, etc.

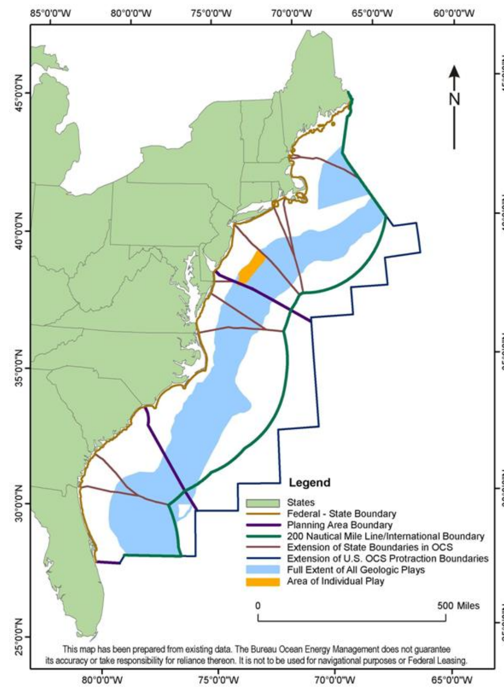

Figure 8. The Cretaceous & Jurassic Interior Shelf Structure Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

Because a hydrocarbon accumulation has been discovered, there is no petroleum system risk for this play. Therefore, the play is considered an established play. However, no reserve estimates for the discovery have been formalized, and risks for individual prospects exist. These risks are related to what may be the local nature of the source rocks, migration conduits connecting older/deeper/mature source rocks with younger reservoirs, the occurrence of permeability in the siliciclastic reservoirs, the presence of traps with minimum rock poroperm volumes, and the presence of effective regional/local top seals.

The play is recognized in the North Atlantic and the extreme northern part of the Mid-Atlantic Planning Areas.

Cretaceous & Jurassic Blake Plateau Basin Play

The conceptual Cretaceous & Jurassic Blake Plateau Basin Play encompasses this entire undrilled basin, an area of over 40,000 mi^2 (Figure 9), in water depths which range between approximately 2,000–3,600 ft. The onshore South Florida basin is interpreted to be an analog (Pollastro et al., 2001). In the South Florida basin, carbonate source rocks immediately underlie and source carbonate reservoirs. Stratigraphic and combination stratigraphic-structural traps in the analog are subtle and difficult to detect. Intraformational evaporites or impermeable carbonates are local and regional seals in the analog.

While this play area is predominantly in the South Atlantic Planning Area, it extends slightly into the Mid-Atlantic Planning Area.

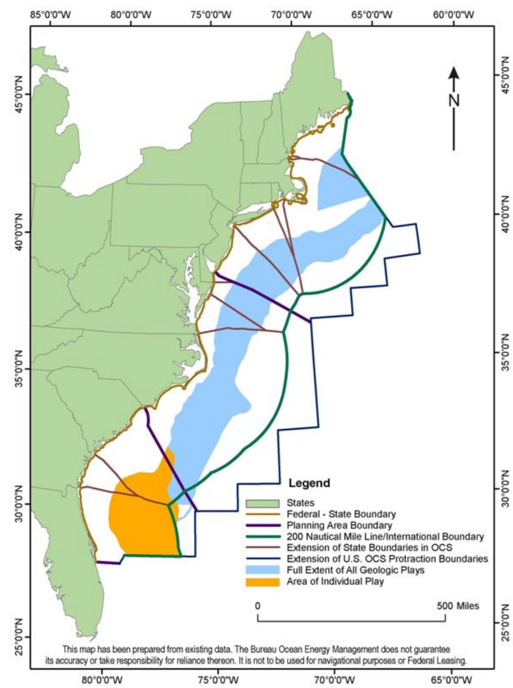

Figure 9. The Cretaceous & Jurassic Blake Plateau Basin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

Triassic–Jurassic Rift Basin and Cretaceous & Jurassic Hydrothermal Dolomite Plays

The conceptual Triassic–Jurassic Rift Basin and Cretaceous & Jurassic Hydrothermal Dolomite Plays are interpreted to occur over the same undrilled area of the North Atlantic Planning Area.

Each is currently interpreted to cover the same estimated area, approximately 10,000 mi^2 (Figure 10 and Figure 11). Water depths over the plays vary from approximately 80–1,100 ft.
Analogs for the Triassic–Jurassic Rift Basin Play are found in the Vulcan Graben of offshore NW Australia where complex rift-related structures trap

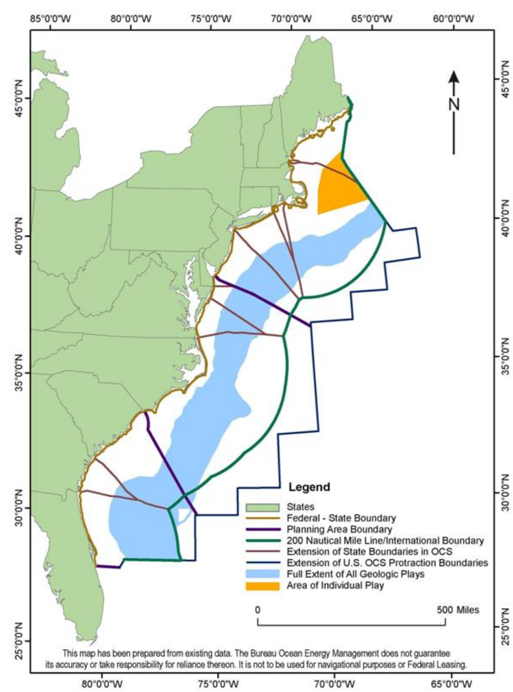

Figure 10. The Triassic–Jurassic Rift Basin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

hydrocarbons in Triassic and Jurassic siliciclastic reservoirs (Geoscience Australia, 2008). Productive inversion structures similar to those interpreted in the undrilled Triassic–Jurassic Rift Basin Play are also documented in the West Natuna basin of Indonesia (Maynard et al., 2002; Burton & Wood, 2010).

In the U.S. Atlantic Region, the presence of reservoirs is a risk. Source rocks have not been directly identified. However, satellite identified sea-surface slicks have been interpreted to occur in the area. Potential structural traps are identified on available seismic data. Sealing mudstone and shale lithologies are likely near the top of the syn-rift and within the post-rift sedimentary interval.

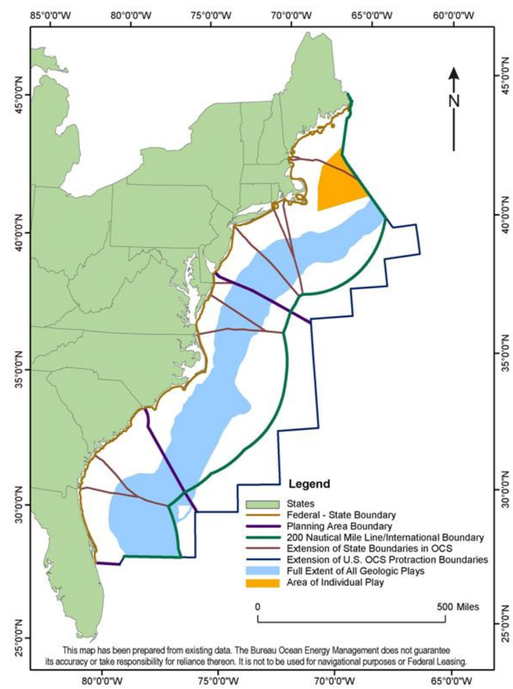

Figure 11. The Cretaceous & Jurassic Hydrothermal Dolomite Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue). Click here for larger image.

Reservoirs in the Cretaceous & Jurassic Hydrothermal Dolomite Play could be formed by hydrothermal dolomitization associated with the upward circulation of deeper, hotter fluids along fault systems resulting in limestone host rock being altered to dolomite, reducing the rock volume and forming sags associated with the trap. Albian-Scipio, the largest oil field in the Michigan basin, and similar fields in the Michigan and Appalachian basin, are considered analogs for this play, with the hydrocarbon seal being typically provided by either undolomitized limestone or a "tite" caliche zone (Davies & Smith, 2006 and references therein).

The hypothesized reservoirs and source rocks are petroleum system element risks.

Atlantic Assessment Results

NOTE: there are no reserves assigned to any of the U.S. Atlantic OCS plays.

This assessment includes data and information available as of January 1, 2009. Estimates of undiscovered recoverable resources for the U.S. Atlantic Region are presented in two categories; undiscovered technically recoverable resources (UTRR), and undiscovered economically recoverable resources (UERR). UTRR estimates are shown at 95th and 5th percentiles and the mean level. This range of estimates corresponds to a 95-percent probability (a 19 in 20 chance) and a 5-percent probability (a 1 in 20 chance) of there being more than those amounts present, respectively. The 95- and 5-percent probabilities are considered reasonable minimum and maximum values, and the mean is the average or expected value. Estimates of UTRR for the U.S. Atlantic OCS range from 1.30 Bbbl at the P95 percentile to 5.58 Bbbl at the P5 percentile with a mean of 3.30 Bbbl (Table 1). Similarly, gas estimates range from 11.11 Tcf to 53.62 Tcf with a mean of 31.28 Tcf. Table 1 also contains estimates of the total endowment by play and total resources for region. Table 2 has UTRR by water depth range.

UERR results are presented as price-supply curves, which show the relationship of price to economically recoverable resource. Price supply curves couple oil prices with gas prices based on the current gas market. Due to fluctuations in the economic value of gas, the 2011 assessment analyzed three different BTU based price pairings between oil and gas, assuming a 40 percent, 60 percent and 100 percent economic value of gas relative to oil on a BTU basis. Tables 3, 4, and 5 have UERR data by water depth range and different economic values of gas relative to oil; e.g., Table 3 presents price pairs associated with a 40 (0.4) percent economic value of gas relative to oil. Table 4 shows a 60 (0.6) percent value of gas relative to oil, and Table 5 shows a 100 (1.0) percent value of gas relative to oil are displayed. BOEM Fact Sheet RED-2011-01a (2011) provides additional information on the logic and development of these price pairs.

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Abbreviations, Acronyms, and Symbols

2D	two-dimensional
3D	three-dimensional
Bbbl	billion barrels
BOE	barrels of oil equivalent
BOEM	Bureau of Ocean Energy Management
ft	feet
mi	miles
OCS	Outer Continental Shelf
Tcf	trillion cubic ft
UERR	undiscovered economically recoverable resources
U.S.	United States
UTRR	undiscovered technically recoverable resources

Terminology

Field: A producible accumulation of hydrocarbons consisting of a single pool or multiple pools related to the same geologic structure and/or stratigraphic condition. In general usage, this term refers to a commercial accumulation.

Petroleum system: A natural system that encompasses a pod of active source rock and all related oil and gas and which includes all the geologic elements and processes that are essential if a hydrocarbon accumulation is to exist (Magoon & Dow, 1994).

Petroleum system elements:

Source (source rock): A rock unit containing sufficient organic matter of suitable chemical composition to biogenically or thermally generate and expel petroleum.

Reservoir (reservoir rock): A subsurface volume of rock that has sufficient porosity and permeability to permit the migration and accumulation of petroleum under adequate trap conditions.

Seal (seal rock): A shale or other impervious rock that acts as a barrier to the passage of petroleum migrating in the subsurface; it overlies the reservoir rock to form a trap or conduit. Also known as roof rock and cap rock.

Overburden (overburden rock): In a petroleum system the overburden rock overlies the source rock and contributes to its thermal maturation by burying the source rock resulting in it attaining higher temperature at greater depth.

Petroleum system processes:

Trap formation (trap): Any geometric arrangement of rock regardless of origin that permits significant accumulation of oil or gas, or both, in the subsurface and includes a reservoir rock and an overlying or updip seal rock. Trap types are stratigraphic, structural, and combination traps.

Generation-expulsion-migration-accumulation of petroleum: The petroleum system process that includes the generation and movement of petroleum from the pod of active source rock to the petroleum show, seep, or accumulation. The time over which this process occurs is the age of the petroleum system.

Preservation (preservation time): The time after generation-expulsion-migration-accumulation of petroleum takes place that encompasses any changes to the petroleum accumulations up to present-day.

Play: A group of known and/or postulated pools that share common geologic, geographic, and temporal properties; petroleum systems and prospect attributes.

Conceptual play: A play hypothesized on the basis of subsurface geophysical data and regional geologic knowledge of the area. It is still a hypothesis, the petroleum system and play concept have not been verified.

Established play: A play in which a petroleum system has been proven.

Pool: A discovered or undiscovered hydrocarbon accumulation, typically within a single stratigraphic interval. As utilized in this report, it is the aggregation of all reservoirs within a field that occur in the same play.

Probability: A means of expressing an outcome on a numerical scale that ranges from nearly impossible to absolute certainty; the chance that a specified event will occur.

Reserves: The quantities of hydrocarbon resources anticipated to be recovered from known accumulations from a given date forward. All reserve estimates involve some degree of uncertainty.

Resources: Concentrations in the earth's crust of naturally occurring liquid or gaseous hydrocarbons that can conceivably be discovered and recovered. Normal use encompasses both discovered and undiscovered resources.

Undiscovered resources: Resources postulated, on the basis of geologic knowledge and theory, to exist outside of known fields or accumulations.

Undiscovered technically recoverable resources (UTRR): Oil and gas that may be produced as a consequence of natural pressure, artificial lift, pressure maintenance, or other secondary recovery methods, but without any consideration of economic viability.

Undiscovered economically recoverable resources (UERR): The portion of the undiscovered technically recoverable resources that is economically recoverable under imposed economic and technologic conditions.

Total endowment: All technically recoverable hydrocarbon resources of an area.

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Figures

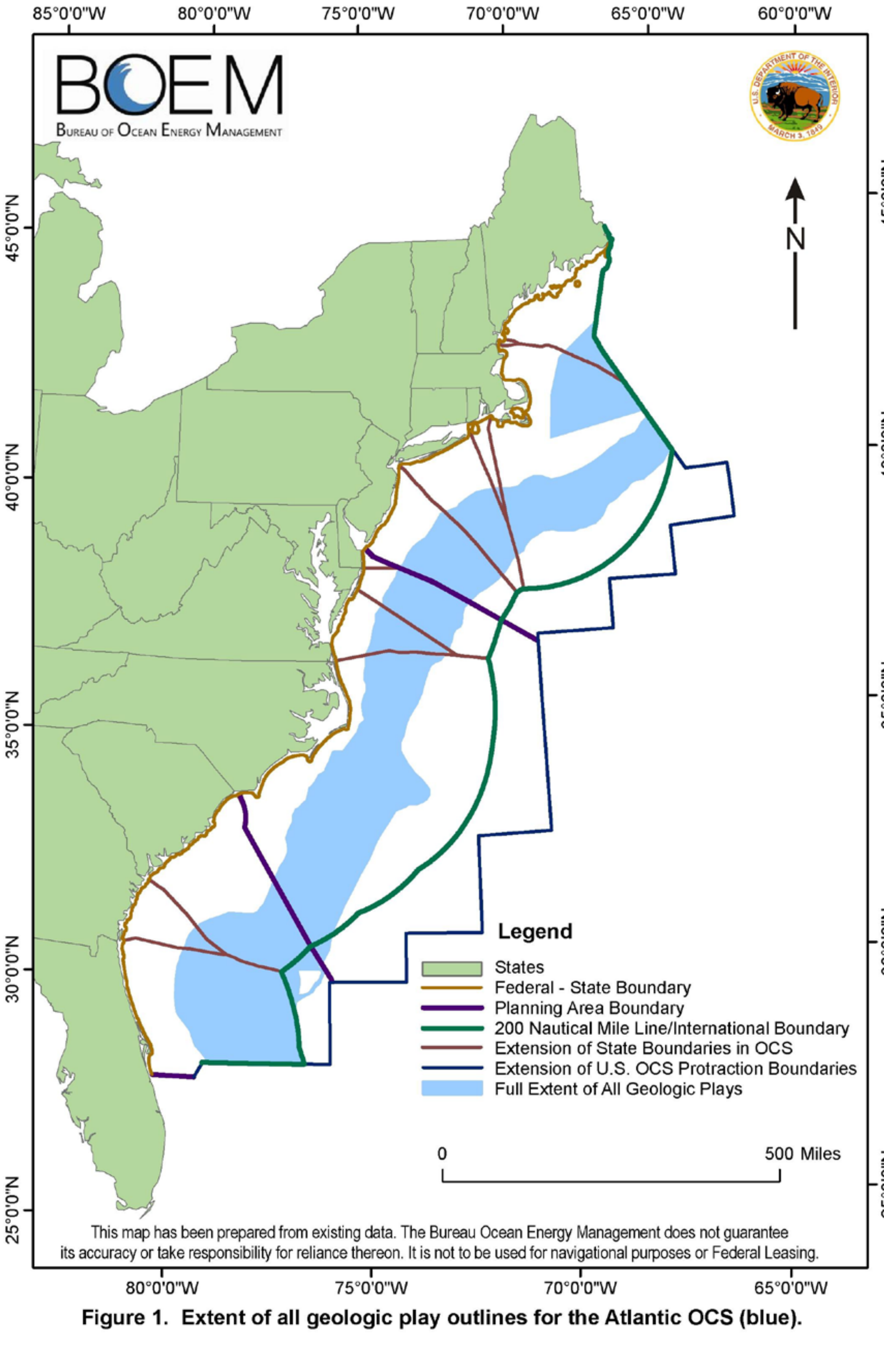

Figure 1. Extent of all geologic play outlines for the Atlantic OCS (blue).

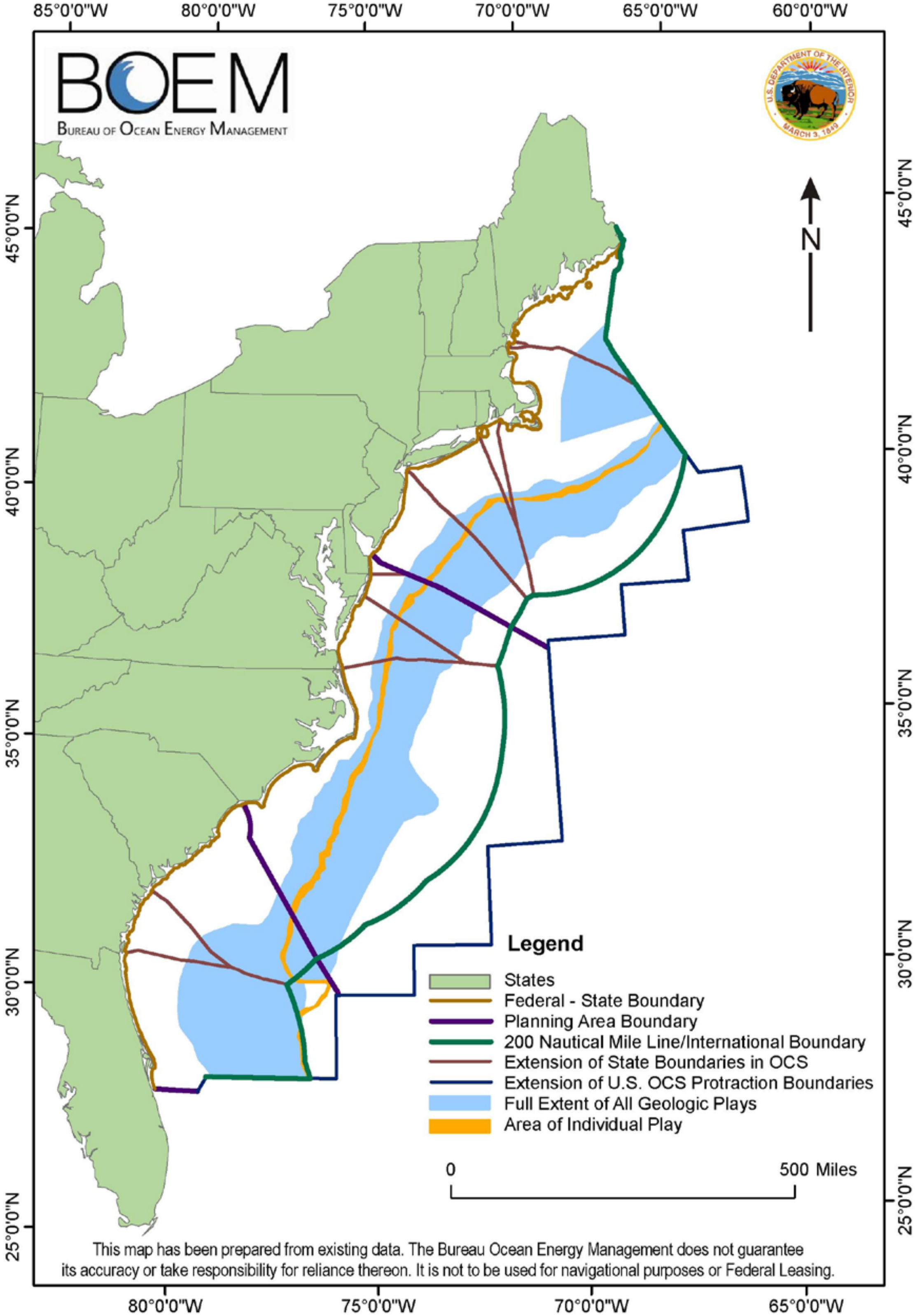

Figure 2. The Late Jurassic–Early Cretaceous Carbonate Margin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

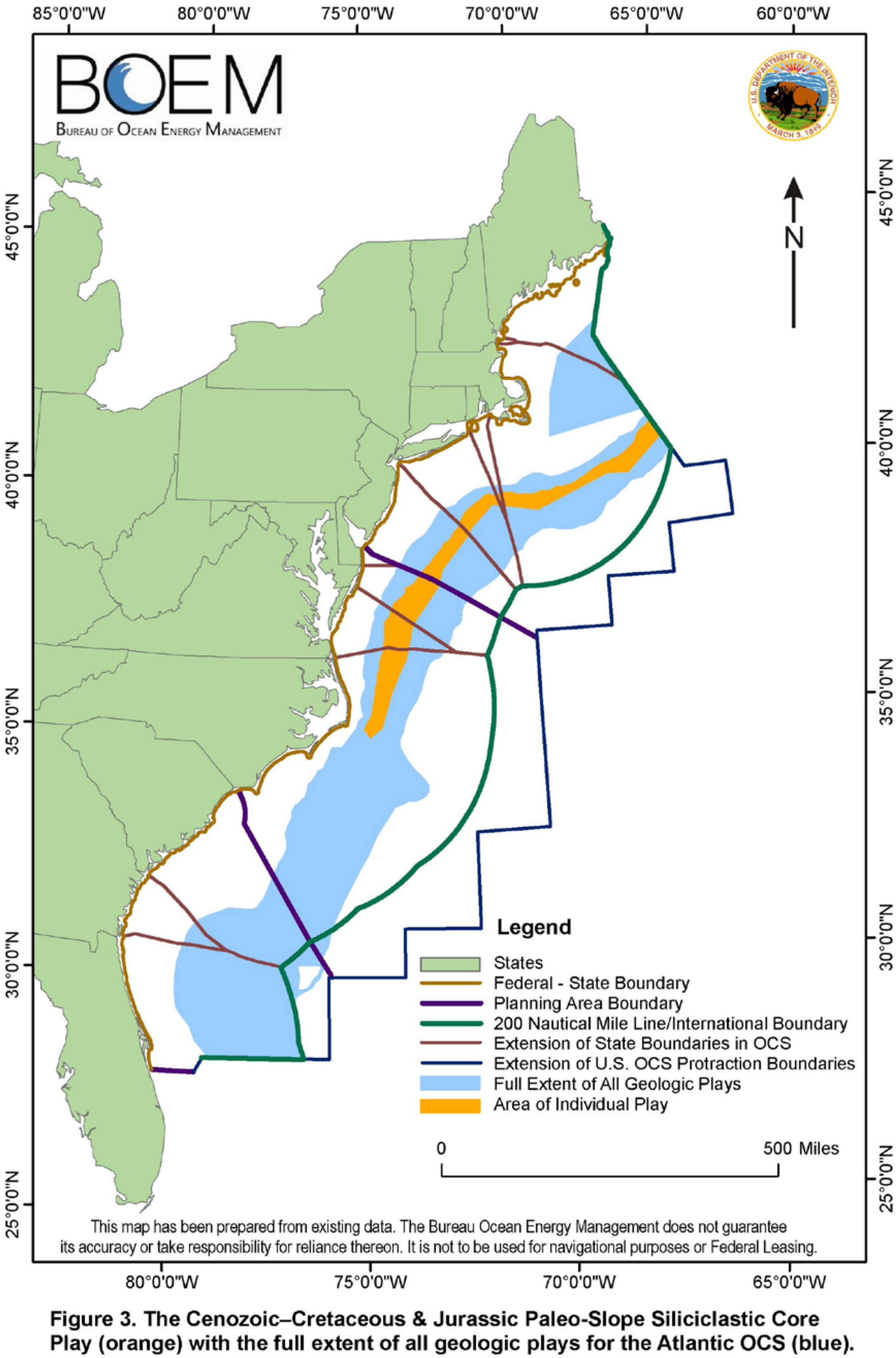

Figure 3. The Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

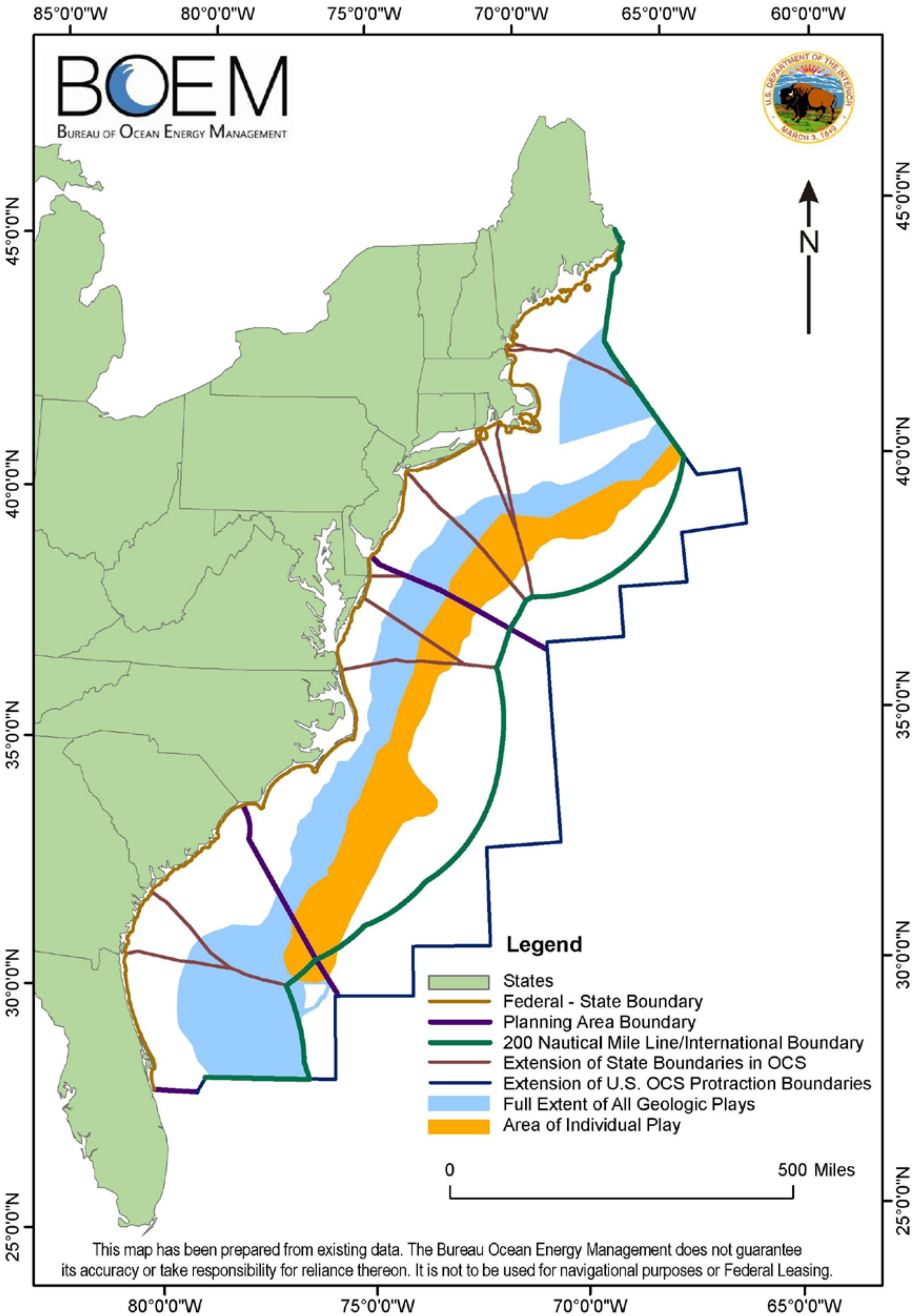

Figure 4. The Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Extension Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

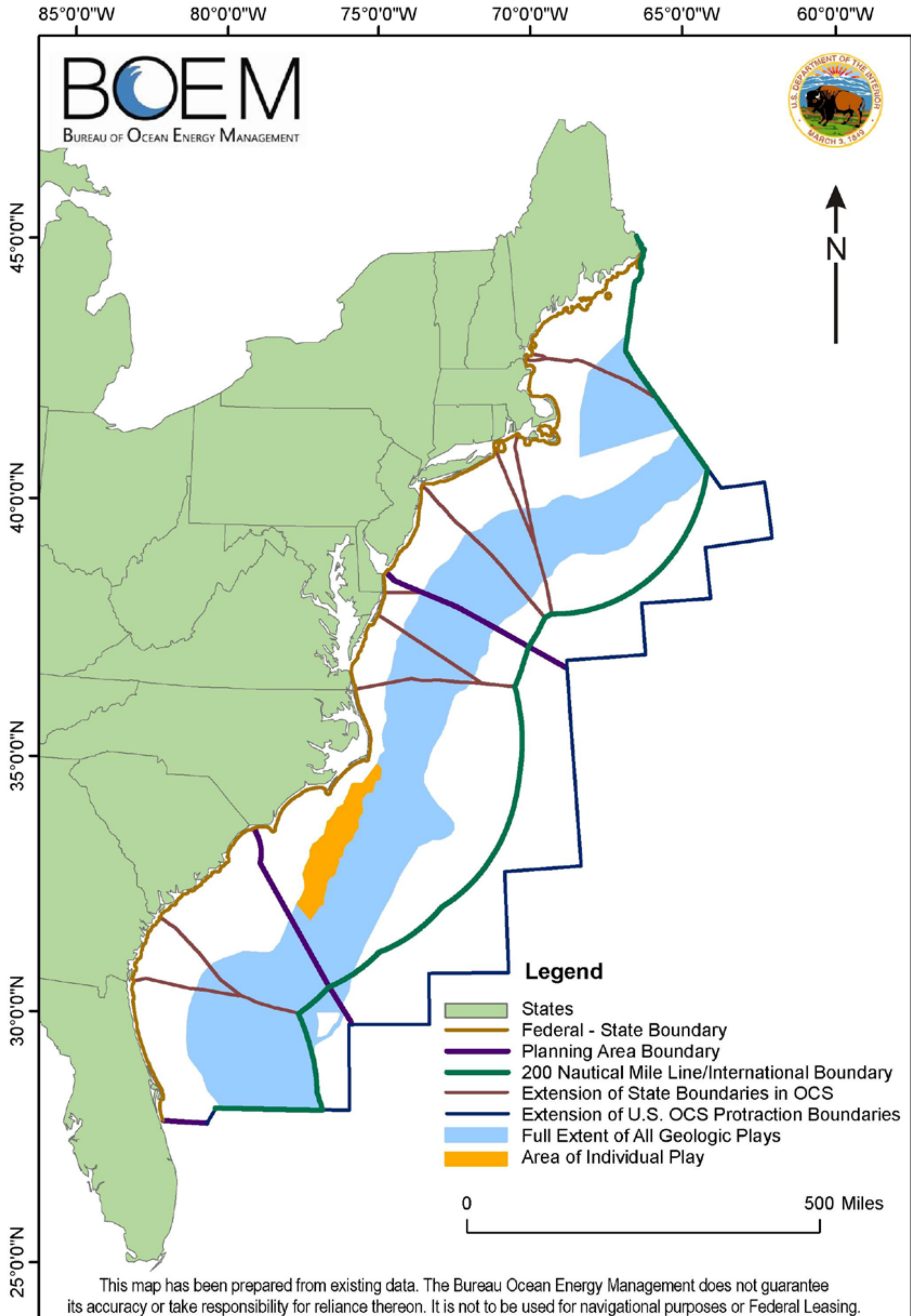

Figure 5. The Cretaceous & Jurassic Marginal Fault Belt Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

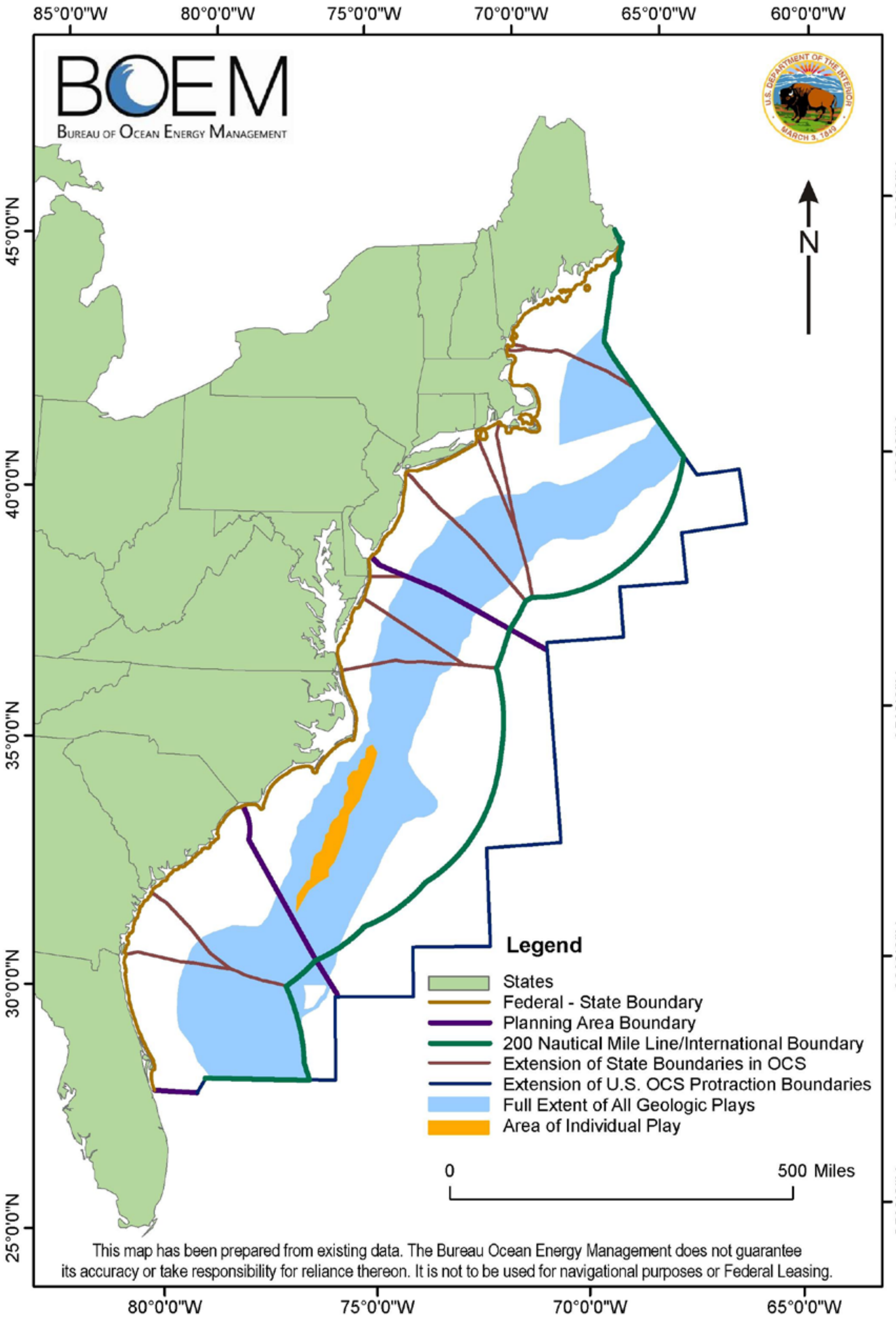

Figure 6. The Cenozoic–Cretaceous & Jurassic Carolina Trough Salt Basin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

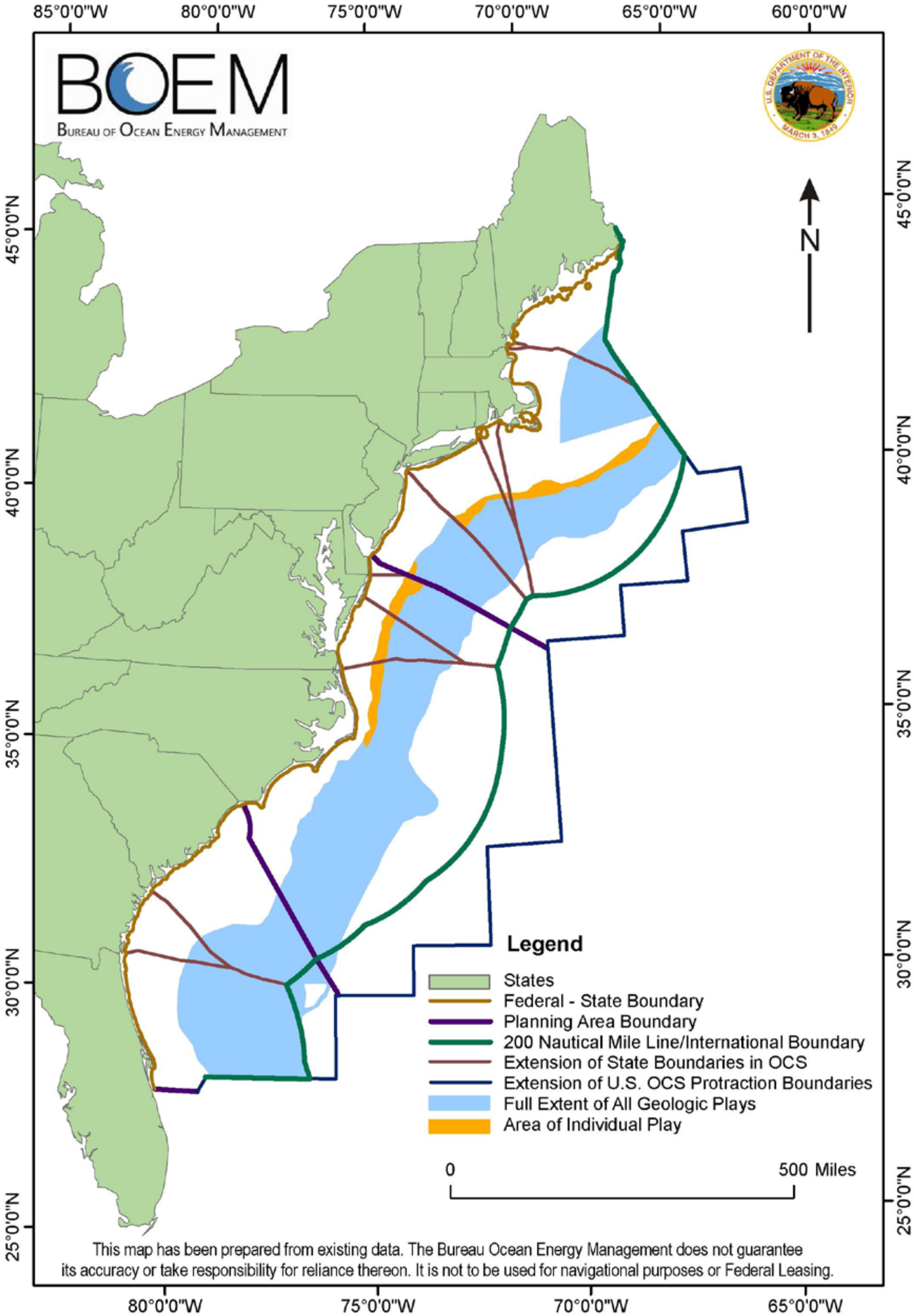

Figure 7. The Jurassic Shelf Stratigraphic Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

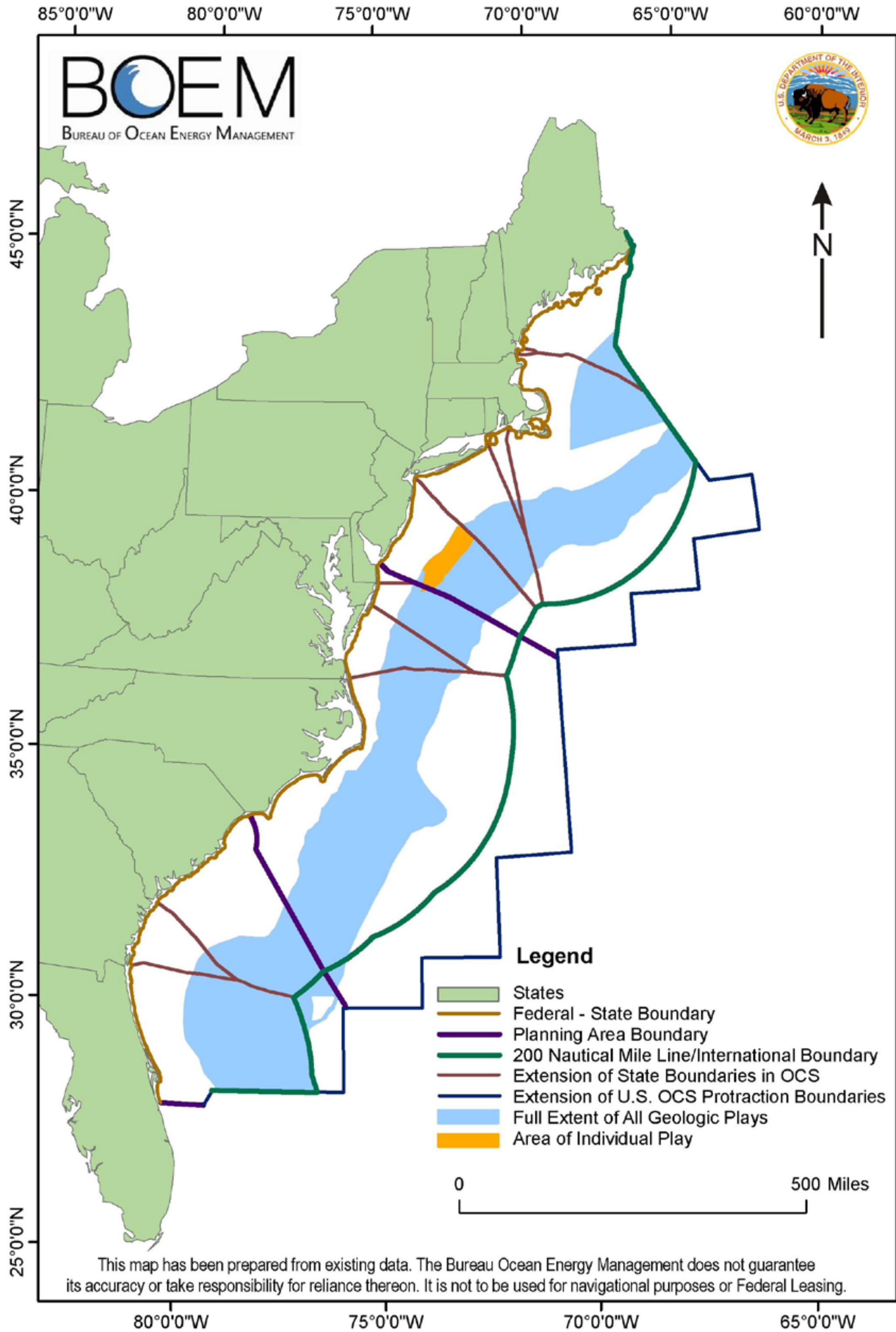

Figure 8. The Cretaceous & Jurassic Interior Shelf Sturcture Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

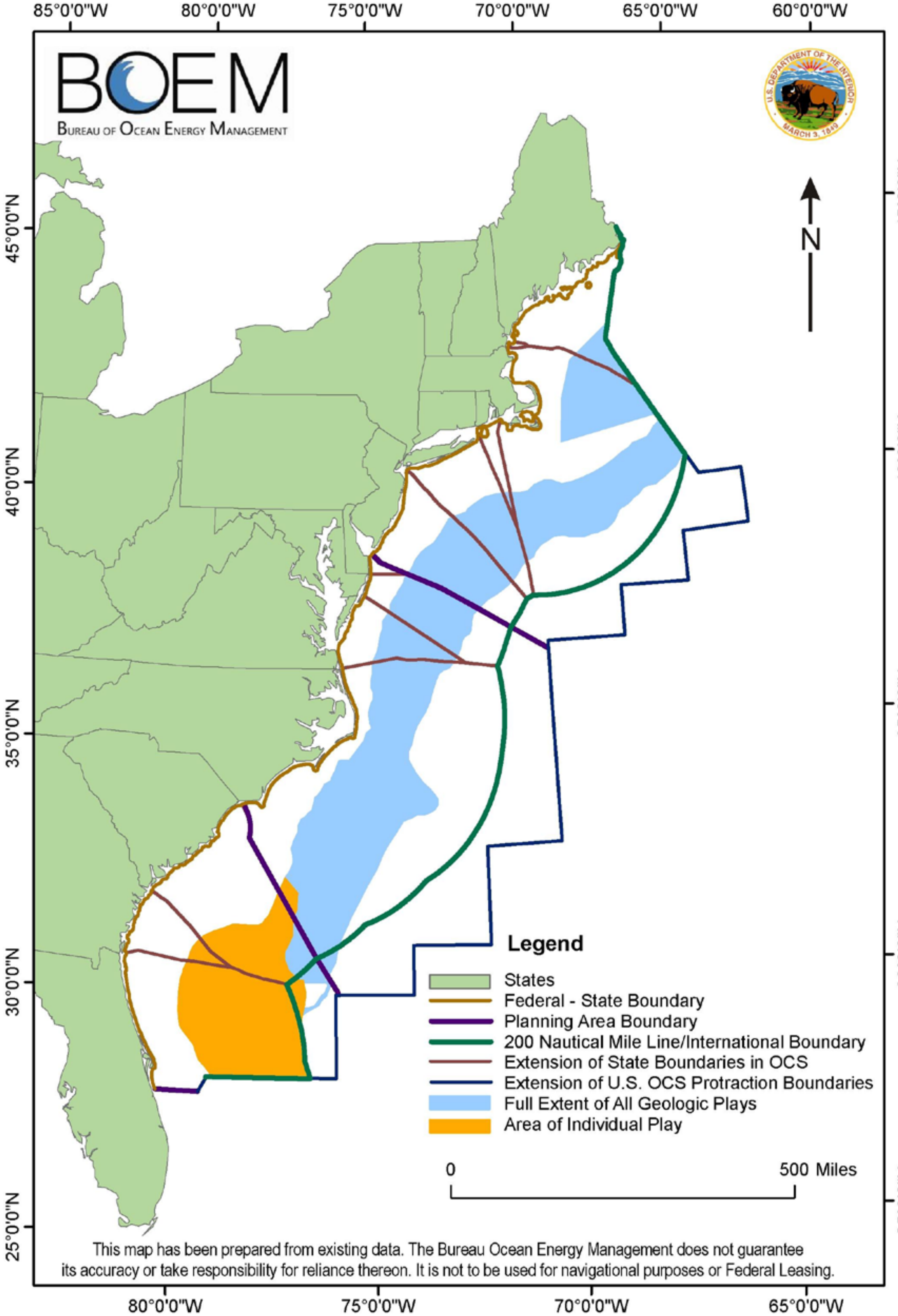

Figure 9. The Cretaceous & Jurassic Blake Plateau Basin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue)..

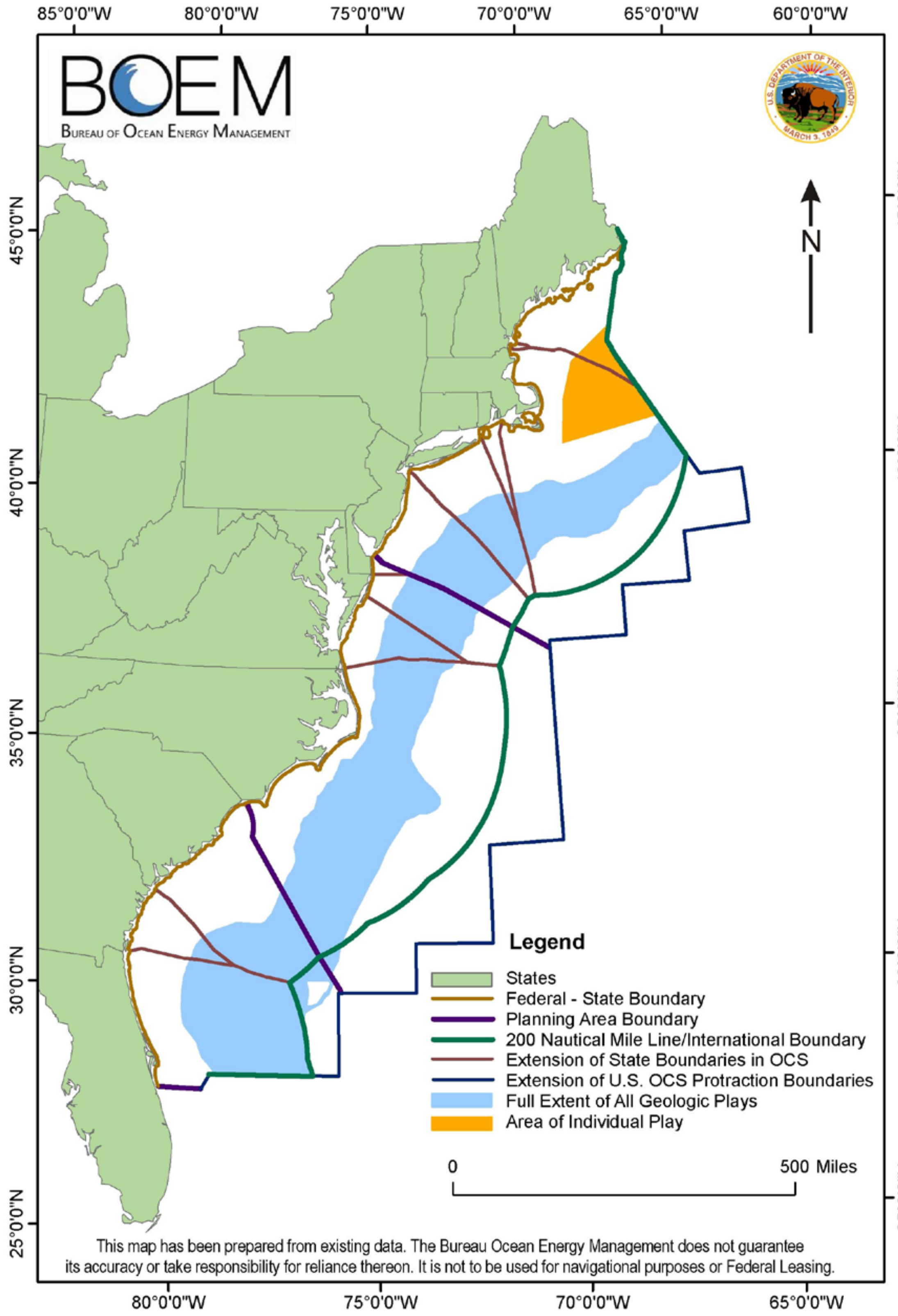

Figure 10. The Triassic–Jurassic Rift Basin Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

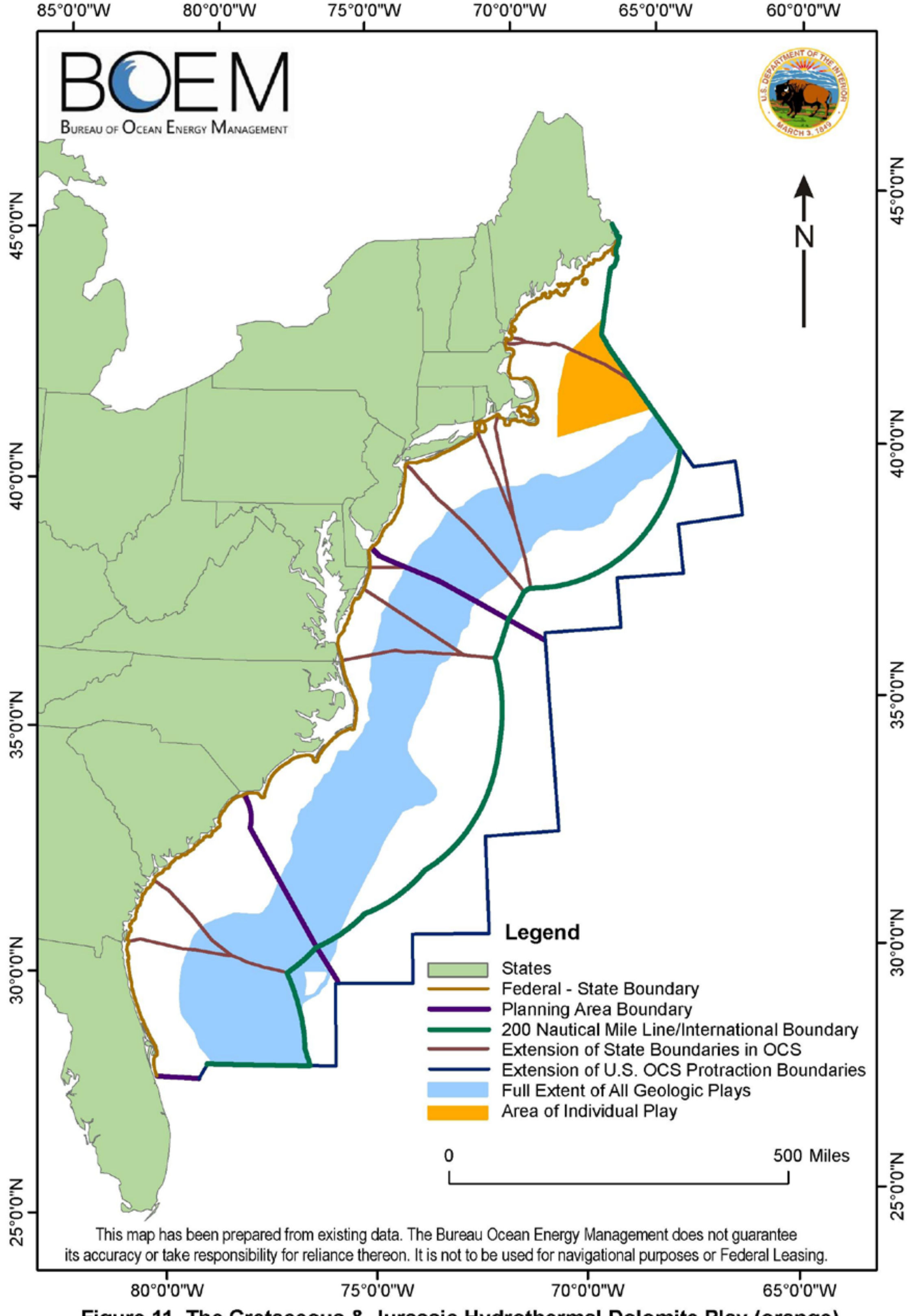

Figure 11. The Cretaceous & Jurassic Hydrothermal Dolomite Play (orange) with the full extent of all geologic plays for the Atlantic OCS (blue).

UTRR Tables

BOEM 2011 Atlantic OCS Assessment

Undiscovered Technically Recoverable Oil and Gas Resources (UTRR) by Play

Region	Undiscovered Technically Recoverable Oil and Gas Resources (UTRR)									Total Endowment*		
	Oil (Bbbl)			Gas (Tcf)			BOE (Bbbl)			Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
Play	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	Mean	Mean	Mean
Atlantic OCS	1.30	3.30	5.58	11.11	31.28	53.62	3.28	8.87	15.12	3.30	31.28	8.87
Late Jurassic–Early Cretaceous Carbonate Margin	0.00	0.32	1.37	0.00	6.14	26.54	0.00	1.41	6.10	0.32	6.14	1.41
Cretaceous & Jurassic Marginal Fault Belt	0.00	0.22	0.68	0.00	4.34	12.95	0.00	0.99	2.98	0.22	4.34	0.99
Cenozoic–Cretaceous & Jurassic Carolina Trough Salt Basin	0.00	0.61	1.64	0.00	7.76	21.03	0.00	1.99	5.38	0.61	7.76	1.99
Jurassic Shelf Stratigraphic	0.00	0.03	0.14	0.00	0.68	2.99	0.00	0.16	0.67	0.03	0.68	0.16
Cretaceous & Jurassic Interior Shelf Structure	0.02	0.07	0.12	0.48	1.36	2.49	0.11	0.31	0.57	0.07	1.36	0.31
Cretaceous & Jurassic Blake Plateau Basin	0.00	0.46	1.18	0.00	0.68	1.75	0.00	0.58	1.49	0.46	0.68	0.58
Triassic–Jurassic Rift Basin	0.00	0.49	2.15	0.00	1.37	6.03	0.00	0.74	3.22	0.49	1.37	0.74
Cretaceous & Jurassic Hydrothermal Dolomite	0.00	0.31	1.50	0.00	0.88	4.25	0.00	0.46	2.26	0.31	0.88	0.46
Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Core	0.00	0.45	1.87	0.00	5.71	25.13	0.00	1.47	6.34	0.45	5.71	1.47
Cenozoic–Cretaceous & Jurassic Paleo-Slope Siliciclastic Extension	0.00	0.34	1.50	0.00	2.37	10.79	0.00	0.76	3.42	0.34	2.37	0.76

* Total Endowment = Total Reserves (None) + UTRR

Table 1. Undiscovered Technically Recoverable Oil and Gas Resources UTRR and estimates of Total Endowment for the U.S. Atlantic OCS by play.

BOEM 2011 Atlantic OCS Assessment

Undiscovered Technically Recoverable Oil and Gas Resources (UTRR) by Water Depth

Region / Planning Area / Water Depth	Undiscovered Technically Recoverable Oil and Gas Resources (UTRR)									Total Endowment*		
	Oil (Bbbl)			Gas (Tcf)			BOE (Bbbl)			Oil (Bbbl)	Gas (Tcf)	BOE (Bbbl)
	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	Mean	Mean	Mean
Total Atlantic OCS	1.30	3.30	5.58	11.11	31.28	53.62	3.28	8.87	15.12	3.30	31.28	8.87
0 - 200m	0.05	0.82	2.45	0.94	4.39	9.26	0.21	1.61	4.10	0.82	4.39	1.61
200 - 800m	0.16	0.53	0.93	1.18	5.82	11.72	0.37	1.56	3.01	0.53	5.82	1.56
> 800m	0.56	1.95	3.59	4.41	21.07	39.79	1.34	5.70	10.67	1.95	21.07	5.70
Northern Atlantic OCS	0.06	1.35	3.16	1.25	9.87	21.23	0.28	3.11	6.94	1.35	9.87	3.11
0 - 200m	0.02	0.76	2.39	0.52	3.04	7.60	0.11	1.30	3.75	0.76	3.04	1.30
200 - 800m	0.02	0.20	0.44	0.35	2.13	5.77	0.08	0.58	1.47	0.20	2.13	0.58
> 800m	0.00	0.40	1.23	0.00	4.70	15.01	0.00	1.24	3.90	0.40	4.70	1.24
Mid Atlantic OCS	0.06	1.42	2.85	1.01	19.36	38.94	0.24	4.87	9.78	1.42	19.36	4.87
0 - 200m	<0.01	0.07	0.17	0.02	1.35	3.45	<0.01	0.31	0.78	0.07	1.35	0.31
200 - 800m	0.01	0.19	0.45	0.02	3.48	8.69	0.01	0.80	1.99	0.19	3.48	0.80
> 800m	0.02	1.17	2.50	0.03	14.54	31.21	0.03	3.76	8.06	1.17	14.54	3.76
South Atlantic OCS	0.00	0.53	1.15	0.00	2.04	5.95	0.00	0.89	2.21	0.53	2.04	0.89
0 - 200m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200 - 800m	0.00	0.14	0.37	0.00	0.21	0.55	0.00	0.18	0.47	0.14	0.21	0.18
> 800m	0.00	0.38	0.83	0.00	1.83	5.72	0.00	0.71	1.85	0.38	1.83	0.71

* Total Endowment = Total Reserves (None) + UTRR

Table 2. Undiscovered Technically Recoverable Oil and Gas Resources UTRR and estimates of Total Endowment for the U.S. Atlantic OCS by water depth.

UERR Tables

BOEM 2011 Atlantic OCS Assessment

Undiscovered Economically Recoverable Oil and Gas Resources (UERR) by Water Depth

Region	Undiscovered Economically Recoverable Oil and Gas Resources (UERR)																							
	$30/bbl						$60/bbl						$90/bbl						$120/bbl					
	$2.14/Mcf						$4.27/Mcf						$6.41/Mcf						$8.54/Mcf					
Planning Area	Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)		
Water Depth	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%
Total Atlantic OCS	0.42	1.49	2.81	2.48	7.53	13.79	0.54	1.88	3.49	4.17	12.39	22.28	0.61	2.06	3.78	4.83	15.05	27.25	0.66	2.16	3.93	5.32	16.58	29.80
0 - 200m	0.01	0.66	2.10	0.10	1.97	5.52	0.02	0.72	2.25	0.22	2.52	6.61	0.03	0.75	2.30	0.31	2.80	7.05	0.03	0.76	2.32	0.35	2.96	7.32
200 - 800m	0.06	0.22	0.44	0.20	1.64	3.43	0.07	0.28	0.55	0.33	2.68	5.89	0.08	0.31	0.60	0.39	3.19	7.04	0.09	0.32	0.63	0.45	3.46	7.65
> 800m	0.10	0.61	1.23	0.96	3.92	7.58	0.15	0.88	1.76	1.64	7.18	13.85	0.18	1.00	1.99	1.94	9.06	17.51	0.20	1.08	2.13	2.13	10.17	19.41
Northern Atlantic OCS	0.01	0.89	2.19	0.08	3.61	8.59	0.02	1.00	2.44	0.22	4.70	10.81	0.03	1.05	2.54	0.31	5.20	11.72	0.03	1.08	2.59	0.40	5.50	12.28
0 - 200m	<0.01	0.63	2.08	0.04	1.71	5.49	0.01	0.68	2.23	0.08	1.98	6.08	0.01	0.70	2.27	0.12	2.13	6.31	0.01	0.71	2.28	0.16	2.21	6.46
200 - 800m	<0.01	0.13	0.30	0.01	0.79	2.50	0.01	0.16	0.36	0.06	1.11	3.51	0.01	0.17	0.38	0.08	1.26	3.98	0.01	0.17	0.39	0.10	1.35	4.19
> 800m	0.00	0.12	0.43	0.00	1.11	3.92	0.00	0.17	0.55	0.00	1.60	5.45	0.00	0.19	0.61	0.00	1.81	6.09	0.00	0.20	0.65	0.00	1.94	6.41
Mid Atlantic OCS	0.01	0.56	1.14	0.13	3.35	6.95	0.02	0.81	1.68	0.23	6.86	14.43	0.02	0.91	1.88	0.30	8.90	18.24	0.03	0.97	1.99	0.34	10.07	20.63
0 - 200m	<0.01	0.03	0.08	<0.01	0.26	0.82	<0.01	0.04	0.11	<0.01	0.54	1.58	<0.01	0.05	0.12	<0.01	0.68	1.96	<0.01	0.05	0.13	0.01	0.75	2.15
200 - 800m	<0.01	0.09	0.23	<0.01	0.85	2.15	<0.01	0.12	0.32	<0.01	1.58	4.25	<0.01	0.13	0.34	0.01	1.92	5.21	<0.01	0.14	0.35	0.01	2.10	5.72
> 800m	<0.01	0.44	0.98	<0.01	2.24	4.72	<0.01	0.65	1.47	<0.01	4.74	10.39	<0.01	0.74	1.65	<0.01	6.30	13.86	<0.01	0.78	1.76	<0.01	7.22	16.00
South Atlantic OCS	0.00	0.05	0.15	0.00	0.57	2.09	0.00	0.06	0.20	0.00	0.83	2.96	0.00	0.09	0.26	0.00	0.95	3.36	0.00	0.11	0.30	0.00	1.01	3.57
0 - 200m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200 - 800m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<0.01	<0.01	0.00	<0.01	<0.01	0.00	0.01	0.02	0.00	<0.01	<0.01	0.00	0.02	0.04	0.00	<0.01	0.01
> 800m	0.00	0.05	0.15	0.00	0.57	2.17	0.00	0.06	0.20	0.00	0.83	3.08	0.00	0.08	0.25	0.00	0.95	3.47	0.00	0.10	0.28	0.00	1.01	3.70

Table 3. Price pairs associated with a 40 (0.4) percent economic value of gas relative to oil.

BOEM 2011 Atlantic OCS Assessment

Undiscovered Economically Recoverable Oil and Gas Resources (UERR) by Water Depth

Region	Undiscovered Economically Recoverable Oil and Gas Resources (UERR)																							
	$30/bbl						$60/bbl						$90/bbl						$120/bbl					
	$3.20/Mcf						$6.41/Mcf						$9.61/Mcf						$12.81/Mcf					
Planning Area	Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)		
Water Depth	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%
Total Atlantic OCS	0.44	1.56	2.93	3.68	10.95	19.73	0.56	1.95	3.60	5.32	16.78	30.18	0.63	2.11	3.87	6.05	18.79	33.73	0.68	2.21	4.02	6.52	19.83	35.32
0 - 200m	0.01	0.67	2.12	0.18	2.34	6.26	0.02	0.73	2.27	0.36	2.95	7.31	0.03	0.75	2.31	0.45	3.20	7.63	0.03	0.76	2.33	0.53	3.33	7.82
200 - 800m	0.06	0.24	0.48	0.28	2.41	5.26	0.07	0.29	0.58	0.44	3.50	7.79	0.08	0.31	0.62	0.52	3.87	8.50	0.09	0.33	0.64	0.59	4.06	8.84
> 800m	0.11	0.66	1.34	1.43	6.19	11.83	0.15	0.93	1.85	2.13	10.32	19.74	0.19	1.04	2.08	2.34	11.73	22.48	0.21	1.12	2.20	2.51	12.44	23.75
Northern Atlantic OCS	0.01	0.91	2.23	0.16	4.36	10.14	0.03	1.02	2.47	0.39	5.49	12.25	0.03	1.07	2.56	0.53	5.99	13.21	0.04	1.09	2.62	0.62	6.29	13.74
0 - 200m	<0.01	0.64	2.10	0.07	1.87	5.79	0.01	0.69	2.24	0.16	2.19	6.42	0.01	0.70	2.27	0.21	2.34	6.66	0.02	0.71	2.29	0.25	2.43	6.79
200 - 800m	<0.01	0.14	0.32	0.04	1.02	3.24	0.01	0.16	0.37	0.10	1.36	4.23	0.01	0.17	0.39	0.14	1.50	4.58	0.01	0.17	0.40	0.16	1.58	4.74
> 800m	0.00	0.13	0.46	0.00	1.47	5.04	0.00	0.17	0.58	0.00	1.93	6.38	0.00	0.20	0.64	0.00	2.15	6.99	0.00	0.21	0.68	0.00	2.28	7.36
Mid Atlantic OCS	0.01	0.61	1.26	0.20	5.82	12.17	0.02	0.86	1.78	0.34	10.28	21.16	0.02	0.95	1.97	0.41	11.69	24.19	0.03	1.00	2.06	0.45	12.37	25.56
0 - 200m	<0.01	0.03	0.09	<0.01	0.47	1.41	<0.01	0.04	0.12	0.01	0.76	2.19	<0.01	0.05	0.13	0.01	0.85	2.40	<0.01	0.05	0.13	0.01	0.90	2.49
200 - 800m	<0.01	0.10	0.26	<0.01	1.40	3.80	<0.01	0.13	0.33	0.01	2.14	5.86	<0.01	0.14	0.35	0.01	2.36	6.37	<0.01	0.14	0.36	0.01	2.47	6.57
> 800m	<0.01	0.48	1.07	<0.01	3.95	8.47	<0.01	0.69	1.56	<0.01	7.38	16.51	<0.01	0.77	1.72	<0.01	8.47	18.95	<0.01	0.81	1.80	<0.01	9.00	20.03
South Atlantic OCS	0.00	0.05	0.16	0.00	0.77	2.77	0.00	0.06	0.21	0.00	1.01	3.58	0.00	0.09	0.27	0.00	1.11	3.90	0.00	0.11	0.31	0.00	1.18	4.06
0 - 200m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200 - 800m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<0.01	<0.01	0.00	<0.01	<0.01	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.02	0.04	0.00	0.02	0.05
> 800m	0.00	0.05	0.16	0.00	0.77	2.86	0.00	0.06	0.21	0.00	1.01	3.73	0.00	0.08	0.25	0.00	1.10	4.04	0.00	0.10	0.28	0.00	1.16	4.19

Table 4. Price pairs associated with a 60 (0.6) percent economic value of gas relative to oil.

BOEM 2011 Atlantic OCS Assessment

Undiscovered Economically Recoverable Oil and Gas Resources (UERR) by Water Depth

Region	Undiscovered Economically Recoverable Oil and Gas Resources (UERR)																							
	$30/bbl						$60/bbl						$90/bbl						$120/bbl					
	$5.34/Mcf						$10.68/Mcf						$16.01/Mcf						$21.35/Mcf					
Planning Area	Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)			Oil (Bbbl)			Gas (Tcf)		
Water Depth	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%
Total Atlantic OCS	0.47	1.68	3.14	5.14	16.42	29.48	0.59	2.03	3.75	6.77	20.56	36.46	0.67	2.19	3.99	7.48	22.41	39.45	0.71	2.28	4.14	7.90	23.53	41.14
0 - 200m	0.02	0.69	2.16	0.35	2.88	7.15	0.03	0.74	2.29	0.57	3.41	7.92	0.03	0.76	2.32	0.65	3.61	8.20	0.03	0.77	2.34	0.71	3.73	8.34
200 - 800m	0.06	0.25	0.51	0.42	3.45	7.69	0.08	0.30	0.60	0.63	4.20	9.05	0.09	0.33	0.63	0.74	4.51	9.57	0.09	0.34	0.66	0.80	4.69	9.86
> 800m	0.13	0.74	1.49	2.09	10.09	19.38	0.16	0.98	1.96	2.59	12.96	24.66	0.20	1.10	2.18	2.89	14.29	27.01	0.22	1.17	2.31	3.04	15.11	28.53
Northern Atlantic OCS	0.01	0.93	2.28	0.36	5.35	11.99	0.03	1.04	2.52	0.66	6.47	14.01	0.04	1.09	2.61	0.86	7.00	14.99	0.04	1.12	2.66	0.92	7.32	15.62
0 - 200m	0.01	0.65	2.13	0.15	2.13	6.27	0.01	0.69	2.25	0.27	2.48	6.82	0.02	0.71	2.28	0.35	2.61	6.99	0.02	0.72	2.30	0.37	2.69	7.08
200 - 800m	0.01	0.15	0.34	0.09	1.33	4.19	0.01	0.17	0.38	0.18	1.63	4.86	0.01	0.17	0.40	0.23	1.75	5.11	0.01	0.18	0.40	0.25	1.82	5.23
> 800m	0.00	0.14	0.49	0.00	1.89	6.26	0.00	0.18	0.61	0.00	2.36	7.61	0.00	0.21	0.67	0.00	2.64	8.38	0.00	0.23	0.72	0.00	2.82	8.96
Mid Atlantic OCS	0.01	0.69	1.42	0.32	10.06	20.79	0.02	0.91	1.89	0.47	12.87	26.53	0.03	1.00	2.06	0.52	14.06	28.88	0.03	1.05	2.14	0.57	14.78	30.27
0 - 200m	<0.01	0.04	0.10	<0.01	0.75	2.17	<0.01	0.05	0.12	0.01	0.93	2.56	<0.01	0.05	0.13	0.01	1.00	2.72	<0.01	0.05	0.14	0.01	1.04	2.81
200 - 800m	<0.01	0.11	0.28	0.01	2.11	5.79	<0.01	0.13	0.35	0.01	2.54	6.74	<0.01	0.14	0.36	0.01	2.71	7.10	<0.01	0.15	0.37	0.02	2.81	7.34
> 800m	<0.01	0.55	1.24	<0.01	7.20	16.06	<0.01	0.73	1.65	0.01	9.40	20.88	<0.01	0.81	1.80	0.01	10.35	22.74	<0.01	0.85	1.88	0.01	10.92	23.92
South Atlantic OCS	0.00	0.05	0.17	0.00	1.00	3.55	0.00	0.07	0.22	0.00	1.22	4.19	0.00	0.10	0.28	0.00	1.35	4.47	0.00	0.12	0.32	0.00	1.43	4.65
0 - 200m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200 - 800m	0.00	<0.01	<0.01	0.00	<0.01	<0.01	0.00	<0.01	<0.01	0.00	0.02	0.07	0.00	0.01	0.02	0.00	0.04	0.13	0.00	0.02	0.04	0.00	0.06	0.17
> 800m	0.00	0.05	0.18	0.00	1.00	3.69	0.00	0.07	0.22	0.00	1.20	4.32	0.00	0.09	0.26	0.00	1.30	4.58	0.00	0.10	0.29	0.00	1.36	4.73

Table 5. Price pairs associated with a 100 (1) percent economic value of gas relative to oil.