The overlying dark shales are early-middle Callovian, which
may possibly be as late as the first half of the Callovian
period, and the age of the Blake Spur and M-28 anomalies, and the time of early spreading of the
central North Atlantic. Widespread Callovian transgression
may be an expression of rapid, early spreading.

The new bio- and magneto-stratigraphic data are being in­
tegrated with local zonal schemes for Atlantic basins to pro­
vide an improved Jurassic time scale of events.

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Cretaceous-Jurassic Dinoflagellate Stratigraphy in Blake-
Bahama Basin

A stratigraphically conformable dinoflagellate zonation
ranging in age from Vraconian Albian to earliest Oxfordian-
middle Callovian is distributed through 875 m of section
recovered at Deep Sea Drilling Project Site 534A. The
Cretaceous interval is the most fossiliferous studied to date in
the paleobathymetrically deep western North Atlantic, and
correlates well with five other sites. The Cretaceous-Jurassic
boundary, considered to be conformable, is in nanofossil
ooze just below the first red intercalated layers but above the
major lithology of the Jurassic Cat Gap Formation. Jurassic
assemblages are not as well preserved, but provide stratigraphically useful species.

Blackish sediment is present intermittently throughout the
investigated section at Site 534A; its origin is considered to be
related to sedimentation rates.

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Bottom Morphology and Shallow Subbottom Sedimentary
Structures on U.S. Continental Shelf Between Cape Hatteras,
North Carolina, and Jacksonville, Florida

During the period July 1978 to 1980, a survey of the U.S.
South Atlantic shelf was made to determine the occurrence and
distribution of biologically productive bottom areas and
bottom and shallow subbottom geologic features of potential
validity to petroleum exploration and production. Methods of
data acquisition included the use of high-resolution seismic
systems, sidescan sonar, towed television, and minisub.

Shelf sediments are largely composed of 2 to 5 m of Quater ­
nary sands and silty clays with mixtures of shell that were
deposited in fluvial, paralic, and shallow-marine environ­
ments. Greater sediment thicknesses (up to 40 m) are
present in buried river channels, tidal inlets, and cut-and-fill
structures associated with meandering tidal streams.

Surficial sediments exhibit a wide range of bed-form type and
maturity. Ripples of less than 0.5 m wavelength and megaripples of 0.5 to 1 m wavelength are common across the
shelf. Crest orientation is generally north-south. Algal growth
along the crests of many of the smaller bed forms as well as
abundant bioturbation and tracks indicate bottom stability ex­
cept during storms. Sand waves up to 100 m long are common,
particularly within the 25-m isobath and are present in discrete
fields 3 km or more wide with north-south crest orientation.
They are less common, less sharply defined offshore and
usually underlie smaller bed forms of different orientation.
These features may have resulted from infrequent major
storms and, because of rising sea level, may now be below the
effect of most storm-generated waves. Although the mobility

of these large bed forms is inferred by the presence of buried
reefs within some of the sand bodies, the time and rate of
movement are unknown. Many areas of the shelf exhibit ir­
regular, low-relief bed forms that appear to be in advance
stages of deterioration from intense bioturbation.

Several distinct, acoustically hard reflectors present in the
shallower subbottom over much of the shelf represent indurated
strata which on outcrop provide substrate for the development
of reef and hardground communities. These temperate
bioherms are primarily populated by sponges and octocorals
and, on the basis of topographic expression, are classified as
low-relief hardgrounds (> 0.5 m), moderate-relief reefs (up
to 2 m), and high-relief reefs (up to 15 m). Low-relief hard­
grounds are the most widely distributed of the three types but
are the least productive in terms of biomass. Moderate-
and high-relief reefs occur most commonly off North and South
Carolina and along most of the shelf break. Substrate ranges
from Pleistocene to Miocene in age and locally contains
significant percentages of phosphate grains. The total area of
shelf occupied by reefs and hardgrounds is estimated to be
less than 10%. Outcrop patterns reflect both local bottom pro­
cesses and regional structural framework.

In the middle to outer shelf off the Georgia coast, a relative­
narrow zone of large channels and numerous cut-and-fill
structures occur in Quaternary deposits just landward of a
shallow buried Miocene high. These features are very similar
to sedimentary structures associated with present-day barrier
islands, tidal inlets, and estuaries and strongly suggest a sea-
level stillstand near the end of the last Pleistocene regression or
early in the present transgression.

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Methane from Coal Beds: Unconventional Energy Source in
Warrior Basin

One of the largest potential gas resources of the Atlantic
Coast margin may lie in coal beds and adjacent strata of the
Warrior basin in Alabama and Mississippi. The resource
assessment phase of the Department of Energy's Methane
Recovery from Coalbeds Project (DOW/MRCP) conservatively
estimates gas content of Warrior basin coals to be 10 Tcf.

The Warrior basin is a triangular area in northern Missis­
ippi and Alabama containing extensive gaseous bituminous coal
reserves. The major coal seams, in the upper Pottsville Forma­
tion, formed as clastic material filled in the channel-lake-
swamp environments of a Late Pennsylvanian upper delta
plain. Of the seven major coal groups in the upper Pottsville,
the Mary Lee Group and Black Creek Group have been iden­
tified as likely candidates to be coal-bed gas reservoirs. Direct
measurement of coal core samples indicates that gas content
ranges from 2 cc/g (64 cu ft/ton) from 700 ft (213 m) of over­
burden to 18 cc/g (576 cu ft/ton) at a depth of 2,000 ft (610 m).

Coal operators in the basin are keenly interested in develop­
ing coal bed methane both to increase safety of underground
mines through degasification in advance of mining and as a
marketable product to be pipelined or used on site. After 2
years of operation, the U.S. Steel mines near Oak Grove,
Alabama, have produced 750 MMcf of gas from a 17-well
field, with an average gas flow per well of 70,000 cf/day. The
Jim Walters Resource Co. has an in-mine system which col­
mects the gas for local use. One horizontal well produced 40
MMcf of methane over its lifetime of 10 months. These and
other examples support the conclusion that the Warrior basin
contains an economically recoverable resource for meeting
local and national energy needs.