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Impact of Holocene Transgression on Depositional Environment of Northern Gulf of Mexico Continental Margin

Sample analysis and geophysical profiles across the continental slope and shelf of the northern Gulf of Mexico indicate that, as a result of a comparatively rapid rise in sea level, the Holocene transgressive facies is not as well developed as that of the Pleistocene. This rise in sea level, combined with the decrease in the rate of precipitation in the Pleistocene and Holocene, caused a diminution of sediment supply to the western margin. The Mississippi River system maintained an adequate sediment flux and a prograding delta to the edge of the shelf. As a result, the mass wasting potential was lessened on the western slope but maintained in the central region. The present sedimentation rates measured by ^{210}Pb-dating vary from 1 cm/year on the upper slope near the delta to 1 mm/year on the western slope off the Rio Grande.

The mineral composition of the fine sediment varied very little if at all during the transgression. The sand-size fraction, however, changed from a dominantly detrital to a biogenic-organic composition. Organic material in the sediment increased and is dominantly of marine origin. The level of the oxygen minimum was elevated to near the shelf and slope break.

Although thinner, the Holocene transgressive unit is similar stratigraphically to units lower in the section and to units that envelope hydrocarbon-producing horizons in the Gulf Coast. In addition, the fine, organic-rich sediment rapidly deposited in an area of low oxygen may become petroleum source beds. The abundance of marine organic materials in this unit favors generation of petroleum over gas.

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Cretaceous-Tertiary Versus Carboniferous Depositional Settings—Factors Affecting Coal Parameters

Recent studies in the coal measures of the Carboniferous, Cretaceous, and Tertiary have shown that one of the most critical determinants of seam parameters is the depositional environment of the coal and enclosing strata. Although some of the differences between the Cretaceous-Tertiary and Carboniferous coals can be explained by their different ages and depth of burial (Btu, moisture content), many of the coal parameters (thickness and continuity, sulfur and trace-element content, ash content, roof and floor conditions) can be attributed to their depositional setting and the effect of energy conditions in the depositional basin on the environments of peat accumulation.

Because of the wave energy in the western Cretaceous seaway, many of the deltas have sandstones that were reworked into interchannel areas from contemporaneous distributary mouth bars. These delta-front sheet sandstones formed platforms upon which widespread coals developed. In contrast, the most laterally continuous Carboniferous coals of the Appalachians accumulated in the upper reaches of the lower delta plain. Because of the low wave energies at the delta front, the only sites for coals to amass were on the levee and splay deposits adjacent to distributary channels which were separated by large interdistributary bay sequences.

Previous studies have related the sulfur content of coals to the occurrence of marine and brackish roof rock. Western coals are considered to be lower in sulfur than eastern coals. Since a significant part of the western reserves are in fluvially related Tertiary coals while most of the low-sulfur fluvial coals of the Appalachian Carboniferous have already been mined, this statement is true in generalities. However, the Cretaceous-Tertiary coals of the west that developed in marginal marine environments are as high in sulfur as the Appalachian Carboniferous coals that accumulated in similar environments.

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Oil Exploration in Southeast Turkey Thrust Belt

The southeast Turkey thrust belt forms the foothills zone of the Late Cretaceous to late Tertiary Alpine orogenic belt, which frames the Arabian craton in southern Turkey and Iran. The thrust belt is characterized by imbricate structures and disharmonic folding. It comprises a northern inner belt in which Late Cretaceous and Tertiary tectonic phases are superimposed, and a southern outer belt in which Late Cretaceous thrusts underlie gently deformed Tertiary sediments. To the south lies the folded foreland.

In southeast Turkey, oil has been found in middle Cretaceous carbonate rocks in the frontal overthrusts of the outer thrust belt and in middle and Upper Cretaceous limestones in faulted anticlines of the foreland. Over 300 exploration wells in this area have resulted in the discovery of about 40 oil fields of which 26 lie in the outer thrust belt. Two oil types can be distinguished: (1) low-sulfur, light crude, mainly confined to the thrust belt and thought to have been derived from Silurian source rocks, and (2) heavy, high-sulfur crude, produced from the foreland fields, probably derived from Lower Mesozoic source rocks.

Oil prospects in the thrust belt are limited by reservoir deterioration toward the highly deformed inner thrust belt and by the distribution of Silurian source rocks. Exploration tools applied to locate the oil traps in the overthrusts include field gravity, bore-hole gravity, seismic reflection and refraction shooting, and structural trend studies based on subsurface data and theoretical models.

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Anticipating Coal Mining Problems in Hartshorne Formation, East-Central Oklahoma, Using Sedimentary Facies Analysis

A study of sedimentary facies associated with the Hartshorne coal beds of east-central Oklahoma provides an opportunity for preventive planning to minimize mining problems.

Sedimentary facies within the Hartshorne formation

include delta distributary sandstones and interdistributary bar-fill shales, siltstones, and sandstones. One distributary channel sandstone body displays a "shoestring" geometry, over 12 mi (19.2 km) long and 1 mi (1.6 km) wide, with an average maximum thickness of 200 ft (61 m). This sandstone rests directly on and locally replaces the Lower Hartshorne coal bed. Three major mining problems are related to this sandstone body: (1) the Hartshorne sandstone in this area is a natural gas reservoir which might emit gas into adjacent coal mines; (2) the sandstone body is directly related to local discontinuities and rolls in the Lower Hartshorne coal bed; and (3) an unstable roof may be locally associated with trough cross-bedding and jointing near the base of the sandstone, and with facies changes and slickensides along the lateral margins of the sandstone body.

In contrast to this sandstone body, interdistributary bay deposits, because of their relative homogeneity and lateral persistence, do not present potential facies-related mining problems. Potential mining problems associated with these facies are local and are directly related to structural and stress-release features which are difficult to predict in advance of mining.

To insure safe and economic coal production from the Hartshorne formation, the distribution of major sandstone bodies overlying the coal beds must be considered when planning degasification programs and shaft, slope, and main entry locations.

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Sedimentation Rates and Illite-Smectite Diagenesis

The percentage of expansible smectite layers in a mixed-layer illite-smectite (I/S) clay has been correlated often with temperatures in a sedimentary basin. Sequences in Tertiary Gulf Coast sediments demonstrate that sediment accumulation rates exert a great influence upon I/S expansibilities by influencing thermal history. In sediment piles with high accumulation rates, the greater redistribution of energy produced by increased forced migration of fluids results in lower temperatures and thermal gradients and, as a consequence, the I/S clays are expected to react toward illite at slower rates. I/S clays from deltaic Wilcox (Eocene) shales have 50% expansible layers, in contrast to 25% expansible layers in I/S clays in marginal shelf Wilcox sediments found at similar present-day burial depths and temperatures. The more expansible I/S assemblages in the rapidly accumulating deltaic sediments are consistent with the predictions of energy transport theory in compacting sediments. As these Eocene I/S clays are now being buried under roughly equal thicknesses of sediment at similar rates, the difference in thermal gradient imposed by the original deltaic and shelf margin Wilcox sedimentation is being slowly reduced until both paleogeographic areas have roughly equal geothermal gradients. At similar present-day temperatures around 100°C, the important consideration is that the I/S clays in the slowly deposited shelf margin sediments reached the minimum reaction temperature before the clays deposited at the same time in deltaic sediments. Implication for I/S diagenesis is that the maximum temperature encountered is not as important as the rate at which minimum reaction activation temperatures in the basin are achieved, and that use of expansibility changes in I/S clays as a geothermometer needs to be reevaluated.

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Delineation of Jacksonian-Vicksburgian Boundary in East-Central Gulf Coast Using Evolutionary Series in Ostracods

A comparison of the Ostracoda from the Shubuta clay (Jacksonian Stage) and the overlying Red Bluff Clay (Vicksburgian Stage) of the east-central Gulf Coast region reveals an easy and reliable method of delineating the Jacksonian-Vicksburgian boundary which separates these Cenozoic shelf deposits.

Ten or more Shubuta ostracod species continue into the overlying Red Bluff, but another six span the Jacksonian-Vicksburgian boundary as evolutionary descendants. *Argilloecia subovata* Huff, *Buntonia shubutaensis* Howe, *Eucythere shubutaensis* Howe & Howe, *Occultocythereis broussardi* (Howe & Chambers), *Trachyleberis? montgomeryensis* (Howe and Chambers), and *Trachyleberis? quadrata* Howe & Howe are Shubuta Clay species which evolved into direct evolutionary descendants in the Red Bluff Clay. The descendants were respectively: *Argilloecia* sp. aff. *A subovata* Huff, *Buntonia* n. sp., *Eucythere woodwardsensis* Howe, *Occultocythereis kempi* (Howe & Law), *Actinocythereis quadrataspinata* (Howe & Law), and *Actinocythereis thomsoni* (Howe & Law).

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Petrographic Variation in Western Kentucky #11 Coal Seam

Vitrinite reflectance (rank) and maceral percentages were studied on 90 samples of the western Kentucky #11 coal (and the correlative Illinois #6 coal) from 14 mines (13 in Kentucky, 1 in Illinois). The coals were collected in 3 benches from 2 to 3 channels per mine. The petrographic data were subjected to analysis-of-variance tests of the rank and of the percentage of reactive macerals.

The rank varies from high volatile C to high volatile B, the highest occurring in Webster County, Kentucky, and Gallatin County, Illinois. The seam has a consistently low percentage of inert macerals (generally less than 10%) throughout the field. The percentage of total vitrinite is usually greater than 80% with a decrease in telocollinite accompanied by an increase in "pseudovitrinite" rather than by an increase in the exinite or inertinite macerals. The consistent petrography, along with the large quantity of the reserves (second largest reserve base in western Kentucky), should make the seam an important resource for the synthetic fuels industry.

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High-Resolution Landsat for Geophysical Studies

Landsat provides a tool which can significantly aid geophysical exploration programs. It can be used for