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Evolution and Hydrocarbon Potential of Navarin Basin, Bering Sea, Alaska

The Navarin basin consists of three en echelon subbasins filled with more than 26,000 ft of layered Tertiary sedimentary rock. The subbasins initially formed as a result of extensional deformation associated with oblique subduction of the Kula plate beneath the North American plate in the Late Cretaceous to early Tertiary. By the late Eocene, the fragment of the Kula plate, which now floors the Aleutian basin, was isolated by initiation of subduction at the present Aleutian arc. Active graben growth and major faulting ceased by the late Oligocene. Regional subsidence, controlled primarily by crustal cooling, initiated a second phase of sedimentation within and beyond structurally defined subbasins of pre-late Oligocene. The Navarin basin COST 1 well suggests that since the late Eocene, sedimentation within the three subbasins consisted of predominantly marine mudstone and siltstone and minor amounts of sandstone. Regressive events in the middle and late Oligocene, however, exposed older Tertiary and Mesozoic basement highs to wave-base erosion, which may have formed aprons of coarser grained detritus along the subbasins flanks. Eocene and early Oligocene marine sediments with good liquid hydrocarbon source potential and favorable levels of thermal maturity were present at the well site. This marine sequence thickens toward the deeper parts of the basin, indicating that a significant amount of source rock may be present next to traps associated with basement highs.

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Status of Underground Coal Gasification

Underground coal gasification appears to be one of the most attractive routes for synfuels from coal because the process can produce methanol and substitute natural gas at prices competitive with existing energy sources. The technical feasibility of underground coal gasification has been well established by small-scale field tests. Cost estimates based on the resultant data are favorable. The environmental effects associated with the technology appear to be acceptable. Successful commercialization of the process would probably triple the proven reserves of United States coal, which would be sufficient to last for hundreds of years.

At this stage of development, underground coal gasification is a high-risk technology and will remain so until large-scale field tests are successfully carried out. These tests are recommended by the Gas Research Institute and by the American Institute of Chemical Engineers. A 7-yr program costing about $200 million would permit initial commercial production in 10 yr.

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Basic Two-Dimensional Model for Thrust-Fold Oil-Field Structures of Rocky Mountain Foreland

Seismic profiles matched by a true-scale structural cross section and a photographed clay model analog can be used to illustrate the two-dimensional geometry and developmental history of oil-field structures of the Big Horn basin. From these real and simulated examples, a two-dimensional model of the typical oil-field structure of the foreland is constructed. These structures have the following characteristics. (1) They involve faulted Precambrian basement. (2) The basement generally acts as a brittle, homogeneous material and does not fold appreciably. (3) The folding in the overlying sedimentary section results from rotational movement on a thrust fault that develops at 30° to the sediment-basement contact. The fault is propagated upward into the sedimentary section, producing an anticlinal fold, and downward into the deeper basement. The amount of shortening determines the displacement on the fault and extent of vertical uplift. (4) The folds are flexural-slip and asymmetric, but not concentric, because the ductile sedimentary layers are differentially stretched and thinned over the steep flank and along the overturned underside of the causal fault zone where layer-parallel extension is greatest. Thinning in these domains is compensated by thickening in the subthrust "synclinal" block. (5) Since the basement surface remains essentially planar and continuous "plateau uplift" cannot occur, a hinge must develop behind the primary thrust zone so that rigid-body rotation can take place. The dip on the fault surface increases upward with continued rotation. Longitudinal and transverse extensional faulting occur at shallow levels. (6) The original point of the basement thrust wedge is blunted under the constriction of the overlying sedimentary section by localized fault imbrication.

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The Geologist in Space: Apollo, Shuttle, and Beyond

(No abstract)

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Petroleum and Source-Rock Potential of Eagle Ford Group (Upper Cretaceous), East Texas Basin

The Eagle Ford Group is one of the most complex clastic units in the East Texas basin. At the type locality in Dallas County, Texas, the Eagle Ford consists of 400 ft of bluish-black, carbonaceous clay-shale, subdivided into the Tarrant, Britton, and Arcadia Park Formations. The Eagle Ford thickens to over 900 ft eastward into the basin. This thickening is due to the acquisition of sand bodies within the Britton, Arcadia Park, and sub-Clarksville (which occurs above the Arcadia Park) Formations. The individual formations of the Eagle Ford change in thickness and character throughout the basin, apparently as result of different depositional regimes.

Significant petroleum reserves have been produced from the sub-Clarksville formation in the East Texas basin. However, no exploration for petroleum that could be present in the sands found in the Britton and Arcadia Park Formations has occurred to date. Application of refined depositional models for the various formation suggests new possible exploration targets.

Geochemical analysis of the Eagle Ford Group throughout the basin suggests that the Eagle Ford shales may be a major source-rock for petroleum in Austin, Eagle Ford, Woodbine, and possible Buda Formations. This study examines the nature, distribution, origin, and possible petroleum contributions of Eagle Ford rocks in the East Texas basin.

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Plate Tectonic Contest in North Greenland

North Greenland is characterized by excellent exposure, lack of strong deformation, and great lateral extent of depositional systems. It is thus a unique region for the study of tectonics and sedimentation in successive plate tectonic configurations covering a period of more than 600 m. y.

During late Precambrian to early Paleozoic times the major east-west-trending Franklinian carbonate shelf-clastic deep-water basin developed. The basin probably reached an incipient or narrow ocean stage. At its eastern end it was truncated by the north-south-trending continental margin of the contemporaneous Iapetus Ocean. The progressive closure of Iapetus resulted in Cambrian-Early Ordovician peripheral bulge upward of the eastern part of the Franklinian shelf. Erosion products from the shelf were resedimented into the Franklinian basin. The remainder of the Ordovician was tectonically quiet with starved basin sedimentation. The eastern part of the Franklinian shelf foundered rapidly in the Llandoverian, probably due to loading by Caledonian nappes advancing from the east during the progressive closure of Iapetus. From the start of the Silurian, the Franklinian basin began to receive enormous quantities of siliciclastic deep-sea fan turbidites (> 1 million km^3) from eastern source areas in the uplifted Iapetus collision zone. A major west-verging thrust belt appears to mark the final phase of Iapetus collision. The Devonian saw the closure of the narrow Franklinian basin by north-south compression. Late Paleozoic, Mesozoic, and Cenozoic basin formation was mainly of transtensional nature in a northwest-southeast-trending zone between Greenland and Svalbard. Eventually, normal continental margin sedimentation started with the onset of spreading in the Paleogene.

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Trinity Shoal: a Reworked Deltaic Barrier on Louisiana Continental Shelf

Abandonment and reworking of deltaic complexes of the Holocene Mississippi River have produced a series of sandy shoals on the muddy Louisiana continental shelf. Trinity shoal, one of these transgressive deposits, is located 30 km offshore of Atchafalaya Bay and the Point Au