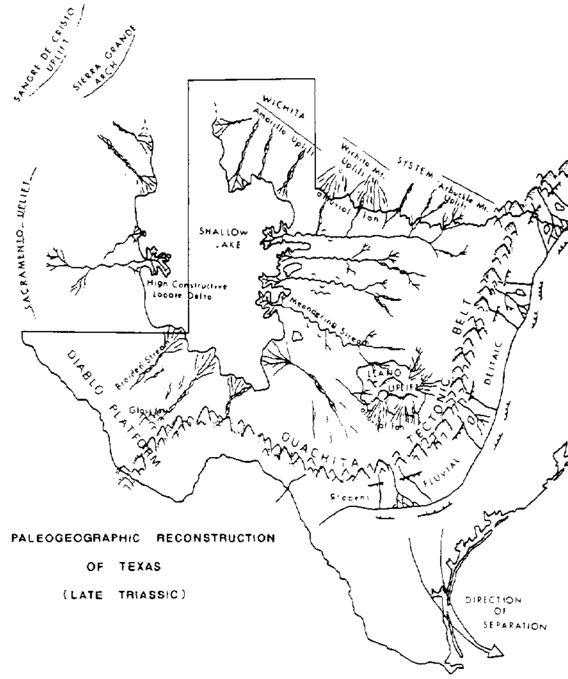
set consists of NW-trending, gulf-parallel faults which define major horst and basin systems. Breaking these are roughly NE-trending cross-faults. Paralleling the coast is a NW-SE trending horst segmented by cross-faults. Relative dissection and weathering of the relict gravel surfaces indicate the most recent uplift of the area occurred sequentially from northwest to southeast in three major segments. As uplift shifted along structure, motion on intervening cross-faults reversed.

Bed-rock facies changes indicate gulf-parallel faulting has continued from the Miocene along preexisting trends to the present day. Miocene and Pliocene reefal concentrations at the crest of the horst give way to thinly laminated limestone down structure and deeper water marls, evaporites, or clastics off structure. Local fault-associated arching also influenced deposition, resulting in thickening Pliocene clastic fill off the crest of the uplift. In the adjacent basins, ongoing sedimentation encouraged growth faulting. In general, the NE-SE cross-faults did not influence sedimentation to the same extent as the gulf-parallel fault system.

Detailed mapping of the neotectonic fault system indicates a continuation of past structural movement through the Quaternary. These fault patterns and their effects on local sedimentation provide a model for subsurface projection of Neogene facies variations. As oil concentrations are intimately related to local structures in the Gulf of Suez, detailed knowledge of Quaternary fault movements combined with seismic interpretation, can significantly aid in understanding the sedimentology and structural features of potential oil reservoirs.



PALEOGEOGRAPHIC RECONSTRUCTION OF TEXAS (LATE TRIASSIC)

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Stratigraphy and Environmental Significance of Continental Triassic Rock of Texas

The continental Triassic rocks of Texas are represented by four distinct but similar rock groups that exist both in outcrop and in the subsurface and include the Eagle Mills Formation (south-central and northeast Texas), Sycamore Formation (central Texas), Dockum Group (west Texas), and Bissett Formation (southwest Texas). They are clearly terrigenous in nature derived principally from older Paleozoic sedimentary rocks. The rock groups are composed in part or entirely of mudstone, siltstone, medium to coarse-grained sandstone, and pebble to boulder conglomerate (intrabasinal and extrabasinal). The sediments were deposited in alluvial fans, braided and meandering streams, lobate deltas, fan deltas, and lakes. The coarse sandstone and conglomerate are the products of high-energy, short-duration depositional events. Sedimentation was greatly affected by alternating climatic conditions that produced changes in base level, water depth, and lake area as well as the type of streams that flowed into the depositional basins. The character of the rock groups strongly suggests semi-arid to arid deposition typical of the low latitude desert regions of today. Thus, the rocks comprising the Eagle Mills, Sycamore, Dockum, and Bissett Formations appear to be products of continental clastic deposition during a major semi-arid to arid climatic episode, such as that of late Triassic time.

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Structural Style of Foothills of Andean Overthrust Belt, Northern Neuquen Basin, Argentina

Basement plays an important role in Andean deformation in central western Argentina. Shortening is controlled by moderate-angle basement-rooted thrusts, primarily eastwardly directed. Four glide horizons in the sedimentary cover locally modify the style of deformation. A variety of structures result, including broad open folds, overturned folds, imbricate thrusting, and décollement-type faults.

Two fault zones, active chiefly during a Miocene compressional event, exert primary control on the structure. The westernmost is a zone of east-verging imbricate thrusts, closely paralleling the hinge line between thick Jurassic sediments to the west and thinner deposits to the east. This zone probably represents reactivation of basin-opening normal faults, which were active during back-arc extension in the late Triassic and early Jurassic. Balanced cross sections indicate marked basement shortening along this belt. The eastern fault zone lifts basement upward and eastward with a throw of 2 to 7 km (1.25 to 4.3 mi). Where these fault zones are widely separated, they divide the foothills into three structural belts: a realm west of both faults consisting of broad basement-cored folds with minor thrusting, a central zone with a variety of structures deriving from both fault zones, an an eastern region with basically minor structures obscured by Quaternary alluvium. Where these two fault zones closely approach each other or merge, the marginal belts remain virtually unchanged. However, the central zone, which is updip from the thickest basinal sediments and encompasses a region of complex stratigraphy, is more intensely deformed and becomes a structurally elevated band, paralleling the faults.

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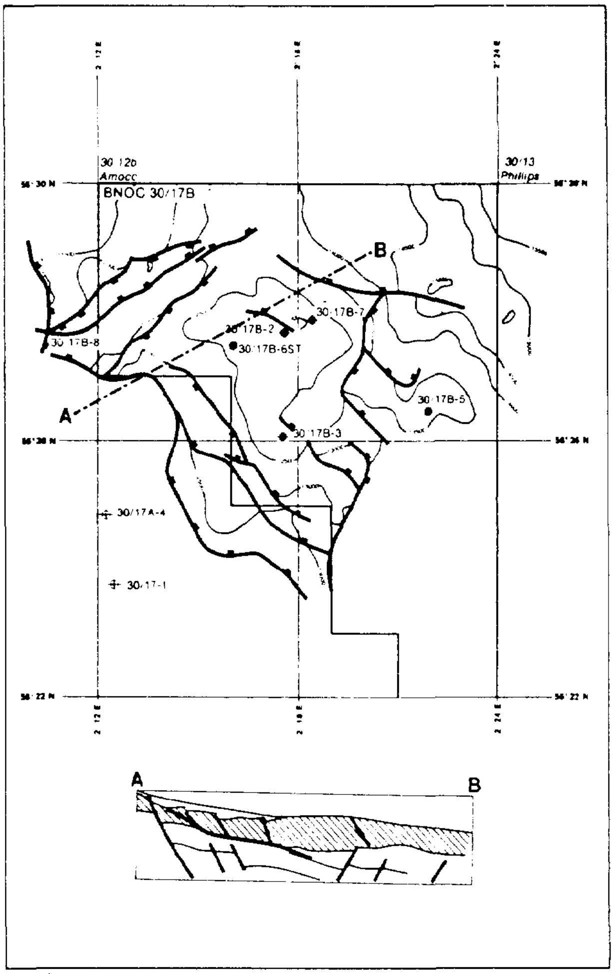
Secondary Detachment Above Basement Faults in North Sea: Clyde Field Growth Fault

The Clyde field in the southern North Sea is a Jurassic (Fulmar Sand) reservoir developed on a fault-bounded terrace on the margin of the Central graben. The structural style of this region was formerly thought to comprise simple tilted fault terraces that were active through the Jurassic. Seismic mapping of the Clyde reservoir and deeper Zechstein, Rotliegendes, and Devonian events shows that Jurassic and Triassic rocks form a characteristic thick structural high, lensoid both in plan and cross section, (see figure) above deeper events dipping toward the basin.

Palinspastic sections were constructed to honor the seismic and well data, and were tested iteratively using new techniques for balancing structural sections in extensional regimes. Cross-sectional area and bed length balance clearly demonstrate the presence of both shallow and deep fault detachments and eliminate models involving tectonic inversion or halokinesis. The deep basement faults form the main regional terrace system and sole-out in the crust at about 15 km (9 mi). A second shallower set of faults defines a listric slide and detachment at the top Permian. The listric shape of the detachment accounts for the lower boundary of the Triassic-Jurassic high. Seismic remapping has substantiated this model and demonstrates the decoupling of the basement and shallow listric fault sets. In plan, the shallower faults are arcuate with pull-apart lows on the downthrown side that show synsedimentary growth of the Upper Jurassic clays. Compaction buckling and uplift of the Jurassic section toward the toe of the slide form positive structural features that are oil-productive. The faults along the margins of the structures have a significant strike slip component where they parallel the structural dip.

The development of this growth fault model for the Clyde field has assisted in understanding the seismic mapping and in establishing a predictive model for the field geology. In particular, the recognition of Jurassic growth and strike slip components on the faults has significance in terms of variations in reservoir quality and possible reservoir discontinuities resulting from fault seals.



Of regional interest is the possibility of further growth fault plays within the North Sea basin. This contrasts with the classical development of growth faults on a continental margin. The distinctive geometry of large growth faults can generate structural highs that are offset from the basement and overlying base Cretaceous structure. This model, along with the lensoid cross section above a simpler basement and distinctive seismic expression of shallow dipping faults, is being used to identify other potential plays that may be analogous to the Clyde field.

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Close Encounters of Reefal Carbonates and Siliciclastics

Siliciclastic depositional environments are not normally favorable for the growth of reef-building organisms because of high turbidity, reduced salinity, or unfavorable substrate. Yet there are numerous examples, both living and fossil, of close associations, even intermixing, of the two kinds of deposits.

In the Red Sea (Gulf of Aqaba), Holocene coral reefs develop on the seaward margins of inactive alluvial fans of gravel. In the nearshore zones of Brazil (Abrolhos Bank), Mexico (Vera Cruz), and the northern Great Barrier Reef, there are reefs surrounded by siliciclastic sands and silty clays; locally some of this noncarbonate fraction occurs as internal sediment within the reefal frame. In the lagoonal areas of both the Belize (Central America) and Great Barrier Reef tracts, the positions and the geometries of some reefs were probably determined by the local relief (channel banks, bars, deltaic lobes) of the underlying siliciclastic foundations.

Throughout the Phanerozoic, there is a wide spectrum of interaction between reefal carbonates and siliciclastics. Reddish or greenish argillaceous internal sediments are common in some Triassic and Devonian reefs of western Europe. In the Phanerozoic of North America, there are numerous examples of reefs encased in shales or siltstones. In the Triassic of Europe and the Yukon (Canada), reefal carbonates are surrounded by and locally interfinger with volcaniclastics. In the Pennsylvanian, Permian, and Jurassic of North American and in the Permian of Japan, reefal carbonates are juxtaposed with deltaic and associated siliciclastics.

At least two factors relating to exploration emerge from this review of the connections between reefal carbonates and siliciclastics. One is the effect of local relief on the underlying siliciclastics in determining the locations and forms of reefs. The other concerns the combined source and seal provided by fine-grained, peri-reefal siliciclastics.

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Upper Eocene North American Microtektite Layer: Associated Radiolarian Extinctions, Climatic Change, and Iridium Anomaly

Tektites are glass objects believed by many authors to have been formed by meteorite (or cometary) impact. The areas on the earth's surface where tektites are found are called strewn fields. Thus, tektites found in Texas and Georgia belong to the North American strewn field. Microtektites (< 1-mm diameter tektites) have been found in upper Eocene sediments from one piston core and in cores from nine Deep Sea Drilling Project sites in the Caribbean Sea, Gulf of Mexico, equatorial Pacific, and eastern Indian Ocean. Based on their fission-track age (34.6 $\pm$4.2 m.y.), geologic age, geographic location, and chemistry, these microtekties are thought to be part of the North American strewn field. The North American tektites have fission-track, K-Ar, and ^{40}Ar-^{39}Ar ages of ~ 34 m.y. The North American microtektite layer