Cored intervals from the Lower Cretaceous Hosston sandstone show sedimentary structures typical of fluvial and deltaic environments. The present depth of burial of the sandstone is 4,300 to 5,500 m (14,100 to 18,050 ft).

Selected samples of the sandstones were analyzed by petrographic, X-ray diffraction, scanning electron microscopy, and other methods to determine the composition and texture of the detrital and authigenic phases, diagenetic sequence, and the relation of facies, diagenesis, and reservoir rock properties.

The sandstones are fine grained, well sorted, and composed on the average of 68% quartz, 17% lithic fragments, 2% feldspars, 7% matrix, and 6% other minerals. Cements include silica and carbonate, which respectively constitute 8% and 9% of the bulk sample in general. Silica cement dominates in the fluvial facies, carbonate cement in the deltaic sandstones.

Alteration of rock fragments and feldspars results in clay authigenesis which accounts for practically all of the < 0.01 mm size fraction in the sandstones. Coarsely crystalline kaolinite makes up 51% of the clays, illite 42%, and chlorite 6%. Kaolinite alters to illite as a function of temperature increase. While kaolinite is pore-filling, illite and chlorite are pore-lining.

The sandstones have an overall average porosity of 4.2%; the fluvial facies generally has porosities below average, the deltaic facies above. Intergranular pores and oversized pores are the dominant porosity types; both have developed by dissolution of cement or detrital grains. The deltaic facies exhibits inverse relation between porosity and total cement content. Because of the persistent presence of authigenic clays in the pores, microporosity forms a significant portion of total porosity, especially in the fluvial facies.

Permeability of the Hosston sandstones ranges from less than 0.01 md to slightly more than 5 md, the average being between 0.1 and 0.2 md. Thin sandstones of fluvial origin, which have microporosity, show lowest permeability, whereas sandstones of deltaic origin in nearby areas have high permeabilities primarily because of dissolution of grains and carbonate cement. Future exploration in the Hosston should, therefore, be directed to the deltaic sandstone.

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Tectonic Trends, Timing, and Mechanics of the Egyptian Edge of the Red Sea and Gulf of Suez

Two major areas of onshore preservation of both pre- and syn-Red Sea sediments occur at Gebel Zeit, near the mouth of the Gulf of Suez, and at Quseir, 200 km (125 mi) to the south. At Quseir, a belt of 600 m.y. greenstone basement has at least three stages of coaxial N30°W deformation curving northwestward into N60°W grain of the regional Hamrawein Synclinorium. In Late Eocene (?) to Early Miocene time, this northwest-trending structure was further downwarped by block faulting with associated local gravity fold tectonics. The Cenozoic synclinorium dies out southeastward into a synchronous or slightly older system of north-south trending fault blocks, many of which show early stage right-lateral strike-slip slickenslides.

In the Mid-Miocene, the Red Sea coast suffered major downwarping along N25°W trends, whereas the interior synclinorium was further broken into generally northwest-trending, northeast-tilted irregular fault blocks reactivating many older fault trends.

By contrast, the Gebel Zeit block appears rigidly parallel with the N25°W Red Sea–Gulf of Suez trend and shows systematic long-term tilting away from the Gulf of Suez with at least five stages of Eocene through Miocene uplift, erosion of its eastern basement edge, and concomitant sinking and deposition on its western edge.

The evidence points to early stage fault patterns "inherited" from the local structural grain of the Precambrian basement that pre-dated the principal Red Sea–Gulf of Suez evolution into its dominant N25°W tectonic trend during the Miocene.

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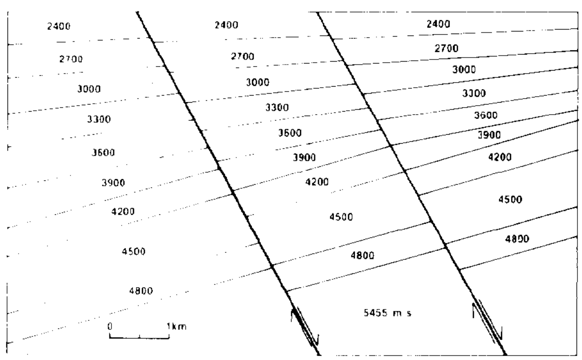
Seismic Reflection Models of Rift-Related Structures

Published field data from several rifted basins indicate that normal faults and associated secondary structures (i.e., minor normal faults, folds produced by drag on fault surfaces, forced folds above faults) are common in rifts. The dip and curvature of the fault surfaces, the fault displacements, the dip of the strata within the fault blocks, and the position and size of the folds vary considerably. Our two-dimensional, seismic-reflection models systematically show how each of these variables, as well as rock velocity, influence the seismic expression of rift-related structures. These seismic models reveal several "pitfalls" of seismic interpretation common to rifts, many of which we have recognized on actual seismic data.

The observed dip and curvature of any fault surface on our unmigrated seismic models depend, not only on the dip and curvature of the actual fault surface, but also on the dip and velocity of the adjacent beds. The observed dip of a fault decreases as the angle between the actual fault surface and strata decreases. For example, normal faults dipping in the opposite direction as the strata appear to have greater dips than identical normal faults dipping in the same direction as the strata. Also, normal faults active during deposition (with beds on the downthrown side having increasing dip toward the faults with depth) appear to steepen

BASIC GEOLOGIC MODEL-FAULTS ACTIVE DURING DEPOSITION



BASIC SEISMIC MODEL-FAULTS ACTIVE DURING DEPOSITION