LAND, C. B., JR., Dept. Geol., Colorado School Mines, Golden, Colo.

FOX HILLS SANDSTONE, ROCK SPRINGS UPLIFT, WYOMING: SHORELINE-TIDAL RIVER SANDSTONE MODEL FOR UPPER CRETACEOUS

The Upper Cretaceous Fox Hills Sandstone exposed in outcrop on the east flank of the Rock Springs uplift is a regressive sequence of sandstone and siltstone which was deposited along barrier island coastlines in littoral, shallow-neritic, and tidal-river environments. The littoral and shallow-neritic sandstones are very fine- to fine-grained, and form coarsening upward sequences which are heavily burrowed by deposit-feeding organisms in the lower part and contain walled burrows of suspension-feeding organisms (principally *Ophiomorpha*) in the upper part.

The littoral and shallow-neritic sandstones are commonly overlain by fine- to medium-grained, channel sandstones interpreted to have been deposited in tidal-river environments. These sandstones exhibit a characteristic vertical sequence of stratification and sedimentary structures. The channel base is defined by a sharp scour surface at which there is a marked grain-size increase from that of the underlying sandstone. Lag deposits of oyster shells, wood imprints, and clay clasts are present above this surface. Individual sandstone units become finer upward and are commonly trough cross-stratified in the middle and lower parts and subparallel bedded in the upper part. The trace fossil *Ophiomorpha* is abundant, and a root zone is present at most places in the upper 1–3 ft. The tidal river sandstones intertongue in a seaward direction with finer grained, littoral and shallow-neritic sandstones. In a landward direction they pass into lagoonal, marsh, and swamp deposits.

The origin of the widespread tidal-river sandstones is interpreted to be associated with the migration of tidal river and estuary channels on the landward and lateral sides of seaward prograding barrier islands.

LAND, L. S., Dept. Geol. Sci., Univ. Texas, Austin, Tex.

CONTEMPORANEOUS DOLOMITIZATION OF MIDDLE PLEISTOCENE REEFS BY METEORIC WATER, NORTH JAMAICA

Middle Pleistocene reefs of northern Jamaica, and elsewhere in the Caribbean, are distinctly different from the late Pleistocene 120,000 year-old "Sangamon" reefs. They are more extensively developed, better lithified, and commonly dolomitized.

In Jamaica, the contact between the two units, the "Sangamon" Falmouth Formation and the middle Pleistocene "Yarmouth"(?) Hope Gate Formation, is erosional. This contact demonstrates that the diagenesis and dolomitization of the Hope Gate took place before Falmouth deposition. The Hope Gate dolomite replaces micrite and fills pores created by the dissolution of aragonite, demonstrating the near contemporaneity of aragonite solution and dolomite precipitation. The dolomites have low Sr (220 ppm) and Na (350 ppm) contents, precluding their precipitation from marine fluids.

Dolomitization took place as meteoric waters first infiltered the seaward growing, submarine-cemented reefs. The composition of the fluid from which the dolomite precipitated was controlled by the composition of the influxing meteoric water, but more significantly by the composition of the primary reef carbonate. Continued meteoric flushing, after the available Mg was consumed by dolomitization, resulted in low Na, low Sr, and C^{12}- and O^{16}-enriched calcites.

The vadose textures superimposed on the intense phreatic-meteoric diagenesis consists only of insignificant amounts of speleothems, despite more than 300,000 years of subareal exposure.

LAPLANTE, R. E., Amoco Production Co., Tulsa, Okla.

PETROLEUM GENERATION IN GULF COAST TERTIARY SEDIMENTS

Organic detritus deposited in sediments is composed principally of carbon, hydrogen, oxygen, and nitrogen. At the time of deposition, only small amounts of hydrocarbons are present. However, this organic matter has the potential to generate hydrocarbons in quantities that depend largely on its hydrogen content.

Studies show that organic matter disseminated in sediments, when heated, undergoes carbonization by mechanisms very similar to the thermochemical processes responsible for coalification. Carbonization is a thermal process marked by the generation of volatiles relatively rich in oxygen and hydrogen and by the formation of a kerogen residue increasingly enriched in carbon. The most significant oxygen-rich volatile is carbon dioxide and the most significant hydrogen-rich volatiles are hydrocarbons. By measuring changes in the elemental composition of the organic matter as a function of depth, the principal volatile products of the carbonization reactions can be determined. Data from the Gulf Coast Tertiary indicate carbon dioxide is the *principal volatile product of early carbonization and* that hydrocarbons are not significant products until the later stages. The amounts of hydrocarbons generated during carbonization are vast compared with amounts from any other naturally occurring source or process.

The data indicate that the rate of carbonization or, more specifically, hydrocarbon generation is a chemical process that follows the general rules of chemical kinetics. That is, as sediment age decreases, the temperature required to reach the level of carbonization associated with hydrocarbon generation increases. For example, significant hydrocarbon generation occurs in the Oligocene at a log temperature of 175°F and above; in lower Miocene at log temperature 186°F; and in upper Miocene at log temperature 205°F. Appreciably higher temperatures are required for significant hydrocarbon generation in post-Miocene sediment.

It is suggested that kerogen with relatively low hydrogen levels (similar to levels found in coals) would generate gas rather than oil. Thus, the relatively low hydrogen level in organic matter from the rocks discussed suggests that the sections penetrated would be better sources for gas than oil.

LATTMAN, L. H., Univ. Cincinnati, Cincinnati, Ohio

COMPARISON OF TYPES OF IMAGERY FOR PHOTOGEOMORPHIC STUDIES

This discussion is limited strictly to photogeo-