the sandstones can be directly correlated with the facies distribution, indicating a strong depositional control on porosity and especially permeability. Diagenetic effects in the sandstones are minimal. The sandstone permeabilities were calibrated against various well-log responses, and it was found that a cross-plot of gamma ray and induction-log values can be used to identify the lithofacies and, to a certain extent, the subfacies in the oil-bearing sequence. Thus, in uncored wells in this reservoir, a cross-plot of these logs can be used to assess the depositional paleoenvironments, and an estimate can be made of the permeability distribution to predict fluid-migration paths during secondary recovery.

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Reef-Crest Wave and Current Interactions and Sediment Transport

A recent investigation of wave-current processes in a shallow reef-crest environment (eastern Nicaragua) indicates that rapid energy transformations associated with breaking waves are important to sediment transport as well as circulation in the back-reef lagoon. Although these interactions have been considered by other studies, they have not been treated quantitatively.

Wave sensors were placed on the seaward and lagoonward sides of the reef crest. Current meters were positioned on the reef crest and in the lee-side moat channel. Energy loss (~67%), calculated from wave-height changes as estimated from wave spectra, are related to depth of water over the reef. At high tide, instantaneous current speeds and wave modifications are minimized even though wave heights are decidedly reduced between fore-reef and back-reef areas. Low-tide conditions favor extreme energy losses resulting from more intense wave breaking. Over-the-crest current velocities are greatest near low tide. Waves in the back reef appear to be solitary in nature, thus favoring greater onshore velocities.

Current surges of 50 to 80 cm/sec for durations of a few seconds occurred under the low-wave-energy input conditions of the experiment (4 to 6 sec input waves and average heights of ~45 cm). These periodic currents of short duration are sufficient to drive coarse-grained sediment into the back-reef lagoon. Mean currents are in the range of 10 to 20 cm/sec and therefore do not reflect the true dynamic nature of reef-crest environments. Most currents reverse with tide. On rising tide, moat-current direction indicates lagoon filling, but the reverse is true of falling tide. Representative current speeds of 10 to 20 cm/sec are typical of these exchanges.

Data from other areas indicate that reef-crest morphology and lagoon geometry are important to the sediment-transport problem. However, breaking waves drive sediment across the crest by strong surge currents. Water driven across the crest controls circulation and resultant sediment-dispersal patterns in shallow back-reef lagoons. Tidal variations cause periodic fluctuations in the intensity of wave and current interactions at the reef crest.

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Statistical Comparison of Mapped Data

Digital contour maps of different geographic parameters of the same location can be compared by isolating similar features and then carrying out an element-by-element multiplication of map pairs. Random spatial data are gridded, then filtered to eliminate bias and unwanted information such as regional trends. The filtered maps are thus compared to produce new maps that display these spatial coherents of similar features. Filtering so tends to produce a normal linear distribution of z values that either parametric or nonparametric statistical comparisons can be used to define the overall goodness of fit.

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Using Petroleum Resource Assessment to Improve Exploration Performance

Private corporations have long used petroleum resource assessment projects for advance design of exploration campaigns, optimal allocation of capital among available exploration theaters, and long-range financial planning.

In addition, however, companies can beneficially utilize petroleum resource evaluation exercises to improve their exploration performance in several different ways: (1) aptness of screening parameters employed in internal prospect selection can be assessed; (2) compatibility of exploration tactics and strategy can be evaluated; and (3) as a purposeful learning process, individuals and teams can, over several years, analyze and improve their exploration effectiveness.

Such an improvement program requires the employment of systematic prospect-evaluation procedures and the comparison of predictions with results. As their confidence improves in estimating exploration-target size and discovery probabilities, companies can adopt increasingly sophisticated ways to deal with risk. Accordingly, they can explore more aggressively.

Finally, resource assessment procedures can be used to attach appropriate values to nonproducing lease acreage, and therefore to manage such corporate assets more responsibly.

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Contrasting Pennsylvanian Carbonate Sedimentation, Southeastern Arizona

The Horquilla Limestone was deposited on a broad carbonate shelf, the central Arizona shelf, and in a large intracratonic basin, the Pedregosa basin. Shelf sequences of limestone, shale, and sandstone are punctuated by unconformities. These sequences contrast with thicker basinal deposits that are generally unbroken by unconformities. On the northern part of the shelf, local sources of weathered clastic material greatly modified