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.

ROBERTS, HARRY H., Louisiana State Univ. Coastal Studies Inst., Baton Rouge, La.

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.

ROBINSON, J. E., P. D. WILLETTE, J. C. BROWER, and D. F. MERRIAM, Syracuse Univ., Syracuse, N. Y.

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.

ROSE, PETER R., Energy Reserves Group, Inc., Houston, Tex.

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.

ROSS, CHARLES A., Western Washington Univ., Bellingham, Wash.

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 the sedimentary pattern. On the southern part of the shelf, the succession is thinner and has less clastic material. Local tectonic disturbances modified the general pattern of deposition.

Marked facies changes and depositional and erosional anomalies are apparent along the southwestern edge of the Pedregosa basin, and many intermediate or transitional facies are not exposed or are missing. Sedimentologic differences were well established by Desmoinesian time and became progressively more marked during the later part of the Pennsylvanian (and Early Permian). The regional Pennsylvanian paleogeography is further complicated by major Late Cretaceous and early Tertiary thrust faulting which moved these sediments about 100 km or farther from their original site of deposition. These faults also may have mixed the relative position of some of the Pennsylvanian outcrops.

Reconstruction of the Pennsylvanian stratigraphic successions to their pre-faulted relations, based on estimates of their carbonate facies relations and their structural displacement, suggests that the southwest side of the Pedregosa basin and adjacent shelf margin are buried beneath a series of imbricated thrust sheets containing mostly shallow-shelf sediments.

ROWLEY, PETER D., and PAUL L. WILLIAMS, U. S. Geol. Survey, Denver, Colo.

Metallic Mineral Resources of Antarctica—Development Far in Future

Metal deposits and occurrences have been found in rocks of most ages in many parts of Antarctica, and Gondwana reconstructions suggest that many others probably exist. However, relatively few deposits are known because ice covers about 96% of the continent and because detailed geologic mapping is sparse. In the Precambrian shield of East Antarctica, iron deposits are present as jaspilite strata and as magnetite in veins, pods, and disseminated in schist. The largest deposits are in the Prince Charles Mountains, where banded iron formation is as thick as 400 m and extends for 120 km. The presence of morainal jaspilite over large parts of East Antarctica suggests a much wider distribution. In the Transantarctic Mountains, the stratiform Dufek gabbroic intrusion (Jurassic) may contain valuable metals, but the base of this intrusion—where metals are probably concentrated—is not exposed. In the Andean province (mostly of Late Cretaceous and Cenozoic age) of the Antarctic Peninsula, there are disseminated and vein-type pyrite deposits on King George Island; magnetite-bearing lava flows on Brabant Island; hydrothermal copper-lead vein deposits on Livingston Island; and probably porphyry-type copper-molybdenum deposits on Anvers Island, Adelaide Island, Brabant Island, the Melchior Islands, in eastern Ellsworth Land (newly discovered), and on the Lassiter Coast. All these deposits, however, are of lower grade than the well-known deposits of the central Andes of South America, which formed under different Cenozoic tectonic conditions. No known deposit in Antarctica is currently economic. The continent's severe climatic and logistic constraints make significant exploitation unlikely for many years.

RUBY, CHRISTOPHER H., and PETER J. REINHART, Univ. South Carolina, Columbia, S. C.

Holocene Stratigraphy of Rapidly Transgressive Barrier Island, Cape Romain, South Carolina

Cape Romain, South Carolina, a barrier island–cuspate foreland just south of the Santee delta, shows a classic transgressive stratigraphic sequence. The island has eroded landward 150 m in the past 30 years. Today, 75% of the island shoreline is manifest as narrow washover fans and coalesced terraces migrating landward under the influence of normal spring high tides and storm events. The remainder of the island is occupied by eroding ridge and swale topography. Landward of the barrier is a lagoon-marsh system 11 km wide which abuts and overlies the Pleistocene mainland.

Using a modified concrete compactor, 40 vibracores 5 to 9 m long were taken from three transects across the island. The coring system permits an undisturbed (preserved primary sedimentary structures and bioturbation) core 7.6 cm in diameter to be removed from any unconsolidated sediment. Cores have been taken in compacted clays, fine to coarse sands, shell lags, and oyster reefs. Recovery ranges from 90 to 100%. Additional data were obtained from box cores and short (1 to 2 m) vibracores taken by divers in specific subtidal locations.

Eight meters under the present berm crest is a relict barrier-marsh complex overlain by a shell storm lag. Overlying the shell lag are flaser-bedded sands and muds of a very shallow-water high-energy lagoonal facies which grades upward into highly bioturbated sandy muds of a deeper water lagoonal facies. A tidal-flat oyster reef complex lies above, grading upward into a fringing marsh. The sequence is capped by washover sands and shells, beachface sands, and/or dunes of the present barrier.

This sequence indicates a general rise in sea level during the Holocene through a combination of eustatic rise and a relatively high subsidence rate. The sequence shows a barrier island overtopped by the rising sea level. At some later time, another barrier was developed seaward on the shelf. This barrier transgressed landward to occupy the present position of Cape Romain.

RUDMAN, ALBERT J., Indiana Univ., Bloomington, Ind., and B. D. KWON, Korea Research Inst., Seoul, Korea

Computer Prediction of Changes in Stratigraphic Intervals

Computer correlation of well-log data usually presumes some prior knowledge of the direction and degree of stratigraphic thickening. Model studies, however, show that power spectra can identify the relative changes in stratigraphic intervals between wells. Given the stretch factor, the displacement between logs is computed without relying on iterative procedures. Study of real data shows that each well log is associated with a specific set of frequencies complicated by the presence of noise. Therefore, successful applications depend on the process of modifying the frequency spectra before correlation.