No abstract available.

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Recent and Potential Advances in DSDP Biostratigraphy

The Deep Sea Drilling Project core collection offers unique opportunities for advances in pelagic biostratigraphy because (1) it represents a rather thorough sampling of the Cenozoic column in the oceans, (2) standard lithologic descriptions and preliminary stratigraphic interpretations of the cores are published routinely, and (3) samples and guides to investigations accomplished and under way are readily available.

A few DSDP sites with long sequences of well-preserved microfossils are being investigated by many workers, thus becoming reference sections through which pelagic stratigraphy is becoming consolidated. Quantitative methods are improving both the consistence of identifications of taxa and the meaningfulness of records of their occurrence. Investigations on the distortion of assemblages by dissolution and paleoenvironmental controls on the distribution of species and subspecies are providing information essential for improved biostratigraphic correlations. Sequences of events in each microfossil group are inevitably tied to those in other groups because all are investigated in the same set of cores. Paleomagnetic and isotopic investigations (mostly on non-DSDP cores) are linking these with the absolute age scale to permit determination of rates of changes and recognition of diachronous events. The sheer volume of DSDP data is encouraging the development of new methods, such as the application of probabilistic statistics to correlation.

We can expect future emphasis on quantitative procedures as the qualitative ones become inadequate for the increasingly rigorous requirements of biostratigraphy. Concurrently, we will obtain a clearer picture of the phylogenetic changes which form the basis for natural taxonomic systems and for biostratigraphic interpretations.

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Marine Permian Rocks of Tunisia

The only marine Permian rocks in northern Africa are exposed in the Djebel Tebaga area of southern Tunisia. Fault-duplicated sections of approximately 850 m of marine shale, limestone, and dolomite, are exposed over a distance of approximately 15 km, in the mountains 25 km northwest of Medenine.

The sections grade upward from moderately deep marine shale and carbonate rocks, through a dolomitic, shallow marine section, to interbedded red and green terrigenous clastic and minor carbonate beds deposited in a littoral environment. The upper section is red beds, at and above the Permian-Triassic boundary. The apparently conformable sequence of Permian and Triassic rocks document a quiet termination of Tethyan marine deposition and suggest that the northern margin of the African plate was not involved in significant forward motion.

Marine Permian rocks near Medenine represent reef complexes that accumulated in relatively low-energy environments, interrupted only by short high-energy pulses of deposition. Reef talus is rare. The reefs are composed principally of algae with some sponges and limited bryozoans and brachiopods. Sponges are particularly abundant around the shaly margins of the carbonate masses. Echinoderms, gastropods, brachiopods, and bivalves are relatively minor interbioherm elements and are scattered through the abundant sponges. Fusulinaceans of the *Neoschwagerina-Yabeina* assemblage occur throughout the marine part of the sequence. Post-Jurassic faulting and possible intra-Permian folding interrupt the section.

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Lignites of Tombigbee and Holly Springs National Forests, Mississippi

Individual lignite bodies have been mapped using over 2,700 water-well records, more than 100 electric logs, literature references, and unpublished well bores of the Forest Service. Petrographic, proximate, ultimate, and fusibility analyses have been determined.

The lignite occurs as scattered pods with overburden ranging from 25 to 200 ft (7 to 60 m). All of the lignite is of Tertiary age. Most of it is in the undifferentiated Wilcox Group and the rest is in the Midway Group.

The lignite bodies vary widely in their properties, but most are low grade. The average heat content is 7,849 BTU (8,280,695 J), but individual samples cover the entire range of heat values for lignite. The volatile content and ash content tend to be high. Sulfur averages 0.82% but ranges up to 3%. The fixed carbon content is low. In thin section, the samples appear to be typical lignites.

Most of the lignite pods contain less than 3 million tons in place, but three deposits range between 25 million and 50 million tons in place.

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Facies Recognition from Well Logs to Predict Permeability of Eocene Deltaic Sandstones, Lake Maracaibo, Venezuela

Secondary oil recovery by gas and water drive is taking place in Maraven's Block V concession in Lake Maracaibo, where the Eocene sandstone reservoirs have produced 531 million bbl of oil. Geologic core studies have been undertaken to explain and quantify reservoir inhomogeneities which affect the injection of fluid and control its distribution. Core interpretations were also used to calibrate subsurface logs. The upper "C" sands were deposited in a river-dominated delta-front environment, and two cores from this unit have been divided into three principal lithofacies, which are further divisible into several subfacies based on grain size, sandstone:shale ratio, and sedimentary structures.

The large variations that occur in reservoir quality in

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