tween the two profiles being correlated. In the magnetic anomaly application, it reveals asymmetries in the spreading rates at the particular spreading center. Uniqueness of the correlations (at any particular level of resolution) is estimated statistically and analytically.

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Particulate Organic Matter of Jurassic-Cretaceous "Black Shales" in Deep North Atlantic Ocean

More than 650 DSDP samples were studied using Masran & Pocock's 1981 classification of particulate organic matter to define a number of particulate organic matter assemblages; these assemblages are characterized both by their source material and the mode of preservation. Both marine and terrestrial sources can be identified. The distribution of these assemblages shows that: (1) the eastern deep North Atlantic, Gulf of Mexico, Caribbean, and Demerara Rise are characterized by a high proportion of marine derived matter; (2) western North Atlantic sites received a high input of terrestrial organic matter; (3) marine-derived material is dominant in Cenomanian sediments of all areas; (4) highly degraded gray amorphous matter, indicating low oxygen conditions, occurs throughout the deep North Atlantic Ocean; (5) circular bodies, occurring in all areas, are interpreted as remains of seaweed spores; and (6) the distribution of various types of organic matter assemblages agrees with the sedimentology studies given in the various reports of the Deep Sea Drilling Project.

The cyclicity reported by sedimentologists is also recognized in the contained organic matter. Its origin must be explained in terms of preservational mode of the organic matter, its original source (marine or terrestrial), and mode of original and final sedimentary deposition.

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Carbonate Sedimentation of Reef and Associated Shoal-Water Facies, Sligo Formation (Aptian), Black Lake Field, Natchitoches Parish, Louisiana

The Black Lake field is one of the larger Lower Cretaceous carbonate hydrocarbon reservoirs along the U.S. Gulf Coast. The field produces from the Pettet porosity zone of the upper Sligo Formation. This porous zone coincides with a variety of carbonate facies that were deposited on a wave-dominated shelf as caprinid reefs and associated shoal-water deposits.

Distinctive associations of lithologies, textures, fabrics, structures, and faunas provided the basis for recognizing seven major carbonate lithofacies in the field. Lithofacies present in the field include (1) caprinid, (2) oncolite, (3) oolite, (4) bioclastic, (5) bioclastic micritic, (6) foraminiferal, and (7) micrite lithotypes.

A sequence of lithofacies maps and stratigraphic cross sections describe the areal geometry, distribution, growth, and movement of the various major carbonate lithofacies within the field through a short span of geologic time. Sediments deposited under the caprinid reef in the field were predominantly foraminiferal and bioclastic lime mudstones and wackestones characterized by massive bedding, bioturbation, mollusk debris, and abundant remains of *Orbitolina texana.* Caprinids initially began flourishing in the northeastern part of the field as one distinct circular body surrounded by mud-supported sediments. The caprinid lithofacies migrated in a southwesterly direction, suggesting that the predominant movement of longshore currents was from the northeast to the southwest. The caprinids formed a distinct linear carbonate buildup that trended in a northeast-southwest direction. Bioclastic micritic and bioclastic sediments formed on the landward and seaward sides of the reef trend, respectively. This demonstrates the the reef acted as a local wave-resistant barrier or baffle that allowed muddier bioclastic wackestones to accumulate behind (landward) the caprinid reef trend. The cross-sectional geometry of the caprinid lithofacies along with the dominance of reef debris landward of the main reef axis suggests that the caprinid reef developed on a wave-dominated shelf. As the reef development continued, a landward shift in local energy levels occurred. Along with the shift of energy level, the position of the longshore current also moved landward. This allowed stronger currents to move behind the reef trend (landward) and form and deposit coarser-grained sediments. The elongate reef trend was severed presumably by longshore and tidal currents. The resultant buildups were separated by a sub-perpendicular trend that consisted of bioclastic sediments which most likely represented a tidal channel through the caprinid reef. Bioclastic micritic sediments accumulated on the lee side of the reef trend in current sheltered areas. Caprinid reef growth stabilized and shoal-water deposits began to develop on the landward side of the reef trend. These shoal-water deposits consist of oolite and oncolite shoals and bioclastic reef-flank sediments deposited laterally adjacent to the caprinid lithofacies. The shoal-water deposits continued to develop and prograded over the area formerly occupied by the caprinid reef trend.

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Origin of Natural Gases, Po Valley Basin

Natural gases from productive wells in Po Valley basin have been investigated in order to study their origin. $^{13}C/^{12}C$, D/H isotopic ratios and GC analyses have been conducted. Some data on vitrinite reflectance and kerogen composition are also supplied where available.

The gases showed $^{13}C/^{12}C$ ratios in the range of -73 to $-38‰$ and D/H ratios in the range of -210 to $-150‰$.

A first interpretation based on stable isotopes, kerogen composition, maturity, and the geological setting indicates two main processes responsible of gas origin: bacterial (or early diagenetic) and thermogenic. Also, some gases seem to be the result of an interaction between the above mentioned processes.

Data on productive wells are in good agreement with some head-space analyses and with maturity values.

MATUSZAK, DAVID R., Amoco Production Co., Tulsa, OK

Evaluation of Potential of Stratigraphic Trends Using Computer Well Data Files

Historical data from approximately 1.5 million wells residing on an IMS data base were computer processed by Amoco's Applications Management and Graphics Systems. Output consists of gridded "blindspot" maps for each stratigraphic section within each of thirty-four United States stratigraphic trend areas. In addition, a table of computed statistics was prepared for each trend in order to characterize rate of drilling, grid success ratio, and the projected number of years needed to find various percentages of remaining reserves of hydrocarbons based on current drilling rates.

From this information, it was possible to identify relatively untested, large scale subbasinal areas which were surrounded by

highly drilled areas. One of these identified subbasinal areas has emerged as productive and subsequent to this analysis has continued to gain momentum and recognition as a major producing trend.

Color-coded computer maps summarize the degree of drilling saturation for shallow, moderate, deep, and ultra deep stratigraphic sections. Statistics gathered during the study indicate that at present drilling rates certain areas will require hundreds of years before even a moderate degree of saturated testing will be achieved. This lends support to the position that considerable additional hydrocarbon reserves can be found, but in more remote areas, deeper sections, and at higher costs.

The study illustrates the importance of adequate structured computing resources for historical well data storage, data base accessing, applications processing, and computer graphical display.

MAY, JEFFREY A., Marathon Oil Co., Littleton, CO

Progradational Conglomeratic Shoreline, Eocene of San Diego

Published examples of conglomeratic sandstone shorelines are extremely rare. Two different middle to late Eocene facies sequences reflect variable proximity to sediment influx and high-energy domination. Storm-generated deposition predominated away from fan-delta input. A tripartite coarsening-upward transition represents an offshore to shoreface succession. The lowermost mudstone contains graded rhythmites, starved ripples, flame structures, and bioturbated zones, indicating alternating low- and high-energy offshore deposition. Overlying sheet sandstones thicken and amalgamate upward, denoting shallowing and increased storm deposition still below fair-weather wave base. These beds contain a basal lag overlain by planar laminae, then hummocky cross-stratification, and finally wave-ripple laminae. Coarse-grained, cross-stratified, upper-shoreface sandstone caps the seqeunce.

In contrast, sedimentation associated with subaerial flooding dominated a coarsening-upward sequence seaward of and truncated by an alluvial fan. T_{bce} turbidites characterize offshore deposition below fair-weather wave base. Thick climbing-ripple intervals and intervening unburrowed rhythmites indicate high sedimentation and/or freshwater influx. The overlying fine-grained, planar-laminated, lower-shoreface sandstone also lacks bioturbation and contains isolated cobbles surrounded by scours. An enigmatic succession of lensoid sandstone bodies, each 2 to 10 m wide and draped by mudstone, caps this sequence. Upper surfaces of these antiformal beds create a swell-and-swale topography. Internally, planar laminae pass upward to trough cross-stratification, then an upper organic-rich, muddy zone with *Ophiomorpha* and *Gyrolithes* burrows. Subaqueous channeling and/or bar formation in front of the fan delta, with intervening quiescent periods, are suggested.

MAYNE, W. HARRY, Geosource Inc., Houston, TX

Evolution of Offshore Seismic Exploration

True offshore seismic exploration had its inception in 1947. Although considerable work had been done prior to this in coastal estuaries, wetlands, and inland waterways, the methods used were adapted almost entirely from the conventional land operations.

The first tentative ventures into the real offshore environment indicated that radical departures from land procedures were required in the following areas: (1) cables and receivers, (2) positioning (surveying, navigation), and (3) seismic energy sources.

Leroy Paslay's continuous tow streamer cable and the replacement of the velocity-responsive geophones with pressure-sensitive hydrophones were significant early breakthroughs.

At first, line positions were determined by land-based optical surveying methods, and shot locations were marked with buoys placed by wire-line distance measurements or triangulation. As work progressed farther offshore, a number of radio location systems were adapted or developed to provide positioning without the need for marker buoys. The present satellite and inertial navigation systems and the projected development of the new Global Positioning System represent continuing developments in this area.

Dynamite and other chemical explosives were exclusively used as seismic sources for a number of years despite their many disadvantages. Development of suitable non-dynamite energy sources was mandated by the advent of the common reflection point method, and the Lamont-type air gun has become the most popular present-day source.

Concurrently, the vessels used were progressively upgraded from converted shrimp boats to surplus air-sea rescue vessels and then to the currently popular 165 ft mud boats.

Individually, these developments may appear to be only evolutionary. In the aggregate, however, they represent a major revolution when compared to our first timid ventures of the late 40s.

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Extensive Coniatolite-Pelagosite Diagenetic Sedimentation in Marine Limestones, Tansill Formation (Permian), New Mexico

Pelagosites (calcareous crust formed in splash zone) and coniatolites (supratidal tufa) composed of inorganic precipitates of aragonite and some high-Mg calcite have been described from Holocene deposits along the western Persian Gulf and elsewhere. Such diagenetic deposits are believed to be restricted to intertidal and supratidal environments, and are only rarely encountered in ancient carbonate rocks. Laminated encrustations, coated grains, and pseudostromatolites of presumed former aragonite mineralogy, all associated to some extent with encrusting marine fossils, are the dominant if not exclusive components of shallow-marine limestones in the Tansill Formation (back-reef facies of the Capitan) in New Mexico.

These deposits occur in shallow back-reef environments of possible hypersaline character. In landward directions, they are replaced by peritidal dolomites. The vertical and lateral occurrence of particular coniatolite-pelagosite structures is related to the hydraulics of the depositional environment in a manner somewhat similar to that which controls algal laminite and stromatolite distributions in modern and ancient deposits. Internally, the laminae of crystalline calcite in these deposits are interlayered with the alga *Archaeolithoporella* and encrusted by *Tubiphytes*. Petrographically, this crystalline calcite consists of square-tipped crystal ghosts and divergent fan-druses in neomorphic sparry mosaics identical to altered aragonites described from other ancient carbonates.

These deposits are similar to the coniatolites and pelagosites described from the Holocene, but represent the first reported occurrence of extensive diagenetic sedimentation of this type in ancient shallow-marine carbonate rocks.

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Significance of Corallite Patterns in Fossil Anthozoan Colonies

Polygonal patterns of corallites in fossil anthozoan colonies have been traditionally explained as a result of close packing arising from space compaction. Such a view envisages polygonal cor-