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AUTHIGENIC DOLOMITES FROM RED SEA

Deep-Sea Drilling Project Sites 225 and 227 were located in the main trough of the Red Sea, 10 and 3 mi, respectively, east of the axial trough in the vicinity of the Atlantis II Deep. Coring was continuous. The sedimentary section included 3 units. Unit 1 (0-175 m) is carbonate and nannofossil ooze and chalk, with minor variable detrital admixture. It is of early Pliocene to Holocene age. Unit 2 (175-195 m) is claystone, rich in dolomite and pyrite, and is earliest Pliocene. Unit 3 (195-? m) is layered anhydrite and halite, with interbeds of black shale. Dolomite is present in the shale and between anhydrite nodules. Unit 3 is of late Miocene age.

Scanning electron micrographs show the dolomites in Units 2 and 3 to have euhedral planar crystal faces and to show penetration twinning, indicating them to be authigenic. The overall percentage of dolomite increases from less than 10% at the top of Unit 2 to, locally, more than 80% within the evaporite.

Geochemical signatures differ between the dolomites of Units 2 and 3. The dolomites in Unit 2 contain excess calcium. The dolomites of Unit 3, generally of finer crystal size, achieve stoichiometric composition and show better ordering. Both types of dolomite are interpreted as early diagenetic, with the calcium-magnesium ratios being indicative of paleosalinity conditions, analogous to the dolomites of the Zechstein and the Triassic Keuper Formation.

Stable carbon and oxygen isotope data show the environments of deposition of dolomite of both units to have been restricted, but to differing degrees. The situation is directly analogous to the dolomites of the Mediterranean basin.

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DEPOSITIONAL ENVIRONMENT OF OIL SHALE IN THE GREEN RIVER FORMATION, WYOMING

Oil shale in the Green River Formation of Wyoming was deposited in shallow water. The sandstones and siltstones spatially associated with oil shale are characterized by mudcracks, ripple marks with flattened crests, ripple marks with mudcracks in the troughs, many burrows and root casts, thinly bedded units with current laminations, and fluviatile channel deposits. The sandstones and siltstones lack graded bedding and other sedimentary structures diagnostic of turbidite sequences.

The assemblage of carbonate rocks associated with oil shale includes dolomicrite with mudcracks, crystal casts, and plant debris; flat-pebble conglomerates; coquinas containing pulmonate gastropods; ooliths and pisoliths; algal bioherms; and mudcracked ostracodal limestones.

Disrupted bedding and a lack of continuous lamination are distinctive of the oil shale in the Green River basin. At some locations oil shale contains abundant ostracodes and insect larvae. The oil shale is closely associated with trona beds in the Wilkins Peak Member of the Green River Formation.

The sedimentological evidence is overwhelmingly in favor of a shallow-water origin for the oil shale in the Green River Formation of Wyoming. This genetic interpretation is consistent with the playa-lake (continental sabkha) model recently proposed by Eugster and Surdam.

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GAUSS-BRUNHES DISCONFORMITY IN SOUTHEASTERN INDIAN OCEAN—PALEOMAGNETIC AND BIOSTRATIGRAPHIC ANALYSIS

Previous work in antarctic regions south of Australia and New Zealand described an erosional disconformity, centered in the southern Tasman basin, that formed when bottom currents removed sediments as old as late Miocene (Gilbert). Detailed analyses of cores from *Eltanin* cruise 39 indicate, however, that the extent of the disconformity is considerably greater than previously reported, especially on the west, along the Southeast Indian Ridge. Sediments just below the erosional surface have a remarkably constant late Gauss age (2.6 m.y.b.p.), but no specific areal trends could be determined from observed age variations. Locally, some Brunhes-age sediments have accumulated during the last 0.3 m.y., and range in thickness from thin veneers to 2 m or more.

Late Gauss and late Brunhes sedimentary hiatuses, as observed in the present area, are easily overlooked in routine core studies. The magnetic polarity is the same, and biostratigraphic definition of the late Brunhes in these latitudes is difficult. An excellent illustration of this problem is given by core E39-40. Th^{230} measurements, visual inspection, evaluation of radiolarian and foraminiferal indices, and polarity changes demonstrate that sediments in the top 60-70 cm are of Brunhes age (less than 0.3 m.y.B.P.), that sediments contain certain reworked Gauss elements, and that the hiatus is marked by a layer of distinctly stained (ferromanganese coatings?) foraminifers. A Gauss-Gilbert sedimentary sequence follows in the remainder of the core.

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FORTIES FIELD, NORTH SEA

The Forties field was discovered in 1970 in the northern part of the British sector of the North Sea, about 110 mi east-northeast of Aberdeen, in a water depth of 350-450 ft. The reservoir is a Paleocene sandstone at a depth of about 7,000 ft, at the base of a thick Cenozoic section consisting primarily of mudstone. The Paleocene is a sandstone-mudstone sequence and is underlain by Danian and Maestrichtian chalk. The trap is a broad, low-relief, anticlinal feature with a closed area of 35 sq mi (22,000 acres). Maximum gross oil column is 510 ft, the structure being full to spill point.

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SEDIMENTARY STRUCTURES AND DISCRIMINANT ANALYSIS OF TEXTURAL CHARACTERISTICS OF RECENT AND ANCIENT POINT BARS

Point-bar deposits of the Raton-Vermejo (Cretaceous) Sandstone are analogous to recent point-bar deposits of the Brazos River of Texas. Sedimentary structures in the two bars are similar; both contain abundant trough (festoon) crossbedding and climbing ripples. Avalanche foreset bedding is prominent at the maximum curvature of the meander in the Brazos River; reverse climbing ripples formed at the toe of the foresets. The upper and lower surfaces of the bars, measured perpendicular to flow direction at the maximum curvature of the meander, converge shoreward in both the Brazos and the Raton-Vermejo bars.

Grain-size analyses of the Brazos River and Raton-Vermejo point bars are similar. In comparison with known suites of eolian, fluvial, and beach sands, all of 33 samples of Brazos River sands are classified as fluvial sands by multiple-group discriminant analysis. Ten of the initial 50 variables calculated for each sample were removed to decrease provenance effects. Classifications were performed from the remaining 40 by using the 16 most discriminating variables.

Individual sedimentary structures in both the recent and ancient bars have similar grain-size distributions. Discriminant analysis indicates that grain-size variables alone are sufficient to separate the samples into 5 different sedimentary-structure groups (trough crossbedding, avalanche foresets, climbing ripples, reverse-climbing ripples, and horizontal laminations).

TIMKO, D. J. and W. H. FERTL

HOW DOWNHOLE TEMPERATURES AND PRESSURES AFFECT DRILLING

No abstract available.

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INFLUENCE OF NATURE AND DIAGENESIS OF ORGANIC MATTER IN FORMATION OF PETROLEUM

Marine or lacustrine sediments may be considered as subaquatic soils, in which organic matter is destroyed, transformed, or preserved to a certain extent, according to the conditions of sedimentation. Small amounts of hydrocarbons can be found, inherited from living organisms, either directly (like certain n-alkanes of high molecular weight) or through an early transformation (like steroid and triterpenoid types). When humic material is present in muds, it may represent a large amount of total organic matter and constitute the support of various functional types of compounds. The whole is able to evolve by loss of functional groups towards several types of kerogen, according to depositional environment.

Elevation of temperature and pressure during burial of sediments results in a physicochemical transformation of the various kerogen types, along different evolutionary paths. The products formed include oil, gas, and other compounds like water and carbon dioxide. Nature and abundance of these products depend on particular evolutionary path and grade of diagenesis. The bulk of oil is formed at that stage of diagenesis in petroleum source rocks: the greatest rate of oil generation can be identified on the evolutionary paths, and is followed by gas generation as burial increases. Other types of organic matter produce little petroleum, but produce methane at great depth.

Identification of the nature of kerogens resulting from depositional environment and of the grade of diagenesis resulting from the burial history allows the evaluation of the petroleum potential of a given formation.

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STATUS OF GAS-STIMULATION TECHNOLOGY EMPLOYING NUCLEAR EXPLOSIONS

Recent studies conclude that the tight gas sands in the Rocky Mountain region contain a resource potential of nearly 600 Tcf of natural gas. Of this amount, approximately 300 Tcf may be recovered through the use of nuclear explosives, assuming that nuclearly stimulated wells will produce for 50 years. This volume is equivalent to the present proved national gas reserves of 290 Tcf. Significant results have been obtained from full-scale tests conducted to date, namely Gasbuggy and Rulison. Additional progress has been made in further developing this technology, including (1) the successful testing of a small-diameter (less than 8-in.), low-tritium producing explosive designed specifically for gas-stimulation applications; (2) the completion of technical plans for the Rio Blanco test which will stimulate a 1,200-ft gas-bearing section; (3) progress on computer-modeling studies comparing simultaneous versus sequential detonations in the same hole; (4) the formulation of the first experiment needed to develop a sequential explosion system.

Extensive studies also have been made on the safety of this technique. Detailed investigations show that users of the gas will be exposed to an increment of radioactivity equal to about 1% of the natural radioactivity in our background. Ground motion due to the nuclear detonation is unavoidable. However, by proper choice of yield, and location, and by sequential detonation, it can be controlled to limit inconvenience and damage such as plaster cracking. Public acceptance will depend largely on a clear understanding of the value of the benefits of the program as compared to the inconveniences involved. The benefits include additional local revenues to those near to stimulated fields, royalties to landowners, and, to the nation, an additional supply of natural gas, which is very much in demand.

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IMPACT OF NASA ERTS SATELLITES ON WORLDWIDE ENERGY RESOURCES

NASA's Earth Resources Technology Satellite, ERTS-A, has returned large volumes of imagery from space since its launch in July 1972. Coverage has been obtained over much of the globe, including many little known, rarely (if ever) photographed regions. Virtually all of the United States has been covered, some areas many times over. The quality of the imagery returned is much better than anticipated, although it is less than desirable for other than regional interpretation. ERTS-B and Skylab are follow-on programs, scheduled for 1973, that promise important improvements in quality of photography.

ERTS photographs are being evaluated by many scientists covering many disciplines, including mineral and land resources, agriculture and forestry, environment, water resources, marine resources, land use, *etc.* Results indicate important findings relative to petroleum and mineral exploration.

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STRUCTURAL EVOLUTION OF WILMINGTON ANTICLINE, CALIFORNIA

Isopach maps of the major zones of the East Wilmington field shed significant light on the structural evolution of the Wilmington anticline.

A minor ancestral basement high marked the location of the Wilmington anticline at the close of the early Mohnian, but the structure was essentially a syncline on the north flank of the Catalina uplift. Uninterrupted sedimentation occurred throughout the late Mohnian and early Delmontian. No evidence of the present Wilmington anticline is seen prior to the deposition of the lower part of the Ranger. The source of sediment supply was on the northeast and the direction of transport was southwest.

Growth of the Wilmington anticline was initiated in late Miocene time, early in Ranger deposition. Most Ranger subzone isopachs reflect Ranger structure, and demonstrate continuous anticlinal growth during lower Repetto deposition. Movement on the Long Beach Unit fault began during Ranger X-sand deposition and culminated at the close of F-sand deposition. The F sand was eroded and channeled by current action along and across the anticlinal axis prior to F_o-sand deposition.

The F_o sand was deposited as a lens-shaped body on the eroded F, and is present over a minimum 48-sq-mi area. No evidence of structural growth is seen during the deposition of this sand, in contrast to the other Ranger sands. The F_o is thought to be primarily a tractionite.

Renewed uplift and additional movement on earlier faults occurred during the Pasadenan orogeny and completed Wilmington structural development.

U.S.G.S. SPOKESMAN

NORTH ATLANTIC OUTER CONTINENTAL SHELF

No abstract available.

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FACIES RELATIONS AND PALEONTOLOGY IN EO-