where contemporaneous planktonic-foraminiferal pelagites accumulated. Middle Eocene to middle Miocene carbonate rocks deposited in the deep-sea realm represent a distinctive lithogenetic unit herein united as the Montpelier Group.

The preponderance of globigerinid and radiolarian tests typifies lower Montpelier (late Eocene to early Miocene) microfossil assemblages. Dominant benthic forms include *Melonis pompilioides, Fontbontia wuellorstorfi*, and species of *Stilostomella* and *Pleurostomella*. Available faunal criteria including assemblage parameters, depth preferences for extant species, and convergent-ecologic morphologies suggest that abyssal (below 2,000 m) paleodepths prevailed at the depositional site on a sediment apron at the base of the Duanvale-Wagwater escarpment. Middle Eocene to early Miocene subsidence computed from inferred paleodepth and estimated sedimentary thickness totals 2,800 m. Biostratigraphic and paleoecologic evidence does not support the concept of a regional unconformity within the Montpelier, as has been proposed.

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NEOGENE STRATIGRAPHY OF PARATETHYS OF CENTRAL EUROPE AND ITS CORRELATION WITH OTHER AREAS

During the last 10 years, a group of Neogene specialists has restudied the Neogene sections in the Alpine and Carpathian foredeep (molasse zone) and the inner Alpine and Carpathian basins. These studies have given rise to a new Neogene stratigraphic concept for this area—the so-called "Paratethys."

The lower boundaries of these Miocene and Pliocene stages (Egerian, Eggenburgian, Ottnangian, Carpathian, Badenian, Sarmatian, Pannonian, Pontian, Dacian, and Romanian, in ascending order) are defined by planktonic and larger foraminifers, calcareous nannoplankton, ostracods, mollusks, microvertebrates, and macrovertebrates. From radiometric age determinations of biostratigraphically dated glauconite and rhyolitic or andesitic tuff zones, correlations are possible with the Neogene planktonic zonation of Blow on one side, and with vertebrate Neogene scales on the other. Correlations can be made between the boreal, Atlantic, and Mediterranean bioprovinces of Europe and, therefore, with most of the stratotypes of the international Neogene time scale. On the basis of Paratethys faunas, the bioprovinces of western Europe can be correlated with the eastern Neogene deposits as far as the Crimean and Caspian Sea areas. Planktonic and larger foraminifers, as well as microvertebrates and macrovertebrate correlation levels, can be related to the Neogene of the United States. There are major conflicts between the early and middle Miocene radiometric dates obtained in the Paratethys and those from deep-sea cores.

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MAJOR PERMIAN TECTONIC FEATURES AND POST-PERMIAN DISPLACEMENTS IN WESTERN UTAH, NEVADA, AND SOUTHEASTERN CALIFORNIA, AS REFLECTED BY DISTRIBUTION OF PERMIAN RIEPE SPRING CORALLINE FACIES

Several facies of the Riepe Spring Limestone and its equivalents in Utah, Nevada, and California have been recognized. The most distinctive is limestone with massive, rugose corals. This facies is interpreted as representing low-energy, shallow-shelf deposition, on the basis of sedimentary characteristics and abundance of algae. Generally eastward, the coralline facies is replaced by dolomite and sandstone representing nearshore, restricted environments of deposition. Westward, higher energy and/or deeper water deposits accumulated. The coralline facies forms a band 15-50 mi wide that extends from southern Idaho to southeastern California. In northeastern Nevada and western Utah, this facies forms an enormous westward-directed loop, where it accumulated around an approximately westward-trending axis of restricted environments. In southern Nevada and southeastern California, the coralline facies clearly is offset tens of miles in a right-lateral sense on the Las Vegas shear zone and on the Furnace Creek-Death Valley fault zones. Southeast of the Garlock fault, either facies trends shift directions abruptly, or there has been tens of miles of movement in a left-lateral sense.

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UPPER PRECAMBRIAN AND LOWER PALEOZOIC MIOGEOCLINE IN GREAT BASIN, WESTERN UNITED STATES

Shallow-marine, intertidal, and supratidal detrital and carbonate strata of late Precambrian (less than 850 m.y.) and early Paleozoic (more than 345 m.y.) age thicken from a few thousand feet in cratonic areas east of the Great Basin to 40,000 ft in the central Great Basin 200-300 mi west. Coeval rocks in the western Great Basin are deep-water strata characterized by chert and argillite associated with mafic pillow lavas. Strata deposited at moderate depths are present between the shallow- and deep-water facies, but have a limited distribution, suggesting a relatively abrupt transition from shelf to deep-ocean basin. The thick accumulation of shallow-water deposits in the Great Basin is similar to deposits along present-day stable continental margins. Such accumulations have been termed miogeoclines, rather that miogeosynclines, because they are open to the sea on one side and are not synclinal in form.

The continental margin along which the late Precambrian and early Paleozoic miogeocline was constructed apparently developed as the result of a late Precambrian (less than 850 m.y.) continental separation. Extensional faulting and flowage related to this separation extended well into the continent and may have produced major crustal thinning as far east as the "Wasatch line," across which the rate of westward thickening of upper Precambrian and Paleozoic strata increases markedly. A persistent positive belt, perhaps analogous to the buried ridge beneath the outer edge of the present-day Atlantic continental shelf, may account for regional thinning and local erosional truncation of lower Paleozoic strata along the western margin of the Cordilleran miogeocline.

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MODELS FROM EUROPEAN SEAS TO AID DETECTION OF, AND SEARCH FOR, ANCIENT SAND BODIES

Many large porous sand bodies formed in open reaches of ancient continental shelves and slopes should be recognizable in the stratigraphic record; they have considerable economic and academic significance. The present paper is concerned with modern analogues in the shallow seas around western Europe. The new deposits and their depositional environment allow the depositional environment of the ancient ones to be interpreted more realistically. In addition to the extensive but thin sand sheets, there are many modern sand bodies that are isolated from one another. They can be tens of miles in length, a few miles wide, and more than 200 ft thick. They may occur singly or in extensive groups and are parallel with or transverse to the currents that formed them. Some of the largest ones were made by the Mediterranean undercurrent on the continental slope of the Gulf of Cadiz. Others, of similar size on the continental shelf, are attributed to a tidal-current origin. Modern tidal flow around the British Isles also is responsible for such sand bodies, as well as a variety of other forms. Only semiunidirectional currents seem to be depositing sand in the western approaches to the Baltic.

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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).

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