rence. Marine minerals will in many instances provide a suitable alternative to terrestrial minerals, and their use will allow more time for technological development of a permanent, nondepletionary resource base.

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BIOGEOGRAPHIC SIGNIFICANCE OF EARLY CRETACEOUS FORAMINIFERA FROM BUDDEN CANYON FORMATION, NORTHWESTERN SACRAMENTO VALLEY, CALIFORNIA

A foraminiferal fauna of 189 species and varieties has been recovered from strata of Barremian-early Cenomanian age in the Chickabally Member of the Budden Canyon Formation. Calcareous perforate species, typified by the lagenids and rotaliids and, to a smaller degree, by the rotaliporids and buliminids, and among the arenaceous groups by the lituolids and valvulinids, constitute the major elements of the fauna.

The Foraminifera show close affinities with contemporaneous, medium-depth faunas widely distributed in the lower and middle latitudes of the northern hemisphere. Many lagenid and rotaliid species in particular appear to be conspecific with forms described from Europe and Trinidad. Common genera recorded for the first time from the Pacific Coast include *Falsoguttulina, Pseudosigmoilina, Reinholdella,* and *Spiroplectinata.* However, a persistent endemic element also can be recognized in the Chickabally assemblages, especially in arenaceous forms, the buliminids and the rotaliids. Resemblance of this microfauna to the marginal and neritic assemblages of the Gulf Coast and Alaska is less marked, and very little relation to the specialized brackish-water and quiet shallow-marine assemblages of the western interior is apparent. Regional correlations demonstrate that, during the late Early Cretaceous, benthonic Foraminifera favoring an offshore, medium-depth, muddy-bottom milieu were extant from Europe through North Africa, the Caribbean, and western North America, their distribution being facilitated by widespread tropical conditions and interconnected seaways.

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ROLE OF STORMS IN DEVELOPMENT OF ANCIENT MARINE RIDGE AND SWALE SYSTEM

Upper Jurassic (Oxfordian) sediments of Montana and Wyoming were deposited on a broad, shallow-marine shelf. Facies relations demonstrate that much of this shelf was characterized by a series of sand ridges separated by muddy swales. Ridges attain a thickness of about 12 m, an axial length of at least several kilometers, and a width measured perpendicular to crest less than 1 km. The crests of individual ridges are not parallel with one another or with the paleoshoreline. Analyses of directional features reveal multidirectional current vectors within individual ridges. The vertical sequence of internal sedimentary structures reveals that the ridges were constructed in distinct episodes, during which current flow was at least in the upper low-flow regime. Each episode is represented in the rocks by a unique style, scale, and vector of cross stratification. Storms are considered to be the main process responsible for the buildup of ridges, individual storms being responsible for each of the sedimentation units of which the ridges are composed. As sand supply, storm intensity, and wind direction varied from storm to storm, so the style, scale, and vectors of the resultant cross stratification varied. Fair-weather processes were minor factors in the development of the ridge and swale system.

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GLOBAL LOOK AT HIGH PRESSURES

Formation pressures higher than hydrostatic have been found in all parts of thw world during oil and gas drilling operations. The present paper analyzes the worldwide distribution of these high pressures. Data used include wells from western Europe, Hungary, Poland, Rumania, Russia, the Middle East, the Indian subcontinent, Australia, New Guinea, New Zealand, Japan, the Arctic, the African West Coast, the Red Sea, South America, and the United States. A statistical analysis to define the main geologic characteristics of high-pressure reservoirs was carried out using data from wells penetrating more than 5,000 reservoirs in the Gulf of Mexico, Santa Barbara Channel, and the Anadarko, Permian, and Uinta basins. The probability of finding high pressures in a given depth range for each of these basins has been established.

The main mechanisms responsible for the creation of these high pressures are concluded to be (1) gravitational compaction, (2) the montmorillonite-illite transformation, (3) wax seals, and (4) tectonic compression. Although in certain instances one of the mechanisms predominates, in most places a combination of them is responsible for the high pressures. Modeling of the geologic processes that have created a basin allows us to recognize in advance the type of pressures to be found there.

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SEDIMENTATION ASSOCIATED WITH TECTONISM OF ANCESTRAL ROCKY MOUNTAINS

During the Pennsylvanian and Early Permian, block-faulted tectonism created mountain ranges (Ancestral Rocky Mountains) as much as 5,000-10,000 ft in elevation in Colorado and adjacent areas. These mountain ranges and associated basins profoundly affected sedimentation; thick sequences (up to 20,000 ft) of Pennsylvanian and Permian strata, with abrupt facies changes and thickness variations, were deposited adjacent to the uplifted mountain blocks.

Early Pennsylvanian tectonic activity developed the general outlines of the north- to northwest-trending Front Range, Apishapa, Uncompahgre, Pathfinder, and Sawatch uplifts. Up to 2,000 ft of nonmarine, alluvial and coastal-plain deposits (Kerber, Sharpsdale, Flechado, and Fountain Formations) accumulated locally in narrow facies bands adjacent to these uplifts, but generally marine shale and carbonate deposition (Morgan, Belden, Casper, and Minnelusa Formations) prevailed.

During the Desmoinesian, 5,000- to 9,000-ft displacements occurred on many faults that bounded the mountain-block uplifts. Narrow bands of thick, coarse-grained arkosic detritus (Minturn, Maroon, Fountain, Sangre de Cristo, Alamitos, Cutler) surround all of the major uplifts; these arid-climate alluvial-fan and coastal-plain deposits change facies abruptly to marine carbonates (Hermosa, Morgan), evaporites (Paradox, Eagle Valley), and shales within short distances from the mountain uplifts.

During the Late Pennsylvanian and Early Permian, the area of alluvial sedimentation expanded onto the mountainous areas and laterally from them, and filled the adjacent basins with up to 3,000 ft of red, arkosic sandstone and shale (Fountain, Maroon, Sangre de Cristo, and Cutler). Local relief of the Ancestral Rocky Mountains became subdued by Guadalupian time, and erosion of low-lying land area or marine deposition (Lykins, Park City, Kaibab) prevailed.

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PALEOBATHYMETRY BY FISH OTOLITHS

Four distinct faunal zones are present in otolith assemblages of bottom muds from the eastern Gulf of Mexico, between depths of 300 and 2,000 ft. At least 2 more zones can be projected on the basis of the literature and known water-circulation patterns in the Gulf, and the outer limit of workable faunas may be far out on the abyssal plain. Within the documented depth range, surprising precision is obtained by mea-