from engineering feats to economics of world petroleum.

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THEORY OF RED RIVER RESERVOIR DEVELOPMENT IN WILLISTON BASIN

Dolomitization of Ordovician Red River carbonates has produced 3 types of dolomite. Mottled dolomite and bedded dolomite developed during early diagenesis, and saccharoidal dolomite is a product of late diagenesis of limestone. Effective porosity is limited to the late diagenetic dolomite.

The mottled dolomite in the section is present as patches in carbonate mudstone and resulted from selective dolomitization of burrows in a shallow marine environment. Anaerobic bacteria, acting on buried organic material produced a chemical environment favorable for dolomite genesis. The concentration of this finely to coarsely crystalline mottled dolomite is proportional to the degree of burrowing and hence to the rate of sedimentation.

The bedded dolomite consists of thin beds of argillaceous, microcrystalline dolomite closely associated with laminated and nodular anhydrite. The dolomite was formed by replacement of carbonate mud under hypersaline conditions in a supratidal environment.

The saccharoidal dolomite ranges greatly in thickness and was produced by subsurface replacement of carbonate mudstone. Fractures permitted entry and circulation of dolomitizing solutions in nonporous limestone resulting in fine-grained porous dolomite. Distribution of the saccharoidal dolomite can be predicted by mapping fracture zones which are commonly related to local structure.

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UNMEASURED RESOURCES OF ROCKIES

(No abstract submitted)

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PEORIA FIELD, ARAPAHOE COUNTY, COLORADO

(No abstract submitted)

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STRATIGRAPHIC RELATIONS BETWEEN CLIFF HOUSE AND LA VENTANA SANDSTONES, SAN JUAN BASIN, NEW MEXICO AND COLORADO

The Cliff House Sandstone, the upper sandstone unit of the Mesaverde Group, was named for outcrops in the northwestern part of the San Juan basin near Mesaverde National Park, Colorado. Maps of the southeastern part of the basin reveal that the Cliff House fingers eastward into the marine Lewis Shale. There, a stratigraphically lower sandstone was named the La Ventana Sandstone Member of the Mesaverde Formation. The La Ventana was traced north to near the Colorado border where it merges with the underlying Point Lookout Sandstone. The nomenclature was revised to elevate the Mesaverde Formation to Mesaverde Group and the 3 members to formations. The La Ventana Member of the Mesaverde Formation was changed to the La Ventana Tongue of the Cliff House Sandstone. This change of the La Ventana from a member of the Mesaverde to a tongue of the Cliff House was based on the supposition that even though the sandstones did not merge on the outcrop, they would be found to merge in the subsurface. Preliminary subsurface studies suggest that the La Ventana Tongue and the Cliff House Sandstone do not merge.

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STRATIGRAPHY OF PHOSPHORIA FORMATION, NO WATER CREEK FIELD, WASHAKIE COUNTY, WYOMING

(No abstract submitted)

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OIL AND GAS POSSIBILITIES IN PEDREGOSA BASIN

Oil and gas have been found in the Pedregosa basin area, but it is not known if they are in commercial quantities. Geologists such as Kottlowski, Wengerd, Foster, and Zeller have suggested the oil potential of various zones. Analogies have been drawn between environmental and structural similarities of the Pedregosa basin and nearby oil-producing basins. Shows of oil have been reported from shallow water wells in southwestern New Mexico, southeastern Arizona, and the northern part of the state of Chihuahua. Zeller reported oil shows in the Big Hatchet Mountains in the Cretaceous strata and good petroliferous odor from Paleozoic rocks. The Hachita Dome well drilled in 1953 near the town of Hachita reported shows of oil from lower Paleozoic limestones. Humble Oil and Refining Company's B. A. State, drilled south of the Big Hatchet Mountains, recovered gas on a drill-stem test from Permian rocks. The Humble well was reentered a few years ago by a group of independent oil men in an attempt to make a commercial gas well. They reported gas flow at the rate of 0.5 MMcf/d, but lost the hole when attempting to acid frac the gas zone. Oil shows were reported in the Cockrell well drilled north of Coyote Hills. Sample shows have been reported in the Pemex well drilled at Los Chinos in northern Chihuahua, Mexico. Oil shows in the surface exposure of the Mississippian near Bavispe, Chihuahua, were noted by Pemex surface geologists.

Porosity in the middle sandstone member of the Cambrian Bliss Sandstone is present in the exposures at Big Hatchet Mountains. Cambrian sandstones produce on anticlines on the Eastern shelf of the Midland basin of West Texas.

The 800 ft of porous Silurian Fusselman Dolomite, present in the Franklin Mountains, was eroded after Middle Devonian uplift in the Big Hatchet Mountains area. The eroded scarp is covered by sapropelic shale and dark chert of the Upper Devonian. Similar conditions on the Eastern shelf and Central Basin platform of the Permian basin of West Texas and southeastern New Mexico produce oil from structural and stratigraphic traps.

Ordovician El Paso-Ellenburger dolomite is present and should be covered by the Devonian shale west of the Fusselman subcrop. The Ellenburger is an excellent producer on structure in the Permian basin of West Texas and southern New Mexico.

Bioherms of Mississippian crinoids are present in the Sacramento and San Andres Mountains and very massive limestone cliffs up to 500 ft thick are present in southwestern New Mexico and southeastern Arizona.

Horquilla reefs, 1,200 ft thick, were described and photographed by Zeller in the Big Hatchet Mountains. The reef started growing in Desmoinesian time and grew into early Wolfcampian time. Numerous reefs in West Texas and southeastern New Mexico grew at the same time and have produced billions of barrels of oil.

Porous Epitaph Dolomite is visible in the Big Hatchet Mountains, reefs are present in the Mustang Mountains, and lagoonal evaporites are present in the Whetstone Mountains of Cochise County, Arizona. Presence of backreef evaporites up to 200 ft thick lends evidence that the Leonardian-age Epitaph Dolomite could be analogous to the prolific Abo production of southeastern New Mexico.

Lower Cretaceous beds contain rudistid, coralline, algal, bioclastic banks up to 500 ft thick in the Big Hatchet Mountains and 200 ft thick in the Mule Mountains of southeastern Arizona.

The large Pedregosa basin contains more than 25,000 ft of sedimentary rocks. For most of Paleozoic time, the basin had a history of environment and structural evolution similar to the Permian basin of West Texas and southeastern New Mexico. Billions of barrels of oil and tens of trillions of cubic feet of gas have been produced in the Permian basin. I believe a like amount will be found in the Pedregosa basin.

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Oil and Gas Potential—Paradox Fold and Fault Belt, Colorado and Utah.

(No abstract submitted)

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Planktonic Foraminiferal Test-Porosity as Paleotemperature Indicator

(No abstract submitted)

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Early Permian Unconformity in Southeastern Wyoming and North-Central Colorado

Evidence for the existence of an unconformity in southeastern Wyoming and north-central Colorado between rocks of the Goose Egg Formation, the Owl Canyon Formation, or the Lyons Sandstone and the Casper or Ingleside Formations is provided by reworked basal sandy zones and conglomerates, truncation of underlying cross-strata, local relief, possible "duricrust" or caliche zones in subjacent rocks, and an isopach description of the configuration of the erosion surface.

Subjacent strata range from Wolfcampian to pre-Desmoinesian age. The subcrop becomes older from east to west. Superjacent strata belong to 3 units ranging from early to late Leonardian. In the southern and central Laramie Range and most of the Laramie basin, the Owl Canyon Formation forms the supercrop. It thins to a zero edge northward and westward by depositional onlap and fills in relief on the underlying unconformity. The Opeche Shale Member of the Goose Egg Formation constitutes the supercrop in the Shirley basin, the northern Laramie Range, and probably most of the western study area. It thins northward slightly in the Shirley basin and the northern Laramie Range and fills in relief on the underlying erosion surface. The Lyons Sandstone forms the supercrop on the southwest margin of the Laramie basin.

Stratigraphic relations in southeastern Wyoming are in accord with an interpretation of the growth of an extensive land area and its transgression in the Rocky Mountain and western Mid-Continent areas in Early Permian time.

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Hydrocarbon Distribution in Casper Formation (Permian-Pennsylvanian) of Laramie and Shirley Basins, Wyoming

Hydrocarbon production from the Casper Formation in the Laramie and Shirley basins of southeastern Wyoming is exclusively from sandstones on closed Laramide structures. Total recoverable reserves are approximately 8 million bbl, half of which is found in the Quealy Dome structure of the southern Laramie basin. The presence of closed structures which are barren of Casper oil suggests that factors other than the present structural configuration are important in controlling the oil distribution in the Casper Formation.

Subsurface data from 137 wells indicate that the present distribution of Casper oil and oil shows is a complex function involving pre-Laramide structural growth, the configuration of the post-Casper unconformity, sandstone porosity (and permeability) patterns in the upper part of the Casper Formation, and the development of Laramide structure. The relative paucity of Casper oil may be related to an extreme distance of migration from the source rock and the presence of major permeability barriers in the upper Casper Formation along the paths of early migration.

Prospects for major accumulations of Casper oil do not appear to be good although stratigraphic traps similar to those found in the eastern Powder River basin are possible.

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Depositional Dynamics of Upper Cretaceous Sandstones, Rocky Mountain Region

Throughout the Rocky Mountain region, numerous Upper Cretaceous intervals display a sequence of deposits, from the base upward, of (1) marine and/or lagoonal shale, (2) barrier-island sandstone, (3) marsh-mudflat deposits, (4) lagoonal-bay deposits, and (5) alluvial–coastal plain sediments. These sequences record seaward progradation of coastal plain, transitional, and nearshore marine deposits in response to a large sediment supply and continuous subsidence.

Barrier-island sandstone units display a characteristic upward sequence of infra-surfzone, surfzone, and beach deposits which reflect depositional regressions. The vertical succession of sedimentary structures in a barrier-island sandstone records building up of the sea floor until a segment emerged and a barrier beach formed.

Sand enters the sea through deltaic distributaries and tidal passes and is transported downcoast by longshore currents and littoral or beach drift to nourish and prograde barrier-island sand bodies. The geologic record is strongly biased toward preservation of case histories