southeastern Wyoming and north-central Colorado
12. M. D. PICARD, L. R. HIGH, JR.: Differentiation of lacustrine and fluvial sandstone by analysis of paleocurrent patterns
13. B. R. TOHILL: Depositional environments of "J" sandstone (Lower Cretaceous), Denver basin, Colorado
14. J. D. VINE, E. B. TOURTELOT: Geochemistry of some lower Eocene sandstones in Rocky Mountain region
15. A. D. JACKA: Principles of cementation and porosity-occlusion in sandstones
16. W. R. PICKENS, M. L. KLOHN: Geology of Felder uranium deposit, Live Oak County, Texas
17. P. R. ROSE: Reevaluation of unconformity criteria in carbonate successions

ABSTRACTS

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QUARTZ EXTINCTION IN SILTSTONE

The distribution of extinction types in siltstone from the Red Peak Formation (Early Triassic) of Wyoming and the Spearfish Formation (Permian-Triassic) of South Dakota has been studied. Results indicate that the amount of nonundulatory extinction, monocrystallinity, and inclusion-free grains in quartz of these rocks is extremely variable. Variability of these characteristics decreases, and the minimum observed values increase, however, with decreasing grain size. Thus, in most thin sections or in grouped results from either formation, populations of successively finer grains (very fine sand to fine silt) contain more nonundulatory, monocrystalline, and inclusion-free grains. Angularity of the quartz grains increases slightly as the size of the grains decreases, but roundness in quartz silt is not related to its internal structure. Sphericity is not related to internal structure or to the size of grains.

Selective abrasion of structurally weak grains may reduce the amounts of undulatory quartz, polycrystalline grains, and quartz with abundant vacuoles and microlites in successive sedimentary cycles. Another possible mechanism is that original size reduction of quartz grains yields increasing amounts of nonundulatory quartz, monocrystalline grains, and inclusion-free grains in finer sizes. We suggest that the second process is probably dominant. There is some evidence to suggest that selective replacement of quartz grains by carbonate cement may reduce the amount of undulatory quartz in successive sedimentary cycles.

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CARBONATE PETROLOGY AND PALEONTOLOGY OF PERMIAN BIOHERMS, SOUTHEAST IDAHO

(No abstract submitted)

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UPPER JURASSIC AND BASAL CRETACEOUS SANDSTONES OF SOUTHERN SASKATCHEWAN AND VICINITY

The Roseray Formation ranges in age from Callovian in the west to Oxfordian(?) in the east and is correlative with the upper part of the Rierdon Shale. Well-sorted quartzose sandstone beds (clinobeds) sloping eastward and southward constitute the formation. Grade size of the clinobeds and kaolin (up to 10% as matrix and laminae) decrease downslope in inverse relation to illitic clay and accessory glauconite. Thickness ranges between 45 and 160 ft for the formation and up to 70 ft for a particular clinobed. The clinobeds are imbricated west to east and resemble marine spits linked to an eroded easterly migrating northern delta.

The Cantuar Formation (Aptian to Albian) comprises (a) white to light-gray quartz-kaolin (feldspathic) arenites; (b) olive-green to dark-gray speckled biotite-chlorite, and argillaceous (feldspathic) quartz-arenites; and (c) dark-gray and gray-black carbonaceous-lignitic mudstone and argillaceous quartz-arenites. Both (a) and (b) grade into (c). Generally bimodal, the arenites range from fine to coarse grained with abundant grit and intraformational conglomerate, but are dominantly coarsely fine and medium. They are mudstone indurated, earthy, and characterized by heterogeneity of crossbedding types, grain size induration and unit thickness, all attributable to fluviatile channel deposition. The carbonaceous facies reflects overbank and floodplain swamp-lacustrine sedimentation. The quartz-kaolin facies apparently blankets a broad low-relief topography on the Upper Jurassic beds, whereas the biotite-chlorite facies belongs to a later valley system entrenched on the former.

The Roseray oil reservoirs are in the updip mesas, buttes, and escarpments cut into the Roseray Formation and isolated by impervious Cantuar lithologies. Oil is also produced from permeable Cantuar quartz-kaolin sandstones overlying these features.

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OPKISHAESA: COAL ON CROW RESERVATION, BIG HORN COUNTY, MONTANA

Geologic information has been gathered from 93 holes drilled and cored during the summers of 1968 and 1970 on coal lands in T6, 7S, R37, 38E, Big Horn County, Montana. Results of drilling indicate that at least 16 correlatable coal seams are present and range in thickness from 2 to 55 ft. Several billion tons of strippable reserves (200 ft high wall) were found in the Canyon, Anderson, Smith, Realbird, Schaak, and Roland seams. Realbird and Schaak are new seam names. Other correlations were established and are found in agreement with the work of the Montana Bureau of Mines and Geology.

Stratigraphic changes in the upper part of the geologic column (surface to 1,000 ft) should be of interest and importance to both the oil explorationist and those involved with the mode of environment and origin of the Northern Powder River basin coal deposits.

The entire project data are being digitized. More than 700,000 points controlling the surface contours are used in conjunction with coal-seam structure maps to arrive at overburden estimates, outcrop patterns, volumetric rock accounting, and mine model studies. Log suites were digitized as were chemical coal analysis results in order to develop both quantitative and qualitative control of the stratified sequence as well as the coal seams.

It is believed that this and other discoveries in the area are nationally significant and are suitably large enough to be able to support petroleum liquid or gasification conversion plants, de-ashing refineries, as well as mine-mouth and char power facilities. Development of those industries will be dependent on many factors

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 mas-