Dolomite and Dedolomite in Mural Limestone, Lower Cretaceous, Arizona and Sonora

Three petrographically distinct types of dolomite occur in the upper member of the Mural Limestone, lower Albian, of southeastern Arizona and northeastern Sonora: (1) very fine to medium grained sucrosic dolomite occurs replacing lime mud fills of constructional reef cavities 5 cm to 2 m in diameter, emplaced along stylolites and in irregular patches of pressure-solved matrix in rudstones and floatstones, and replacing matrix in oolitic and skeletal packstones; (2) medium to extremely coarse ferroan baroque dolomite, characterized by curved cleavage and sweeping extinction, is an important void filling cement; and (3) euhedral, non-ferroan dolomite cement partly fills some late fractures.

Available evidence indicates that dolomitization occurred in four episodes. Petrographic and field evidence suggests that sucrosic dolomite in reef cavity fills and in coarse packstones preceded baroque dolomite cement. Baroque dolomite followed calcite rim cements and some blocky spar, and was followed by additional blocky spar. Fractures containing non-ferroan dolomite cement postdate all of these cements. Pressure solution-related dolomite formed still later, during middle to late burial diagenesis and tectonism.

Dedolomitization affected all dolomite types in the Mural Limestone. Nearly all sucrosic dolomite has been calcitized. The resultant fabric consists of calcite rhombs in a mass of anhedral calcite, stained by exsolved iron. Baroque dolomite cement is commonly partly calcitized. It alters to single crystals of "rusty" calcite in optical continuity with the dolomite, retaining the latter's curved cleavage and sweeping extinction.

Dedolomitization in the Mural is attributed to exposure to low-Mg fresh water under near-surface temperatures and pressures. These conditions have probably been in effect since the mid-Tertiary.

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Methane Measurement from "Saline Zone" Oil Shale, Piceance Creek Basin, Northwest Colorado

Oil shale from the Parachute Creek Member of the Green River Formation gives up methane in various amounts when penetrated by drilling or shaft sinking. The "Saline zone" from the base of the second salt to the base of the R-2 zone has been cored and drill-stem tested in 30-ft (9 m) intervals; the core has been sealed in PVC sleeves and the methane given off has been measured. The methane data have been correlated with the geologic section and the results have been presented for use in mine design.

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Wattenberg and Spindle Fields—Paleostructural and Stratigraphic Traps, Denver Basin, Colorado

The most important mineral resource activity in Colorado during the past decade has been the discovery and development of the Wattenberg gas field and the shallow overlying Spindle oil and gas field. Located north of Denver near the axis of the Denver basin, Wattenberg is estimated to have reserves of 1.3 Tcf of gas in the "tight" J sandstone (delta front) reservoir over an area of 600,000 acres (240,000 ha.), at depths of 7,600 to 8,400 ft (2,316 to 2,560 m). Spindle field, in the southwest part of the Wattenberg field, produces from two marine sandstone bar complexes (Terry and Hygiene Sandstones) in the middle part of the Pierre Shale. From an area of 30,000 acres (12,000 ha.), total production is in excess of 28,000,000 bbls of oil and 100 Bcf of gas at depths of 4,000 to 5,000 ft (1,219 to 1,524 m).

Although both fields are regarded as stratigraphic traps, paleostructural analysis of the area clearly shows that during middle Cretaceous the fields were located on an ancient structural high that was subsequently downwarped into the present low structural setting. Evidence for recurrent movement on the paleohigh are unconformities at the top of the J sandstone and at the base and top of the Niobrara Formation, and also thinning of shale intervals and localization of marine sand bars within the Pierre Shale.

The outline of the Wattenberg paleostructure is best shown by the area of truncation by erosion of the upper chalk of the Niobrara Formation over an area 10 mi wide × 50 mi long (16.1 km × 80.5 km). The east-west trend of the paleostructure changes to northeast and extends for more than 100 mi (16.1 km) into western Nebraska. Three other similar paleostructural trends can be mapped in the northern Denver basin.

Knowledge of paleostructural control on reservoir facies and petroleum migration provides new ideas for petroleum exploration in Cretaceous rocks and in the deeper Paleozoic section of the Denver basin.

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Dynamics of Unvegetated Tidal-Flat Muds

Process-oriented field studies of tidal-flat muds, together with satellite imagery and aerial photography, have provided new data for a synthesis of tidal-flat dynamics in low-, moderate-, and high-tide-range environments where vegetation is lacking in the intertidal zone. In the three areas studied since 1974 (coast of Louisiana, tide range 0.5 m; coast of Surinam, tide range 2.0 m; west coast of South Korea, tide range 5 to 9 m), intertidal exposures of mud measured normal to the shoreline range from less than 150 m (Louisiana) to over 50 km (Korea) width. Each area is blanketed by a layer of gelatinous fluid mud, several centimeters to over 1 m thick, which extends into the subaqueous zone seaward of the low-tide line.

Shallow-water waves in the nearshore zone are substantially attenuated when propagating over soft tidal-flat muds. Attenuation of wave height (without breaking) from a water depth of 15 m to 1 m indicates that there is an 87% energy loss (utilizing linear-wave theory) when waves propagate over a 40-cm thick fluid-mud bottom with a bulk density of 1.30 g cm^{-3}, and greater than 99% energy reduction over a 1-m thick layer of fluid mud with bulk density of 1.18 g cm^{-3}.

Tidal-flat muds are suspended and redeposited at