Shallow gas fields have been developed in the basin; ongoing exploration for deeper oil and gas is not yet definitive. Potentially good source rocks in the deeper parts of the basin, underlying organic-rich Franciscan sediments, and the abundance of potential reservoir rocks higher in the section make this structurally complex onshore/offshore basin an attractive exploration target.

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Mid-Cretaceous Biostratigraphic Units, Unconformities, and Diastrophism in Wyoming, Colorado, and Adjacent Areas

In the central Rocky Mountains and adjoining Great Plains, lithologies and hiatuses within sequences of mid-Cretaceous formations reflect widespread fluctuations of sea level and intermittent tectonism during Cenomanian, Turonian, and Coniacian time (88 to 96 m.y.B.P.). Siliciclastic and carbonate strata of marine origin in the Graneros, Belle Fourche, Greenhorn, Carlile, and Niobrara Formations grade laterally into marine and nonmarine siliciclastic beds of the Frontier Formation. The clastic strata are products of uplift and erosion in both the Sevier orogenic belt of Utah, Idaho, and western Montana, and a contiguous region within Utah, Colorado, Wyoming, Montana, and Nebraska. The ages of these rocks, the durations of intervening hiatuses, and the times of diastrophism were determined mainly from a detailed succession of marine molluscan index fossils.

Outcrops at scattered localities in this region, in a western part of the Cretaceous seaway, as well as outcrops in eastern South Dakota and northwestern Iowa, near the eastern shore of the seaway, indicate a marine transgression in the Cenomanian and early Turonian (Belle Fourche and Greenhorn time), a marine regression in the middle Turonian (early Carlile time), and a marine transgression in the late Turonian and Coniacian (late Carlile and early Niobrara time). However, the stratigraphic record of these widespread events has been obscured in most of Wyoming and Colorado by submarine and subaerial erosion and attendant sedimentation associated with episodic orogenic activity during the Turonian and Coniacian (88 to 91 m.y.B.P.).

In central and northwestern Wyoming, strata as young as late Cenomanian (early Greenhorn age) are disconformably overlain by beds of early middle Turonian (latest Greenhorn) age. Uplift and erosion in these areas probably occurred during early to earliest middle Turonian time. In western Colorado, early middle Turonian strata (Fairport Member of the Carlile) and older rocks are disconformably overlain by late middle Turonian strata (Blue Hill Member of the Carlile), indicating deformation and truncation in the middle Turonian. Moreover, truncated beds as young as late middle Turonian (Codell Sandstone Member of the Carlile) are overlain by early late Turonian strata (Juana Lopez Member of the Carlile) in Colorado and Wyoming, reflecting earliest late Turonian orogenic activity in the vicinity of the Front Range, Laramie Range, and Bighorn Mountains. Some of the rocks of early late Turonian age (a lower part of the Wall Creek Member of the Frontier) were, in turn, uplifted and eroded during later late Turonian time in an area that extends from Yellowstone Park to central Wyoming. Furthermore, at outcrops near the Laramie Range, truncated beds of late Turonian age (Wall Creek Member of the Frontier) and the overlying Coniacian strata (basal Niobrara) indicate earliest Coniacian tectonism and erosion in southeastern Wyoming.

Elongate areas of uplift and erosion and of discrete sedimentary facies of mid-cretaceous age commonly trend approximately southeastward and northeastward in the central Rocky Mountains–western Great Plains region. From Yellowstone Park southeast to the vicinity of Casper, Wyoming, intermittent truncation and deposition during the Turonian are especially evident.

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Trace Fossils Within Limestone Interbeds, Oak Grove Member, Carbondale Formation (Pennsylvanian, Desmoesian), Northwestern Illinois

Most trace fossils have been described from terrigenous rocks, commonly sandstones or sandstone/shale interbeds. The prevailing opinion appears to be that carbonate rocks rarely contain trace fossils or that ichnofossils are more difficult to study in them. Neither is true. Methodology is especially important in these studies, and the peculiarities of carbonates make them particularly rewarding subjects for trace fossil analysis.

At Wolf Covered Bridge in Knox County, Illinois, the Desmoinesian Oak Grove Member is more than 5 m (16 ft) thick and consists mostly of shale with several thin carbonate (limestone and siderite) interbeds. The two thickest of these carbonates are a lower "gray septarian" (or "*Marginifera*") limestone about 0.2 m (8 in.) thick, and about 1.5 m (5 ft) higher a 0.3 m (1 ft) thick "*Linoproductus*" limestone. Both are sparse to packed mixed biomicrites with diverse and abundant fossils. The depositional environments of these limestones were similar: nearshore, quiet, delta-influenced, somewhat brackish, shallow water deposits interpreted by Merrill (in 1975) to have formed in water less than 20 m (66 ft) deep.

Limestones were sliced perpendicular to bedding in the normal fashion and large slabs were also cut parallel to bedding with a wire saw. Serial sections cut perpendicular to bedding were photographed by X-radiography permitting three-dimensional reconstruction of some burrows. Large slabs cut parallel to bedding were etched and acetate peels prepared in the convention manner, but of unconventional size (some more than 1.0 m, 39 in., long). The polished surfaces were later gridded, coated, and the distribution of body and trace fossils mapped both megascopically and microscopically from the peels.

The level of bioturbation is exceedingly high, especially in the "*Marginifera*" limestone. Several generations of truncating trace makers are evident. Recognizable ichnogenera include a spectacular *Rhizocorallium* 40 cm (16 in.) long with waves of spreite outlined by calcitornellid (pseudopthalmid) foraminifers, numerous *Chondrites* up to 10 cm (4 in.) high, and common *Planolites*. Lithologic differences among burrow types are striking and many vague, relict, earlier generations of traces remain, traced primarily by allochem distribution. Substrate stabilities differed between the pair of limestones and bearing strength was probably a major factor controlling community structure. There are suggestions of "ghost biota" and lack of significant compaction of the micrite in the lower carbonate interbed.

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Geochemistry of Regionally Extensive Calcite Cement Zones, Mississippian of New Mexico

Carbonate cements from Mississippian skeletal limestones of southern New Mexico are dominated by echinoderm-syntaxial calcites that comprise 4 regionally extensive compositional zones. Previous petrography and cement stratigraphy proves that the oldest three zones (zones 1, 2, and 3) are pre-