Recent Deep Sea Drilling Project (DSDP) coring along U.S. Geological Survey (USGS) multichannel seismic lines 25 and 35 provides direct sampling of the depositional sequences that constitute the lower continental slope and upper continental rise of New Jersey. The sedimentary record from four core sites, integrated with a closely spaced grid of multichannel seismic profiles, reveals 12 depositional sequences in the upper Campanian to Quaternary section that are bounded by erosional unconformities. Equivalent unconformity-bound depositional sequences are present on the contiguous continental shelf and upper slope; most sequences have counterparts in the Vail depositional model. Of particular interest is a complicated, stacked series of buried erosional channels dramatically displayed on seismic lines paralleling the depositional strike of the upper continental rise. The channels, which cut the upper surface of nearly every depositional sequence, probably formed during periods of low sea level. Channels on the lower Eocene surface display the greatest physiographic relief. Integration of seismic and bore-hole data suggests alternative correlations for several stratigraphically significant regional reflectors, such as A*, A^c, and A^u.

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Early Diagenetic History of Late Pennsylvanian Calclithite Beds, Hueco Mountains, El Paso County, Texas

Calclithite beds exposed on the western escarpment of the Hueco Mountains were deposited in a fan-delta system featuring fluvial channels, marine bars or beach sands, shallow-marine shale and limestone, and tidal flats and lagoons. Two distinct calclithite types occur. One is a coarse, poorly sorted gravelly sand with angular to subrounded grains. This type occurs in discontinuous or channel-shaped beds. Sedimentary structures include fining-upward sets, imbrication, and trough cross-bedding. These characteristics indicate sporadic unidirectional flow, as would be expected in ephemeral streams. The second calclithite type is fine to medium-grained well-sorted sand with very well-rounded grains. This type crops out as thin, relatively continuous units. Sedimentary structures include ripples, small-scale cross-beds, low-angle and horizontal or planar bedding.

The early diagenetic history of the calclithites reflects their depositional environment. The coarse calclithite was deposited in undersaturated freshwater conditions, shown by the absence of early cement. Early compaction of the coarse calclithite, indicated by intergranular microstylolitization and shale-clast deformation, is the most commonly observed texture. The fine-grained calclithite exhibits a markedly different diagenetic history. The first recognizable "diagenetic" event is micritization of marine-derived fossils and calclithite grains. Early cementation in the marine phreatic environment resulted in isopachous rims of fibrous aragonite and bladed Mg-calcite cement. Pore centers contain a later equant calcite cement. Little or no early compaction occurred in the fine calclithite. Freshwater flushing is indicated by the replacement of former aragonite cement rims by finely crystalline equant calcite.

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Environmental Significance of Evaporitic Textures of Mississippian Mission Canyon Formation, Williston Basin, North Dakota

The Mission Canyon evaporite wedge, the Frobisher-Alida interval, has commonly been interpreted as typical nodular or "chicken-wire" anhydrite from a sabkha depositional setting. Upon examination of over 190 cores from North Dakota and Montana, we identified a variety of evaporite textures and interpreted several distinct origins for them. The following evaporite textures were recognized: (A) precipitative or primary, (B) intraclastic, (C) evaporite cement, (D) replacement, and (E) dissolution-stage.

Depositional evaporites (A, B) form by direct precipitation in supersaturated solutions (primary texture) or by reworking of primary evaporite (intraclastic texture). Primary texture forms by direct precipitation from a supersaturated brine occurring in shallow lagoons or tidal ponds (subaqueous evaporite) or within the sediment (nodular anhydrite). Three types of subaqueous textures were identified: (1) isolated laths, (2) rosettes or clusters of laths, and (3) large "swallowtails." Intraclastic texture results from the reworking of previously precipitated evaporite. It is recognized by angularity of the clasts, size sorting, and association with carbonate intraclasts. Depositional environment of this texture is interpreted as evaporitic shallow-water lagoons, punctuated by occasional storm events.

Diagenetic textures include cementation, replacement, and evaporite dissolution. Cementation by evaporite was found primarily in carbonate grainstones and is usually poikilotopic. Replacement textures may develop early or late in the diagenetic history of the rocks. Early replacement was found in primary restricted carbonate facies. Original texture (algal laminations, bioturbation, carbonate grains) were usually preserved after replacement. Late-stage replacement was observed in more marine facies, with the original texture not preserved. Isolated nodules of fibrous anhydrite result.

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Exploration Applications of a Transgressive Tidal-Flats Model to Mississippian Midale Carbonates, Eastern Williston Basin

Midale (Mississippian) production was first indicated in 1953 in Saskatchewan, Canada. The unit was initially defined in the subsurface as the carbonate interval between the top of the Frobisher Anhydrite and the base of the Midale Anhydrite. This same nomenclature is used in this paper. In 1953, Midale production was found on the United States side of the Williston basin in Bottineau County, North Dakota. Later exploration extended Midale production westward into Burke County, North Dakota, in 1955. Cumulative production from the Midale is approximately 660 million bbl with 640 million from the Canadian side of the Williston basin.

Initially, hydrocarbon entrapment in the Midale was believed to be controlled by the Mississippian subcrop, with the Burke County production controlled by low-relief structural closure. Petrographic examination of cores and cuttings from the Midale in both Saskatchewan, Canada, and Burke and Bottineau Counties, North Dakota, indicates that production is controlled by facies changes within the unit. Stratigraphic traps are formed by the lateral and vertical changes from grain-supported facies deposited in tidal-channel, subtidal-bar, or beach settings; seals are formed by mud-rich sediments. Use of a transgressive carbonate tidal-flats model best explains current production patterns and indicates substantial potential for additional production in eastern North Dakota and South Dakota.

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Provincial Variations in Cap Rock Source Materials of Gulf Coast Salt Domes

Isotopes of strontium, carbon, and oxygen are used to model hydrocarbon, brine, and meteoric fluid interactions during cap rock evolution. Provincial isotopic variations occur between older salt domes of the east Texas (ETx) and northern Louisiana (NLa) basins and the younger domes of the Texas-Louisiana (Tx-La) coastal basin. ETx and NLa cap rocks exhibit normal, mid-Jurassic seawater values ($^{87}Sr/^{86}Sr = 0.7068$ to 0.7076), very wide $\delta^{13}C$ ranges (-5 to -49 per mil PDB) and $\delta^{18}O$ values (-6 to -11 per mil PDB) that are slightly lighter than Tx-La (-4 to -10 per mil). Tx-La domes yield remarkably high $^{87}Sr/^{86}Sr$ ratios (0.7073 to 0.7100), and their $\delta^{13}C$ values (-8 to -41 per mil) have means which are 5 to 15 per mil heavier than ETx and NLa domes.

Detailed studies of the Hockley dome (Tx-La basin) reveal chemical diversity not recognized in domes farther inland. Anhydrite from the salt stock (mid-Jurassic Louann evaporites) mixed with two separate strontium sources during calcite formation. Calcites near the dome's center formed from an intermediate Sr ratio fluid ($^{87}Sr/^{86}Sr \cong 0.7090$), which, based on heavier than average $\delta^{13}C$ values, was enriched in CO_2 relative to CH_4; peripheral calcites evolved from a high Sr ratio fluid ($^{87}Sr/^{86}Sr \cong 0.7105$) with a lower CO_2/CH_4 ratio.

High $^{87}Sr/^{86}Sr$ ratios in other Tx-La anhydrite cap rocks compared with normal mid-Jurassic type values in ETx and NLa cap rocks suggest