

EARLY PRECIPITATION OF AUTHIGENIC CLAY BY METEORIC WATER, PICTURED CLIFFS, SAN JUAN BASIN, NEW MEXICO AND COLORADO

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ABSTRACT

The Pictured Cliffs, which is exposed around the San Juan Basin in New Mexico and Colorado, was deposited in a variety of nearshore environments during the last of a series of major regressions of the Cretaceous epicontinental seaway. The Pictured Cliffs is a prolific producer of natural gas. The permeability of the Pictured Cliffs sandstones decreases from the southwest to the northeast, apparently in response to a progressive increase in the amount of authigenic grain-coating clay to the northeast. Gas-production trends are oriented parallel to depositional strike and cut across present-day structure contours. Thus, it appears that most of the authigenic clay was precipitated before the formation of the San Juan Basin.

Oxygen and hydrogen isotopic analyses of eight samples from different parts of the basin argue strongly for precipitation of the clays by meteoric water. The early precipitation of authigenic clay in marine sandstone by meteoric water has not been previously described. However, there are significant differences between the Cretaceous Western Interior basin and marginal basins such as the Gulf Coast basin which might help explain this occurrence. The highest rates of sedimentation and subsidence in the Cretaceous Western Interior basin were near the adjacent highlands, resulting in the stratigraphic rise of the marine sandstones towards the seaway. Also, marine shales constitute less than half of the thickest part of the basin fill. Thus, compactional fluids were probably less significant diagenetically than in the Gulf Coast basin. These factors may have contributed to the development of a regional-flow system in which large volumes of meteoric water moved seaward through the marine sandstones.

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