# Stratigraphic and structural compartmentalization in a basin-centered gas accumulation, Lower Cretaceous Muddy (J) Sandstone, Wattenberg Field, Denver-Julesburg Basin, Colorado

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**ABSTRACT**
The Lower Cretaceous Muddy (J) Sandstone has produced nearly 1.0 TCF of gas from the basin-center Wattenberg Gas Field. Gas-in-place maps reveal broad, regional trends punctuated by an irregular distribution of “sweet spots” and “dead spots”. Results of a core-based, sequence stratigraphic and structural study of the Muddy, integrated with test and production data, reveal a complex interplay among depositional processes, syndepositional faulting and pedogenesis, and post-depositional faulting and diagenesis that helps explain both regional and small-scale compartmentalization and reservoir performance anomalies.

The Muddy is divided into two members, the Fort Collins and Horsetooth Members. The older Fort Collins Member is a progradational parasequence set that is unconformably overlain by fluvial-estuarine valley-fill deposits of the Horsetooth Member. Individual Fort Collins shoreface parasequences display different proportions of bioturbated and stratified lithofacies. Stratified lithofacies were pervasively cemented by silica, whereas bioturbated lithofacies were protected from silica cementation by clay coatings. Clinoforms within parasequences create permeability anisotropy relative to the paleoshoreline strike. Several NW- and NE-trending valley tributaries were eroded into the composite Fort Collins strandplain. Quartz-rich Horsetooth valley-fill deposits were also prone to pervasive silica cementation and create stratigraphic barriers. Essentially, the regional J Sandstone “sweet spot” is an erosional remnant of the Fort Collins composite strandplain surrounded by “tight” Horsetooth valley-fill deposits.

Without 3-D seismic data faults are mapped by structure contouring at 10-foot intervals. The structure is characterized by rapid changes in contour spacing along straight and rectilinear segments. Isopach maps also indicate that faults were active during the development of the sequence boundary, controlling Horsetooth paleovalley trends and the “preserved” thickness of the Fort Collins strandplain. This pattern suggests that both syndepositional and post-depositional faulting may play a key role in small-scale reservoir compartmentalization.