Fault Patterns in the Niobrara Formation—Examples from the Eastern and Central DJ Basin

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The Upper Cretaceous Niobrara Formation is the latest in a series of fractured plays at the forefront of exploration activity within the Rocky Mountain region. Prolific oil and gas production has been achieved through the use of modern exploration methods followed by advanced horizontal and vertical drilling and completion techniques.

Regional archival 2-D seismic data as well as single fold seismic data is used to target the more attractive exploration areas within the mature Denver Julesburg (DJ) Basin of eastern Colorado, southeastern Wyoming, and western Nebraska. The use of these reconnaissance data is followed by modern high-resolution 3-D seismic surveys that are used to identify Niobrara faults along with their orientation and throw.

McElvain Oil & Gas Properties, Inc. acquired a series of three proprietary 3-D surveys in Yuma County, Colorado, which were merged into one 54.5 square mile continuous 3-D survey through the use of reprocessing. Subsequent interpretation techniques, including volume curvature, were used to identify Niobrara fault trends, patterns, and fault displacements and reveal attractive structural exploration targets for the Niobrara Formation. These techniques led to the discovery of two new Niobrara fields within the Mildred combined 3-D survey area. Two additional 3-D surveys, the 4.2 square mile Krieger 3-D in Weld County, Colorado and the 14.6 square mile Cedar Creek 3-D in Cheyenne County, Nebraska are shown to illustrate Niobrara faulting signatures in other portions of the DJ Basin. These surveys reveal that fault patterns within the Niobrara Formation are the result of both Laramide tectonism and post-Cretaceous dissolution of Permian salt beds.