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Slope Fan Deposits of the 2nd Bone Spring Sand, Young North Field, Lea County, New Mexico

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ABSTRACT

The Bone Spring Formation is a series of three carbonate and three siliciclastic members that were deposited on the north slope of the Delaware Basin in the early Permian (Leonardian). Detailed core descriptions, thin section petrography and digital grain-size analysis of three cores and well log evaluation from various fields in Lea County, New Mexico, were utilized to ascertain the depositional environment of the 2nd Bone Spring sand.

The 2nd Bone Spring sand represents deposition of sands and shales during a transition from active to abandoned slope fan environments during a general rise in sea level. The fine-grained siliciclastic slope deposits can be divided into three major facies. The first, the midfan facies, is composed of massive, wavy laminated, ripple cross-laminated and weakly bioturbated sandstones. It is the coarsest of the three facies, and represents slope deposition during high energy channel deposition associated with strong currents and active fan deposition. The distal fan facies contains wavy laminated sandstone, planar laminated shales and weakly to intensely bioturbated shales and sandy shales, intercalated with thin beds of cross-laminated sandstones and shales. This facies represents deposition of non-channelized sheetflood sands and shales on the slope during a time when flow energy and sedimentation rates were gradually waning. The slump facies consists of convolute bedded siltstones and shales, and it marks a major slope failure during a rise in sea level. The shale units commonly contain abundant pyrite alteration in the form of laminae and large nodules and minor amounts of calcite diagenesis. These features are also found in the sandstone units but with less frequency.

The vertical succession within the 2nd Bone Spring Sand begins with a basal mid fan, high energy facies that grades upward into the distal fan, low energy facies, occasionally interrupted by short perturbations of high energy sediment input. The mid fan facies specifically represents deposition during a period of low relative sea level and the distal fan and slump facies represent deposition during a relative rise in sea level. This succession represents low amplitude, high frequency sea level fluctuations. Not all facies are present within each sequence, but cyclicity is clearly present and indicates a general rise in sea level with time in the Delaware basin.