

## **Outcrop Gamma Ray Response to Depositional Facies in the Honaker Trail Formation, Durango, Colorado**

Miskell-Gerhardt, Kimberlee J. \*<sup>1</sup> (1) Consulting Geologist, Durango, CO.

Lithofacies and outcrop gamma ray data from the Honaker Trail Member of the Hermosa Formation were collected in Steven's Creek, near the classic location at Hermosa Mountain, ten miles north of Durango, Colorado. This work is a continuation of a previous study by Miskell-Gerhardt, Gianniny and Ritter (2010)<sup>1</sup> on Paradox-equivalent strata on the southeastern margin of the Paradox Basin. In this field area the upper Akah through the upper Ismay progressively fill in accommodation space, evolving from a shelf-slope break to a gentle ramp margin.

Lithofacies of the Honaker Trail section formed in very shallow-marine to terrestrial depositional environments. Marine facies include fossiliferous pack to grainstones, fossiliferous limey sandstones (tidal bars), fossiliferous mudstones (lagoonal) and thin sandstones with abundant mud interlayers and desiccation cracks (updip tidal). Terrestrial facies include gray, calcareous, nodular mudstones with thin rhyzoliths (water-saturated paleosols), red-brown siltstones with abundant caliche nodules and large rhyzoliths (arid climate paleosols with alkaline groundwater), thick, cross-bedded sandstones (fluvial) and red-brown, micaceous, siltstones and sandstones (overbank). Most of these lithologies are at least weakly calcareous.

Typically shalier lithologies are the "hottest" (highest gamma ray response) with decreasing responses from sandstones then limestones. In this section however, caliche paleosols and limestones are equally "cold" due to the high carbonate content of the caliche nodules. There is also very little difference between limestones/caliche paleosols and sandstones, because of the abundant carbonate cement or calcareous components (minor fossils or ripped-up caliche clasts) in the sandstones. The hottest response comes from red/green micaceous siltstones (overbank) or paleosols with fewer caliche nodules.

Implications for industry are threefold. First, it is difficult to predict depositional environments and lithologies from gamma ray response in this transitional setting (i.e. confusion between marine limestones and caliche paleosols). Second, correlation of this section to basinal cycles may not be possible, as the marine signal may not have been recorded here. Third, fluvial channel sandstones seen in outcrop are potential hydrocarbon reservoirs on the SE margin of the Paradox Basin. Currently, sandstones in the Honaker Trail with gas shows are interpreted as reworked eolian sands, analogous to those seen along the San Juan River. Near Durango however, there are five intervals of fluvial sandstones in the Honaker Trail which may form thicker (>5m), cleaner reservoirs downdip. Because these sandstones are of limited extent, even in outcrop, potential reservoirs would be lenticular.