A Case History of the Eagle Ford Oil Shale Play, South Texas

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The city of Eagle Ford, Texas derived its name from the Eagle Ford shale formation that outcropped in the area. The Eagle Ford shale underlies the Austin Chalk and at its base, the Buda limestone, lies beneath. The Eagle Ford has long been considered the "source rock" for hydrocarbons that are now found in the Austin Chalk formation across much of South Texas. Compared to other shale formations the Eagle Ford is more brittle and contains as much as seventy percent calcite with an average clay content of ten percent, and as a result is a very "fraccable" rock. The Eagle Ford shale has the "perfect mineralogical makeup for a shale gas play" according to Petrohawk Energy's President, Dick Stoneburner. EOG Resources has already called the oil window of the play, the sixth largest domestic oil discovery in U.S. history.

Murphy Exploration entered the play in the fall of 2008 and has amassed some 200,000+ acres spread across the play from Karnes to Dimmit Counties. To date, Murphy's position covers the oil, condensate and dry gas windows, on which it has drilled and completed 4 gas wells and 2 oil wells. Murphy is currently running 3 rigs in the play, with plans to grow to 5 rigs by year-end 2010 with its focus on the oily areas of the play. By November of 2010, Murphy will have drilled and completed 11 additional oil wells reflecting the variability of the oil window from the western to eastern limits of the play.

Most operators are running a full suite of open hole logs in the vertical pilot hole to provide a full spectrum shale log across the Eagle Ford gross interval, but few, if any logs (open hole or cased) are run in the lateral, other than a GR on LWD, to provide information about the rock characteristics across the lateral. In an effort to verify whether mineralogy and brittleness have a direct correlation to productivity, Murphy is currently running production logs within 60 days of completion, to compare to the cased hole logs run in the lateral. The cased hole logs assist with cluster placement and the combining of like rock characteristics within each stage. RA and chemical tracers are also used to aid in the identification of which stages are the most prolific hydrocarbon contributors, and to assist in unlocking relationships between productivity and minerology, frac design parameters, and rock characteristics.

The oil window of the play exhibits strong variability both aerially and vertically within the trend, even within the stages of a single horizontal completion. Wells within the oil window across the play have experienced peak rates as high as 2000 bopd with GOR's of 1000-4000, some with sustainable rates and others with steep declines. Wells located in higher geo-pressured areas appear to be the most prolific producers with limited production histories in all wells drilled to date by all operators. Most wells in the play are still producing in the transient flow regime and have not yet reached boundary dominated flow, which results in a large error bar for recoverable reserve determination. There is also considerable variability among operators as to completion techniques and numerous examples of offset wells completed in one manner resulting in poor productivity with direct offsets completed in another with great success. It is not clearly understood as to whether the failure in productive response is due to completion method, rock variability, geo-mechanical stresses or flow back procedure or some combination.

Murphy has made considerable changes in completion design parameters within individual wells to compare productivity to the various frac design parameters inclusive of fluid types, treating rates, sand concentrations and volumes and various types of proppants to help determine the most effective stimulation design as a function of rock characteristics. In an attempt to optimize performance, as well as cost, Murphy is attempting to compare the variation of rock characteristics experienced within a single lateral to their respective productivity contributions.

Murphy is also experimenting with flow back methodologies, and has seen strong evidence to indicate that maintaining back pressure on the formation, results in shallower declines and higher EUR's. This implies that pulling wells too hard to obtain higher IP's may have a long term detrimental impact on productivity and recovery. It is not understood yet as to whether this "damaging effect" will be permanent and irreparable if continued on a long term basis.

It is Murphy's intention with its testing program within the oil window of the Eagle Ford shale play, to attempt to define the relationship that might exist between the brittleness of the formation and productivity. As an additional point of examination, Murphy also intends to determine if a difference in frac fluids play a role in effectively stimulating and improving proppant carrying capability to more effectively create complex fractures in all types of rock characteristics. It is hypothesized that since not all shales are created equal, that even within each stage of the lateral of a horizontal completion, may require different completion fluids and frac recipes for optimum completion effectiveness to ultimately result in enhanced productivity.