Identifying Some Mechanical Stratigraphic Controls on IP30 (First Month) Hydrocarbon Production Volumes in the SCOOP (South Central Oklahoma Oil Province) Play

Carlos Molinares-Blanco[1], Muizz Matemilola[1], Jing Zhang[1], Henry Galvis[1], Daniela Becerra[1], Lennon Infante[1], and Roger Slatt[1]

[1]University of Oklahoma

ABSTRACT

The SCOOP (South Central Oklahoma Oil Province), has been one of the most competitive lower 48 unconventional play areas in terms of persistent rig count. Oil and gas companies have significantly reduced operational costs and have become more efficient during drilling and completion activities. However, these efforts do not directly result in better horizontal well performance. Horizontal wells are also controlled by reservoir properties and the principal stress field orientation which are sometimes not recognized before drilling.

To understand these reservoir controls, a detailed mapping and reservoir characterization study was conducted that included 8 vertical wells, 12 horizontal wells and 1 cored Woodford Shale well. The horizontal wells were separated into two sets. The first set includes horizontal wells with the best hydrocarbon and liquid-rich production during the first month (IP30), which were drilled from north to south, with landing zones mainly associated with the upper part of the middle Woodford and the upper Woodford Shale. These rocks are characterized in outcrop by the presence of more brittle, silica-rich intervals, and characterized in core by higher Acoustic Impedance (A.I.), high Young Modulus (E) and low Poisson's ratio (v) values. The second set of horizontal wells were poor in hydrocarbon liquid production. These wells were drilled from south to north and landed in more ductile lower Woodford Shale rock intervals. These two sets of wells were drilled by the same operator, under similar completion conditions and separated by a relatively short distance (< 1,000 ft).

The interaction of the principal stresses with the landing orientation of the horizontal wells was another factor analyzed in this study. In the SCOOP play, companies have demonstrated a preference for drilling horizontal wells in a north-south or south-north orientation, possibly because it is the fastest (economic) and most efficient way of infilling a section (640 acres) with a minimum number of horizontal wells. Due to the horizontal wells and the stress field orientation (SHmax ~ N85°±5°E), induced fractures are propagated vertically into some Mississippian pay units identified in the vertical wells analyzed. These could be stimulated during the completions and improve the hydrocarbon production in wells that land in the upper part of the middle Woodford and the upper Woodford Shale.