

LateralScienceSM Wells Outperform Offset Wells in the Wolfcamp Shale



C&J Energy Services

LateralScience engineered completion delivers superior production results

Completion efficiency and productivity

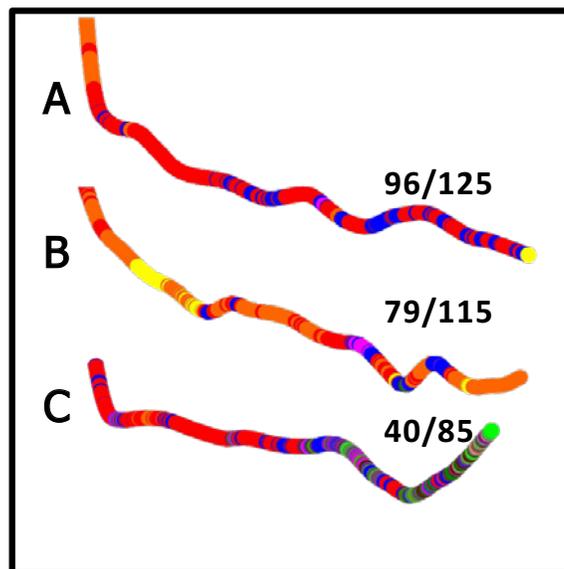
One of the strengths of the LateralScienceSM process approach is that the input data is available on every well, even those that were drilled years ago. This allows C&J Energy Services to evaluate historical wells to understand the relationship between the lateral heterogeneity results from the LateralScience process and actual well productivity.

To make this approach credible, we choose sets of wells where conditions correlate closely—the geology, the drilling program, and the completion procedures need to be very similar on the subject wells, and they should be as close together as possible geographically. When these conditions are satisfied, the primary factors driving variability in productivity between these “sister” wells are differences in lateral heterogeneity.

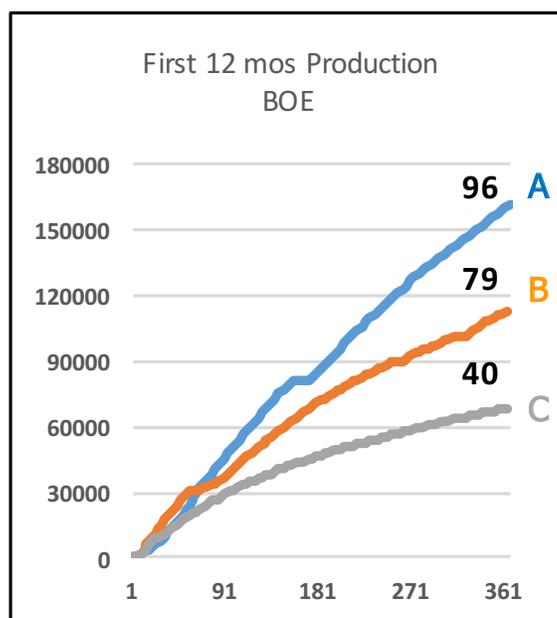
Predicting productivity in the Bone Springs formation

The three subject wells were all drilled in 2013-2014, targeting the Bone Springs formation. TVD of the horizontal section is 10640 ft. +/- 20 ft. All completions were executed in a similar fashion; five clusters per stage, with 50 ft. cluster spacing, and 150K lbs. proppant per stage. The lateral lengths varied between wells (4400-6150 ft.), as did the number of stages (17-25). As well productivity can be easily normalized to account for the lateral length, the similarity of these parameters made this set of wells appropriate for our evaluation of the relationship between lateral heterogeneity and well productivity.

Well A produced from a 6,150 ft. lateral with a 25-stage completion. LateralScience analysis predicted that 96 of the 125 clusters (77%) would contribute to flow. Well B produced from a 5,550 ft. lateral with a 23-stage completion. The prediction for this was that 79 of the 115 clusters (63%) would contribute to flow. Finally, Well C produced from a 4,400 ft. lateral with a 17-stage completion where LateralScience predicted that 40 of 85 clusters (47%) would contribute to flow. Well C was particularly interesting because it drilled very much like Well A until the midpoint of the lateral, where it appeared to have strayed out of the target zone. The operator attempted to steer back into zone but ultimately TD'd the well early because they were unsuccessful in their attempts to get back into the target formation.



LateralScience trajectory plots for the three Bone Springs wells



Cumulative oil production for the three subject wells correlates well with the contributing clusters prediction

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Findings

The cumulative oil production curves from the wells' first year online demonstrated an excellent correlation between well productivity and the LateralScience prediction of contributing clusters. LateralScience was able to differentiate the good well (Well A, with 161,355 BOE in year 1) from the bad well (Well C, with 68,801 BOE in year 1), both qualitatively and quantitatively. This case study supports the hypothesis that (1) well productivity is influenced by completion efficiency, and (2) the LateralScience process can quantify the completion efficiency and predict well performance.

The LateralScience analysis in the Bone Springs formation convinced the operator to use LateralScience to design engineered completions for three wells in a Wolfcamp play that they were actively developing.

LateralScience applied with success in the Wolfcamp Shale

The three subject wells were drilled and completed in the Wolfcamp A formation during 2015. Two of the wells were direct offsets and were compared to 21 other wells (group A) that were within a four mile radius. The third well was analyzed separately because it was not in close proximity to the other two wells. It was also compared to a group of wells within four miles. This group of wells (group B) included nine offsets.

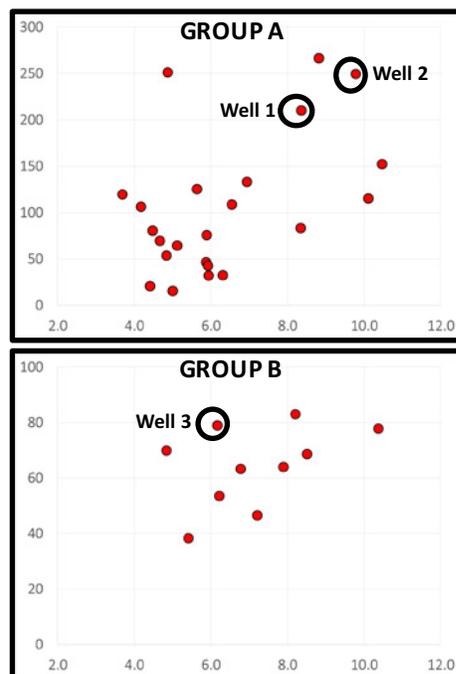
The two groups were chosen to ensure that the comparison wells had minimal differences in both geology and hydraulic fracture treatment technique. By controlling these factors we are able to effectively evaluate productivity differences between geometric completion designs and LateralScience-engineered designs. Productivity is expressed by the first six months' cumulative well production. The analysis is normalized for both proppant volumes and lateral length.

Result – Group A

In the first six months, these 23 wells produced an average of 3.4 BOE/lateral ft. per month. The two subject wells, completed with LateralScience designs, produced 5.7 and 5.2 BOE/ft. per month respectively, 61% better than the average. Only two of the other 21 wells in group A wells outperformed the LateralScience wells, putting these wells clearly in the top quartile for this area. We also evaluated the technique by looking at BOE as a function of proppant volume. By this metric, the two wells were 50% better than the average with only three of the other 21 wells ranking higher.

Result – Group B

The third well, which is located 17 miles southeast of the group A wells, was compared to the nine other wells in group B. The group B wells, in general, are significantly less productive than the group A wells. Group B wells averaged 2.3 BOE/lateral ft. per month. The LateralScience well produced 2.94 BOE/lateral ft. per month, 28% better than this average and is the best well in the group according to this metric. As a function of proppant volume, the subject well was 38% better than the average and only one of the other nine wells outperformed the subject well.



Cross-plot for each group with six month production (BOE* 103) on Y-axis and total proppant volume (lbs* 106) on X-axis