



# TAKING A TURN FOR THE WORST?

Examining the role of wellbore  
direction and fracture tortuosity

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# Taking a Turn for the Worst?

## Examining the role of wellbore direction and fracture tortuosity

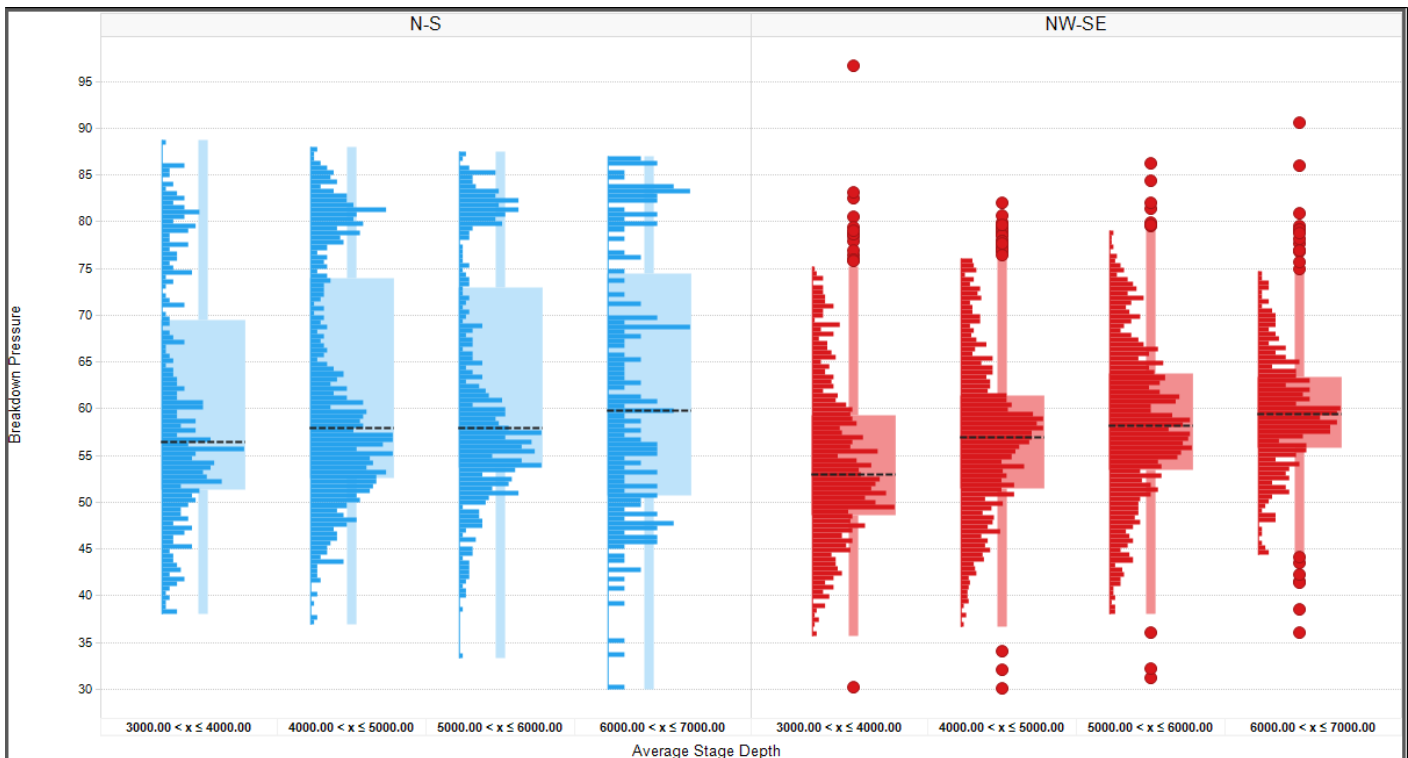
Melanie Popp, P.Eng., Senior Engineering Advisor, geoLOGIC systems Ltd.



While a breakdown may signal the *end* of a celebrity's career, a breakdown is just the start of a fracturing treatment – it is the pressure at which the near wellbore pressures “break down” to allow for fluids to be pumped into the formation and a fracture to be created. Often, the breakdown pressure is the highest pressure encountered during a fracture treatment and it is important to design the well to ensure that the breakdown pressure does not exceed the maximum allowable working pressure (MAWP).

Most operators choose to drill wells in the direction of minimum principal stress so that fractures can propagate transverse to the wellbore, which reduces the breakdown pressure. In the Western Canadian Sedimentary Basin (WCSB), the maximum stress is governed by mountain formation in the NE-SW direction, making NW-SE the desired azimuthal direction for minimum stress.

However, drilling diagonally in a grid-based land system presents issues from an exploitation perspective. Unless the operator has a large contiguous land base, it may make more sense to drill wells either N-S or E-W to maximize coverage of the land. How does that impact breakdown pressures? The chart below shows the average breakdown pressure by stage-measured depth, ordered by wellbore azimuthal direction.



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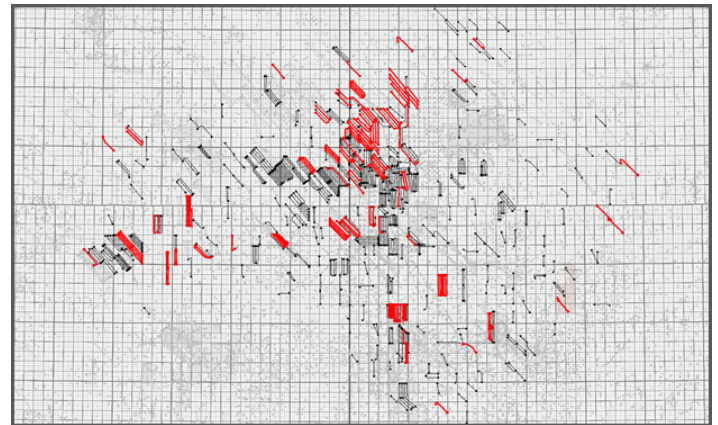
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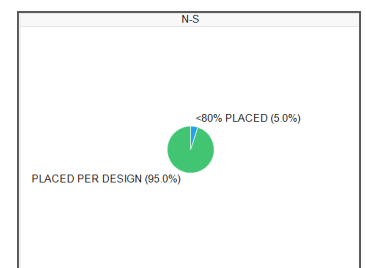
All the wells featured are cased, cemented and perforated. Due to the lack of E-W wells, they are eliminated from this analysis. Breakdown pressures are rarely affected by fluid type, although a large majority of the wells here are hybrid slickwater treatments.

Due to frictional losses in pipe, one would expect higher breakdown pressures at the toe of the well. Both sets of data exhibit this, yet the phenomenon is more pronounced in the NW-SE wells. The NW-SE data sets appear to be normally distributed, while the N-S wells are distributed bimodally with a larger confidence interval (shown in grey-shaded boxes) than the NW-SE wells. This lack of predictability may cause the working pressures of the well to be under-designed for the anticipated breakdown pressures.

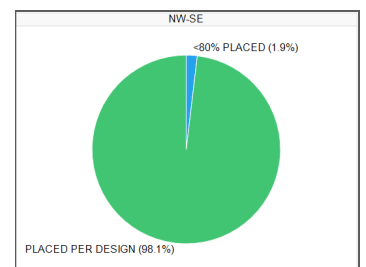
The map to the right highlights, in red, all the wells that have at least one stage with a breakdown pressure greater than 70 MPa. An initial look at the distribution spatially doesn't suggest any regional issues; the accumulation of high breakdown pressures in the center of the map can be attributed to a higher well count in that area.



Another effect of tortuosity is lack of placement success. The graphs to the right represent placement success by stage, where the hurdle for a successful treatment was >80% of the designed proppant placed. Note that the size of each pie is relative to the number of stages pumped. Placement success is greater in NW-SE wells (1.9%) than the N-S wells (5%).



If placement and pressure predictability is the main objective, then NW-SE wells are optimal. The next step will be to see what affect perforation strategy has on breakdown pressures – we'll examine this in a future article.



This work is made possible by combining multiple premium data sets together using the direct data link to the geoLOGIC Data Center (gDC).

To learn more about the gDC and our premium data sets, please contact [sales@geologic.com](mailto:sales@geologic.com).

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