

## **Geomechanical Approach to Assess and Mitigate Risk**

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### **ABSTRACT**

The exploitation of the north region in Colombia is very challenging. Its geological evolution has involved lateral/oblique compressional stresses, tilted blocks and subsidence followed by intense folding/uplift that impacts stress regime and pore pressure behavior. This complexity has posed significant technical challenges for drilling and commercial exploitation of gas resources in the area due to the frequent simultaneous occurrence of water inflows, gas kicks and high volume of losses (a gains-losses situation). Previous approaches considered a shallow overpressure associated with a high fracture gradient (FG), allowing for a wide operational mud window. Drilling experience indicated, however, that a better understanding and a more accurate estimation of overpressure and FG was necessary. With the aim of drilling optimization, a geomechanics analysis was conducted, based on existing information from local geology and production wells, in order to predict wellbore stability, pore pressure and fracture gradient and to identify drilling risks for the N-1 planned well. This analysis confirmed the presence of a shallow overpressure, whose occurrence, distribution and magnitude is controlled by the same geological events (especially uplifting) that shaped the basin. Understanding the geological evolution also allowed for a better understanding of stress regime changes over time. An accurate geomechanical model for pore pressure and fracture gradient estimation was constructed. This model offered a straightforward explanation of the gain-losses situations recorded in previous wells, and it indicated a feasible but conservative mud weight window for well N-1. N-1 well schematic and mud weight window were optimized through the geomechanics approach to deal with the challenges imposed by a narrow mud window. As a result, the N-1 planned well was successfully drilled in record time with no major drilling problems by using the recommended mud pressures and good drilling practices.