Modeling Detailed Wellbore Breakout Rotations in a Single Borehole in the Papua New Guinea Area to Constrain Active Fault Geometry Away from the Borehole

Castillo, David[1], Jon Rowse[2], Gavin Douglas[2], Katharine Burgdorff[1], Juergen Streit[1], Dan Kendrick[3], Nigel Wilson[2] (1) GeoMechanics International, Perth, Australia (2) Oil Search Limited, Sydney, NSW, Australia (3) 3-D-Geo, Brisbane, Queensland, Australia

High-resolution borehole image data acquired in the South East Mananda-5 and South East Gobe-11 wells has been used to constrain the far-field geomechanical model for their respective structures in the PNG Fold Belt area. Each of these wells indicated a locally consistent far field SHmax stress direction and stress magnitude profile. Interestingly, there was also fine-scale and localized wellbore breakout rotations or positions (borehole reference frame) within each well that clearly contrasted the regional SHmax stress trend. A few of these wellbore breakout rotations were abrupt particularly where the well intersected an active natural fracture. Many of these breakout rotations were massive but they varied systematically with measured depth with wavelengths exceeding over several hundred metres measured depth.

It has long been appreciated that slip failure along active faults will generate a localized and 2nd order stress field in the immediate vicinity of the fault. If a well is subsequently drilled in the vicinity of the fault, but never intersects the fault, the wellbore stresses resolved along the wellbore wall will be the superposition of the far-field stress (regional stress) and the fault-slip-induced near-by stress field (fault specific).

Modeling these observed wellbore breakout rotations has been performed to constrain the fault strike, fault dip and fault position with respect to the borehole location. A full integration of the breakout rotation modeling with a recently acquired passive seismic survey represents new information to better understand the neotectonic framework of the PNG area.