The Stress Regime of the Liard Basin, Western Canada

J.S. Bell[1], Larry S. Lane[2], and Sarah Saad[2]
[1]*Sigma-H Consultants, Ltd., Invermere, BC, Canada*
[2]*Geological Survey of Canada, Calgary, Alberta, Canada*

Abstract

As part of the Federal Geo-mapping for Energy and Minerals (GEM) Program, an in-situ stress analysis was undertaken in Liard Basinregionto assess regional stress orientations and magnitudes; and determine what influences createlocal perturbations. Stress trajectory maps provide useful information for hydrocarbon production strategy. Induced fractures at depth are likely to be vertical and aligned with the maximum horizontal stress. Also, fractures in such orientations are more likely to be open and thus provide preferred flow pathways for formation fluids. The study area includes northeastern British Columbia and adjacent Yukon and Northwest Territories. Only 49wells were found suitable to providestress orientation information, all but two from borehole breakout orientations. Accordingly, some of the conclusions must be considered preliminary. A regional horizontal stress trajectory map is broadly consistent with that of thebroader Western Canada Sedimentary Basin. Apronounced deflection of the regional stress trajectories is evident within the area bounded by the mountain front and the Bovie Fault. Local perturbations may relate to proximity to faults close to the foothills, or to the Slave Point edge/Arrowhead Salient farther east.

A broad regional selection of 64 wells provided density log data from which vertical stresses and effective vertical stresses were mapped.Vertical stress magnitudes were mapped at various depths. At depths of 500m and 1500m, they display complex local variations superimposed on a general trend of westward-increasing magnitudes.

Horizontal minimum stress data are limited by a regional scarcity of leak-off test data, and what data were available were concentrated inonlytwo areas.Accordingly, these data are more generalized and apply to a somewhat more restricted area. Finally, vertical stress and minimum horizontal stress magnitude estimates were used to model maximum horizontal stressgradients and magnitudes using breakout simulation techniques, for 27 wells where well-developed breakouts were available.From these models a preliminary map of the regional SHmaxgradient wasalsoproduced.