ESTIMATING SUBSURFACE FRACTURE SPACING WITH DATA FROM NEAR-VERTICAL WELLS

Wayne N'Arr(1)

ABSTRACT

Productivity of many petroleum reservoirs is enhanced by the presence of natural fractures. Typically the productive fractures are effectively a subsurface joint set - i.e. an areally extensive set of spaced, parallel fractures that are orthogonal to bedding. A new method has been developed for estimating the average distance between joints, based on statistics of fracture-borehole intersection. This method is particularly powerful where the spatial distribution of fractures is unknown, such as in the case of vertical wells through horizontal. beds.

Knowledge of fracture spacing is important for reservoir modelling and for planning optimal well deviation. When comparing well productivity differences due to fractures, or when looking for stratigraphic, structural, or other geologic effects on fracture density, it is necessary to normalize data into a common, comparative, and geologically meaningful format, and the **average fracture spacing** satisfies these requirements. For example, thick carbonate sequences often do not contain regular mechanical layering, hence the use of a bulk fracture characteristic for an entire formation, such as the average fracture spacing, is appropriate.

Results of applying this method show that in different formations in a single well the average fracture spacing of open, joint-like fractures can vary from 4.5' to >3000'. Within a single formation in different wells average fracture spacing can vary from 15' to >2000'.

After establishing areal fracture spacing trends in a target formation, the fracture intersection rate as a function of well deviation can be computed in order to plan **optimal well deviation**. Optimal deviation (from vertical) is the angle that balances a high fracture-intersection rate with the need to achieve vertical progress through a formation.

(1)Chevron Overseas Petroleum Incorporated

U.S.A.