AAPG Datapages/Search and Discovery Article #90255 © 2016 AAPG/SEG International Conference & Exhibition, Barcelona, Spain, April 3-6, 2016

Prediction of Fracture Networks in Structural Traps: Insights from Outcrop Characterisation of Four-Way Closing Anticlines in Reservoir Analogues

Richard Jones[1], Sotirios Kokkalas[2], Jonathan Long[3], and Susie Daniels[3]

[1]Geospatial Research Ltd
[2]The Petroleum Institute, Abu Dhabi
[3]Geospatial Research Ltd.

Abstract

Detailed, quantitative characterisation of fracture networks measured in outcrop analogues provides the basis for robust discrete fracture network (DFN) models that can be used to predict flow performance of fractured reservoirs. The extent of outcrop studies is often sub-optimal, caused by many factors, including limitations in the amount of suitable surface exposure, access restrictions, or considerations of time or budget. In the absence of reliable outcrop data to quantify the spatial variation of fracture network parameters across an entire anticline, a common strategy is to assume correlation with elements of the regional fold geometry; for instance, fold curvature is typically used as a proxy for fracture intensities. We present extensive new field data from anticlines in the Middle East to test the validity of this approach.

In order to be able to constrain the spatial variation of fracture intensity we measure fractures at multiple scales, and carefully relate intensity to fracture size. Virtual outcrop models derived using terrestrial lidar and photogrammetry are useful in generating large fracture models that bridge the scale-gap between satellite analysis and traditional outcrop-based ("hands-and-knees") studies.

Study areas across wide areas of the northern Zagros (Kurdistan Region of Iraq) and from the frontal part of the Oman Fold Belt in United Arab Emirates contain excellent surface outcrops of regionally important fractured reservoir units, exposed in large-scale fractured periclines (four-way closing anticlines). Surface data allows the regional fold geometry to be well constrained and the multi-scale fracture network to be characterised in detail. Seismic and borehole data provide additional constraint on the sub-surface fold geometry and the existence of large-scale thrusts in the core of some of the folds. Data showing the complexity of the relationship between fold geometry and fracture intensity are presented, and the implications for prediction of fracture networks in naturally fractured reservoirs are discussed.