AAPG Datapages/Search and Discovery Article #90295 ©2017 AAPG Asia Pacific Region GTW,
Influence of Volcanism and Associated Magmatic Processes on Petroleum Systems, Oamaru, New Zealand, March 14-16, 2017

Fracture Analysis of Deformation Structures Sssociated with the Trachyte Mesa Intrusion, Henry Mountains, Utah: Implications for Reservoir Connectivity and Fluid Flow Around Sill Intrusions

Penelope I.R. Wilson[1], Ken J.W. McCaffrey[2], David J. Sanderson[3], Robert. W. Wilson[4], and Ian Jarvis[1]

[1]Kingston University London, UK
[2]Durham University, UK
[3]University of Southampton, UK
[4]BP Exploration, UK

ABSTRACT

Shallow level intrusions are a common feature of many basins currently being explored for hydrocarbon potential. However the sub-seismic structure and reservoir scale implications of igneous intrusions are poorly understood. The Trachyte Mesa intrusion is a small (~1.5 km2), NE–SW trending satellite intrusion to the Mount Hillers intrusive complex in the Henry Mountains, Utah. It is emplaced within the highly porous, aeolian Entrada Sandstone Formation producing a network of deformation bands with conjugate sets of NE–SW striking deformation bands trending parallel to the intrusion margins. A small study of the fracture network has been carried out at 6 sample stations along a ~100 m long, NW–SE trending transect across the north-western lateral intrusion margin. Following the methodology of Sanderson and Nixon (2015), the network was characterized by a series of nodes and branches, from which the frequency, density (intensity), spacing, characteristic length, and dimensionless intensity of the deformation band traces and branches were determined. These quantitative geometric and topological measures are supplemented with petrological, porosity and microstructural analyses. Results show a marked increase in deformation band intensity and significant porosity reduction with proximity to the intrusion. The deformation bands are likely to impede fluid flow, forming barriers and baffles within a reservoir. A corresponding increase in Y- and X- nodes highlights the significant increase in deformation band connectivity, which in turn will significantly reduce the permeability of the sandstone. This study indicates that fluid flow in deformed host rocks around igneous bodies may vary significantly from that in the undeformed host rock. Therefore, a better understanding of the variability of deformation structures, and their association with intrusion geometry, will have important implications for hydrocarbon reservoir deliverability and CO2 sequestration.