Accepted Manuscript

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PII: S0191-8141(17)30183-9

DOI: 10.1016/j.jsg.2017.09.010

Reference: SG 3528

To appear in: *Journal of Structural Geology*

Received Date: 26 May 2017

Revised Date: 7 September 2017

Accepted Date: 13 September 2017

Please cite this article as: Farrell, N.J.C., Healy, D., Anisotropic pore fabrics in faulted porous sandstones, *Journal of Structural Geology* (2017), doi: 10.1016/j.jsg.2017.09.010.

Anisotropic pore fabrics in faulted porous sandstones

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Keywords: Porosity, Faulting, Image analysis, Anisotropy, Porous sandstone, Permeability

Abstract

The fabric of pores in sedimentary rocks around fault zones can be subject to significant modification. Knowledge of how pore fabrics vary during and after faulting is important for understanding how rocks transmit fluids around fault zones, and can help to predict mechanical instability due to changes in pore fluid pressure. Datasets detailing the geometry of pore fabrics in faulted porous rocks are lacking. This paper describes pore fabrics quantified from two outcrops of normally faulted sandstone. The porosity and the size, shape and geometry of pores were quantified from core plugs and thin sections. Results were mapped within a framework of the faults to better illustrate how these datasets may be used to improve understanding of fluid flow around fault zones. Results from a mature, quartz-rich arenite show a change in pore fabric from pores oriented horizontally and parallel to laminations to pores oriented at a low angle to σ_1. Pore fabrics quantified from a clay-rich, quartz sub-arkose changed from moderate aspect ratio pores with no preferred orientation, to high aspect ratio pores oriented dominantly sub-parallel to the fault surface. Permeabilities measured on corresponding core plugs showed anisotropy of permeability with maximum permeability oriented down fault dip around both faults.

1. Introduction

Porosity is a measure of a rock's capacity to store fluid, and is simply defined as a scalar value equal to the ratio of the void volume to the total rock volume. Porosity is important to quantify as fluid storage capability determines the amounts of valuable resource fluids that may have