Click to View Poster Presentation (33mb)

PS Influence of Sedimentary Fabric on Fracture Characteristics of Two Thick Shoreface Deposits of the Lower Cretaceous Moosebar Formation, West Central Alberta*

Jenna Sie[1] and Per Kent Pedersen[2]

Search and Discovery Article #51312 (2016)**
Posted October 31, 2016

*Adapted from poster presentation given at AAPG 2016 Annual Convention and Exhibition, Calgary, Alberta, Canada, June 19-22, 2016

[1]Department of Geoscience, University of Calgary, Calgary, Alberta, Canada (jksie@ucalgary.ca)
[2]Department of Geoscience, University of Calgary, Calgary, Alberta, Canada

Abstract

Reservoir properties, such as preferential fracture flow pathways, can be better understood by studying the connectivity and continuity of natural fracture networks. By quantifying the fracture networks observed in outcrops, extrapolation of fracture populations within the subsurface can aid in maximizing fluid extraction. In this study, the influence of sedimentary fabric on the fracture network of two shoreface sandstones was analyzed to determine the effect of internal fabric on fracture characteristics. Two thick shoreface sandstones of the Lower Cretaceous Moosebar Formation (equivalent to the subsurface basal Falher Member H of the Spirit River Formation) were chosen because of their lithological similarities but different sedimentary fabric. Collection of outcrop scanlines allowed comparison of fracture characteristics and observation of the influence of fabric controlled by bioturbation and cross-stratification.

The consecutively deposited shoreface sandstones are comprised of very fine- to fine- grained coarsening upwards succession with high clay and glauconite content, and similar thicknesses of ~4.5 meters. The upper sandstone (A) has well developed hummocky cross-stratification; the lower sandstone (B) is more massive due to intense bioturbation. Scanlines were measured on three distinct sedimentary facies within each sandstone based on bed thickness: Facies 1 has bed thicknesses of 0.05-0.30m, Facies 2 of 0.30-0.60m, and Facies 3 of 0.60-2.50m. Although individual fracture characteristics of each facies is not directly applicable to the subsurface, relative ratios between corresponding facies can likely be applied when comparing fracture intensities collected at the same orientation. For example, a 70m visual scanline provides fracture intensities of Facies 3A and Facies 3B of 2.01f/m and 1.31f/m, respectively. Facies 2A and Facies 2B have fracture intensities of 2.36f/m and 2.01f/m, while Facies 1A and Facies 1B are 3.22f/m and 2.55f/m. Therefore, the overall ratio of Sandstone A to Sandstone B tends to correlate to an average of ~30-35% higher fracture intensity in the cross-stratified sandstone. Fracture height appears to be inversely proportional to fracture intensity for both sandstones, which might be caused by the presence of mud on bedding planes in Sandstone A, where the majority of

fractures terminate. The more massive character of the intensely bioturbated Sandstone B has taller and fewer fractures. Results of this analysis suggest that internal fabric, mechanical bed thickness, and presence of mud have an effect on fracture characteristics of shoreface sandstones.

References Cited

Berg, C.R., 2012, The Effect of Fracture and Borehole Orientation on Fracture Frequency and Density: RDA Dip Interpretation Suite Tutorial, ResDip Systems, 43 p. http://www.resdip.com/docs/fracture%20orientation.pdf Website accessed October 2016.

Cooke, M.L., and C.A. Underwood, 2001, Fracture Termination and Step-Over at Bedding Interfaces Due to Frictional Slip and Interface Opening: Journal of Structural Geology, v. 23, p. 223-238.

Hayes, B.J.R., J.E. Christopher, L. Rosenthal, G. Los, B. McKercher, D. Minken, Y.M. Tremblay, and J. Fennell, 1994, Cretaceous Mannville Group of the Western Canada Sedimentary Basin, *in* G.D. Mossop and I. Shetsen (compilers), Geological Atlas of the Western Canada Sedimentary Basin: Canadian Society of Petroleum Geologists and Alberta Research Council, p. 317–334.

Odling, N.E., P. Gillespie, B. Bourgine, C. Castaing, J.P. Chiles, N.P. Christensen, E. Fillion, A. Genter, C. Olsen, L. Thrane, R. Trice, E. Aarseth, J.J. Walsh, and J. Watterson, 1999, Variations in Fracture System Geometry and Their Implications for Fluid Flow in Fractured Hydrocarbon Reservoirs: Petroleum Geoscience, v. 5, p.373-384.

Rosenthal, L., 1988, Stratigraphy and Depositional Facies, Lower Cretaceous Blairmore-Luscar Groups, Central Alberta Foothills: Field Trip Guide to Sequences, Stratigraphy, Sedimentology, Surface and Subsurface: Canadian Society of Petroleum Geologists, 55 p.

Taylor, D.R., and R.G. Walker, 1984, Depositional Environments and Paleogeography in the Albian Moosebar Formation and Adjacent Fluvial Gladstone and Beaver Mines Formations, Alberta: Canadian Journal of Earth Sciences, v. 21/6, p. 698-714.

Underwood, C.A., M.L. Cooke, J.A. Simo, and M.A. Muldoon, 2003, Stratigraphic Controls on Vertical Fracture Patterns in Silurian Dolomite, Northeastern Wisconsin: AAPG Bulletin, v. 87/1, p. 121-142.

Zeeb, C., E. Gomez-Riva, P.D. Bons, and P. Blum, 2013, Evaluation of Sampling Methods for Fracture Network Characterization Using Outcrops. AAPG Bulletin, v. 97/9, p. 1545-1566.