

# Characteristics of the Great Plains Polygonal Fault System within the Williston Basin

Andy St-Onge<sup>1</sup>

## Abstract

*Late Cretaceous sediments deposited within the Western Interior Seaway are host to an extensive polygonal fault system throughout the Williston Basin. This talk will present faulting characteristics for sediments throughout the Basin using 3-D seismic, well control and surface geology. Polygonal fault systems (PFSs) are normal faults and fractures that can form in fine-grained sediments shortly after deposition without external stresses. They grow vertically and intersect laterally to form coalesced fault traces with characteristic planform polygonal geometries. Faults can begin within Colorado Group sediments at the base of the Upper Cretaceous and can continue through the Frenchman Formation at the Top of the Upper Cretaceous. The faults can have up to 80 m of vertical offset with strikes up to 1 km and dips ranging from 40° to 80°. Fault densities can reach up to 10 faults/km<sup>2</sup>. The faulting has been identified at outcrop but has been attributed to other causes such as toe slope erosional slumping and glacial processes. The faulting has been identified on seismic data and has been attributed to Devonian Prairie Evaporite Formation bed dissolution. The PFS faulting may be responsible for wide ranging processes from surface drainage patterns to in situ hydraulic transmissivity enhancement, structure at outcrop and other geotechnical hazards, or hydrocarbon seal integrity loss. Numerous examples using 3-D seismic, surface geology and wellbore cross section will show some of the structural characteristics for the polygonal fault system. This is the largest PFS in the world; most other PFS have been identified on continental margins where drilling density is very low. Improving our understanding of the Great Plains PFS within the Williston Basin using well control surface geology and outcrop will help us to understand PFS worldwide.*

<sup>1</sup>PFS Interpretations Ltd., Calgary geophysicist@shaw.ca 1-403-969-3272

**Andy St-Onge, P. Geoph., Ph. D., MBA**, is a geophysicist based in Calgary with extensive experience exploring for hydrocarbons throughout the Williston Basin since 1988.