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Seismogenic polygonal fault system generation

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Summary

Polygonal fault systems (PFS) have been studied since their identification with the advent of 3-D seismic data. PFS are large areas of normal faulting. The faults are so numerous they intersect to form polygonal forms in plan view. A model for the formation of polygonal faults is presented here. The model is based upon the stratigraphy in the Upper Cretaceous in the Western Interior Seaway (WIS).

Refracted and/or reflected P-waves (possibly from volcanic eruption) impede the shallow ocean muds which contain a lot of bentonite. Bentonite mud is a non-Newtonian fluid. The mud becomes more solid as more force is applied. So, the upward wave reflects to go downward eventually (but quickly); there is a lot of energy in a small space, where thermoacoustic effects may dominate. If there is anytime where the tensile mud strength is overcome by the waves, the mud will fail, like tempered glass.

Faulting initiates and can grow over time, to where beds have 80 m of vertical offset in southeast Saskatchewan. The PFS faulting can be seen across the WCSB, from the Colorado Formation in Manitoba, throughout all of Saskatchewan in the Upper Cretaceous, in various areas of Alberta as well as British Columbia. Finally the model can be used across the entire extent of the WIS down to Texas.

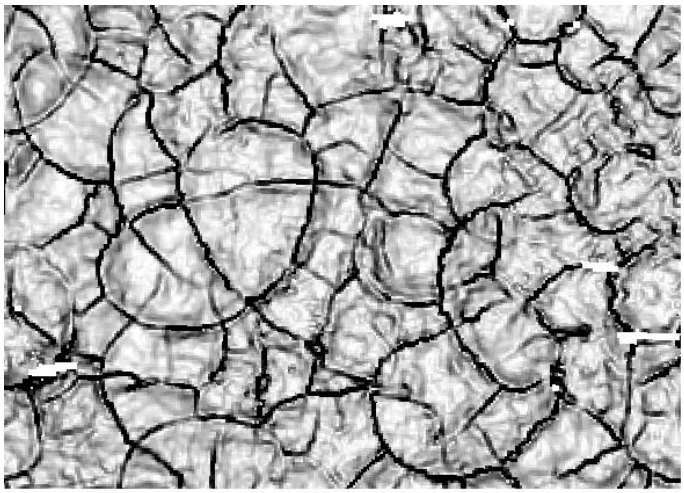

Figure 1 – a typical polygonal fault pattern from a 3-D seismic dataset acquired on the Manitoba/Saskatchewan border, about 150 km north of the USA. The faults resemble mudcracks at a 10,000x scale. A 3x3 Gaussian edge detection filter applied to the interpreted Milk River reflection on the 3-D dataset produced this image.