Damage Away from a Small Fault in the Porous Sandstones of the Satanka Formation, Colorado

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Damage can accrue incrementally away from faults, even when the offset on that fault is small, as has been shown by a vast body of previous work. This damage often includes fractured and compacted grains, and therefore significantly reduces porosity in the vicinity of the fault. Previous studies have shown that the damage zone around a fault can often act as a considerable barrier to fluid flow. This study takes thin sections from the interbedded Permian Satanka (Owl Canyon) and Ingleside Formations at Carter Lake Reservoir, Colorado, which is a fine-grained, quartz sandstone interbedded with shale layers. The rocks are gently dipping to the E, part of the limb of a syncline associated with a NW-trending oblique slip fault to the E of the reservoir. In thin section, the sandstone unit of interest from the Ingleside Formation is revealed to be porous, well-sorted and probably eolian in origin. This study presents thin sections within the damage zone of a small strike-slip fault in the study area. The fault itself is a reactivated or sheared joint, part of a systematic NE-trending sub-vertical joint set, which displays horizontal mineral lineations. Not all joints within this systematic set are sheared. Close to the fault, the quartz grains are compacted and grain boundaries sutured, pore space is reduced and the grains show a high fracture density. There does not appear to be a systematic orientation to the fractures in the cataclasite in this highly deformed zone. As distance from the fault increases, porosity gradually increases again and microfracturing (that is, fracture density) and cataclasis decrease. It is important to note that all damage in this damage zone is micro-scale; the rock in hand sample and in outcrop appears intact either side of the slip surface. We anticipate that the permeability of the sample close to the fault surface and where the damage zone appears to end will be

significantly different due to the observed differences in porosity; this result has implications for fluid flow around fracture systems that may have been reactivated due to shear in favorably oriented stress regimes.

AAPG Datapages/Search and Discovery Article # 91200 © 2020 AAPG Annual Convention & Exhibition Online, Sept. 29- Oct. 1.