Introduction to special section: Fault damage zones

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In this special section, we include investigations of different aspects of fault damage zones, including seismic interpretation, field observations, laboratory experiments, theoretical models, numerical simulations, and case studies of exploration and production of reservoirs. Fault damage zones are complex bodies that develop along major faults and include a multitude of faults, fractures, breccia bodies, secondary mineralization, alteration zones, and gouge. The mechanical and hydrologic properties of damage zones play a central role not only in hydrocarbon basin analysis, e.g., migration and trapping of hydrocarbons, but also earthquake activity, ore deposits, and geothermal sites. We are still a long way from fully understanding the structure and geomechanical properties of damage zones, which is critical for production through horizontal boreholes and successful hydrofracturing of unconventional deposits.

Kolyukhin et al. detail seismic analysis of fault damage zone models described by using a novel fault facies technique. The authors compare geological models and seismic images to study how well seismic images reflect the modeled geological features.

Damaskinskaya et al. describe a method for the early prediction (at early stages of deformation) of the spatial region in which a fault can be formed in rock samples. The authors show that the fracture stages can be distinguished by the type of energy distribution function of acoustic emission signals.

In order to show the potential of seismic data for characterization of fault zones, **Botter et al.** investigate synthetic seismic images of a reservoir fault-facies model. By using an adequate combination of seismic attributes, the authors are able to subdivide seismic images of the fault zone into several seismic facies from a highly deformed fault core to a less deformed damage zone.

Gong et al. describe the distribution characteristics of fractures in volcanic rocks of the Yingcheng Formation. The authors also discuss the controlling factors, roles, and sequences of fractures, and the relationship between fracture formation and gas migration and accumulation.

Qu et al. investigate the response of reservoir simulations to the inclusion of an explicitly rendered fault damage zone in combination of different fault core transmissibility multiplier. The authors address whether, or under which circumstances, the spatial property variation of fault damage zones influences reservoir performance.

Alaei and Torabi develop a method using reflection seismic data to image fault details that are otherwise hidden in the data. For the first time, the authors extract geometrical data of seismic fault damage zones and statistically correlate them with the data derived from outcropped faults.

Lyu et al. characterize the subsurface fault damage zones in the tight-oil sandstones integrating cores, image logs, and conventional logs. The fault damage zones differ from the background fractured zones in the response intensity in conventional logs and the depth interval.

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