Geophysical Research Abstracts
Vol. 16, EGU2014-7780, 2014
EGU General Assembly 2014

Surface analogue outcrops of deep fractured basement reservoirs in extensional geological settings. Examples within active rift system (Uganda) and proximal passive margin (Morocco).

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The important role of extensive brittle faults and related structures in the development of reservoirs has already been demonstrated, notably in initially low-porosity rocks such as basement rocks. Large varieties of deep-seated resources (e.g. water, hydrocarbons, geothermal energy) are recognized in fractured basement reservoirs. Brittle faults and fracture networks can develop sufficient volumes to allow storage and transfer of large amounts of fluids. Development of hydraulic model with dual-porosity implies the structural and petrophysical characterization of the basement. Drain porosity is located within the larger fault zones, which are the main fluid transfer channels. The storage porosity corresponds both to the matrix porosity and to the volume produced by the different fractures networks (e.g. tectonic, primary), which affect the whole reservoir rocks. Multi-scale genetic and geometric relationships between these deformation features support different orders of structural domains in a reservoir, from several tens of kilometers to few tens of meters. In subsurface, 3D seismic data in basement can be sufficient to characterize the largest first order of structural domains and bounding fault zones (thickness, main orientation, internal architecture, ...). However, lower order structural blocks and fracture networks are harder to define. The only available data are 1D borehole electric imaging and are used to characterize the lowest order. Analog outcrop studies of basement rocks fill up this resolution gap and help the understanding of brittle deformation, definition of reservoir geometries and acquirement of reservoir properties. These geological outcrop studies give information about structural blocks of second and third order, getting close to the field scale. This allows to understand relationships between brittle structures geometry and factors controlling their development, such as the structural inheritance or the lithology (e.g. schistosity, primary structures). Two field cases, located in Morocco and Uganda, allow us to investigate basement complexes at different stages of an extension process and give us analog geological data of similar fractured basement reservoirs. Border faults and associated fracture networks of an active rifting system propagated in Proterozoic basement rocks are analyzed in the Albertine rift system in Uganda. Brittle structures developed along a proximal passive margin of the Atlantic domain are analyzed in Proterozoic basements rocks in Western Anti-Atlas in Morocco.