Geophysical Research Abstracts
Vol. 19, EGU2017-1083, 2017
EGU General Assembly 2017

The Interactions of tensile fractures with the surrounding lithology and other tensile fractures

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Abstract–Tensile (mode 1) fractures such as joints and veins are ubiquitous in the upper crust and are potential pathways for fluid migration. Fractures often cross cut one another and terminate at other fractures. This is dependent on whether the older fracture was open or shut when the younger fracture propagated. There is a paucity of data concerning the geometric properties of the fracture intersections (branchlines), including their orientations, length, continuity and connectivity. This poster aims to investigate how natural hydraulic fractures propagated and interacted along branchlines, through study of well-preserved, three-dimensional exposures of natural hydraulic fracture surfaces that cut the organic rich Bituminous Shale (Mulgrave Shale Member of the Lower Jurassic Whitby Mudstone Formation) at Saltwick Nab, Whitby, the Yorkshire coast, UK.
A specific objective is to investigate the possible influence of branchlines on key structures associated with fracture surfaces, such as fracture tip lines, radial striations and arrest lines, as well as petrographic differences between fractured and non-fractured rocks. These relationships will be investigated by quantifying: a) the spacings between neighbouring arrest lines, measured in directions parallel and perpendicular to the sedimentary layering, and b) the scaling relationships between arrest lines observed on large and smaller fracture surfaces. Combining these findings with previous work it will be possible to make models for how natural hydraulic fractures propagate and terminate giving a greater understanding of how natural hydraulic fractures link together within an exhumed shale analogue, such as those seen at Saltwick Nab. It may also provide an insight in to the growth of anthropogenic hydraulic fractures that are induced during stimulation of shale gas and oil reservoirs.