Brittleness Index: a tool to quantify the probability of dilatant fracturing in mudrock topseals.

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One of the characteristics of good top seal lithologies is their ability to undergo deformation without the formation of permeable fracture networks. This property is often loosely called ductility. The opposite of this may then be defined as top seal brittleness. Such lithologies will dilate during deformation and form fracture networks, which may prevent the accumulation of hydrocarbons or cause existing accumulations to leak. The main parameter to quantify brittleness is the ratio of compressive strength and mean effective stress at the time under consideration.

We present a theoretical analysis of this condition, propose a definition of the Brittleness Index (BRI) for the stress regime corresponding to normal faulting, and compare this with experimental determinations of the onset of dilatancy in mudrocks.

A practical application of this method requires an estimate of the compressive strength which is obtained from acoustic velocities and surface area measurements on cuttings. We present the results of a regional study of top seal brittleness in Paleozoic and Mesozoic mudrock top seals in North Oman. In general BRI was found to increase with depth. A database of established seals was analyzed for the occurrence of hydrocarbon accumulations as a function of BRI distribution in the top seal. Results show a clear tendency for accumulations to occur under top seals with low BRI, while structures with higher BRI are less likely to be hydrocarbon-bearing.