Characteristics of fluid-flow migration (bleached rock) around major structures in a reservoir-cap rock system, SE Utah, USA

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Bleached rocks are commonly formed from CO$_2$-saturated water leakage to the surface. It could provide opportunities to understand the mechanisms and controlling factors associated with injected and sequestrated CO$_2$ leakages as well as fluid flow in the subsurface. In this study, we investigated the various bleaching patterns and their related structures in order to understand the characteristics of fluid-flow migration around the major structures. Also, we examined the effects of lithology and structural characteristics on fluid flow in detail along and around the major structures. For this purpose, we analyzed bleaching characteristics of multiple layered sedimentary rocks around two major faults (Moab and Salt Wash Faults) and fold axes (Green river anticline system) based on field observations and quantitative measurements (scanline survey and permeability) in the exhumed reservoir-cap rock systems in SE Utah, USA. The results showed that strongly bleached layers of sedimentary rock have a higher density of deformation bands compared to unbleached layers. This is consistent with the general property of deformation bands that frequently develop in layers with higher porosity and permeability. Although almost all fault zones act as conduits for fluid flow, some fault zones filled with clay-rich gouges could impede fluid flow. In addition, the internal sealing characteristics of the layer boundaries such as bedding planes could be important factors as they can act either as a pathway or a barrier for lateral fluid flow depending on the existence of filling materials such as calcite or kerogen. Our research may be useful for assessing CO$_2$ leakage in oil reservoirs or CO$_2$ sequestration sites located in a reservoir-cap rock system of sedimentary basins.