Comparison of digital outcrop and conventional data collection approaches for the characterisation of naturally fractured reservoir analogues

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In this study, fracture systems developed within faulted, high porosity sandstones in the decommissioned mines of Alderley Edge, Cheshire, UK are characterised using lidar based analysis. The geometry of the mine workings prove to be conducive to the extraction of fracture attributes, whilst providing a degree of exposure of a notable Triassic aged reservoir outcrop analogue (Helsby Sandstone Formation) not afforded at the surface.

To test the fidelity of the approach, fracture statistics generated from lidar derived digital outcrop models are compared to an equivalent dataset collected using conventional manual surveys, with digital outcrop and manually acquired fracture attributes used to populate discrete fracture network models. These are upscaled to provide equivalent porous medium properties, enabling the impact of uncertainties introduced into fracture modelling workflows by lidar based techniques to be assessed.

Whilst broadly comparable to fracture attributes obtained using manual surveys, the systematic underrepresentation of fracture properties is observed within lidar derived dataset, resulting in the underestimation of fracture network flow capacity. The study results suggest that, whilst enhancing data acquisition rates and coverage of exposure surfaces, the use of digital discontinuity analysis may introduce additional biases into fracture datasets, increasing the level of uncertainty within resultant modelled networks.