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Using core and outcrop analogues to predict flow pathways in core: examples from the Permo-Trias of North-Cheshire UK

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As part of the UK Geoenergy Observatories (UKGEOS) project at Ince Marshes in Cheshire (north-western England), it is planned that boreholes will be drilled, across a ∼12km2 spatial area. The proposed boreholes will range in drilled depth from 50m to 1200m (below surface), producing >3000m of new core in the area of interest largely from the Permo-Triassic Sherwood Sandstone Group (SSG). Alongside the drilled core, a series of downhole sensors will be installed in the holes providing an exceptional array of monitoring within the subsurface. The SSG is a principal aquifer, a hydrocarbon reservoir offshore and onshore and a potential host for CO_2 storage. Borehole core provides detailed vertical data which can be used to interpret the subsurface sandbody architecture but relies on assumptions including the relationship between lateral and vertical thickness, and the interconnectivity of units. The sedimentological complexity of the Sherwood Sandstone succession in this area, passing between aeolian and fluvial packages creates local- and regional-scale heterogeneity which will impact fluid flow within the rock mass. Measured thickness might represent an architectural element's true maximum thickness or more likely a partial thickness as a result of incision by overlying facies types or as a result of the borehole sitting towards the margins of individual elements (e.g. tapering margin of channel elements). Length and thickness data was gained from a suite of primary outcrop data and secondary published data in the region. Statistical techniques were then used to provide a series of predictive measurements for interpreted length variations from vertical logged information. The addition of field data allows the interpretation of likely 3D volumes from a one-dimensional datasets, providing potential architectural framework of the Permo-Triassic succession in this area to be established. The interpreted high resolution sub-seismic architecture will contribute to methodologies for tests at the UK Geoenergy Observatory at Ince Marshes and continuing refinements to the thickness-length relationship data will be made as more data becomes ingested. Length and thickness data has been used to create a series of qualitative stochastic realisations of possible subsurface architectural geometries and arrangements. Therefore increasing understanding of flow pathways and how these may effect sustainable energy technologies such as geothermal, carbon storage and energy storage.