Inferring Likely Fluid Movement From Rock Outcrops – The Range of Interpretations

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ABSTRACT

One issue in reservoir development is the predictability of reservoir performance given the limited available data. It would be beneficial if we could view an outcrop and infer the likely dynamic behaviour in an analogous reservoir. In viewing outcrops therefore we need to understand the complex interplay of how specific fluids interrogate the various heterogeneities; this can lead to a variety of interpretations. Previous work has shown that a variety of interpretations are available when viewing the same seismic section – this study proceeds along similar lines in the case of a rock outcrop. Within field simulation can enhance our ability to identify the key geological aspects affecting fluid flow. Thirty-five Reservoir Engineers and Geoscientists, from different companies, were asked to view the outcrop at Tullig Point in south west Ireland. The outcrop is interpreted as a distributary channel or mouth bar succession that can be viewed both panoramically, from a neighbouring promontory, and also in detail through field glasses; thus, enabling geological interpretation. The group was divided into 7 teams; each team estimated the horizontal and vertical permeability. A 2-D grid was superimposed over a photograph of the outcrop, pseudo-logs of an injector and a producer well, and the fluid properties of the resident oil, gas as well as the water that was to be injected into the reservoir section. Each team interpreted the geology and estimated values for the each node of the grid; these values were then used to simulate the recovery of oil, gas and water-cut development using a black-oil simulator. The seven sets of results could then be compared and the performance pegged to the estimated permeability and hence back to the observations at the outcrop. The simulation ran for one year and the recovered cumulative oil varied 3 fold (38Mbbls to120Mbbls), the time to 80% water cut ranging from 12 days to 131 days. The span of predicted performance was thought surprising, since the data set was possibly richer than is usual in the evaluation of reservoir performance for real reservoirs. It was concluded that both the geology and the fluid movement needed to be taken into account when considering the outcrop. Understanding how small variations in rock properties can profoundly influence fluid movement is enhanced.