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Predicting porosity, permeability frequency and hydrocarbon saturation using cuttings gas logs

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The aim of this project is predict the porosity, permeability and hydrocarbon saturation of reservoir rocks during drilling using advanced techniques to analyse the cuttings gas measurements. Success in such a venture would reduce the necessity for LWD or traditional wireline data as well as enabling the characteristics of the subsurface rocks to be better understood extremely early in the exploration. Previous work, especially that of Cuddy has indicated that low resolution hydrocarbon shows during drilling may be used to predict porosity and hydrocarbon saturation. Three parameters show promise. These are the hydrocarbon wetness ratio, the hydrocarbon balance ratio, and the hydrocarbon character ratio. Each of these is calculated from the first five cuttings gas measurements (i.e., C1 to C5). The relationship of these hydrocarbon ratio to specific rock properties is complex: advanced analysis techniques such as the use of genetic algorithms and/or fuzzy logic needs to be used. An anonymous but typical well from the UK Sector North Sea has been analysed in the standard manner for porosity and hydrocarbon saturation using conventional well log data. This data was then used together with the cuttings gas ratios to calibrate a genetic algorithm. The software to do this combines the advantages of both the genetic algorithm approach and the fuzzy logic analysis technique. The resulting calibrated genetic algorithm can be used to predict the porosity, permeability and hydrocarbon saturation from cuttings gas ratios in other associated wells in the same field with a high degree of accuracy.