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Integrated Petrophysical Characterisation of a Highly Heterogeneous and Layered Carbonate Reservoir: a New Approach

A new detailed approach, used in order to evaluate a huge gas-condensate carbonate reservoir, is here presented. This approach, based on the integration of core and log data, resulted very efficient in the petrophysical properties characterisation. The reservoir is made of vertically heterogeneous Permian/Triassic carbonates, covering a wide spectrum from sabkha to deep marine environments. The petrophysical properties appear to be controlled both by the depositional setting and by their diagenetic modifications. Wellbore logs have been statistically analysed through a cluster analysis algorithm grouping hierarchically the log readings according to their statistical similarity and producing a set of electrofacies. The core plug population has been then subdivided into different groups corresponding to the various electrofacies of the cluster analysis and subsequently grouped into four aggregates, supported by the sedimentological and diagenetic classification. The rock typing based on the aggregation of different electrofacies represented the key point to decode the initial petrophysical chaos and re-conduct the reservoir rock to a more tidy scenario obtaining different PHI vs. K relationships, consistent with the geological data. The electrofacies aggregates resulted to be also effective in driving the log interpretation (CPI) in terms of saturation and cementation exponents ("m" and "n") and in estimating the synthetic permeabilities, stochastically calculated, according to the statistical scattering of the PHI vs. K relationships The procedure therefore has been extended/applied to un-cored wells, for which the CPI porosity were available.