Use of Quantitative Outcrop Data As a Guide for Geological Reservoir Modelling

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In the petroleum profession, geostatistics offer fast and flexible methods for reservoir studies and heterogeneities simulations. However, the starting point in every reservoir simulation process should remain the geological framework and conceptual model, from which all the results are depending. This paper illustrates on some outcrop examples how to produce satisfactory realistic geological simulations by optimizing the parameters and the methods according to the geological background knowledge.

The Campanian series of the Mesa Verde example are characterized by a regressive-transgressive cycle where coastal plain sediments are interfingering with shoreface series. In that case, the definition of a 3D matrix of vertical proportions allows to perform non stationary simulations which reproduce the lateral facies changes through the sedimentary sequence.

The second example addresses the problem of complex facies transition, in the carbonate/siliciclastic shelf system of the Paradox basin (Utah). Several sequences are vertically stacked, in which shallow marine tidal bioclastic bars are interfingered in mudstones deposits. In that case, a combination of the truncated gaussian and plurigaussian methods has been successfully applied.

Another study on the eolian and fluvial permian series in Utah involved the use of both non stationary truncated gaussian and boolean methods in order to express the incision of the eolian dunes by fluvial channels at the base of the genetic units.

These outcrop examples allow to understand and to build realistic geological simulations. The calibrated geostatistical parameters may then be applied in analog subsurface cases when it becomes difficult or impossible to quantify them from well data.