Porosity Semivariogram Parameters for Carbonate Reservoirs

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Geostatistical models are a routine part of the reservoir appraisal and development process. The stochastic algorithms that are used to populate reservoir models use the semivariogram as the measure of spatial continuity. For reservoirs with abundant, good quality well log data the semivariogram parameters can be defined and their uncertainty established from the field data. For fields with few wells the semivariogram parameters are usually taken from an analog or inferred from the likely geometry of depositional elements. In data limited cases, it is difficult to assess appropriateness of the analog derived parameters or assign appropriate ranges to the parameters as part of an uncertainty assessment.

This review of porosity semivariogram parameters is based on carbonate reservoirs from the Permian Basin, western Canada, Kazakhstan, and the Middle East with abundant good quality porosity well logs. Some key findings include: (1) the semivariogram range parameter is typically 1000-2000 m; (2) most carbonate reservoirs do not show significant porosity anisotropy; (3) the variation of semivariogram parameters between reservoirs is similar to the variation by stratigraphic interval within a reservoir; (4) the variation of the semivariogram range parameter for different sequence stratigraphic layers within a reservoir is typically a factor of three; (5) the minimum reported range is 150 m and the maximum is 6500 m; (6) there no correlation of the range parameter with depositional age and only a slight correlation with depositional setting; and (7) there is no difference in the range parameter for limestone dominant and dolomite dominant reservoirs.