A FRACTAL MODEL FOR CHARACTERIZING SPATIAL DISTRIBUTION OF UNDISCOVERED HYDROCARBON RESOURCE

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During the past three decades hydrocarbon resource assessment methodological development has focused mainly on assessing aggregate properties of hydrocarbon resources such as, the total potential and number of pools/fields in a play, or the distribution of pool/field sizes in a hydrocarbon play population. Little attention has been paid to the spatial characteristics of the undiscovered resource. New global demands for both better natural resource management and improved exploration efficiency make it important to understand the spatial characteristics of the undiscovered hydrocarbon resource. Study of mature plays in the Western Canada Sedimentary Basin illustrates that the play resource spatial distribution exhibits a self-affinity characteristic. This characteristic motivates examination of a fractal model for the quantitative description of hydrocarbon resource spatial distributions. The proposed fractal model transforms the spatial information regarding discovered hydrocarbon pools resulting from previous exploration into a frequency domain represented by a spectrum density function. Because this spectrum density function contains no direct indication of the undiscovered resource potential, the spectrum density is calibrated using the self-affinity characteristics derived from exploration data. The calibrated spectrum density is subsequently transformed back to the spatial domain and the resulting map is inferred to represent the spatial characteristics of the discovered and undiscovered hydrocarbons in the play area. An example, the Middle Devonian Keg River reef play from the WCSB illustrates how the fractal model can be used to assess petroleum resources.