Simulations of Migration in Heterogeneous Carriers

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As fluid mines, oil and gas must migrate a certain distance to accumulate in pools. In actual basins, the carriers, that offer paths for oil and gas, are generally heterogeneous. However, the influences of such heterogeneous properties of carriers on migration pathways have not been well studied. In this work, the authors used a gravity percolation model to simulate migration behaviors of hydrocarbon in heterogeneous carriers. The model consists of quadrilateral network where the links represent throats whose radii distribute randomly.

The model was calibrated by experimental migration results in micro scale. Simulated results show that such a gravity percolation model may famous couple the fluid potential that acts as driving force with capillary pressure that acts as resistance. In the macro-homogeneous carriers, the migration pathways may generally perpendicular the potential isolines, but locally the pathways are very irregular because of the influence of micro-heterogeneous. By designing various macro-heterogeneous carriers, hydrocarbon may form especial pathways as well as accumulations in heterogeneous carriers. The simulator was used in oil migration studies in the upper-Triassic formations of the Ordos Basin, China, where the carriers consist of fluviatile-lacustrine deposits. The heterogeneous properties of the carriers were mainly controlled by diagenesis patterns at the principle accumulation period. Since the diagenesis was the result of fluid flowing through the carriers, the corresponding paleo-permeability distribution may reflect the fluid path at principle accumulation period. With the path defined by the paleo-permeability and fluid potential obtained with basin modeling, the oil migration pathways may be satisfactorily described.