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**Migration Pathway Patterns and Residual Loss**

The loss of hydrocarbons is probably small during secondary migration because hydrocarbons circulate only along limited pathways. An estimate of the loss, nevertheless, is important to petroleum exploration (e.g. reserve calculation). We investigated migration pathway pattern and associated hydrocarbon losses by experimenting and simulating the diphasic immiscible draining process. The processes of pathway formation, distribution of non-wetting oil along pathways, and re-utilization of pre-existing pathways with residual traces were observed in the experiments. For migrations in which buoyancy plays an important role, the pathway appears under one of three possible typical patterns: the stable displacement, the capillary fingering and the buoyancy stringing. These patterns may be characterized in a phase diagram using two dimensionless parameters: the capillary number and the Bond number. It is measured that the saturation of residual oil within pathways after migration is commonly <30%, using the NMR technique with a scanning resolution of 0.4 mm/pixel. A numerical simulation model- Buoyancy Percolation (BP) simulator, was designed from experimental results to simulate oil migration in porous media with variable water saturation. Oil saturation along pathways and volumetric proportions of migrating cluster structures (pathway saturation) in the media can be estimated. Our experiments and simulating results conclude: 1) the hydrocarbon loss during migration should be calculated as the product between pathway saturation and average oil residual saturation in the pathway; 2) for a given petroleum system, the hydrocarbon loss as the residuals within pathway should be a fixed value but not a proportion of migration amount.