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Multilayer Secondary Migration Using Parallel Processing Techniques

A detailed analysis of hydrocarbons contained in drilled traps sometimes reveals that a number of wells show multi-layered trapping. This is often observed in the form of vertical variations in the fluid properties, e.g. mature versus immature or marine versus terrestrial geochemical fingerprints. Frequently this information is used to qualitatively assess migration into the traps. Sometimes, however, the effects are more pronounced, and gas columns may be observed below the oil column, clearly showing vertical barriers between the two hydrocarbon phases.

Such scenarios occurring in stacked reservoir sequences are difficult to reproduce using conventional hydrocarbon migration modelling tools, and this was one of the main motives behind the development of Semi3D, a multicarrier hydrocarbon migration simulator. This extension of a map-based migration simulator allows for 3D simulations across faults, which means that hydrocarbons can migrate between different carriers when fault juxtapositions are favourable. The simulator has recently been further developed to also account for other processes controlling migration between different carriers, including cap-rock leakage, fault leakage above traps and migration where carriers are directly superposed.

The simulator is based on a concept where each carrier unit is simulated as a separate computer process and the vertical migration of hydrocarbons between the carriers is handled by a message passing scheme. One of the main advantages of this approach is that it allows for the efficient handling of extremely large basin models, e.g. models with more than 10 million nodes. The software can be run on Linux clusters or massive parallel computers.