700599 Refined Migration Techniques in Basin and Petroleum Systems Modeling - Is It worth the Effort? a Study from the Jeanne D'Arc Basin Offshore Newfoundland

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Combining compositional predicting PhaseKinetcs with state of the art migration methods such as map-based ray-tracing, pressure driven Darcy-flow and capillary pressure driven invasion percolation, allows to take into account the influence of petroleum composition and its phase behavior even during hydrocarbon generation, migration and accumulation. In combination with these migration models different adsorption methods and different critical saturations as well as secondary cracking processes inside and outside the source rock and different API calculation methods are applied. The question is: which minor processes can be calibrated independently and can therefore be validated? Or is the system over-determined and minor processes are just helpful to calibrate and manipulate the system? In the present study area, the geochemical composition of the Egret source rock and the accumulated quantities in the Jeanne d'Arc basin are well known. Therefore, we can test and quantify the processes, which affect the fluids during primary and secondary migration. Chemical properties of the source rock have been investigated based on 38 samples and PhaseKinetics were determined. The first step was the evaluation of a heat-flow history through time, using different crustal- and stretching-models. The heat-flow maps were then calibrated based on available vitrinite reflectance, bottom hole temperature and apatite fission track data. In a second step different fluid flow simulators were combined with different types of kinetic data. Additionally, we tested the influence of different equations of states (EOS), namely Peng-Robinson and the Soave-Redlich-Kwong EOS, on the ensuing phase behavior and physical properties (e.g. API gravity) of the migrating fluids in the models. We demonstrate also that some other minor processes are not completely taken into account such as the real nature of the hysteresis effect of drainage and imbibition for capillary pressure vs. saturation and that real interfacial tension maps for both gas and oil should be used instead of two constant IFT values. However, defining all minor processes in detail does not always lead to more accurate results due to the generally high uncertainties in basin modeling, which causes also a very poor determination of losses during primary and secondary migration. However, to reproduce and calibrate the general pattern of generation, migration and accumulation these minor processes can be used very well.

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