

3D Numerical Stratigraphic Model for Basin Scale Modeling of the Organic Matter Deposition in a Marine Environment: Application to the Natih Formation (Late Cretaceous, Oman)

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Abstract

One of the main objectives of numerical tools in Geosciences is to better evaluate the oil and gas potential in sedimentary basins. Basin models simulate the main physical and chemical processes that control the maturation and the migration of hydrocarbons. Despite the complexity of these models, their predictive capability is still limited by the quality of the input parameters. Among the list of poorly constrained parameters, the distribution and the quality of the initial source rock is one of the most important. Estimations of the initial TOC and HI (before thermogenic transformation) are difficult as their values result from a set of degradation processes and depend on the nature of the organic matter initially preserved. To fill this gap, we present a new numerical model of the organic matter deposition and preservation fully coupled with a 3D numerical stratigraphic model. Our method consists in simulating the production, the transport and the degradation phases of the organic matters deposition during the filling of the sedimentary basin using a forward approach. The nature of the source-rock is estimated in terms of TOC and HI and mainly depends on the depositional environments. These environments are defined by the sedimentation rate and the redox conditions, two parameters that are estimated in our model for every time-steps of the simulation. Our goal is to bring a simple but powerful tool that will help the geologists in building realistic scenarii for the organic matter deposition within a stratigraphic framework. We illustrate the model by simulating an intrashelf basin derived from the geological framework of the Upper Cretaceous Natih formation of Oman. We show in particular that even simple organic matter accumulation scenario allow reproducing the main signatures of the two source-rocks formations.