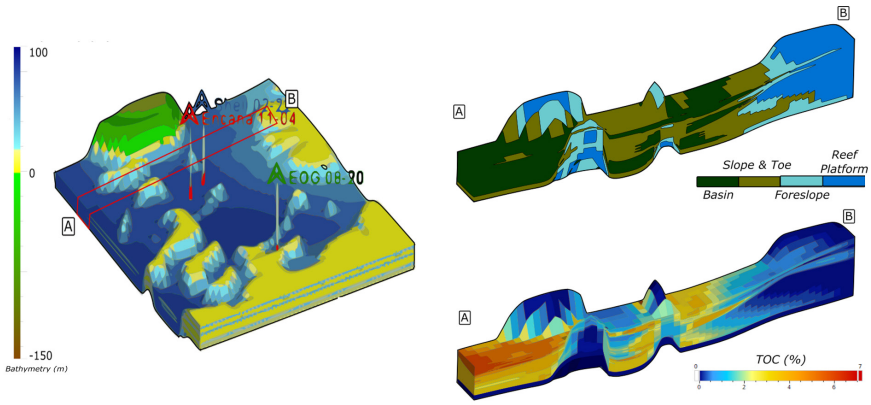
Dionisos organic-rich sediments: DORS 2

A Joint Industry Project

Advanced basin-scale 3D stratigraphic modeling

The DionisosFlow™ methodology has been developed at IFPEN over the last 20 years. Based on the definition of key structural and sedimentary parameters, such as basin deformation, sediment supply and sediment transport, the DionisosFlow™ methodology consists in performing a simulation of sedimentary processes and in providing a 3D numerical grid that represents the basin structure and stratigraphy, yielding quantitative insights into reservoir properties. Thanks to the first JIP DORS, organic matter modules are now available and their robustness has been proven. These modules allow the simulation of the main depositional environments in marine, lacustrine and terrestrial domains. The main result is a quantification of the organic matter quality and volumetric content (bulk TOC, HI, etc.).



3D stratigraphic modeling of the Duvernay Fm. with the organic matter modules. Results in TOC and facies.

The main principles of the organic matter modules are the following:

- the primary productivity is controlled by the nutrients availability,
- the degradation is linked to the bathymetry and the redox conditions,
- the residual organic matter is transported as a bedload along the seafloor.

Objectives

The aim of the JIP DORS 2 is to smoothen the link between stratigraphic and basin models, in order to constrain better the simulation of hydrocarbon genesis, migration and trapping, and lead to better basin prospect evaluations. The first objective is to develop geochemical proxies to make it possible the application and

calibration of organic matter simulation on a real case study. The second objective is to characterize kerogen properties and organo-facies distribution to facilitate the link between DionisosFlow™ and basin models. Finally, particular attention will be paid to rift basins and the impact of climate on soil and organic matter production.

Key benefits

- Use of DionisosFlow™, leader in the stratigraphic modeling market, with new R&I modules bringing a strong added value in basin exploration.
- Ensure access to a prototype with new functionalities in advance, in comparison to users of the industrial software version.
- An easy to use tool for a rapid integration of the model into basin exploration partner's workflows.
- Reinforce the model ability to be properly calibrated with the geochemical proxies.
- Make the link between DionisosFlow™ and basin models for use of the simulated organo-facies as a quality index of the source rock.

Technical program

The greatest challenge now consists in facilitating the use of the organic matter modules of DionisosFlow™ in a petroleum exploration workflow. To tackle this issue, the DORS 2 extension program is planned for two years and is split into three main work packages.

Work Package 1 – Marine and terrestrial geochemical proxies

WP1 is focused on marine and terrestrial organic matters, and aims at providing geochemical proxies to smoothen the calibration process. These proxies will be validated and calibrated thanks to the simulation of the Congo deep-sea fan and its turbiditic system over the last 200 kyr. The metho-dology used will be as follows:

- development of geochemical proxies,
- calibration of these proxies using data from modern or recent sedimentary systems (e.g. TOC, HI, $d^{13}C$),
- calibration of the organic and proxies models over the last 200 kyr.

Work Package 2 – From DionisosFlow™ to basin modeling software

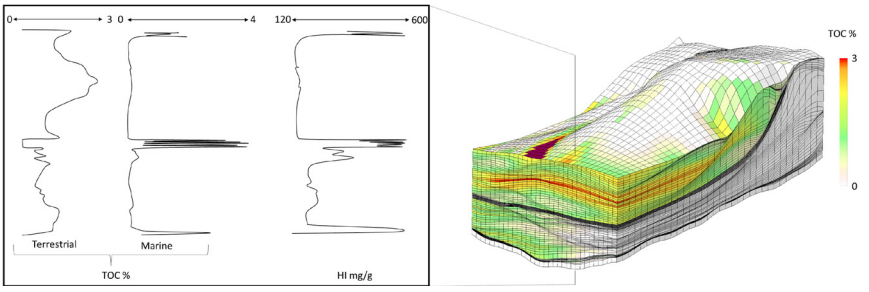
WP2 is focused on the link between DionisosFlow™ and basin models. Organo-facies distribution will be used to describe the regional variability, in space and time, of continuous characteristics of the kerogen such as TOC, HI or activation energy. A dedicated guideline will be delivered to manage the upscaling phase from the stratigraphic results to the basin models inputs.

Work Package 3 – Organo-facies in rifts

WP3 will look at the conditions of the organic matter production and accumulation in rifts. Marine and lacustrine paleoproductivity is controlled by nutrients supplies. Hydric balance and soil leaching processes will be simulated to better quantify the rift flank erosion and organo supplies to the lacustrine-marine system will be modelled using. These nutrient and salinity environmental characteristics will be used for a better description of the organo-facies in ifts.

Deliverables

All the numerical models developed in the frame of this JIP will be delivered as plug-ins into DionisosFlow™. JIP partners will receive as many licenses of these organic-matter plug-in as they have DionisosFlow™ licenses.
User-meeting will be held every 12 months to present and discuss the on-going work. Training will be proposed to partners to learn the latest functionalities of DionisosFlow™.



3D stratigraphic modeling of a deltaic system with both marine and terrestrial organic matters. Results in marine and terrestrial TOC and bulk HI.

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