THE UPPER CARBONIFEROUS RESERVOIRS OF NW EUROPE


Carboniferous outcrops in Kentucky

TNO innovation for life

Production efficiency from deep Carboniferous gas reservoir is largely controlled by understanding reservoir properties distribution and sand connectivity in a relative low net:gross environment. After more than 50 years of production, this play still mature represents a key target for further exploration and near field appraisal. Therefore developing a simple predictive model to assist the location and characterisation of reservoir quality and connected net-volumes is both of primary importance and challenging due to complex facies heterogeneity, internal reservoir architecture and diagenetic history. Past studies on fields developed in similar fluvial and fluvio-deltaic geological settings indicate that after few years from the start of production a large discrepancy between predicted vs. actual connected hydrocarbons is often observed (e.g. Schooner gas field, Brent oil field).

TNO is currently working on a joint industry project, sponsored by eight E&P companies operating in the Southern North Sea and by the Dutch Ministry of Economic Affairs aiming to develop a working method for defining the criteria to assess and predict connectivity and reservoir properties through the deployment of high-resolution geological 3D models of Carboniferous reservoirs.

This project benefits from experience gained in a previous TNO project, and furthermore, it includes knowledge and expertise from the UK sector and in-house experience on analogue outcrop studies from Eastern Kentucky (USA).
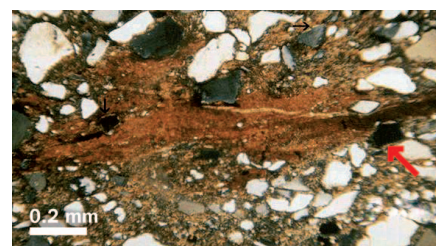
Anisotropic, parallel alignment of clay minerals, also with a parallel extinction pattern; grain coatings present (arrowed)
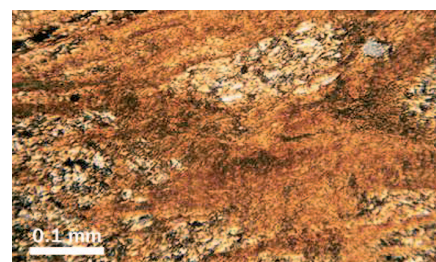
Multiple-stress cutans and Opaque clay filled fine brecciation cracking, developing through soil fabric from larger cracks
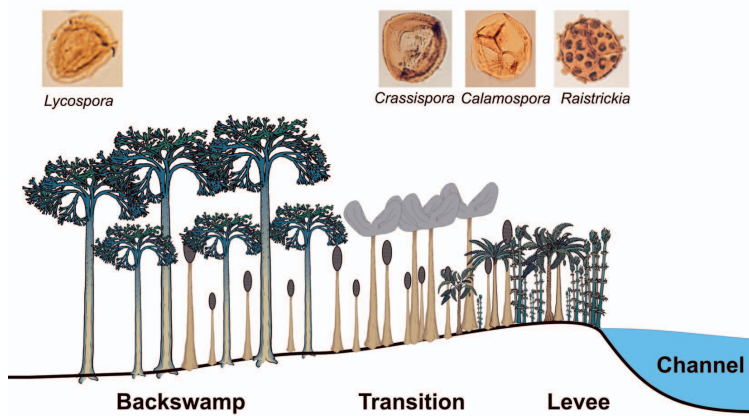
Schematic ecology of Carboniferous swamps

Our approach consists of 4 major components:
— High-resolution reservoir correlation, sequence stratigraphic framework and 3D modelling and connectivity assessment based on outcrop analogues of both coal-bearing and red paleosols bearing successions.
— Rock typing on core and cuttings using high-resolution automatic petrography technology (QEMSCAN).
— Eco grouping: vertical stacking of bio-facies can help in predicting lateral occurrence of channel belts.
— Integration and validation using production dynamic data.

We test our approach in a number of fields in the Southern North Sea (both on British and Dutch sectors), and we compare our model to analogue outcrops from Eastern Kentucky (USA). This will enable us to focus on the understating of Carboniferous reservoir systems, to propose a predictive tool to drive the 3D reservoir modelling and to optimise production performance and assist operators to locate potential undeveloped reserves. This approach can be applied to other fluvial and fluvio-deltaic reservoir successions in other parts of the world, especially in North Africa and Middle East.

TNO

TNO is one of Europe's largest independent companies in the areas of technology development and technical consultancy. TNO employs over 4,000 scientists in a wide range of economical sectors, including energy, mobility, industrial innovation, information society and defence.
We have over 70 years of experience in:
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— Development of innovative technologies in close collaboration with major industrial parties and universities
— Knowledge transfer programs for industry and universities worldwide.

We distinguish ourselves by our independent position and capability to address challenging technological issues with multi-disciplinary teams of highly qualified scientists. We develop technology, on the basis of top quality scientific knowledge, into practical applications with industrial use. As an independent company TNO is not active in the production or commercialisation of its innovations.

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