GEORESOURCES
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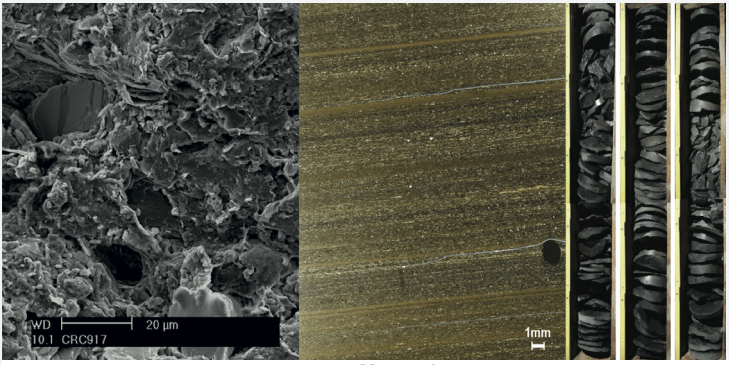
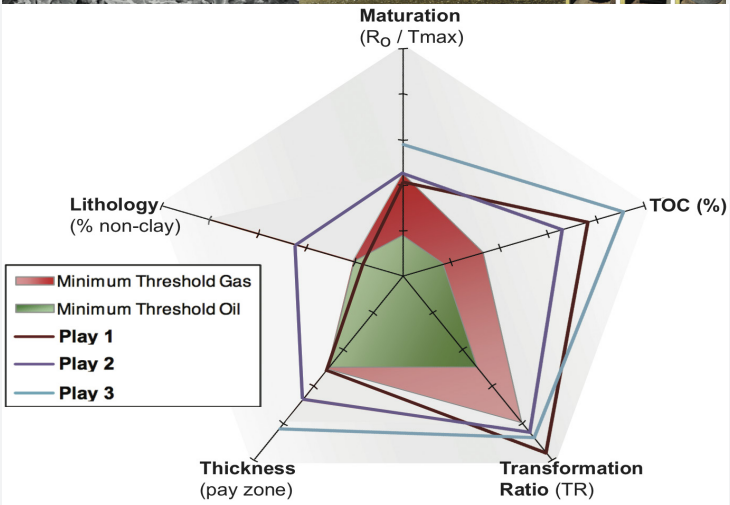
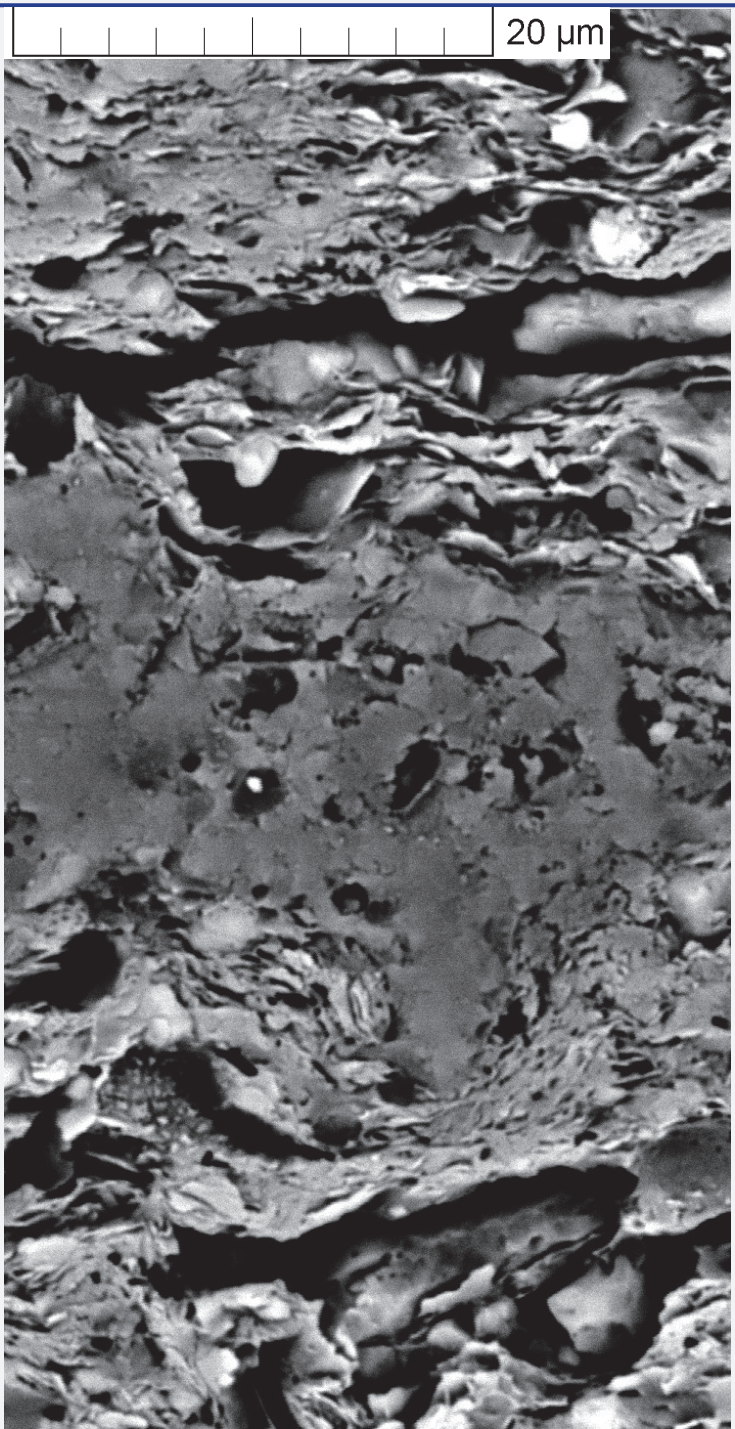
GeoResources

Unconventional Shale Play Analysis
Shale Gas - Shale Oil





Integrated Workflow from Pore-scale to Play-size for Enhanced Evaluation of Unconventional Shale Plays



High organic matter porosity (centre) in calcareous shales, Oil Shale, Lower Jurassic, Germany

Benefits for HC Exploration

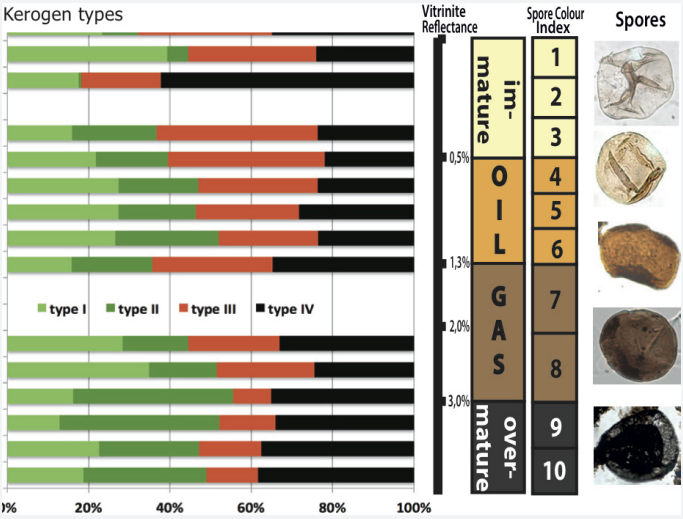
- Innovative high-resolution analysis of kerogen and rock pattern of unconventional shale plays
- Improved evaluation of hydrocarbon source rock potential based on Optical Kerogen Analysis and Integrated Organic Maturation studies
- Quantification of net-TOC (productive kerogen) and definition of net-source rock units / pay zone
- Integrated organic maturation analysis for better identification of the influence of in-situ vs. recycled material in maturation data
- Multiple optical analysis from normal light microscopy to high-resolution SEM
- Multi-scale analysis of rock parameters from core to thin section and upscaling of results from pore-scale to play size
- Integrated lithological analysis including all hydrocarbon play relevant rock properties

Add Ons - for unconventional hydrocarbon shale plays

- TOC/CNS analysis - quantification of total organic carbon and information on depositional environment
- Core Logging & Thin Section Analysis - analysis of texture & composition of shales and defintion of shale lithofacies types with specific shale play potential
- Clay mineralogy & carbonate quantification - information on petromechanical rock properties
- Correlation of well logs with core descriptions for the definition of electric log facies based on studied cores
- Spatial data integration & modelling - mapping and distribution of hydrocarbon system relevant parameters in 1D to 3D models

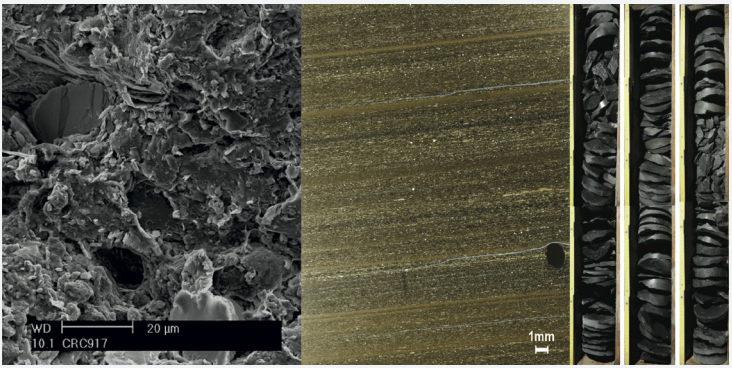
Optical Kerogen Analysis & Maturation

- Optical analysis of kerogen isolated from the rock using different microscope techniques
- Identification of mixed kerogen, regarding mixed composition, preservation & maturation - impossible by geochemical analysis (based on bulk rock)
- Detailed quantification of each single kerogen type within the total kerogen
- Quantification of productive versus unproductive proportions of the total kerogen (= net-TOC)
- Quantification of oil-prone vs. gas-prone kerogen within the productive kerogen



- Detailed analysis of preservation of each kerogen type – estimation of HC generation from oil-prone and gas-prone parts of kerogen
- High resolution analysis of organic maturation by two independent methods
- Detailed palaeothermal history and HC maturity
- Identification of different kerogens with different HC potential mixed within the total kerogen

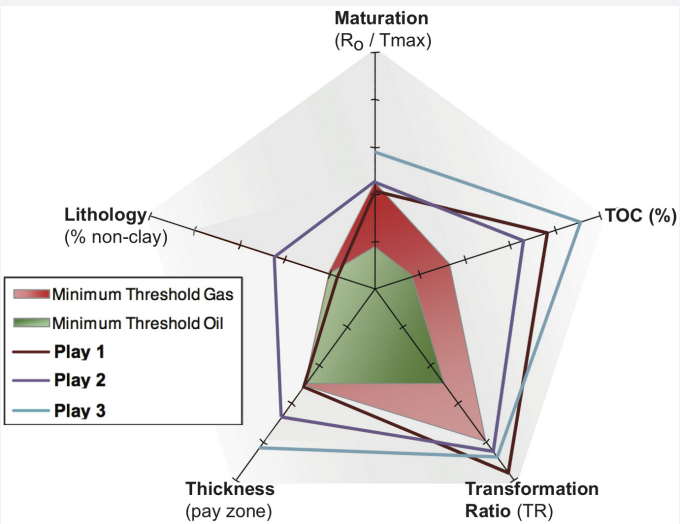
Multi-scale Lithological Analysis



- Thin section analysis focused on rock texture, microscopic structures, quantification of main mineral phases and in-situ distribution of organic matter and main mineral phases
- SEM/EDAX for high-resolution analysis of rock texture, in-situ distribution pattern and analysis of microporosity in rock matrix and organic matter
- Evaluation of in-situ microporosity within organic matter - where most shale gas/oil is trapped - for estimation of unconventional HC storage capacity
- Petrophysical analysis of total microporosity and permeability
- TOC analysis for quantification of total organic carbon
- CNS analysis for information of origin of organic matter and palaeoenvironmental conditions during shale deposition
- Clay mineralogy for quantification of swellable vs. non-swellable clay minerals
- Carbonate / Silica quantification for information on petromechanical patterns of shales
- Compilation of all exploration related rock properties

Unconventional HC-System Analysis

- Integration of multiple data sets into unconventional play assessment schemes, including all aspects of unconventional shale plays - from source rock potential to production related rock properties
- Integration of high-resolution data sets of rock properties and organic matter for identification of net-source rock units / pay zone
- Even with poor and inconsistent data unconventional system analysis / play assessment can be done for enhanced play evaluation
- Full data integration of all available data sets covering as many disciplines as possible - no data is left behind or aside



- Improved risk assessment by integrated, quantitative basin and HC systems analysis based on cross-calibration of different methods for reduced model uncertainties
- Spatial data integration & modelling - mapping and distribution of hydrocarbon system relevant parameters in 1D to 3D models

Projects

on Unconventional Hydrocarbon Systems Analysis:

- Basin development and unconventional hydrocarbon potential, lower Jurassic, SW-Germany
- Basin development and unconventional hydrocarbon potential, Silurian-Ordovician, N-Poland
- Multidisciplinary analysis of unconventional shale plays, Silurian, Arabia
- Optical and geochemical analysis of hydrocarbon potential and basin maturation, Paleozoic to Cenozoic, Peru
- Organic maturation & source rock analysis, Mesozoic to Cenozoic, Upper Rhine Graben, Germany
- Unconventional HC source rock potential based on Optical Kerogen Analysis, Silurian, Russia
- Unconventional hydrocarbon potential of Lower Carboniferous shale systems, North German Basin
- Evaluation of unconventional hydrocarbon source rock potential, North German Basin, Germany
- Unconventional hydrocarbon source rock potential, Silurian, SE-Poland
- Evaluation of hydrocarbon source rock potential, Mesozoic & Cenozoic, Southern Germany
- Basin and paleothermal history for unconventional gas exploration - North German Basin
- Integrated basin and hydrocarbon system analysis Palaeozoic, Saharian Basins, Algeria
- Source rock and organic maturation analysis, Palaeozoic, Basins, Marocco

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