GEORESOURCES
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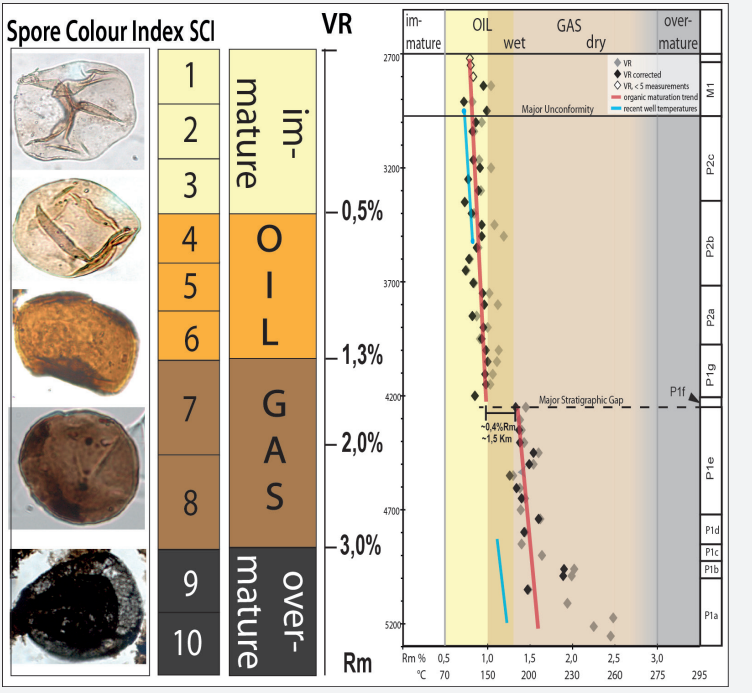
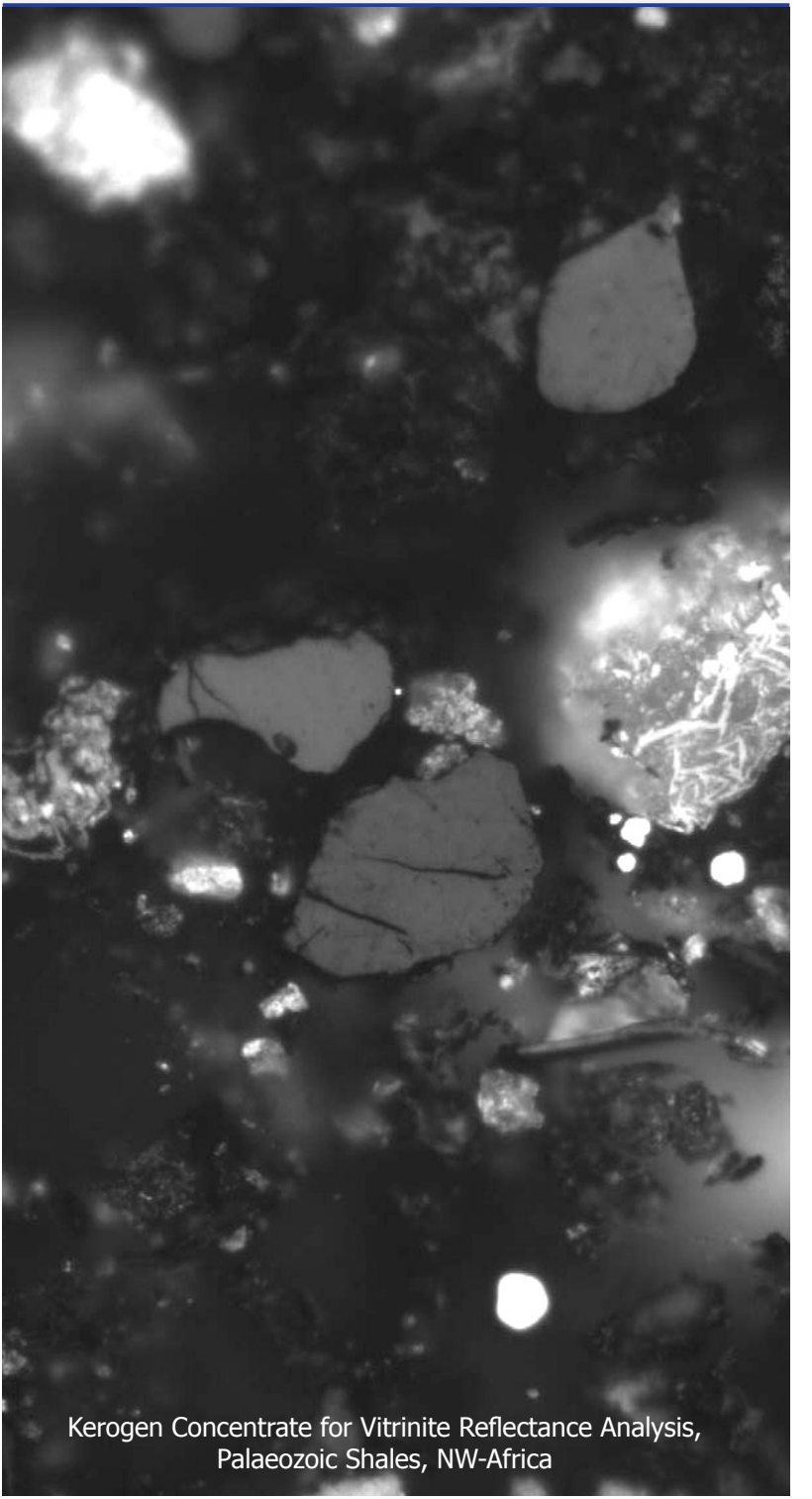
# GeoResources

## Integrated Organic Maturation




**High-resolution Organic Maturation**

Vitrinite Reflectance and Colour Indices
for Maximum Accessibility and Reliability
of Maturation Data



Kerogen Concentrate for Vitrinite Reflectance Analysis,
Palaeozoic Shales, NW-Africa

## Benefits for HC Exploration

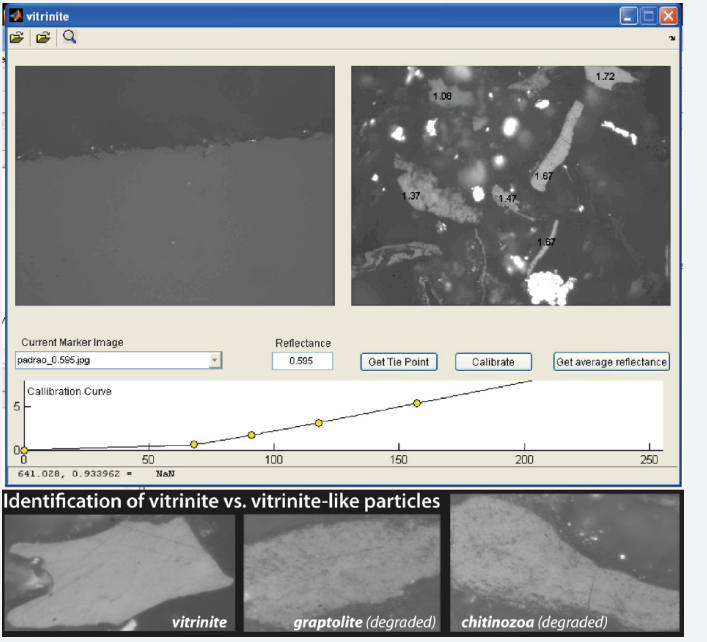
- Digital image based VR analysis enables measurements of small vitrinite grains down to pixel-size (<10µm) without any side effects
- Strongly improved interpretation of mixed VR data sets by identification of degraded and recycled vitrinite vs. in-situ vitrinite populations
- better identification of real vitrinite vs. vitrinite-like particles by image analysis
- VR analysis is limited by availability of vitrinite, which is not available before late Silurian times and rare towards distal marine basin settings
- Palynomorph colour indices are good alternatives for analysis of organic maturation and hydrocarbon generation levels, when vitrinite is absent
- Combination of VR and palynomorph colour analysis minimizes uncertainty of maturation analysis by maximum application to different geological settings and highest reliability by data cross-check from both methods

## Add Ons - for integrated hydrocarbon system anaylsis

- Optical Kerogen Analysis - integrated analysis of kerogen composition and preservation for improved evaluation of hydrocarbon potential
- Core logging and thin section analysis - analysis of texture and composition of source and reservoir units
- Petrophysical analysis - information on petromechanical rock properties, porosity and permeability
- Spatial data integration & modelling - distribution of HC system relevant parameters in 1D to 3D models based on integrated lithological and kerogen data sets

# Vitrinite Reflectance - New Method

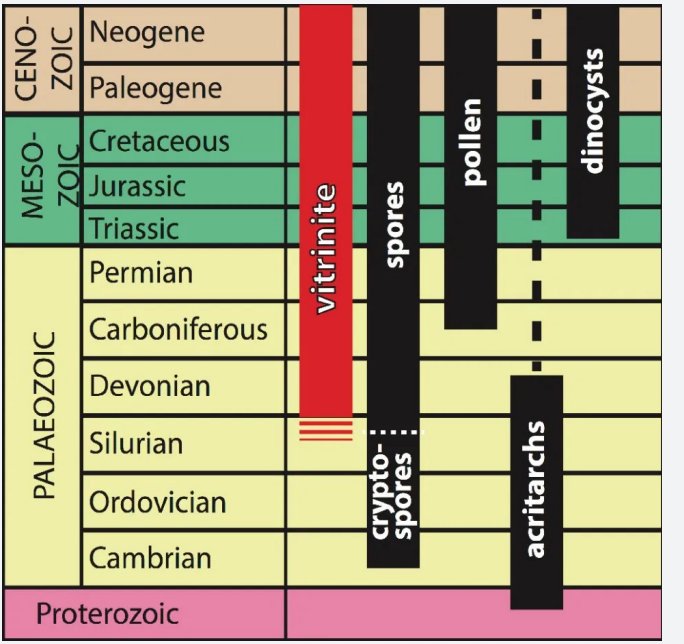
- small vitrinite particles, typical in dispersed kerogen of hydrocarbon source rocks, cause problems in classical vitrinite reflectance analysis (based on photometer)
- photometer analysis measures reflectance from all components in the measuring field, not only from vitrinite particles => mixed reflectance value




- new VR method based on high-resolution digital images of vitrinite from reflected-light microscopy
- image grey levels represent reflectance, which are recalculated to real VR by image analysis software
- high-resolution reflectance analysis of single vitrinite grains down to pixel-size (<10 µm) without any negative side effects
- identification of in-situ, recycled and degraded vitrinite in mixed vitrinite assemblages and separation of real vitrinite from vitrinite-like particles.

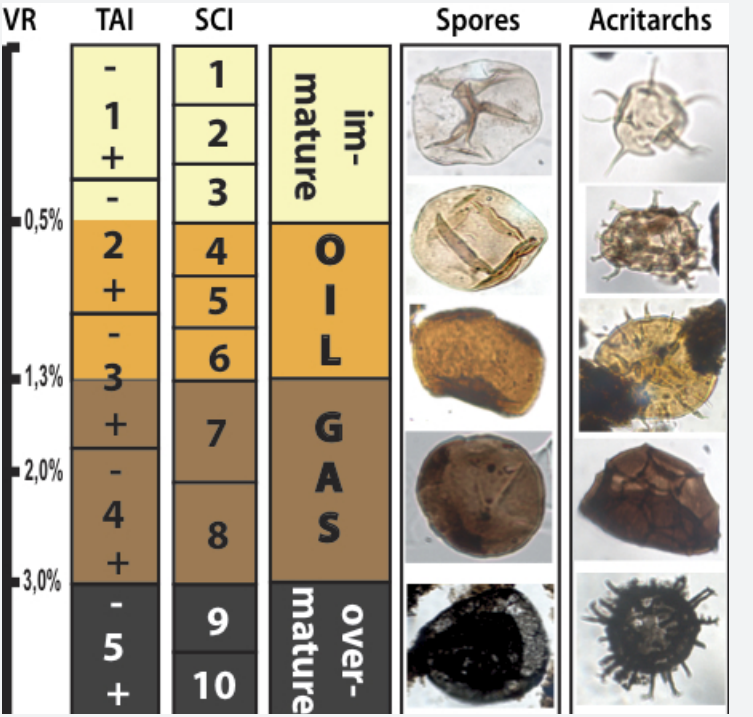
# Vitrinite Reflectance - Limitations

- all organic matter shows reflectance of light, but only vitrinite reflectance is calibrated for the recalculation of palaeotemperatures
- vitrinite (woody material from higher land plants) is widely distributed from terrestrial to marine systems, with some limitations by depositional environments and stratigraphy




- vitrinite is available from the late Silurian and therefore not available for the analysis of early Palaeozoic (Cambrian to Silurian) hydrocarbon systems.
- alternative methods needed, like palynomorph colour indices (TAI, SCI, PDI), particularly based on acritarch and cryptospore colors for early Palaeozoic hydrocarbon plays

# Palynomorph Colour Indices




- palynomorph colour analysis (SCI/TAI/PDI) is used as an alternative, when vitrinite is not available - due to facies, preservation or stratigraphical limitation
- SCI/TAI/PDI - developed for spores & pollen, but works also for marine palynomorphs (acritarchs, dinocysts)
- SCI/TAI/PDI - maturation analysis in a wide range of geological settings - from terrestrial to deep marine
- SCI/TAI/PDI provide easy-access, first estimates of organic maturation levels
- SCI/TAI/PDI is used for independent cross-check of vitrinite reflectance data sets
- combination of vitrinite reflectance analysis and SCI/TAI/PDI analysis for maximum accessibility and reliability of organic maturation data.

# Projects

including Integrated Organic Maturation:

- Thermal history and source rock potential of the Palaeozoic below the Molasse basin, Austria
- Optical and geochemical kerogen and hydrocarbon potential analysis, Palaeozoic to Cenozoic, Peru
- Rift-graben development and hydrocarbon generation, Cenozoic, Southern Germany
- Unconventional hydrocarbon potential of Silurian Shales, Arabia
- Unconventional HC source rock potential based on Optical Kerogen Analysis, Silurian, Russia
- Source rock potential of organic rich shales, Lower Carboniferous, North German Basin
- Evaluation of unconventional hydrocarbon source rock potential, North German Basin, Germany
- Evaluation of hydrocarbon source rock potential, Mesozoic & Cenozoic, Southern Germany
- Reservoir analysis, Mesozoic & Cenozoic, Upper Rhine Graben, Central European Rift Basins
- Unconventional hydrocarbon source rock potential, Silurian, SE-Poland
- Integrated basin and hydrocarbon system analysis Palaeozoic, Saharian Basins, Algeria
- Source rock and organic maturation analysis, Palaeozoic, Basins, Marocco
- Organic maturation & source rock analysis, Mesozoic to Cenozoic, Upper Rhine Graben, Germany
- Basin and paleotemperature development for unconventional gas exploration – North German Basin

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