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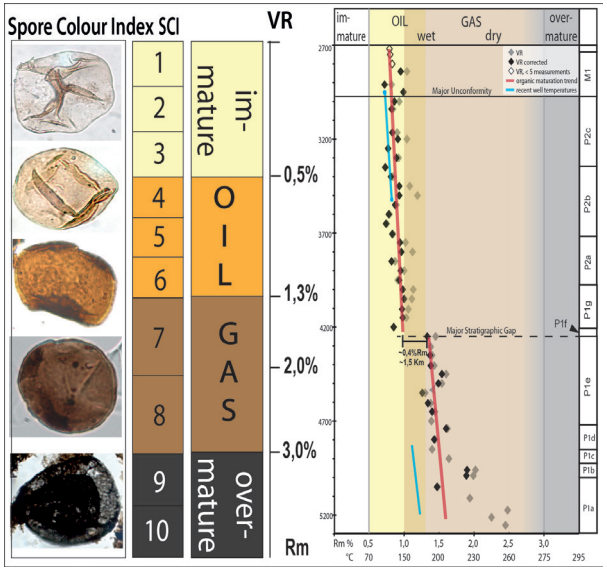
Organic Maturation



High-resolution Organic Maturation

Vitrinite Reflectance & Colour Indices
for maximum accessibility & reliability
of maturation data

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 middle 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 VR / palynomorph colours minimizes uncertainty of maturation analysis by maximum application to different geological settings and reliability by data cross-check from both methods

Add Ons - For Integrated Source Rock Analysis

Optical Kerogen Analysis - Integrated analysis of kerogen composition and preservation for improved evaluation of hydrocarbon potential

Core Logging & **Thin Section Analysis** - texture & composition of source rocks (organic rich shales)

SEM - high-resolution analysis of microporosity, rock texture and mineral/kerogen distribution

Clay Mineralogy & **Carbonate Quantification -** information on petromechanical rock properties

Further Informations:
www.georesources.de/organic_maturation.html

About GeoResources

GeoResources provides industry and research expertise for exploration of hydrocarbon systems - conventional and unconventional. Our aim is the transfer of latest research knowledge into industry consultancy, improving the understanding, exploration and evaluation of georesources, mainly hydrocarbons

GeoResources Steinbeis Transfer Centre (STC) is one of more than 700 science and technology transfer centres of the Steinbeis Foundation, dedicated to the transfer of research knowledge into industry consulting.

GeoResources is associated to the Heidelberg University of Excellence. It was founded in 2005 at the Institute of Earth Sciences of the University of Heidelberg.

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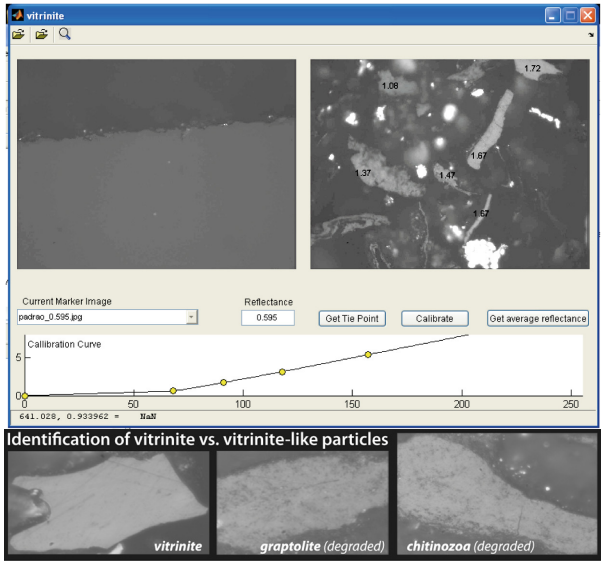
Vitrinite Reflectance - new method

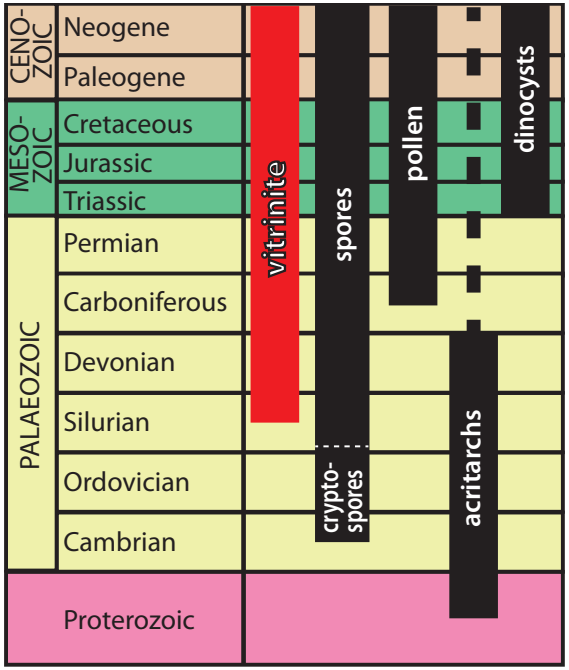
- Small vitrinites, typical in dispersed kerogen of hydrocarbon source rocks, cause problems in classical photometer-based vitrinite reflectance (VR) analysis, because reflectance is measured from all components in the measuring field, not only from single vitrinite grains = mixed reflectance value



- new VR method based on high-resolution digital images of vitrinite from reflected-light microscopy
- image grey levels represent reflectance, which are re-calculated 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.

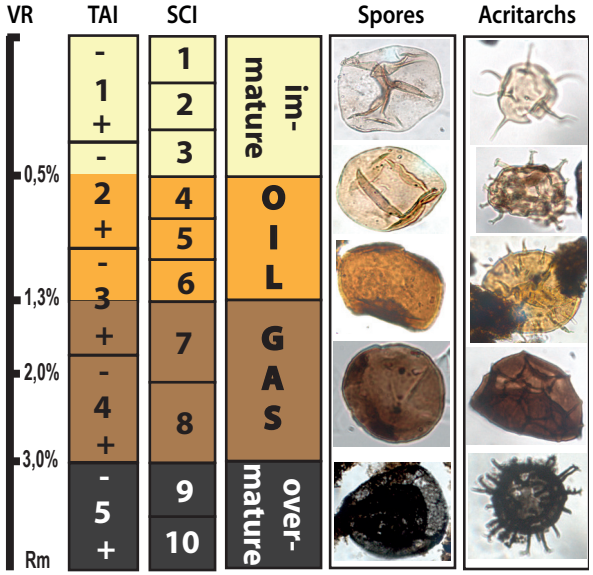
Vitrinite Reflectance - Limitations

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



- vitrinite is available from the middle Silurian, thus not applicable in early Palaeozoic (Cambrian to mid-Silurian) hydrocarbon systems.
- alternative methods needed, like palynomorph colour indices (TAI, SCI), especially based on cryptospore and acritarch colours for early Palaeozoic hydrocarbon plays

Palynomorph Colour Indices



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