Organic Petrography

Determination of organofacies and thermal maturity

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3.2 Organic Geochemistry

Microscope LEICA DM 4 P-Mikroskop,
equipped with the programmes Hilgers FOSSIL and FOSSIL MOT
Background

Macerals are organic particles in sediments.

They are composed of three classes:

- Huminite/Vitrinite: woody tissue
- Inertinite: aromatized particles
- Liptinite: pollen, spores, cuticles, algae

Their analysis enables:

- Facies analysis

(Reflected white light)

Source: coalandcarbonatlas.siu.edu
Why to use reflected white light and UV light?

Liptinite appears black under reflected white light. It can be made visible by UV light illumination. At the end of the oil window liptinite becomes vitrinite.
Maturation of organic matter

The physicochemical properties of vitrinite and liptinite change during burial:

- Huminite/Vitrinite get aromatized and thus can better reflect the light. This is used as a maturity parameter, and is measured as "vitrinite reflectance (%), calibrated against known reflectance standards.

Vitrinite reflectance data enable to reconstruct:

- Thermal history of a sediment

<table>
<thead>
<tr>
<th>Oil/gas window</th>
<th>Depth (km)</th>
<th>Temp (°C)</th>
<th>Vitrinite Reflection</th>
<th>Subsurface process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerogen</td>
<td>1</td>
<td>30°C</td>
<td></td>
<td>Diagenesis</td>
</tr>
<tr>
<td>Oil</td>
<td>2</td>
<td>60°C</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>3</td>
<td>90°C</td>
<td></td>
<td>Katagenesis</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>120°C</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>160°C</td>
<td>2.0</td>
<td>Metagenesis</td>
</tr>
</tbody>
</table>

Source: coalandcarbonatlas.siu.edu
Macroalga species Chara in Tibetan lakes

Graptolites in Ordovician Dictyoname Shale: 
*Reconstruction of palaeo upwelling zones*

**Case study: Palaeofacies**

- **Graptolite**
  - (Reflected white light)

- **Graptolite**
  - (UV light illumination)

100 µm
Case study: Oil and gas potential

Thermal maturity and organofacies of Ca2 black shales in the Brandenburg

- Onset of oil generation at 2300 m
- Gas generation below 3500 m
- Well Schadewalde 2/75 was tectonically uplifted by 1500 m

Biogenic shale gas in the Alum Shale (c/o)

Fluorescing microbial mats
(UV light illumination)