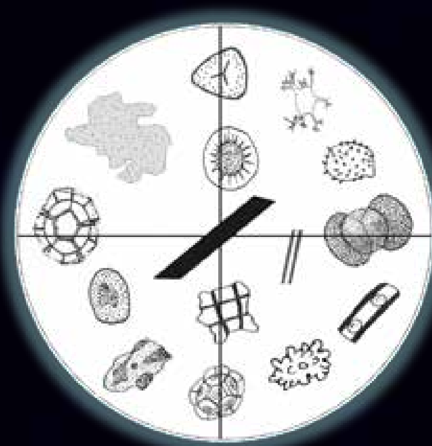
Palynofacies Working Group



Proposal

Convener: João Graciano Mendonça Filho

General Information

Palynofacies WG will be developed on particulate OM present in sediments and sedimentary rocks using the OM isolation methods for sample preparation (KC) and applying microscopy techniques (TWL and FM) as principal tool for acquiring data and statistical methods for its interpretation.

Objectives

The main objective of this WG will be the origin characterization of the OM (botanical precursors), using a combination of morphology and optical properties (fluorescence and translucency), and the assessment of all aspects of the palynological OM assemblage, such as:

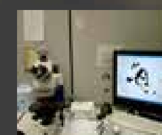
- Identification of the individual particulate components;
- Assessment of their absolute and relative proportions;
- Particle sizes;
- Preservation states;

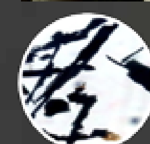
- See feasibility of an integration and correlation of the palynofacies information obtained in this WG with the classification of organic components from ICCP/TSOP ;

Palynofacies Classification (TWL/FM)				ICCP/TSOP Classification (RWL/FM)	
Groups	Subgroups	Particles		Maceral	Group
Phytoclast	Opaque	Equant		?	Inertinite
		Lath		?	
		Corroded		?	
		Sclereids		?	
	Non-opaque	Non-Biostructured		?	Vitrinite
		Biostructur.	Striate	Telinite ?	
			Striped		
			Banded		
			Pitted		
		Fungal Hyphae		Funginite	Inertinite
		Membrane		Cutinite	Liptinite
		Cuticle			
Palynomorph	Sporomorphs	Spores		Sporinite	
		Pollen Grain			
	Freshwater Microplankton	*Botriococcus*		Telalginite	
		Pediatrum		Lamalginite	
		Zygnemataceaea		Lamalginite (?)	
	Marine Microplankton	Dinocysts		Lamalginite	
		Prasinophyte		Telalginite / Lamalginite	
		Acritarchs		Lamalginite	
	Zoomorph	Foraminiferal		Zooclasts	Zooclasts
		Scolecodonts			
		Chitinozoa			
Others	Zooclasts	Zooclasts			
Amorphous	AOM	AOM		Bituminite/Amorphinite (?)	Liptinite
	Resin	Resin		Resinite	
	Macrophyte Tissues	AOM		Bituminite/Amorphinite (?)	
	Microbial Mats	AOM		Lamlginite/Bituminite (?)	
	Bacterial EPS	AOM		Lamlginite/Bituminite (?)	

In this case, it is possible to prepare (depending on the amount of samples available and the number of participants) a KC strewn slides (TL), and KC and WR polished sections (RL)

TWL and FM
(KC Strewn Slide)



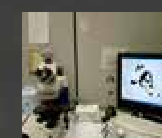
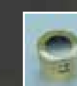



Opaque Phytoclasts (TWL)

Non-opaque Phytoclasts (TWL)

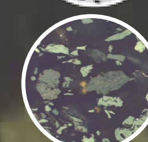
Opaque and non-opaque Phytoclasts (TWL)

RWL and FM
(KC Polished Section)

Inertinite (Fusinite) (RWL)

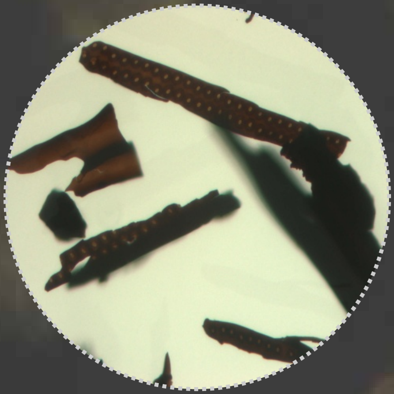
Vitrinite (RWL)



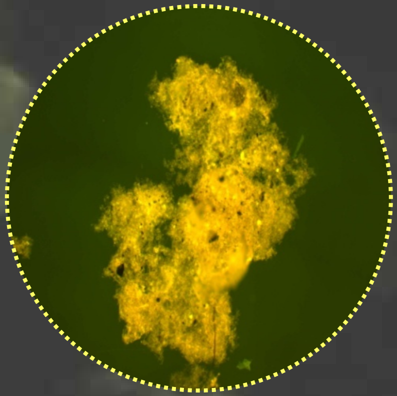
Inertinite and Vitrinite (RWL)

Subject of Study

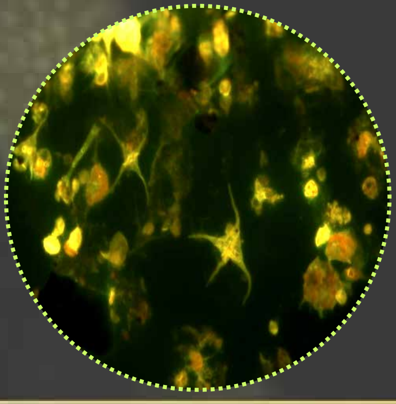
Main Groups of OM: the three main groups of morphologic constituents of the OM, which can be recognized in the assemblage, are:



Phytoclast Group: Fragments of tissues derived from higher plants or fungi



Amorphous Group: Phytoplankton or bacterially derived AOM, higher plants resins and amorphous products of the diagenesis of macrophyte tissues



Palynomorph Group: organic walled constituents that remain after maceration using HCl and HF acids

Criteria that will be used in the Optical Organic Matter Classification

The criteria that will be used to define the main categories of OM components are:

1. Origin:
Biological source
Process of formation

2. Structure:
Structureless
Structured
Type of structure

3. Morphology (descriptive):
Shape
Fabric

4. Measurable optical properties:
Reflectance
Translucency
Fluorescence

5. Geochemical composition:
Indirect evidence only
Fluorescence is essential

6. Preservation state:
Environmental oxidation
Environmental biodegradation
Thermal alteration

Organic Matter Classification

What has been achieved in terms of OM classification so far?

Background:

☼ The classification of organic particles has always been rather subjective and often has a particular objective;

☼ Particles have been divided by their modification and thermal alteration, their depositional environments, botanical classification, degree of terrigenous supply (and thus distance from land), degree of degradation, and allochthonous and autochthonous fractions;

☼ The classification of dispersed OM constituents is based primarily on their appearance and preservation state, using TWL with ancillary observation employing fluorescence methods (UV mode);

Organic Matter Classification

The challenge:

☼ Create a standardised classification for organic particles in TL studies;

☼ Trace a correlation of the organic particles classification in TL with RL;

As a consequence:

☼ The edition of a practical guide to palynofacies analysis;

☼ Create an atlas of particulate organic matter for Palynofacies studies;

Organic Matter Classification Objectives

For a detailed OM classification, in these exercises, will be requested:

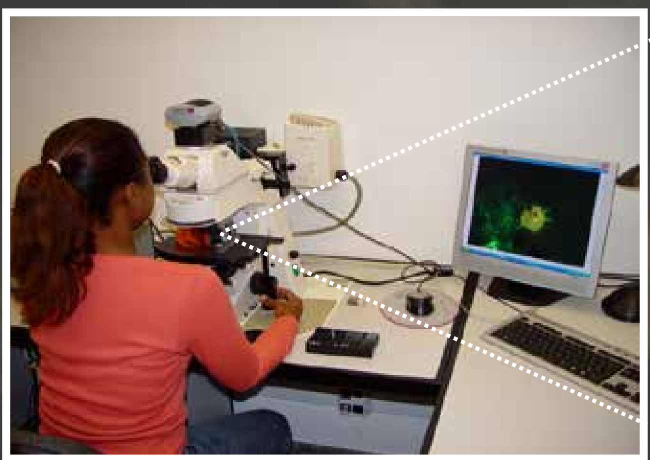
- At least 10 categories of particulate organic components, and up to 30 or more;
- At least 300 counts (particles) per sample for each set of counts;
- Fluorescence observations must be made;

Obs. Additional counts can be done for key important ratios;

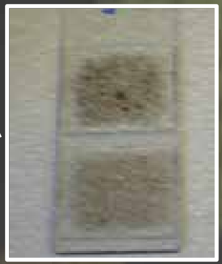
Palynofacies WG

In this case, it is possible to prepare (depending on the amount of samples available and the number of participants) , a KC strewn slides (TL) ,and KC and WR polished sections (RL)

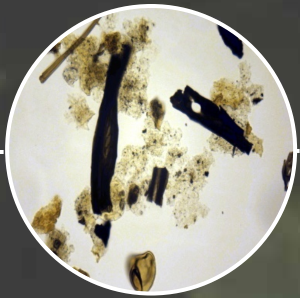
The microscopic analysis will be performed on strewn slides (TWL and FM) and, whenever possible, on polished section (RWL and FM) of KC and WR samples;



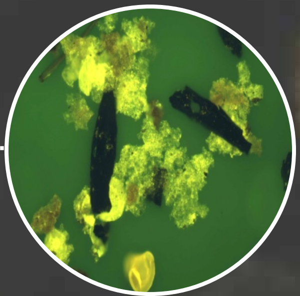
Palynofacies and Organic Facies Lab.
(LAFO-UFRJ)



Strewn Slide
(KC)

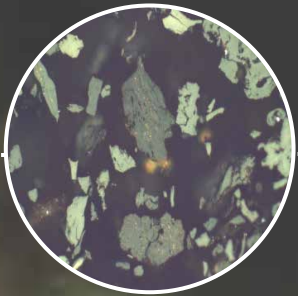


TWL



FM

Polished Section
(KC)



RWL

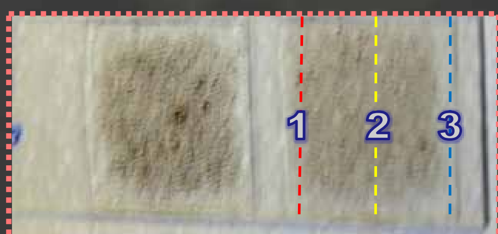
FM

Organic Matter (individual organic particle) Counting Procedures

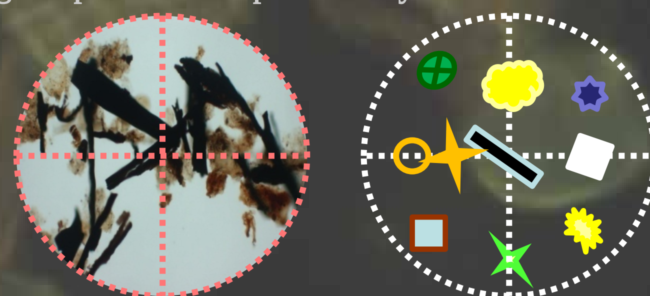
For obtaining data in this palynofacies WG a counting of the organic particles will be requested;

The organic particles will be assigned according to the more updated classification system and the counting data may be obtained using the standard method of counting;

Transverse lines on strewn slides



Organic particles that pass directly under the cross-wires



All participants will receive a guideline explaining the counting procedures.

Organic Matter (individual organic particle) Counting

The counting data will be recorded on counting sheets (based on the classification system);

All participants will receive a counting sheet according to organic particles present in the samples that will be analyzed.

Groups	Subgroups	Particles		Count
PHYTOCLAST	Opaque	Equant		
		Lath		
		Corroded		
	Non-opaque	Non-Biostructured		
		Cuticle		
		Membrane		
		Biostructured	Striate	
			Striped	
			Banded	
			Pitted	
		Fungal Hyphae		
	Sclereids	Sclereids		
PALYNOMORPH	Sporomorphs	Spores		
		Pollen Grain		
	Freshwater Microplankton	*Botriococcus*		
		Pediatrum		
		Zygnemataceaea		
	Marine Microplankton	Dinocysts		
		Prasinophyte		
		Acritarchs		
	Zoomorph	Foraminiferal		
		Scolecodonts		
		Chitinozoa		
Others	Zooclasts			
AOM	AOM			
	Resin			
	Macrophyte Tissues			
	Microbial Mats			
	Bacterial EPS			

Palynofacies Exercise Results

All participants will receive a guideline explaining how to present the results.

After obtaining of the palynofacies absolute data (through the counting methods of organic constituents) it will be necessary to transform them to percentage values;

These palynofacies exercises will deal primarily with the characterization of the OM assemblage in terms of the relative contributions of its constituents (percentages based on relative numeric particle frequencies) and they will be based on:

1. Percentage frequency (the frequency of any component related to that of the total population of particles presents);
2. Relative frequency ratios (the numeric frequency of any component related to that of any other component, not the total particle population);

For the data closure all results must sum 100% in order to evaluate real correlations that may exist within the data;

Palynofacies WG Proposal

The proposal for Palynofacies WG is composed by 4 exercises:

1st Exercise: Phytoclast Group

2nd Exercise: Palynomorph Group

3rd Exercise: Amorphous Group

4th Exercise: Three main groups of OM

Palynofacies Working Group

Proposal:

1st Exercise (2013?): Phytoclast Group

Convener: João Graciano Mendonça Filho

Phytoclast Group

The main objective of this 1st Exercise will be the characterization of the origin of the phytoclast* particles and the all aspects of the phytoclast assemblage, such as:

- Identification of the individual particulate components;





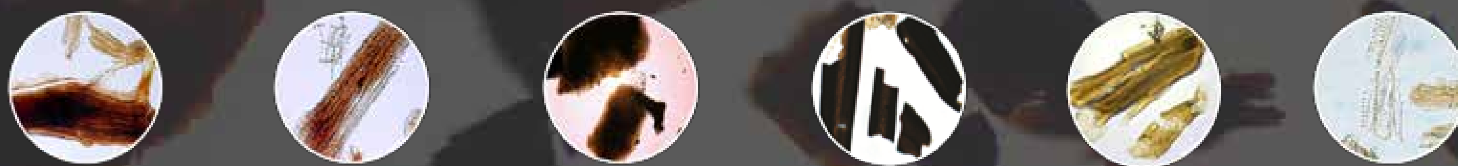
- Assessment of their absolute and relative proportions;
- Particle sizes;
- Preservation states;

* The phytoclast term was introduced by Bostick (1971) to describe all particles with size clay or fine-sand derived from higher plants or fungi and fluorescence depending on the origin of the tissues.

The criteria that will be used for phytoclast description in TWL microscopy and FM are:

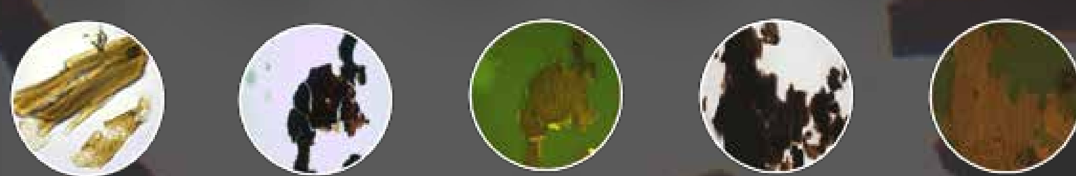
Edge translucency: opaque (black) and non-opaque (translucent);

Translucency color: orange-brown (± black thickenings), dark brown to black, yellow, and colorless;



Autofluorescence: moderate-strong green-yellow colors, weak (but clearly present), and absent;

Gelification: pervasive (massive, non-porous, homogeneous, subconchoidal fracture or slight);

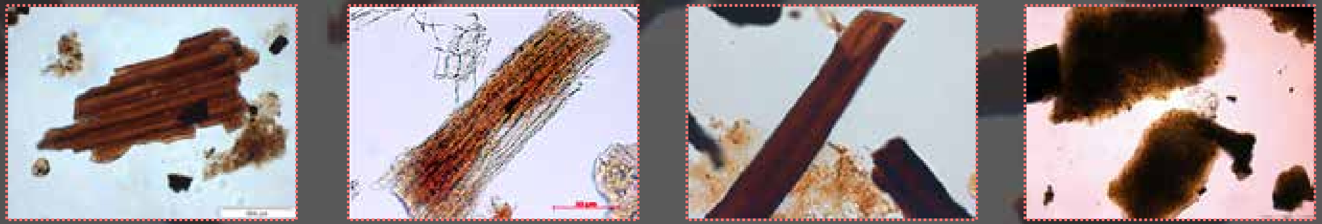


 # Microstructure: Biostructured and non-biostructured phytoclasts;

 # Type of Biostructure:

Definitive (tissue specific): "cellular" (one cell layer thick, e.g. cuticle), cellular (several cells thick, e.g. cortex), bordered pits: various types, e.g. tracheids, cross-hatched (ray tissue), and hollow tubes (tracheids or vessels);

Non-definitive: ribs, thickenings (xylem fragments), fibrous (without other structure), and non-biostructured (no biostructure apparent but recognizable as a fragment of a larger organized body) or pseudoamorphous/amorphous (ghost or relict structure or with only a characteristic outline);



Form/Symmetry:

Laths, "blades" , cylinders (length:width ≥ 2-3) **or Equant** (equidimensional, length:width ≤ 2-3);




Acicular ("needles", few µm in width, length:width ≥ 2-3) **or Planar** (thin sheets);





Irregular and thin, ± branched, narrow (few µm) **tubules** (± septal);



\# **Angularity:** angular, rounded, and irregular;






\# **Outline:** sharp (± clear internal structures), frayed or splintered (especially on short sides), embayed, corroded and/or diffuse outline;





 # Size of particles: variable






Detailed classification system of the individual organic components from Phytoclast Group that will be used in this 1st Exercise

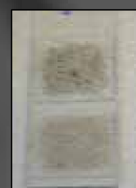
PHYTOCLAST	GROUPS & SUBGROUPS				DESCRIPTION
	Fragments of Tissues Derived from Higher Plants or Fungi	Opaque	**Equidimensional (Equant)** **lenght: width ratio < 2**		Black or opaque in colour even at grain boundary. Sharp outline; mostly no internal structure.
		Opaque	**Lath** **lenght: width ratio > 2**		Black or opaque in colour even at grain boundary. Sharp outline; it may shows pits.
		Opaque	**Corroded**		Black in colour. More diffuse outline; irregular.
		Non-Opaque (Translucent)		**Fungal Hyphae**	Fragments of hyphae. Brown in colour. Individual filaments of the mycelium of the vegetative phase of eumycote (higher) fungi.
		Non-Opaque (Translucent)	***Undegraded*** Sharp outline (may be slightly irregular). May be splintered. or ***Degraded*** Irregular and diffuse outline or ***Pseudoamorphous/ "Amorphous"*** Diffuse outline, it may light brown, brown and dark brown in colour. Starting to show some features of AOM, but homogenous in apperance, not pyrite specked, no inclusions. It may exhibits fluorescence. or ***In decomposition (gelified)*** ***"Highly preserved"*** Irregular outline in transmitted white light, it exhibits coloration of fluorescence. The characteristics indicate a highly degree of chemistry preservation due to specific conditions.	**Non-biostructured**	No botanical structure. Translucent, generally brown in colour. Lath or equant in shape.
		Non-Opaque (Translucent)		**Cuticle**	Epidermal tissue of higher plants. Pale yellow-green, yellow, reddish-yellow in colour particle. Regular cell outlines; sheet-like, in some cases with visible stomata. It may occurs thick translucent phytoclasts that under fluorescence, present a yellow fluorescing cuticle overlaying ("coating") on these phytoclasts. This particular feature (cuticular layer fragments associated with innermost part of epiderms) could be indicating that the land plants fragments derived from leaves.
		Non-Opaque (Translucent)		**Membrane**	Pale yellow in colour; thin; sheet-like; irregular. They often fluorescent; highly translucent. Lack of diagnostic internal structure.
		Non-Opaque (Translucent)		**Biostructured**	Generally brown in colour; lath to equant in shape; clearly visible internal structure. Striate: shown thin (regular fibrous lineation). Striped: Irregular or unequal stripes (may be thicknings). Banded: Regular and equal parallel sided thickenings. Pitted: Bordered or scalariform pits.
		Sclereids	Generally opaque, but may be translucent (dark brown). Sclerenchymatic tissue cells, with thickened secondary wall and impregnated with lignin. Found in different parts of the plant (root, stem and leaf) with the sustentation function and mechanical resistance.		

Tyson, 1995; Mendonça Filho, 1999; Mendonça Filho *et al.*, 2002, 2010, 2011, 2012

Correlation

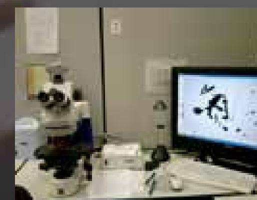
- For a correlation of the particulate OM in TL (KC strewn slide) with the organic components in RL (KC and WR polished sections) is still being suggested a description of DOM according to ICCP /TSOP classification;

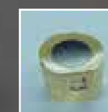
TWL and FM



KC
Strewn
Slide

RWL and FM



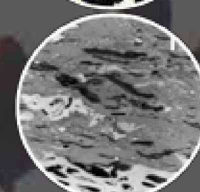


KC and WR
Polished
Sections

Opaque Phytoclasts
(TWL)

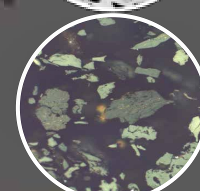
Inertinite (Fusinite)
(RWL)

Non-opaque Phytoclasts
(TWL)



Vitrinite
(RWL)

Opaque and non-opaque
Phytoclasts (TWL)



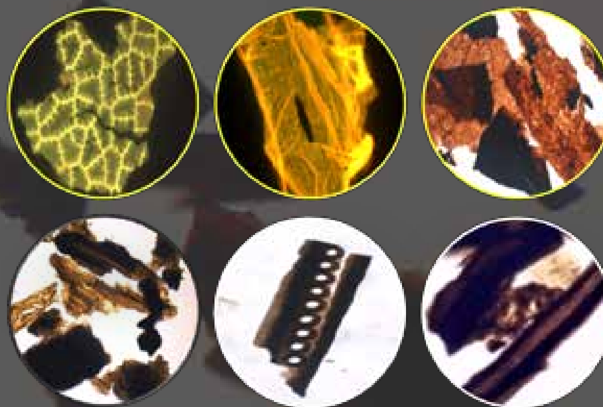
Inertinite and Vitrinite
(RWL)

Samples

2 samples* encompassing the subgroups from Phytoclast Group will be used in this 1st Exercise:

Opaque Phytoclasts

Non-Opaque Phytoclasts:



* The samples will be chosen according to their depositional system:

- One sample from a continental/transitional system (Brasil?)
- One sample from a transitional/marine system (Portugal?)

Participants

This participant list was extracted from the signing list given after the Palynofacies WG proposal made during the activities from ICCP Commission II, Porto (2011).

Participant	Affiliation	Country
01. Barcelona, Elvira	Weatherford Laboratories Australia	Australia
02. Borrego, Angeles G.	INCAR-CSIC	Spain
03. Nandita Choudhury		India
04. Cisternas, Maria Eugenia	Universidad de Concepcion	Chile
05. Esterle, Joan	Un. Queensland, Sch. Earth Sc	Australia
06. Flores, Deolinda	Porto University	Portugal
07. Galicia, Carlos Manuel Tejeda		Mexico
08. Gentzis, Thomas	CORELAB	USA
09. Gonçalves, Paula	Porto University	Portugal
10. Gonzalez, Felipe J.	Huelva University	Spain
11. Hackley, Paul	U.S. Geological Survey	USA
12. Hámor-Vidó, Maria		Hungary
13. Hartkopf-Fröder, Christoph	Geologischer Dienst NRW	Germany
14. Holstein, Björn	RWE Dea / Wietze Laboratory	Germany
15. Kalaitzidis, Stavros	BMA	Australia
16. Kern, Marcio L.	Federal University of Rio de Janeiro	Brazil
17. Kus, Jolanta	Federal Institute for Geosciences and Natural Resources	Germany
18. Mendonça Filho, João G.	Federal University of Rio de Janeiro	Brazil
19. Mendonça, Joalice O.	Federal University of Rio de Janeiro	Brazil
20. Menezes, Taíssa R.	Petrobras R&D Center	Brazil
21. Misz-Kennan Magdalena		Poland
22. Oskay, Riza Görkem	University of Patras	Greece
23. Pickel, Walter		Australia
24. Shaaban, Aly	Alex Palynological Consultant	Egypt
25. Ashok Singh		India
26. Suarez-Ruiz, Isabel	INCAR-CSIC	Spain
27. Sýkorová, Ivana		Czech Republic
28. Valentin, Bruno	Porto University	Portugal
29. Zivotič, Dragana	University of Belgrade	Serbia
30.	....	....
31.	....	....


INTERNATIONAL COMMITTEE FOR COAL AND ORGANIC PETROLOGY -
謝謝