

# **ANALYTICAL REPORT**

## **SOURCE ROCK ORGANIC MATTER REFLECTANCE AND TYPING**

**CANDACE 1**

**PREPARED FOR  
GEOLOGICAL SURVEY AND RESOURCE STRATEGY DIVISION  
DMIRS**

**SEPTEMBER 2021**



Energy Resources Consulting Pty Ltd  
PO Box 54  
Coorparoo, Qld 4151  
Australia

## SOURCE ROCK ORGANIC MATTER REFLECTANCE AND TYPING

### INTRODUCTION

Samples were received (see table below) to be evaluated for the reflectance of organic matter (vitrinite where possible) as well as an assessment of the types of organic matter present. If HAWK pyrolysis was also requested, the equivalent sample number is also indicated. HAWK data are reported separately.

ERC Sample No.		Company Reference	Sample Type	Other information
V <sub>r</sub>	HAWK			
E4446		237739	Cuttings	1387.5 - 1390 m
E4447		237759	Cuttings	1602.5 - 1605 m
E4448		237738	Cuttings	1680 - 1685 m
E4449		237737	Cuttings	1837.5 - 1840 m
E4450		237736	Cuttings	1930 - 1935 m
E4451		237734	Cuttings	1990 - 1992.5 m

### METHODS

Sample preparation methods may vary slightly depending upon whether core/ outcrop or cuttings were received.

With core and outcrop samples, a flat face perpendicular to bedding is prepared by grinding. This is placed in a 30 mm diameter mould along with several randomly oriented grains. The whole is mounted in epoxy resin.

With cuttings, the samples are passed through a 2 mm sieve and where necessary are gently cracked in a mortar and pestle. This is then mounted in epoxy resin.

The epoxy resin mounted samples are polished using a variety of wet and dry papers, diamond polishing compounds and colloidal silica. The polished samples are dried in a desiccator for a minimum of 12 hours prior to analysis.

Analysis is made using a Leica MP4500P system with Hilgers DISKUS software. A mechanical stage is used to traverse the sample in a regular pattern. Mean maximum reflectance in oil of the organic matter is determined by rotating the microscope stage. Reflectance is determined of a 2  $\mu\text{m}^2$  area at 546nm using a total magnification of 500X.

A visual estimation of organic matter types and abundances was also made using comparison charts under both reflected and blue light excitation. The categories used are:

Descriptor	%
Absent	0
Rare	<0.1
Sparse	$0.1 < x < 0.5$
Common	$0.5 < x < 2.0$
Abundant	$2.0 < x < 10.0$
Major	$10.0 < x < 40.0$
Dominant	>40.0

The samples are also examined in blue light fluorescence using a Royal Blue LED as the excitation source.

## RESULTS

Results are tabulated as follows. Low resolution images are provided in an appendix for reference purposes. High quality images are provided in a separate image file.

### Data presentation

Individual sample results are reported in the following format:

ERC No. Client No.	Depth (ft / m)	$R_{Vmax}^{*1}$	Range <sup>*2</sup>	SD <sup>*3</sup>	N <sup>*4</sup>
x1234	3106	0.79	0.64 - 0.91	0.145	25
	$R_I^{*5}$				
	Alginite <sup>*5</sup>				
	Bitumen <sup>*5</sup>				

\*1 Mean of all the maximum reflectance readings obtained.

\*2 Lowest Rmax and highest Rmax of the population considered to represent the first generation vitrinite population.

\*3 Standard Deviation

\*4 Number of fields measured (Number of measurements = 2N because 2 maximum values are recorded for each field)

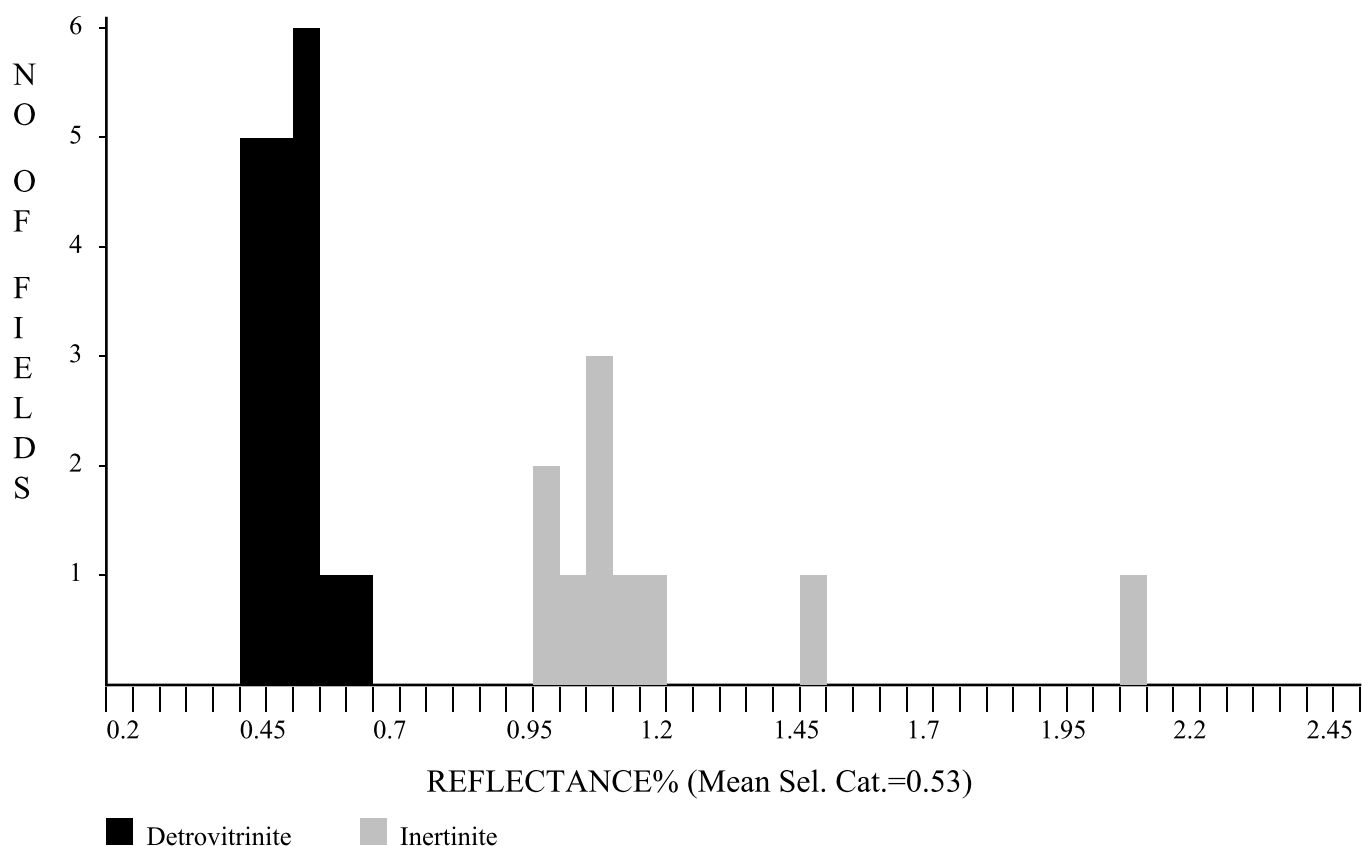
\*5 Reflectance of multiple vitrinite populations or of other organic matter types.  $R_I$  = Inertinite mean maximum reflectance etc; subscripts may be expanded as necessary.

HAWK data, where requested, are reported separately in spread sheet format.

Note that if samples are retained by ERC, they will be held for at least 12 months after reporting but may be discarded after that date.

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA						
Sample# Client ref.	Depth (ft)	$\overline{R}_{vmax}$	Range	SD	N	Sample description including liptinite fluorescence, maceral abundances, mineral fluorescence CANDACE 1 GSWA# 237739
E4446 237739 Ctgs	1387.5-1390 $\overline{R}_I$	0.53 1.25	0.46-0.65 1.02-2.14	0.053 0.328	17 10	Common sporinite and sparse liptodetrinite yellow to dull orange, rare cutinite yellow to orange. (Claystone>carbonate>argillaceous siltstone>sandstone. Dom common, L>I>V. Liptinite common, inertinite sparse to common, vitrinite rare. Mineral fluorescence weak to moderate orange. Iron oxides common. Pyrite common.) GSWA# 237759
E4447 237759 Ctgs	1602.5-1605 $\overline{R}_I$	0.49 1.22	0.40-0.59 0.90-1.70	0.042 0.280	25 10	Abundant sporinite and sparse liptodetrinite orange to dull orange, common cutinite yellow to orange. (Shaly coal>sandstone>claystone>coal. Shaly coal dominant, I>L>V, clarodurite>duroclarite>clarite>inertite. Shaly coal comprises about 50% of the sample and approximate maceral composition on mineral free basis: inertinite 55%; liptinite 25%; vitrinite 20%. Coal abundant, V>L>I, duroclarite>clarite>vitrite. Coal comprises about 5% of the sample and approximate maceral composition on mineral free basis: vitrinite 60%; liptinite 25%; inertinite 15%. Dom sparse to common, V>I>L. All three maceral groups sparse. Mineral fluorescence weak orange. Iron oxides rare. Pyrite sparse.) GSWA# 237738
E4448 237738 Ctgs	1680-1685 $\overline{R}_I$	0.56 1.36	- 0.97-2.30	- 0.408	1 10	Rare sporinite and liptodetrinite yellow to orange, rare cutinite dull orange. (Coarse sandstone>>claystone>carbonate. Dom rare, L>I>V. All three maceral groups rare. Rare claystone grains, containing organic matter, could be cavings and dom may be absent on contaminant free basis. Mineral fluorescence mostly none, weak orange in rare claystone grains. Iron oxides rare. Pyrite rare.) GSWA# 237737
E4449 237737 Ctgs	1837.5-1840 $\overline{R}_I$	0.59 1.37	0.45-0.71 0.93-2.02	0.066 0.299	25 10	Sparse sporinite and rare liptodetrinite yellow to orange, sparse cutinite orange to dull orange, rare resinite greenish yellow. (Silty claystone>argillaceous siltstone>sandstone>carbonate. Dom abundant, I>L>V. Inertinite common, liptinite sparse to common, vitrinite rare. Mineral fluorescence weak orange in fine grained sediments. Iron oxides sparse. Pyrite abundant.) GSWA# 237736
E4450 237736 Ctgs	1930-1935 $\overline{R}_I$	0.60 1.49	0.52-0.71 0.94-2.06	0.052 0.352	25 10	Rare sporinite and liptodetrinite orange to dull orange, rare cutinite dull orange. (Sandstone>siltstone>claystone>carbonate>artificial composites. Dom common, I>V>L. Inertinite common, vitrinite sparse, liptinite rare to sparse. Mineral fluorescence weak orange in fine grained sediments. Iron oxides abundant. Pyrite sparse.) GSWA# 237734
E4451 237734 Ctgs	1990-1992.5 $\overline{R}_I$	0.64 1.56	- 1.02-3.01	- 0.384	1 25	Rare lamalginite and liptodetrinite orange to dull orange. (Fine claystone>ferruginous claystone>argillaceous siltstone>carbonate. Dom sparse to common, I>L?V. Inertinite sparse to common, liptinite and vitrinite rare. Dom mainly consists of fine inertodetrinite in claystones. Mineral fluorescence pervasive dull orange. Iron oxides common. Pyrite rare.)

GSWA, 237739, Candace 1, 1387.5-1390ft, Ctgs(E4446)

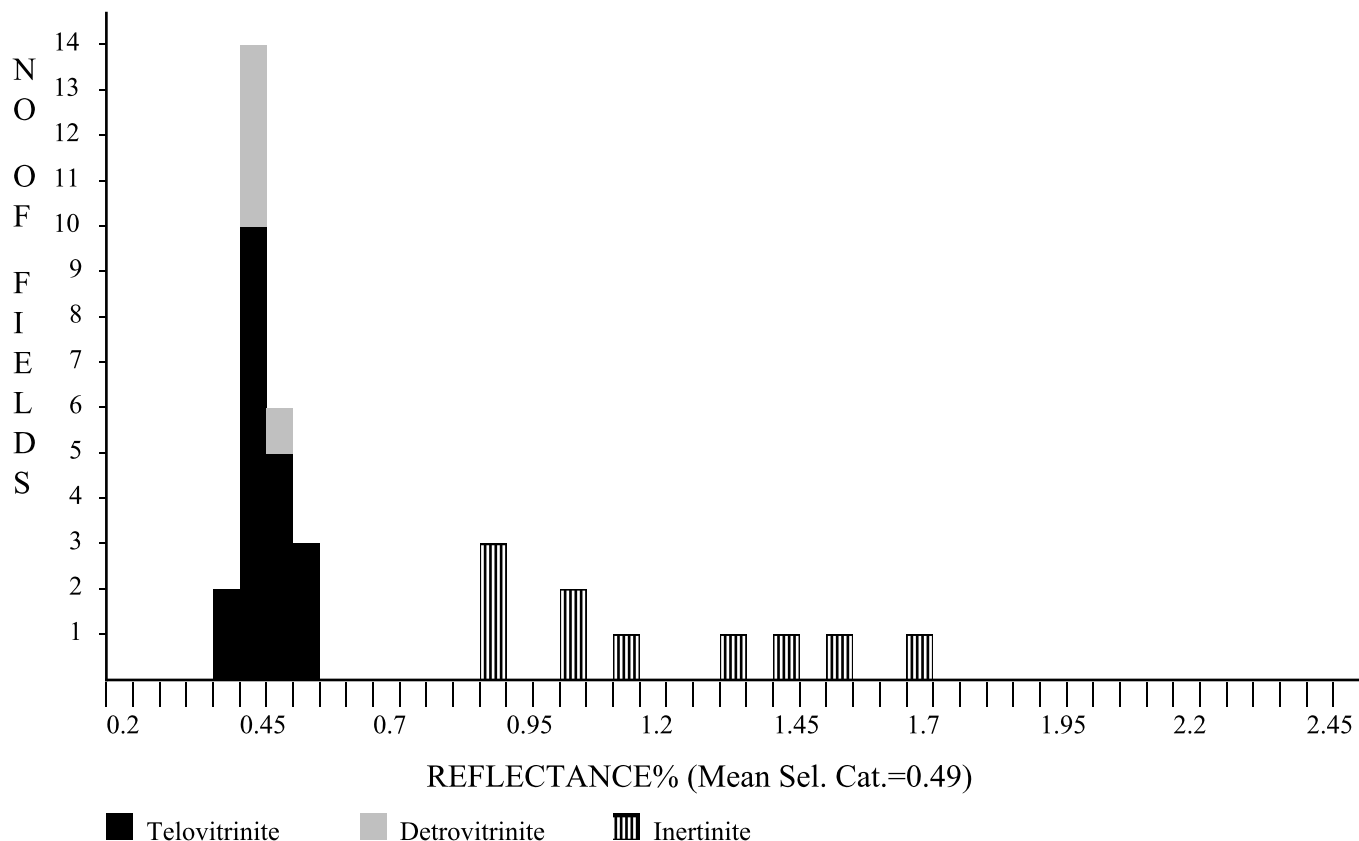


Maceral Category	N	Mean	Standard Deviation
Detrovitrinite	18	0.53	0.053
Inertinite	10	1.25	0.328
Total	28	0.79	0.398

Selected categories: Detrovitrinite:

No. of Readings:	18
Mean of Selected Categories:	0.53
Standard Deviation of Selected categories:	0.053

GSWA, 237759, Candace 1, 1602.5-1605ft, Ctgs(E4447)

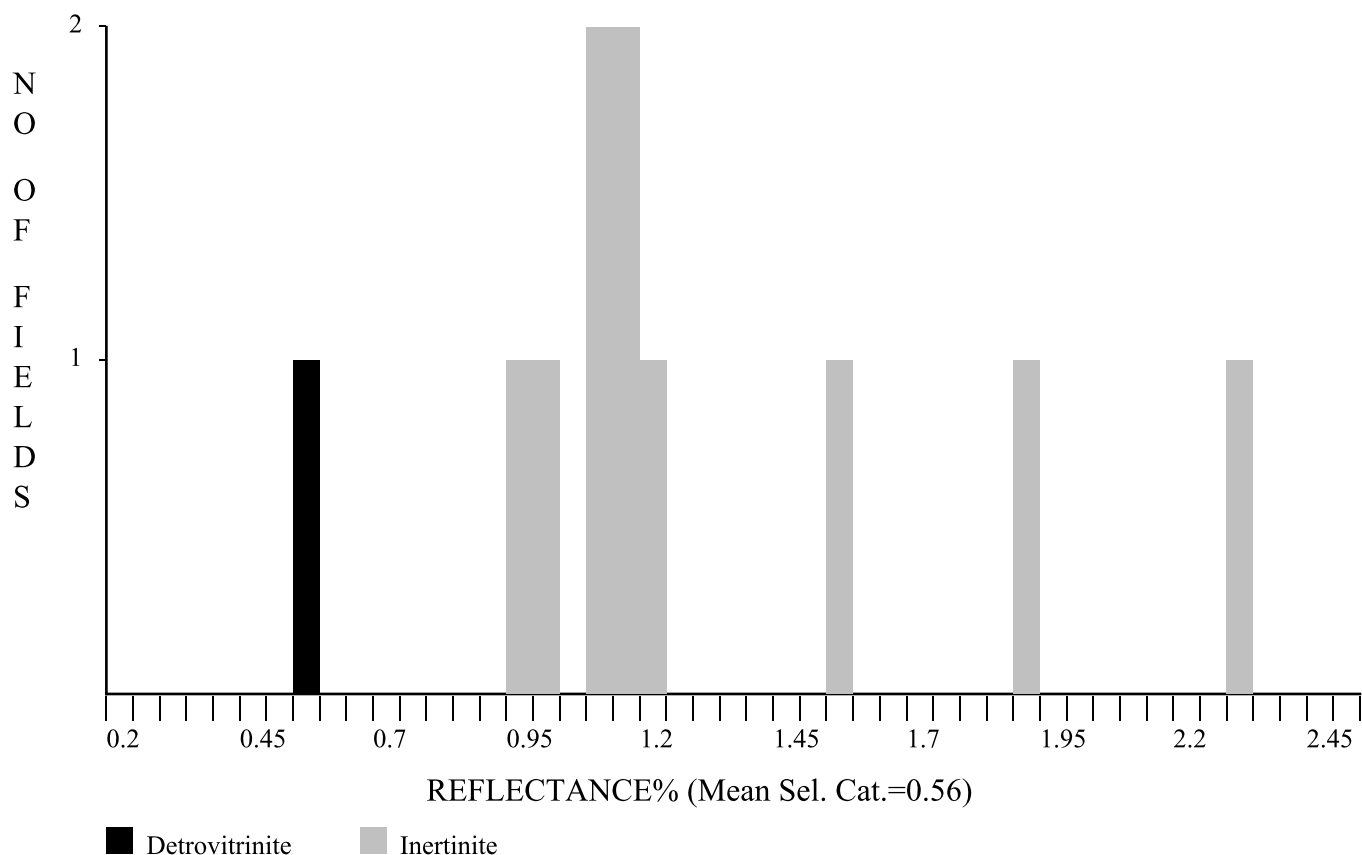


Maceral Category	N	Mean	Standard Deviation
Telovitrinite	20	0.49	0.045
Detrovitrinite	5	0.48	0.023
Inertinite	10	1.22	0.280
<b>Total</b>	<b>35</b>	<b>0.70</b>	<b>0.363</b>

Selected categories: Telovitrinite, Detrovitrinite:

No. of Readings: 25  
Mean of Selected Categories: 0.49  
Standard Deviation of Selected categories: 0.042

GSWA, 237738, Candace 1, 1680-1685ft, Ctgs(E4448)

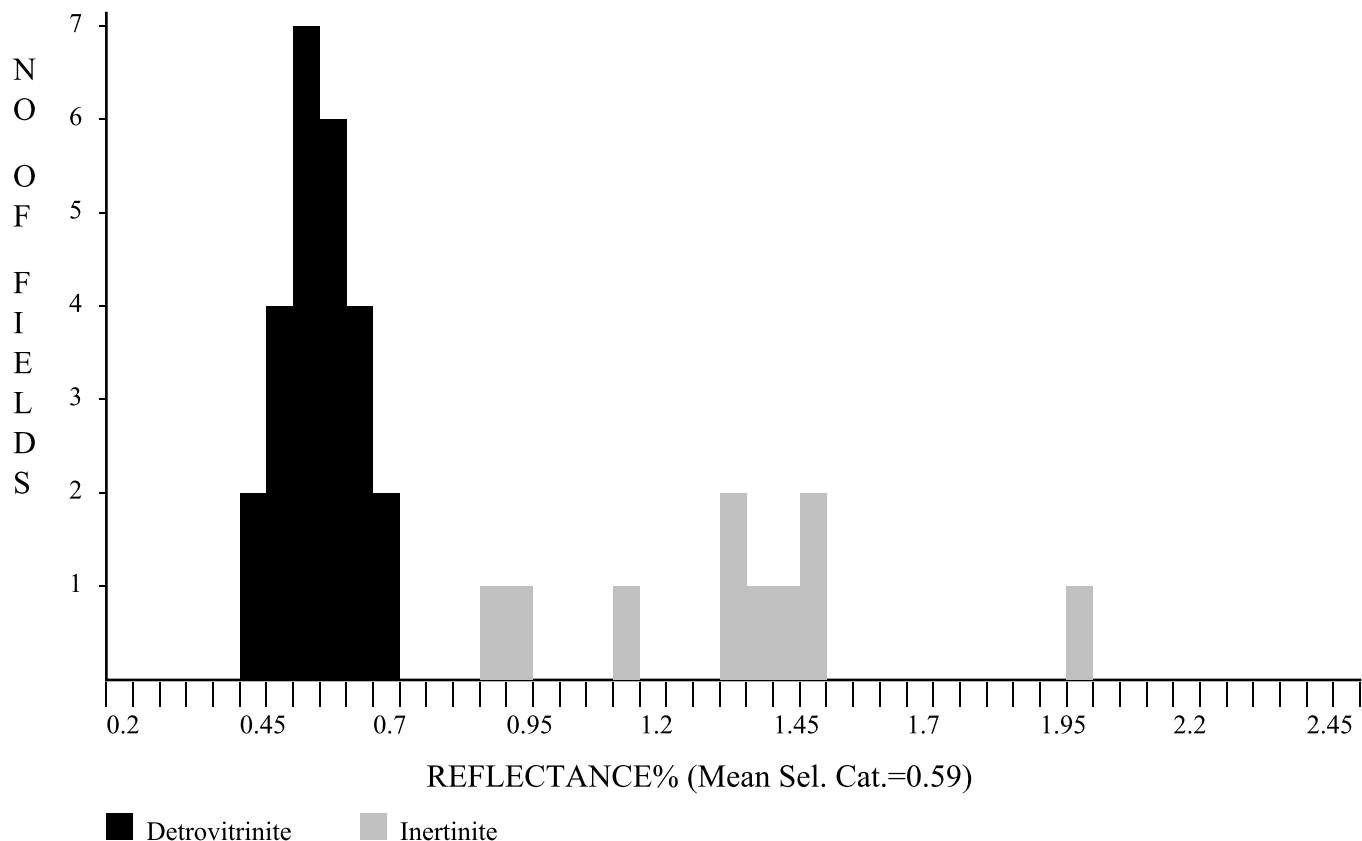


Maceral Category	N	Mean	Standard Deviation
Detrovitrinite	1	0.56	0.000
Inertinite	10	1.36	0.408
<hr/>			
Total	11	1.29	0.452

Selected categories: Detrovitrinite:

No. of Readings:	1
Mean of Selected Categories:	0.56
Standard Deviation of Selected categories:	0.000

GSWA, 237737, Candace 1, 1837.5-1840ft, Ctgs(E4449)



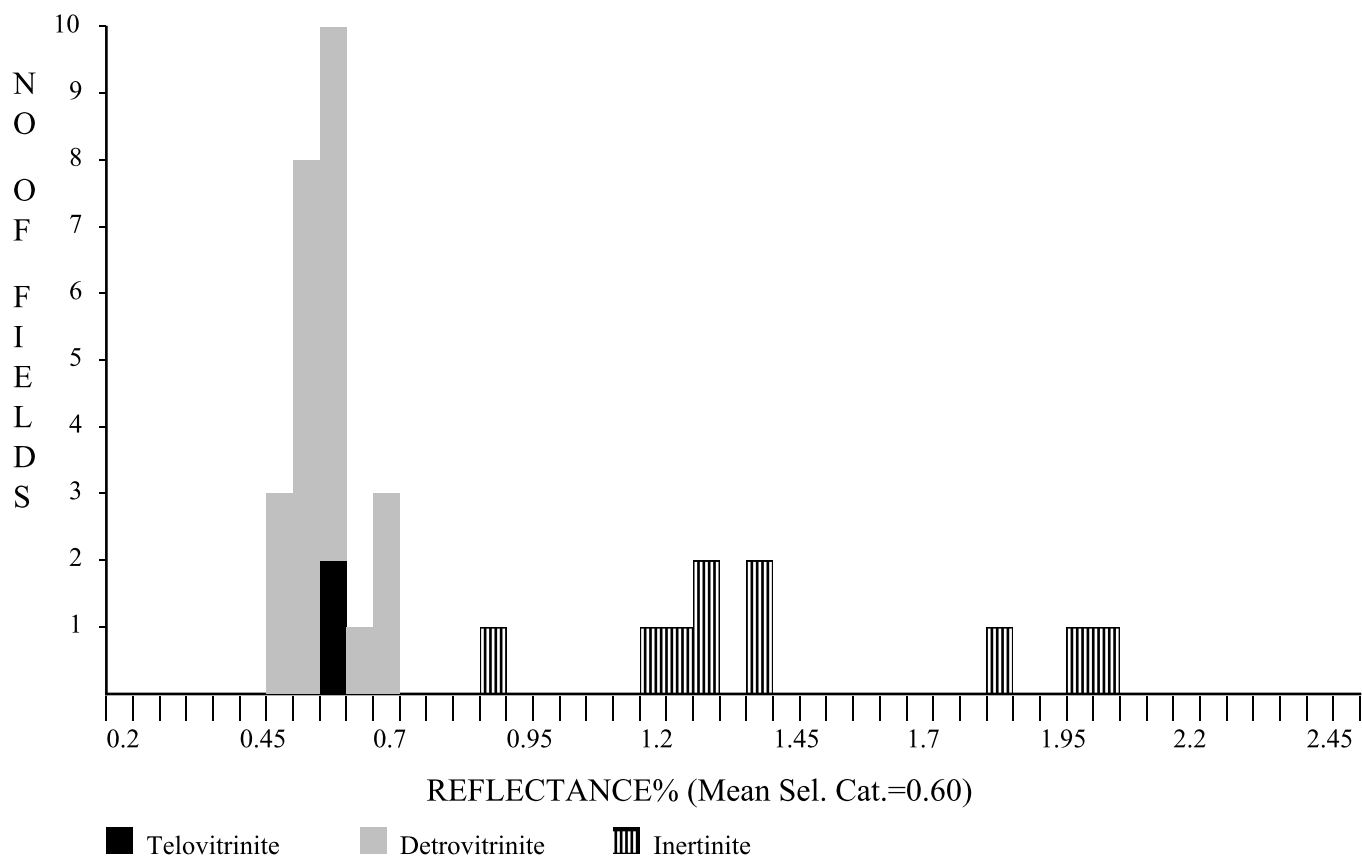
Maceral Category	N	Mean	Standard Deviation
Detrovitrinite	25	0.59	0.066
Inertinite	10	1.37	0.299
<b>Total</b>	<b>35</b>	<b>0.81</b>	<b>0.392</b>

Selected categories: Detrovitrinite:

No. of Readings:	25
Mean of Selected Categories:	0.59
Standard Deviation of Selected categories:	0.066



GSWA, 237736, Candace 1, 1930-1935ft, Ctgs(E4450)



Maceral Category	N	Mean	Standard Deviation
Telovitrinite	2	0.63	0.000
Detrovitrinite	23	0.60	0.054
Inertinite	10	1.49	0.352
<b>Total</b>	<b>35</b>	<b>0.86</b>	<b>0.443</b>

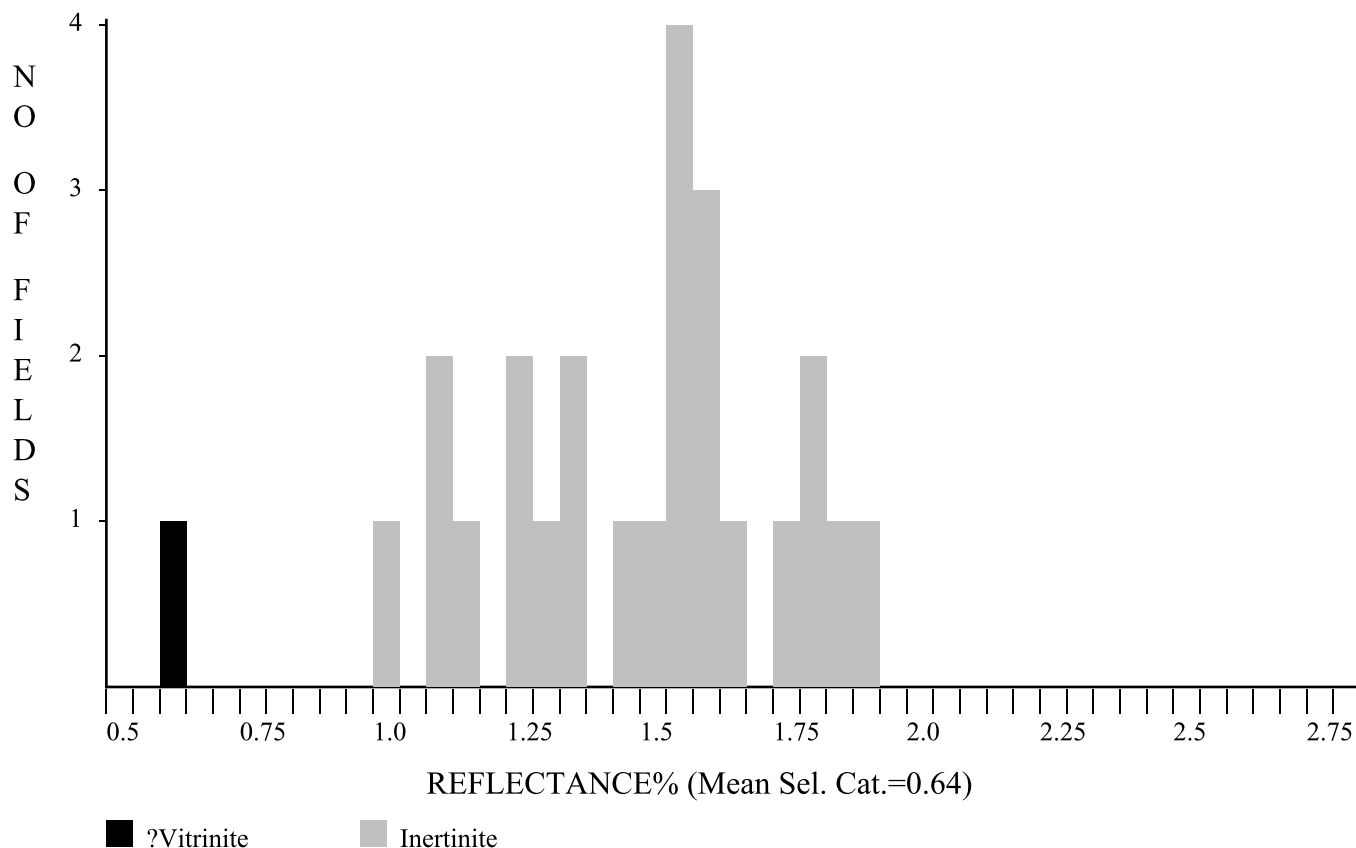
Selected categories: Telovitrinite,Detrovitrinite:

No. of Readings: 25  
Mean of Selected Categories: 0.60  
Standard Deviation of Selected categories: 0.052

Energy Resources Consultants Pty Ltd  
4/55 Clarence Street  
Coorparoo, QLD4151  
Australia

Telephone: (07) 3394 3011  
International: +61-2-42 549700  
Fax: +61-7-3394 3088  
Email: Paddy.Ranasinghe@gmail.com

GSWA, 237734, Candace 1, 1990-1992.5ft, Ctgs(E4451)



Maceral Category	N	Mean	Standard Deviation
?Vitrinite	1	0.64	0.000
Inertinite	25	1.56	0.384
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Total	26	1.53	0.416

Selected categories: ?Vitrinite:

No. of Readings: 1  
Mean of Selected Categories: 0.64  
Standard Deviation of Selected categories: 0.000

Dr Peter Crosdale (MAIG)  
Director, ERC  
29<sup>th</sup> September, 2021

## **APPENDIX - PLATES**

High quality images are provided in a separate image file. Images provided in this report are for reference purposes only.

E4446A Detrovitrinite in claystone,  $R_{v\max} = 0.46\%$ , reflected white light, X50

E4446B Same as E4446A, in fluorescence mode

E4446C Sporinite in claystone, reflected white light, X50

E4446D Same as E4446C, in fluorescence mode

E4447A Shaly coal, duroclarite,  $R_{v\max} = 0.51\%$ , reflected white light, X50

E4447B Same as E4447A, in fluorescence mode

E4447C Clarite coal with cutinite,  $R_{v\max} = 0.55\%$ , reflected white light, X50

E4447D Same as E4447C, in fluorescence mode

E4448A Detrovitrinite in claystone,  $R_{v\max} = 0.56\%$ , reflected white light, X50

E4448B Same as E4448A, in fluorescence mode

E4448C Pyritized sporinite in claystone, reflected white light, X50

E4448D Same as E4448C, in fluorescence mode

E4448E Barren sandstone, reflected white light, X50

E4448F Same as E4448E, in fluorescence mode

E4449A Detrovitrinite in silty claystone,  $R_{v\max} = 0.62\%$ , reflected white light, X50

E4449B Same as E4449A, in fluorescence mode

E4449C Cutinite and resinite in silty claystone, reflected white light, X50

E4449D Same as E4449C, in fluorescence mode

E4450A Detrovitrinite in carbonate,  $R_{v\max} = 0.57\%$ , reflected white light, X50

E4450B Same as E4450A, in fluorescence mode

E4450C Sporinite and cutinite in silty claystone, reflected white light, X50

E4450D Same as E4450C, in fluorescence mode

E4451A ?Detrovitrinite in fine claystone,  $R_{v\max} = 0.64\%$ , reflected white light, X50

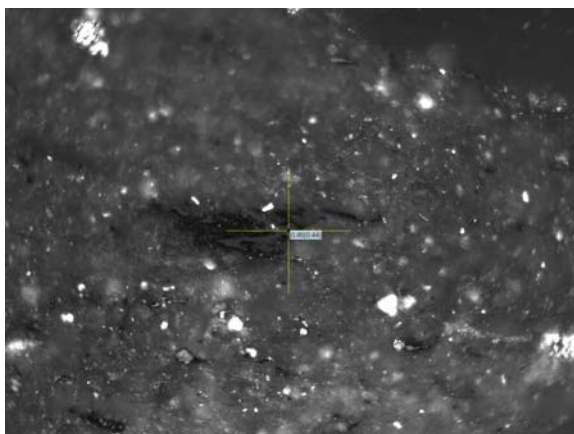
E4451B Same as E4451A, in fluorescence mode

E4451C Inertodetrinite in fine claystone,  $R_t = 1.56\%$ , reflected white light, X50

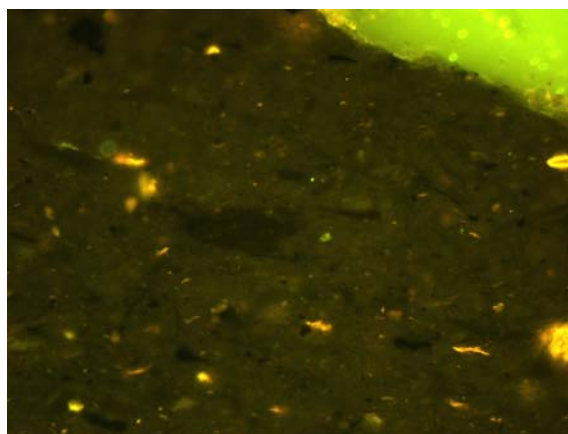
E4451D Same as E4451C, in fluorescence mode

E4451E Lamalginite in fine claystone, reflected white light, X50

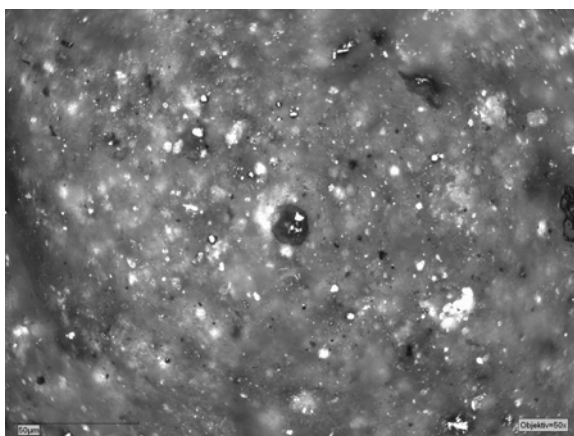
E4451F Same as E4451E, in fluorescence mode



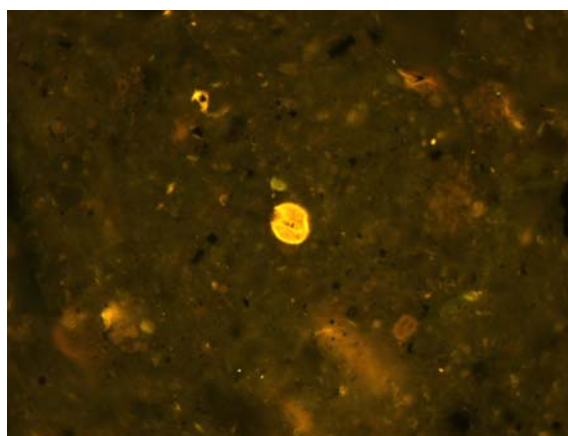
E4446A Detrovitrinite in claystone,  $R_{v\max} = 0.46\%$ , reflected white light, X50



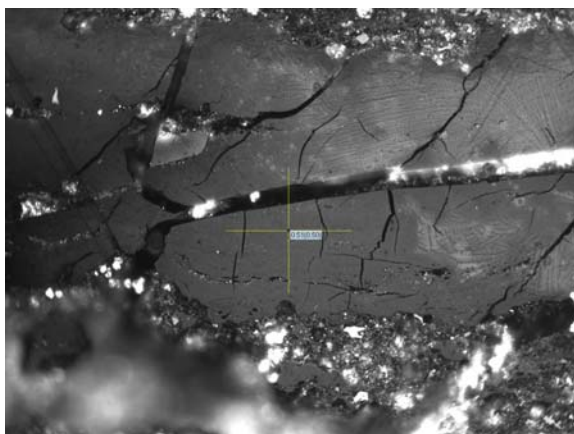
E4446B Same as E4446A, in fluorescence mode



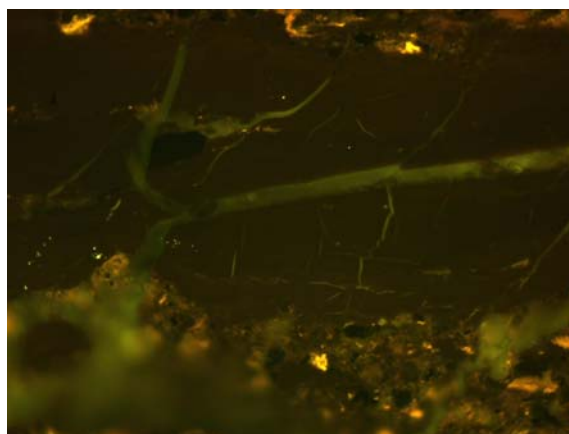
E4446C Sporinite in claystone, reflected white light, X50



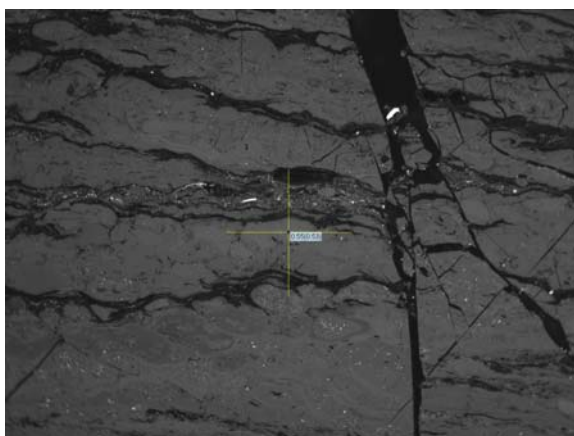
E4446D Same as E4446C, in fluorescence mode



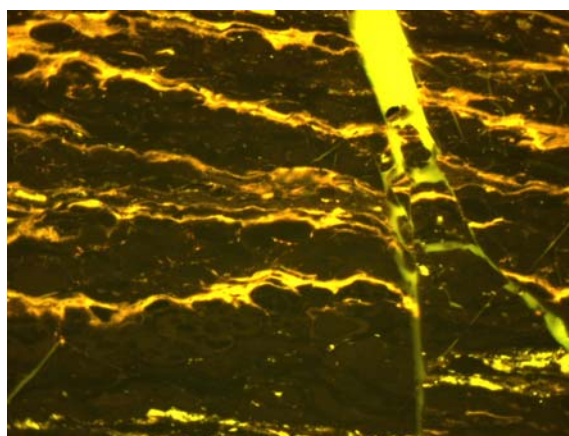
E4447A Shaly coal, duroclarite,  $R_{v \max} = 0.51\%$ , reflected white light, X50



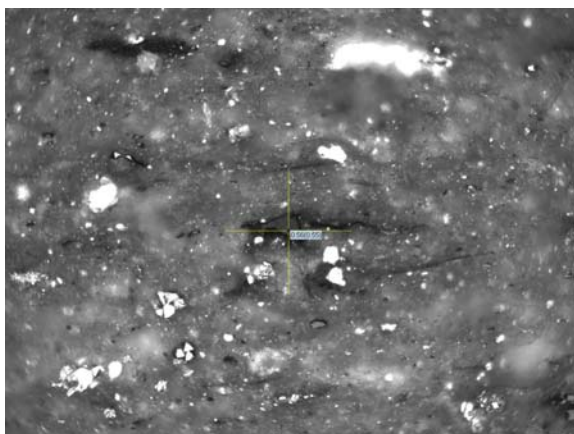
E4447B Same as E4447A, in fluorescence mode



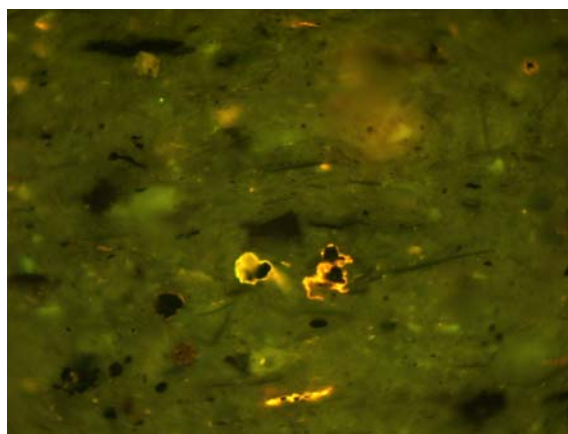
E4447C Clarite coal with cutinite,  $R_{v \max} = 0.55\%$ , reflected white light, X50



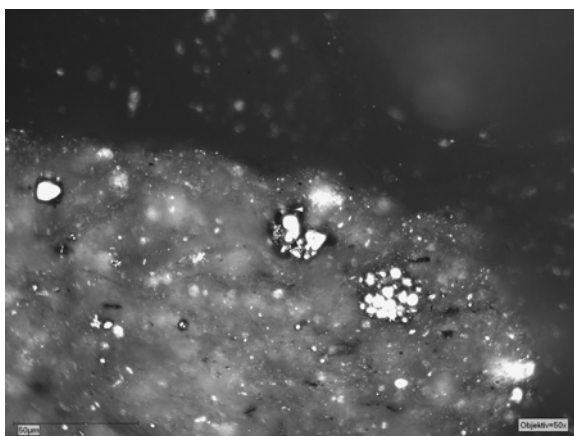
E4447D Same as E4447C, in fluorescence mode



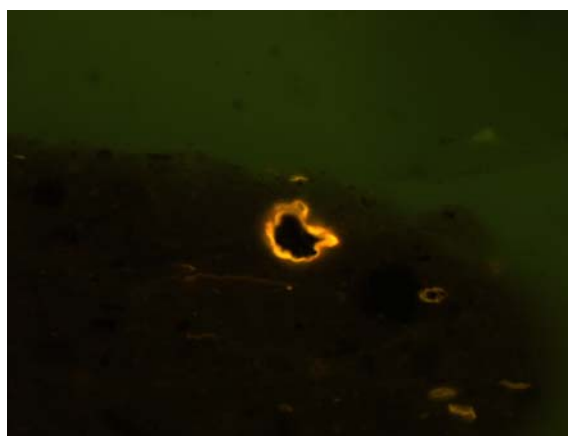
E4448A Detrovitrinite in claystone,  $R_{v\max} = 0.56\%$ , reflected white light, X50



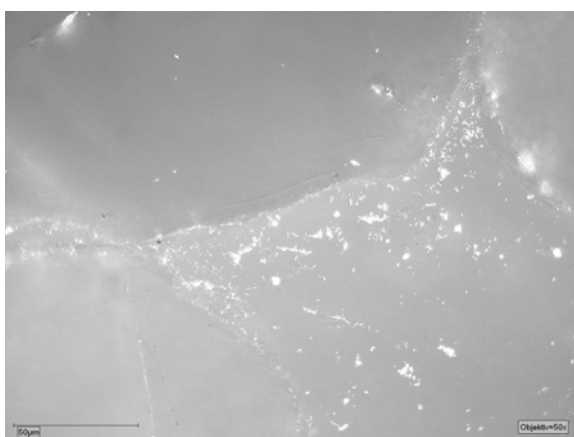
E4448B Same as E4448A, in fluorescence mode



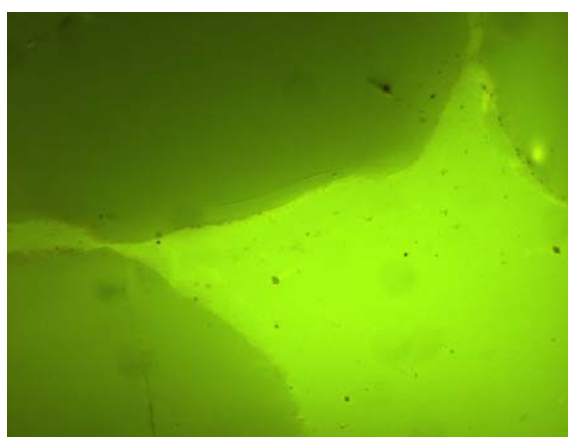
E4448C Pyritized sporinite in claystone, reflected white light, X50



E4448D Same as E4448C, in fluorescence mode

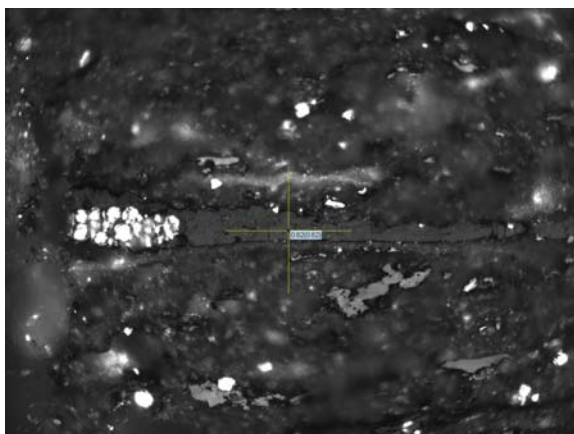


E4448E Barren sandstone, reflected white light, X50

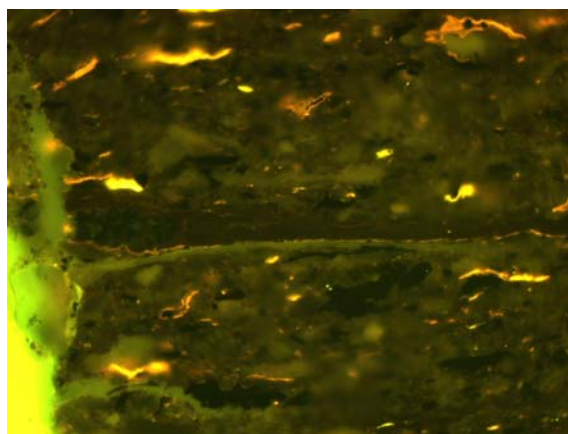


E4448F Same as E4448E, in fluorescence mode

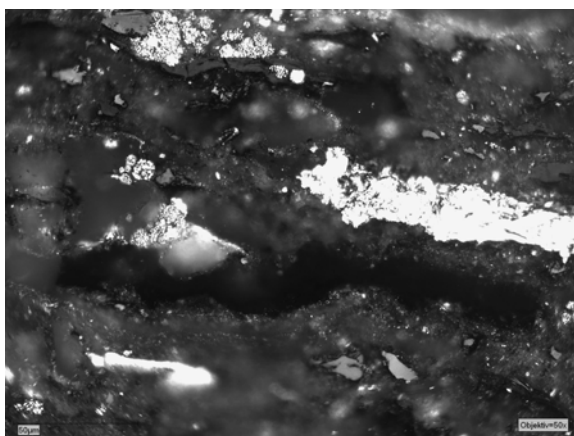




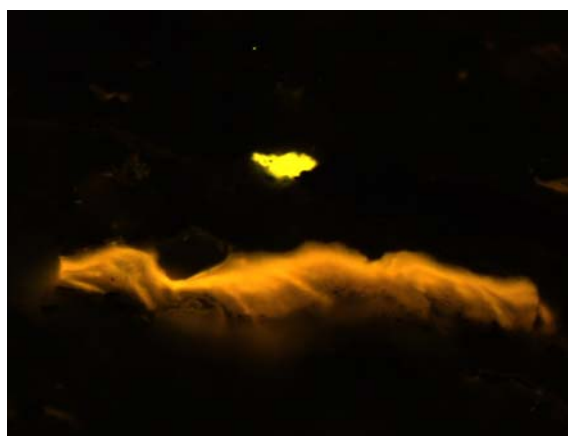
E4449A Detrovitrinite in silty claystone,  $R_{\text{max}} = 0.62\%$ , reflected white light, X50



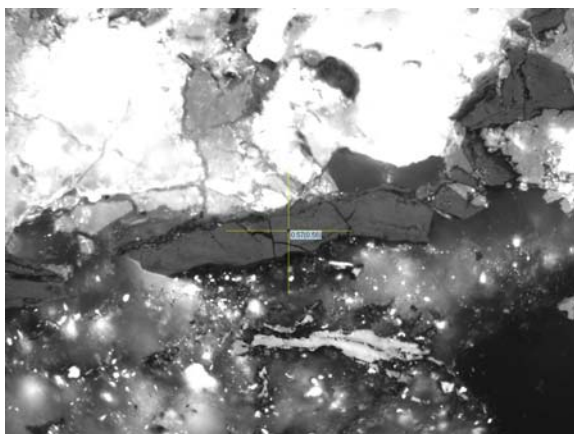
E4449B Same as E4449A, in fluorescence mode



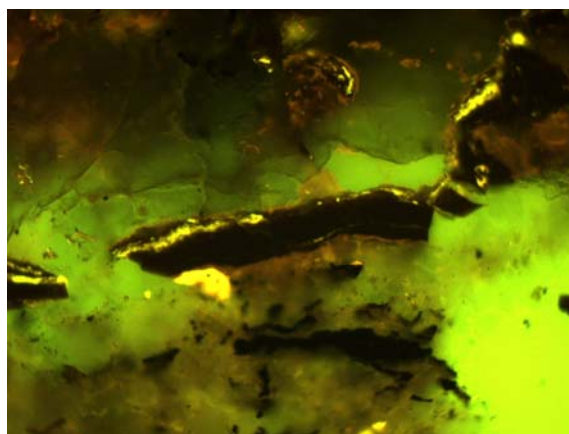
E4449C Cutinite and resinite in silty claystone, reflected white light, X50



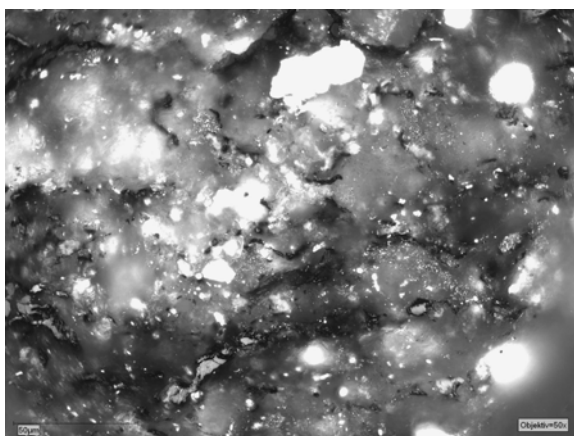
E4449D Same as E4449C, in fluorescence mode



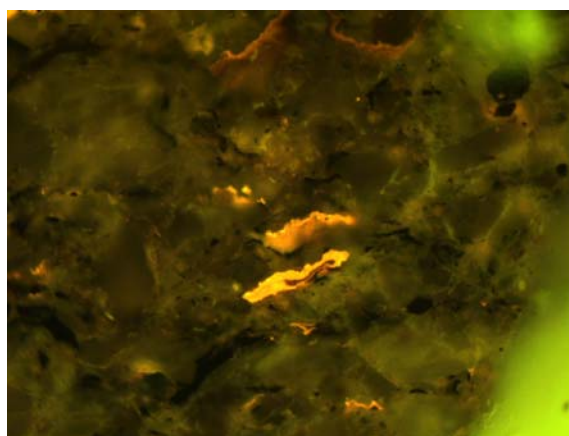
E4450A Detrovitrinite in carbonate,  $R_{v \max} = 0.57\%$ , reflected white light, X50



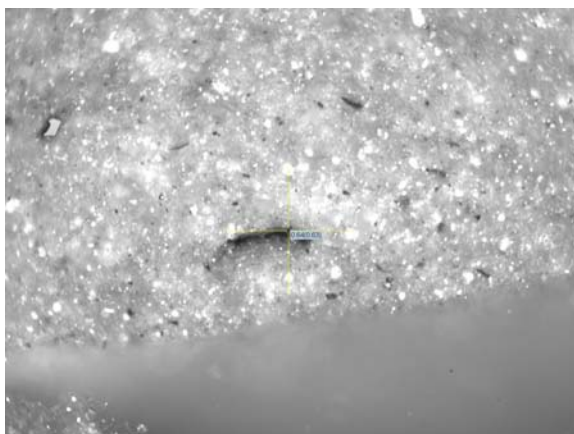
E4450B Same as E4450A, in fluorescence mode



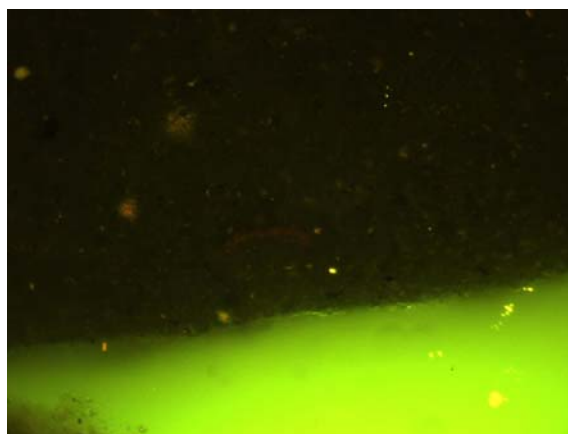
E4450C Sporinite and cutinite in silty claystone, reflected white light, X50



E4450D Same as E4450C, in fluorescence mode



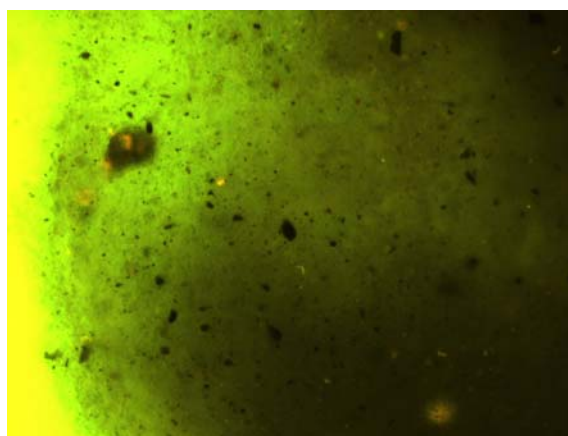
E4451A ?Detrovitrinite in fine claystone,  
 $R_{v \max} = 0.64\%$ , reflected white light, X50



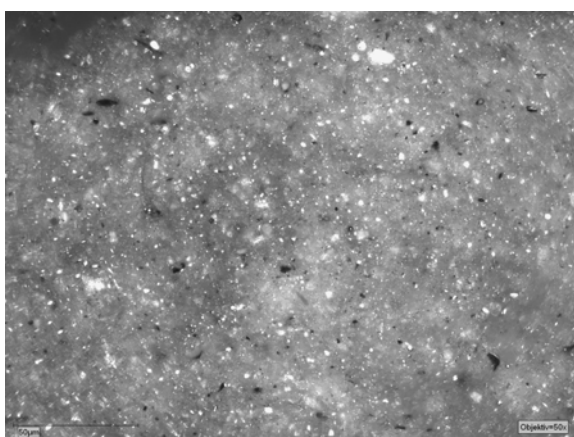
E4451B Same as E4451A, in fluorescence  
mode



E4451C Inertodetrinite in fine claystone,  $R_1$   
 $= 1.56\%$ , reflected white light, X50



E4451D Same as E4451C, in fluorescence  
mode



E4451E Lamalginite in fine claystone,  
reflected white light, X50



E4451F Same as E4451E, in fluorescence  
mode