

ANALYTICAL REPORT

SOURCE ROCK ORGANIC MATTER REFLECTANCE AND TYPING

ROUGH RANGE 1

PREPARED FOR GEOLOGICAL SURVEY AND RESOURCE STRATEGY DIVISION DMIRS

SEPTEMBER 2021



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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 _r	HAWK			
E4442		237749	Cuttings	6300 - 05 ft
E4443		237747	Cuttings	6620 - 30 ft : tillite including igneous and metasedimentary clasts

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 μm^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 ^{*2}	SD ^{*3}	N ^{*4}
x1234	3106	0.79	0.64 - 0.91	0.145	25
	R_I^{*5}				
	Alginite ^{*5}				
	Bitumen ^{*5}				

*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)

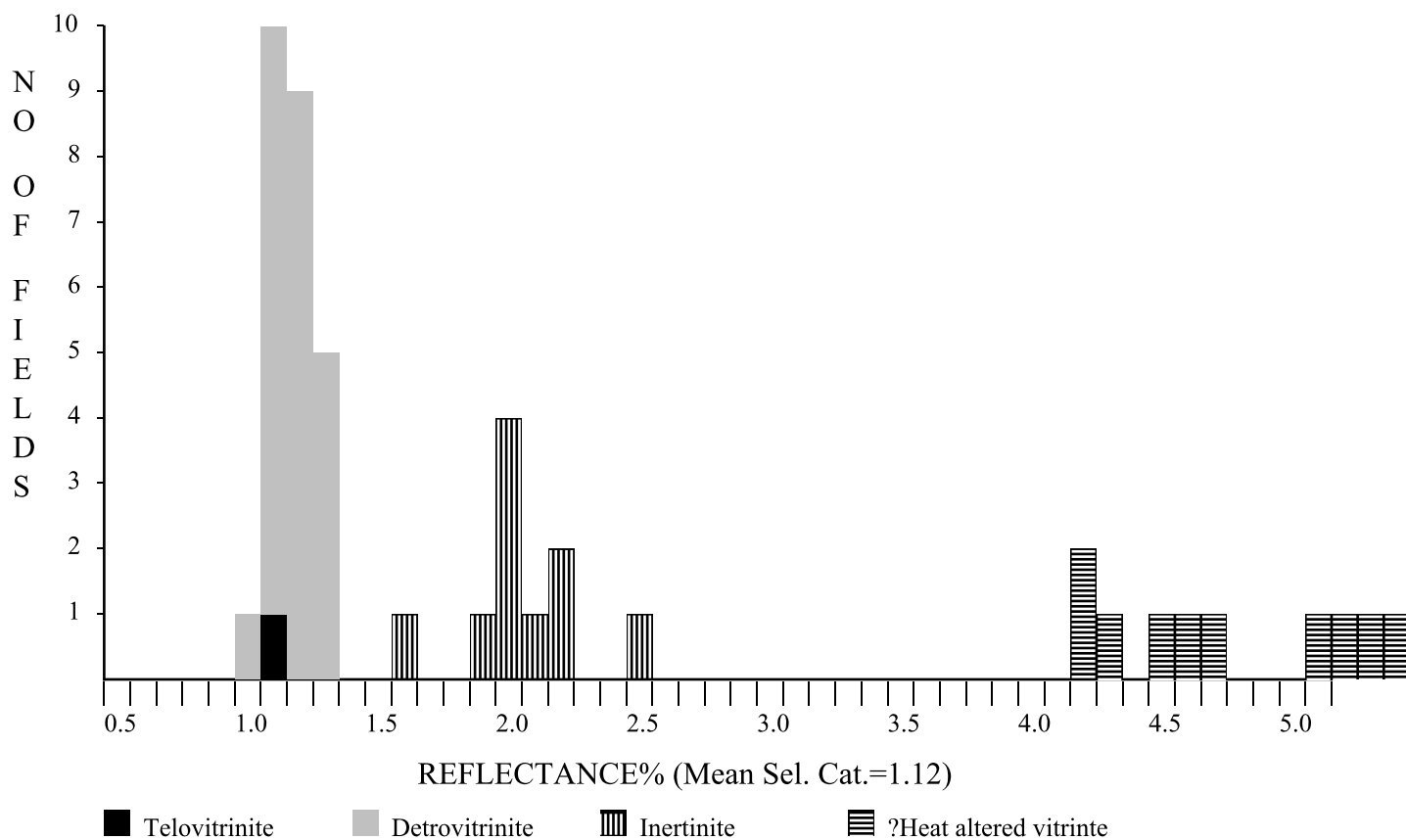
*5 Reflectance of multiple vitrinite populations or of other organic matter types. R_I = Inertinite mean maximum reflectance etc; subscripts may be expanded as necessary.

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 ROUGH RANGE 1 GSWA# 237749
E4442	6300-6305	1.12	0.98-1.28	0.077	25	Fluorescing liptinite absent. (Claystone>calcareous siltstone>sandstone>carbonate. Dom abundant, I>>V. Inertinite abundant, vitrinite rare, liptinite absent. Rare calcareous siltstone grains containing very high reflecting vitrinite and the sample is very likely from a contact altered zone. Mineral fluorescence pervasive dull orange. Iron oxides sparse. Pyrite abundant.) GSWA# 237747
237749	?heat altered	4.69	4.14-5.30	0.433	10	
Ctgs	\overline{R}_I	2.01	1.58-2.48	0.221	10	
E4443	6620-6630	P1 2.29	0.98-1.28	0.246	16	Sparse sporinite and rare liptodetrinite yellow to dull orange, rare cutinite orange to dull orange. (Sandstone>carbonate>siltstone>silty claystone>calcareous claystone. Dom common, I>V>L. Inertinite common, vitrinite sparse to common, liptinite sparse. Population 1 vitrinite could be heat altered equivalent of population 2 vitrinite. Alternatively, population 1 vitrinite could be in cavings and population 1 vitrinite could be in-situ vitrinite. Considering the high heterogeneous nature of the clasts in the sample, it is also possible that clasts containing different vitrinite populations may have come from different provenances. Mineral fluorescence dull orange to none. Iron oxides abundant. Pyrite abundant.)
237747		P2 0.58	0.43-0.74	0.073	25	
Ctgs	\overline{R}_I	1.33	0.77-1.78	0.272	10	

GSWA, 237749, Rough Range 1, 6300-6305ft, Ctgs(E4442)

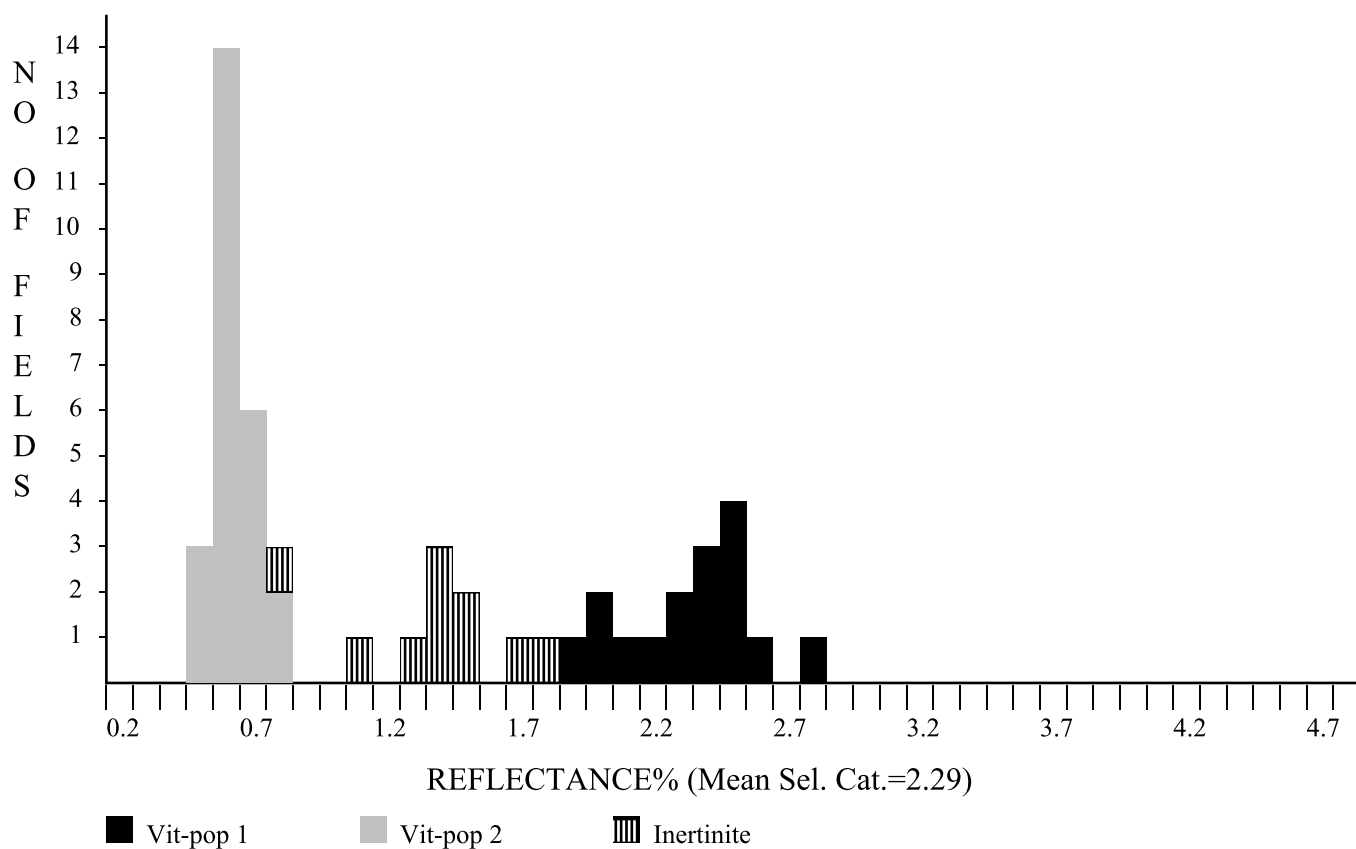


Maceral Category	N	Mean	Standard Deviation
Telovitrinite	1	1.04	0.000
Detrovitrinite	24	1.12	0.076
Inertinite	10	2.01	0.221
?Heat altered vitrinte	10	4.69	0.433
Total	45	2.11	1.446

Selected categories: Telovitrinite, Detrovitrinite:

No. of Readings: 25
Mean of Selected Categories: 1.12
Standard Deviation of Selected categories: 0.077

GSWA, 237747, Rough Range 1, 6620-6630ft, Ctgs(E4443)



Maceral Category	N	Mean	Standard Deviation
Vit-pop 1	16	2.29	0.246
Vit-pop 2	25	0.58	0.073
Inertinite	10	1.33	0.272
Total	51	1.26	0.772

Selected categories: Vit-pop 1:

No. of Readings:	16
Mean of Selected Categories:	2.29
Standard Deviation of Selected categories:	0.246

Dr Peter Crosdale (MAIG)
Director, ERC
29th September, 2021

APPENDIX - PLATES

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

E4442A Detrovitrinite in calcareous siltstone, $R_{v \max} = 1.17\%$, reflected white light, X50

E4442B Same as E4442A, in fluorescence mode

E4442C High reflecting vitrinite in silty claystone, $R_{v \max} = 4.55\%$, reflected white light, X50

E4442D Same as E4442C, in fluorescence mode

E4443A Population 2 vitrinite in silty claystone, $R_{v \max} = 0.57\%$, reflected white light, X50

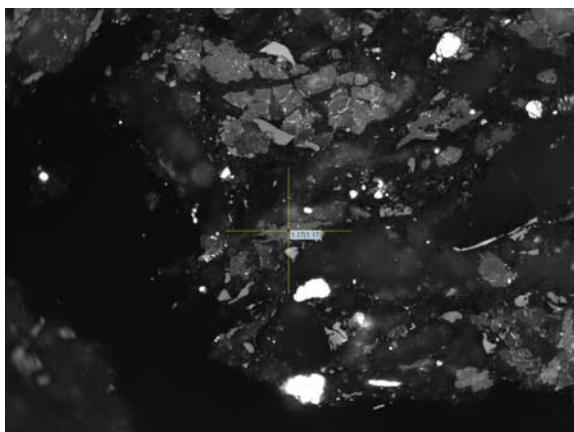
E4443B Same as E4443A, in fluorescence mode

E4443C Population 1 vitrinite in calcareous claystone, $R_{v \max} = 2.43\%$, reflected white light, X50

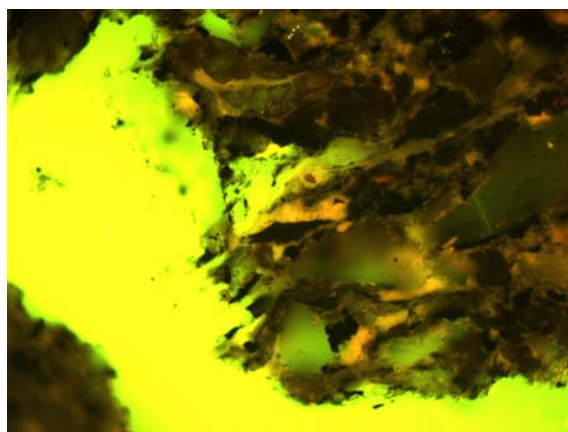
E4443D Same as E4443C, in fluorescence mode

E4443E Sporinite in silty claystone, reflected white light, X50

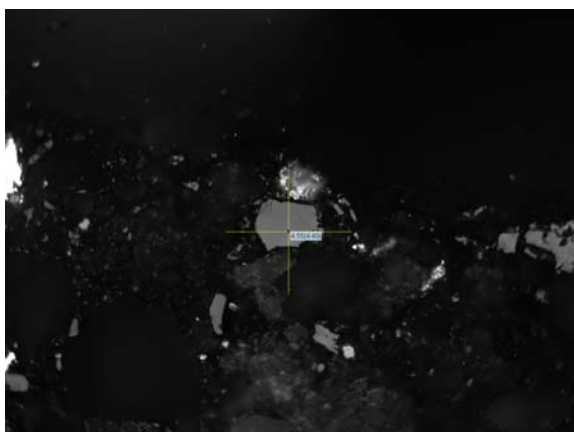
E4443F Same as E4443E, in fluorescence mode



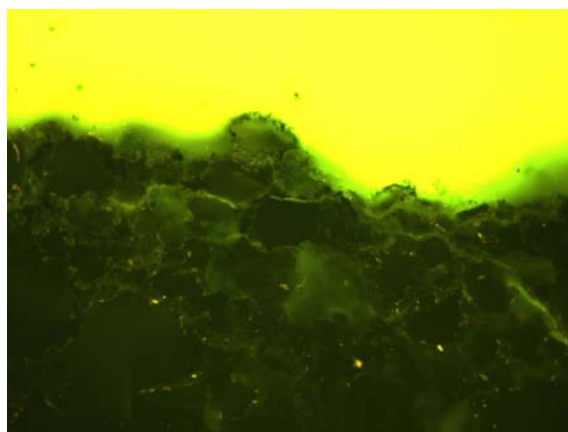
E4442A Detrovitrinite in calcareous siltstone, $R_{v\max} = 1.17\%$, reflected white light, X50



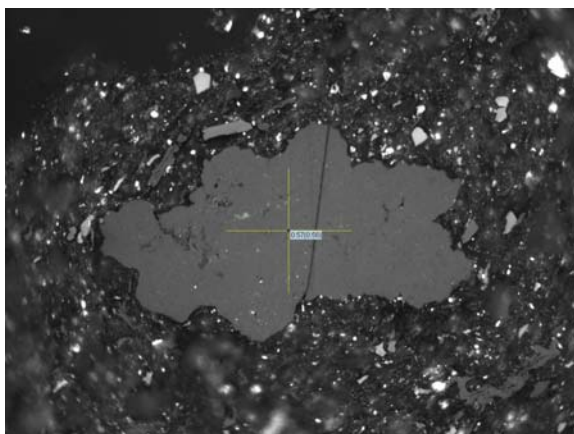
E4442B Same as E4442A, in fluorescence mode



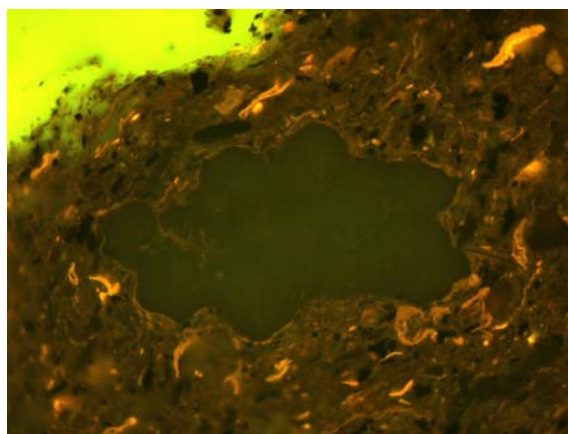
E4442C High reflecting vitrinite in silty claystone, $R_{v\max} = 4.55\%$, reflected white light, X50



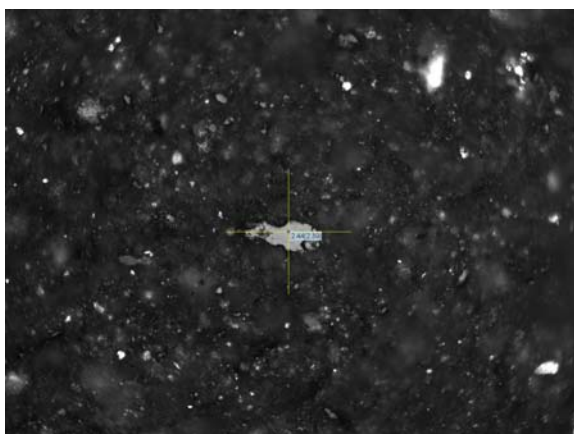
E4442D Same as E4442C, in fluorescence mode



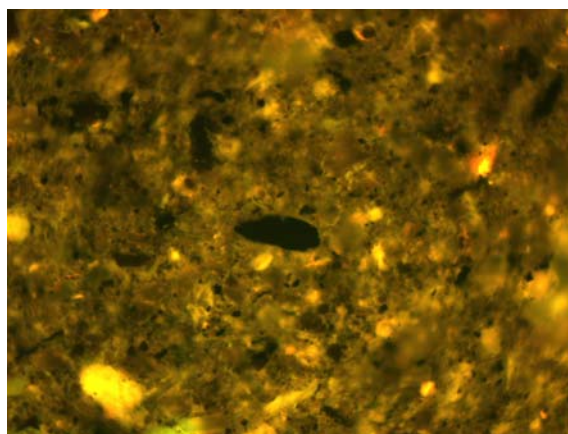
E4443A Population 2 vitrinite in silty claystone, $R_{v\max} = 0.57\%$, reflected white light, X50



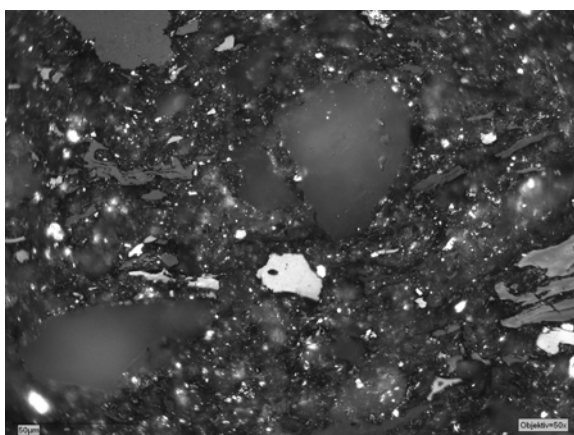
E4443B Same as E4443A, in fluorescence mode



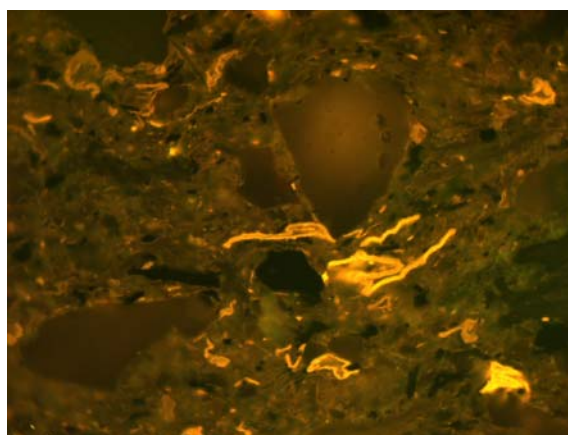
E4443C Population 1 vitrinite in calcareous claystone, $R_{v\max} = 2.43\%$, reflected white light, X50



E4443D Same as E4443C, in fluorescence mode



E4443E Sporinite in silty claystone, reflected white light, X50



E4443F Same as E4443E, in fluorescence mode