

Appendix 7-C. Bitumen reflectance reports for Pennsylvania samples

API# 3704920049 – PA Dept. of Forests & Waters Block 2 No. 1

DISPERSED VITRINITE REFLECTANCE REPORT

Run

SAMPLE INFORMATION

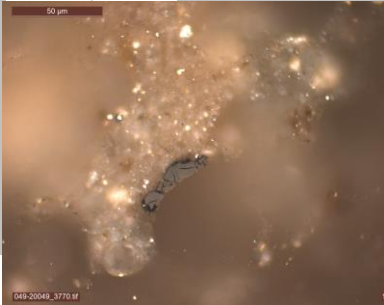
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 2
 maceral type: bitumen
 R_o: 0.98
 s.d.: 0.13

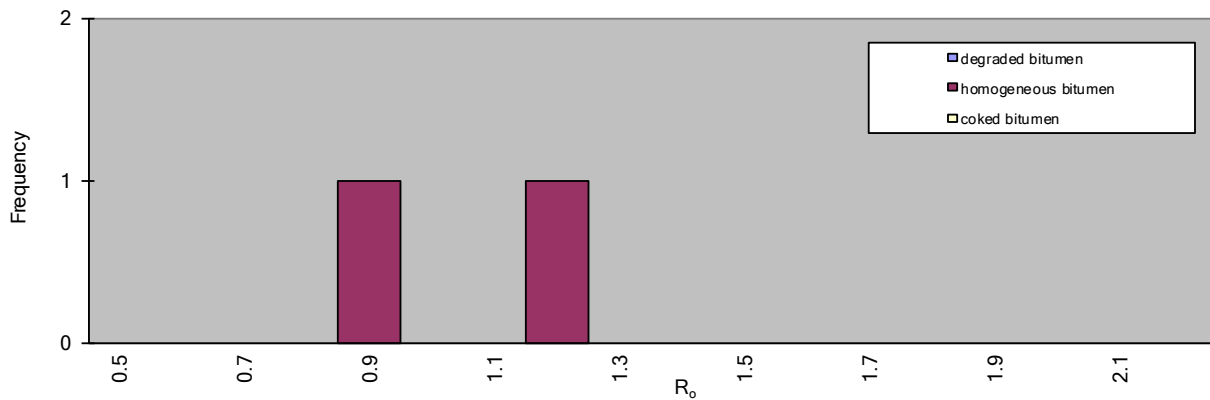
Sample ID: **049-20049_3770**
 Lab ID: 049-20049_3770
 Sample Type: shale
 Date Analyzed: 1/6/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

049-20049_3770



DATA

0.852									
1.113									

All Data: min: 0.852 max: 1.113

Vitrinite Only: min: 0.852 max: 1.113 V-types: 4

COMMENT

Standard: YAG [0.901]; lean with a few scattered and very dark macerals.

DISPERSED VITRINITE REFLECTANCE REPORT

Run

SAMPLE INFORMATION

RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

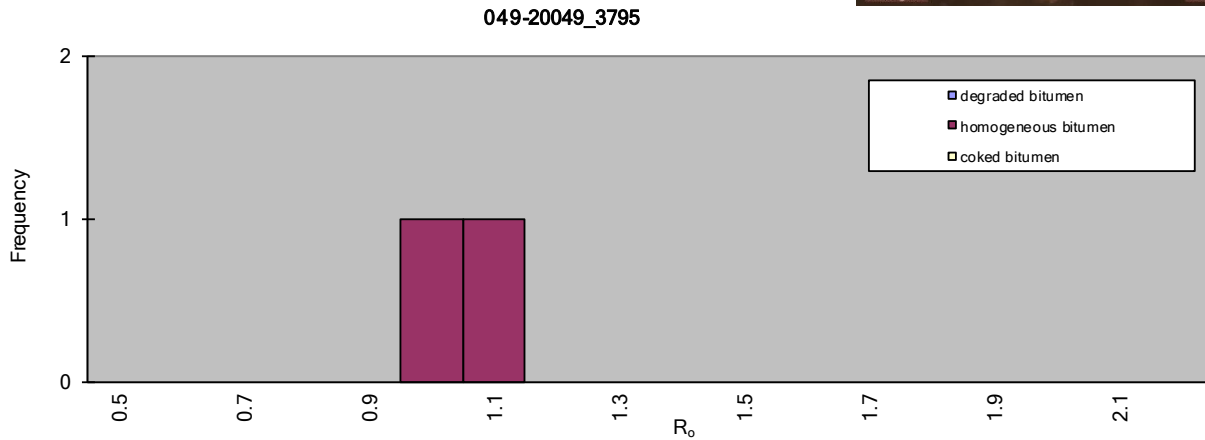
No. measurements: 2
 maceral type: bitumen
 R_o: 1.01
 s.d.: 0.02

Sample ID: **049-20049_3795**
 Lab ID: 049-20049_3795
 Sample Type: shale
 Date Analyzed: 1/6/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.990								
1.038								

All Data: min: 0.990 max: 1.038

Vitrinite Only: min: 0.990 max: 1.038 V-types: 2

COMMENT

Standard: YAG [0.901]; Very lean, some very small and dark macerals, too small to measure. Some red "unknowns".

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

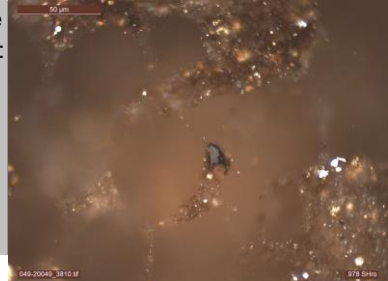
Sample ID: **049-20049_3810**
 Lab ID: 049-20049_3810
 Sample Type: shale
 Date Analyzed: 1/6/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

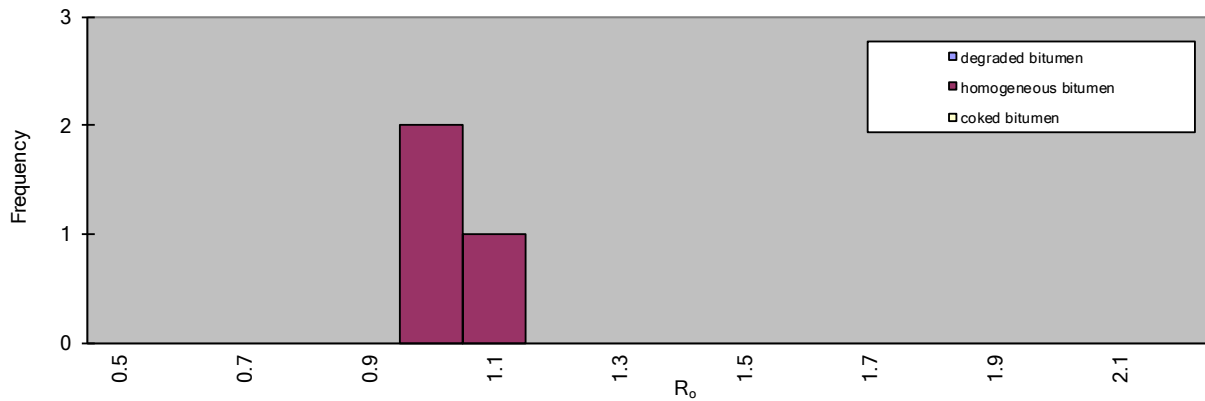
RESULTS

No. measurements: 3
 maceral type: bitumen
 R_o: 0.96
 s.d.: 0.04

Example Photograph:



049-20049_3810



DATA

0.900									
0.978									
1.000									

All Data: min: 0.900 max: 1.000

Vitrinite Only: min: 0.900 max: 1.000 V-types: 1

COMMENT

Standard: YAG [0.901]; Very Lean, some very small, dark macerals.

SAMPLE INFORMATION

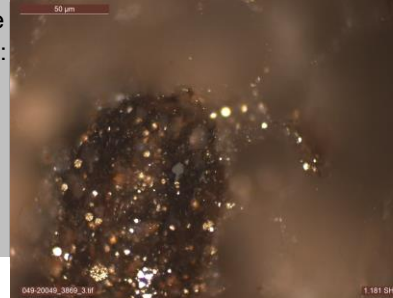
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 2
 maceral type: bitumen
 R_o: 1.08
 s.d.: 0.10

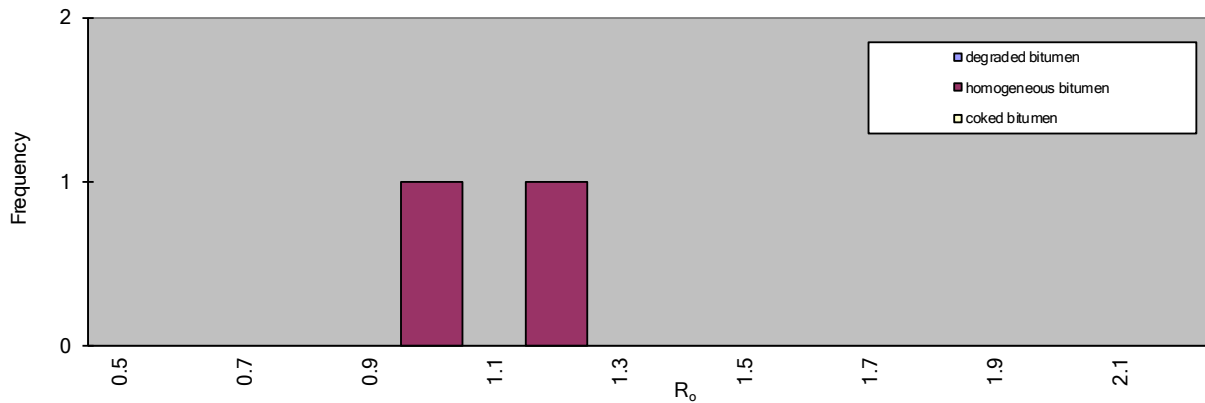
Sample ID: **049-20049_3869**
 Lab ID: 049-20049_3869
 Sample Type: shale
 Date Analyzed: 1/8/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

049-20049_3869



DATA

0.973									
1.181									

All Data: min: 0.973 max: 1.181

Vitrinite Only: min: 0.973 max: 1.181 V-types: 3

COMMENT

Standard: YAG [0.901]; very lean with large, red "unknowns". Some macerals, but most are too small for measurement. Macerals are very dark in color with dark edges.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

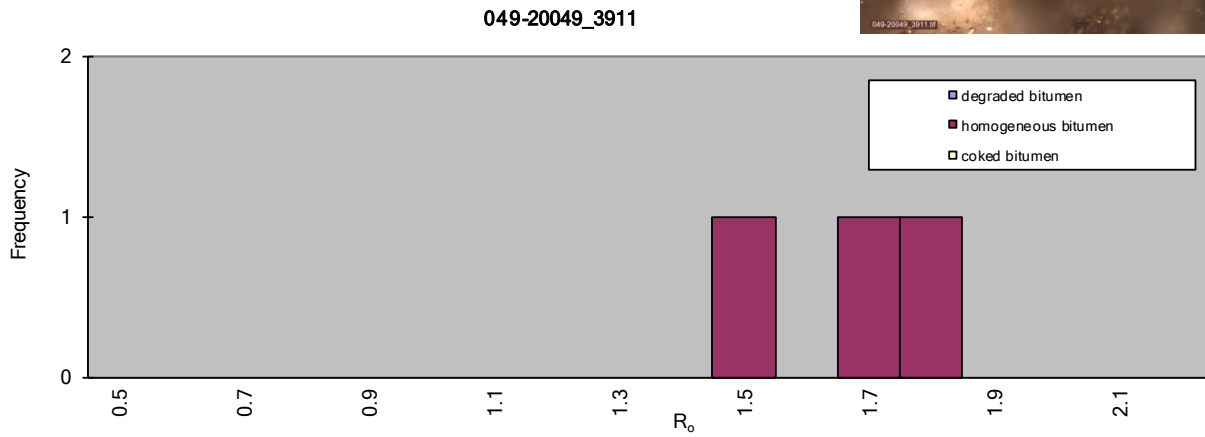
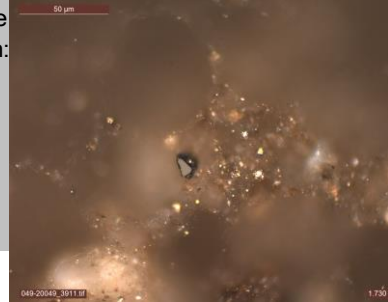
Sample ID: **049-20049_3911**
 Lab ID: 049-20049_3911
 Sample Type: shale
 Date Analyzed: 1/8/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 3
 maceral type: bitumen
 R_o: 1.58
 s.d.: 0.13

Example Photograph:



DATA

1.404									
1.610									
1.712									

All Data: min: 1.404 max: 1.712

Vitrinite Only: min: 1.404 max: 1.712 V-types: 4

COMMENT

***Standard: GGG [1.719]; Very lean with some dark macerals and relatively high reflectance values.

SAMPLE INFORMATION

RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 1
 maceral type: bitumen
 R_o: 1.92
 s.d.: 0.00

Sample ID: **049-20049_3930**
 Lab ID: 049-20049_3930
 Sample Type: shale
 Date Analyzed: 1/9/2013
 Operator: M. Cooney

Example Photograph: N/A

Standard: ASTM D2798 7708

049-20049_3930



DATA

1.922									

All Data: min: 1.922 max: 1.922
 Vitrinite Only: min: 1.922 max: 1.922 V-types: 1

COMMENT

Standard: GGG [1.719] Very lean, some red "unknowns". Some small and very dark macerals.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

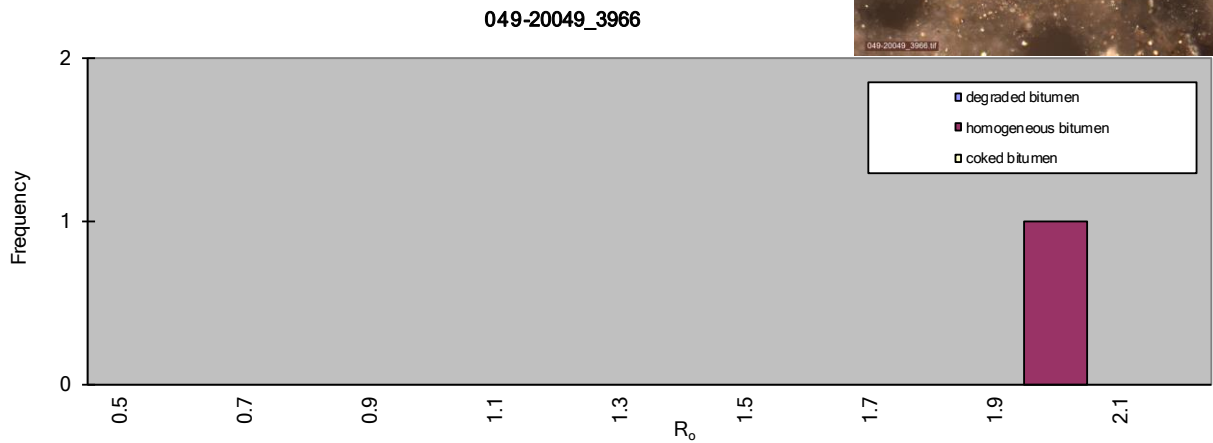
Sample ID: **049-20049_3966**
 Lab ID: 049-20049_3966
 Sample Type: shale
 Date Analyzed: 1/0/1900
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 1
 maceral type: bitumen
 R_o: 1.95
 s.d.: 0.00

Example Photograph:



DATA

1.954									

All Data: min: 1.954 max: 1.954
 Vitrinite Only: min: 1.954 max: 1.954 V-types: 1

COMMENT

Standard: GGG [1.719]; Very lean, some red "unknowns".

SAMPLE INFORMATION

RESULTS

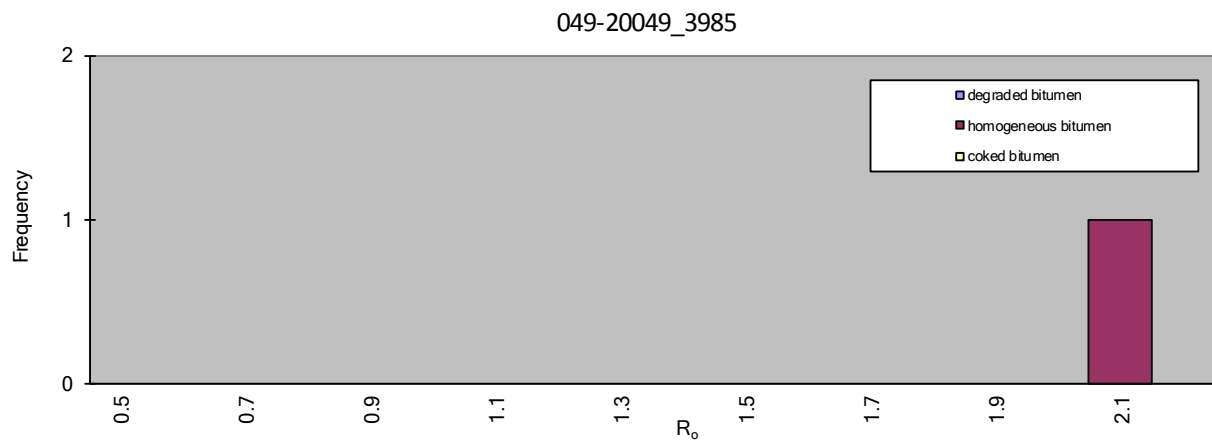
Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 1
 maceral type: bitumen
 R_o: 2.01
 s.d.: 0.00

Sample ID: **049-20049_3985**
 Lab ID: 049-20049_3985
 Sample Type: shale
 Date Analyzed: 1/9/2013
 Operator: M. Cooney

Example Photograph: N/A

Standard: ASTM D2798 7708



DATA

2.012									

All Data: min: 2.012 max: 2.012

Vitrinite Only: min: 2.012 max: 2.012 V-types: 1

COMMENT

Standard: GGG [1.719]; Very lean. Some red "unknowns".

API# 3706720001 – Shade Mt. No. 1

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

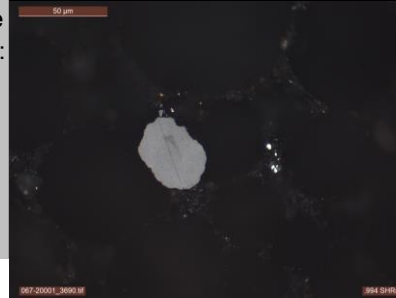
Sample ID: **067-20001-3690**
 Lab ID: 067-20001-3690
 Sample Type: shale
 Date Analyzed: 12/9/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

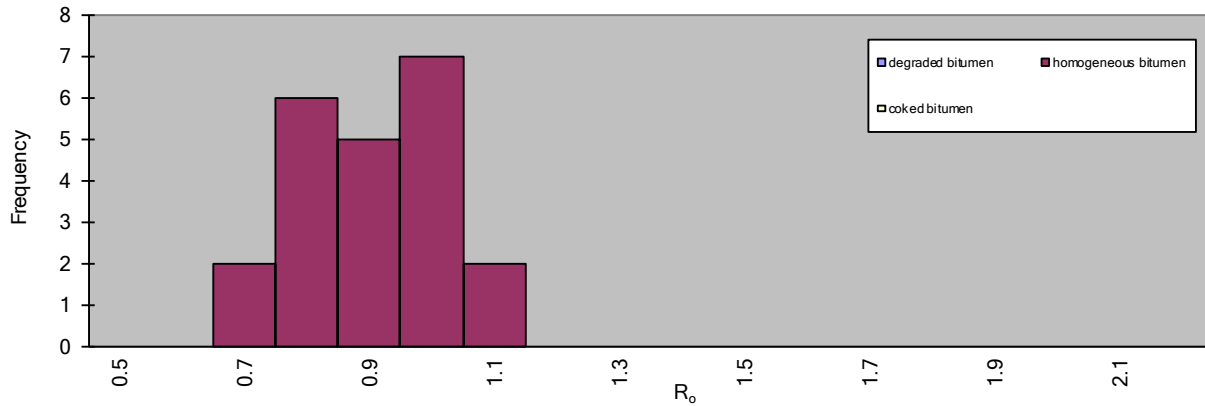
RESULTS

No. measurements: 22
 maceral type: bitumen
 R_o: 0.86
 s.d.: 0.12

Example Photograph:



067-20001_3690



DATA

0.655	0.842	1.103
0.690	0.845	1.119
0.718	0.862	
0.725	0.911	
0.751	0.922	
0.759	0.924	
0.771	0.939	
0.781	0.955	
0.803	0.983	
0.833	0.994	

All Data: min: 0.655 max: 1.119

Vitrinite Only: min: 0.655 max: 1.119 V-types: 6

COMMENT

Standard: YAG [0.901]; some small fill structures with abundant small macerals.

SAMPLE INFORMATION

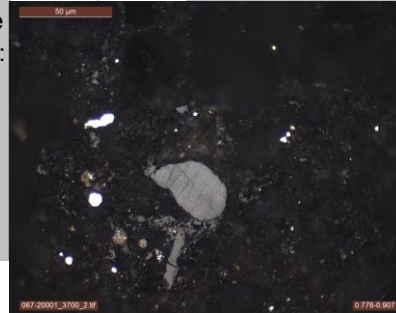
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 16
 maceral type: bitumen
 R_o: 0.81
 s.d.: 0.09

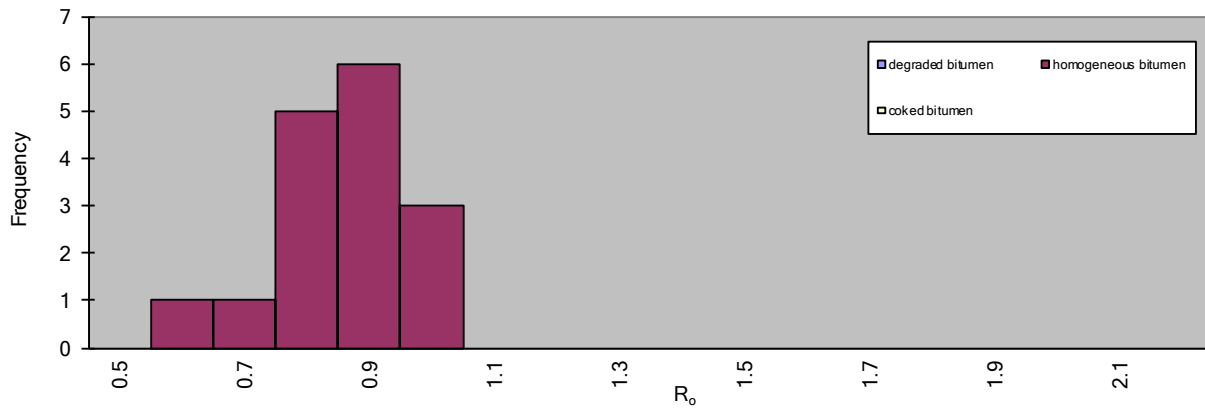
Sample ID: **067-20001**
 Lab ID: 067-20001
 Sample Type: shale
 Date Analyzed: 1/0/1900
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

067-20001_3700



DATA

0.597	0.860				
0.693	0.861				
0.715	0.868				
0.739	0.907				
0.751	0.930				
0.772	0.962				
0.776					
0.831					
0.831					
0.839					

All Data: min: 0.597 max: 0.962

Vitrinite Only: min: 0.597 max: 0.962 V-types: 5

COMMENT

Standard: YAG [0.901]; a lot of fill structures, abundant small macerals.

SAMPLE INFORMATION

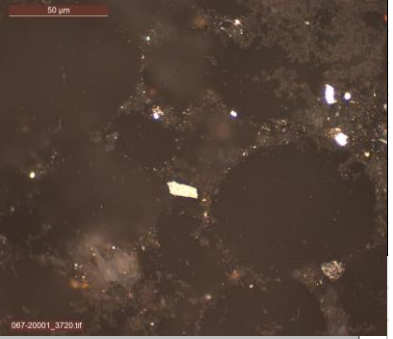
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

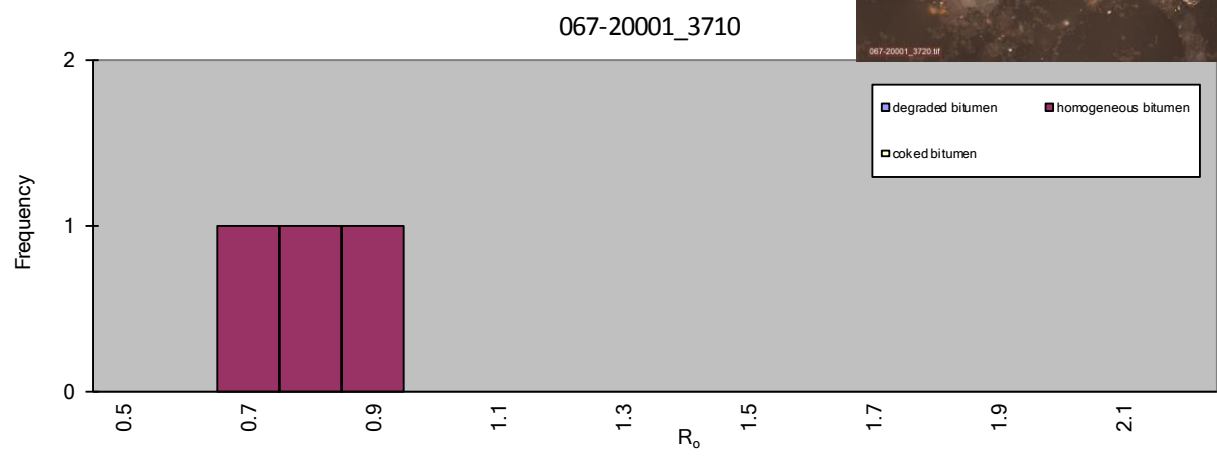
No. measurements: 3
 maceral type: bitumen
 R_o: 0.78
 s.d.: 0.08

Sample ID: **067-20001_3710**
 Lab ID: 067-20001_3710
 Sample Type: shale
 Date Analyzed: 12/9/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.688									
0.791									
0.872									

All Data: min: 0.688 max: 0.872

Vitrinite Only: min: 0.688 max: 0.872 V-types: 3

COMMENT

Standard: YAG [0.901]; macerals not as abundant as in other samples.

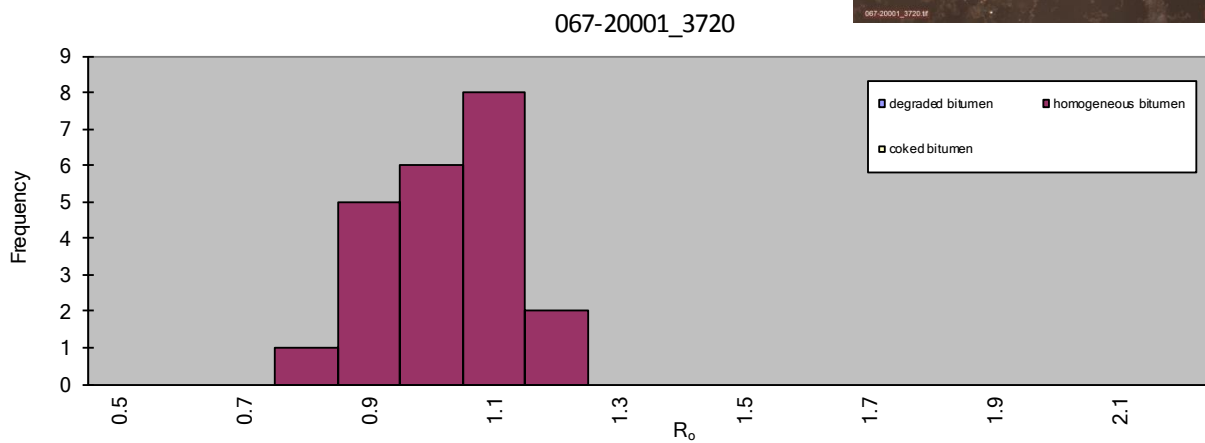
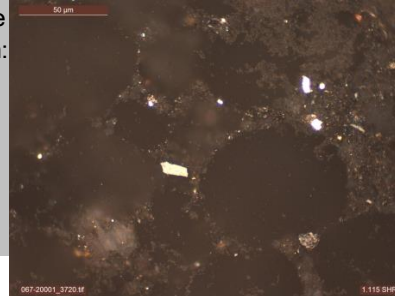
SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook
 Sample ID: **067-20001_3720**
 Lab ID: 067-20001_3720
 Sample Type: shale
 Date Analyzed: 12/9/2013
 Operator: M. Cooney
 Standard: ASTM D2798 7708

RESULTS

No. measurements: 22
 maceral type: bitumen
 R_o: 0.96
 s.d.: 0.10

Example Photograph:



DATA

0.783	0.982	1.115
0.811	0.996	1.119
0.817	1.009	
0.825	1.015	
0.830	1.022	
0.885	1.024	
0.903	1.024	
0.931	1.028	
0.940	1.055	
0.968	1.073	

All Data: min: 0.783 max: 1.119

Vitrinite Only: min: 0.783 max: 1.119 V-types: 5

COMMENT

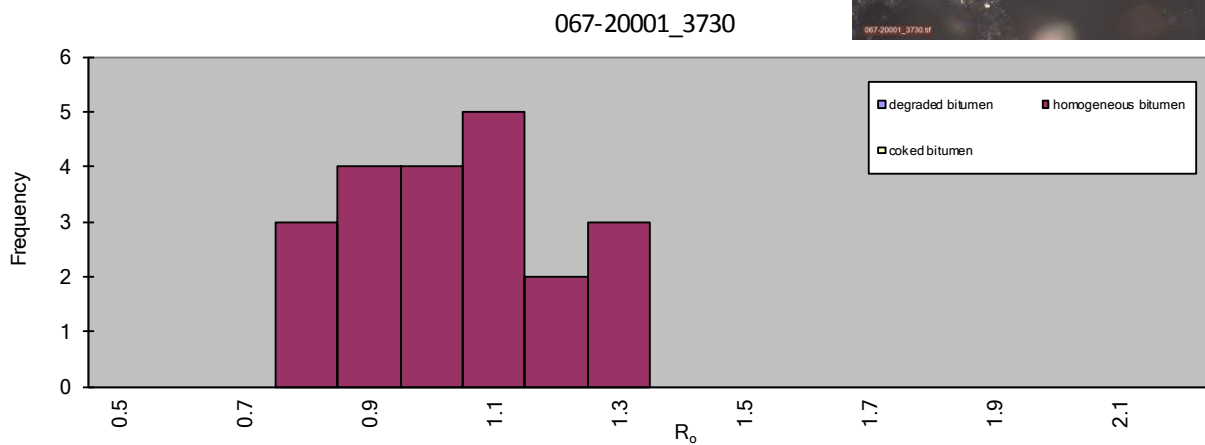
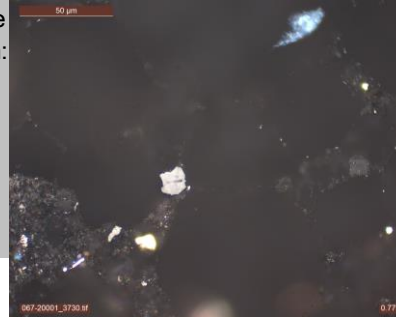
Standard: YAG [0.901]; Small fill structures are abundant. Smaller macerals. Starting to see higher reflectance values.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook
 Sample ID: **067-20001_3730**
 Lab ID: 067-20001_3730
 Sample Type: shale
 Date Analyzed: 12/16/2013
 Operator: M. Cooney
 Standard: ASTM D2798 7708

RESULTS

No. measurements: 20
 maceral type: bitumen
 R_o: 0.99
 s.d.: 0.14
 Example Photograph:



DATA

0.779	0.989
0.787	1.029
0.798	1.059
0.836	1.063
0.867	1.072
0.879	1.074
0.893	1.146
0.944	1.155
0.961	1.248
0.963	1.264

All Data: min: 0.779 max: 1.264

Vitrinite Only: min: 0.779 max: 1.264 V-types: 6

COMMENT

Standard: YAG [0.901]; Fill structures and abundant larger macerals.

SAMPLE INFORMATION

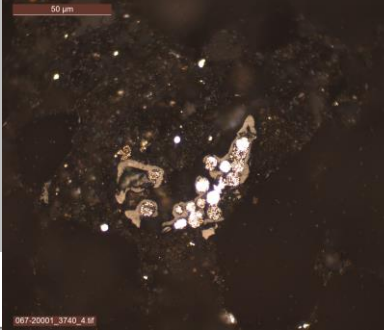
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

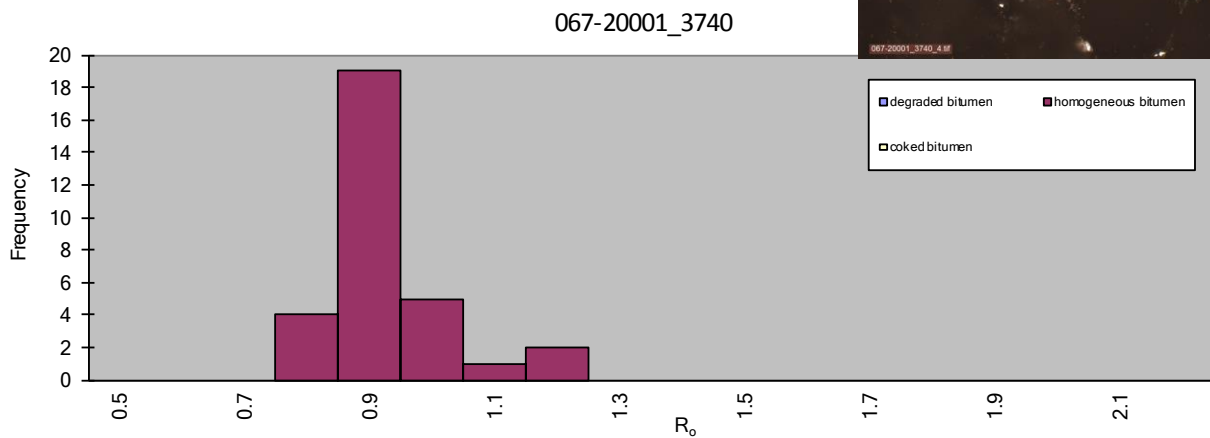
No. measurements: 31
 maceral type: bitumen
 R_o: 0.89
 s.d.: 0.10

Sample ID: **067-20001_3740**
 Lab ID: 067-20001_3740
 Sample Type: shale
 Date Analyzed: 12/19/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.703	0.845	0.885	1.158
0.719	0.849	0.889	
0.759	0.855	0.894	
0.797	0.859	0.940	
0.801	0.868	0.975	
0.805	0.869	0.990	
0.806	0.871	0.991	
0.811	0.874	0.992	
0.837	0.874	1.067	
0.841	0.885	1.149	

All Data: min: 0.703 max: 1.158

Vitrinite Only: min: 0.703 max: 1.158 V-types: 5

COMMENT

Standard: YAG [0.901]; Medium size macerals, abundant bitumen and some fill structures.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/23/2013
 Project: Utica Shale Playbook

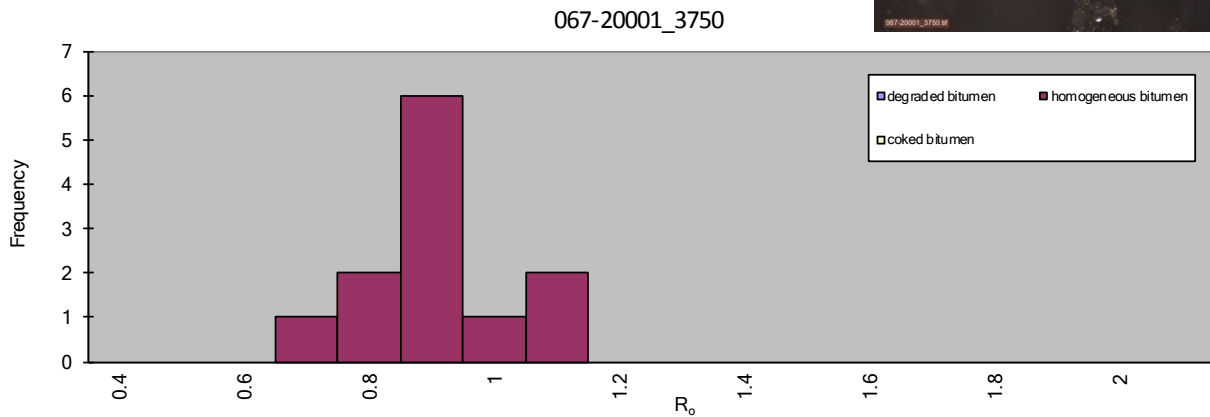
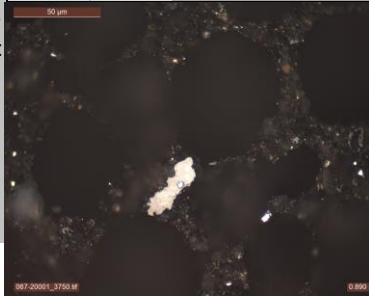
Sample ID: **067-20001_3750**
 Lab ID: 067-20001_3750
 Sample Type: shale
 Date Analyzed: 12/23/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 12
 maceral type: bitumen
 R_o: 0.85
 s.d.: 0.11

Example Photograph:



DATA

0.640	1.028				
0.728	1.051				
0.775					
0.809					
0.809					
0.819					
0.860					
0.860					
0.890					
0.912					

All Data: min: 0.640 max: 1.051

Vitrinite Only: min: 0.640 max: 1.051 V-types: 5

COMMENT

Standard: YAG [0.901]; mostly larger macerals. Some small fill structures.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/23/2013
 Project: Utica Shale Playbook

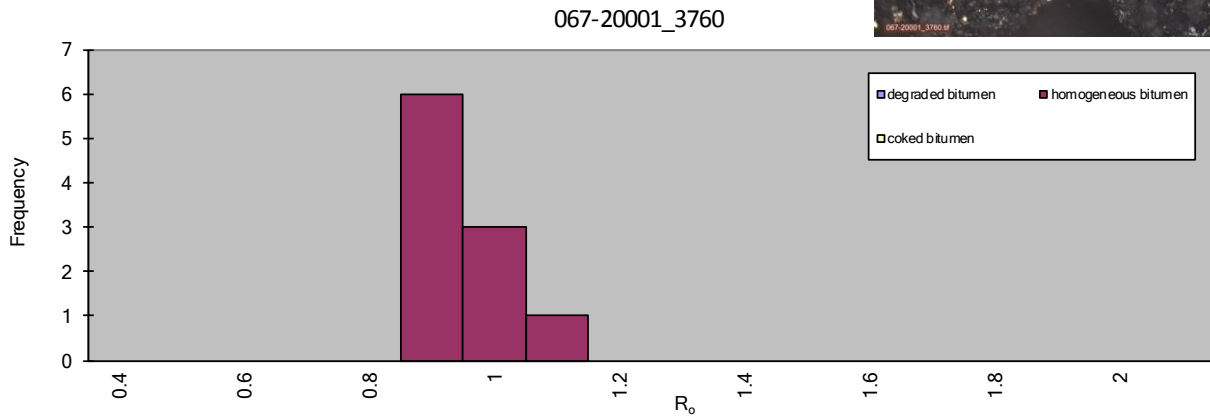
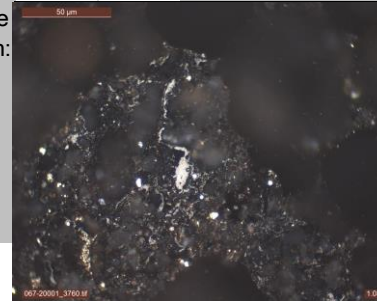
Sample ID: 067-20001_3760
 Lab ID: 067-20001_3760
 Sample Type: shale
 Date Analyzed: 12/23/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 10
 maceral type: bitumen
 R_o: 0.89
 s.d.: 0.07

Example Photograph:



DATA

0.801									
0.819									
0.836									
0.851									
0.855									
0.867									
0.933									
0.948									
0.983									
1.032									

All Data: min: 0.801 max: 1.032

Vitrinite Only: min: 0.801 max: 1.032 V-types: 3

COMMENT

Standard: YAG [0.901]; abundant disseminated bitumen, most of it can't be measured. One large unknown.

SAMPLE INFORMATION

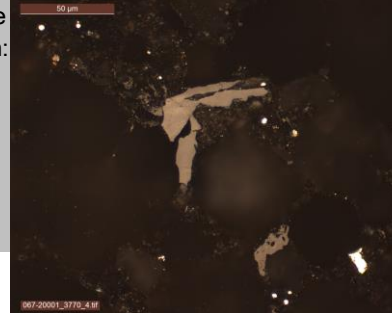
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

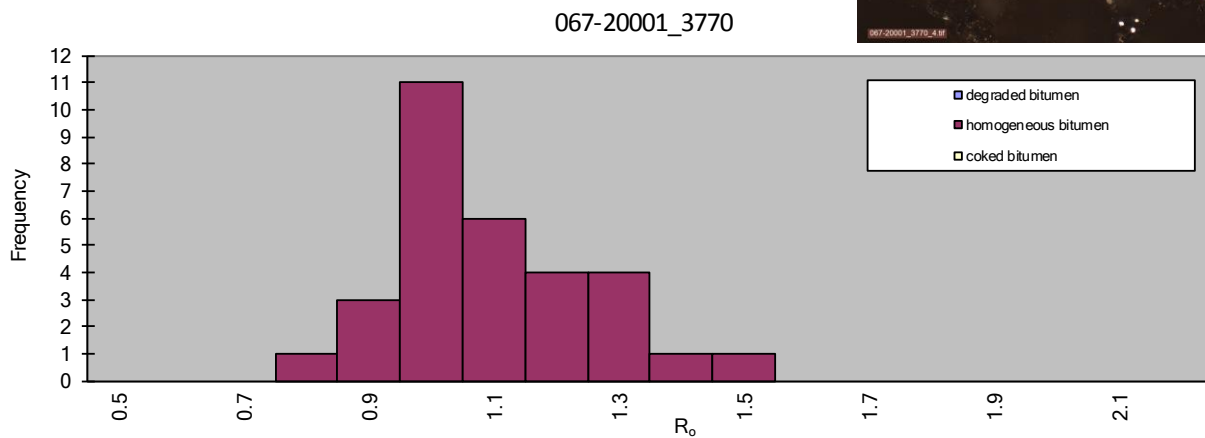
No. measurements: 31
 maceral type: bitumen
 R_o: 1.05
 s.d.: 0.16

Sample ID: **067-20001_3770**
 Lab ID: 067-20001_3770
 Sample Type: shale
 Date Analyzed: 1/3/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.791	0.951	1.095	1.459
0.864	0.954	1.134	
0.881	0.965	1.134	
0.886	0.977	1.190	
0.904	0.995	1.192	
0.912	1.021	1.200	
0.917	1.025	1.208	
0.923	1.037	1.208	
0.928	1.054	1.290	
0.938	1.082	1.390	

All Data: min: 0.791 max: 1.459

Vitrinite Only: min: 0.791 max: 1.459 V-types: 8

COMMENT

Standard: YAG [0.901]; Abundant fill structures and very small macerals; most macerals are too small to measure; abundant pyrite framboids and large "unknowns".

SAMPLE INFORMATION

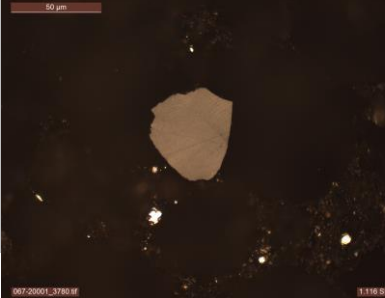
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 18
 maceral type: bitumen
 R_o: 1.08
 s.d.: 0.16

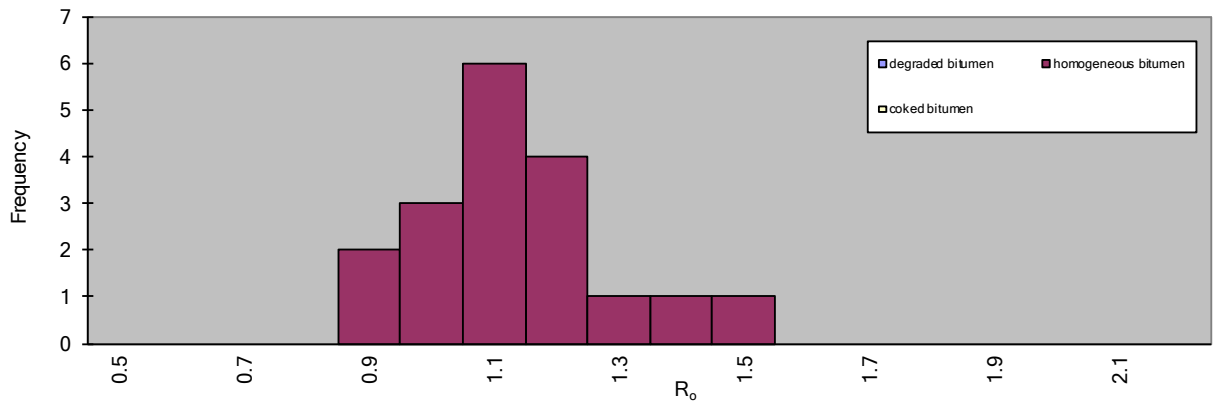
Sample ID: **067-20001_3780**
 Lab ID: 067-20001_3780
 Sample Type: shale
 Date Analyzed: 1/3/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

067-20001_3780



DATA

0.800	1.064
0.849	1.116
0.942	1.130
0.971	1.156
0.974	1.183
1.007	1.284
1.010	1.332
1.026	1.471
1.040	
1.044	

All Data: min: 0.800 max: 1.471

Vitrinite Only: min: 0.800 max: 1.471 V-types: 7

COMMENT

Standard: YAG [0.901]; Abundant fill structures and larger macerals. Abundant small pyrite framboids. Many macerals were too small to measure.

API# 3711120045 – Svetz No. 1

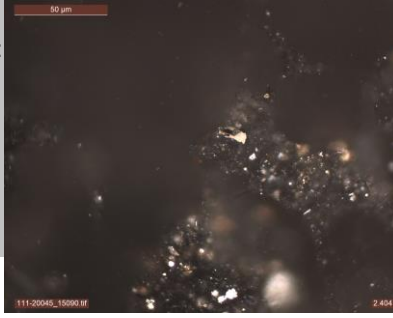
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 3/3/2014
 Project: Utica Shale Playbook

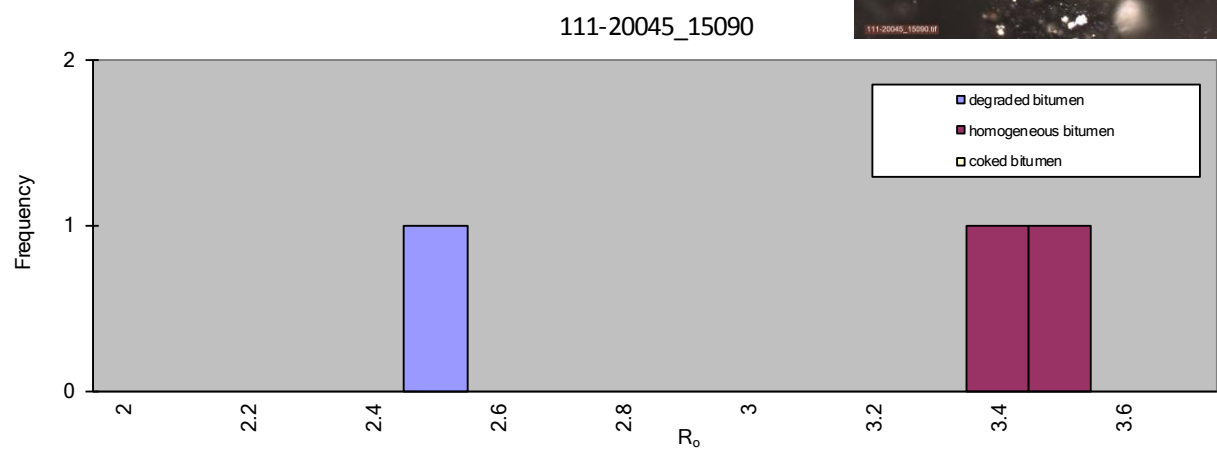
No. measurements: 3
 maceral type: bitumen
 R_o: 3.05
 s.d.: 0.46

Sample ID: 111-20045_15090
 Lab ID: 111-20045_15090
 Sample Type: shale
 Date Analyzed: 3/3/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

2.404									
3.337									
3.421									

All Data: min: 2.404 max: 3.421

Vitrinite Only: min: 2.404 max: 3.421 V-types: 11

COMMENT

Standard: GGG [1.719]; Some small, linear, macerals. Almost appear graptolitic. Some small unknowns with red coloration. Some clay mineral assemblages are very dark.

SAMPLE INFORMATION

RESULTS

Submitted by: M. Cooney
 Date Submitted: 3/3/2014
 Project: Utica Shale Playbook

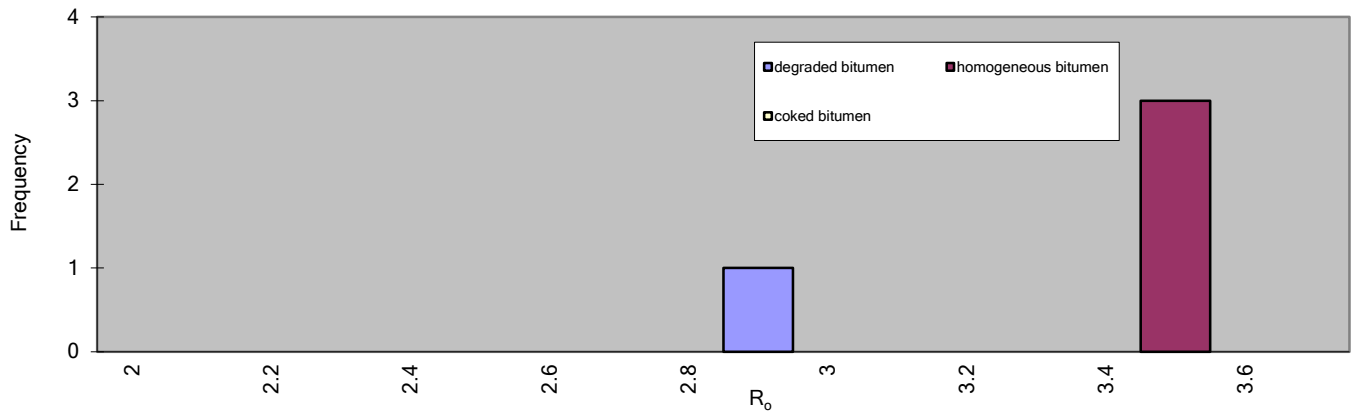
No. measurements: 4
 maceral type: bitumen
 R_o: 3.27
 s.d.: 0.26

Sample ID: 111-20045_15130
 Lab ID: 111-20045_15130
 Sample Type: shale
 Date Analyzed: 3/3/2014
 Operator: M. Cooney

Example Photograph: N/A

Standard: ASTM D2798 7708

111-20045_15130



DATA

2.810
 3.411
 3.421
 3.421

All Data: min: 2.810 max: 3.421

Vitrinite Only: min: 2.810 max: 3.421

V-types: 7

COMMENT

Standards: GGG [1.719]; some small macerals and graptolitic looking macerals. Some macerals have red edging. Bitumen relatively more abundant than previous samples. Some clay mineral assemblages are very dark in color. Red, orange, yellow staining.

API# 3711720181 – Marshlands No. 2

SAMPLE INFORMATION

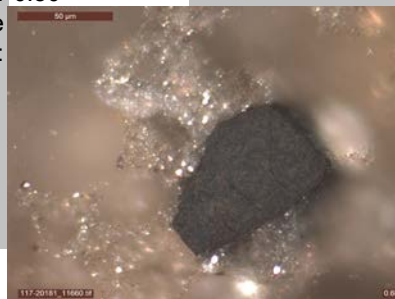
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 48
 maceral type: bitumen
 R_o: 1.75
 s.d.: 0.30

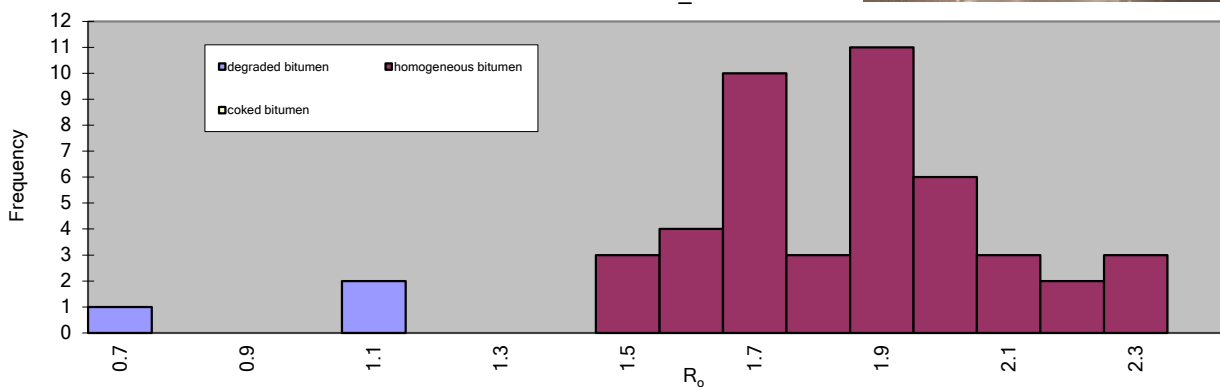
Sample ID: 117-20181_11660
 Lab ID: 0
 Sample Type: shale
 Date Analyzed: 1/14/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

117-20181_11660



DATA

0.681	1.600	1.711	1.876	2.031
1.047	1.600	1.736	1.877	2.032
1.093	1.603	1.773	1.888	2.050
1.436	1.609	1.801	1.895	2.103
1.474	1.616	1.815	1.920	2.199
1.476	1.624	1.831	1.926	2.202
1.533	1.645	1.833	1.935	2.222
1.548	1.645	1.836	1.948	2.268
1.593	1.662	1.838	1.974	
1.595	1.668	1.871	1.978	

All Data: min: 0.681 max: 2.268

Vitrinite Only: min: 0.681 max: 2.268 V-types: 17

COMMENT

Standard: GGG [1.719]; Significant number of macerals. All macerals are very dark. Macerals very in size. All macerals appear inhomogeneous with variation in color and texture. Some red coloration to macerals. "Unknowns".

SAMPLE INFORMATION

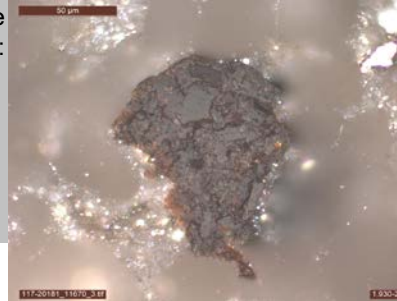
RESULTS

Submitted by: M. Cooney
Date Submitted: 10/16/2013
Project: Utica Shale Playbook

No. measurements: 16
maceral type: bitumen
R_o: 1.72
s.d.: 0.18

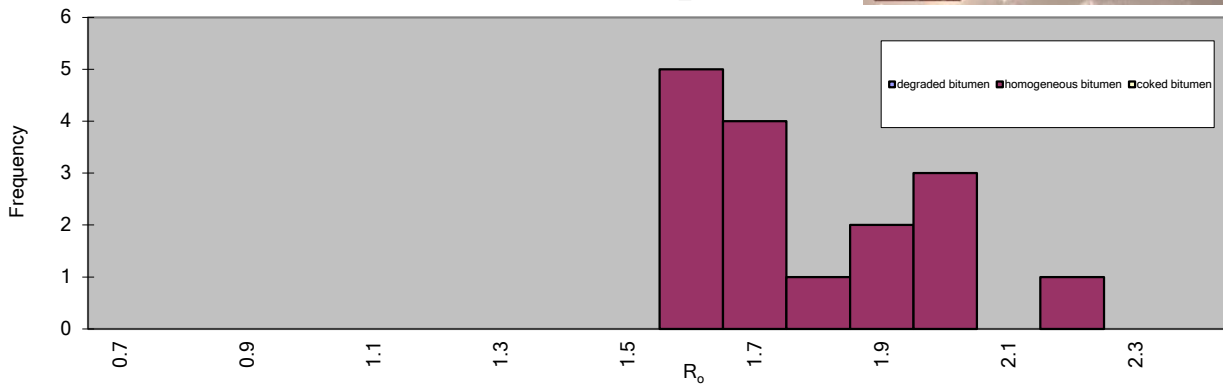
Sample ID: 117-20181_11670
Lab ID: 117-20181_11670
Sample Type: shale
Date Analyzed: 1/15/2014
Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

117-20181_11670



DATA

1.509	1.819
1.525	1.859
1.571	1.915
1.581	1.930
1.582	1.964
1.605	2.108
1.613	
1.620	
1.626	
1.763	

All Data: min: 1.509 max: 2.108

Vitrinite Only: min: 1.509 max: 2.108 V-types: 7

COMMENT

Standard: GGG [1.719]; larger macerals, very dark in color. Most macerals inhomogeneous. Dark edges; High SHRo values. Red coloration to some of the macerals.

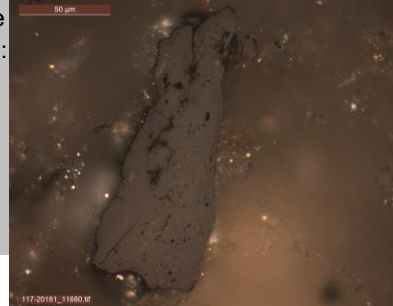
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 12
 maceral type: bitumen
 R_o: 1.71
 s.d.: 0.21

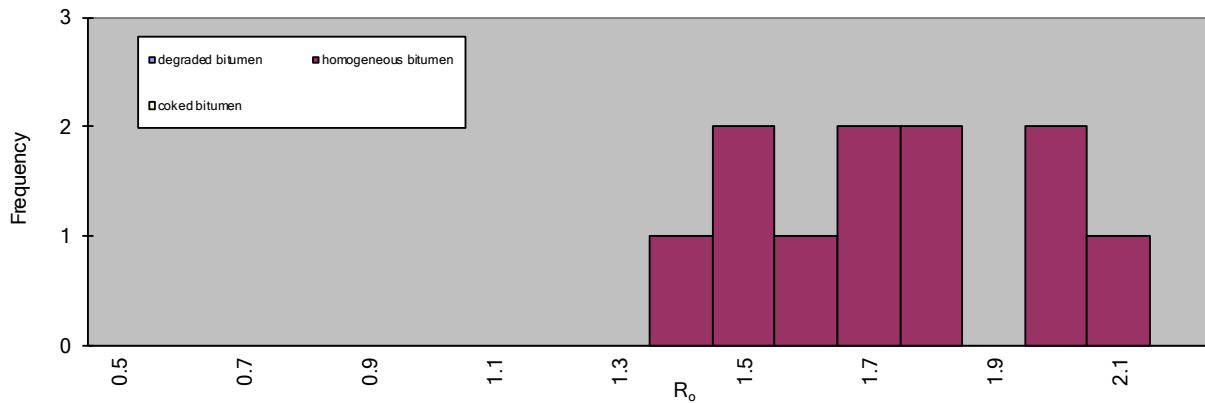
Sample ID: **117-20181_11680**
 Lab ID: 117-20181_11680
 Sample Type: shale
 Date Analyzed: 1/14/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

117-20181_11680



DATA

1.395	1.976
1.437	2.046
1.458	
1.534	
1.642	
1.682	
1.716	
1.776	
1.903	
1.931	

All Data: min: 1.395 max: 2.046

Vitrinite Only: min: 1.395 max: 2.046 V-types: 8

COMMENT

Standard: YAG [0.901]; Most macerals are very dark, but there are some lighter-colored macerals mixed in. A few red unknowns.

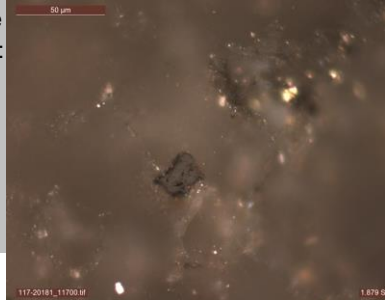
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

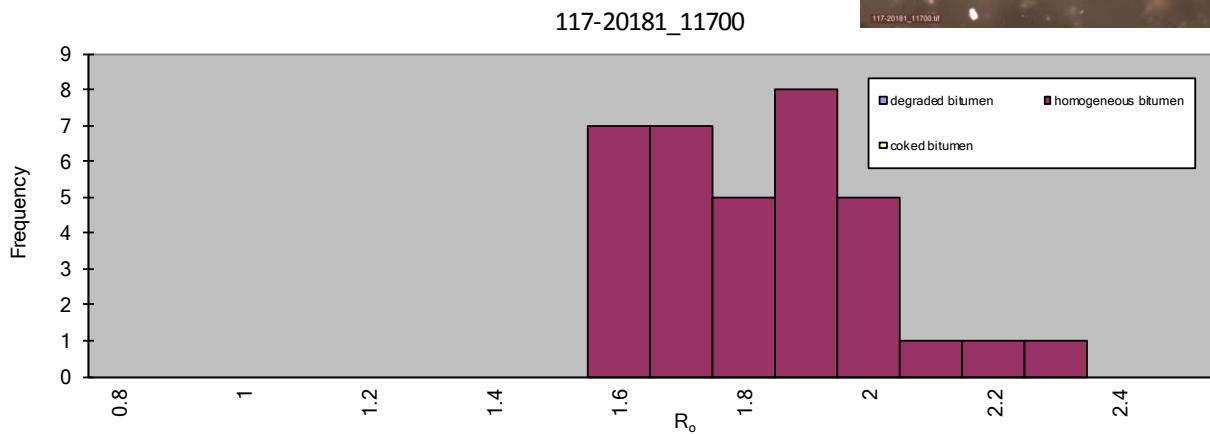
No. measurements: 36
 maceral type: bitumen
 R_o: 1.80
 s.d.: 0.18

Sample ID: 117-20181_11700
 Lab ID: 117-20181_11700
 Sample Type: shale
 Date Analyzed: 1/14/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.505	1.679	1.842	1.980
1.514	1.690	1.847	1.998
1.551	1.690	1.857	2.060
1.566	1.690	1.879	2.133
1.579	1.741	1.882	2.141
1.590	1.741	1.891	2.200
1.598	1.772	1.899	
1.638	1.777	1.923	
1.652	1.793	1.949	
1.671	1.831	1.964	

All Data: min: 1.505 max: 2.200

Vitrinite Only: min: 1.505 max: 2.200 V-types: 7

COMMENT

Standard: GGG [1.719]; red color to some of the macerals. Large homogenous macerals, some with red coloration. Some large, red unknowns. Starting to have abundant bitumen again.

SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

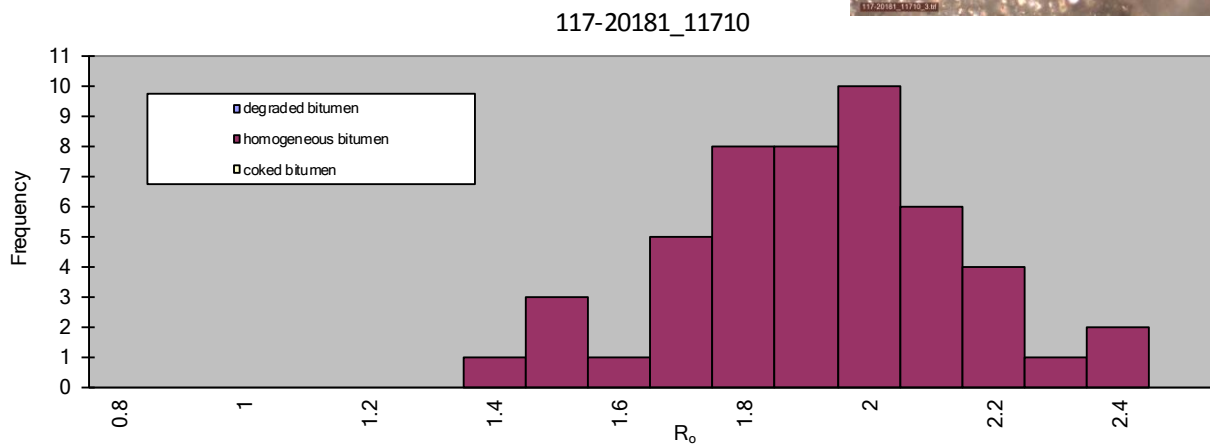
No. measurements: 50
 maceral type: bitumen
 R_o: 1.87
 s.d.: 0.23

Sample ID: 117-20181_11710
 Lab ID: 0
 Sample Type: shale
 Date Analyzed: 1/14/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.357	1.654	1.819	1.962	2.064
1.447	1.704	1.848	1.967	2.074
1.478	1.709	1.867	1.973	2.079
1.485	1.733	1.871	1.978	2.117
1.572	1.747	1.882	1.982	2.168
1.606	1.749	1.882	1.991	2.190
1.625	1.759	1.886	1.998	2.196
1.636	1.769	1.910	2.004	2.222
1.647	1.793	1.914	2.017	2.335
1.654	1.807	1.930	2.046	2.381

All Data: min: 1.357 max: 2.381

Vitrinite Only: min: 1.357 max: 2.381 V-types: 11

COMMENT

Standard: GGG [1.719]; Abundant large, inhomogenous macerals. Variations in color. Some red unknowns in matrix. Macerals are very abundant.

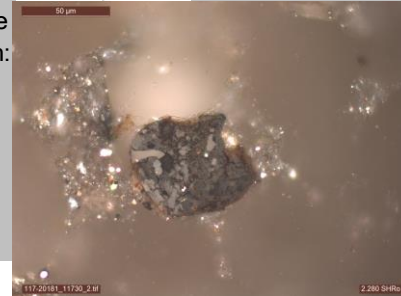
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 1/16/2014
 Project: Utica Shale Playbook

No. measurements: 117
 maceral type: bitumen
 R_o: 1.85
 s.d.: 0.24

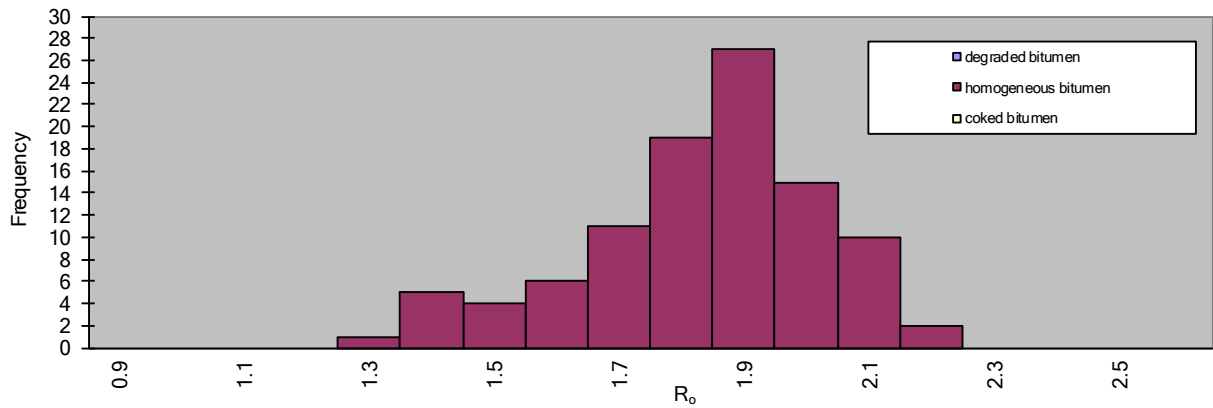
Sample ID: **117-20181_11720**
 Lab ID: 0
 Sample Type: shale
 Date Analyzed: 1/16/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

117-20181_11720



DATA

1.296	1.529	1.659	1.721	1.780	1.823	1.866	1.897	1.956	2.027
1.304	1.545	1.662	1.724	1.789	1.827	1.869	1.899	1.967	2.036
1.336	1.555	1.668	1.732	1.789	1.830	1.869	1.899	1.969	2.043
1.353	1.569	1.671	1.736	1.796	1.830	1.880	1.906	1.980	2.047
1.391	1.577	1.687	1.743	1.797	1.832	1.884	1.908	1.982	2.056
1.396	1.583	1.690	1.746	1.798	1.832	1.886	1.917	1.987	2.062
1.408	1.605	1.690	1.757	1.800	1.840	1.887	1.934	1.992	2.067
1.425	1.640	1.704	1.757	1.804	1.841	1.894	1.935	1.995	2.094
1.428	1.641	1.713	1.768	1.810	1.851	1.895	1.939	2.005	2.107
1.490	1.652	1.716	1.780	1.817	1.861	1.896	1.941	2.021	2.108

All Data: min: 1.296 max: 2.108

Vitrinite Only: min: 1.296 max: 2.108 V-types: 10

COMMENT

Standard: GGG [1.719]; numerous large inhomogeneous macerals with wide ranges of reflectance values. Not many unknowns. Most abundant bitumen in this well with > 100 samples (Therefore, most reliable proxy for this interval).

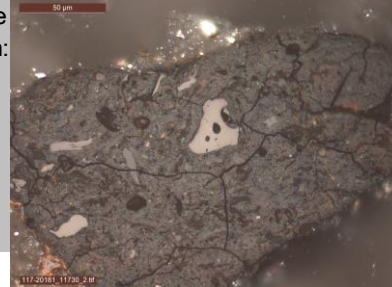
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 43
 maceral type: bitumen
 R_o: 1.80
 s.d.: 0.21

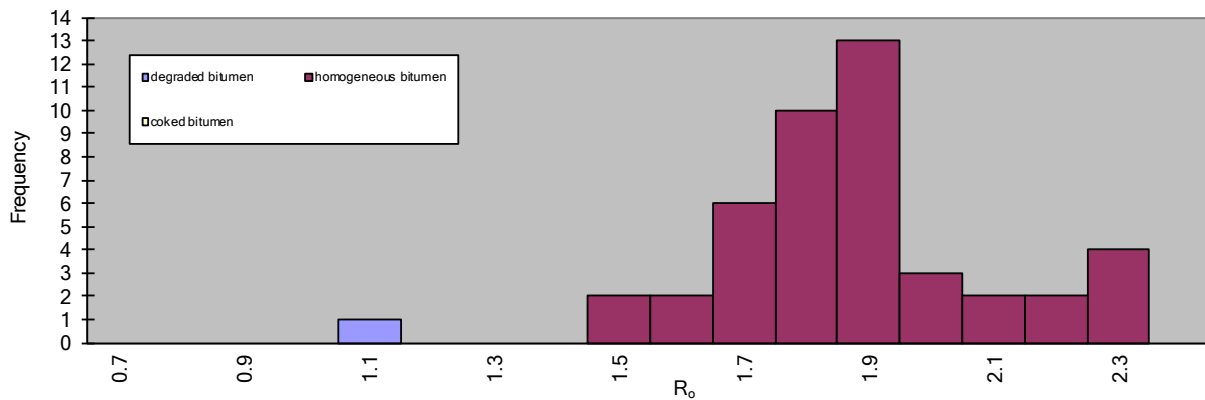
Sample ID: **117-20181_11730**
 Lab ID: 117-20181_11730
 Sample Type: shale
 Date Analyzed: 1/21/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

117-20181_11730



DATA

1.097	1.691	1.799	1.880	2.180
1.421	1.702	1.806	1.893	2.215
1.499	1.709	1.810	1.894	2.216
1.529	1.732	1.813	1.897	
1.594	1.733	1.828	1.944	
1.604	1.749	1.841	1.974	
1.617	1.752	1.848	1.974	
1.617	1.767	1.856	2.008	
1.645	1.771	1.872	2.068	
1.676	1.790	1.880	2.124	

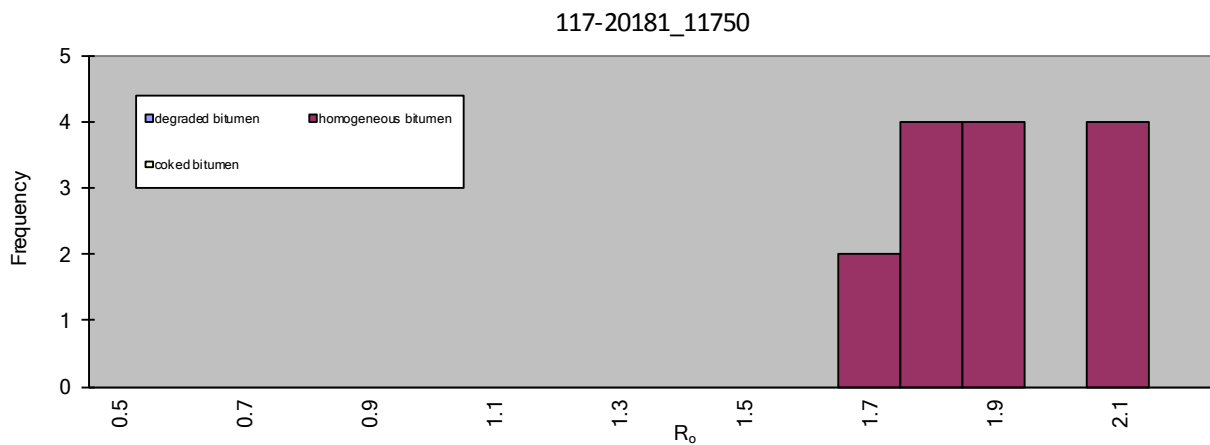
All Data: min: 1.097 max: 2.216

Vitrinite Only: min: 1.097 max: 2.216 V-types: 13

COMMENT

Standard: GGG [1.719]; some larger homogeneous macerals. Does not appear to be as organic rich as previous interval. Some red unknowns.

SAMPLE INFORMATION		RESULTS	
Submitted by: M. Cooney		No. measurements: 14	
Date Submitted: 1/21/2014		maceral type: bitumen	
Project: Utica Shale Playbook		R _o : 1.86	
		s.d.: 0.13	
Sample ID: 117-20181_11750		Example Photograph:	N/A
Lab ID: 117-20181_1175			
Sample Type: shale			
Date Analyzed: 1/21/2014			
Operator: M. Cooney			
Standard: ASTM D2798 7708			



DATA	
1.668	2.001
1.690	2.033
1.704	2.052
1.744	2.087
1.783	
1.787	
1.862	
1.871	
1.875	
1.879	

All Data: min: 1.668 max: 2.087

Vitrinite Only: min: 1.668 max: 2.087 V-types: 5

COMMENT
 Standard: GGG [1.719]; large homogeneous macerals. Very lean compared to the other samples. A few large, red unknowns.

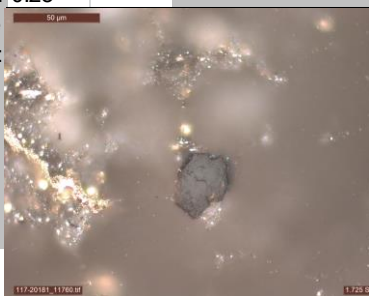
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 12/23/2013
 Project: Utica Shale Playbook

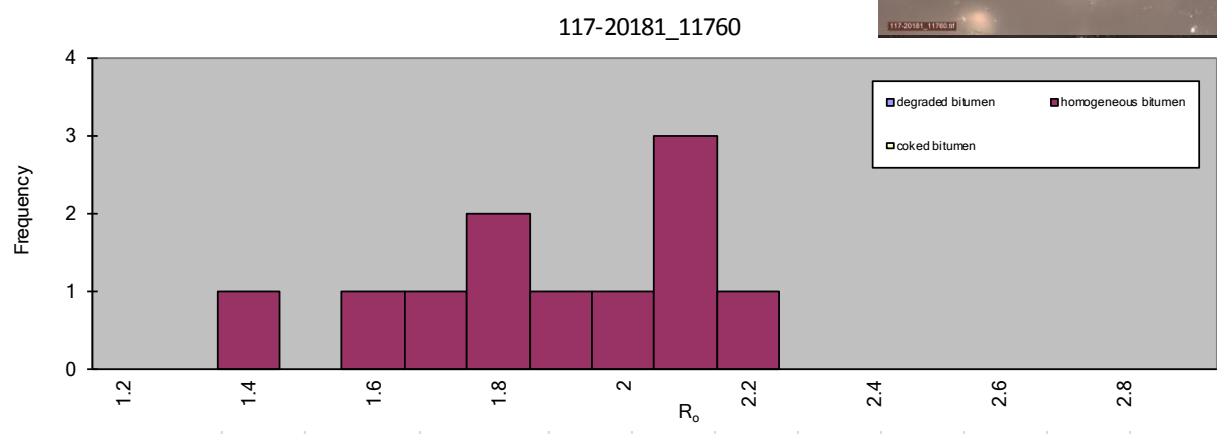
No. measurements: 11
 maceral type: bitumen
 R_o: 1.83
 s.d.: 0.23

Sample ID: **117-20181_11760**
 Lab ID: 117-20181_11760
 Sample Type: shale
 Date Analyzed: 12/23/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.355	2.176
1.581	
1.651	
1.725	
1.798	
1.802	
1.905	
2.022	
2.028	
2.063	

All Data: min: 1.355 max: 2.176

Vitrinite Only: min: 0.640 max: 1.051 V-types: 5

COMMENT

Standard: GGG [1.719]; lean. Some large inhomogeneous macerals. Some small red "unknowns".

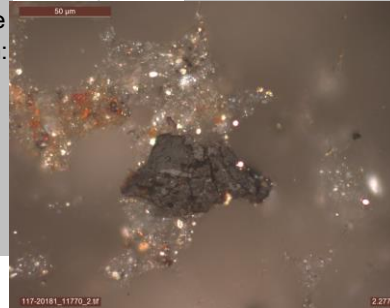
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 1/23/2014
 Project: Utica Shale Playbook

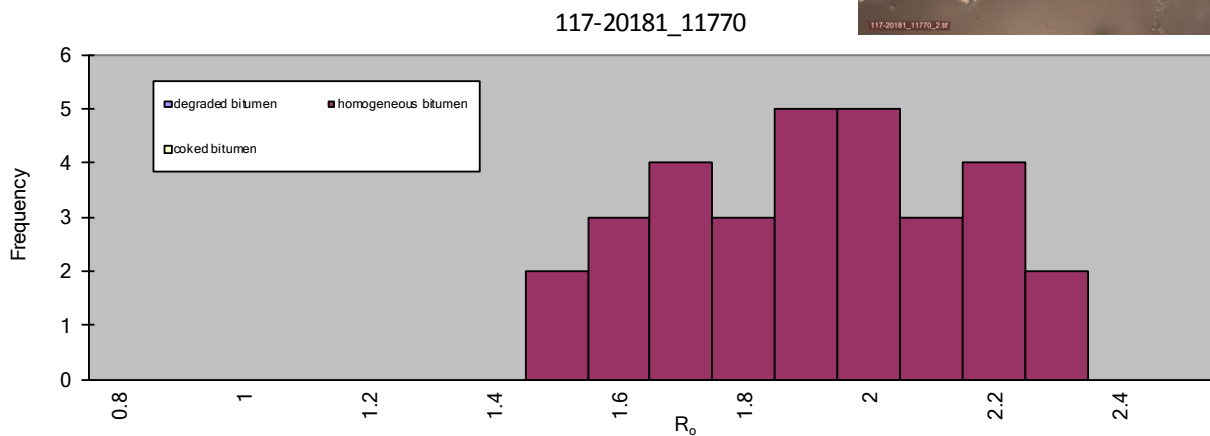
No. measurements: 31
 maceral type: bitumen
 R_o: 1.86
 s.d.: 0.24

Sample ID: **117-20181_1770**
 Lab ID: 117-20181_1770
 Sample Type: shale
 Date Analyzed: 1/23/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.408	1.760	1.964	2.293
1.447	1.778	1.987	
1.509	1.806	2.031	
1.534	1.815	2.047	
1.546	1.863	2.066	
1.608	1.888	2.116	
1.634	1.897	2.131	
1.670	1.917	2.133	
1.694	1.920	2.187	
1.716	1.947	2.277	

All Data: min: 1.408 max: 2.293

Vitrinite Only: min: 1.408 max: 2.293 V-types: 9

COMMENT

Standard: GGG [1.719]; Very lean. Some small, red unknowns. More carbonate than other samples. Macerals are inhomogeneous and dark in color.

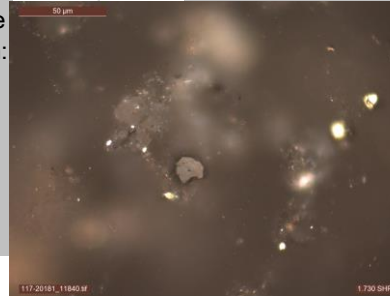
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 1/28/2014
 Project: Utica Shale Playbook

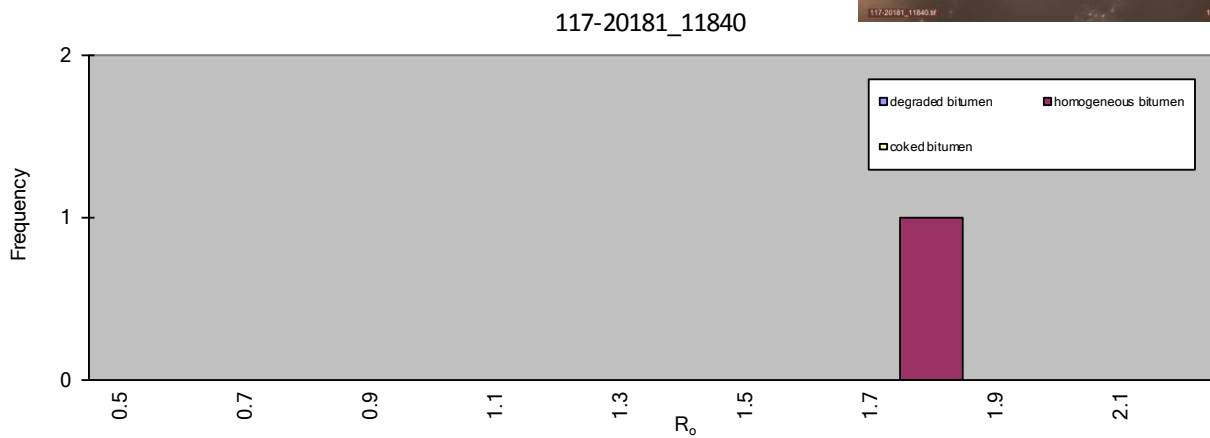
No. measurements: 1
 maceral type: bitumen
 R_o: 1.73
 s.d.: 0.00

Sample ID: 117-20181_11840
 Lab ID: 117-20181_11840
 Sample Type: shale
 Date Analyzed: 1/28/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.730									

All Data: min: 1.730 max: 1.730

Vitrinite Only: min: 1.730 max: 1.730 V-types: 1

COMMENT

Standard: GGG [1.719] Very lean. Not a lot of red unknowns. Only 1 notable maceral.

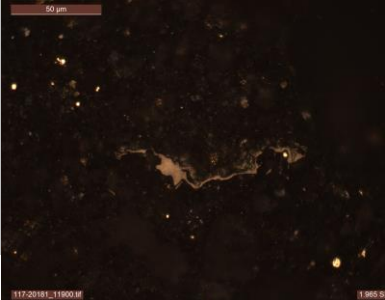
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 1/0/1900
 Project: Utica Shale Playbook

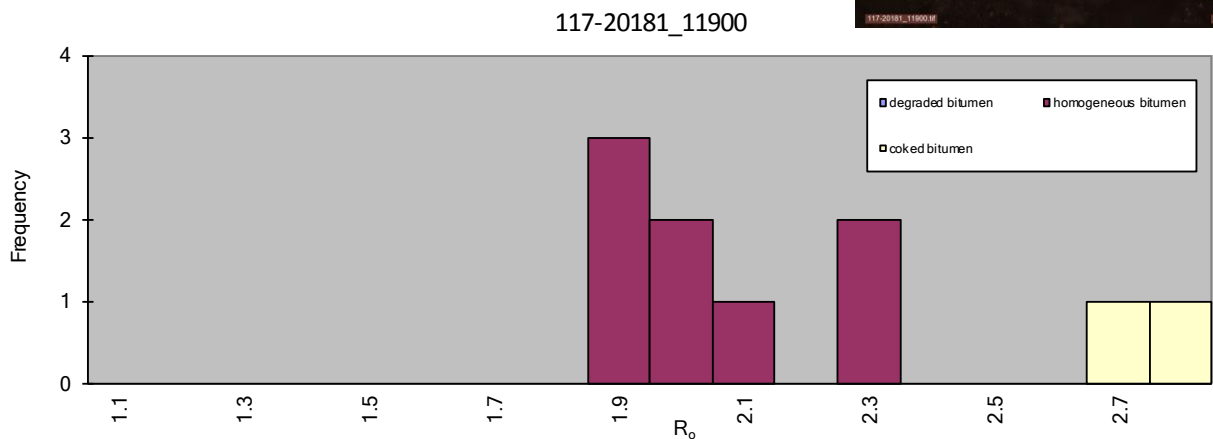
No. measurements: 10
 maceral type: bitumen
 R_o: 2.15
 s.d.: 0.31

Sample ID: 117-20181_11900
 Lab ID: 117-20181_11900
 Sample Type: shale
 Date Analyzed: 1/0/1900
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.811
1.868
1.889
1.965
1.969
2.096
2.274
2.299
2.607
2.746

All Data: min: 1.811 max: 2.746

Vitrinite Only: min: 1.811 max: 2.746 V-types: 10

COMMENT

Standard: GGG [1.719]; Some really small fill structures. A lot of carbonate. Macerals appear very bright. Abundant pyrite framboids. Some macerals look like graptolite fragments. Bitumen is more abundant than in previous samples, though relatively lean overall.

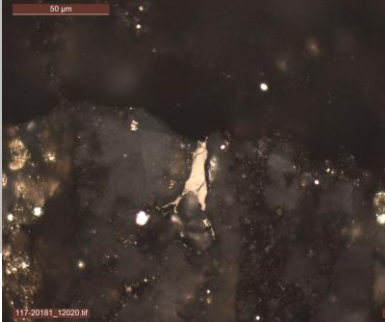
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 2/4/2014
 Project: Utica Shale Playbook

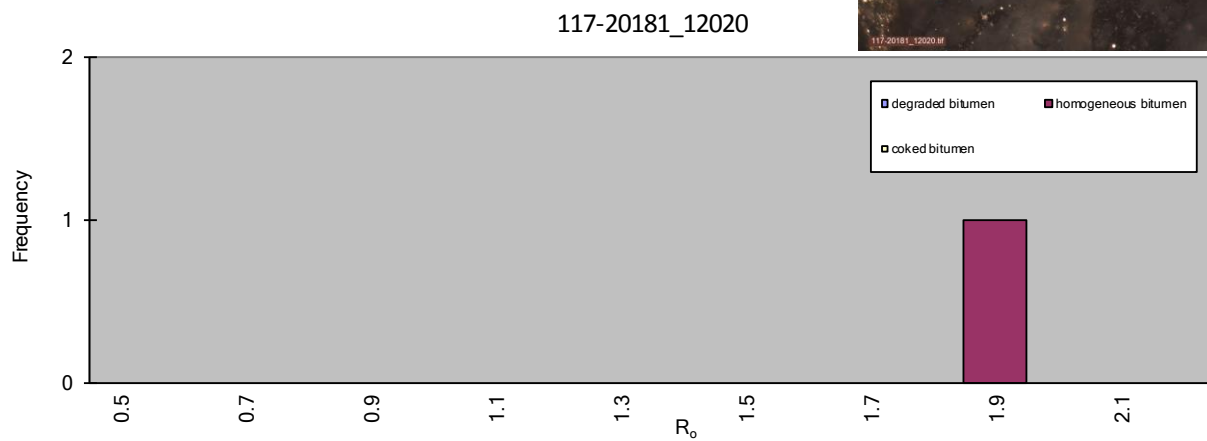
No. measurements: 1
 maceral type: bitumen
 R_o: 1.80
 s.d.: 0.00

Sample ID: **117-20181_12020**
 Lab ID: 117-20181_12020
 Sample Type: shale
 Date Analyzed: 2/4/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.800									

All Data: min: 1.800 max: 1.800

Vitrinite Only: min: 1.800 max: 1.800 V-types: 0

COMMENT

Standard: GGG [1.719]; Very lean; abundant carbonate; some very small fill structures that are too small to measure. Small, red unknowns scattered in the matrix.

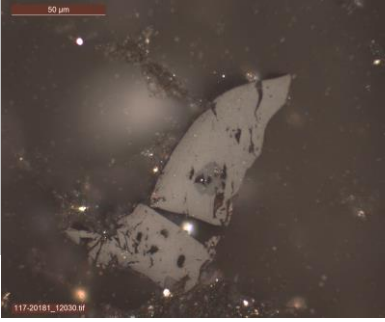
SAMPLE INFORMATION	RESULTS
--------------------	---------

Submitted by: M. Cooney
 Date Submitted: 2/4/2014
 Project: Utica Shale Playbook

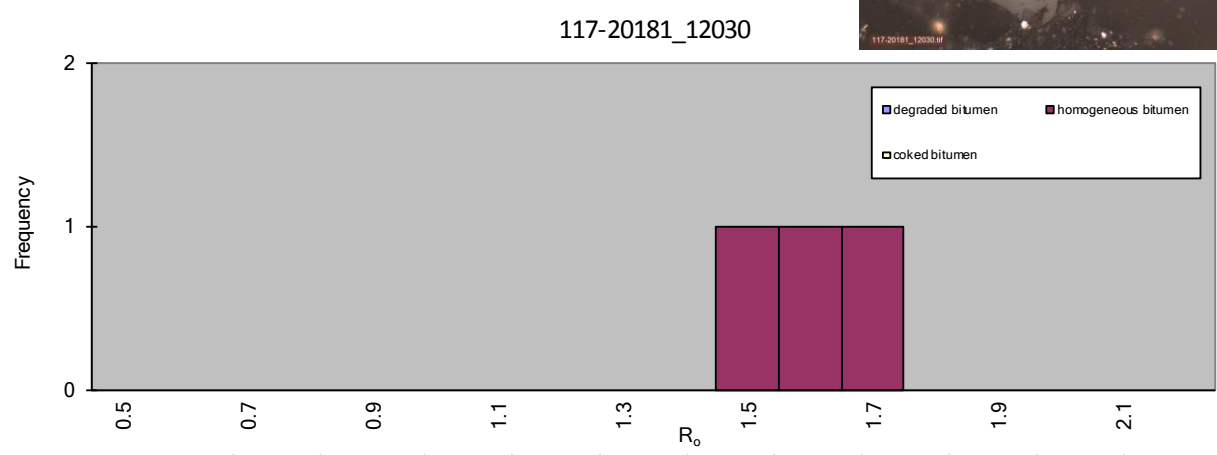
No. measurements: 3
 maceral type: bitumen
 R_o: 1.54
 s.d.: 0.06

Sample ID: 117-20181_12030
 Lab ID: 117-20181_12030
 Sample Type: shale
 Date Analyzed: 2/4/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA	
------	--

1.472									
1.541									
1.615									

All Data: min: 1.472 max: 1.615
 Vitrinite Only: min: 1.472 max: 1.615 V-types: 3

COMMENT	
---------	--

Standard: GGG [1.719]; Small red unknowns; abundant carbonate; some small fossil fragments.

API# 3712320150 – Shaw No. 1

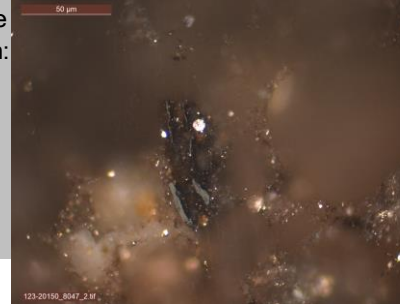
SAMPLE INFORMATION

Submitted by: M.Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Research C
 Sample ID: 123-20150_8047
 Lab ID: 123-20150_8047
 Sample Type: shale
 Date Analyzed: 11/25/2013
 Operator: 0
 Standard: ASTM D2798 7708

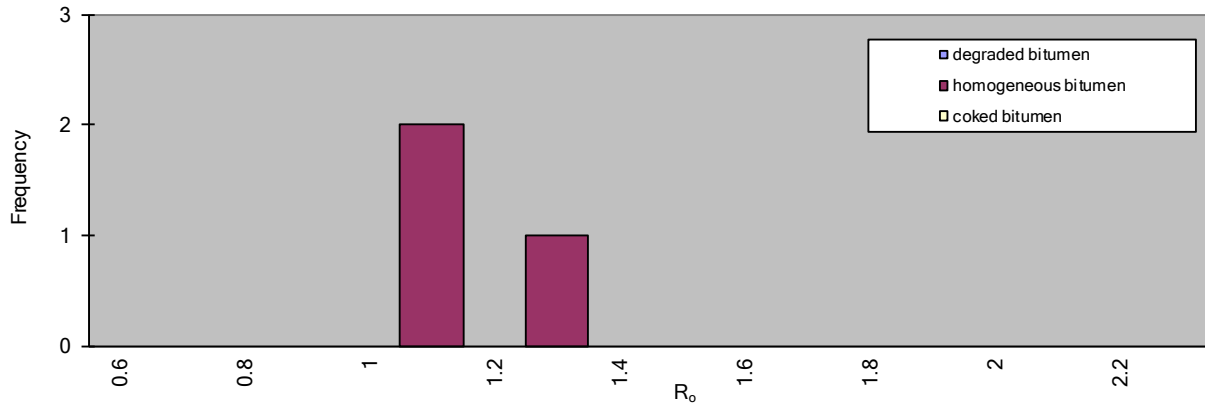
RESULTS

No. measurements: 3
 maceral type: bitumen
 R_o: 1.13
 s.d.: 0.10

Example Photograph:



123-20150_8047



DATA

1.040									
1.089									
1.272									

All Data: min: 1.040 max: 1.272

Vitrinite Only: min: 1.040 max: 1.272 V-types: 3

COMMENT

Standard: YAG [0.901]; Very lean, almost entirely clay minerals. One large maceral with high reflectance though partially obscured by other minerals. Some smaller macerals and fill structures. Seems like there is clay WITHIN the macerals? Could this be some kind of filling in of OM porosity with clay?

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 11/25/213
 Project: Utica Shale Playbook

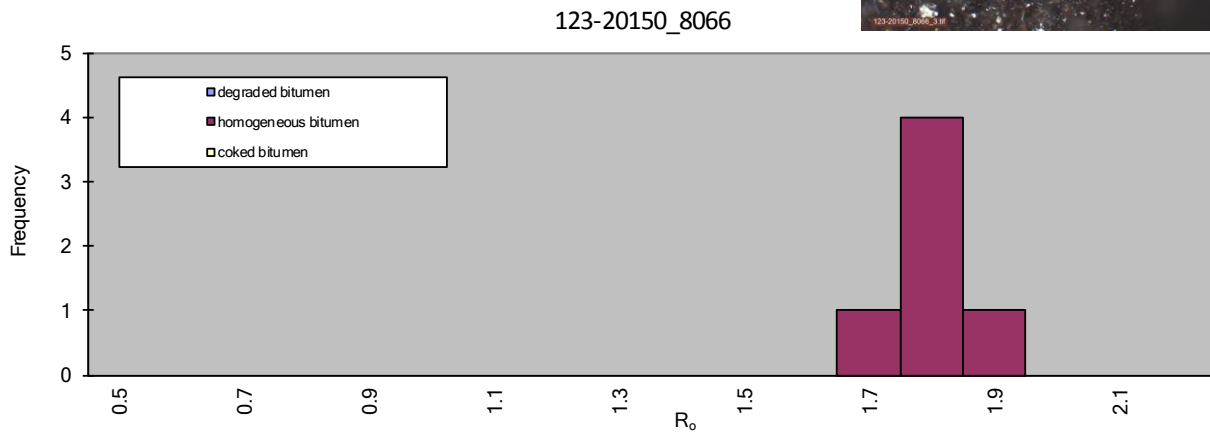
Sample ID: 123-20150_8066
 Lab ID: 123-20150_8066
 Sample Type: shale
 Date Analyzed: 11/25/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 6
 maceral type: bitumen
 R_o: 1.75
 s.d.: 0.07

Example Photograph:



DATA

1.684									
1.719									
1.719									
1.754									
1.754									
1.894									

All Data: min: 1.684 max: 1.894

Vitrinite Only: min: 1.684 max: 1.894 V-types: 3

COMMENT

Standard: CHANGED GGG [1.719]; standard changed due to accuracy issues. Fill structures and small macerals. Some small fossil fragments. Abundant small macerals, too small to measure.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 11/26/2013
 Project: Utica Shale Playbook

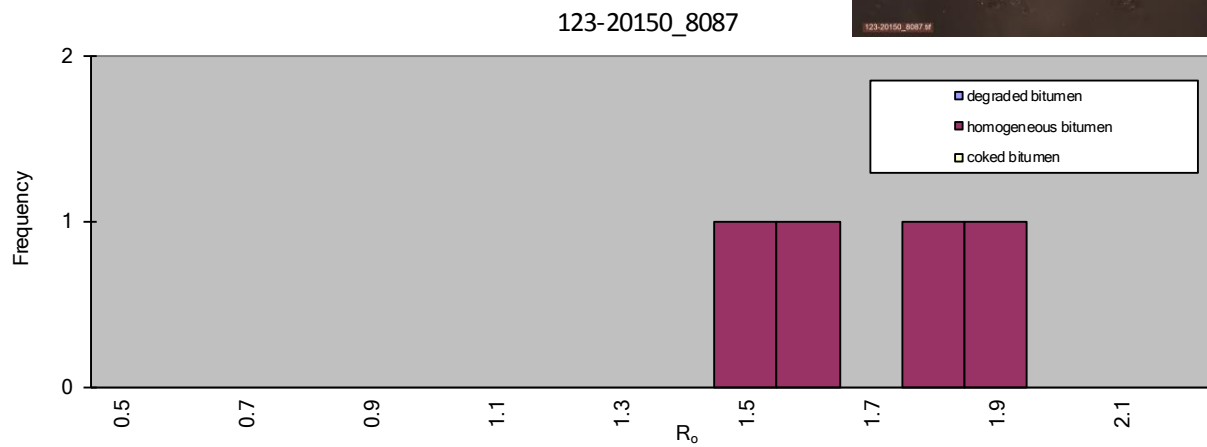
Sample ID: **123-20150_8087**
 Lab ID: 123-20150_8087
 Sample Type: shale
 Date Analyzed: 11/26/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 4
 maceral type: bitumen
 R_o: 1.63
 s.d.: 0.17

Example Photograph:



DATA

1.436									
1.510									
1.706									
1.884									

All Data: min: 1.436 max: 1.884

Vitrinite Only: min: 1.436 max: 1.884 V-types: 5

COMMENT

Standard: GGG [1.719]; Sample somewhat lean. Some larger macerals.

SAMPLE INFORMATION

RESULTS

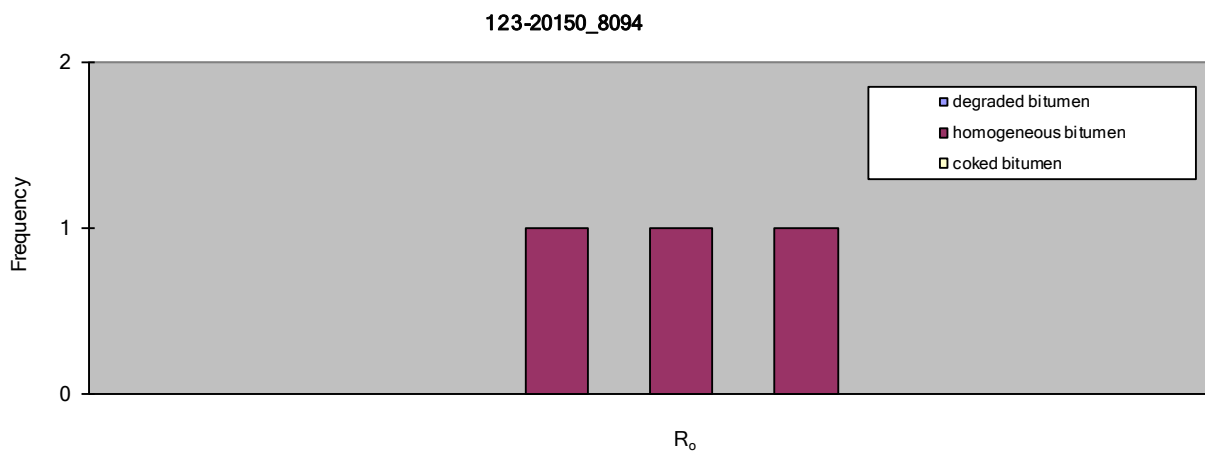
Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 3
 maceral type: bitumen
 R_o: 1.73
 s.d.: 0.19

Sample ID: **123-20150_8094**
 Lab ID: 123-20150_8094
 Sample Type: shale
 Date Analyzed: 11/26/2013
 Operator: M. Cooney

Example Photograph:

Standard: ASTM D2798 7708



DATA

1.505					
1.727					
1.960					

All Data: min: 1.505 max: 1.960

Vitrinite Only: min: 1.505 max: 1.960 V-types: 5

COMMENT

Lean. Some large macerals. Similar reflectance values as previous samples.

SAMPLE INFORMATION

RESULTS

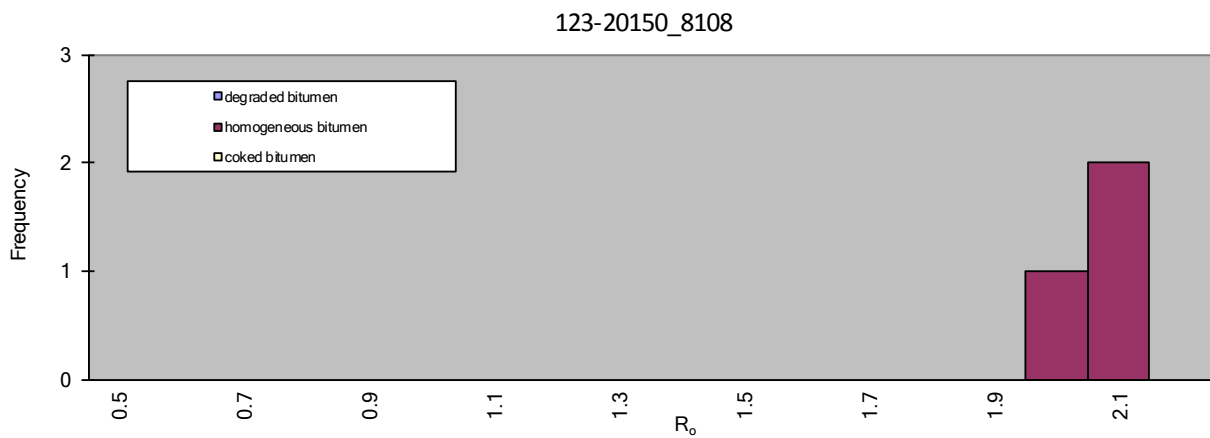
Submitted by: M. Cooney
 Date Submitted: 11/26/2013
 Project: Utica Shale Playbook

No. measurements: 3
 maceral type: bitumen
 R_o: 2.02
 s.d.: 0.04

Sample ID: **123-20150_8108**
 Lab ID: 123-20150_8108
 Sample Type: shale
 Date Analyzed: 11/26/2013
 Operator: M. Cooney

Example Photograph: N/A

Standard: ASTM D2798 7708



DATA

1.956									
2.046									
2.052									

All Data: min: 1.956 max: 2.052

Vitrinite Only: min: 1.956 max: 2.052 V-types: 2

COMMENT

Standard: GGG [1.719] Very lean. Most macerals are too small for measurement.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 11/26/2013
 Project: Utica Shale Playbook

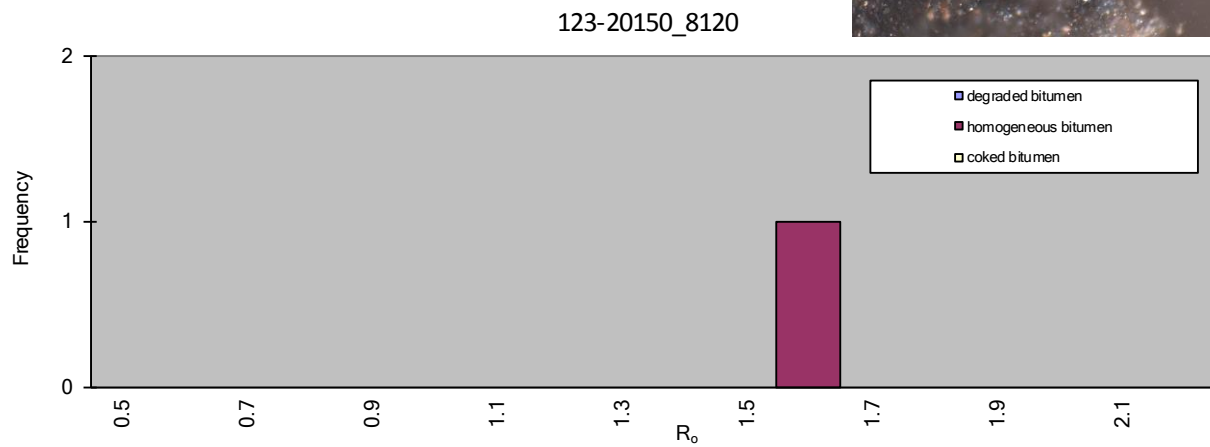
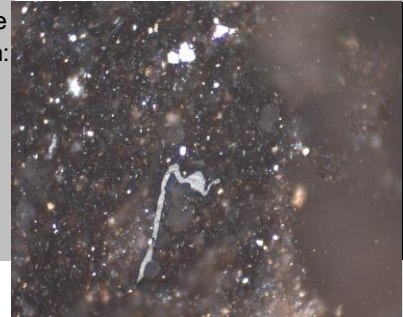
Sample ID: **123-20150_8120**
 Lab ID: 123-20150_8120
 Sample Type: shale
 Date Analyzed: 11/26/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 1
 maceral type: bitumen
 R_o: 1.51
 s.d.: 0.00

Example Photograph:



DATA

1.511									

All Data: min: 1.511 max: 1.511

Vitrinite Only: min: 1.511 max: 1.511 V-types: 1

COMMENT

Standard: GGG [1.719]; very lean, mostly thin fill structures.

SAMPLE INFORMATION

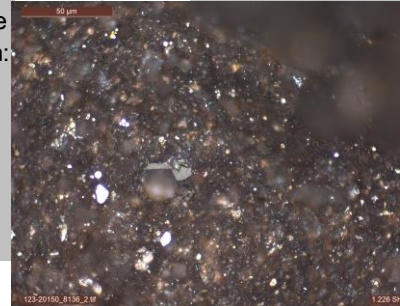
RESULTS

Submitted by: M. Cooney
 Date Submitted: 12/2/2013
 Project: Utica Shale Playbook

No. measurements: 7
 maceral type: bitumen
 R_o: 1.70
 s.d.: 0.22

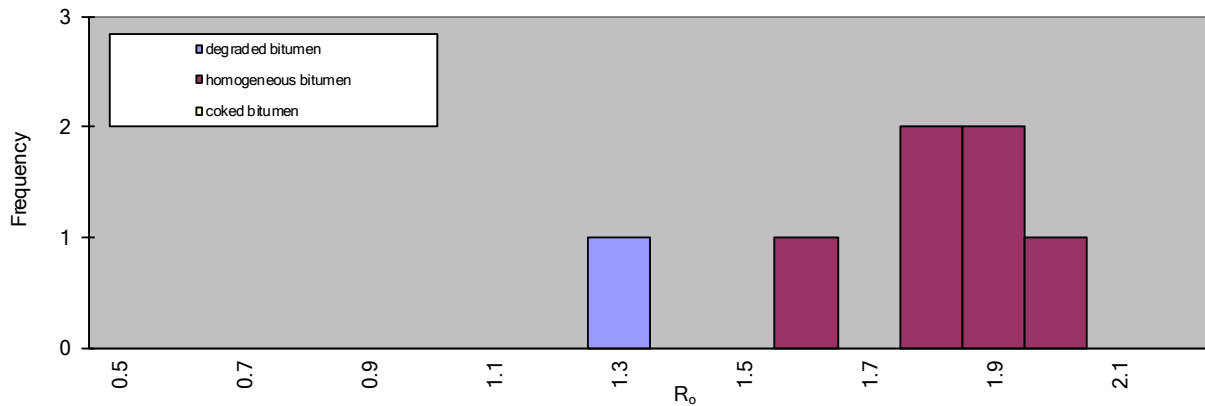
Sample ID: 123-20150_8136
 Lab ID: 123-20150_8136
 Sample Type: shale
 Date Analyzed: 12/2/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

123-20150_8136



DATA

1.226									
1.519									
1.769									
1.776									
1.812									
1.843									
1.923									

All Data: min: 1.226 max: 1.923

Vitrinite Only: min: 1.226 max: 1.923 V-types: 8

COMMENT

Standard: GGG [1.719] ;Small fill structures with some scattered larger macerals.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/2/2013
 Project: Utica Shale Playbook

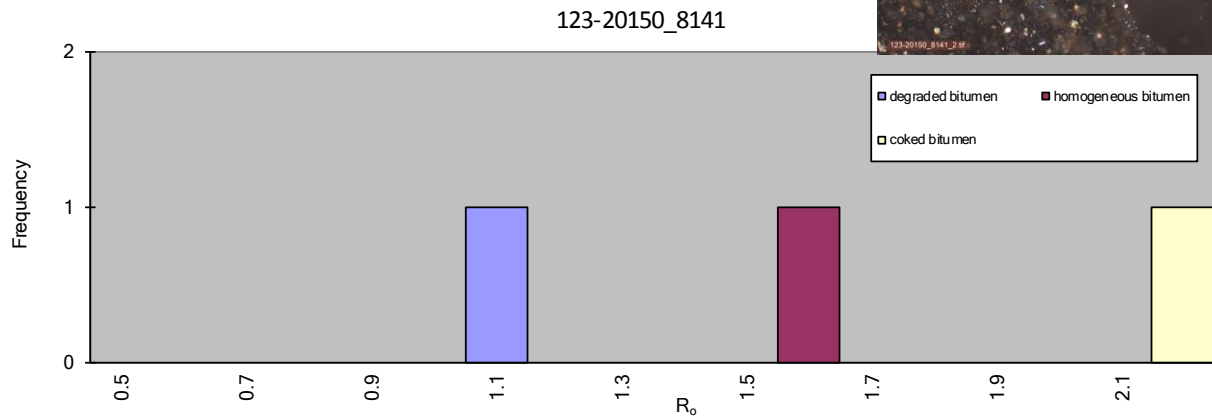
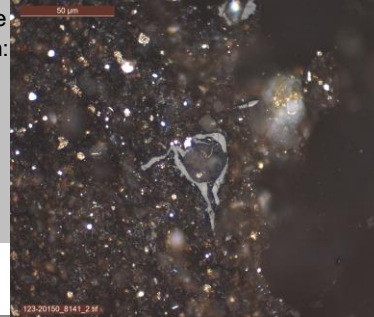
Sample ID: 123-20150_8141
 Lab ID: 123-20150_8141
 Sample Type: shale
 Date Analyzed: 12/2/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 3
 maceral type: bitumen
 R_o: 1.57
 s.d.: 0.44

Example Photograph:



DATA

1.059									
1.511									
2.138									

All Data: min: 1.059 max: 2.138

Vitrinite Only: min: 1.059 max: 2.138 V-types: 12

COMMENT

Standard: GGG [1.719]; extremely lean. Not an accurate representation of the interval.

SAMPLE INFORMATION

RESULTS

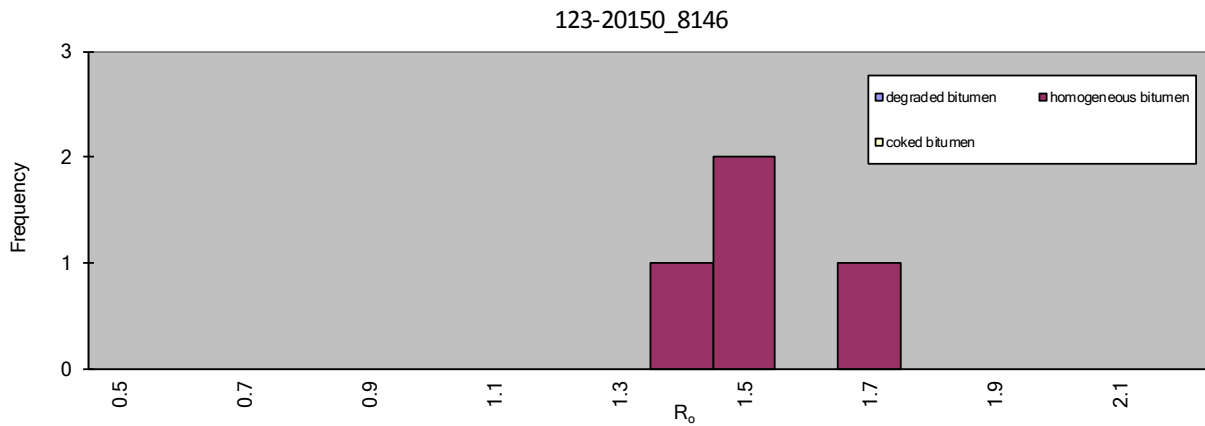
Submitted by: M. Cooney
 Date Submitted: 12/2/2013
 Project: Utica Shale Playbook

No. measurements: 4
 maceral type: bitumen
 R_o: 1.45
 s.d.: 0.11

Sample ID: 123-20150_8146
 Lab ID: 123-20150_8146
 Sample Type: shale
 Date Analyzed: 12/2/2013
 Operator: M. Cooney

Example Photograph: N/A

Standard: ASTM D2798 7708



DATA

1.312					
1.415					
1.458					
1.620					

All Data: min: 1.312 max: 1.620

Vitrinite Only: min: 1.312 max: 1.620 V-types: 4

COMMENT

Standard: GGG [1.71]; more solid macerals than fill structures. Still very lean.

SAMPLE INFORMATION

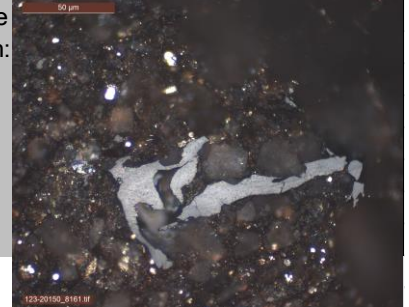
RESULTS

Submitted by: M. Cooney
 Date Submitted: 12/2/2013
 Project: Utica Shale Playbook

No. measurements: 9
 maceral type: bitumen
 R_o: 1.65
 s.d.: 0.30

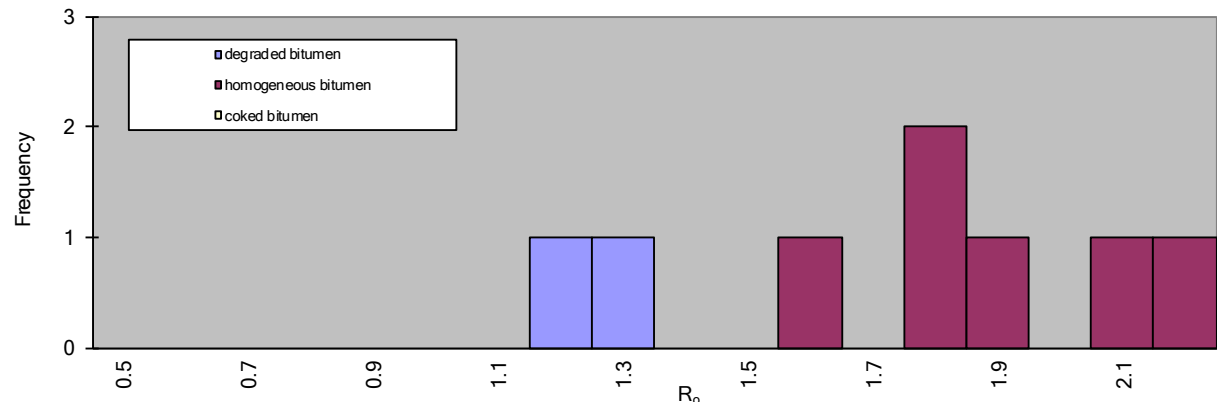
Sample ID: 123-20150_8161
 Lab ID: 123-20150_8161
 Sample Type: shale
 Date Analyzed: 12/2/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

123-20150_8161



DATA

1.161				
1.299				
1.470				
1.517				
1.735				
1.743				
1.824				
2.014				
2.104				

All Data: min: 1.161 max: 2.104

Vitrinite Only: min: 1.161 max: 2.104 V-types: 11

COMMENT

Standard: GGG [1.719]; Some very large macerals, very scattered reflectance values.

SAMPLE INFORMATION

RESULTS

Submitted by: M. Cooney
 Date Submitted: 12/3/2013
 Project: Utica Shale Playbook

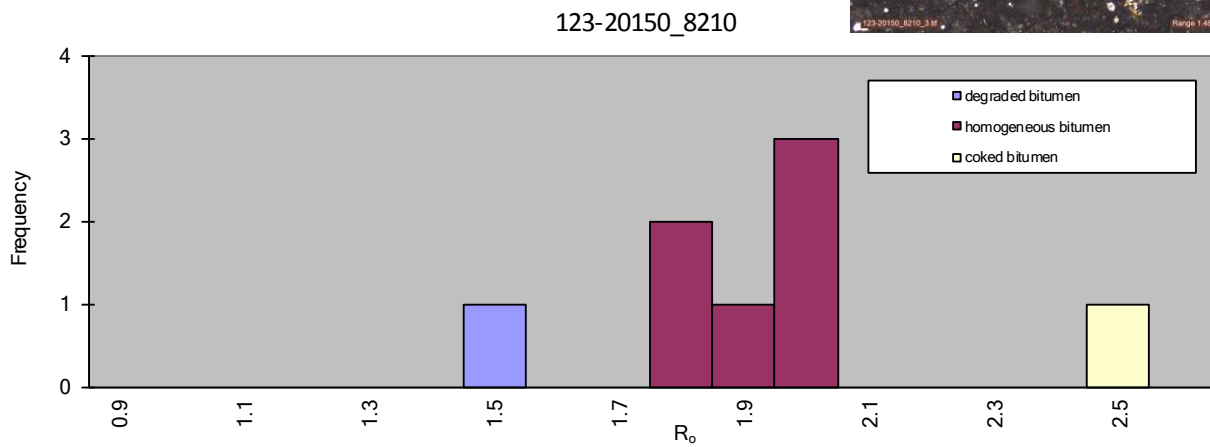
No. measurements: 8
 maceral type: bitumen
 R_o: 1.90
 s.d.: 0.26

Sample ID: 123-20150_8210
 Lab ID: 123-20150_8210
 Sample Type: shale
 Date Analyzed: 12/3/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.486			
1.761			
1.781			
1.824			
1.933			
1.956			
1.981			
2.483			

All Data: min: 1.486 max: 2.483

Vitrinite Only: min: 1.486 max: 2.483 V-types: 11

COMMENT

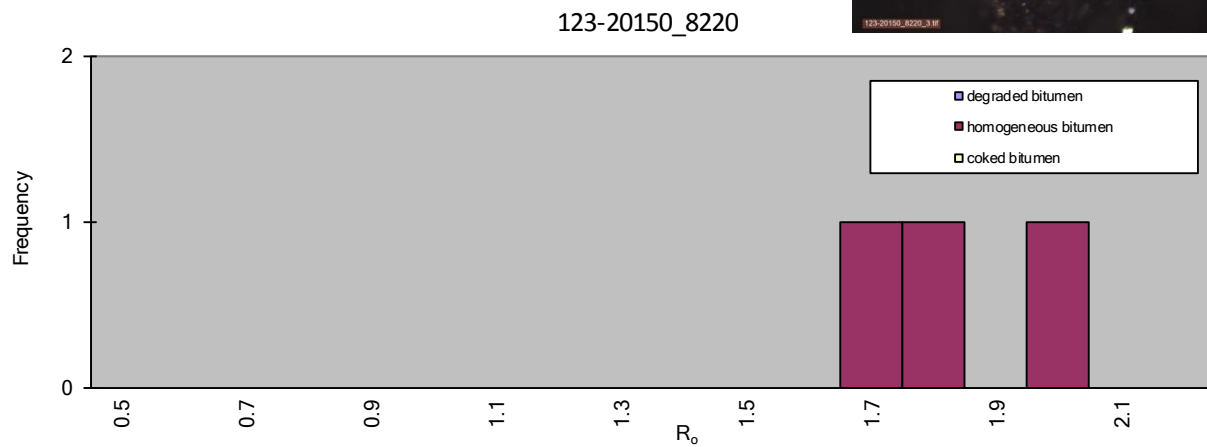
Standard: GGG [1.719]; Some fossil fragments. Macerals are long and skinny - look graptolitic.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/3/2013
 Project: Utica Shale Playbook
 Sample ID: 123-20150_8220
 Lab ID: 123-20150_8220
 Sample Type: shale
 Date Analyzed: 12/3/2013
 Operator: M. Cooney
 Standard: ASTM D2798 7708

RESULTS

No. measurements: 3
 maceral type: bitumen
 R_o: 1.79
 s.d.: 0.11
 Example Photograph:



DATA

1.679									
1.760									
1.936									

All Data: min: 1.679 max: 1.936

Vitrinite Only: min: 1.679 max: 1.936 V-types: 4

COMMENT

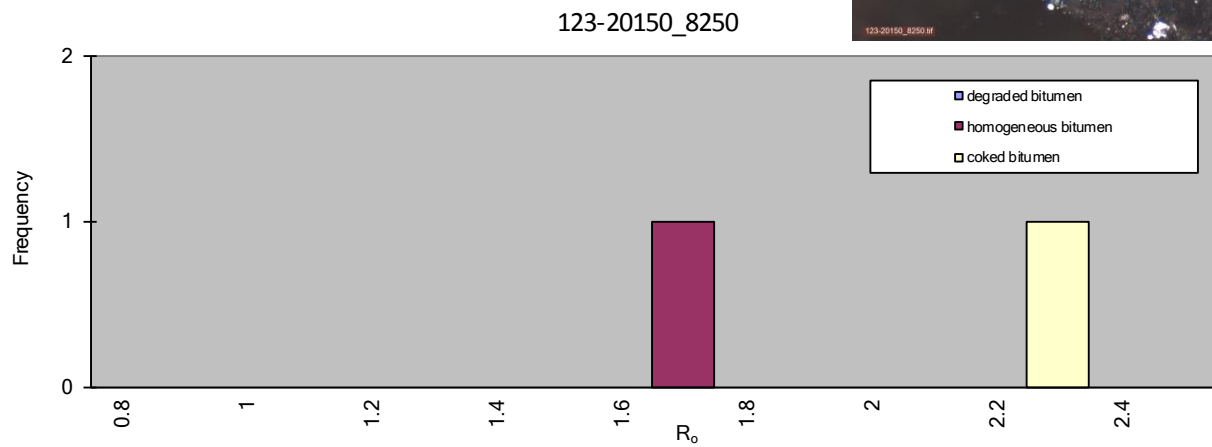
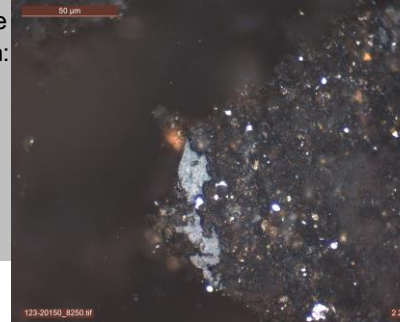
Standard: GGG [1.719]; Fossil fragments, sparse larger macerals. In clay mineral assemblages, where there are fossils, there do not seem to be bitumen macerals and visa versa. Don't seem to be as many fill structures. Abundant fossils. Large unknown. Not red, but very reflective.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/3/2013
 Project: Utica Shale Playbook
 Sample ID: 123-20150_8250
 Lab ID: 123-20150_8250
 Sample Type: shale
 Date Analyzed: 12/3/2013
 Operator: M. Cooney
 Standard: ASTM D2798 7708

RESULTS

No. measurements: 2
 maceral type: bitumen
 R_o: 1.93
 s.d.: 0.31
 Example Photograph:



DATA

1.620									
2.230									

All Data: min: 1.620 max: 2.230

Vitrinite Only: min: 1.620 max: 2.230 V-types: 7

COMMENT

Standard: GGG [1.719]; Abundant fossils (occur with bitumen) and some small fill structures. Red "unknowns".

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/3/2013
 Project: Utica Shale Playbook

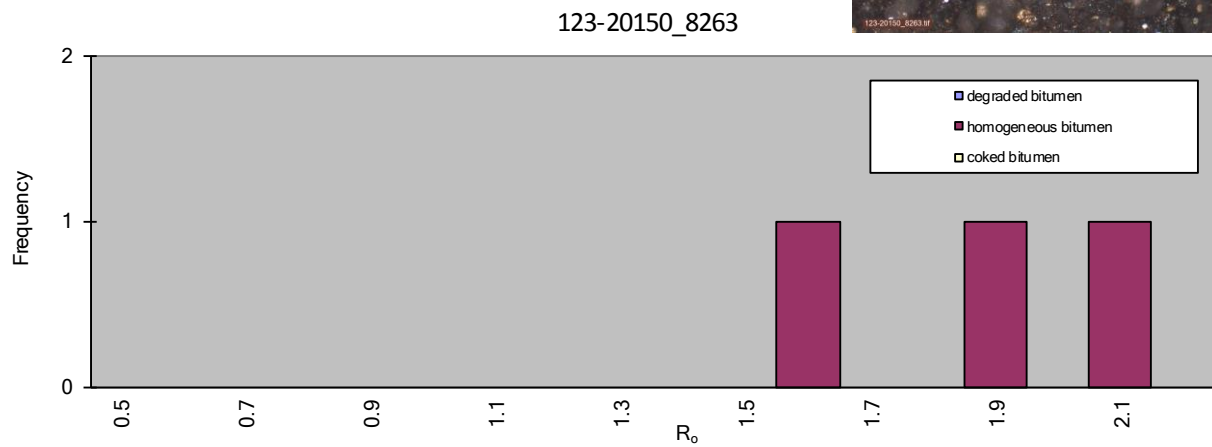
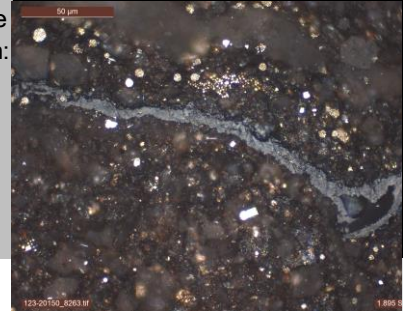
Sample ID: 123-20150_8263
 Lab ID: 123-20150_8263
 Sample Type: shale
 Date Analyzed: 12/3/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 3
 maceral type: bitumen
 R_o: 1.84
 s.d.: 0.22

Example Photograph:



DATA

1.542									
1.895									
2.068									

All Data: min: 1.542 max: 2.068

Vitrinite Only: min: 1.542 max: 2.068 V-types: 6

COMMENT

Standard: GGG [1.719]; Fossil fragments.

SAMPLE INFORMATION

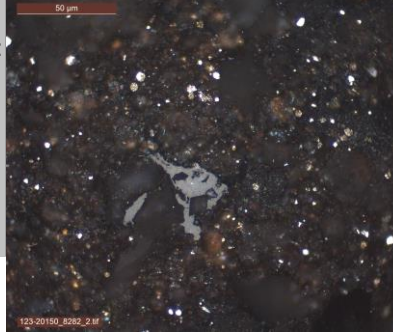
RESULTS

Submitted by: M. Cooney
 Date Submitted: 12/4/2013
 Project: Utica Shale Playbook

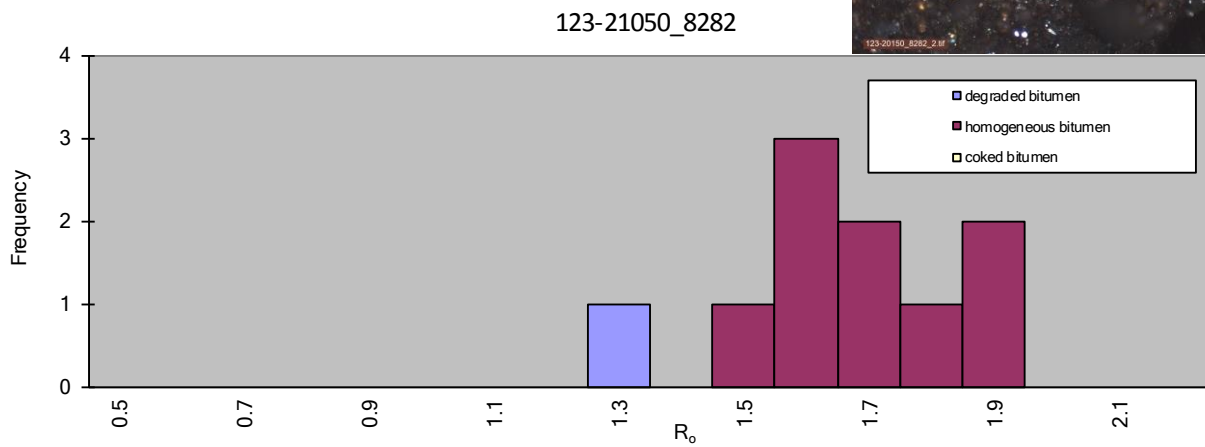
No. measurements: 10
 maceral type: bitumen
 R_o: 1.62
 s.d.: 0.18

Sample ID: 123-21050_8282
 Lab ID: 123-21050_8282
 Sample Type: shale
 Date Analyzed: 12/4/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

1.255
1.462
1.505
1.548
1.594
1.674
1.689
1.758
1.835
1.867

All Data: min: 1.255 max: 1.867

Vitrinite Only: min: 1.255 max: 1.867 V-types: 7

COMMENT

Standard: GGG [1.719]; Fill structures. Larger macerals look like crled-up graptolites. Abundant macerals in various forms.

SAMPLE INFORMATION

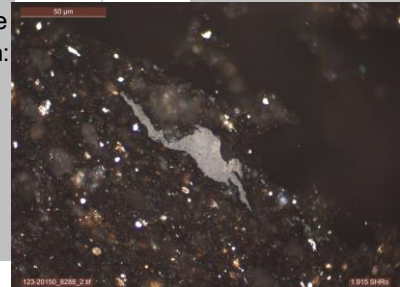
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 18
 maceral type: bitumen
 R_o: 1.75
 s.d.: 0.17

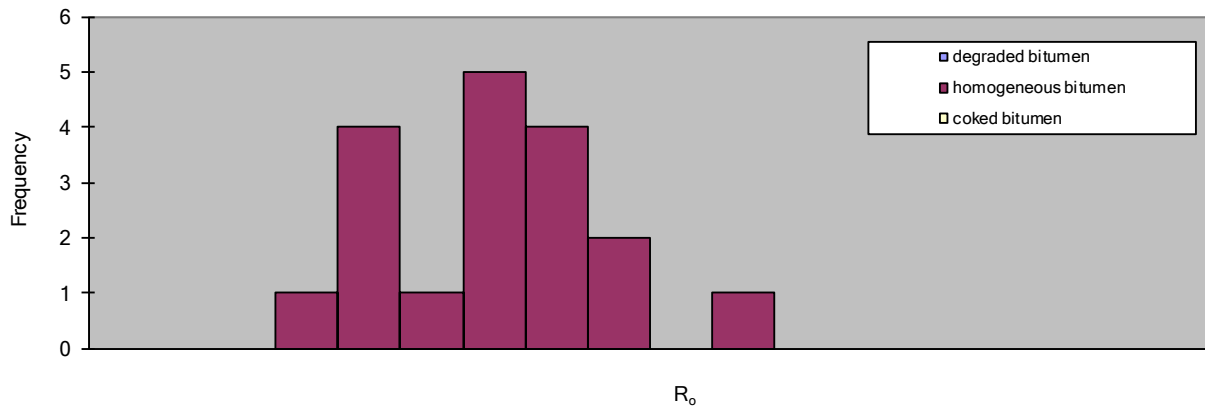
Sample ID: **123-20150-8288**
 Lab ID: 123-20150-8288
 Sample Type: Shale
 Date Analyzed: 7/14/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

123-20150_8288



DATA

1.470	1.793						
1.546	1.817						
1.567	1.833						
1.572	1.851						
1.579	1.877						
1.683	1.915						
1.700	1.972						
1.708	2.174						
1.710							
1.715							

All Data: min: 1.470 max: 2.174

Vitrinite Only: min: 1.470 max: 2.174 V-types: 8

COMMENT

SAMPLE INFORMATION

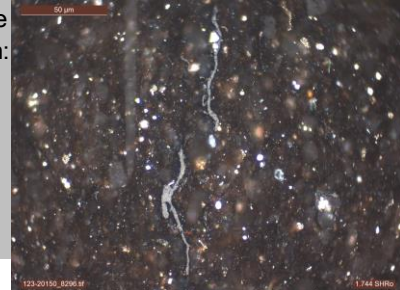
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 15
 maceral type: bitumen
 R_o: 1.78
 s.d.: 0.16

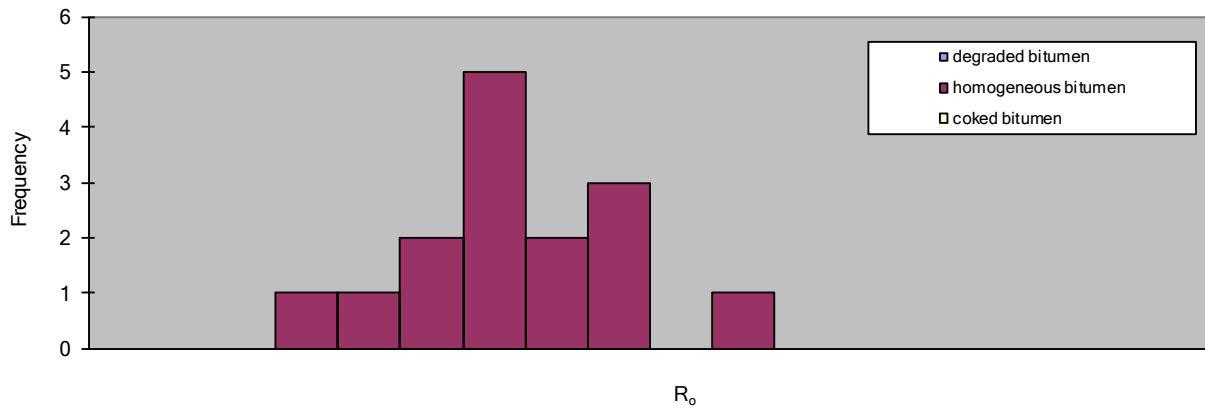
Sample ID: 123-20150-8296
 Lab ID: 123-20150-8296
 Sample Type: Shale
 Date Analyzed: 7/14/2014
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

123-20150_8296



DATA

1.425	1.835						
1.541	1.913						
1.682	1.914						
1.693	1.954						
1.721	2.115						
1.732							
1.744							
1.781							
1.789							
1.816							

All Data: min: 1.425 max: 2.115

Vitrinite Only: min: 1.425 max: 2.115 V-types: 8

COMMENT

SAMPLE INFORMATION

RESULTS

Submitted by: M. Cooney
 Date Submitted: 12/5/2013
 Project: Utica Shale Playbook

No. measurements: 13
 maceral type: bitumen
 R_o: 1.79
 s.d.: 0.13

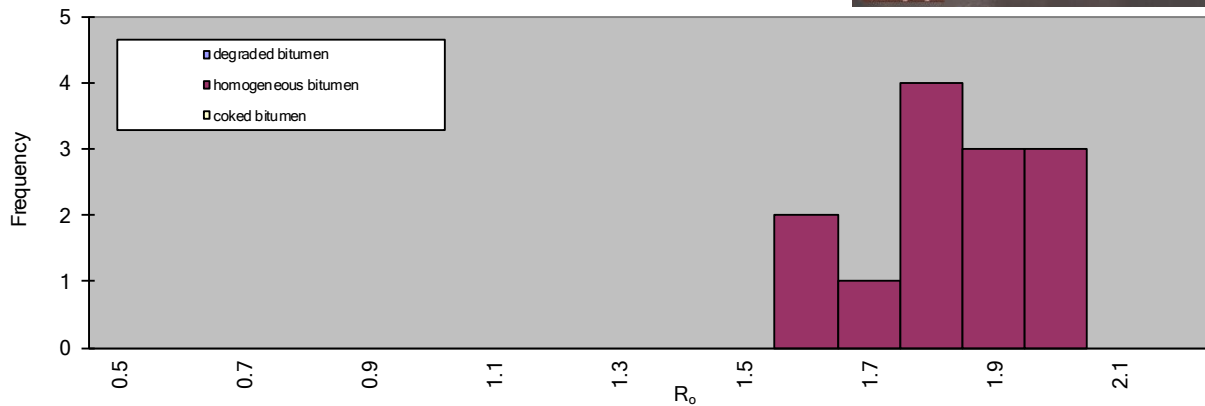
Sample ID: 123-20150_8317
 Lab ID: 123-20150_8317
 Sample Type: shale
 Date Analyzed: 12/5/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

123-20150_8317



DATA

1.552	1.923
1.572	1.926
1.671	1.991
1.700	
1.746	
1.788	
1.796	
1.819	
1.867	
1.880	

All Data: min: 1.552 max: 1.991

Vitrinite Only: min: 1.552 max: 1.991 V-types: 5

COMMENT

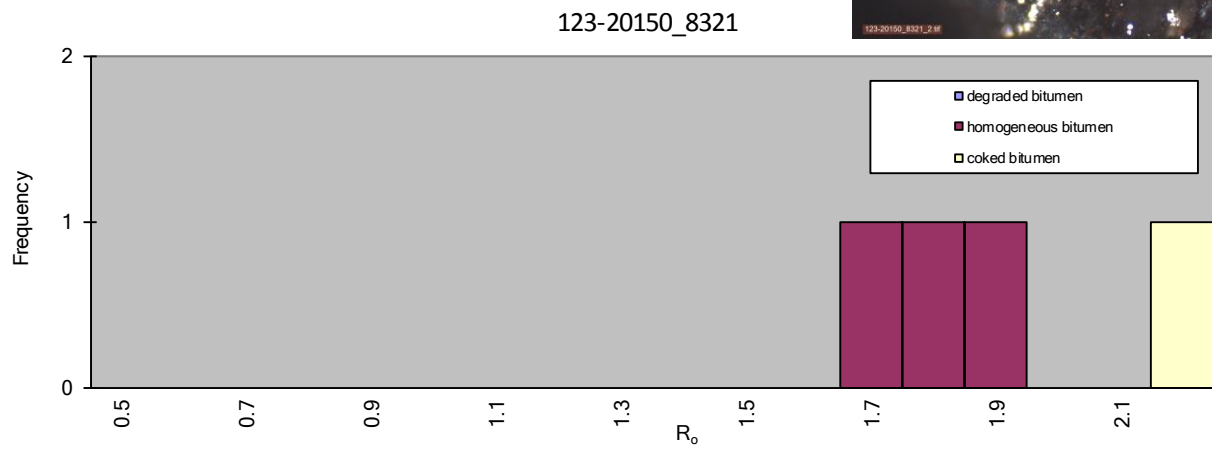
Standard: GGG [1.719]; Large macerals and fill structures. Red unknowns.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/5/2013
 Project: Utica Shale Playbook
 Sample ID: 123-20150_8321
 Lab ID: 123-20150_8321
 Sample Type: shale
 Date Analyzed: 12/5/2013
 Operator: M. Cooney
 Standard: ASTM D2798 7708

RESULTS

No. measurements: 4
 maceral type: bitumen
 R_o: 1.85
 s.d.: 0.17
 Example Photograph:



DATA

1.673									
1.777									
1.815									
2.126									

All Data: min: 1.673 max: 2.126

Vitrinite Only: min: 1.673 max: 2.126 V-types: 6

COMMENT

Standard: GGG [1.719]; Fossil fragments. Small fill strctures. More carbonate but still sufficient clay. Large red unknowns.

SAMPLE INFORMATION

RESULTS

Submitted by: M. Cooney
 Date Submitted: 12/5/2013
 Project: Utica Shale Playbook

No. measurements: 9
 maceral type: bitumen
 R_o: 1.77
 s.d.: 0.27

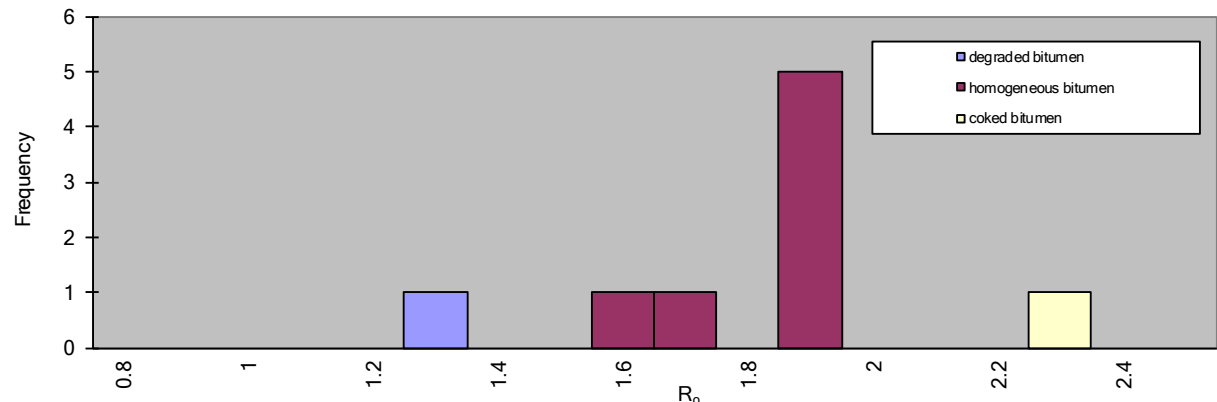
Sample ID: 123-20150_8326
 Lab ID: 123-20150_8326
 Sample Type: shale
 Date Analyzed: 12/5/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

123-21050_8326



DATA

1.224			
1.511			
1.667			
1.811			
1.815			
1.849			
1.898			
1.899			
2.250			

All Data: min: 1.224 max: 2.250

Vitrinite Only: min: 1.224 max: 2.250 V-types: 11

COMMENT

Standard: GGG [1.719]; Very lean. Abundant carbonate. Some large macerals between the carbonate grains.

SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/5/2013
 Project: Utica Shale Playbook

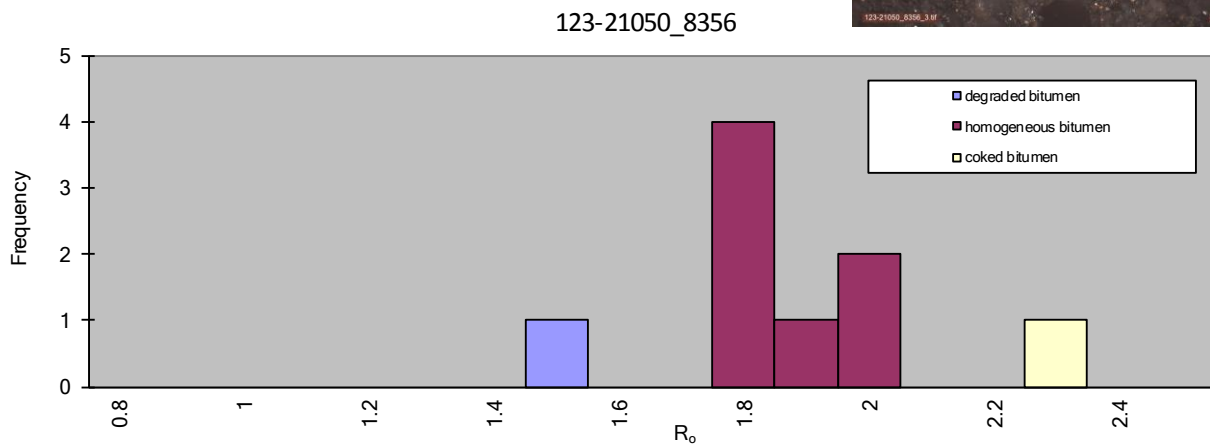
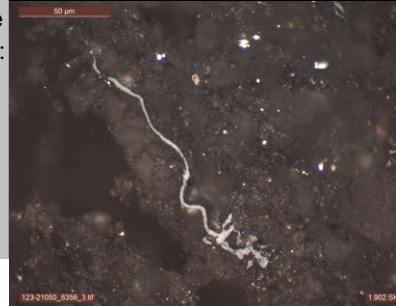
Sample ID: **123-21050_8356**
 Lab ID: 123-21050_8356
 Sample Type: shale
 Date Analyzed: 12/5/2013
 Operator: M. Cooney

Standard: ASTM D2798 7708

RESULTS

No. measurements: 9
 maceral type: bitumen
 R_o: 1.83
 s.d.: 0.21

Example Photograph:



DATA

1.455				
1.703				
1.769				
1.785				
1.792				
1.848				
1.902				
1.953				
2.291				

All Data: min: 1.455 max: 2.291

Vitrinite Only: min: 1.455 max: 2.291 V-types: 9

COMMENT

Standard: GGG [1.719]; Large, very reflective unknowns (not red in color). Some long, skinny, graptolitic macerals.

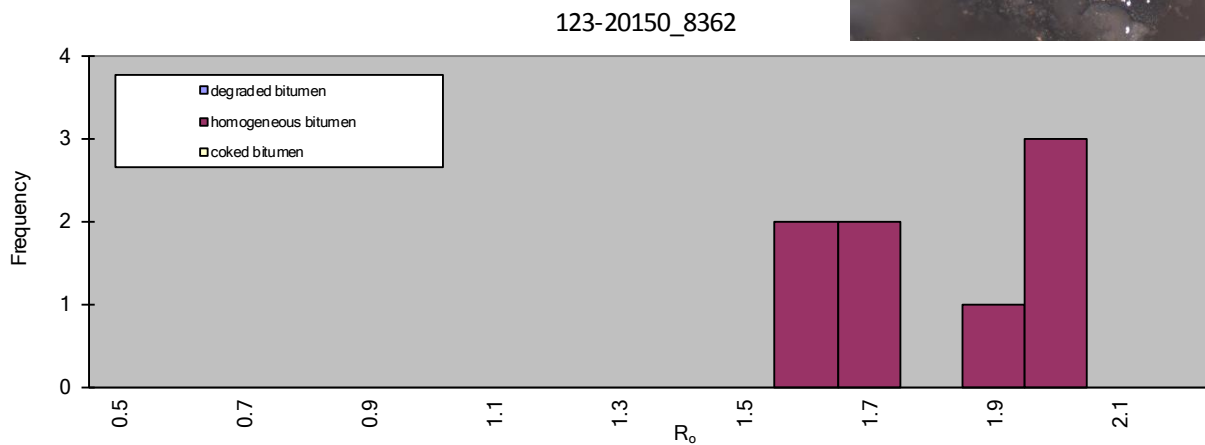
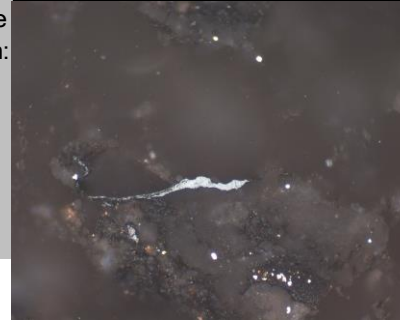
SAMPLE INFORMATION

Submitted by: M. Cooney
 Date Submitted: 12/5/2013
 Project: Utica Shale Playbook
 Sample ID: 123-21050_8362
 Lab ID: 123-21050_8362
 Sample Type: shale
 Date Analyzed: 12/5/2013
 Operator: M. Cooney
 Standard: ASTM D2798 7708

RESULTS

No. measurements: 8
 maceral type: bitumen
 R_o: 1.77
 s.d.: 0.18

Example Photograph:



DATA

1.526									
1.570									
1.623									
1.698									
1.809									
1.911									
1.996									
1.999									

All Data: min: 1.526 max: 1.999

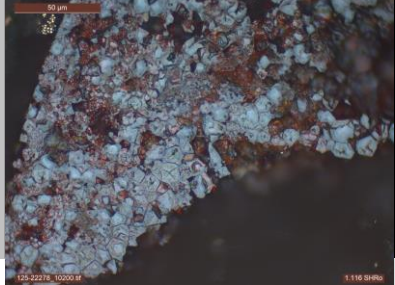
Vitrinite Only: min: 1.526 max: 1.999 V-types: 5

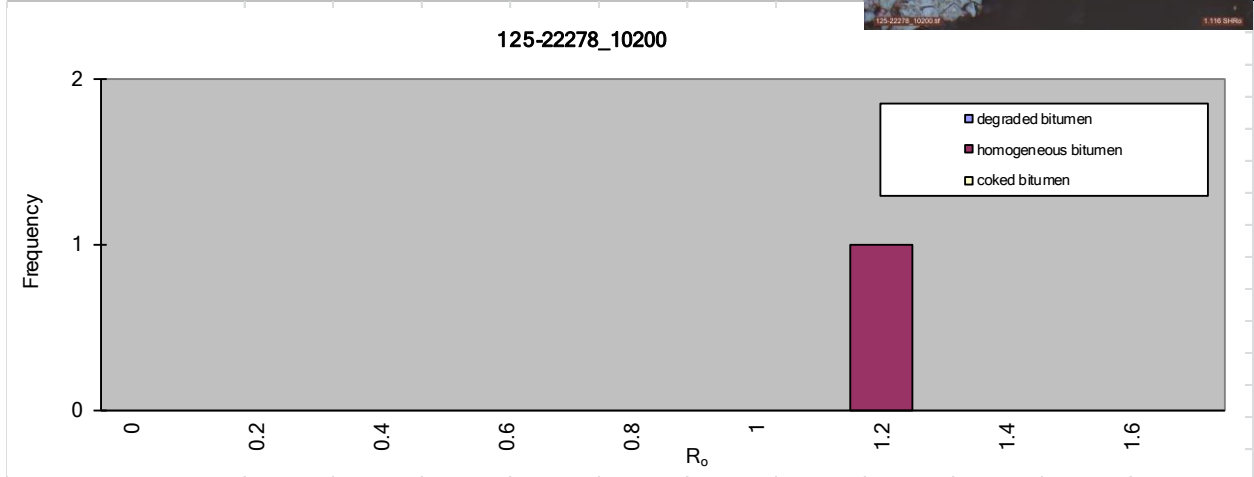
COMMENT

Standard: GGG [1.719]; A lot of carbonate; red unknowns; some every small fill structures or graptolitic looking macerals. Almost entirely carbonate. Some clay.

API# 3712522278 – Starvaggi No. 1

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/11/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10200 Lab ID: 0 Sample Type: shale Date Analyzed: 10/11/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 1 maceral type: bitumen R _o : 1.12 s.d.: 0.00 Example Photograph: 
---	--



DATA

	1.116								

All Data: min: 1.116 max: 1.116

Vitrinite Only: min: 1.116 max: 1.116 V-types: 1

COMMENT

Standard: YAG [0.901]; very lean sample.

SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/15/2013
 Project: Utica Shale Playbook

No. measurements: 7
 maceral type: bitumen
 R_o: 0.86
 s.d.: 0.17

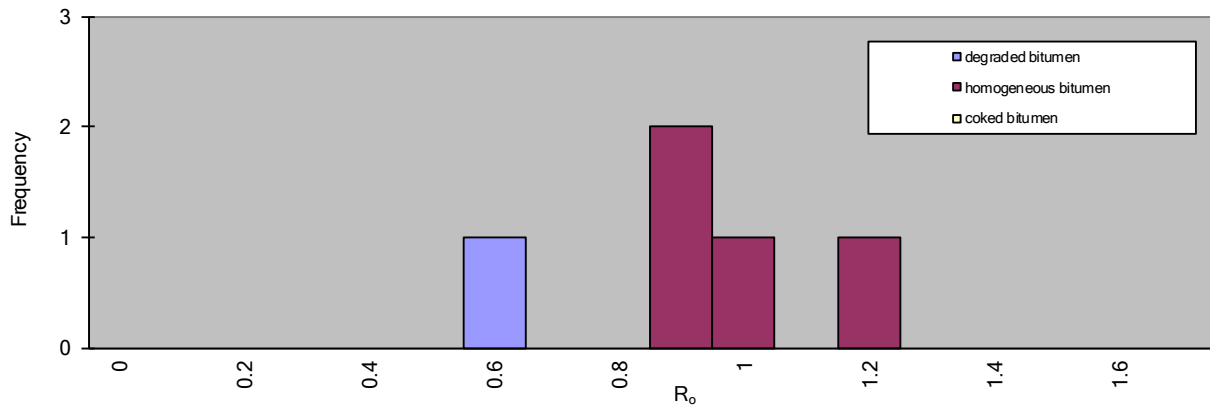
Sample ID: **125-22278_10210**
 Lab ID: 0
 Sample Type: shale
 Date Analyzed: 10/15/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

125-22278_10210



DATA

0.560	0.814				
0.726	0.883				
	0.912				
	0.980				
	1.138				

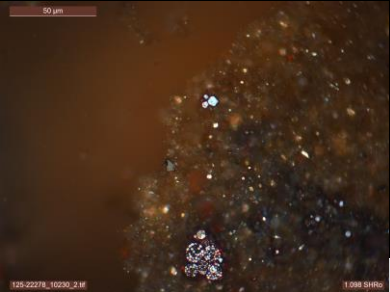
All Data: min: 0.560 max: 1.138

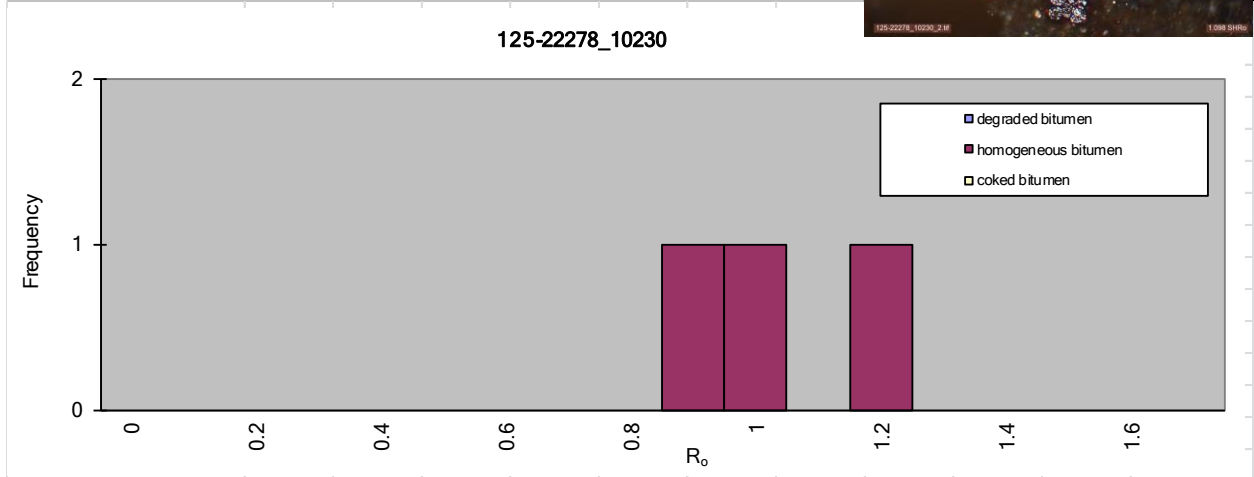
Vitrinite Only: min: 0.560 max: 1.138 V-types: 7

COMMENT

Standard: YAG [0.901]; Noticed more bitumne but macerals are very small; looks like bitumen may have replaced some pyrite framboids - this has been observed in other samples as well, perhaps as some kind of secondary fluid movement of HC?

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/15/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10230 Lab ID: 0 Sample Type: shale Date Analyzed: 10/15/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 3 maceral type: bitumen R _o : 1.06 s.d.: 0.12 Example Photograph: 
---	--



DATA	
-------------	--

	0.899								
	1.098								
	1.188								

All Data: min: 0.899 max: 1.188

Vitrinite Only: min: 0.899 max: 1.188 V-types: 4

COMMENT	
----------------	--

Standard: YAG [0.901]; lean with some very small macerals

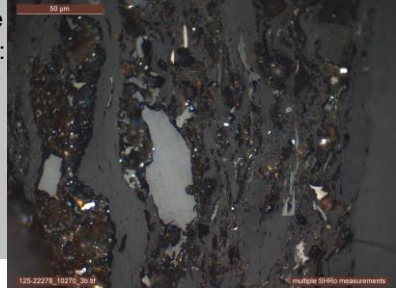
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 20
 maceral type: bitumen
 R_o: 1.10
 s.d.: 0.19

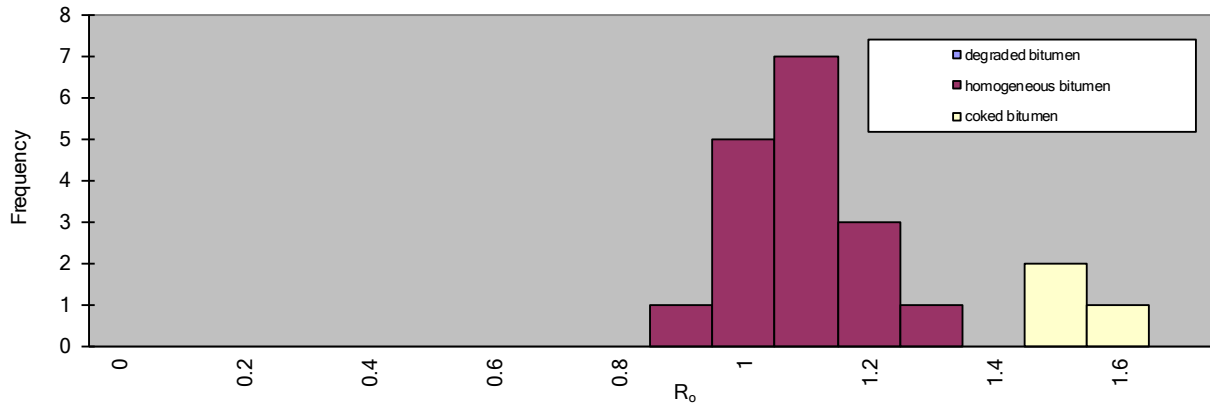
Sample ID: **125-22278_10270**
 Lab ID: 0
 Sample Type: shale
 Date Analyzed: 10/16/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

125-22278_10270



DATA

0.886	1.056
0.906	1.056
0.909	1.060
0.941	1.123
0.956	1.150
0.966	1.169
1.008	1.282
1.039	1.405
1.042	1.472
1.049	1.571


All Data: min: 0.886 max: 1.571

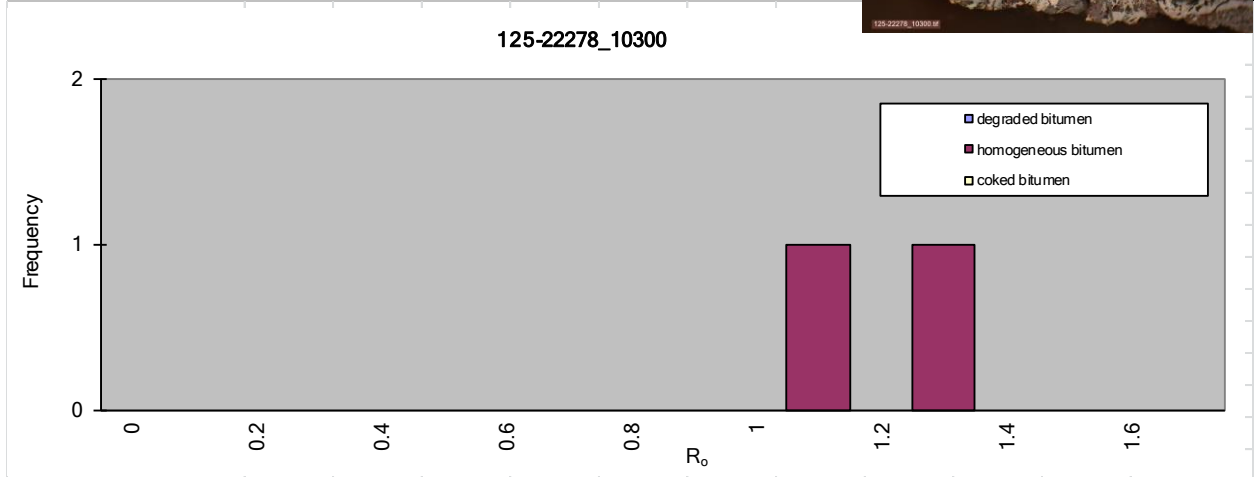
Vitrinite Only: min: 0.886 max: 1.571 V-types: 8

COMMENT

Standard: YAG [0.901]; Larger macerals but still relatively lean; one very large inhomogenous bitumen maceral (see photo 10270_3a or b) - appears to have multiple stages of HC movement?

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Uica Shale Playbook Sample ID: 125-22278_10300 Lab ID: 0 Sample Type: shale Date Analyzed: 10/16/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 2 maceral type: bitumen R _o : 1.11 s.d.: 0.10 Example Photograph: 
--	--



DATA

	1.002								
	1.210								


All Data: min: 1.002 max: 1.210

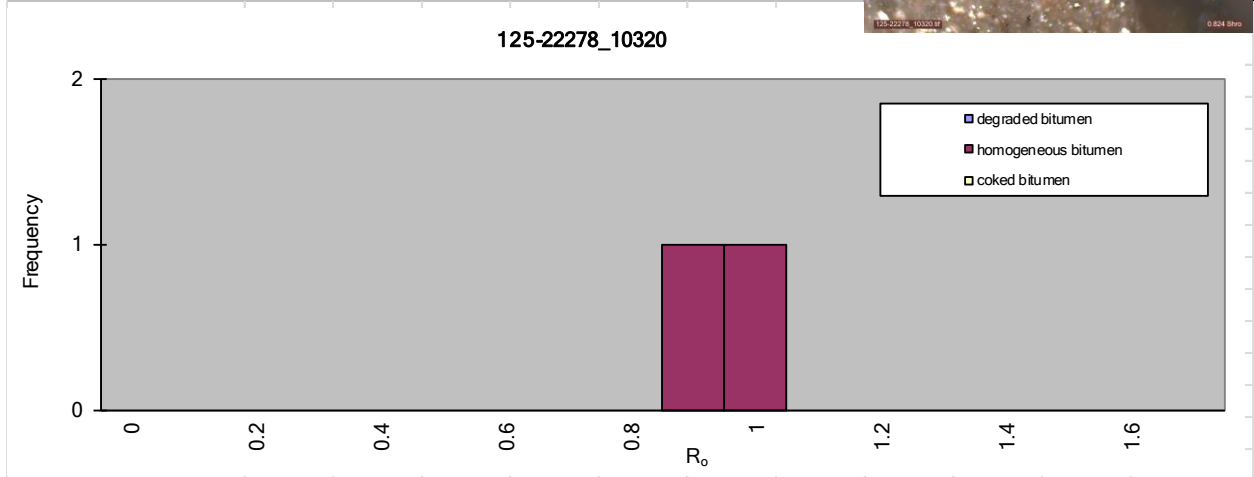
Vitrinite Only: min: 1.002 max: 1.210 V-types: 3

COMMENT

Standard: YAG [0.901]; abundant pyrite, but not in framboid form; some very small macerals, otherwise extremely lean

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10320 Lab ID: 0 Sample Type: shale Date Analyzed: 10/16/2013 Operator: M. cooney Standard: ASTM D2798 7708	No. measurements: 2 maceral type: bitumen R _o : 0.91 s.d.: 0.08 Example Photograph: 
---	--



DATA

	0.824								
	0.991								

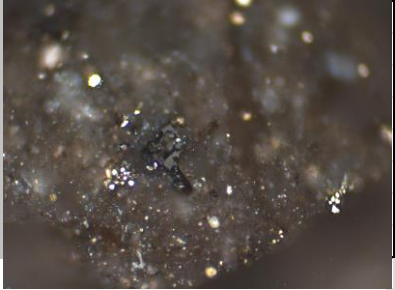
All Data: min: 0.824 max: 0.991

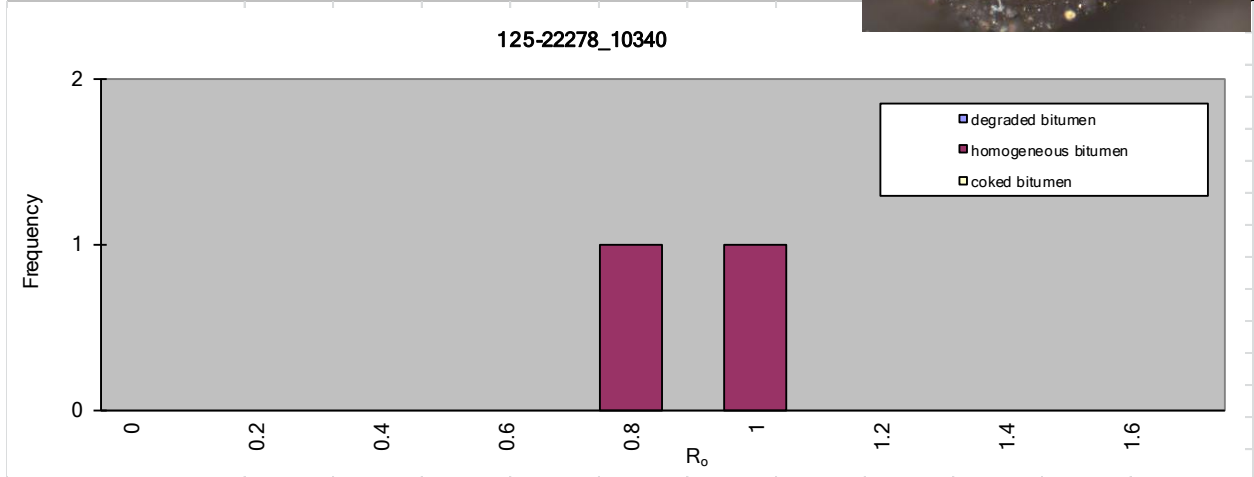
Vitrinite Only: min: 0.824 max: 0.991 V-types: 2

COMMENT

Standard: YAG [0.901]; first observed chlorite

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10340 Lab ID: 125-22278_1034 Sample Type: shale Date Analyzed: 10/16/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 2 maceral type: bitumen R _o : 0.85 s.d.: 0.09 Example Photograph: 
--	--



DATA	
-------------	--

	0.757								
	0.939								

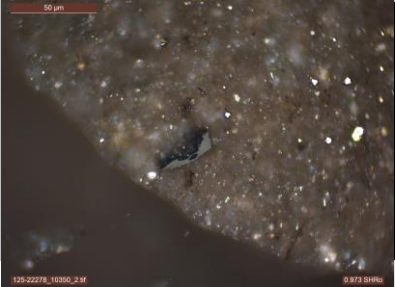
All Data: min: 0.757 max: 0.939

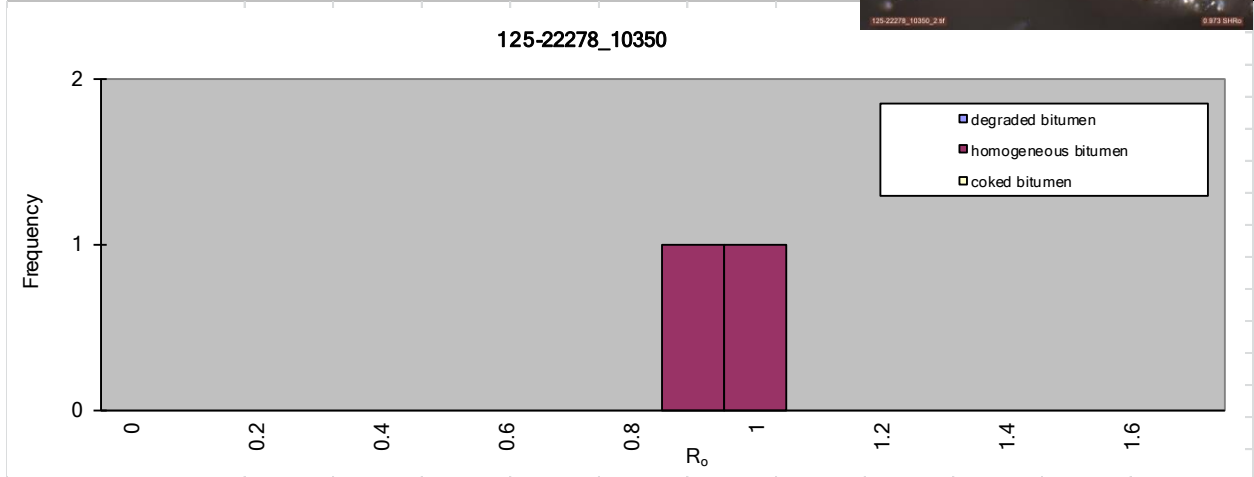
Vitrinite Only: min: 0.757 max: 0.939 V-types: 3

COMMENT	
----------------	--

Standard: YAG [0.901]: Some shell fragments

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-2278_10350 Lab ID: 125-2278_10350 Sample Type: shale Date Analyzed: 10/16/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 2 maceral type: bitumen R _o : 0.92 s.d.: 0.05 Example Photograph: 
---	--



DATA	
-------------	--

	0.876								
	0.973								

All Data: min: 0.876 max: 0.973

Vitrinite Only: min: 0.876 max: 0.973 V-types: 2

COMMENT	
----------------	--

Standard: YAG [0.901]; Though there is not a lot of pyrite, pyrite growths appear to have replaced some fossil fragments; more large "unknowns" with red, rusty coloring.

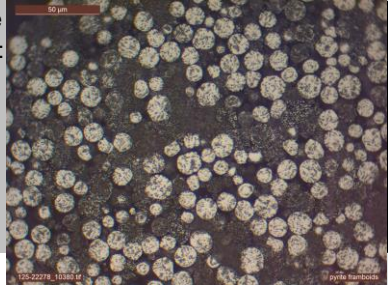
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

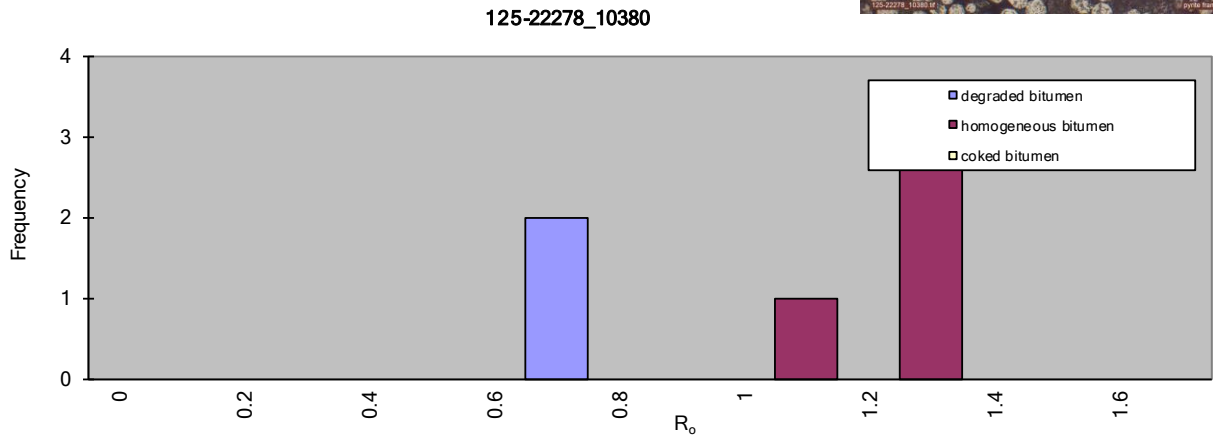
No. measurements: 6
 maceral type: bitumen
 R_o: 0.99
 s.d.: 0.19

Sample ID: 125-22278_10380
 Lab ID: 125-22278_10380
 Sample Type: shale
 Date Analyzed: 10/17/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.724	1.092				
0.741	1.108				
	1.114				
	1.185				

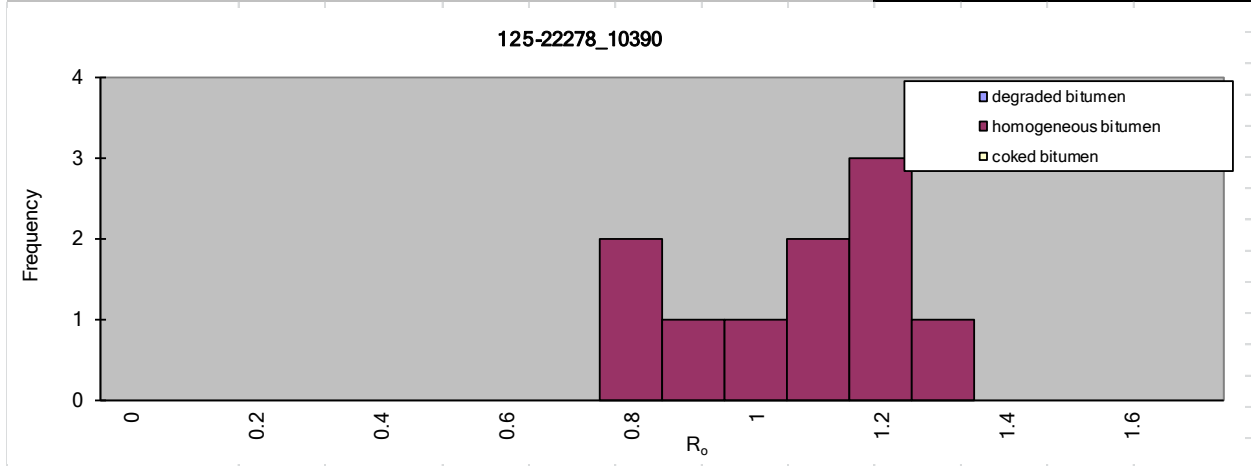
All Data: min: 0.724 max: 1.185

Vitrinite Only: min: 0.724 max: 1.185 V-types: 5

COMMENT

Standard: YAG [0.901]; very small macerals, many not large enough for measurement; abundant pyrite framboids

SAMPLE INFORMATION		RESULTS	
Submitted by:	M. Cooney	No. measurements:	10
Date Submitted:	10/16/2013	maceral type:	10/17/2013
Project:	Utica Shale Playbook	R _o :	1.01
		s.d.:	0.17
Sample ID:	125-22278_10390	Example Photograph:	
Lab ID:	125-22278_10390		
Sample Type:	Shale		
Date Analyzed:	10/17/213		
Operator:	M. Cooney		
Standard:	ASTM D2798 7708		



DATA

0.724	0.980		
0.741	1.027		
0.842	1.092		
	1.108		
	1.114		
	1.185		
	1.244		

All Data: min: 0.724 max: 1.244

Vitrinite Only: min: 0.724 max: 1.244 **V-types:** 6

COMMENT
 Standard: YAG [0.901]; most of the macerals consisted of fill structures. There appeared to be some fossil fragments in the matrix.

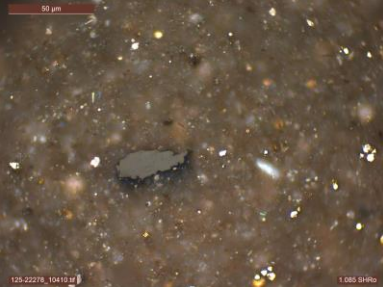
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

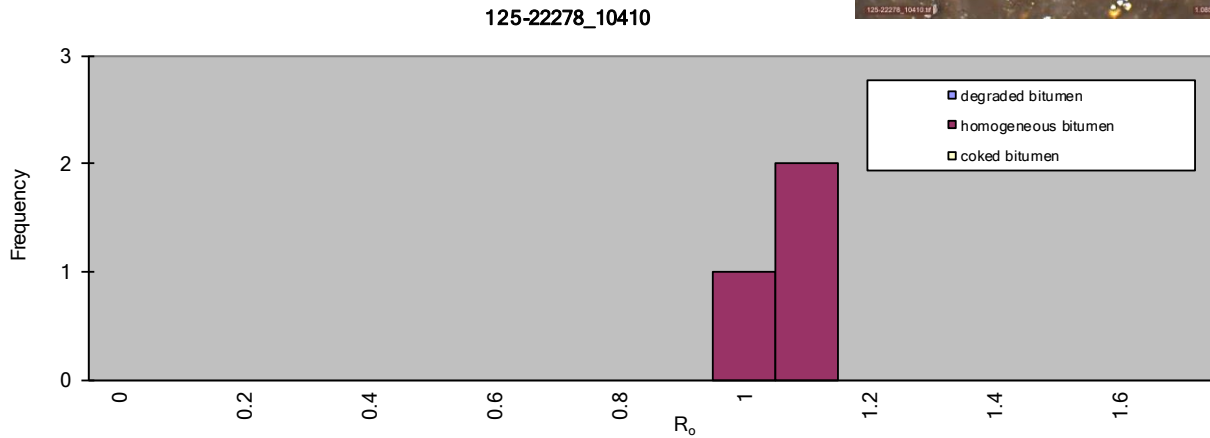
No. measurements: 4
 maceral type: bitumen
 R_o: 1.01
 s.d.: 0.06

Sample ID: 125-22278_10410
 Lab ID: 125-22278_10410
 Sample Type: shale
 Date Analyzed: 10/21/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.924									
1.000									
1.032									
1.085									

All Data: min: 0.924 max: 1.085

Vitrinite Only: min: 0.924 max: 1.085 V-types: 2

COMMENT

Standard: YAG [0.901]; Lean but some larger macerals for measurement; macerals are dark around the edges.

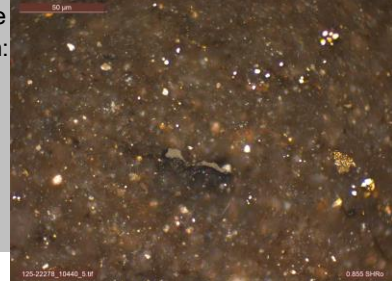
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

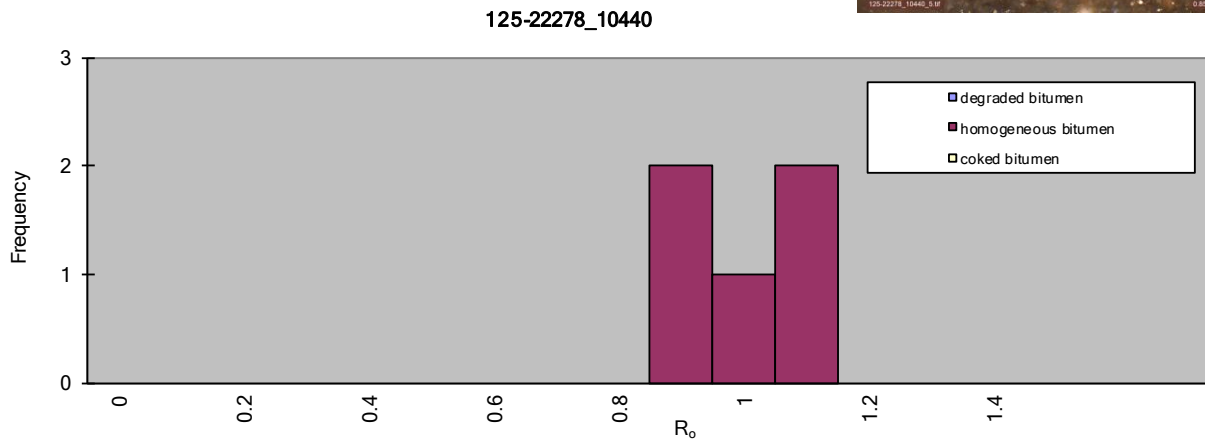
No. measurements: 5
 maceral type: bitumen
 R_o: 0.97
 s.d.: 0.09

Sample ID: **125-22278_10440**
 Lab ID: 125-22278_10440
 Sample Type: shale
 Date Analyzed: 10/21/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.855					
0.889					
0.944					
1.060					
1.095					

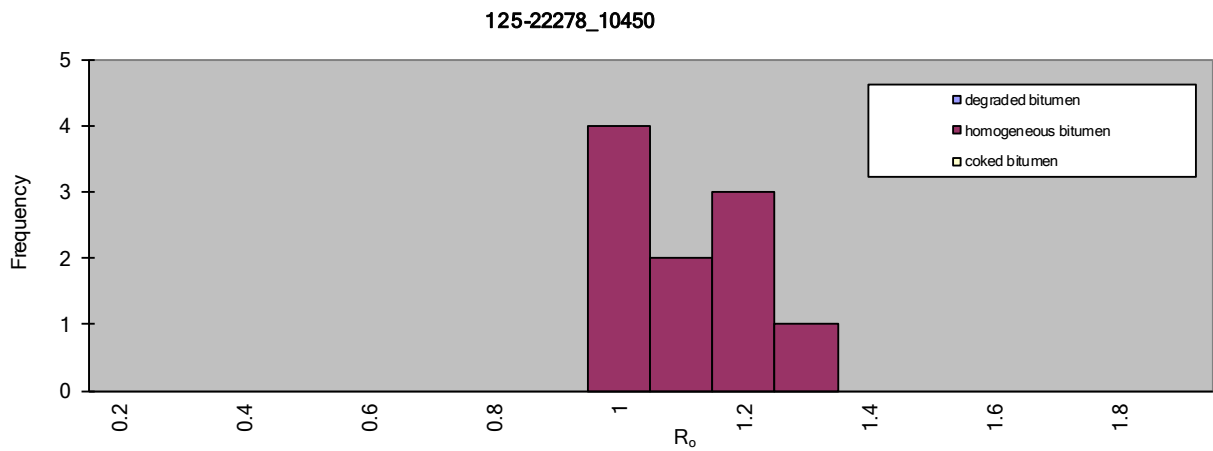
All Data: min: 0.855 max: 1.095

Vitrinite Only: min: 0.855 max: 1.095 V-types: 3

COMMENT

Standard: YAG [0.901]; pyrite framboids appear to be infilled by bitumen; most macerals are very small, but some appear to be possible graptolite fragments; a lot of red, rusty colors in the clay matrix.

SAMPLE INFORMATION		RESULTS	
Submitted by: M. Cooney		No. measurements: 10	
Date Submitted: 10/16/2013		maceral type: bitumen	
Project: Utica Shale Playbook		R _o : 1.06	
		s.d.: 0.11	
Sample ID: 125-22278_10450		Example Photograph:	
Lab ID: 125-22278_10450			
Sample Type: shale			
Date Analyzed: 10/16/2013			
Operator: M. Cooney			
Standard: ASTM D2798 7708			



DATA			
1.114			
1.274			
0.949			
1.064			
1.103			
1.064			
1.181			
0.985			
0.914			
0.943			
All Data:	min: 0.914	max: 1.274	
Vitrinite Only:	min: 0.914	max: 1.274	V-types: 4

COMMENT
 Standard: YAG [0.901]; Some very small macerals. Many smaller macerals appear dark around the edges with very high SHRo values; abundant pyrite framboids.

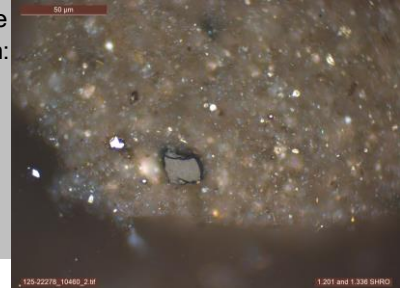
SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

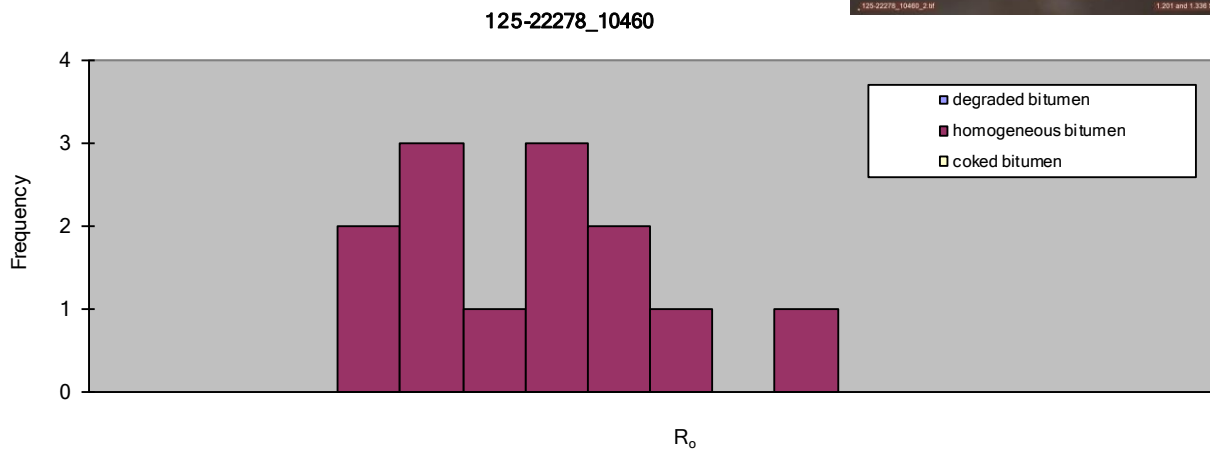
No. measurements: 13
 maceral type: bitumen
 R_o: 1.22
 s.d.: 0.19

Sample ID: **125-22278_10460**
 Lab ID: 125-22278_10460
 Sample Type: shale
 Date Analyzed: 10/23/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA	
-------------	--

0.980	1.397				
0.993	1.456				
1.017	1.602				
1.046					
1.069					
1.150					
1.201					
1.272					
1.292					
1.336					

All Data: min: 0.980 max: 1.602

Vitrinite Only: min: 0.980 max: 1.602 V-types: 8

COMMENT	
----------------	--

DISPERSED VITRINITE REFLECTANCE REPORT Run

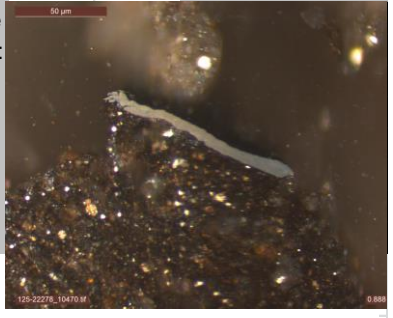
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

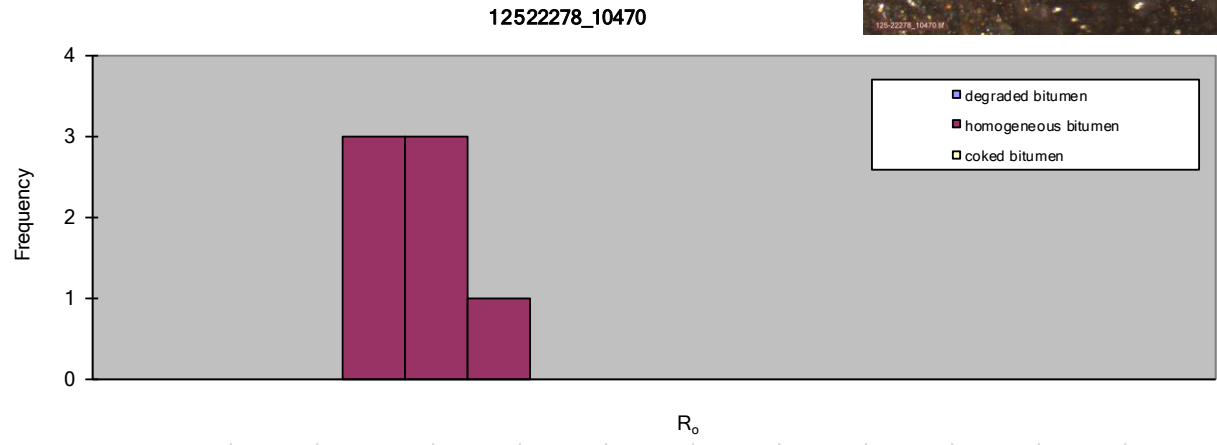
No. measurements: 7
 maceral type: bitumen
 R_o: 0.93
 s.d.: 0.08

Sample ID: 125-22278_10470
 Lab ID: 125-22278_10470
 Sample Type: shale
 Date Analyzed: 10/30/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.805									
0.888									
0.892									
0.911									
0.941									
0.973									
1.070									

All Data: min: 0.805 max: 1.070

Vitrinite Only: min: 0.805 max: 1.070 V-types: 3

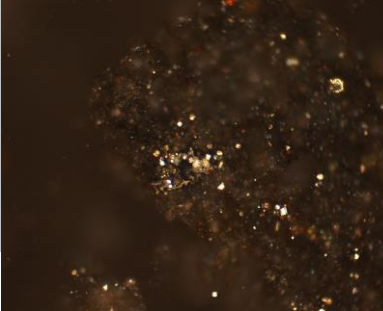
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

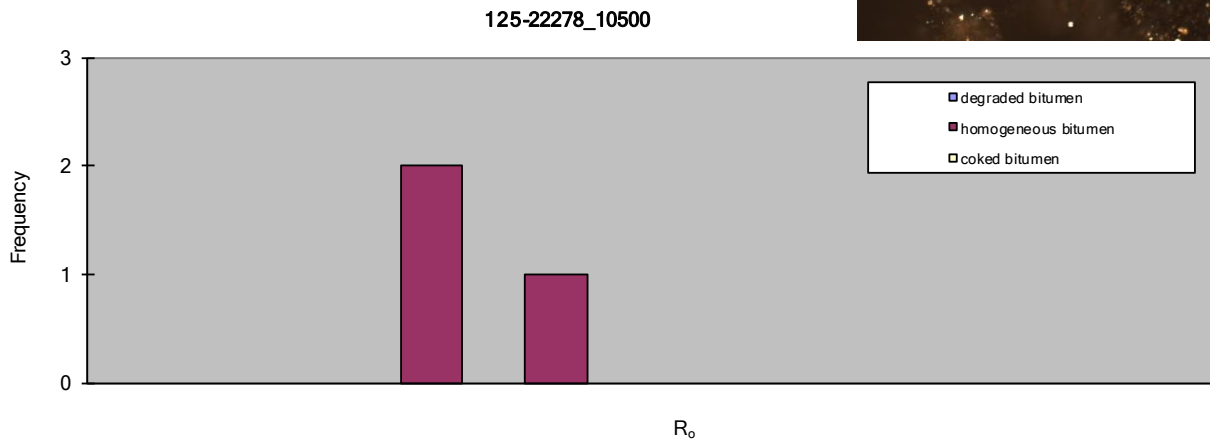
No. measurements: 3
 maceral type: bitumen
 R_o: 1.02
 s.d.: 0.07

Sample ID: **125-22278_10500**
 Lab ID: 125-22278_10500
 Sample Type: shale
 Date Analyzed: 11/1/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

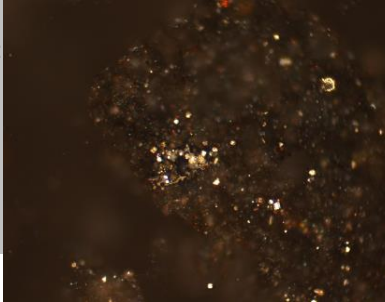
0.962									
0.979									
1.121									

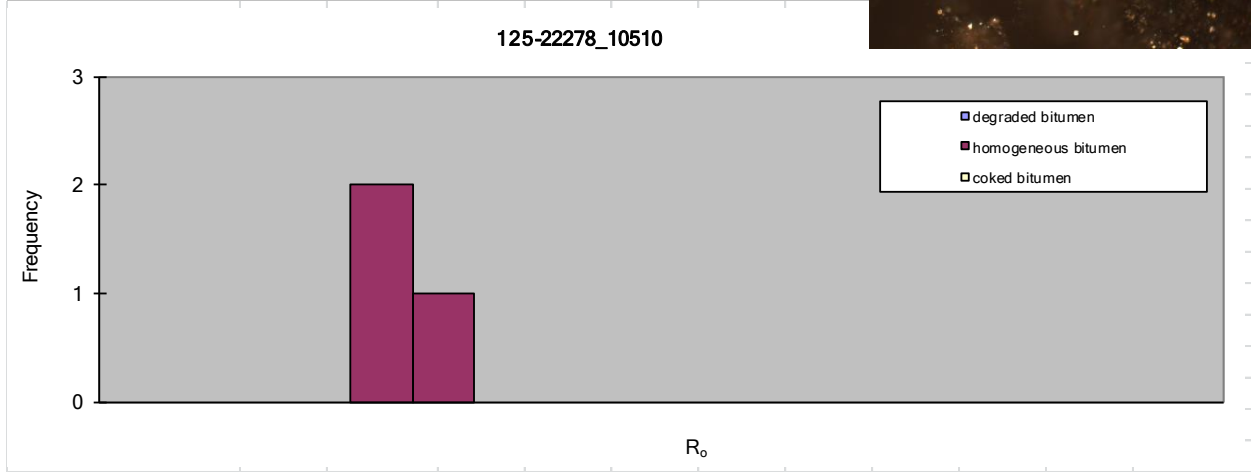
All Data: min: 0.962 max: 1.121

Vitrinite Only: min: 0.962 max: 1.121 V-types: 3

COMMENT

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10510 Lab ID: 125-22278_10510 Sample Type: shale Date Analyzed: 11/4/2013 Operator: M. Coomey Standard: ASTM D2798 7708	No. measurements: 3 maceral type: bitumen R _o : 0.89 s.d.: 0.03 Example Photograph: 
--	--



DATA	
-------------	--

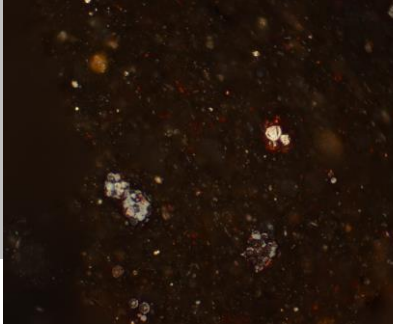
	0.860								
	0.879								
	0.935								

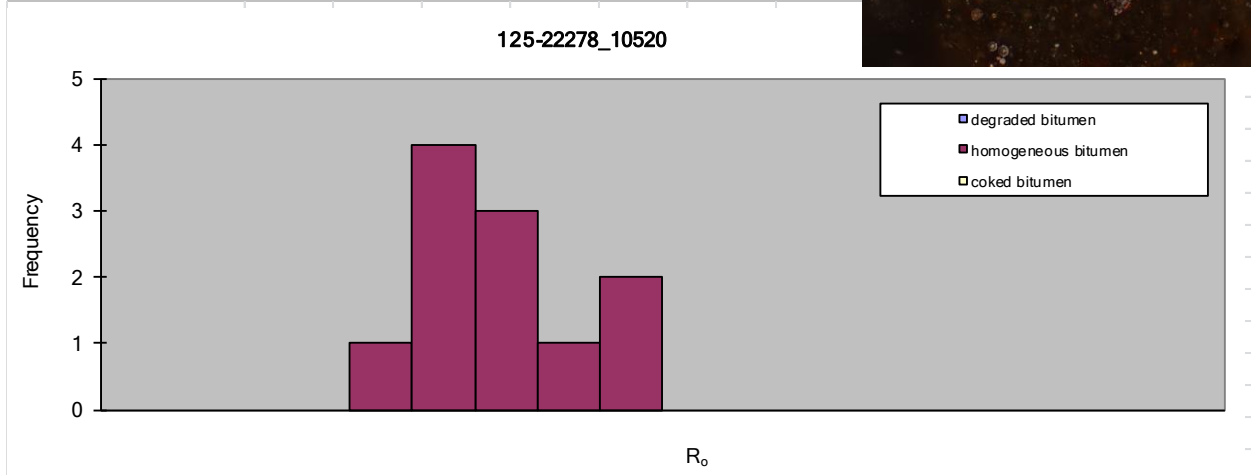
All Data: min: 0.860 max: 0.935
 Vitrinite Only: min: 0.860 max: 0.935 V-types: 2

COMMENT	
----------------	--

Standard: YAG [0.901]; Very small macerals and fill structures. Most macerals too small to measure.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10520 Lab ID: 125-22278_10520 Sample Type: shale Date Analyzed: 11/4/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 11 maceral type: bitumen R _o : 0.95 s.d.: 0.13 Example Photograph: 
--	---



DATA	
-------------	--

0.788	1.178				
0.802					
0.844					
0.852					
0.881					
0.973					
0.978					
0.983					
1.091					
1.130					

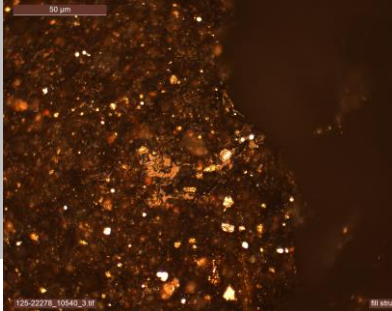
All Data: min: 0.788 max: 1.178

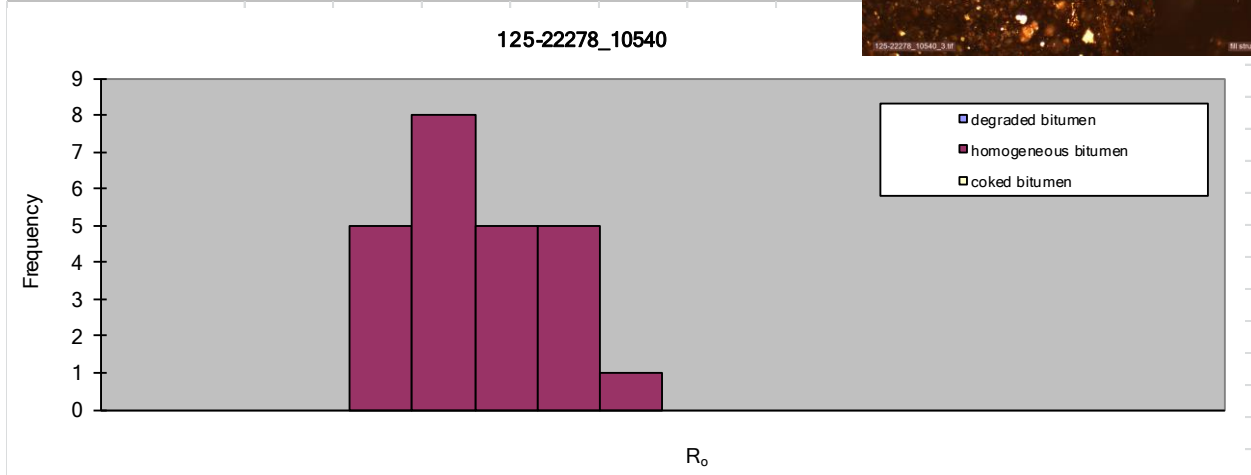
Vitrinite Only: min: 0.788 max: 1.178 V-types: 5

COMMENT	
----------------	--

Standard: YAG [0.901]; numerous fill structures; significantly more bitumen but the structures are too small to measure.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10540 Lab ID: 125-22278_1054 Sample Type: shale Date Analyzed: 11/5/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 24 maceral type: bitumen R _o : 1.00 s.d.: 0.11 Example Photograph: 
---	---



DATA	
-------------	--

0.846	0.965	1.134							
0.859	0.970	1.149							
0.875	0.990	1.191							
0.889	1.000	1.203							
0.897	1.006								
0.901	1.054								
0.929	1.062								
0.937	1.073								
0.950	1.118								
0.963	1.125								

All Data: min: 0.846 max: 1.203

Vitrinite Only: min: 0.846 max: 1.203 V-types: 5

COMMENT	
----------------	--

Standard: YAG [0.901]; Small macerals and fill structures in darker clay mineral assemblages.

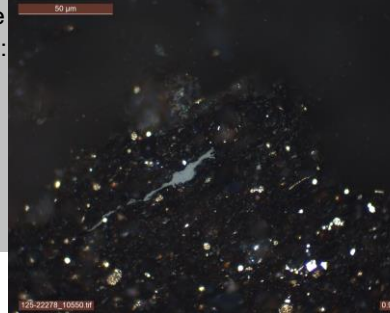
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

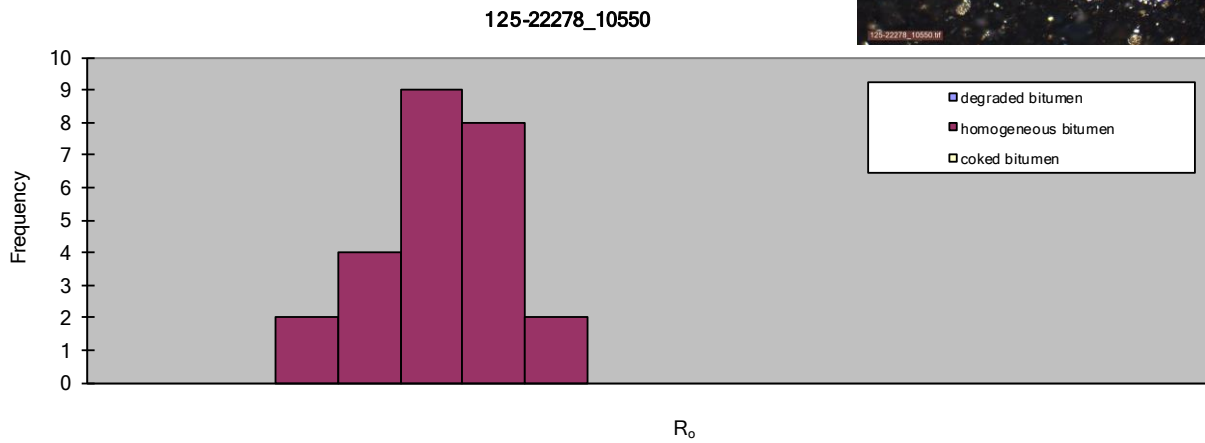
No. measurements: 25
 maceral type: bitumen
 R_o: 0.97
 s.d.: 0.11

Sample ID: **125-22278_10550**
 Lab ID: 125-22278_10550
 Sample Type: shale
 Date Analyzed: 11/5/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.720	0.958	1.077
0.788	0.971	1.080
0.806	0.973	1.088
0.841	0.991	1.159
0.875	0.998	1.173
0.888	1.012	
0.916	1.036	
0.927	1.038	
0.927	1.071	
0.936	1.072	

All Data: min: 0.720 max: 1.173

Vitrinite Only: min: 0.720 max: 1.173 V-types: 5

COMMENT

Standard YAG [0.901]; Some larger macerals; mostly small fill structures.

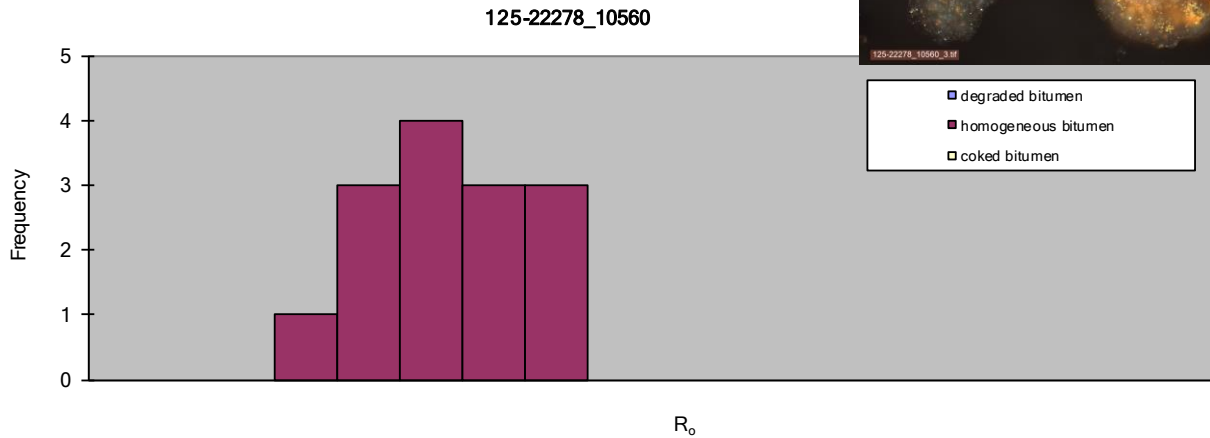
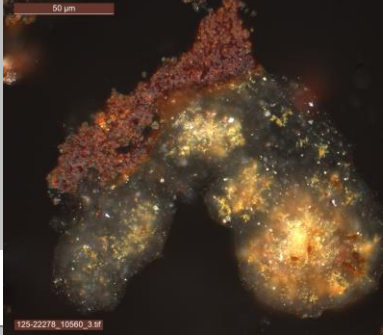
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 14
 maceral type: bitumen
 R_o: 0.98
 s.d.: 0.12

Sample ID: 125-22278_10560
 Lab ID: 125-22278_10560
 Sample Type: shale
 Date Analyzed: 11/5/2013
 Operator: M. Cooney

Example Photograph:



DATA

0.771	1.064				
0.818	1.132				
0.820	1.142				
0.831	1.148				
0.929					
0.974					
0.983					
0.984					
1.027					
1.047					

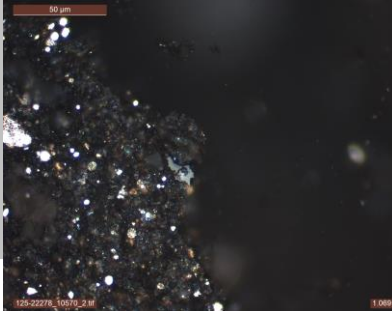
All Data: min: 0.771 max: 1.148

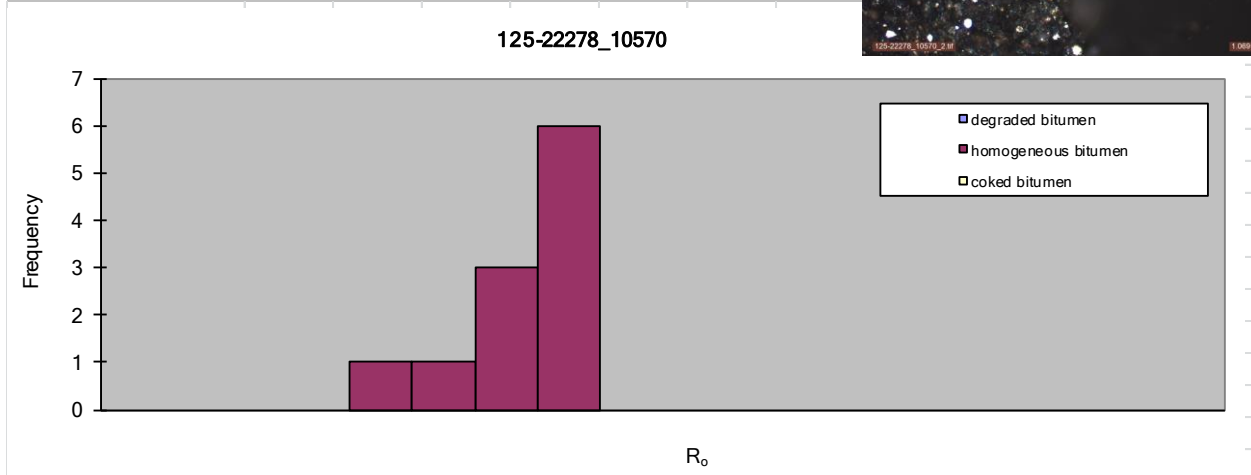
Vitrinite Only: min: 0.771 max: 1.148 V-types: 5

COMMENT

Standard: YAG [0.901]; Abundant fill structures with some larger macerals.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10570 Lab ID: 125-22278_1057 Sample Type: shale Date Analyzed: 11/6/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 11 maceral type: bitumen R _o : 1.06 s.d.: 0.07 Example Photograph: 
---	---



DATA	
-------------	--

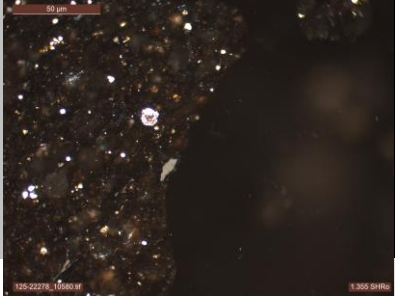
0.889	1.125				
0.946					
1.023					
1.050					
1.069					
1.101					
1.103					
1.104					
1.115					
1.124					

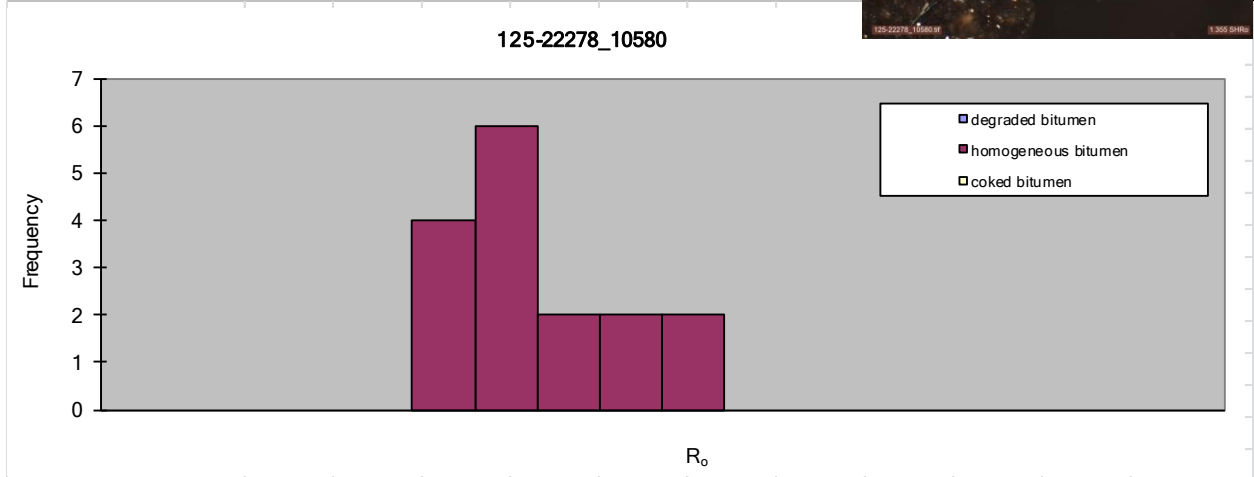
All Data: min: 0.889 max: 1.125

Vitrinite Only: min: 0.889 max: 1.125 V-types: 4

COMMENT	
----------------	--

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10580 Lab ID: 125-22278_10580 Sample Type: shale Date Analyzed: 11/6/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 16 maceral type: bitumen R _o : 1.10 s.d.: 0.13 Example Photograph: 
--	---



DATA	
-------------	--

0.926	1.142				
0.927	1.152				
0.981	1.269				
0.988	1.270				
1.018	1.311				
1.023	1.355				
1.029					
1.057					
1.079					
1.099					

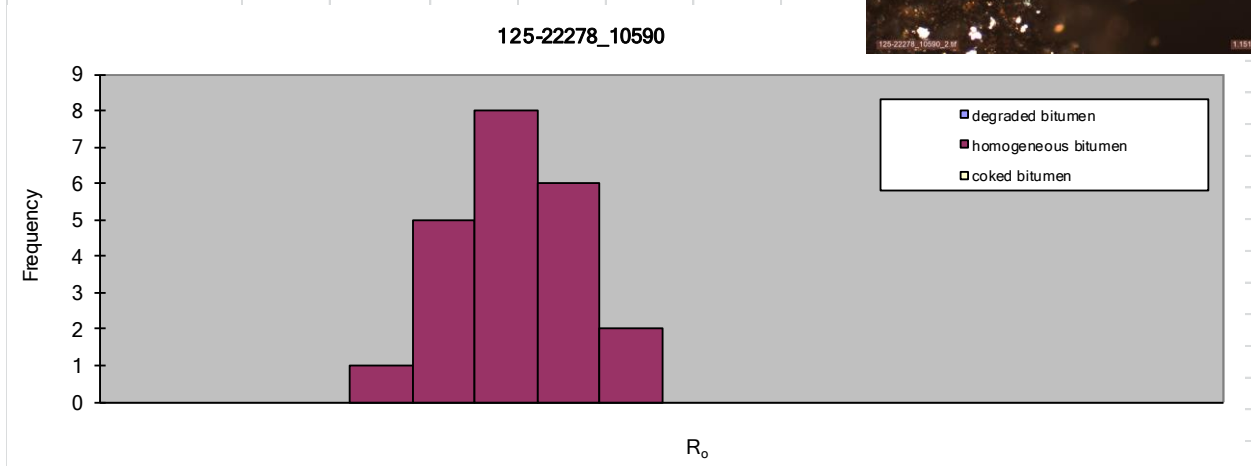
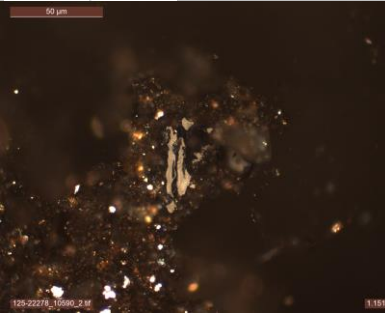
All Data: min: 0.926 max: 1.355

Vitrinite Only: min: 0.926 max: 1.355 V-types: 5

COMMENT	
----------------	--

SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10590 Lab ID: 125-22278_10590 Sample Type: shale Date Analyzed: 11/6/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 21 maceral type: bitumen R _o : 1.06 s.d.: 0.10 Example Photograph:
--	---



DATA

0.871	1.051	1.285						
0.915	1.068							
0.925	1.079							
0.952	1.096							
0.977	1.115							
0.983	1.127							
1.017	1.151							
1.020	1.165							
1.023	1.185							
1.031	1.198							

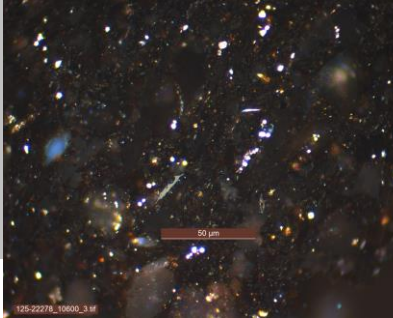
All Data: min: 0.871 max: 1.285

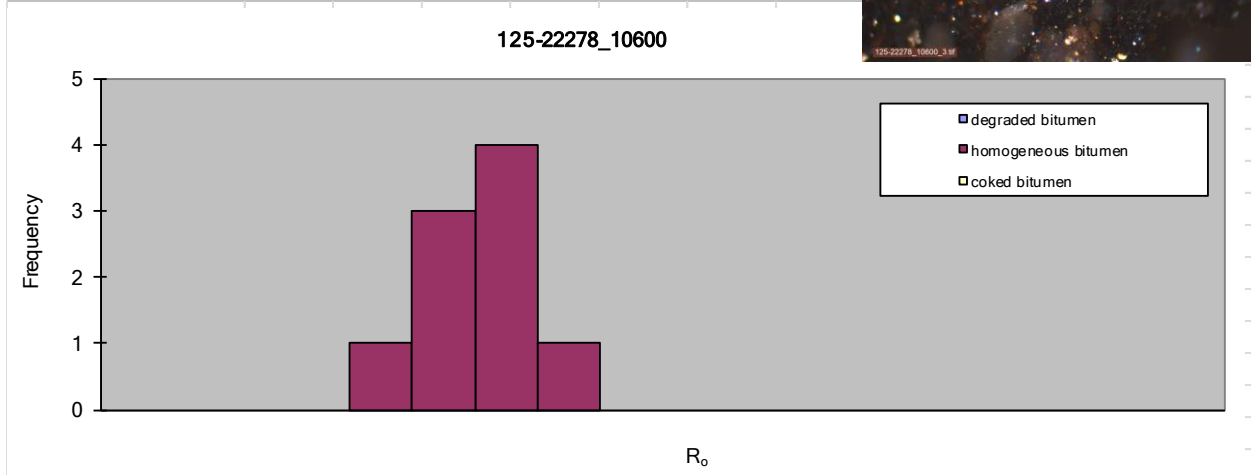
Vitrinite Only: min: 0.871 max: 1.285 **V-types:** 5

COMMENT

Standard: YAG [0.901]; Similar to other samples - numerous fill structures with sporadic larger macerals.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10600 Lab ID: 125-22278_10600 Sample Type: shale Date Analyzed: 11/7/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 10 maceral type: bitumen R _o : 1.04 s.d.: 0.10 Example Photograph: 
--	---



DATA	
-------------	--

0.868					
0.942					
0.966					
0.984					
1.003					
1.069					
1.092					
1.098					
1.171					
1.173					

All Data: min: 0.868 max: 1.173

Vitrinite Only: min: 0.868 max: 1.173 V-types: 4

COMMENT	
----------------	--

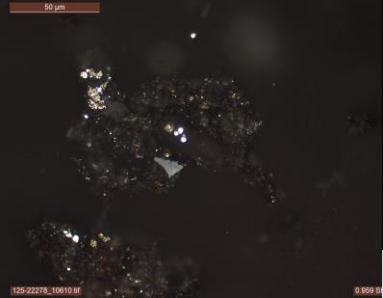
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

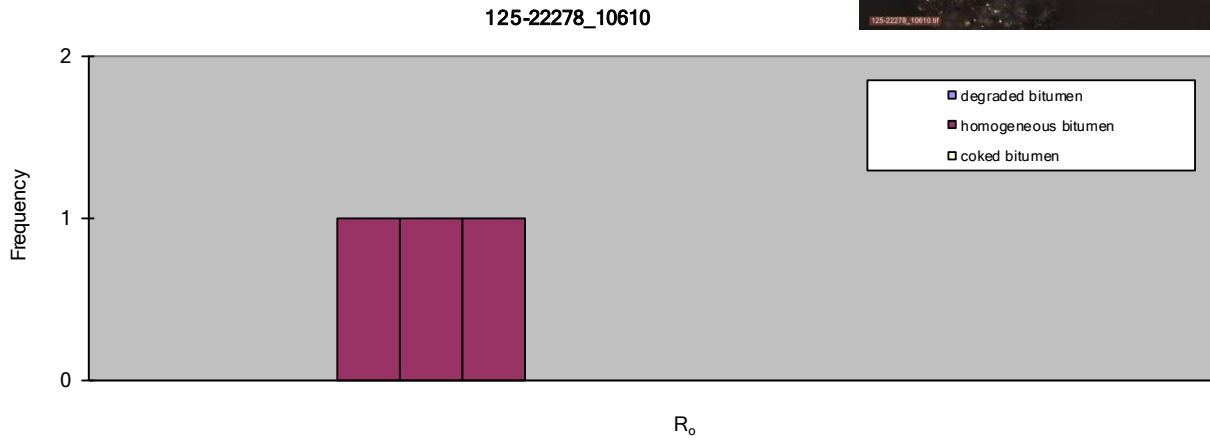
No. measurements: 3
 maceral type: bitumen
 R_o: 0.96
 s.d.: 0.06

Sample ID: 125-22278_10610
 Lab ID: 125-22278_10610
 Sample Type: shale
 Date Analyzed: 11/6/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA


0.889									
0.959									
1.024									

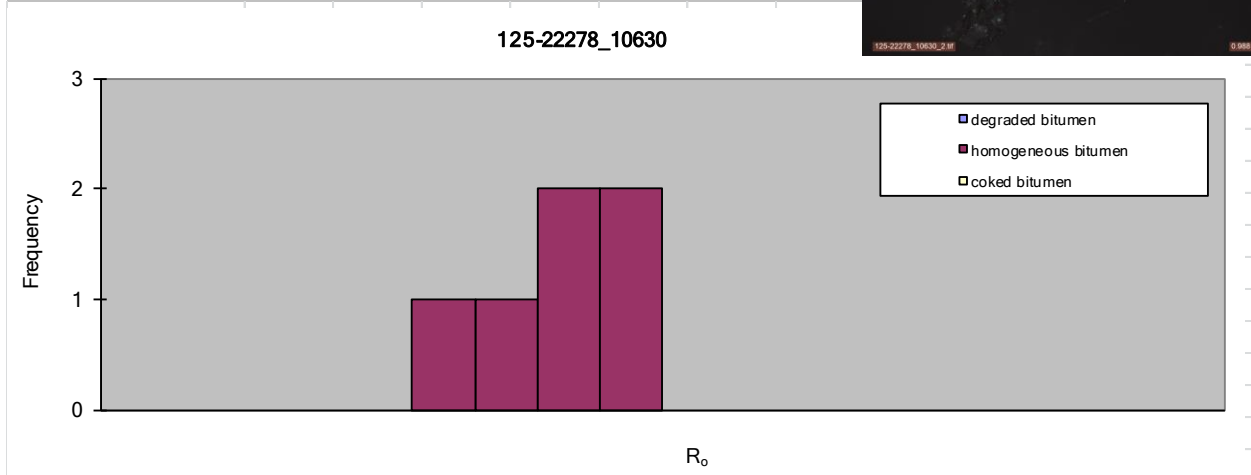
All Data: min: 0.889 max: 1.024

Vitrinite Only: min: 0.889 max: 1.024 V-types: 3

COMMENT

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10630 Lab ID: 125-22278_10630 Sample Type: shale Date Analyzed: 11/7/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 6 maceral type: bitumen R _o : 1.14 s.d.: 0.10 Example Photograph: <div style="text-align: right;">  </div>
--	--



DATA	
-------------	--


0.988									
1.059									
1.105									
1.166									
1.232									
1.277									

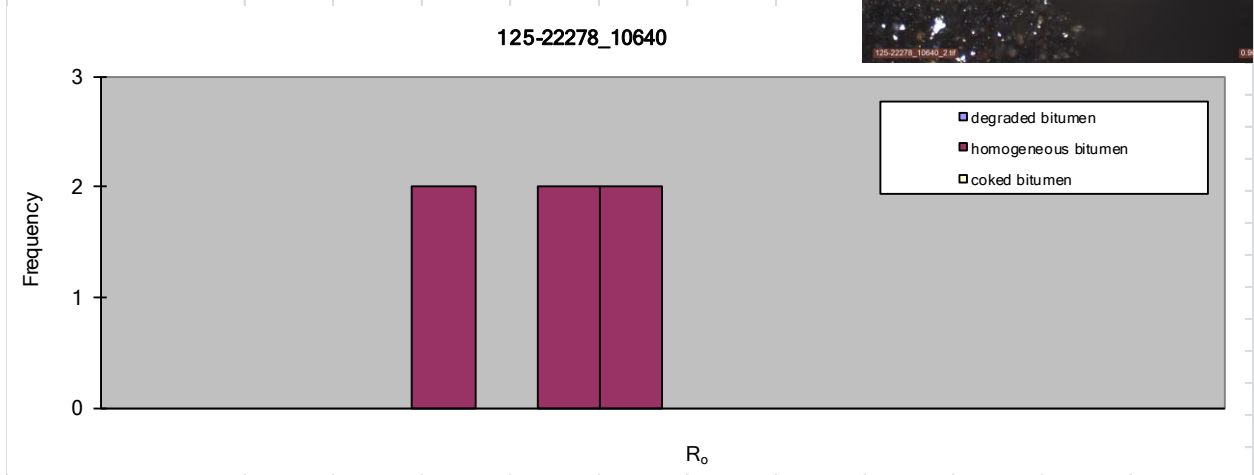
All Data: min: 0.988 max: 1.277

Vitrinite Only: min: 0.988 max: 1.277 V-types: 4

COMMENT	
----------------	--

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Consortium Sample ID: 125-22278_10640 Lab ID: 125-22278_1064 Sample Type: shale Date Analyzed: 11/7/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 6 maceral type: bitumen R _o : 1.11 s.d.: 0.13 Example Photograph: 
---	--



DATA	
-------------	--

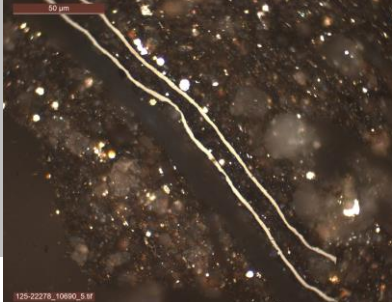
	0.930								
	0.961								
	1.123								
	1.173								
	1.213								
	1.276								

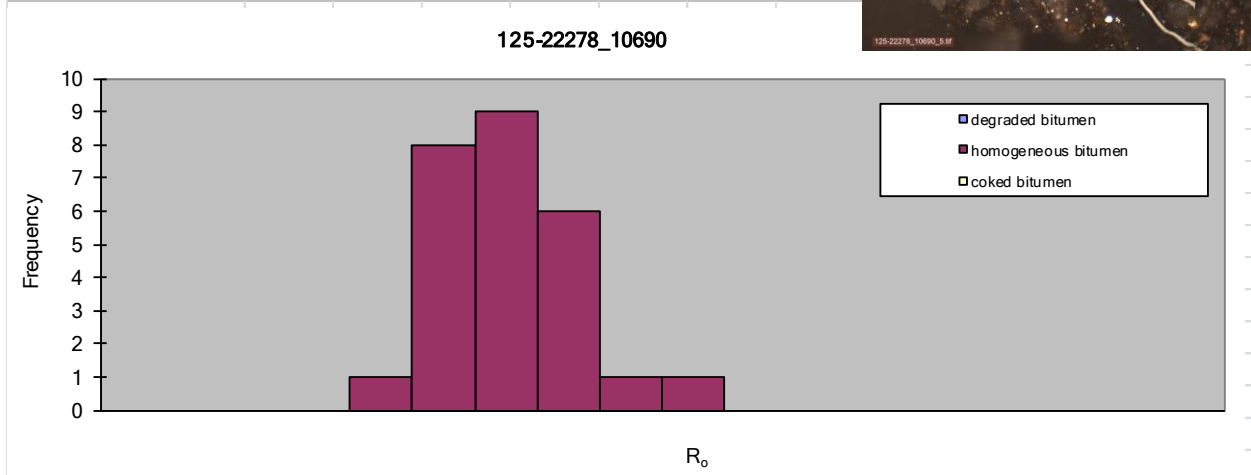
All Data: min: 0.930 max: 1.276

Vitrinite Only: min: 0.930 max: 1.276 V-types: 4

COMMENT	
----------------	--

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10690 Lab ID: 125-22278_10690 Sample Type: shale Date Analyzed: 11/13/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 26 maceral type: bitumen R _o : 1.06 s.d.: 0.11 Example Photograph: 
---	---



DATA	
-------------	--

0.856	1.026	1.128							
0.902	1.048	1.139							
0.954	1.055	1.168							
0.973	1.067	1.176							
0.974	1.068	1.270							
0.982	1.083	1.369							
0.984	1.089								
0.988	1.097								
0.997	1.104								
1.007	1.127								

All Data: min: 0.856 max: 1.369

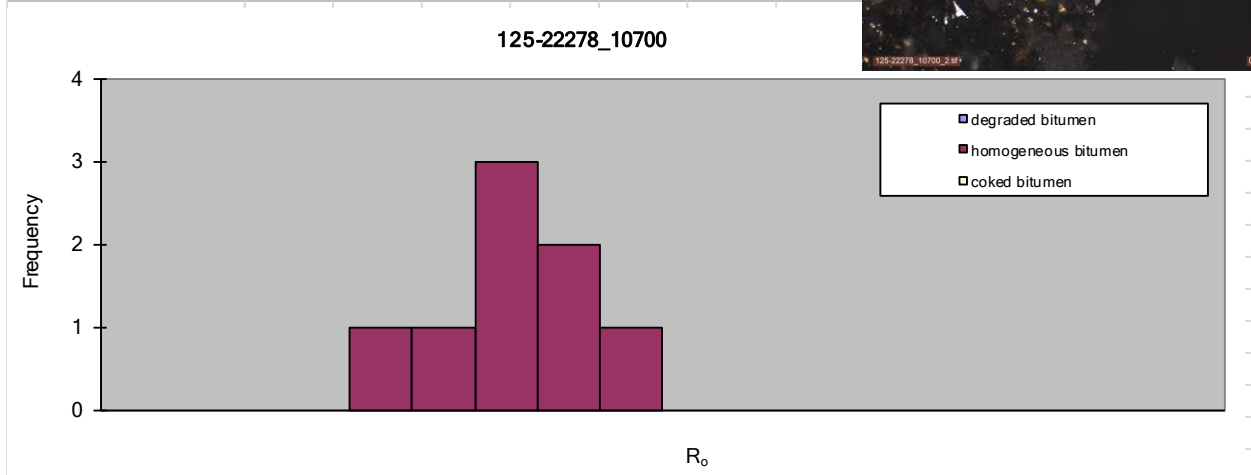
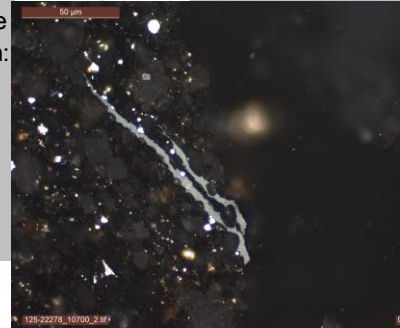
Vitrinite Only: min: 0.856 max: 1.369 V-types: 6

COMMENT	
----------------	--

Standard: YAG [0.901]; Some fossil fragments. A few scattered but very large macerals.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10700 Lab ID: 125-22278_10700 Sample Type: shale Date Analyzed: 11/13/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 8 maceral type: bitumen R _o : 1.07 s.d.: 0.11 Example Photograph:
---	--



DATA	
-------------	--

0.879									
0.970									
1.027									
1.085									
1.098									
1.108									
1.119									
1.286									

All Data: min: 0.879 max: 1.286

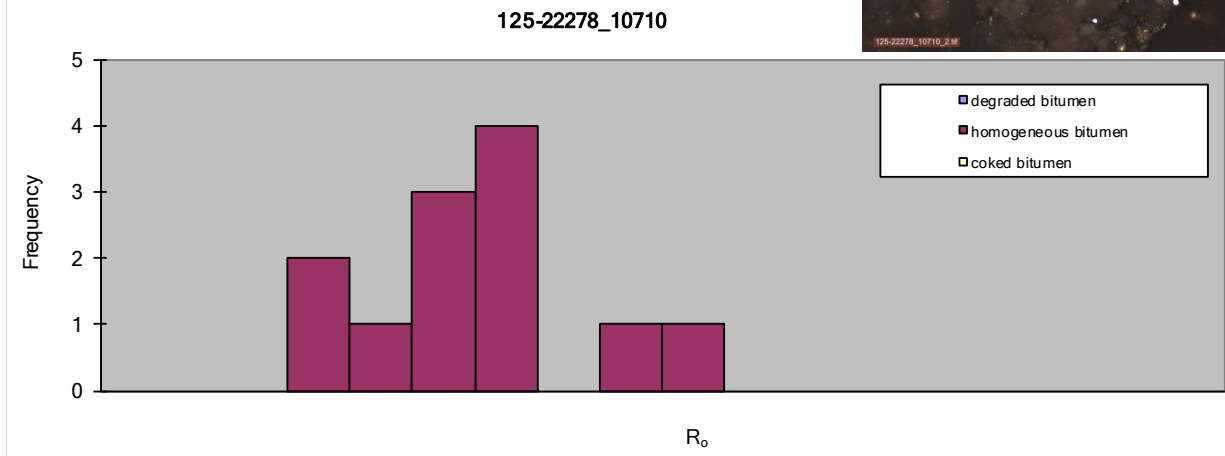
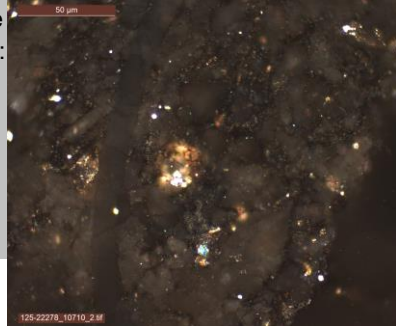
Vitrinite Only: min: 0.879 max: 1.286 V-types: 5

COMMENT	
----------------	--

Standard: YAG [0.901]; Very lean

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10710 Lab ID: 125-22278_1071 Sample Type: shale Date Analyzed: 11/13/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 12 maceral type: bitumen R _o : 1.00 s.d.: 0.15 Example Photograph:
--	---



DATA	
-------------	--

0.763	1.217				
0.791	1.303				
0.869					
0.933					
0.949					
0.989					
1.026					
1.051					
1.060					
1.066					

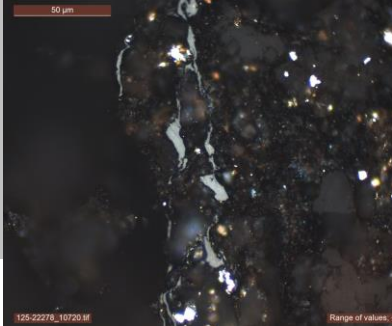
All Data: min: 0.763 max: 1.303

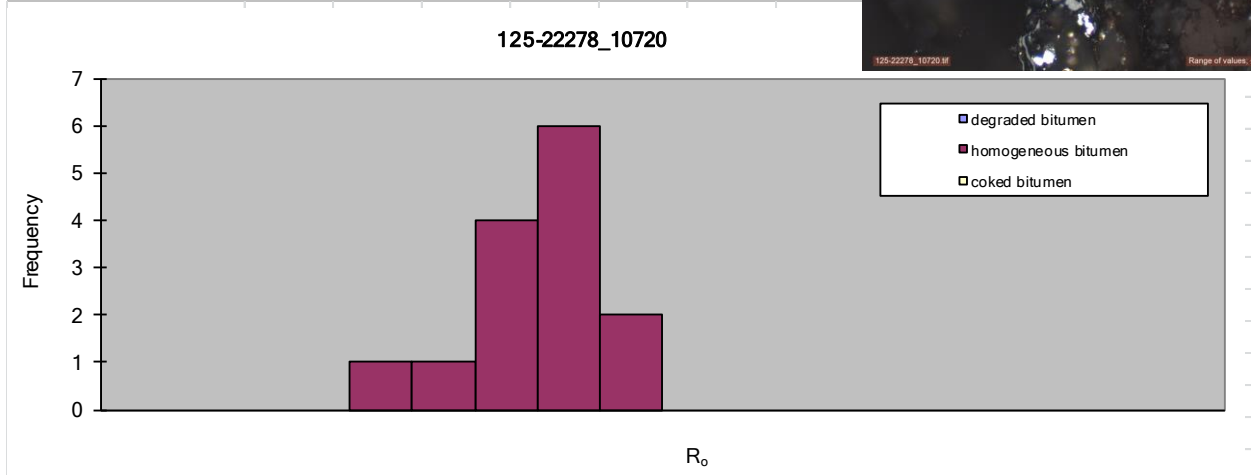
Vitrinite Only: min: 0.763 max: 1.303 V-types: 7

COMMENT	
----------------	--

Standard: YAG [0.901]; Not a lot of bitumen, but a lot of fossil fragments.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10720 Lab ID: 125-22278_10720 Sample Type: shale Date Analyzed: 11/13/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 14 maceral type: bitumen R _o : 1.10 s.d.: 0.10 Example Photograph: 
---	---



DATA	
-------------	--

0.874	1.143				
0.954	1.191				
1.012	1.221				
1.038	1.298				
1.096					
1.099					
1.101					
1.114					
1.124					
1.128					

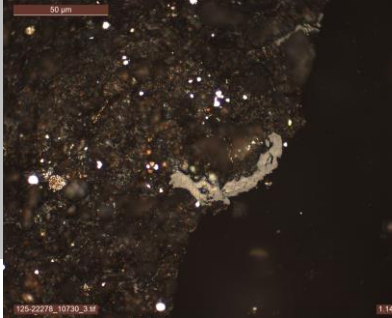
All Data: min: 0.874 max: 1.298

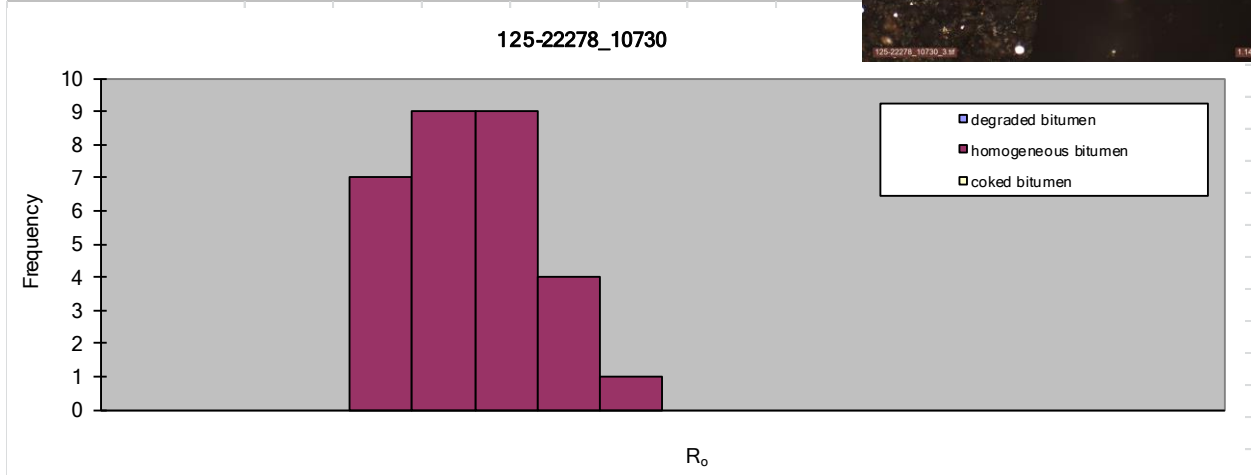
Vitrinite Only: min: 0.874 max: 1.298 V-types: 5

COMMENT	
----------------	--

Standard: YAG [0.901]; fossil fragments and some larger macerals.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10730 Lab ID: 125-22278_10730 Sample Type: shale Date Analyzed: 11/14/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 30 maceral type: bitumen R _o : 1.00 s.d.: 0.11 Example Photograph: 
---	---



DATA	
-------------	--

0.803	0.931	1.067							
0.805	0.959	1.086							
0.829	0.968	1.086							
0.873	0.985	1.090							
0.878	0.989	1.091							
0.895	0.989	1.100							
0.899	1.006	1.138							
0.910	1.013	1.141							
0.925	1.032	1.155							
0.931	1.049	1.266							

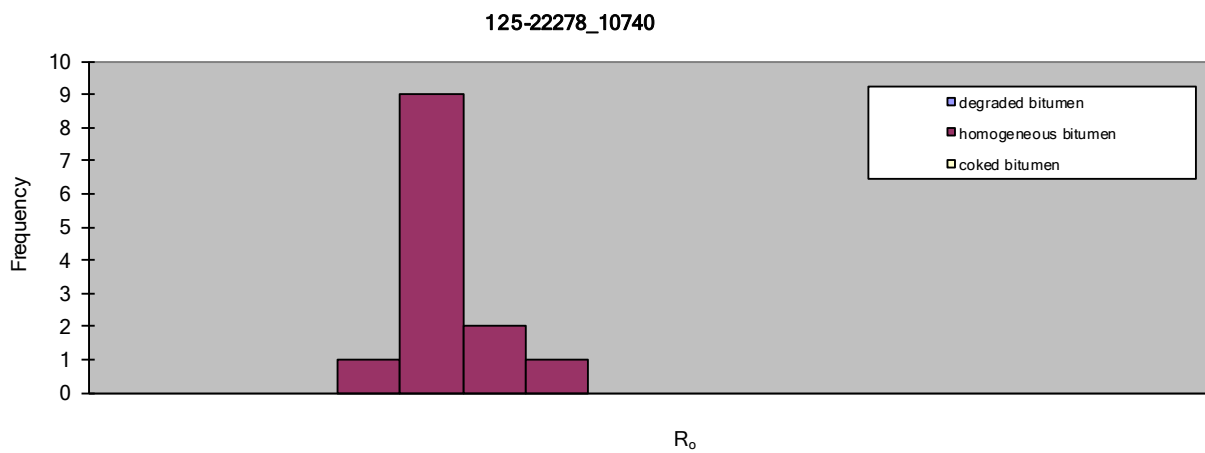
All Data: min: 0.803 max: 1.266

Vitrinite Only: min: 0.803 max: 1.266 V-types: 5

COMMENT	
----------------	--

Standard: YAG [0.901]; fossil fragments; fill scutures; abundant bitumen macerals.


SAMPLE INFORMATION				RESULTS			
Submitted by: M. Cooney				No. measurements: 13			
Date Submitted: 10/16/2013				maceral type: bitumen			
Project: Utica Shale Playbook				R _o : 0.97			
				s.d.: 0.06			
Sample ID: 125-22278_10740				Example Photograph: N/A			
Lab ID: 125-22278_1074							
Sample Type: shale							
Date Analyzed: 11/14/2013							
Operator: M. Cooney							
Standard: ASTM D2798 7708							

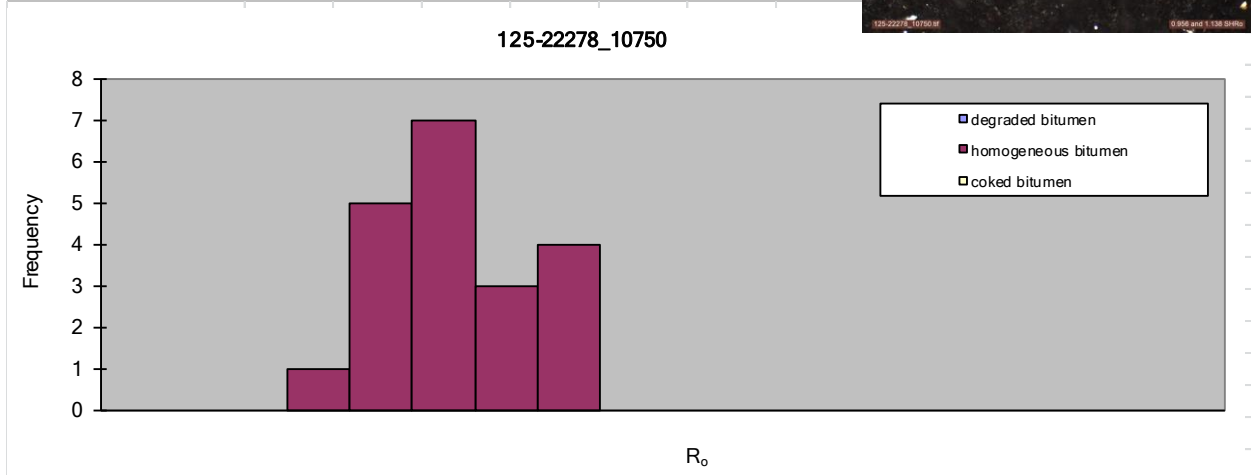


DATA							
0.830	1.000						
0.919	1.008						
0.933	1.116						
0.942							
0.951							
0.969							
0.969							
0.970							
0.989							
0.993							
<p>All Data: min: 0.830 max: 1.116</p> <p>Vitrinite Only: min: 0.830 max: 1.116 V-types: 4</p>							

COMMENT

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10750 Lab ID: 125-22278_10750 Sample Type: shale Date Analyzed: 11/14/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 20 maceral type: bitumen R _o : 0.97 s.d.: 0.11 Example Photograph: 
---	---



DATA	
-------------	--

0.788	0.962								
0.839	0.971								
0.845	0.991								
0.849	1.027								
0.873	1.053								
0.882	1.066								
0.916	1.102								
0.920	1.126								
0.942	1.135								
0.956	1.138								

All Data: min: 0.788 max: 1.138

Vitrinite Only: min: 0.788 max: 1.138 V-types: 5

COMMENT	
----------------	--

Standard: AYG [0.901]; Abundant fossil fragments.

DISPERSED VITRINITE REFLECTANCE REPORT

Run

SAMPLE INFORMATION

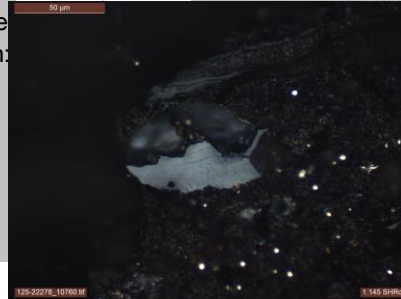
RESULTS

Submitted by: Range Resources
 Date Submitted: 10/16/2013
 Project: Utica Shale Consortium

No. measurements: 24
 maceral type: bitumen
 R_o: 1.07
 s.d.: 0.09

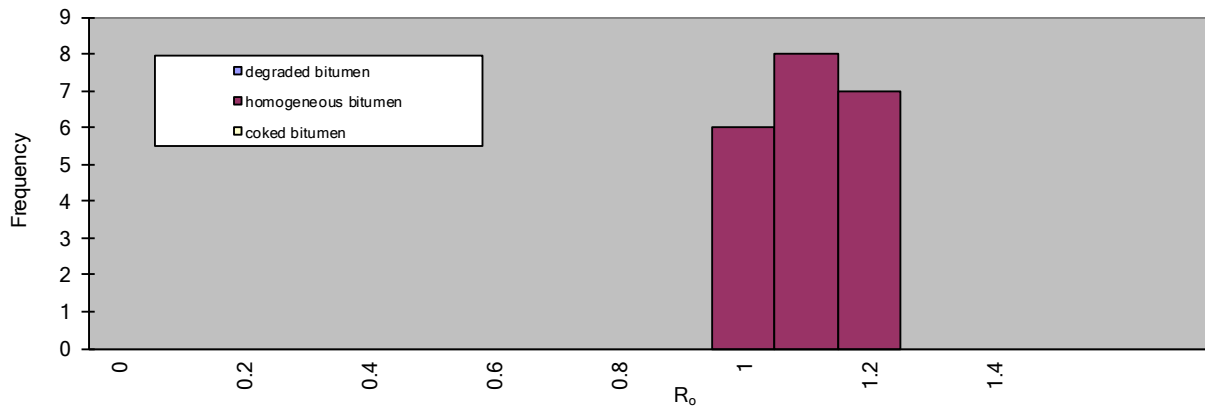
Sample ID: **125-22278_10760**
 Lab ID: 125-22278_10760
 Sample Type: shale
 Date Analyzed: 11/14/2013
 Operator: M. Cooney

Example Photograph



Standard: ASTM D2798 7708

125-22278_10760



DATA

0.910	1.079	1.149
0.924	1.088	1.220
0.944	1.090	1.248
0.963	1.093	1.253
0.979	1.100	
0.979	1.107	
1.023	1.118	
1.025	1.124	
1.029	1.131	
1.073	1.145	

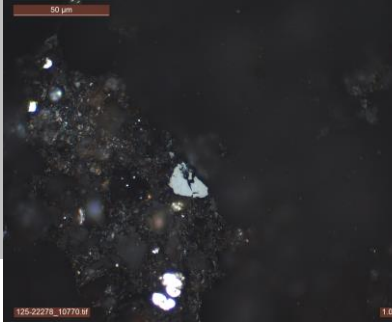
All Data: min: 0.910 max: 1.253

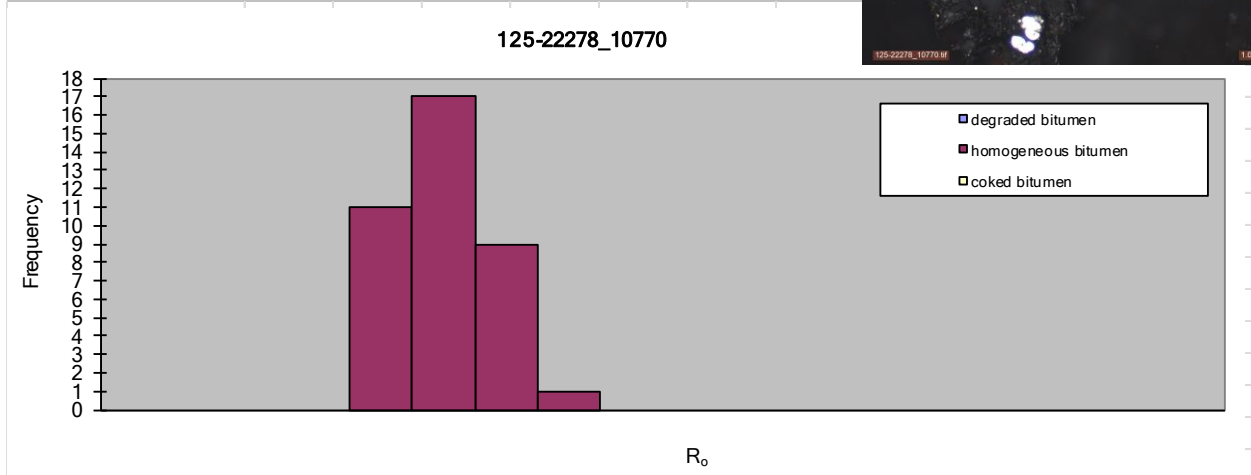
Vitrinite Only: min: 0.910 max: 1.253 V-types: 4

COMMENT

Small fossil fragments; larger bitumen macerals and some small fill structures; most appear homogeneous

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10770 Lab ID: 125-22278_1077 Sample Type: shale Date Analyzed: 11/14/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 38 maceral type: bitumen R _o : 0.94 s.d.: 0.08 Example Photograph: 
--	---



DATA	
-------------	--

0.801	0.897	0.934	1.038						
0.813	0.901	0.935	1.043						
0.824	0.909	0.936	1.065						
0.830	0.911	0.954	1.072						
0.832	0.916	0.958	1.072						
0.846	0.917	0.960	1.089						
0.857	0.917	0.975	1.091						
0.869	0.919	0.991	1.105						
0.878	0.927	1.003							
0.883	0.931	1.009							

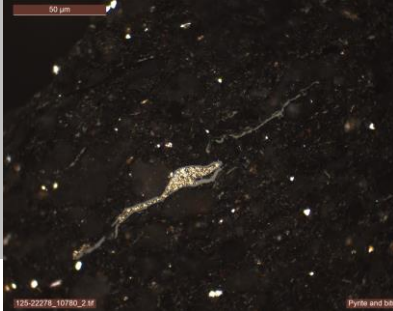
All Data: min: 0.801 max: 1.105

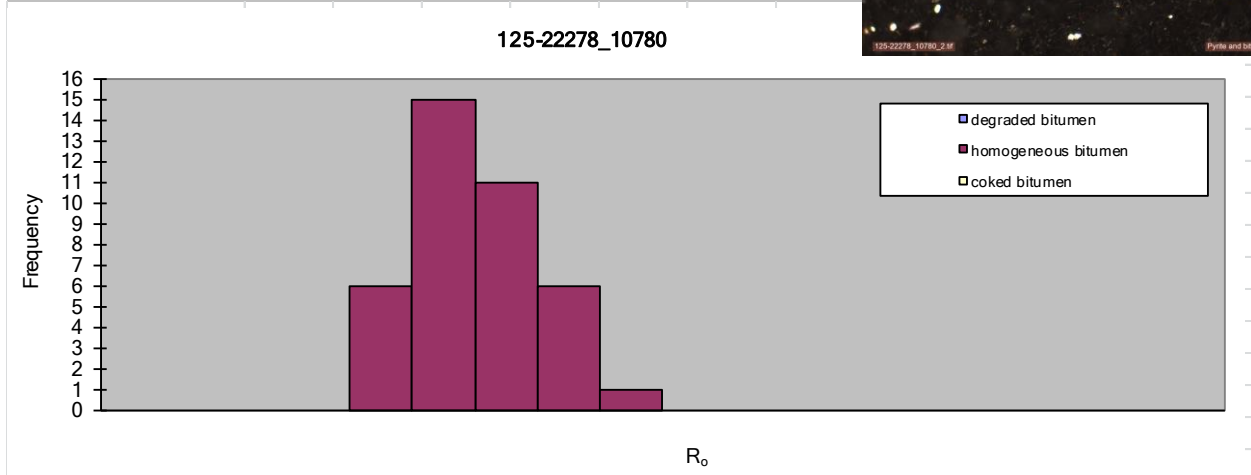
Vitrinite Only: min: 0.801 max: 1.105 V-types: 4

COMMENT	
----------------	--

Standards: YAG [0.901]; Abundant bitumen macerals of all shapes and sizes.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10780 Lab ID: 125-22278_10780 Sample Type: shale Date Analyzed: 11/15/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 39 maceral type: bitumen R _o : 1.00 s.d.: 0.10 Example Photograph: 
---	---



DATA	
-------------	--

0.810	0.936	0.998	1.064				
0.827	0.950	1.004	1.094				
0.831	0.953	1.008	1.105				
0.843	0.968	1.021	1.107				
0.866	0.979	1.022	1.118				
0.870	0.983	1.024	1.142				
0.921	0.984	1.027	1.151				
0.932	0.984	1.037	1.176				
0.934	0.991	1.040	1.212				
0.934	0.991	1.042					

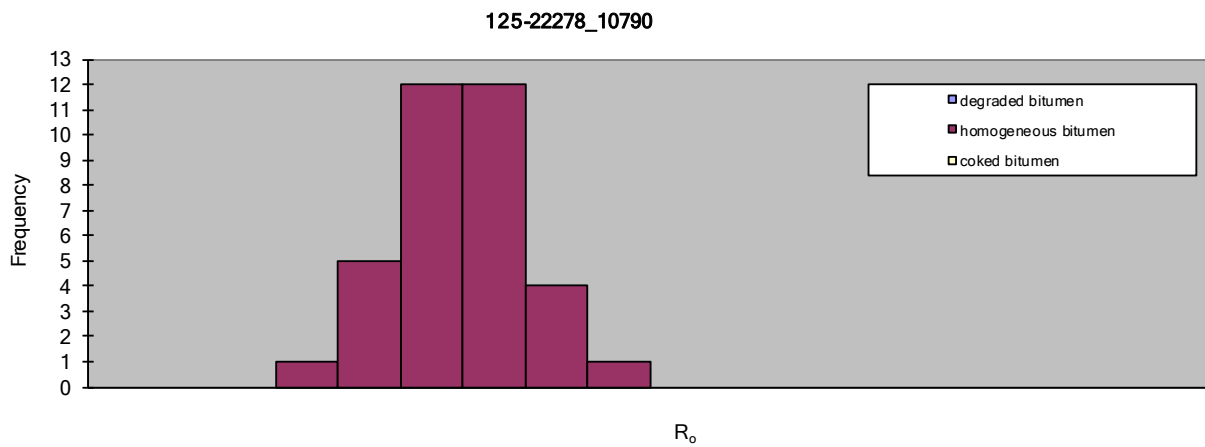
All Data: min: 0.810 max: 1.212

Vitrinite Only: min: 0.810 max: 1.212 V-types: 5

COMMENT	
----------------	--

Standard: YAG [0.901]; Abundant pyrite and bitumen; large macerals and fill structures.

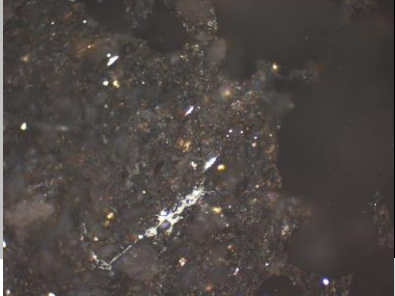
SAMPLE INFORMATION			RESULTS		
Submitted by:	M. Cooney		No. measurements:	35	
Date Submitted:	10/16/2013		maceral type:	bitumen	
Project:	Utica Shale Consortium		R _o :	1.00	
			s.d.:	0.10	
Sample ID:	125-22278_10790		Example	N/A	
Lab ID:	125-22278_10790		Photograph:		
Sample Type:	shale				
Date Analyzed:	11/15/2013				
Operator:	M. Cooney				
Standard:	ASTM D2798 7708				

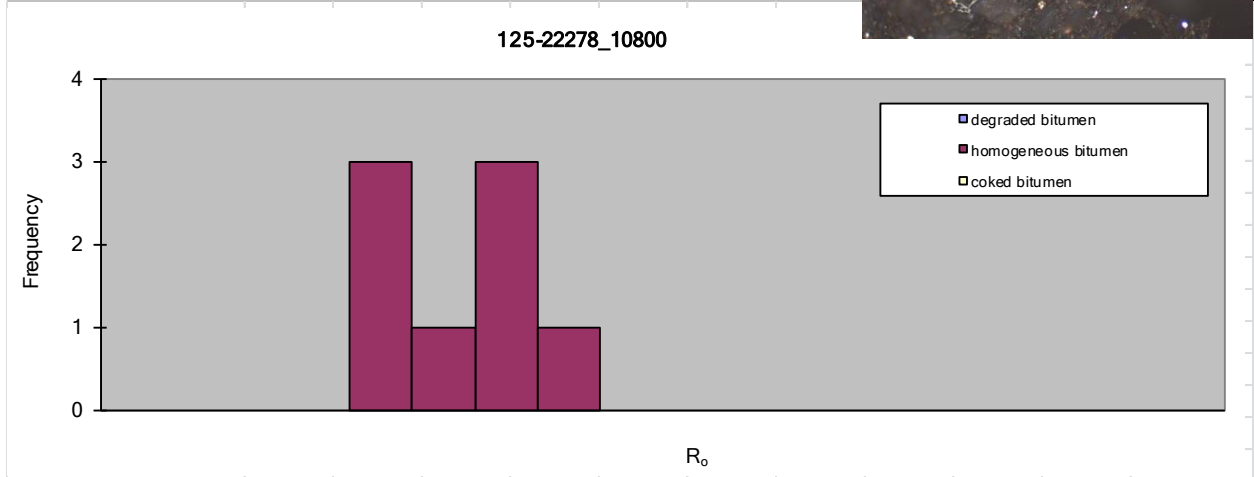


DATA							
0.757	0.949	1.017	1.107				
0.847	0.950	1.020					
0.871	0.968	1.029	1.150				
0.878	0.970	1.034	1.195				
0.889	0.978	1.053	1.215				
0.896	0.985	1.056					
0.925	0.990	1.065					
0.930	0.998	1.067					
0.935	1.000	1.092					
0.942	1.001	1.098					
All Data:		min: 0.757	max: 1.215				
Vitrinite Only:		min: 0.757	max: 1.215	V-types: 6			

COMMENT

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10800 Lab ID: 125-22278_10800 Sample Type: Shale Date Analyzed: 11/15/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 8 maceral type: bitumen R _o : 0.99 s.d.: 0.11 Example Photograph: 
---	--



DATA	
-------------	--

0.850									
0.883									
0.890									
0.988									
1.022									
1.035									
1.043									
1.216									

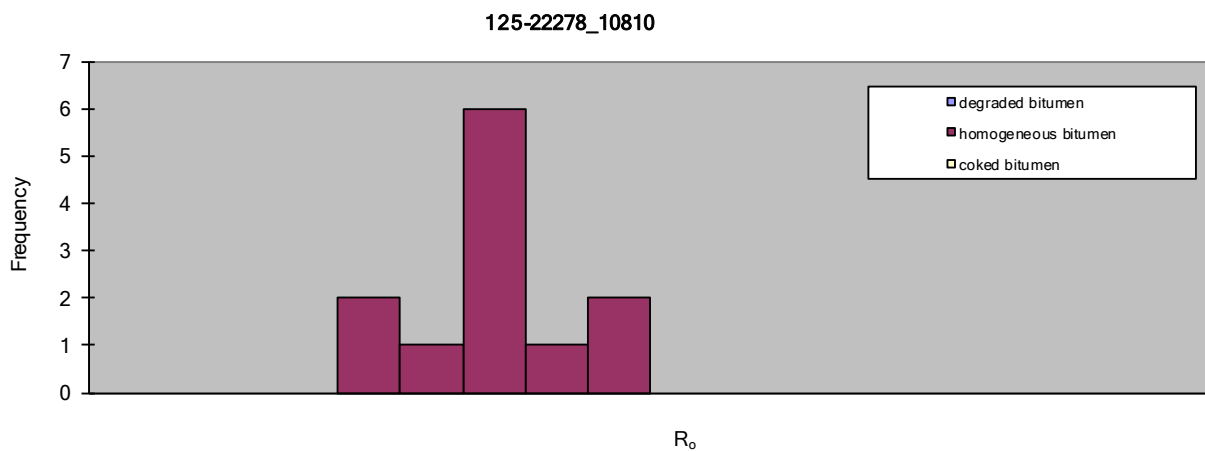
All Data: min: 0.850 max: 1.216

Vitrinite Only: min: 0.850 max: 1.216 V-types: 5

COMMENT	
----------------	--

Standard: YAG [0.901]; very small fill structures

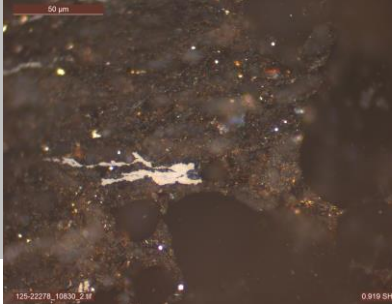
SAMPLE INFORMATION				RESULTS			
Submitted by: M. Cooney				No. measurements: 12			
Date Submitted: 10/16/2013				maceral type: bitumen			
Project: Utica Shale Playbook				R _o : 1.06			
				s.d.: 0.11			
Sample ID: 125-22278_10810				Example Photograph: N/A			
Lab ID: 125-22278_1081							
Sample Type: shale							
Date Analyzed: 11/15/2013							
Operator: M. Cooney							
Standard: ASTM D2798 7708							

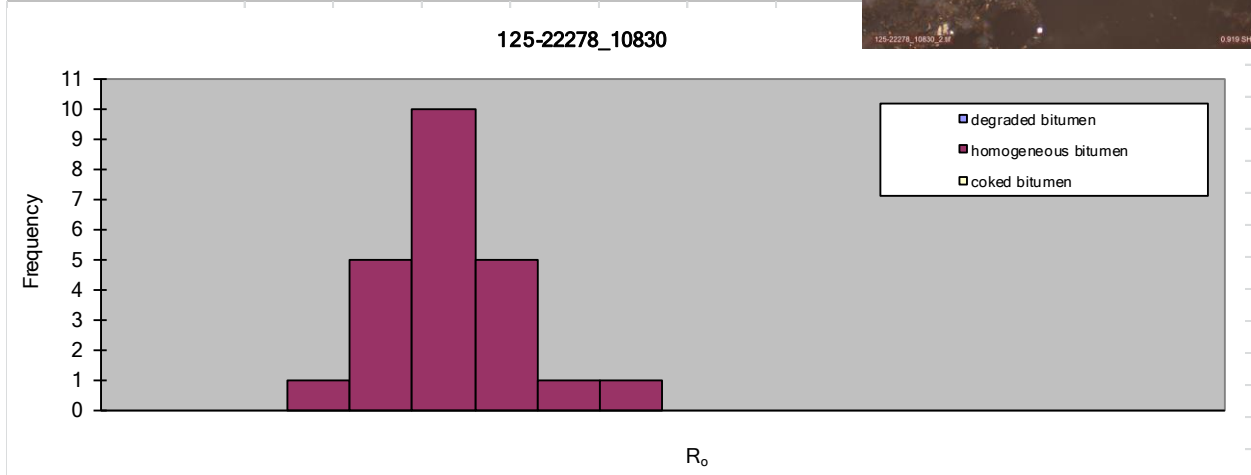


DATA							
0.878	1.203						
0.889	1.256						
0.997							
1.031							
1.035							
1.064							
1.075							
1.086							
1.096							
1.121							
<p>All Data: min: 0.878 max: 1.256</p> <p>Vitrinite Only: min: 0.878 max: 1.256 V-types: 5</p>							

COMMENT

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10830 Lab ID: 125-22278_10830 Sample Type: shale Date Analyzed: 11/18/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 23 maceral type: bitumen R _o : 0.96 s.d.: 0.11 Example Photograph: 
---	---



DATA	
-------------	--

0.733	0.940	1.086					
0.829	0.942	1.140					
0.846	0.945	1.242					
0.873	0.974						
0.885	0.983						
0.894	0.985						
0.901	1.031						
0.905	1.033						
0.915	1.037						
0.919	1.070						

All Data: min: 0.733 max: 1.242

Vitrinite Only: min: 0.733 max: 1.242 V-types: 6

COMMENT	
----------------	--

Standard: YAG [0.901]; Small fill structures; large macerals but reflectance values seem fairly low. Abundant fill structures - most too small to measure.

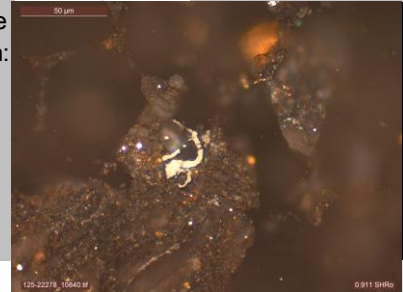
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

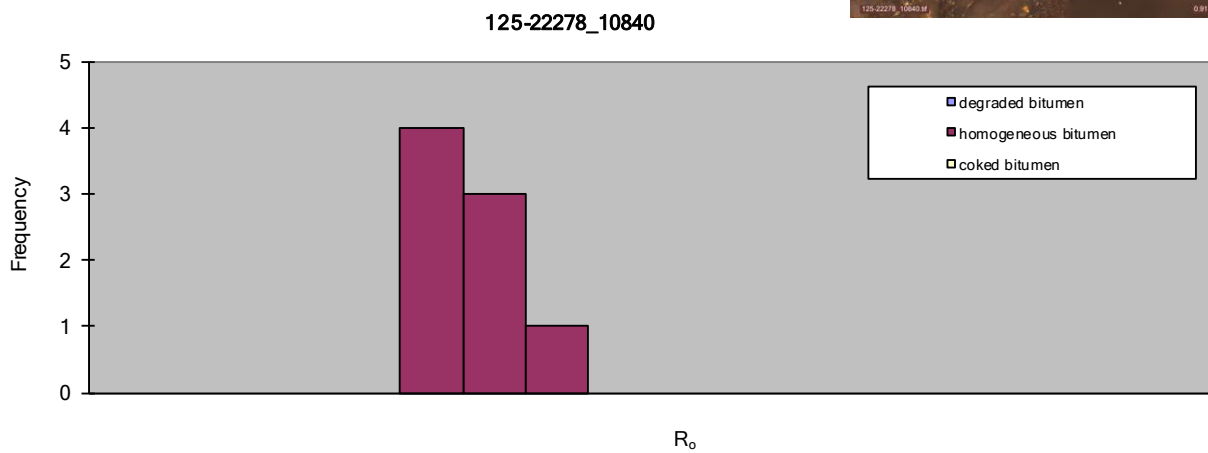
No. measurements: 8
 maceral type: bitumen
 R_o: 1.01
 s.d.: 0.07

Sample ID: **125-22278_10840**
 Lab ID: 125-22278_1084
 Sample Type: shale
 Date Analyzed: 11/18/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708



DATA

0.911									
0.932									
0.932									
0.995									
1.017									
1.059									
1.091									
1.123									

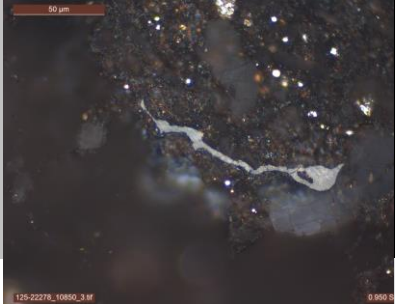
All Data: min: 0.911 max: 1.123

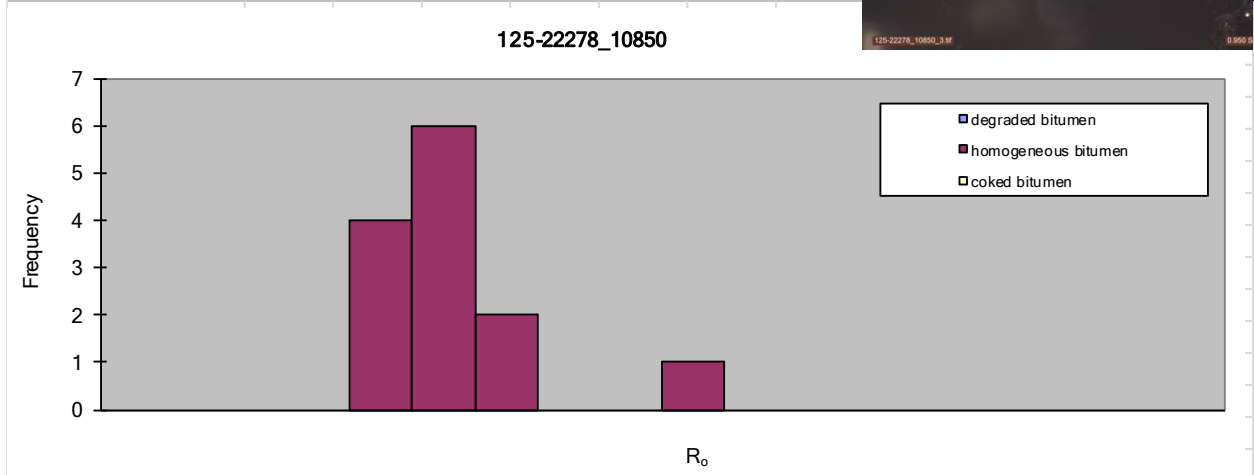
Vitrinite Only: min: 0.911 max: 1.123 V-types: 3

COMMENT

Standard: YAG [0.901]; Small fill structures but very lean.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10850 Lab ID: 125-22278_10850 Sample Type: shale Date Analyzed: 11/18/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 13 maceral type: bitumen R _o : 0.97 s.d.: 0.12 Example Photograph: 
---	---



DATA	
-------------	--

0.811	1.025				
0.875	1.047				
0.883	1.313				
0.891					
0.929					
0.950					
0.955					
0.956					
0.991					
0.991					

All Data: min: 0.811 max: 1.313

Vitrinite Only: min: 0.811 max: 1.313 V-types: 6

COMMENT	
----------------	--

SAMPLE INFORMATION

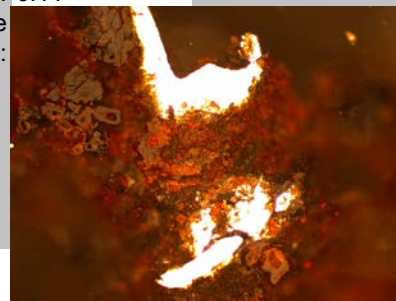
RESULTS

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 16
 maceral type: bitumen
 R_o: 0.95
 s.d.: 0.11

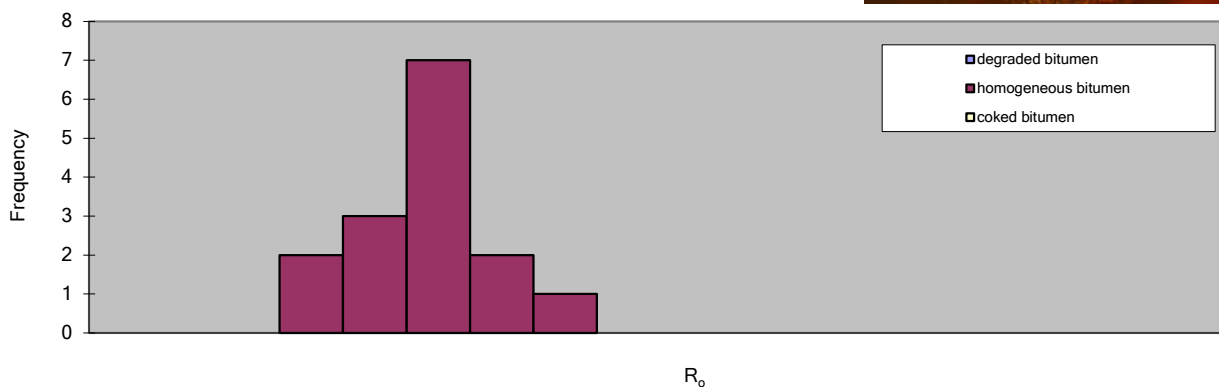
Sample ID: 125-22278_10900
 Lab ID: 125-22278_10900
 Sample Type: shale
 Date Analyzed: 11/18/2013
 Operator: M. Cooney

Example Photograph:



Standard: ASTM D2798 7708

125-22278_10900



DATA

0.779 0.968
 0.794 0.982
 0.807 1.078
 0.859 1.088
 0.869 1.108
 0.918 1.113
 0.929
 0.932
 0.950
 0.961

All Data: min: 0.779 max: 1.113

Vitrinite Only: min: 0.779 max: 1.113 V-types: 5

COMMENT

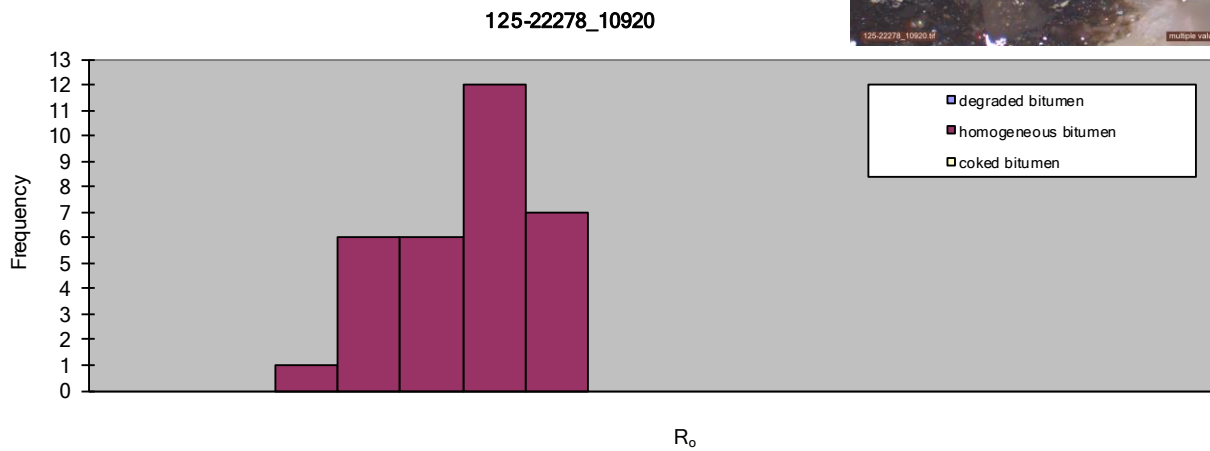
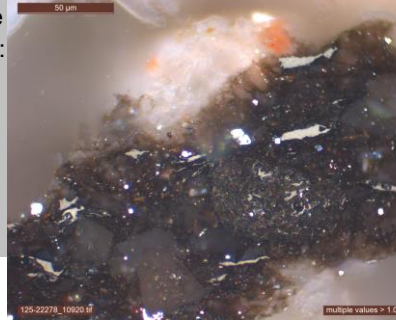
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 32
 maceral type: bitumen
 R_o: 1.01
 s.d.: 0.10

Sample ID: **125-22278_10920**
 Lab ID: 125-22278_10920
 Sample Type: shale
 Date Analyzed: 11/18/2013
 Operator: M. Cooney

Example Photograph:



DATA

0.797	0.967	1.050	1.141			
0.836	0.984	1.062	1.142			
0.850	0.988	1.080				
0.866	1.004	1.083				
0.872	1.017	1.084				
0.889	1.020	1.119				
0.894	1.026	1.120				
0.909	1.035	1.122				
0.948	1.036	1.126				
0.959	1.042	1.131				

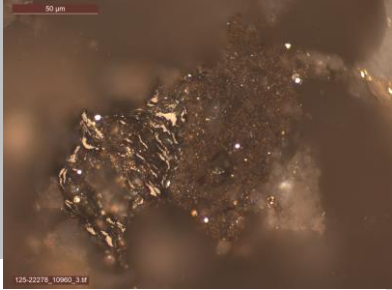
All Data: min: 0.797 max: 1.142

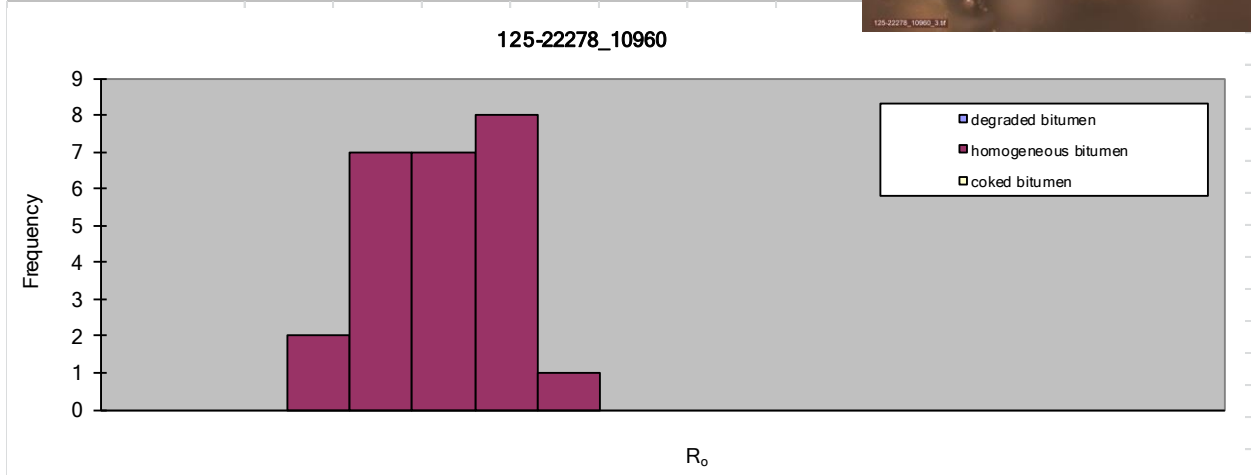
Vitrinite Only: min: 0.797 max: 1.142 V-types: 5

COMMENT

Standard: YAG [0.901]; Abundant, small macerals. Less clay mineral assemblages and more carbonate.

SAMPLE INFORMATION	RESULTS
--------------------	---------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10960 Lab ID: 125-22278_10960 Sample Type: shale Date Analyzed: 11/18/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 25 maceral type: bitumen R _o : 0.94 s.d.: 0.10 Example Photograph: 
---	---



DATA	
------	--

0.704	0.932	1.047	
0.780	0.964	1.056	
0.801	0.967	1.072	
0.824	0.972	1.074	
0.834	0.992	1.103	
0.857	0.994		
0.860	1.016		
0.863	1.023		
0.895	1.025		
0.921	1.032		

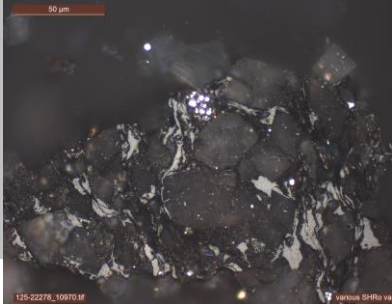
All Data: min: 0.704 max: 1.103

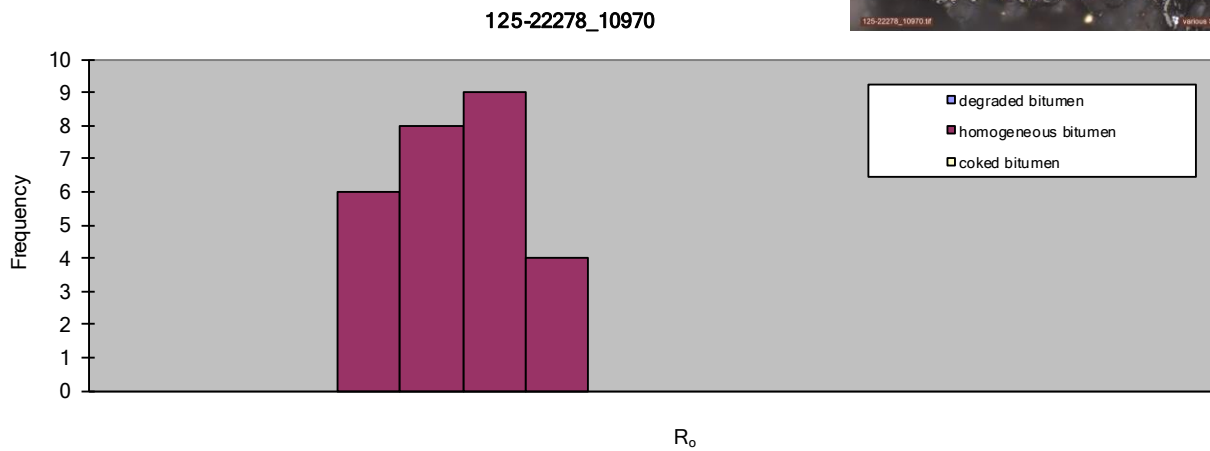
Vitrinite Only: min: 0.704 max: 1.103 V-types: 5

COMMENT	
---------	--

Standards: YAG [0.901]; Most macerals appear to be smaller and degraded. Very abundant carbonate.

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10970 Lab ID: 125-22278_1097 Sample Type: shale Date Analyzed: 11/18/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 27 maceral type: bitumen R _o : 0.99 s.d.: 0.09 Example Photograph: 
--	---



DATA	
-------------	--

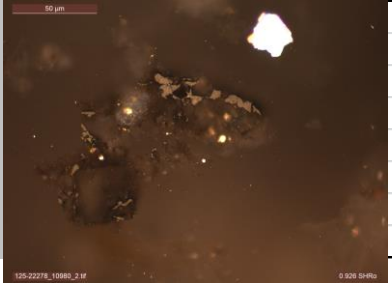
0.828	0.961	1.068					
0.868	0.972	1.072					
0.887	0.983	1.076					
0.891	0.994	1.119					
0.898	1.003	1.121					
0.899	1.011	1.142					
0.918	1.029	1.161					
0.932	1.035						
0.937	1.036						
0.945	1.039						

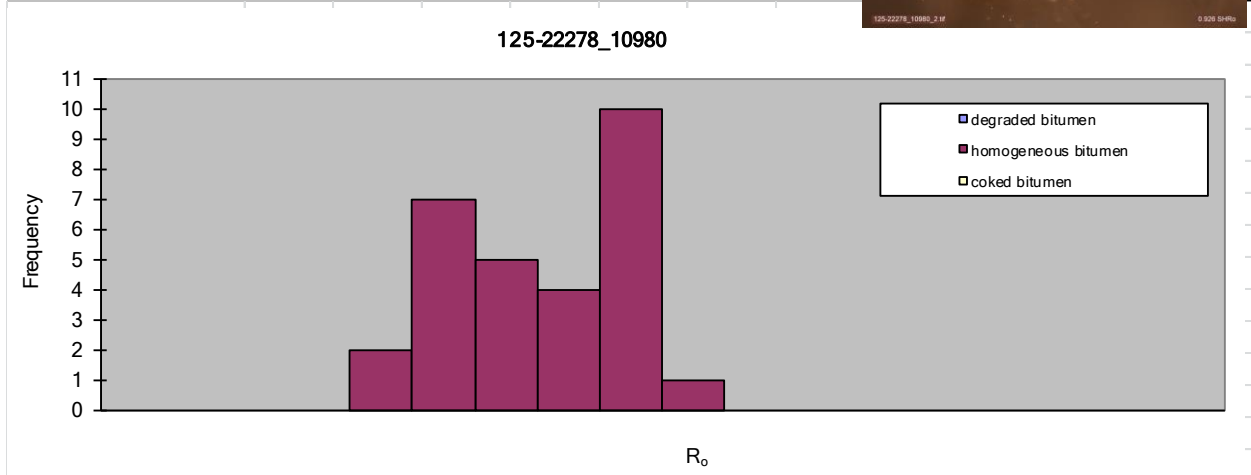
All Data: min: 0.828 max: 1.161

Vitrinite Only: min: 0.828 max: 1.161 V-types: 4

COMMENT	
----------------	--

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10980 Lab ID: 125-22278_10980 Sample Type: shale Date Analyzed: 11/19/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 29 maceral type: bitumen R _o : 1.09 s.d.: 0.13 Example Photograph: 
---	---



DATA	
-------------	--

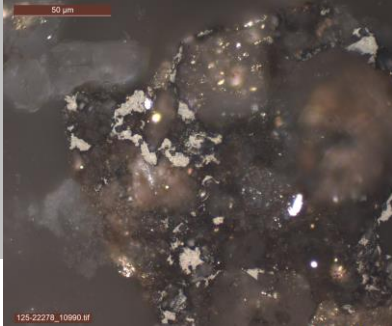
0.865	1.039	1.208					
0.882	1.072	1.216					
0.909	1.088	1.219					
0.917	1.132	1.220					
0.918	1.142	1.225					
0.926	1.159	1.233					
0.967	1.184	1.245					
0.969	1.201	1.339					
1.000	1.202	#REF!					
1.031	1.208						

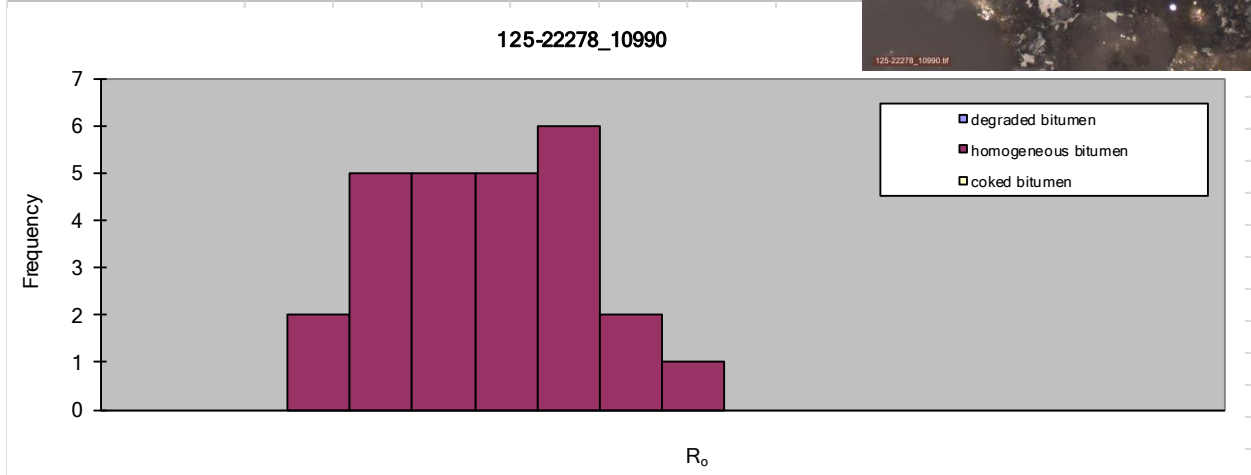
All Data: min: #REF! max: #REF!

Vitrinite Only: min: 0.865 max: 1.339 V-types: 6

COMMENT	
----------------	--

SAMPLE INFORMATION	RESULTS
---------------------------	----------------

Submitted by: M. Cooney Date Submitted: 10/16/2013 Project: Utica Shale Playbook Sample ID: 125-22278_10990 Lab ID: 125-22278_10990 Sample Type: shale Date Analyzed: 11/19/2013 Operator: M. Cooney Standard: ASTM D2798 7708	No. measurements: 27 maceral type: bitumen R _o : 1.03 s.d.: 0.15 Example Photograph: 
---	---



DATA	
-------------	--

0.764	0.982	1.146					
0.771	0.992	1.157					
0.846	1.012	1.195					
0.855	1.047	1.196					
0.859	1.054	1.227					
0.867	1.061	1.264					
0.883	1.074	1.344					
0.918	1.105						
0.934	1.111						
0.953	1.133						

All Data: min: 0.764 max: 1.344

Vitrinite Only: min: 0.764 max: 1.344 V-types: 7

COMMENT	
----------------	--

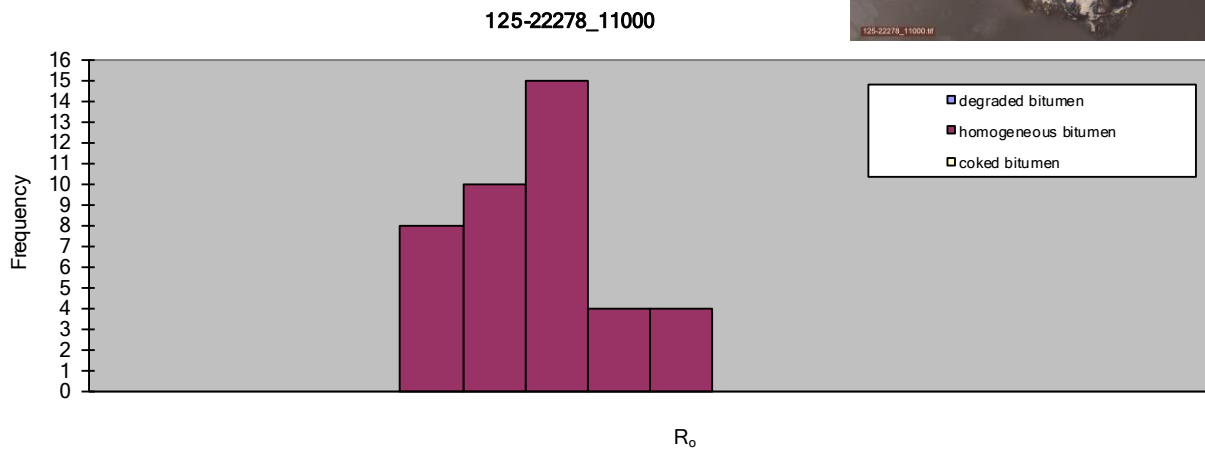
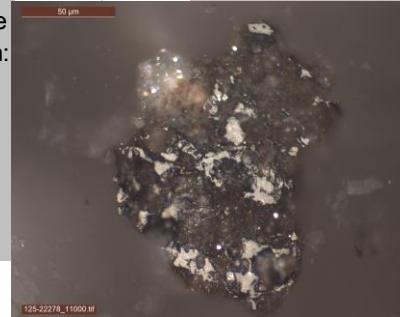
SAMPLE INFORMATION **RESULTS**

Submitted by: M. Cooney
 Date Submitted: 10/16/2013
 Project: Utica Shale Playbook

No. measurements: 41
 maceral type: bitumen
 R_o: 1.05
 s.d.: 0.16

Sample ID: **125-22278_11000**
 Lab ID: 125-22278_11000
 Sample Type: shale
 Date Analyzed: 11/19/2013
 Operator: M. Cooney

Example Photograph:



DATA

0.921	1.028	1.136	1.332	#REF!			
0.922	1.035	1.148	1.378				
0.938	1.048	1.158	#REF!				
0.946	1.051	1.197	#REF!				
0.967	1.059	1.224	#REF!				
0.983	1.069	1.227	#REF!				
0.997	1.080	1.249	#REF!				
0.999	1.092	1.282	#REF!				
1.006	1.104	1.301	#REF!				
1.022	1.131	1.331	#REF!				

All Data: min: #REF! max: #REF!

Vitrinite Only: min: 0.725 max: 1.378 V-types: 7

COMMENT