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MICROANALYSIS, LLC.

April 10, 2015

Joe Cook, *et al,*
VA Sierra Club
259 Granby Street, Suite 250
Norfolk, VA 23510

Re: Analysis of air-borne material for the presence of coal: *Chemoptix #G-MIC-11341 through -11346.*

Dear Mr. Cook:

The samples cited herein have been analyzed via gas chromatography (GC/FID) as well as variety of microanalytical techniques per EPA 8015M and ASTM D1245, respectively. The result should be of interest:

Analysis Summary:

Particles consistent with coal were recovered from all the samples submitted for analysis. They were well represented in each sample, and were identified on the basis of their hydrocarbon fingerprint as well as by their microscopic morphology.

The samples submitted for analysis were identified as:

VA Sierra Club ID	*Chemoptix ID*	*Sample Date:*
Lab treated sample[1]	G-MIC-11341	11/17/14
1415 W 27th and 1430 W 26th Lambert's Point	G-MIC-11342	12/3/14
Skylight 1342 Westover, West Ghent	G-MIC-11343	12/3/14
913 Weyandoke Rd. West Ghent	G-MIC-11344	2/14/15
1342 Westover Ave., West Ghent	G-MIC-11345	2/14/15
1405 W. 27th, Lambert's Point	G-MIC-11346	2/20/15
Reference A[2]	G-MIC-11347	ND

1) Sample extraction method: William J. Bounds, Karen H. Johannesson: *Water Air Soil Pollut* 185:195-207 DOI 10.1007/s 11270-007-9442-9.
2) Reported to have been collected from the public right of way of 21st street that runs parallel to the railroad tracks leading into the terminal.

Methods:

The samples in their entirety were examined with diffuse reflected LED illumination under a dissection stereomicroscope. Fractions were further examined and photographed under high-magnification brightfield and darkfield episcopic illumination-equipped compound microscope, and compared to both the reference sample submitted with the sample set, and a National Bureau of Standards (NBS) subbituminous coal reference standard archived at this laboratory. Sample particles were also subjected to capillary fusion (1200-1370° C (2200-2500° F) for cursory hydrocarbon evaluation. Sample material was then analyzed via gas chromatography coupled with a flame-ionization detector (GC/FID) after extraction and sonication in dichloromethane. This method combines hydrocarbon boiling points/vapor pressures, and traction

within a resinous capillary column to produce a 'fingerprint' based on retention time the evolved gasses take to pass through the column.

Results:

GC/FID gas chromatograms and photomicrographs are presented below:

Microscopy: All the samples showed an abundance of discrete black particles exhibiting angular blocky to splintery outlines, resinous lusters and crazed conchoidal fracture surfaces. These particles compared favorably in these parameters to both the NBS coal standard and the G-MIC-11347 reference sample. The samples also showed fragments of insect exoskeletons, pollen, cellulose and other fragments of plant material, minerals grains, wear from belts/tires, fibers of various compositions, and small amounts of milky-white thermoplastic scuffing wear. Although hydrocarbons from some of these materials contributed to the GC/FID 'fingerprint', the reference material GC/FID is clearly visible through the background of other hydrocarbon contributions.

Gas chromatography:

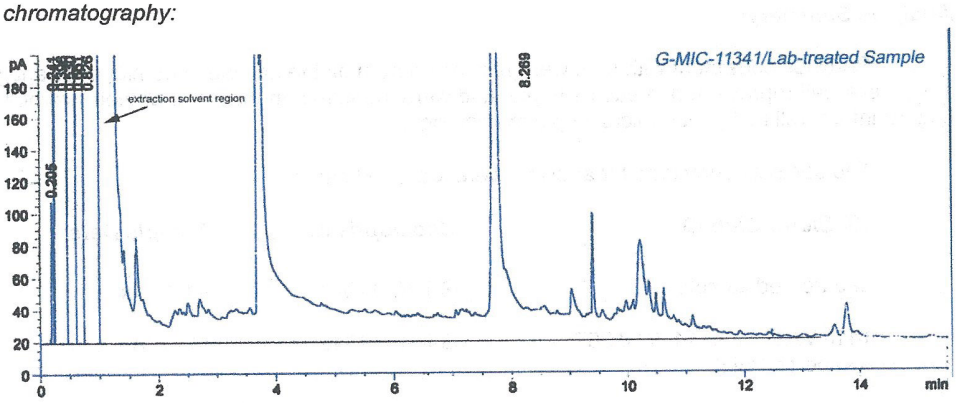

Figure 1: Gas chromatogram of material gravimetrically extracted using the method employed for the William J. Bounds, Karen H. Johannesson *study, cited above. The horizontal axis denotes the retention time within the gas chromatograph's capillary column, in minutes. Peak shapes and retention times are both used for determining hydrocarbon fingerprints.*

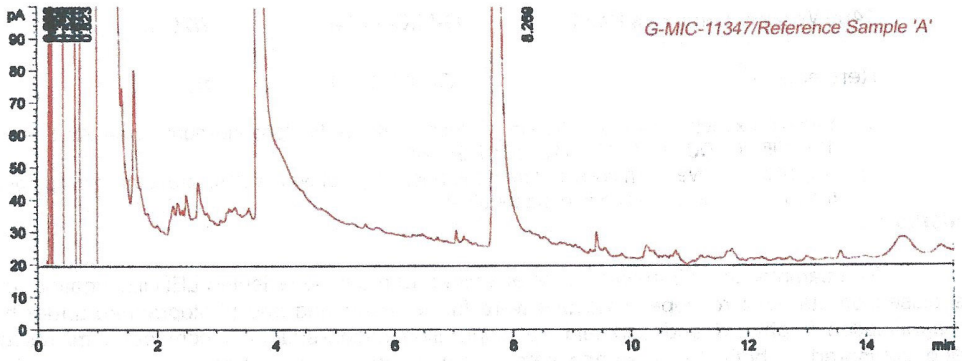

Figure 2: Gas chromatogram of the Reference Sample A*: The sample consisted of large fragments of coal: there was no ancillary debris in this sample.*

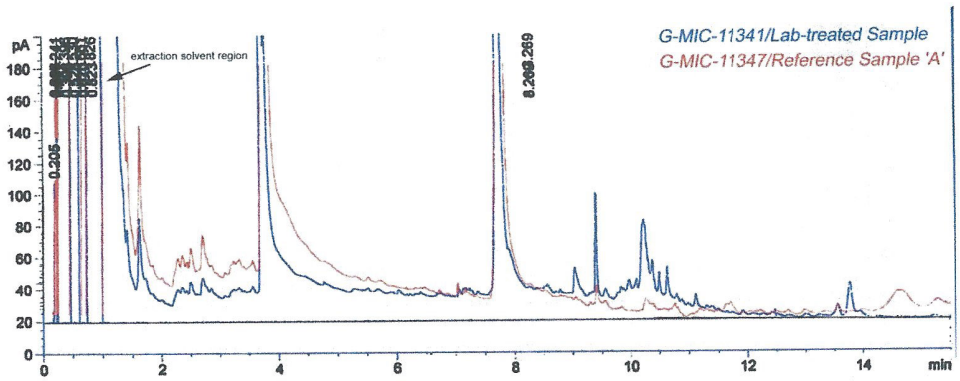

Figure 3: Overlay of Figures 1 *and 2: This shows a very favorable comparison. Additional peaks within the ~10-minute region correspond to hydrocarbons from other detritus extracted in the* Lab-Treated *sample.*

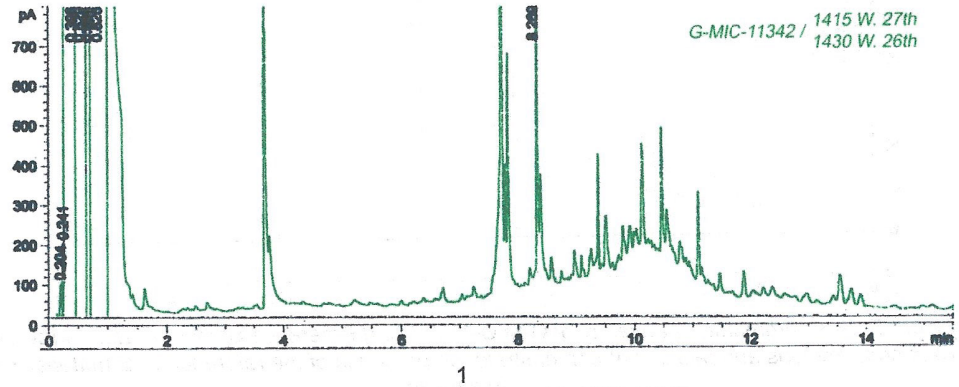

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Figure 4: Gas chromatogram of G-MIC-11342.

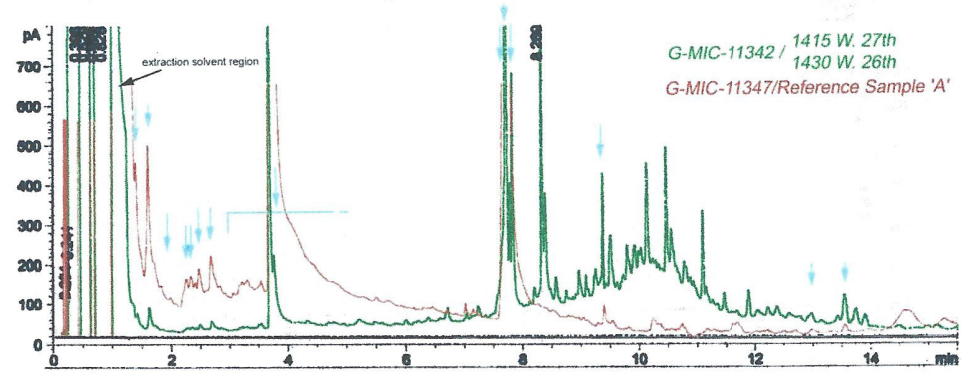

Figure 5: Gas chromatogram overlay of G-MIC-11342 *and* Reference Sample A. *Blue arrows and lines show regions and peaks that demonstrate the presence of the reference coal material within the sample.*

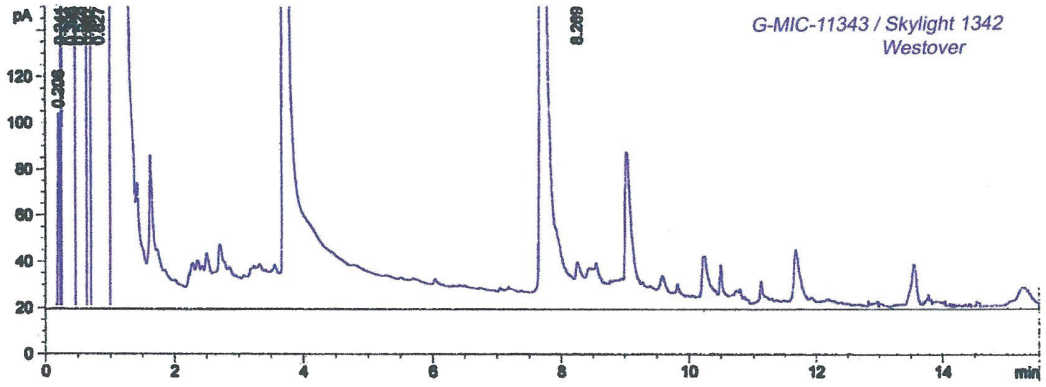

Figure 6: Gas chromatogram of G-MIC-11343.

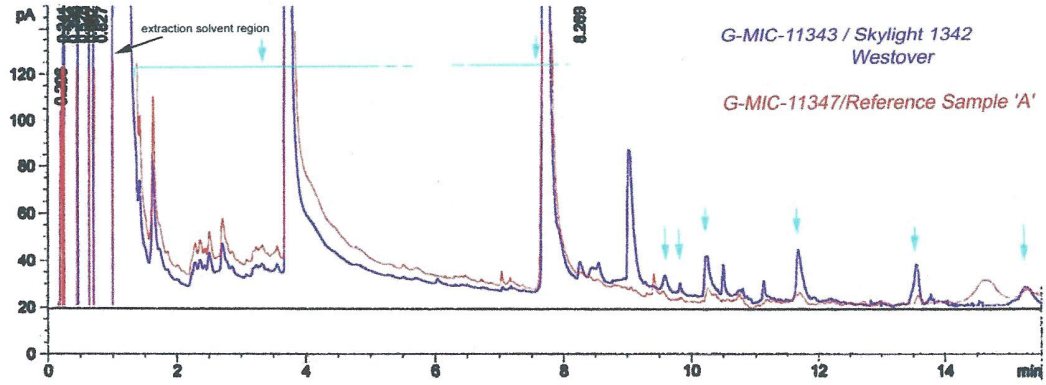

Figure 7: Gas chromatogram overlay of G-MIC-11343 *and* Reference Sample A. *Blue arrows and lines show regions and peaks that demonstrate the presence of the reference coal material within the sample.*

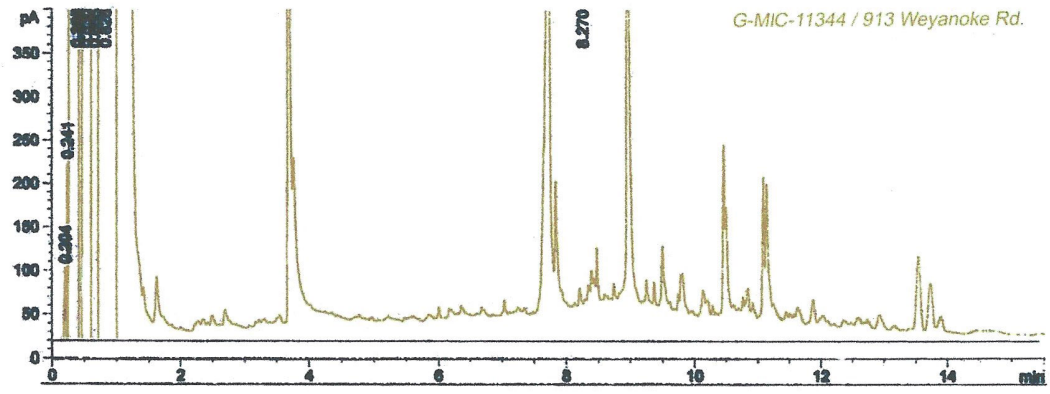

Figure 8: Gas chromatogram of G-MIC-11344.

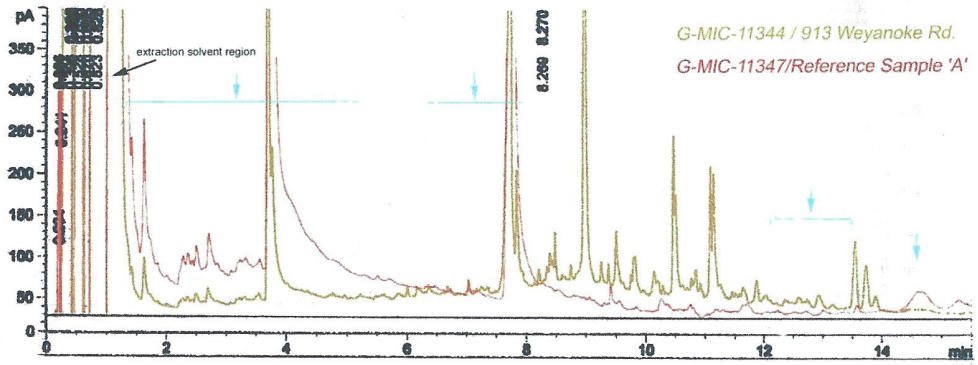

Figure 9: Gas chromatogram overlay of G-MIC-11344 *and* Reference Sample A. *Blue arrows and lines show regions and peaks that demonstrate the presence of the reference coal material within the sample.*

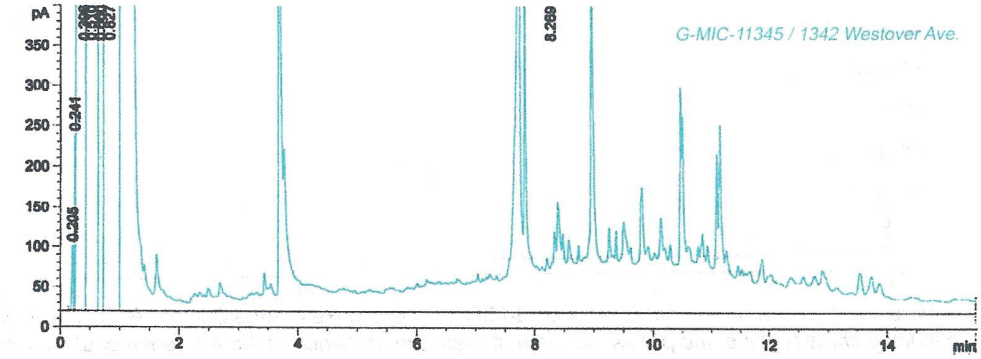

Figure 10: Gas chromatogram of G-MIC-11345.

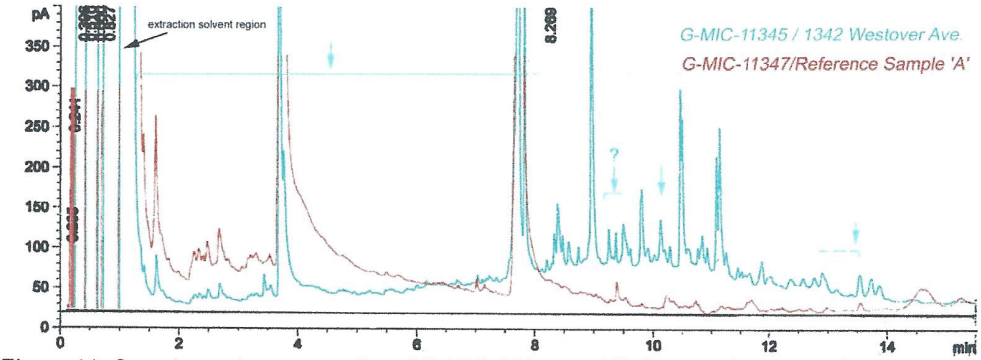

Figure 11: Gas chromatogram overlay of G-MIC-11345 *and* Reference Sample A. *Blue arrows and lines show regions and peaks that demonstrate the presence of the reference coal material within the sample.*

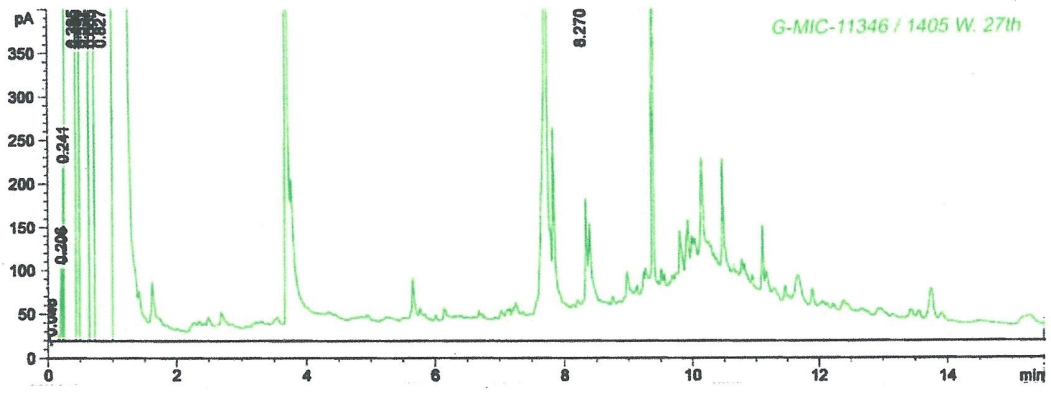

Figure 12: Gas chromatogram of G-MIC-11346.

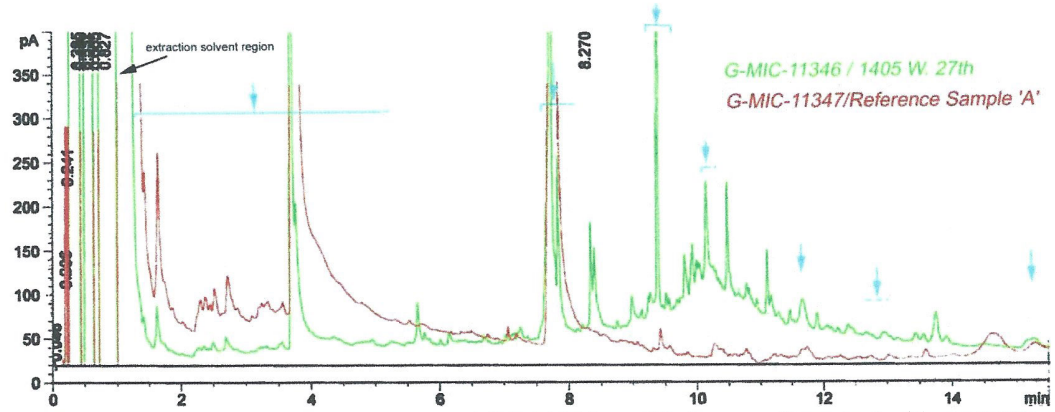

Figure 13: Gas chromatogram overlay of G-MIC-11346 *and* Reference Sample A. *Blue arrows and lines show regions and peaks that demonstrate the presence of the reference coal material within the sample.*

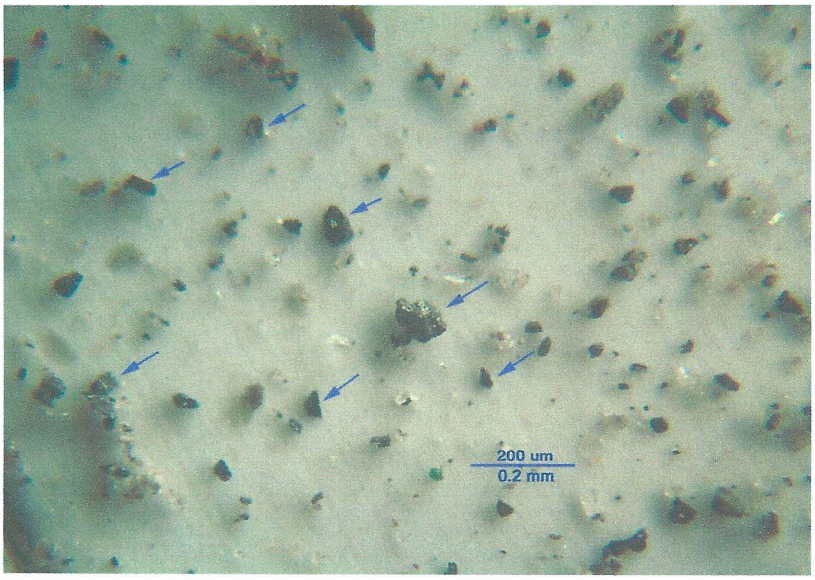

Figure 14: G-MIC-11341 *particle array as seen episcopically. Some of the particles showing color, luster and fracture for coal are arrowed.*

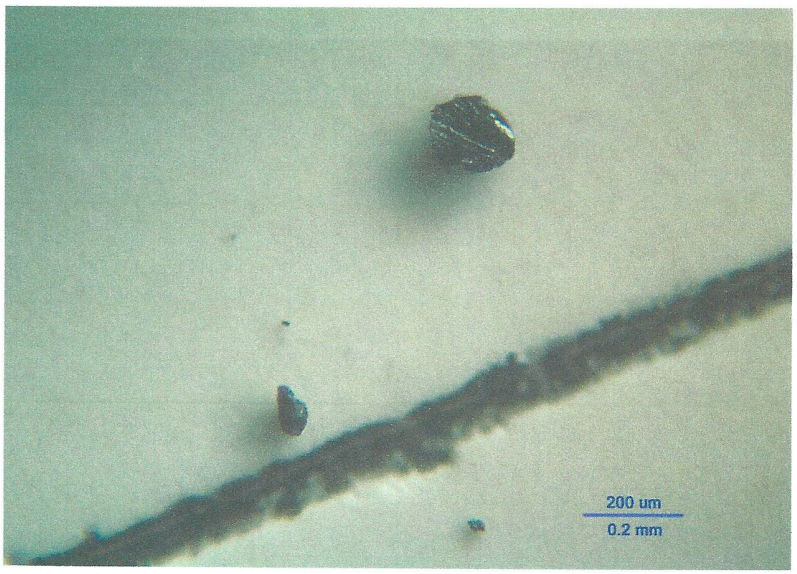

Figure 15: Particles Reference Sample A, *showing the color, luster and fracture of coal.*

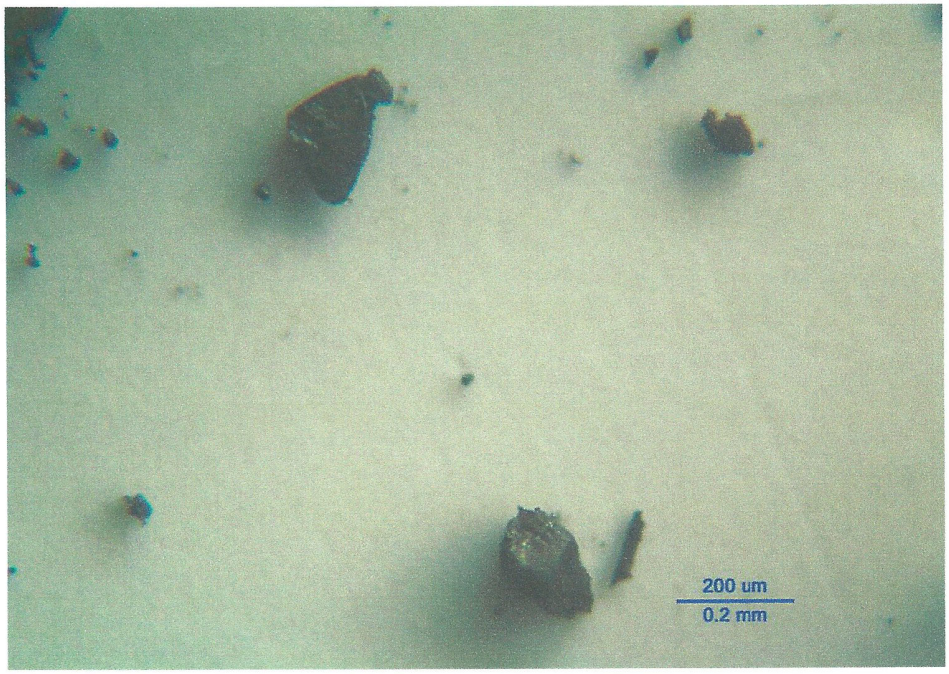

Figure 16: NBS *laboratory reference standard. Note the color, luster and fracture.*

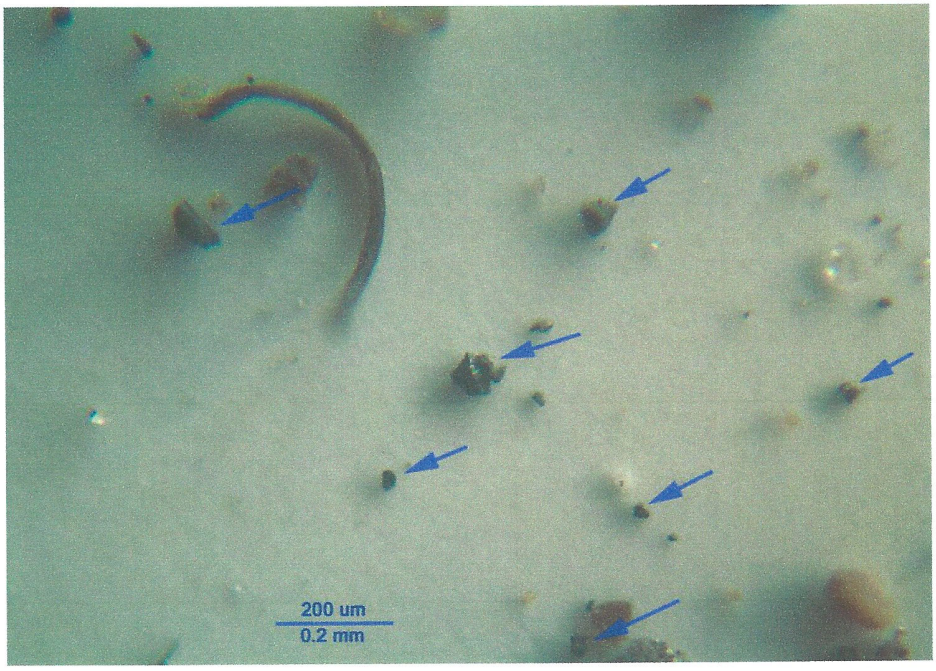

Figure 17: G-MIC-11342 *particle array as seen episcopically. Some of the particles showing color, luster and fracture for coal are arrowed.*

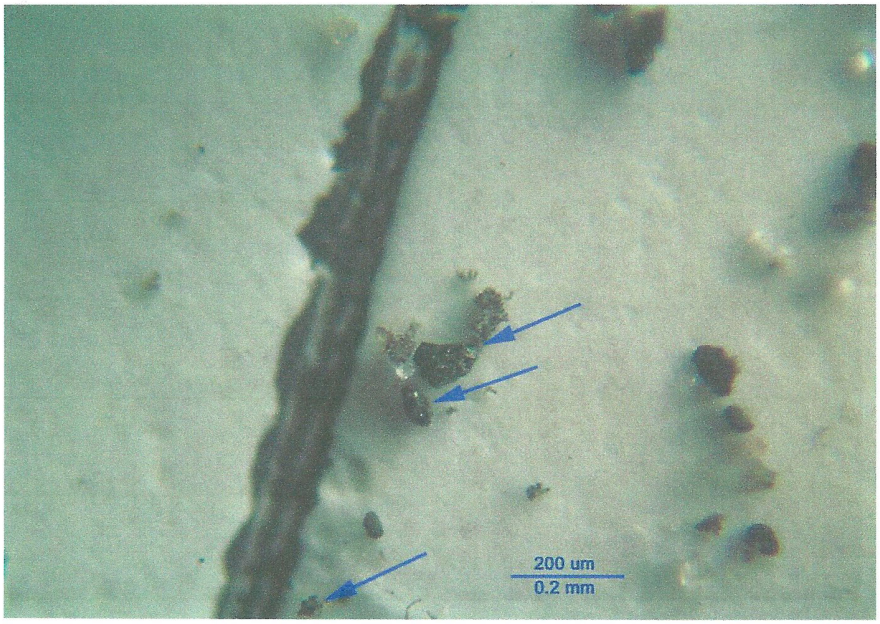

Figure 18: G-MIC-11343 *particle array as seen episcopically. Some of the particles showing color, luster and fracture for coal are arrowed.*

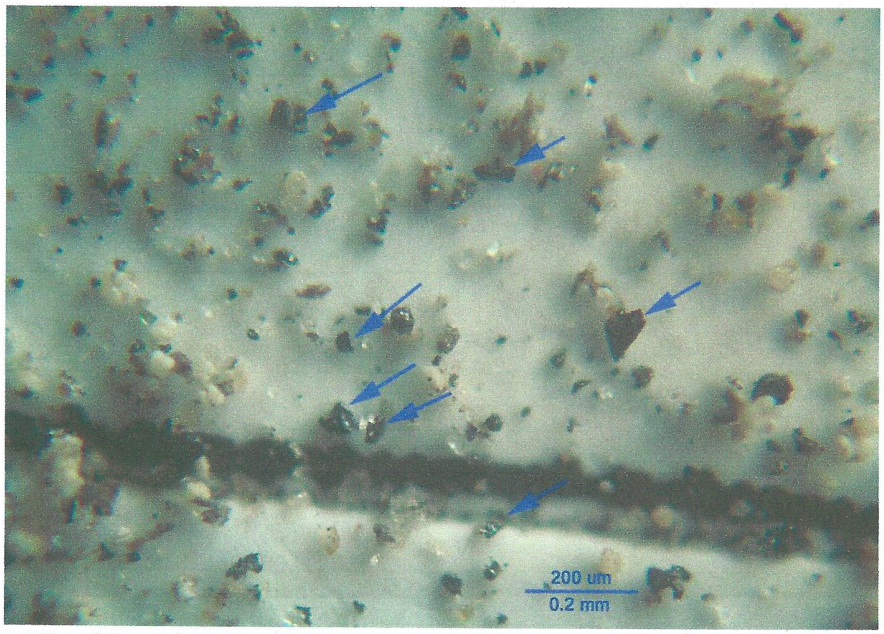

Figure 19: G-MIC-11344 *particle array as seen episcopically. Some of the particles showing color, luster and fracture for coal are arrowed.*

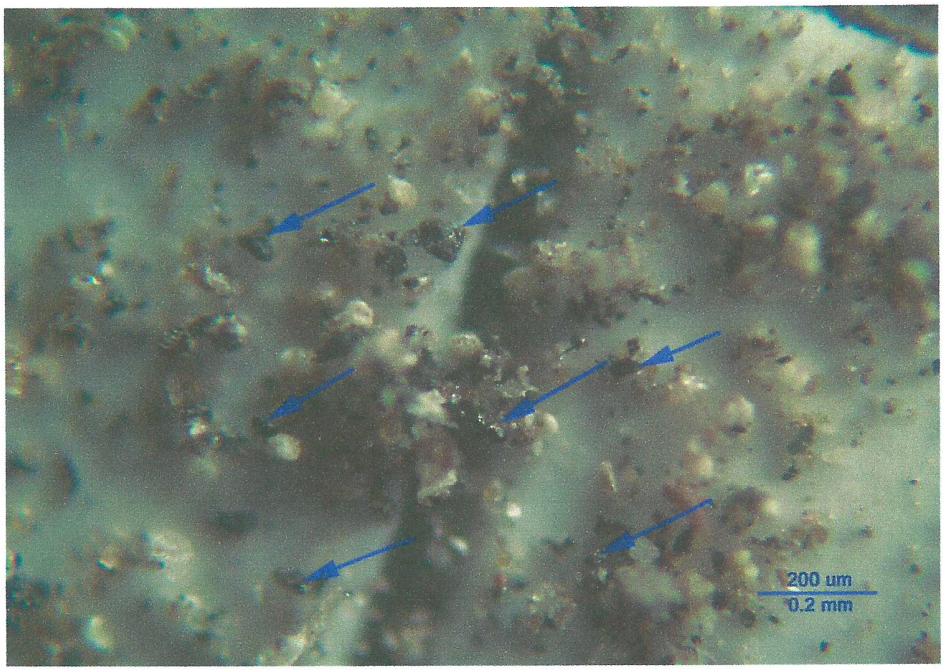

Figure 20: G-MIC-11345 *particle array as seen episcopically. Some of the particles showing color, luster and fracture for coal are arrowed.*

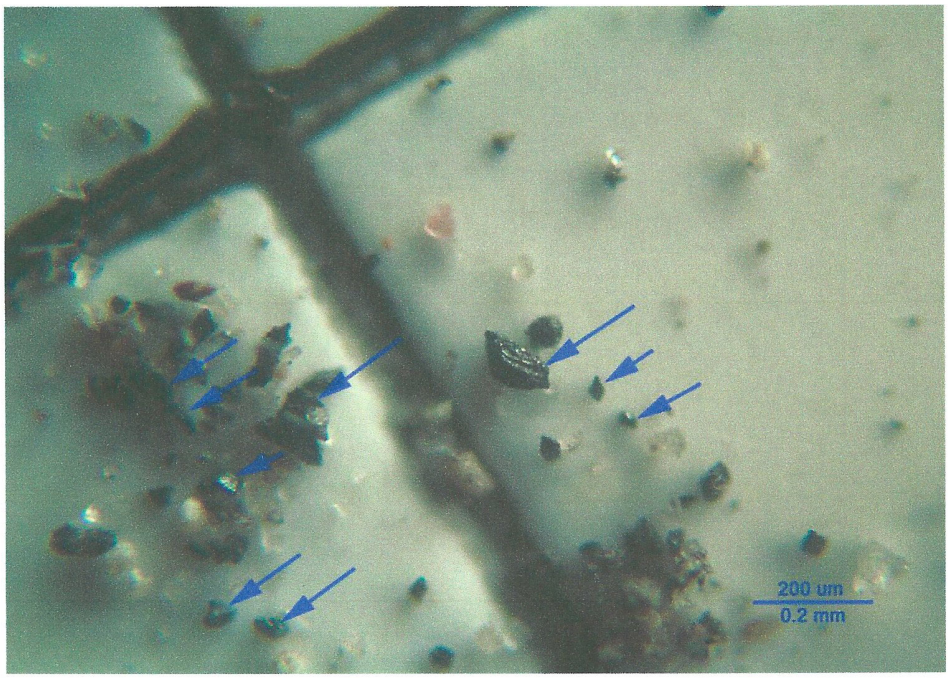

Figure 21: G-MIC-11346 *particle array as seen episcopically. Some of the particles showing color, luster and fracture for coal are arrowed.*

Discussion:

Despite the hydrocarbon background extracted from the wind-blown detritus within each of the samples in the set, the coal reference sample hydrocarbons showed a very good and reliable pattern match.

Suggestions for further work:

Depending on the goals, any number of analyses can be performed on these samples, should the need arise. There is still a substantial fraction of each sample, as received, remaining.

Thank you for your considerable patience during our investigation into this interesting material. If you have questions, require additional data, additional testing, or other elaboration on any aspect of this project, feel free to call (503) 636-9251, or email me at stancassell@chemoptix.com.

Respectfully Submitted,

Stan Cassell,
Microanalyst