

Haolin Zhou, Nicholas B. Harris, Tian Dong, Korhan Ayrancı, Jilu Feng, Benoit Rivard, Paul Hackley, and Javin Hatcherian, 2021, New insights into organic matter accumulation from high-resolution geochemical analysis of a black shale: Middle and Upper Devonian Horn River Group, Canada: GSA Bulletin, <https://doi.org/10.1130/B36091.1>.

Supplemental Material

Table S1. Whole-rock data by ICP-MS and Leco combustion analyses. * is standard sample.

Table S2. Averaged EDXRF scans and ICP-MS data of each core slab.

Table S3. EDXRF repeating scans for the interval of 3141 m. Note that the slight variations between two datasets are due to the heterogeneity of shales.

Table S4. EDXRF repeating scans for the interval of 3144.9 m.

Table S5. EDXRF repeating scans for the interval of 3270.66 m.

Figure S1. Elemental proxies' calibration between ICP-MS and EDXRF data (Table S2).

Figure S2. Ti-Al and Zr-Al correlation based on Table S2.

Figure S3. Profiles in Figure 5 with the identical scales.

Figure S4. TOC-proxies plots for the interval of 3128.05 m (Fig. 5A).

Figure S5. TOC-proxies plots for the interval of 3146.05 m (Fig. 5D).

Figure S6. Biogenic silica SEM images of the interval of 3269.15 m (Sibio > 50%). The matrix microcrystalline quartz is probably sourced from dissolved siliceous fossils (Milliken and Olson, 2017).

Figure S7. Example of registration between EDXRF and hyperspectral imagery data, which show similar trends between profiles. Note that the silica data of hyperspectral imagery are raw data without calibration which can still show the relative abundance. Minor difference between the profiles may be due to the heterogeneity of the shale slab.

File S1. Organic matter (OM) type identification by the U.S. Geological Survey (USGS). Note that there is no evidence for fusinite which is broadly consistent with distal samples from the Middle Devonian, e.g., the Marcellus Formation in the Appalachian Basin. The fusinite noted in the attachment is probably solid bitumen which took an extraordinary polish, i.e., 'fusinite' here is identified based on R_o values rather than morphology, so it does not indicate Type III organic matter. Since the petrography is consistent with the petrography of all North American shale gas plays, which are all marine rocks containing a Type II 'kerogen' at low maturity, we think of the presence of the solid bitumen network as residual evidence of the thermal conversion of original Type II kerogen. All USGS-generated data are available from <https://doi.org/10.5066/P9OVXH6H>.

File S2. EDXRF scans for all the core slabs in this study.

Table DR1

Table DR2

ICP-MS																				
EDXRF	Depth	Mg	Al	Si	S	K	Ca	Ba	Ti	Fe	Depth	Mg	Al	Si	S	K	Ca	Ba	Ti	Fe
	m	%	%	%	%	%	%	%	%	%	m	%	%	%	%	%	%	%	%	%
	3140	0.882	4.232	86.628	1.644	1.650	0.791	1.198	0.308	1.411	3140	0.41	4.56	85.41	0.54	0.87	0.4	0.5112	0.18	1.51
3141	0.984	4.563	85.712	1.605	1.752	0.986	1.292	0.328	1.482	3141	0.49	4.92	84.08	0.57	0.93	0.5	0.5726	0.19	1.85	
3142	1.085	4.780	84.141	1.766	1.856	1.251	1.460	0.364	1.690	3142	0.56	5.03	84.08	0.54	0.95	0.64	0.6124	0.19	1.79	
3144.9	1.413	10.081	70.335	5.246	4.265	1.006	1.636	0.676	3.858	3144.9	0.85	11.56	69.64	1.83	2.33	0.57	0.6565	0.44	3.14	
3146.05	1.294	9.900	71.397	5.376	4.123	0.568	1.528	0.649	3.771	3146.05	0.7	10.96	71.44	1.56	2.21	0.34	0.6384	0.41	2.96	
3147.15	2.546	13.188	62.624	4.543	5.536	0.572	0.872	0.873	4.882	3147.15	0.51	7.41	79.42	1.08	1.47	0.3	0.4932	0.25	2.26	
3148.25	1.115	7.532	77.848	3.623	3.137	0.775	1.305	0.496	2.738	3148.25	0.58	8.09	76.24	1.1	1.57	0.44	0.519	0.29	2.34	
3149.18	1.523	10.449	67.118	6.580	4.449	0.674	1.124	0.742	5.071	3149.18	0.9	11.7	68.06	3.33	2.45	0.39	0.5498	0.49	4.94	
3150.4	1.167	8.087	75.568	4.375	3.498	0.522	1.274	0.544	3.409	3150.4	0.57	8.67	74.71	1.34	1.81	0.27	0.5218	0.33	2.49	
3152.51	1.750	9.885	72.327	3.467	3.904	0.586	1.093	0.676	3.443	3152.51	0.66	10.6	72.02	1.5	2.16	0.3	0.5126	0.39	2.63	
3153.93	3.046	10.888	56.860	5.408	4.034	9.636	1.233	0.828	5.496	3153.93	2.33	11.44	58.56	2.44	2.28	5.29	0.556	0.54	4.17	
3154.7	4.405	7.293	53.009	4.119	2.341	19.591	0.880	0.664	5.085	3154.7	3.51	7.48	52.9	1.56	1.31	10.29	0.3896	0.39	3.24	
3155.9	2.152	12.501	57.931	8.437	4.519	2.978	1.022	1.028	6.756	3155.9	1.46	12.93	59.4	4.36	2.33	1.8	0.414	0.69	6.5	
3156.9	1.494	8.617	73.213	3.248	3.459	2.431	0.879	0.572	3.861	3156.9	0.93	9.43	73.86	1.35	1.89	1.26	0.3947	0.37	3.01	
3158	1.679	11.655	67.393	4.178	4.800	1.792	0.871	0.818	4.471	3158	0.96	12.56	68.3	1.67	2.55	0.89	0.3935	0.53	3.36	
3158.75	1.320	7.886	74.933	3.501	3.207	1.876	0.755	0.560	3.716	3158.75	0.76	8.8	75.04	1.65	1.73	0.93	0.3476	0.36	3.3	
3159.77	1.267	7.649	75.500	3.512	3.035	1.796	0.783	0.528	3.727	3159.77	0.73	8.31	75.47	1.91	1.63	0.95	0.3532	0.33	3.52	
3160.8	1.256	7.478	77.451	2.739	3.048	1.560	0.629	0.559	2.927	3160.8	0.65	8.04	77.6	1	1.57	0.76	0.2952	0.35	2.34	
3164	3.563	14.290	52.531	5.278	5.536	0.572	0.872	0.873	4.882	3164	2.95	15.04	53.25	1.64	3.18	5.66	0.4192	0.66	5.28	
3267.92	0.910	4.423	69.729	4.776	2.131	13.680	0.112	0.326	2.517	3267.92	0.55	4.27	69.22	1.5	1.12	7.01	0.1028	0.2	2.1	
3270.66	1.081	5.246	62.073	4.924	2.661	17.628	0.120	0.427	2.948	3270.66	0.62	5.32	63.84	1.68	1.38	8.91	0.1088	0.25	2.12	
3271.61	5.208	4.550	45.593	3.746	1.964	33.177	0.175	0.378	2.620	3271.61	4.45	4.19	45.52	1.45	1.08	17.52	0.1364	0.2	1.8	
3272.77	1.700	5.792	59.981	4.982	2.876	18.121	0.175	0.451	3.314	3272.77	1.41	6.15	59.53	1.98	1.59	10.48	0.1377	0.28	2.42	
3273.91	1.006	4.992	71.294	5.196	2.500	9.014	0.132	0.384	2.853	3273.91	0.54	5.13	72.59	1.61	1.26	4.51	0.0972	0.24	2.09	
3274.8	0.814	3.640	50.079	3.423	1.600	34.873	1.148	0.314	2.479	3274.8	0.51	3.34	50.81	1.17	0.84	20.31	0.0926	0.15	1.41	
3275.75	1.348	6.969	51.976	5.809	3.483	22.570	0.245	0.548	4.125	3275.75	0.87	7.54	54.76	2.31	2.03	11.79	0.1843	0.34	2.85	
3276.75	1.616	2.045	6.950	1.444	0.814	82.659	0.185	0.236	4.136	3276.75	1.13	2.16	9.17	0.77	0.56	46.41	0.1057	0.11	0.94	
3278.47	1.315	2.791	9.456	1.510	1.254	78.921	0.430	0.288	1.575	3278.47	0.93	2.89	11.89	0.87	0.81	44.8	0.1838	0.15	1.11	
3279	1.200	2.237	8.059	1.181	0.939	82.059	0.283	0.259	1.249	3279	0.84	2.22	10.14	0.68	0.62	46.8	0.1826	0.12	0.88	
3280.02	3.725	2.547	8.317	1.106	0.970	78.917	0.062	0.272	1.504	3280.02	2.52	2.23	8.63	0.67	0.56	45.99	0.071	0.12	0.92	
3280.47	1.350	2.156	7.881	0.801	0.893	84.048	0.059	0.244	1.042	3280.47	0.82	1.66	8.26	0.42	0.48	49.11	0.0491	0.09	0.59	
3281.38	1.334	0.390	1.119	0.197	0.188	93.507	0.044	0.073	0.309	3281.38	0.81	0.92	3.89	0.43	0.23	52.34	0.0585	0.05	0.54	
3282.32	1.008	0.267	1.345	0.205	0.175	93.744	0.174	0.078	0.269	3282.32	0.61	0.18	1.48	0.1	0.05	54.43	0.0254	0.01	0.12	
3283.34	1.259	0.577	1.097	0.381	0.253	93.966	0.162	0.105	0.471	3283.34	0.65	0.35	1	0.19	0.08	54.42	0.0404	0.02	0.21	
3284.3	1.130																			

Table DR3

First Test										Second Test									
Depth	Mg	Al	Si	S	K	Ca	Ba	Ti	Fe	Depth	Mg	Al	Si	S	K	Ca	Ba	Ti	Fe
m	%	%	%	%	%	%	%	%	%	m	%	%	%	%	%	%	%	%	%
3141	1	4.8	82.9	2.6	2	1.6	1.6	0.4	1.8	3141	1	4.7	86.1	1.4	1.7	1	1.3	0.3	1.4
3141.001	1.1	5	82.5	2.6	2	1.6	1.6	0.4	1.9	3141.001	1	4.6	86.1	1.3	1.8	1	1.5	0.3	1.4
3141.003	0.9	4.7	84.6	2.1	1.8	1.1	1.3	0.4	1.7	3141.003	0.9	4.5	86	1.3	1.7	1.1	1.3	0.4	1.4
3141.004	0.9	4.8	85.5	1.6	1.8	0.9	1.4	0.4	1.5	3141.004	0.9	4.8	85.7	1.5	1.9	0.8	1.4	0.3	1.5
3141.006	0.9	4.6	86.3	1.3	1.8	1.1	1.2	0.4	1.4	3141.006	1	4.7	85.6	1.4	1.8	1	1.4	0.4	1.4
3141.007	0.9	4.5	86.2	1.6	1.7	1	1.4	0.3	1.4	3141.007	1.6	5.3	83.2	2	2.2	0.7	1.4	0.5	1.7
3141.009	1	4.5	85.3	1.9	1.7	1.2	1.4	0.3	1.6	3141.009	0.9	4.9	84.9	1.8	2	0.7	1.4	0.4	1.7
3141.01	1	4.8	85.3	1.6	1.8	1.2	1.3	0.4	1.5	3141.01	0.9	4.7	85.8	1.5	1.8	0.8	1.3	0.4	1.5
3141.012	1	4.9	85	1.6	1.9	1.2	1.4	0.4	1.5	3141.012	1.1	4.8	85.9	1.2	1.8	0.9	1.4	0.4	1.3
3141.013	1.1	4.6	85.1	1.7	1.7	1.3	1.4	0.3	1.6	3141.013	1.2	4.3	86.2	1.4	1.7	1.1	1.3	0.3	1.4
3141.015	0.9	4.6	85.1	1.7	1.9	1.4	1.2	0.4	1.6	3141.015	1.1	4.4	86.6	1.2	1.5	1	1.4	0.3	1.3
3141.016	1	4.6	86.2	1.3	1.7	1.1	1.4	0.3	1.3	3141.016	1.1	4.5	86.3	1.5	1.7	0.9	1.2	0.3	1.4
3141.018	0.8	4.7	85.4	1.9	1.7	0.9	1.2	0.3	1.3	3141.018	1	4.7	85.6	1.4	1.8	1.1	1.3	0.4	1.5
3141.019	1.3	4.7	85.3	1.5	1.7	1.3	1.1	0.3	1.4	3141.019	0.9	4.6	86.1	1.4	1.7	1.1	1.3	0.3	1.4
3141.021	1.1	4.4	86.2	1.3	1.6	1.2	1.4	0.3	1.4	3141.021	1.2	4.6	85.6	1.5	1.7	1.2	1.2	0.3	1.5
3141.022	1	4.5	85.5	1.7	1.7	1.1	1.3	0.3	1.5	3141.022	1	4.4	85.7	1.5	1.8	1.4	1.2	0.4	1.5
3141.024	1	4.5	85.2	2.1	1.7	1.2	1.2	0.3	1.7	3141.024	1	4.4	84.6	1.6	1.6	1	1.3	0.3	1.4
3141.025	1.1	4.7	85.3	1.4	1.8	1.3	1.3	0.4	1.5	3141.025	1.1	4.4	85.1	1.5	1.7	1.3	1.3	0.3	1.4
3141.027	1	4.9	84.7	1.7	1.9	1.2	1.3	0.4	1.6	3141.027	1.2	4.3	85.9	1.6	1.6	1.1	1.4	0.3	1.3
3141.028	1.1	4.8	83.5	2.6	1.8	1.3	1.2	0.4	2	3141.028	1	4.4	86	1.4	1.7	1.1	1.2	0.3	1.5
3141.03	1.2	4.9	84.1	1.8	1.9	1.6	1.3	0.3	1.7	3141.03	1	4.4	86.1	1.2	1.6	1.3	1.2	0.3	1.4
3141.031	1	4.7	85.1	1.7	1.8	1.2	1.4	0.4	1.6	3141.031	0.9	4.7	84.1	1.8	1.9	1.6	1.4	0.4	1.8
3141.033	1.2	4.7	85.5	1.3	1.7	1.4	1.2	0.4	1.4	3141.033	1	4.7	84.5	2.2	1.8	1	1.5	0.3	1.8
3141.034	1.1	4.4	85.7	1.4	1.7	1.5	1.3	0.3	1.4	3141.034	1	4.6	85.2	1.6	1.7	1.4	1.3	0.3	1.5
3141.036	1.2	4.3	86.5	1.3	1.6	1.2	1.2	0.3	1.3	3141.036	0.9	4.6	85.2	1.9	1.8	1	1.4	0.3	1.7
3141.037	0.8	4.2	87.3	1.2	1.6	1	1.2	0.3	1.2	3141.037	1	4.6	86.1	1.2	1.8	1.2	1.3	0.3	1.4
3141.039	1.1	4.2	86.4	1.4	1.6	1.2	1.3	0.3	1.3	3141.039	1.1	4.4	86	1.5	1.7	1.3	1.3	0.3	1.3
3141.04	0.9	4.2	86.4	1.5	1.6	1.2	1.1	0.4	1.4	3141.04	0.8	4	87.5	1.2	1.6	1.1	1.3	0.3	1.2
3141.041	1	4.3	86.5	1.3	1.7	1	1.3	0.3	1.3	3141.041	1	4.2	87.2	1.3	1.6	0.9	1.3	0.3	1.2
3141.043	1.3	4.4	84.9	1.7	1.6	1.7	1.4	0.3	1.6	3141.043	1.1	4.2	86.8	1.2	1.6	1.2	1.1	0.3	1.3
3141.044	0.9	4.7	86.5	1.3	1.8	0.8	1.3	0.3	1.3	3141.044	0.8	4.1	87	1.4	1.6	1	1.3	0.3	1.3
3141.046	0.9	4.4	85.7	1.8	1.6	1.3	1.2	0.3	1.6	3141.046	1	4.2	86.9	1	1.6	1.2	1.2	0.3	1.3
3141.047	1.1	4.6	85.4	1.3	1.7	1.6	1.1	0.4	1.4	3141.047	1.1	4.3	85.7	1.6	1.6	1.5	1.2	0.3	1.5
3141.049	1.2	4.6	85.4	1.4	1.8	1.3	1.2	0.4	1.4	3141.049	1	4.5	86	1.6	1.7	1	1.3	0.3	1.4
3141.05	0.9	4.5	86.3	1.2	1.7	1.2	1.3	0.4	1.3	3141.05	1	4.4	86.5	1.3	1.6	1.1	1.2	0.3	1.4
3141.052	0.9	4.6	86	1.3	1.7	1.2	1.4	0.3	1.3	3141.052	1	4.6	85.5	1.7	1.7	1.4	1.2	0.3	1.5
3141.053	1.1	4.9	85.2	1.4	1.8	1.1	1.4	0.3	1.4	3141.053	1	4.4	86.7	1.2	1.7	1	1.3	0.4	1.3
3141.055	0.8	5.1	85.4	1.4	2	0.8	1.5	0.4	1.4	3141.055	1	4.4	86.3	1.2	1.6	1	1.2	0.4	1.3
3141.056	1	5.3	84.3	1.6	2.1	0.9	1.5	0.4	1.6	3141.056	1.1	4.7	85.7	1.5	1.8	1	1.3	0.4	1.4
3141.058	1	5.5	83.3	2.2	2.3	0.8	1.4	0.4	1.8	3141.058	1	4.8	85.8	1.5	1.9	0.8	1.4	0.4	1.3
3141.059	0.8	5.2	82.3	3.3	2.1	1	1.3	0.4	2.3	3141.059	1.1	5.3	84.3	1.6	2.1	1	1.6	0.3	1.5
3141.061	0.8	5.3	82.8	3	2.1	0.7	1.3	0.4	2.3	3141.061	0.9	5.4	83.6	2.1	2.1	0.8	1.4	0.4	1.9
3141.062	1.1	5.1	84.1	2.2	2	0.7	1.4	0.4	1.7	3141.062	0.9	5.1	83.8	2.2	2	0.9	1.5	0.4	2
3141.064	1	4.8	86.1	1.2	1.9	0.9	1.2	0.4	1.3	3141.064	0.9	5	84	2.5	2	0.7	1.3	0.4	1.9
3141.065	1.3	4.6	85.4	1.4	1.8	1.2	1.4	0.3	1.4	3141.065	1.1	4.7	86.1	1.1	1.9	0.8	1.4	0.4	1.3
3141.067	0.8	4.4	86.5	1.4	1.7	1	1.5	0.3	1.3	3141.067	1	4.7	85.8	1.5	1.8	1.1	1.3	0.4	1.4
3141.068	0.9	4.4	85.9	2.1	1.7	0.7	1.3	0.3	1.5	3141.068	1	4.4	86.8	1.2	1.7	0.9	1.2	0.3	1.2
3141.07	1	4.8	86.3	1.4	1.8	0.7	1.2	0.3	1.3	3141.07	0.6	4.4	86.6	1.8	1.8	0.6	1.1	0.3	1.5
3141.071	0.9	4.6	86.1	1.8	1.9	0.6	1.1	0.3	1.5	3141.071	0.9	4.6	87	1.3	1.8	0.6	1.2	0.3	1.2
3141.073	0.8	4.6	84.9	2	1.8	1	1.2	0.4	2	3141.073	0.8	4.4	85.5	2.3	1.8	0.6	1.1	0.3	1.8
3141.074	0.9	4.7	86.4	1.3	1.8	1	1.1	0.4	1.3	3141.074	0.9	4.5	85.6	1.6	1.8	1.1	1.3	0.3	1.8
3141.076	1	4.7	84.8	2.4	1.7	1	1.1	0.3	1.8	3141.076	1.1	4.4	86.1	1.5	1.7	1.2	1.2	0.3	1.4
3141.077	0.7	4.5	82.7	4.5	1.7	0.8	1.2	0.3	2.6	3141.077	0.9	4.4	83.4	3.6	1.6	1	1.2	0.3	2.4
3141.078	1	4.6	85.2	2.4	1.6	0.7	1.3	0.3	1.8	3141.078	0.9	4.4	84.9	2.9	1.6	0.8	1.1	0.3	2
3141.08	1	4.5	85.6	2.1	1.7	0.7	1.2	0.4	1.7	3141.08	1.1	4.3	86.2	1.9	1.6	0.7	1.2	0.3	1.5
3141.081	0.8	4.6	86.7	1.3	1.8	0.7	1.2	0.3	1.3	3141.081	0.8	4.4	87.4	1.2	1.7	0.6	1.2	0.3	1.2
3141.083	0.9	4.7	86.1	1.3	1.8	1.1	1.1	0.3	1.4	3141.083	0.9	4.4	86.9	1.1	1.7	1	1.3	0.3	1.3
3141.084	1	5	85.6	1.4	1.8	1.1	1.3	0.3	1.5	3141.084	1	4.5	86.3	1.4	1.6	1.1	1.2	0.3	1.4
3141.086	0.9	5	85.9	1.2	1.9	0.9	1.3	0.3	1.3	3141.086	1.1	4.9	85.6	1.5	1.9	0.9	1.2	0.4	1.5
3141.087	1.1	4.8	86.2	1.2	1.8	0.8	1.2	0.4	1.3	3141.087	1.1	4.7	85	2.2	1.8	0.8	1.1	0.4	1.7
3141.089	0.9	4.8	85.6	1.8	1.9	0.7	1.2	0.3	1.5	3141.089	0.8	4.7	8						

Table DR4

First Test										Second Test									
Depth m	Mg %	Al %	Si %	S %	K %	Ca %	Ba %	Ti %	Fe %	Depth m	Mg %	Al %	Si %	S %	K %	Ca %	Ba %	Ti %	Fe %
3144.9	1.2	7.8	75.4	4.3	3.2	1.3	1.8	0.5	3.2	3144.9	1.3	8.6	73.4	4.9	3.5	1.1	1.7	0.6	3.5
3144.901	1.4	7.9	75.2	4.1	3.1	1.3	2	0.5	3.2	3144.901	1.5	8.5	73.3	5	3.5	1.1	1.6	0.6	3.5
3144.903	1.1	8.8	73	5.2	3.7	1.2	1.5	0.7	3.6	3144.902	1.4	8	75.2	4.7	3.1	1.1	1.5	0.5	3.3
3144.904	1.5	9.2	71.7	5.4	3.7	1.1	1.5	0.6	3.9	3144.903	1.2	8.4	74.3	4.5	3.5	1.3	1.8	0.5	3.3
3144.906	1.4	9.7	70.3	5.5	4.1	1.2	1.7	0.7	4.1	3144.904	1.4	9.2	72.5	4.9	3.7	1.2	1.6	0.6	3.5
3144.907	1.4	10.1	68.6	6.1	4.4	1.1	1.5	0.8	4.3	3144.905	1.3	9.2	71.9	5.5	3.9	1.1	1.3	0.7	3.8
3144.908	1.5	10.1	67.8	6.8	4.2	1	1.5	0.8	4.6	3144.906	1.5	9.8	70.3	5.7	4	1.1	1.6	0.7	4
3144.91	1.6	10.4	67.4	6.8	4.4	0.9	1.6	0.7	4.6	3144.907	1.5	10.6	69.5	5.3	4.5	1	1.8	0.7	3.9
3144.911	1.2	10.7	69.2	5.5	4.6	0.9	1.6	0.8	4	3144.909	1.5	10.5	67.6	5.6	4.3	1.7	1.5	0.8	4.2
3144.913	1.4	10	69.1	6	4.2	1	1.5	0.7	4.3	3144.91	1.1	10.1	67.8	6	4.3	1.8	1.6	0.7	4.3
3144.914	1.3	9.5	70.7	5.9	4.1	1	1.6	0.7	4.1	3144.911	1.4	10.7	68.4	6.3	4.5	0.8	1.4	0.8	4.3
3144.915	1.5	9.6	71.7	4.8	3.9	1.1	1.6	0.7	3.6	3144.912	1.3	10.9	67.9	6.4	4.5	0.9	1.6	0.8	4.3
3144.917	1.5	9.6	71	5.6	4	0.9	1.6	0.6	3.8	3144.913	1.3	10.5	68.2	7	4.3	0.8	1.4	0.7	4.5
3144.918	1.5	9.9	70.4	5.5	4.2	0.9	1.7	0.7	3.9	3144.914	1.4	10.1	69.2	6.4	4.2	1	1.5	0.7	4.2
3144.919	1.5	10	71.4	4.7	4.1	1.1	1.6	0.7	3.7	3144.915	1.1	9.7	69	5.3	4.2	1.9	1.8	0.6	3.9
3144.921	1.2	9.8	71.4	4.7	4.1	1.2	1.8	0.6	3.6	3144.916	1.3	9.8	71	5.2	4	1.4	1.6	0.6	3.6
3144.922	1.5	10	71	5.1	4.1	1.1	1.7	0.6	3.7	3144.917	1.4	9.6	71	5.9	3.9	1	1.6	0.6	3.8
3144.924	1.3	9.5	71.3	5.6	4	1	1.7	0.6	4	3144.918	1.2	9.9	70.2	6.3	4.1	1	1.6	0.7	3.9
3144.925	1.4	9.6	71.8	4.8	4	1.1	1.6	0.6	3.7	3144.919	1.4	10.1	69.9	5.8	4.3	1.1	1.8	0.6	3.7
3144.926	1.4	9.6	70.9	5.3	4.2	0.9	1.5	0.7	4	3144.92	1.5	10.1	69.4	6	4.2	1.1	1.5	0.7	4
3144.928	1.1	9.5	71.6	4.8	3.9	1.2	1.8	0.6	3.8	3144.921	1.5	9.9	68.8	6.6	4.2	1.1	1.6	0.7	4.3
3144.929	1.2	10.3	70.3	5.5	4.3	0.9	1.7	0.7	3.9	3144.922	1.4	10.2	70.1	5.7	4.1	1.1	1.5	0.7	4.1
3144.931	1.5	10.2	70	5.2	4.4	0.9	1.7	0.7	3.9	3144.923	1.4	10	71.4	4.7	4.2	1.1	1.8	0.6	3.8
3144.932	1.6	10.2	70.7	4.9	4.4	0.9	1.6	0.7	3.7	3144.925	1.3	9.8	71.4	5.1	4.1	1	1.6	0.7	3.9
3144.933	1.4	9.8	70	5.9	4.1	1.1	1.7	0.6	4.1	3144.926	1.5	9.6	70.8	5.6	3.9	1.2	1.6	0.7	4
3144.935	1.3	9.2	63.8	11.1	3.8	1	1.4	0.6	6	3144.927	1.4	9.8	69.9	6.1	4.1	1.1	1.7	0.6	4.1
3144.936	1.5	10	70.3	4.9	4.3	1.1	1.8	0.7	4.2	3144.928	1.5	10.1	70.9	5.1	4.1	0.9	1.6	0.7	3.7
3144.938	1.6	9.4	72.2	4.1	4	1.4	1.8	0.6	3.5	3144.929	1.5	9.9	70.7	5.5	4	1	1.6	0.7	3.8
3144.939	1.3	9.2	72.8	4.5	3.8	1.5	1.7	0.6	3.5	3144.93	1.5	10.5	70	5.3	4.3	0.9	1.6	0.7	3.7
3144.94	1.5	9.2	72.5	4.8	3.8	1.4	1.7	0.6	3.5	3144.931	1.4	10.6	69.3	5.7	4.6	0.9	1.6	0.7	3.9
3144.942	1.5	9.1	73	4.4	3.7	1.4	1.7	0.6	3.3	3144.932	1.3	10.4	68.3	6.7	4.5	0.9	1.8	0.7	4.2
3144.943	1.3	9.1	72.6	4.8	3.9	1.1	1.7	0.6	3.5	3144.933	1.4	10.5	68.9	6.3	4.3	1	1.7	0.7	4
3144.944	1.2	9.3	72.3	4.7	3.9	1.2	1.6	0.6	3.6	3144.935	1.5	9.9	68.9	6.9	4.1	1.1	1.5	0.7	4.3
3144.946	1.2	9.5	72	4.3	4.1	1.5	1.8	0.6	3.6	3144.937	1.4	10.2	68.7	6.9	4.1	1.1	1.6	0.7	4.2
3144.947	1.8	9.5	71.7	4.8	4	1.2	1.6	0.6	3.6	3144.939	1.7	9.8	71.5	5	4	1.2	1.6	0.6	3.5
3144.949	1.3	9.5	72.8	4.4	4	1.1	1.8	0.6	3.3	3144.94	1.3	9.6	71.3	5.4	3.9	1.3	1.4	0.6	3.8
3144.95	1.1	9.3	71.7	4.3	4	1.8	1.7	0.6	3.3	3144.942	1.6	9.1	70.8	5.6	3.7	1.7	1.6	0.6	3.9
3144.951	1.5	9.8	71.6	4.4	4.3	1.2	1.6	0.7	3.5	3144.944	1.6	9.5	72.3	4.6	3.9	1.3	1.7	0.6	3.2
3144.953	1.5	10.2	71.3	4.7	4.3	1.1	1.6	0.7	3.6	3144.946	1.5	9.5	72	4.7	3.9	1.3	1.8	0.6	3.4
3144.954	1.6	10.2	70	5.5	4.2	0.9	1.7	0.7	4	3144.947	1.4	9.9	71.5	5.1	4	1.2	1.5	0.7	3.5
3144.956	1.4	10.3	70.4	4.7	4.4	1.3	1.6	0.7	3.6	3144.949	1.4	9.9	73.1	3.9	4	1.2	1.7	0.6	3
3144.957	1.3	10.1	70.4	5.2	4.3	0.9	1.7	0.7	3.9	3144.951	1.4	9.9	72.3	4.5	4	1.2	1.5	0.7	3.2
3144.958	1.7	10.4	70	5	4.3	1	1.5	0.7	3.8	3144.953	1.3	10.5	70.9	4.9	4.4	0.9	1.7	0.7	3.5
3144.96	1.4	10.8	68.6	5.4	4.7	0.9	1.7	0.7	4.1	3144.955	1.4	10.4	70.5	5.2	4.3	1	1.6	0.7	3.7
3144.961	1.6	11.3	68.5	5.1	4.9	0.9	1.7	0.7	3.9	3144.956	1.6	10.4	70.1	5.2	4.5	1	1.8	0.7	3.6
3144.963	1.5	10.9	68.6	5.5	4.5	1.2	1.5	0.8	4	3144.958	1.6	10.1	69.6	5.8	4.3	1	1.6	0.7	4.1
3144.964	1.4	10.8	69	5.6	4.6	1.1	1.5	0.8	4	3144.96	1.6	10.7	69.9	5	4.5	1.1	1.7	0.7	3.6
3144.965	1.7	11	69.1	5.2	4.7	0.8	1.8	0.7	3.9	3144.962	1.6	11.3	68.2	5.4	4.8	0.9	1.7	0.8	4
3144.967	1.4	10.6	69.9	4.7	4.6	0.9	1.6	0.7	3.9	3144.963	1.6	10.9	68.7	5.3	4.7	1.1	1.7	0.7	3.8
3144.968	1.4	10.2	65.9	7.9	4.4	1	1.6	0.7	4.8	3144.965	1.7	10.9	68.1	5.8	4.7	1.1	1.8	0.7	4
3144.969	1.4	10.6	69.6	5.3	4.5	0.9	1.6	0.7	3.7	3144.967	1.4	11	67.5	5.3	4.5	1.7	1.7	0.7	4
3144.971	1.3	10.9	69.1	5.3	4.7	0.7	1.6	0.7	4	3144.969	1.5	10.9	68.5	5.7	4.7	1	1.6	0.7	4.1
3144.972	1.3	10.9	69.3	5.2	4.7	0.7	1.6	0.8	3.9	3144.97	1.5	11	69.7	5.1	4.5	0.8	1.7	0.7	3.8
3144.974	1.4	11	69.4	5.4	4.5	0.7	1.8	0.7	4	3144.972	1.4	11.3	67.7	6.2	4.8	0.8	1.7	0.7	4.2
3144.975	1.5	11.3	68.7	5.2	4.9	0.7	1.6	0.8	4	3144.974	1.5	11.2	68.8	5.3	4.8	0.9	1.8	0.7	3.8
3144.976	1.5	11.2	68.2	5.5	4.8	0.7	1.5	0.8	4.1	3144.976	1.5	11	67.8	6.6	4.7	0.7	1.8	0.7	4
3144.978	1.4	11.1	70.5	4.5	4.7	0.6	1.7	0.8	3.5	3144.977	1.4	11.6	68	5.9	5	0.6	1.7	0.8	3.9
3144.979	1.8	11.5	69.5	4.1	5.1	0.6	1.4	0.9	3.5	3144.979	1.4	11.2	68.7	5.2	4.8	1.1	1.7	0.7	3.7
3144.981	1.3	11.2	68.5	5.3	4.8	0.6	1.6	0.7	4.2	3144.981	1.3	11.5	67.8	6.2	4.9	0.6	1.5	0.8	4.1
3144.982	1.6	11.1	68.6	5.6	4.6	0.7	1.7	0.7	4.1	3144.983	1.3	11.1	68	6.2	4.9	0.7	1.7	0.8	4.1
3144.983	1.3	10.8	69.4	5.5	4.7	0.6	1.7	0.7	3.9	3144.985	1.6	11.1	69	5.7	4.7	0.5	1.6	0.	

Table DR5

First Test										Second Test									
Depth m	Mg %	Al %	Si %	S %	K %	Ca %	Ba %	Ti %	Fe %	Depth m	Mg %	Al %	Si %	S %	K %	Ca %	Ba %	Ti %	Fe %
3270.66	1.3	5.2	57.8	5.3	2.4	22.4	0.7	0.4	2.8	3270.66	0.8	4.6	56.2	3.9	2.1	26.6	0.2	0.4	2.4
3270.661	0.7	5	58.5	5.1	2.4	22.7	0.6	0.4	2.8	3270.661	1.1	4.6	56.1	3.9	2.2	26.5	0.3	0.3	2.4
3270.663	1.1	4.7	58.3	4.6	2.3	24.2	0.3	0.3	2.6	3270.663	1.2	4.9	57.7	4.4	2.4	23.6	0.2	0.4	2.6
3270.664	1	4.8	57.5	4.3	2.2	25.7	0.1	0.4	2.5	3270.664	1.3	4.9	58.9	4.9	2.4	21.7	0	0.5	2.9
3270.666	1	4.8	59	5	2.4	22.9	0.2	0.3	2.8	3270.666	1.3	5.3	61.4	5.1	2.5	18.6	0	0.5	2.9
3270.667	0.9	5.3	62.9	5.3	2.5	17.8	0.2	0.4	3.1	3270.667	1	5.2	61.5	5	2.5	18.7	0.2	0.4	2.9
3270.668	0.9	5.3	62.6	5.4	2.6	18.1	0.1	0.4	2.9	3270.668	1	5.2	61	4.7	2.4	19.4	0.1	0.4	2.8
3270.67	1.3	5.1	62.2	5.3	2.5	18.7	0.1	0.4	2.9	3270.67	1.3	5.3	61.3	5.3	2.5	18	0.1	0.4	2.9
3270.671	1	5.3	63.5	5.3	2.7	16.9	0.2	0.4	3	3270.671	1	5.1	61.5	5.4	2.7	17.7	0.2	0.4	3.1
3270.672	1.1	5.3	62.6	5.3	2.7	17.9	0.2	0.4	3	3270.672	1.2	5.5	61.3	5.1	2.7	18	0.1	0.4	2.9
3270.674	0.9	5.4	62.4	5	2.7	18.5	0.1	0.4	2.9	3270.674	1.1	5.3	61.2	4.9	2.7	17.9	0.2	0.4	3
3270.675	1.3	5.4	63.3	5.6	2.8	16.2	0.2	0.4	3.1	3270.675	1	5.7	63.3	5.5	2.9	14.9	0.2	0.4	3.1
3270.677	1	5.9	63.8	5.9	2.9	14.8	0.2	0.5	3.3	3270.677	1.4	6.4	62.4	6	3.2	13.7	0.2	0.5	3.4
3270.678	1.3	8.2	61.5	8	4.3	9.3	0	0.7	4.6	3270.678	1.4	8	59.7	8.4	4.2	8.7	0.1	0.7	5.2
3270.679	1.1	6.1	65.1	5.7	3.3	13.2	0.2	0.5	3.1	3270.679	1.5	6.9	61.6	6.4	3.9	11.7	0	0.7	4
3270.681	0.9	5.5	65.9	5.4	2.8	14.4	0	0.5	2.9	3270.681	1	5.6	64.9	4.9	2.8	14.3	0	0.5	2.8
3270.682	1.2	5.3	63.2	5.3	2.5	17.4	0.2	0.4	2.7	3270.682	0.9	5.3	64.7	4.9	2.7	15.3	0.1	0.4	2.8
3270.683	1	5.2	65.3	5.1	2.5	15.9	0.2	0.4	2.7	3270.683	0.9	5	62.1	4.6	2.6	18.5	0	0.5	2.8
3270.685	0.9	5	63.9	5.1	2.4	18	0	0.4	2.6	3270.685	1.1	5.1	64.3	5.2	2.6	15.9	0	0.5	2.7
3270.686	0.8	4.9	65.5	5	2.5	16.5	0.1	0.4	2.5	3270.686	0.9	5.1	62.6	4.7	2.4	18.4	0	0.4	2.6
3270.688	1	4.7	60.1	4.5	2.2	22.9	0.1	0.4	2.5	3270.688	0.9	5	64.8	4.6	2.4	16.8	0	0.4	2.5
3270.689	0.9	4.6	57.7	4.6	2.2	25.2	0.2	0.3	2.5	3270.689	0.9	4.6	60.7	4	2.3	21.4	0	0.4	2.5
3270.69	0.7	4.8	62.5	5	2.3	19.8	0.2	0.4	2.6	3270.69	0.9	4.5	55.7	3.7	2	26.8	0.2	0.4	2.4
3270.692	0.8	5	62.9	4.9	2.4	19.2	0.1	0.4	2.5	3270.692	1.2	4.7	60.4	4.9	2.4	20.2	0.2	0.4	2.7
3270.693	0.9	5	64.2	5.2	2.6	17.1	0.3	0.4	2.8	3270.693	1.1	4.8	62.3	5	2.4	18.8	0	0.5	2.6
3270.695	0.9	5.1	62.1	4.8	2.5	19.7	0.1	0.4	2.6	3270.695	0.9	4.9	62.4	4.4	2.4	18.4	0.2	0.4	2.6
3270.696	1	5.2	62.2	5	2.6	19	0.1	0.4	2.8	3270.696	0.9	5.2	63.2	4.9	2.6	17	0.2	0.4	2.8
3270.697	0.9	5.3	63.6	5.4	2.7	17.1	0.1	0.5	2.8	3270.697	0.9	5	61.9	4.6	2.5	18.6	0	0.4	2.8
3270.699	0.8	5.2	60.6	5.7	2.5	20.1	0.2	0.4	2.9	3270.699	0.8	5	62	4.8	2.6	18.6	0.2	0.4	2.7
3270.7	1	5.3	61.9	5.4	2.7	18.6	0.1	0.4	2.9	3270.7	1.1	5.3	62.1	4.6	2.7	17.6	0.1	0.4	2.8
3270.701	0.9	5	62.1	4.9	2.6	19.6	0.2	0.3	2.8	3270.701	1.1	5.2	59.7	5.3	2.7	19.7	0.2	0.4	2.8
3270.703	1.1	5	61.7	5	2.5	19.9	0.1	0.4	2.8	3270.703	1.1	5.2	59.9	4.6	2.7	20.3	0.2	0.4	2.8
3270.704	1.2	5.2	61.3	5.1	2.7	18.2	0.2	0.4	4.1	3270.704	0.9	5.2	62.3	4.8	2.7	18.1	0.1	0.4	2.9
3270.706	1.1	5.2	61.4	5	2.8	18.2	0.2	0.4	4.2	3270.706	1	5.1	61.2	4.6	2.6	19.2	0.2	0.4	2.9
3270.707	1	5.2	63.4	5.4	2.7	17.4	0.1	0.4	3	3270.707	1.1	5	63	4.6	2.6	17.4	0	0.4	2.8
3270.708	0.8	5	62.9	5.9	2.8	17.7	0.2	0.4	3	3270.708	1	5.2	63.3	4.8	2.6	16.5	0.2	0.4	2.9
3270.71	1.1	5.1	63.3	5.2	2.6	17.9	0.1	0.4	2.9	3270.71	1	5.1	62.7	5.1	2.7	17.6	0	0.4	3
3270.711	1.2	5	62.8	5.1	2.6	18.4	0.1	0.4	2.9	3270.711	1	5.2	62.4	4.5	2.6	18	0.1	0.4	2.9
3270.712	1	5.2	62.6	5.5	2.6	17.9	0	0.4	3.1	3270.712	1.2	5.2	63.4	4.7	2.6	17.2	0	0.4	2.9
3270.714	1.3	5.2	61.9	5.4	2.6	18.5	0.1	0.4	3.1	3270.714	1.2	5.2	62.9	4.5	2.7	17.3	0	0.4	2.9
3270.715	1.1	5	60.9	5	2.5	20.5	0.2	0.4	3	3270.715	1	5.1	62.2	4.8	2.7	17.9	0.1	0.4	2.9
3270.717	1.2	5	59.7	5	2.6	21.4	0.3	0.4	3	3270.717	1	4.9	61.6	4.5	2.6	19.2	0.1	0.4	2.9
3270.718	0.9	5.1	61.7	4.9	2.6	19.9	0.2	0.4	2.9	3270.718	0.9	5	62.5	4.5	2.6	18.1	0.1	0.4	2.9
3270.719	1	5.1	63.4	5.3	2.5	17.9	0.2	0.4	2.9	3270.719	1	5.1	60.6	4.7	2.5	20.3	0.1	0.4	3
3270.721	1	5.1	65.4	5.1	2.7	15.9	0.2	0.4	2.8	3270.721	1.2	4.9	58.9	4.5	2.5	21.8	0.1	0.4	3
3270.722	1	5.1	65.3	5.3	2.7	15.5	0	0.4	3	3270.722	1.1	4.9	59.4	4.3	2.6	21.4	0.2	0.4	2.9
3270.723	1.1	5.2	66.5	5.4	2.7	14	0.1	0.4	3	3270.723	1	5	62.1	4.8	2.6	18.7	0.1	0.4	2.9
3270.725	1.1	5.2	66.5	5.1	2.7	14.5	0.2	0.4	3	3270.725	1	5.1	64.5	4.7	2.7	15.7	0.3	0.4	2.9
3270.726	1	5.3	65.3	5	2.7	15.8	0.2	0.4	2.9	3270.726	1.2	5.2	64.9	4.7	2.8	14.9	0.2	0.4	2.9
3270.728	0.9	5.1	65	5.2	2.6	16.4	0.1	0.4	2.9	3270.728	0.9	5.1	66.6	4.7	2.7	13.9	0.1	0.4	2.9
3270.729	1	4.9	64.6	5.3	2.5	16.7	0	0.4	2.9	3270.729	1.1	5	65.5	4.6	2.7	15.1	0.2	0.4	2.8
3270.73	1.1	4.9	65	5.1	2.4	16.7	0.2	0.4	2.7	3270.73	1.3	5.2	64.3	4.4	2.7	16	0.1	0.4	2.7
3270.732	1	5.1	64.6	4.9	2.4	17.4	0.1	0.4	2.5	3270.732	1.3	5	64.8	4.7	2.5	15.9	0.2	0.4	2.8
3270.733	1.1	6	61	5	3	17.1	0	0.5	4.6	3270.733	1	5	64.3	4.7	2.5	16.6	0.3	0.3	2.7
3270.735	1.7	6.8	57.5	7.2	3.6	15.4	0.3	0.6	4.9	3270.735	1.3	5	63.7	4.5	2.5	16.9	0.1	0.4	2.6
3270.736	1.2	6.1	61.2	6.5	3.2	16	0.1	0.5	3.6	3270.736	1.2	5.5	61.4	4.9	2.8	17.4	0.2	0.5	3.5
3270.737	1	5.4	64.7	4.9	2.7	16.5	0.3	0.4	2.7	3270.737	1.3	6.3	55.7	7.7	3.4	16.1	0.2	0.6	5.3
3270.739	1.2	5.2	64.2	5.7	2.7	15.8	0.2	0.4	3.2	3270.739	1.1	6.1	59.2	7.1	3	15.2	0.2	0.5	4.1
3270.74	1.2	5.3	65.5	5.6	2.7	14.5	0.3	0.4	3.1	3270.74	1.1	5.3	64	4.6	2.6	16.2	0.1	0.4	2.7
3270.741	1.5	5.4	66.1	5.5	2.9	13.6	0.1	0.5	3	3270.741	1.2	5.3	63.2	5.6	2.5	15.5	0.2	0.4	3.4
3270.743	1.2	5.7	66.3	5.6	2.9	13.2	0	0.5	3.1	3270.743	1.2	5.4	65.4	4.8	2.9	14.1	0.2	0.4	2.9
3270.744																			

Figure DR1

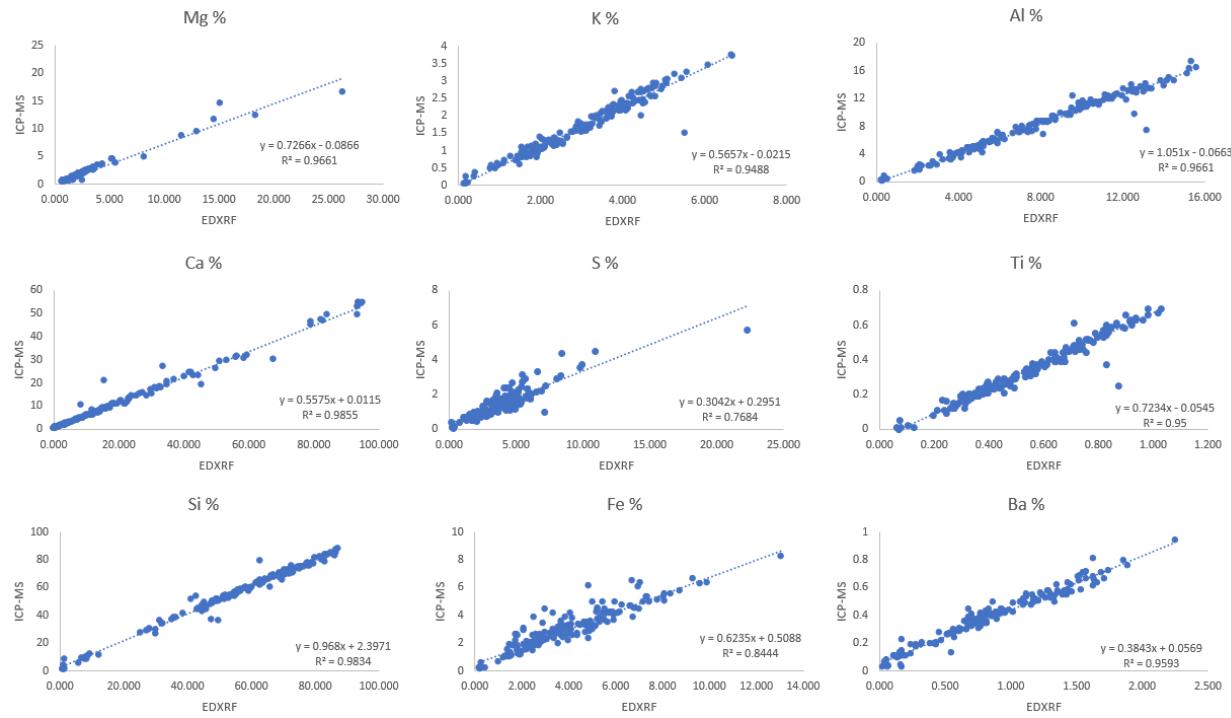


Figure DR2

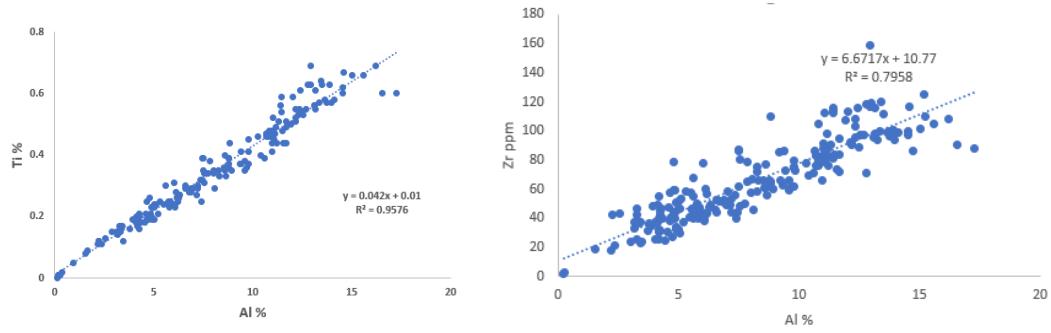


Figure DR3

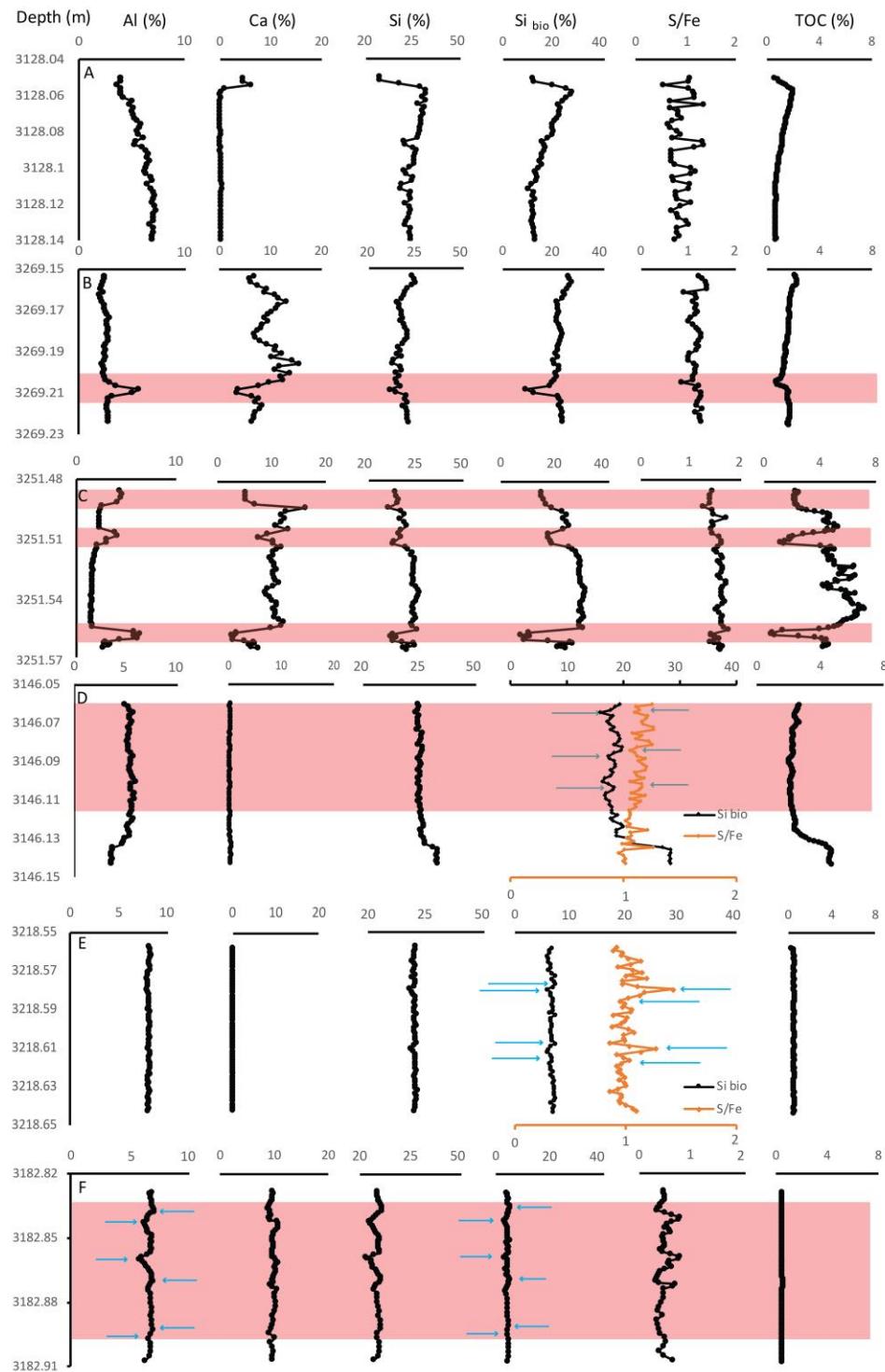


Figure DR4

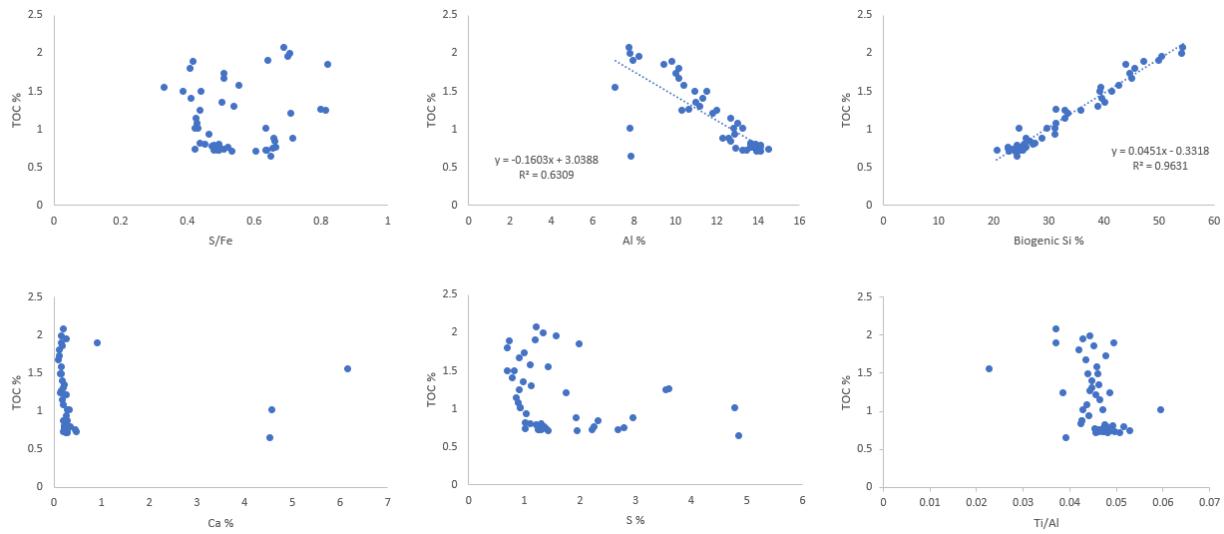


Figure DR5

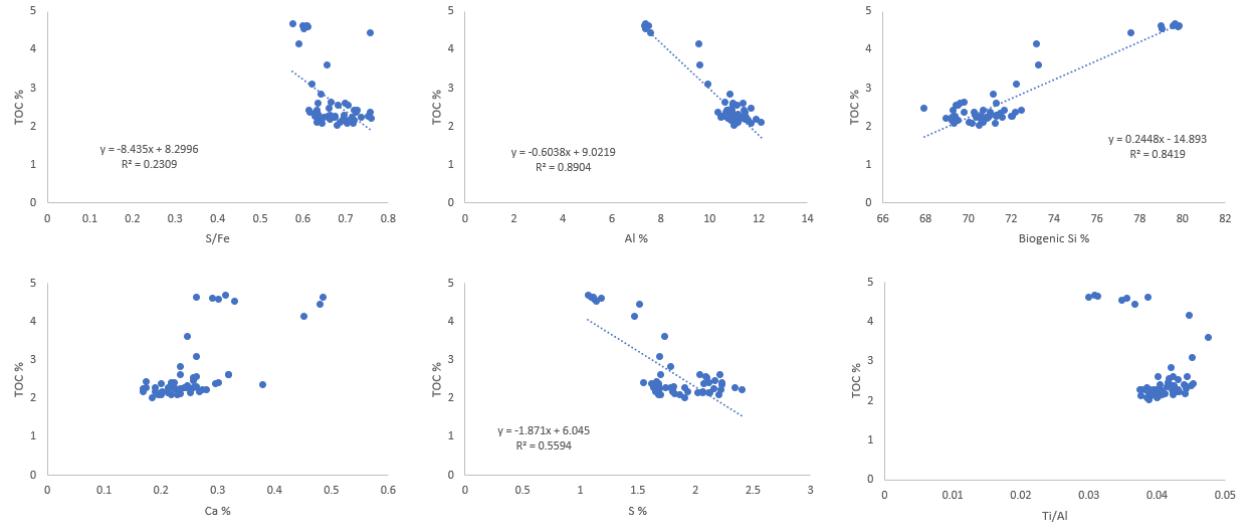


Figure DR6

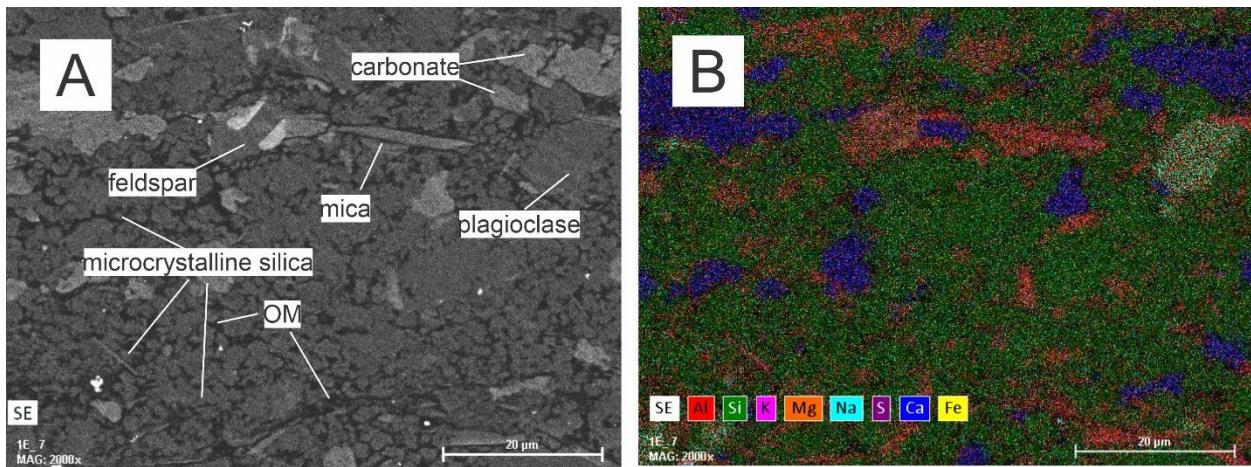
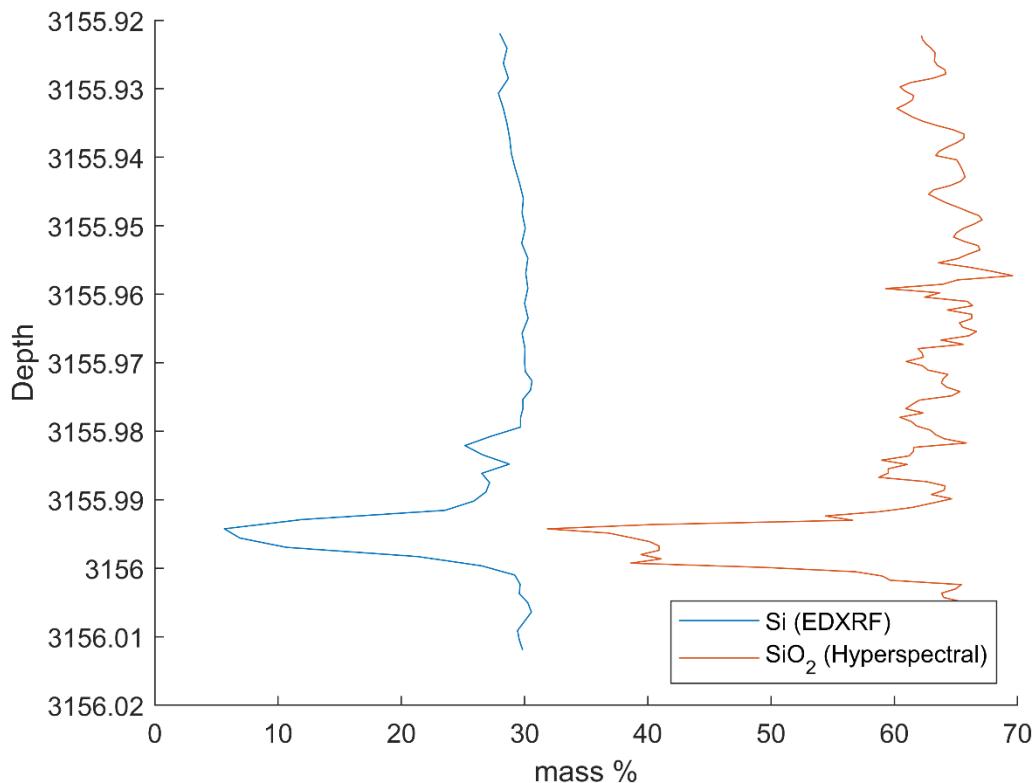


Figure DR7



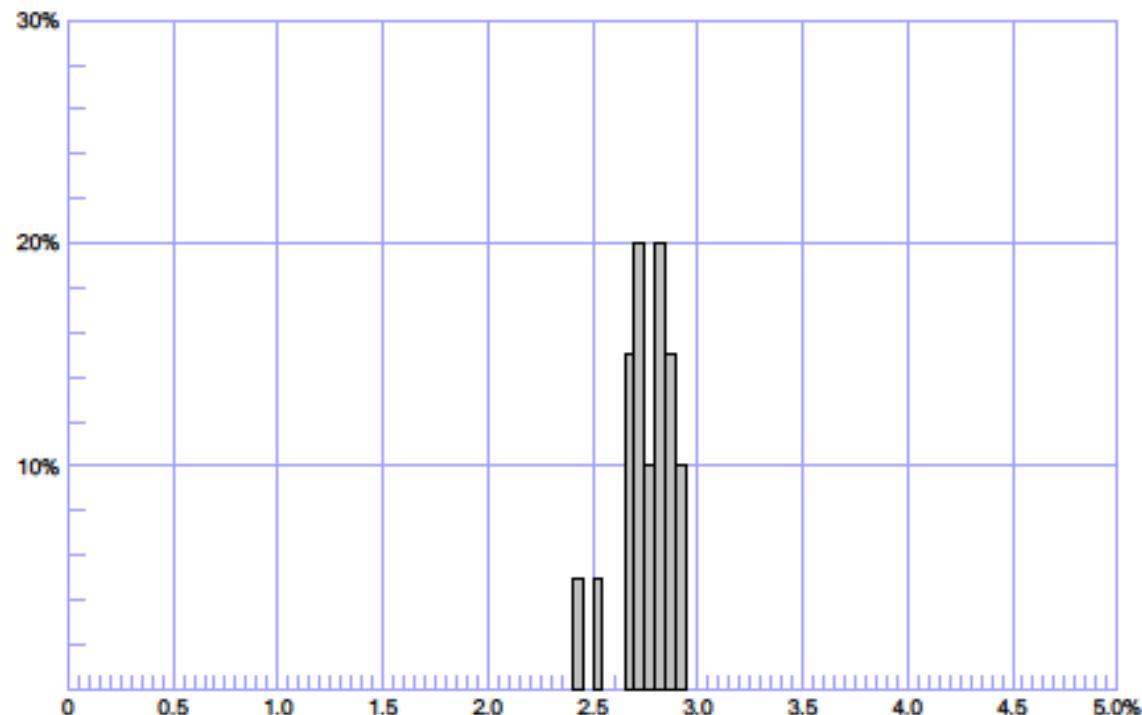
File DR1

The data contained in this data package were collected according to the quality requirements of the U.S. Geological Survey Energy and Minerals Mission Area Quality Management System. The data have undergone secondary data review by a technical expert. The data have not been formally peer reviewed, nor approved for public release by the Director of the U.S. Geological Survey. As such, the data are considered provisional and are subject to revision. Neither the U.S. Geological Survey nor the United States Government may be held liable for any damages resulting from authorized or unauthorized data use. All USGS-generated data are available from <https://doi.org/10.5066/P9OVXH6H>.

E200205 Tattoo summary

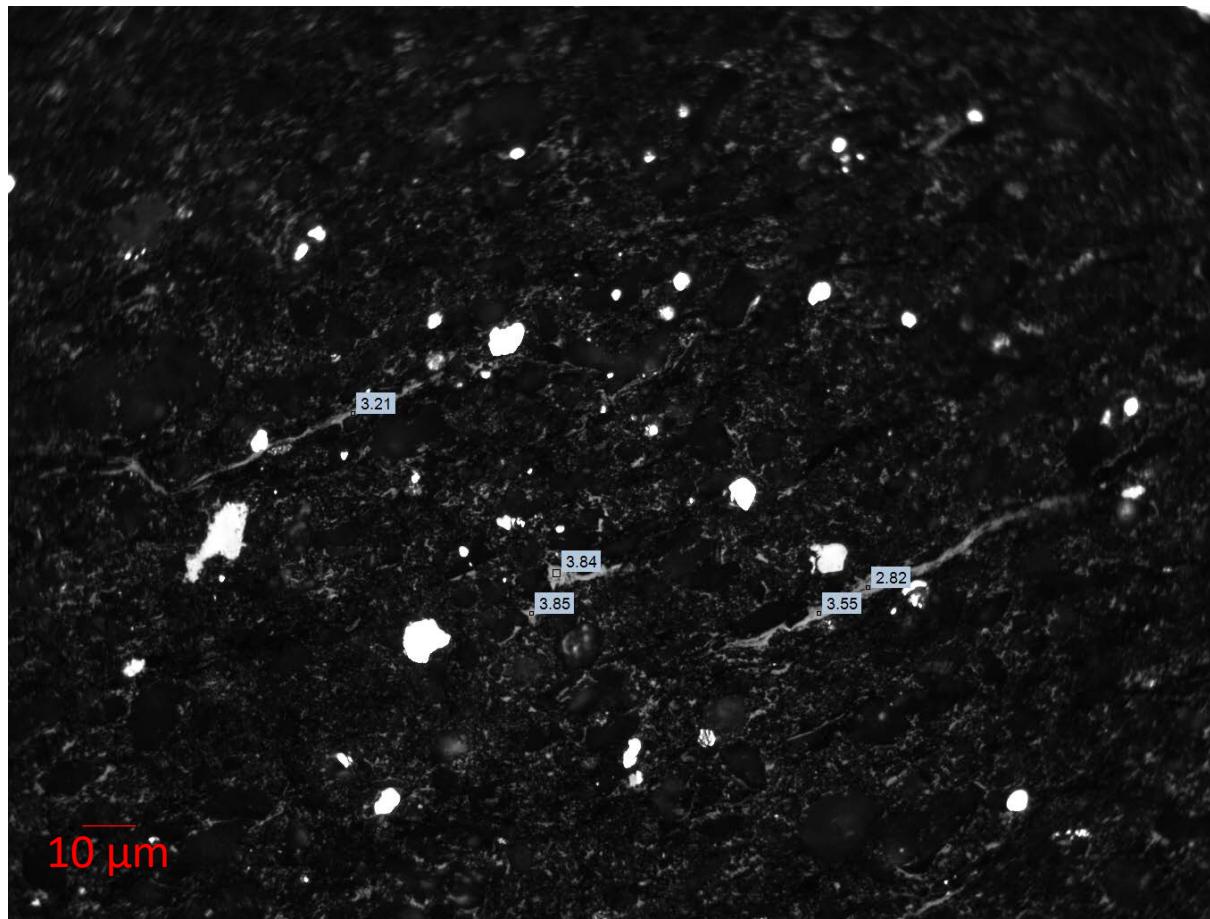
Lab ID	Field ID	Ro	STD	n	Comments
E200205-001	Tattoo 3128.05'	2.76	0.127	20	Solid bitumen present, mostly in void-filling texture. Pyrite, abundant mineral content.
E200205-002	Tattoo 3146.05'	2.842	0.102	20	Solid bitumen present, mostly in void-filling texture. Pyrite, abundant mineral content. Fusinite present
E200205-003	Tattoo 3182.81'	3.22	0.219	20	Solid bitumen present, mostly in void-filling texture. Abundant pyrite, abundant mineral content. Fusinite present
E200205-004	Tattoo 3218.55'	3.35	0.297	20	Solid bitumen present, mostly in void-filling texture. Pyrite, abundant mineral content. Fusinite present
E200205-005	Tattoo 3251.48'	3.25	0.268	21	Solid bitumen present, mostly in void-filling texture. Abundant pyrite, abundant mineral content.

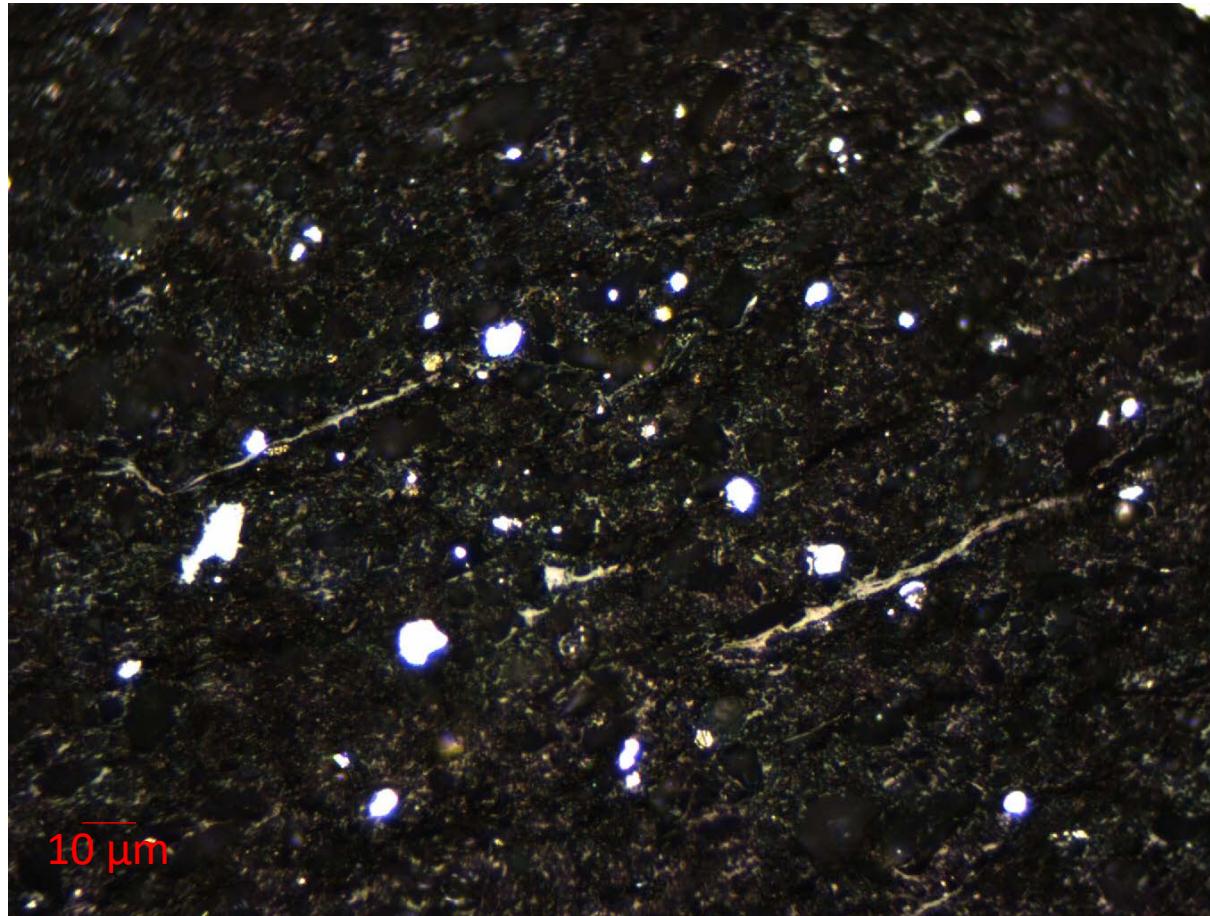
Sample : E200205_001_Tattoo_3128_05_shale_VR1



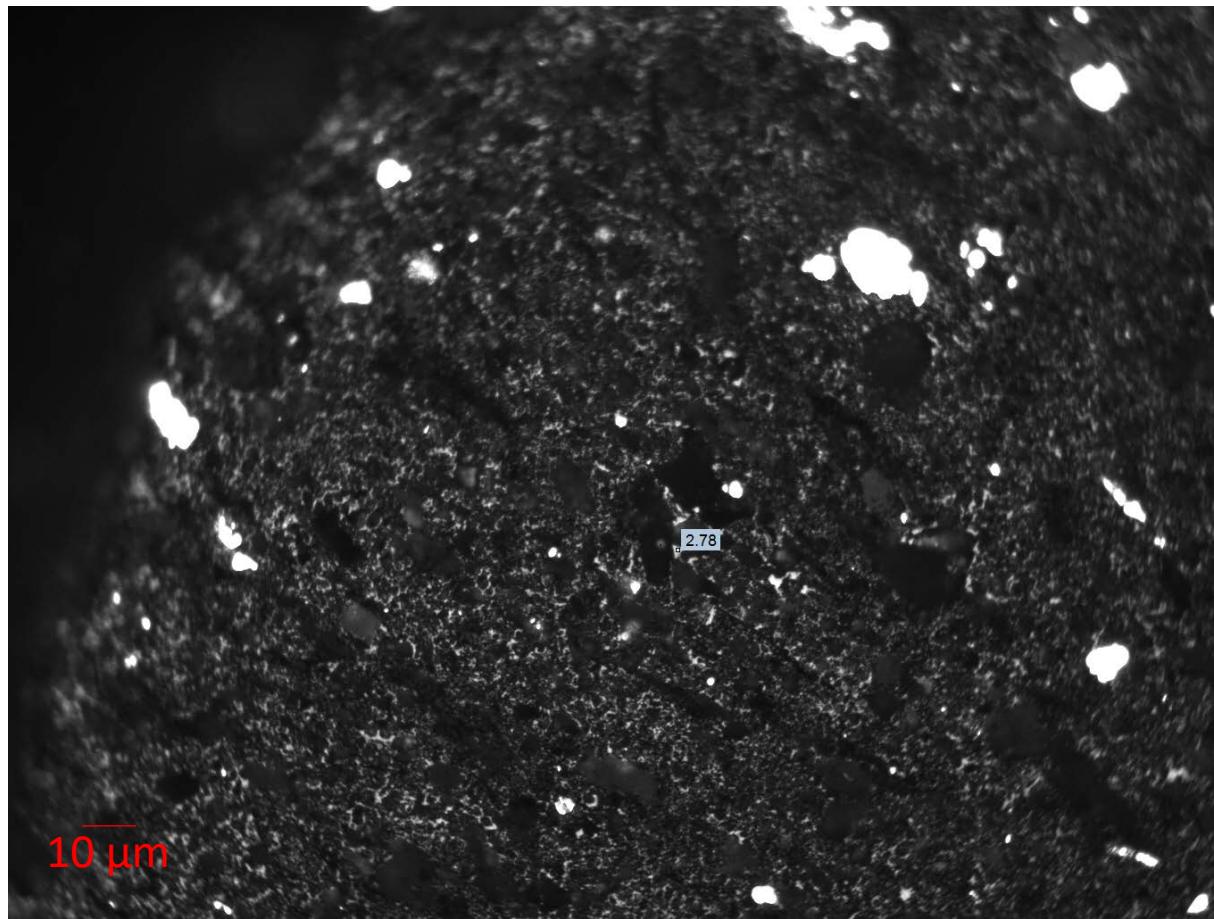
Measure count =	20	Date	2/24/2020	10:08 AM
Reflectance Rr =	2.764 %	Operator	Javin	
s =	0.127 %	Printed	3/2/2020	

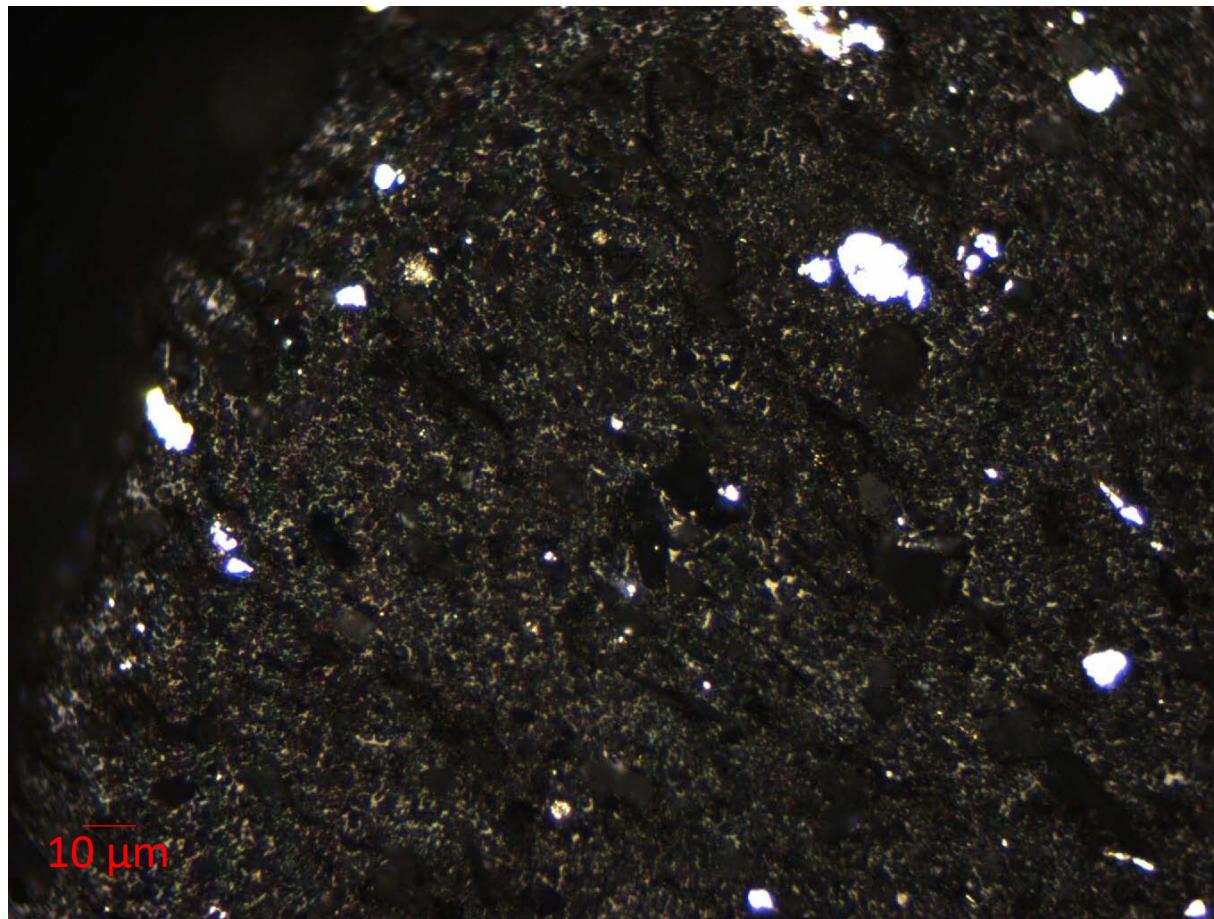
2.40 - 2.45 % R	5.0 %	2.75 - 2.80 % R	10.0 %
2.50 - 2.55 % R	5.0 %	2.80 - 2.85 % R	20.0 %
2.65 - 2.70 % R	15.0 %	2.85 - 2.90 % R	15.0 %
2.70 - 2.75 % R	20.0 %	2.90 - 2.95 % R	10.0 %



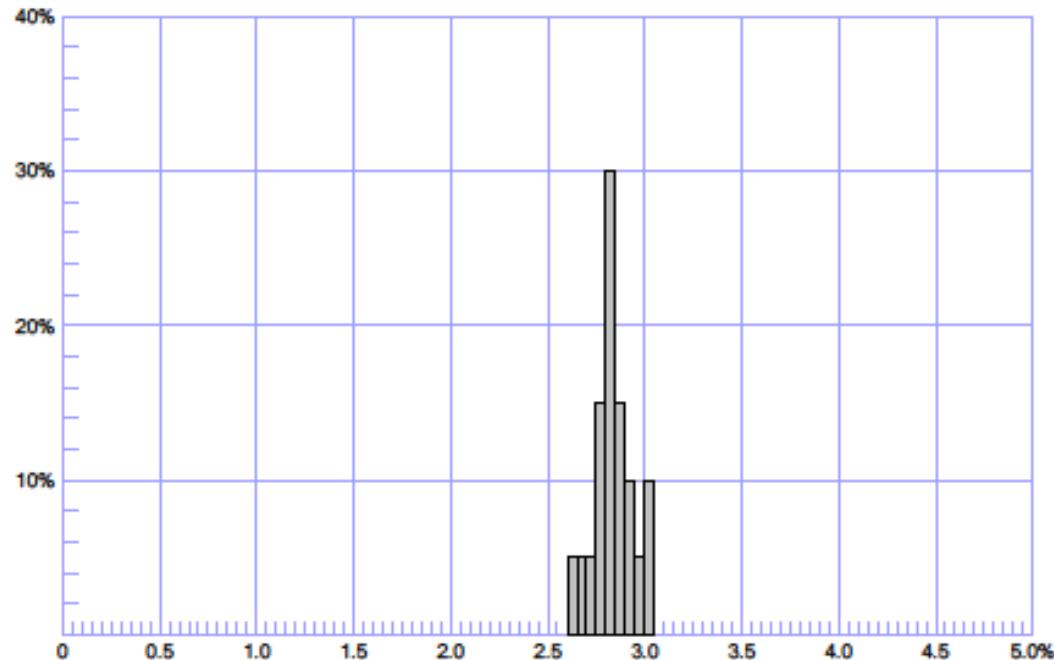


10 μ m



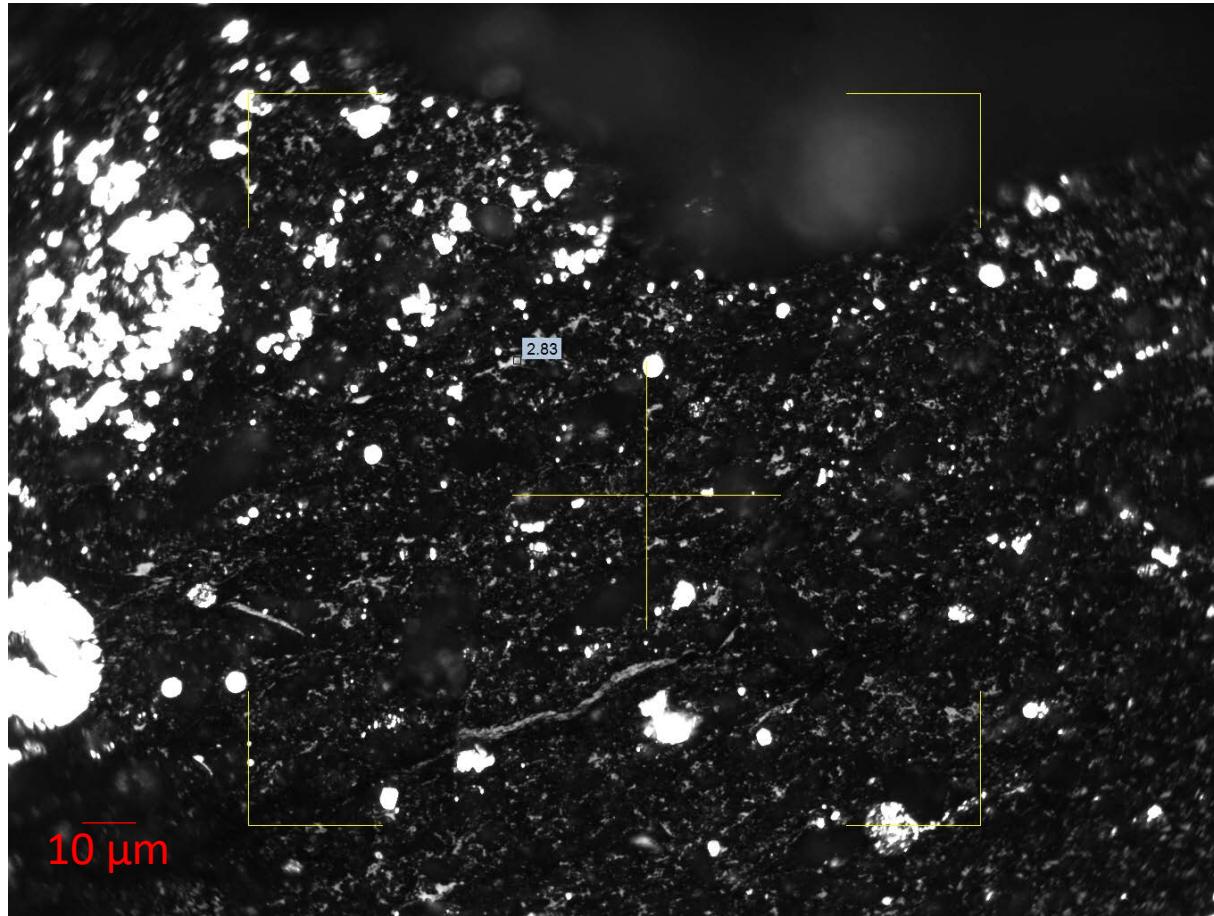


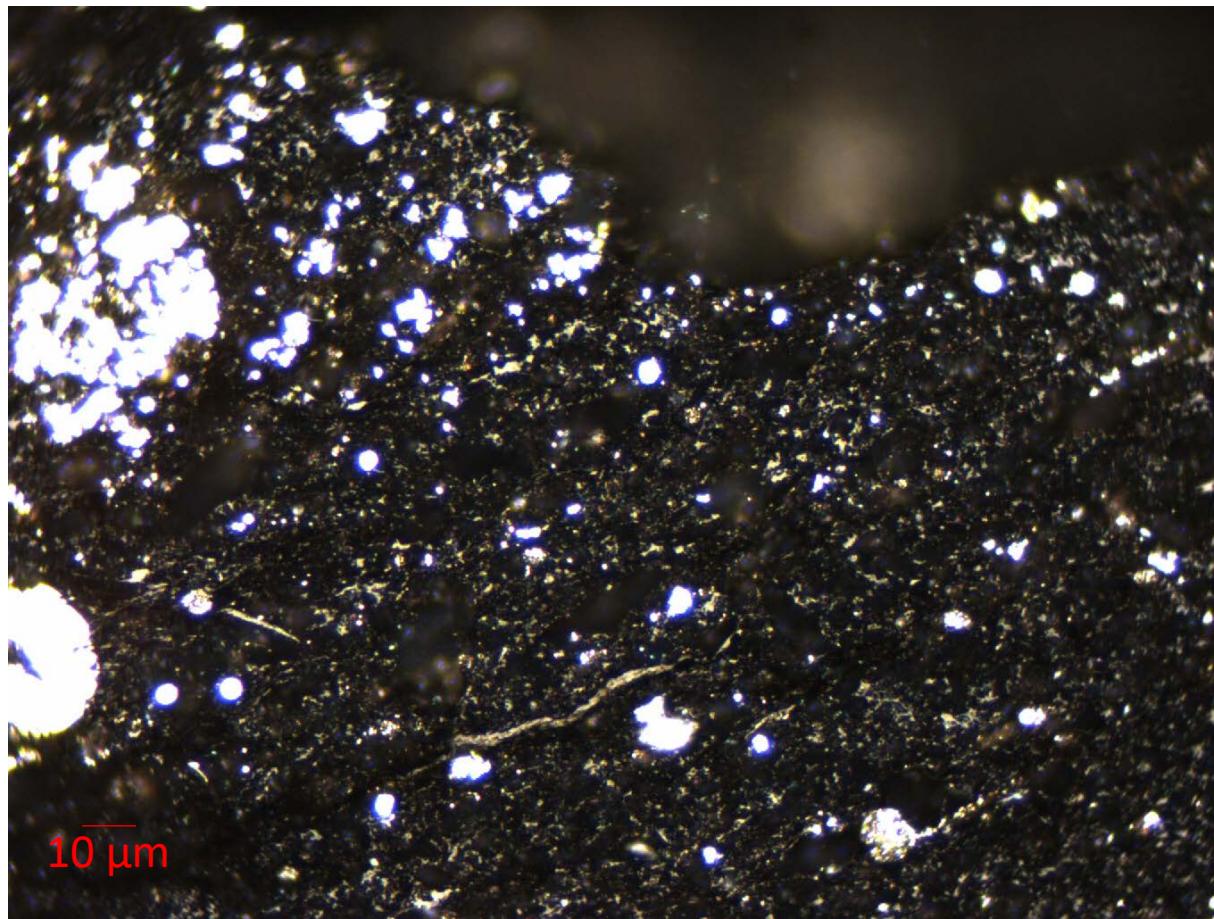
Sample : E200205_002_Tattoo_3146_05_VR1



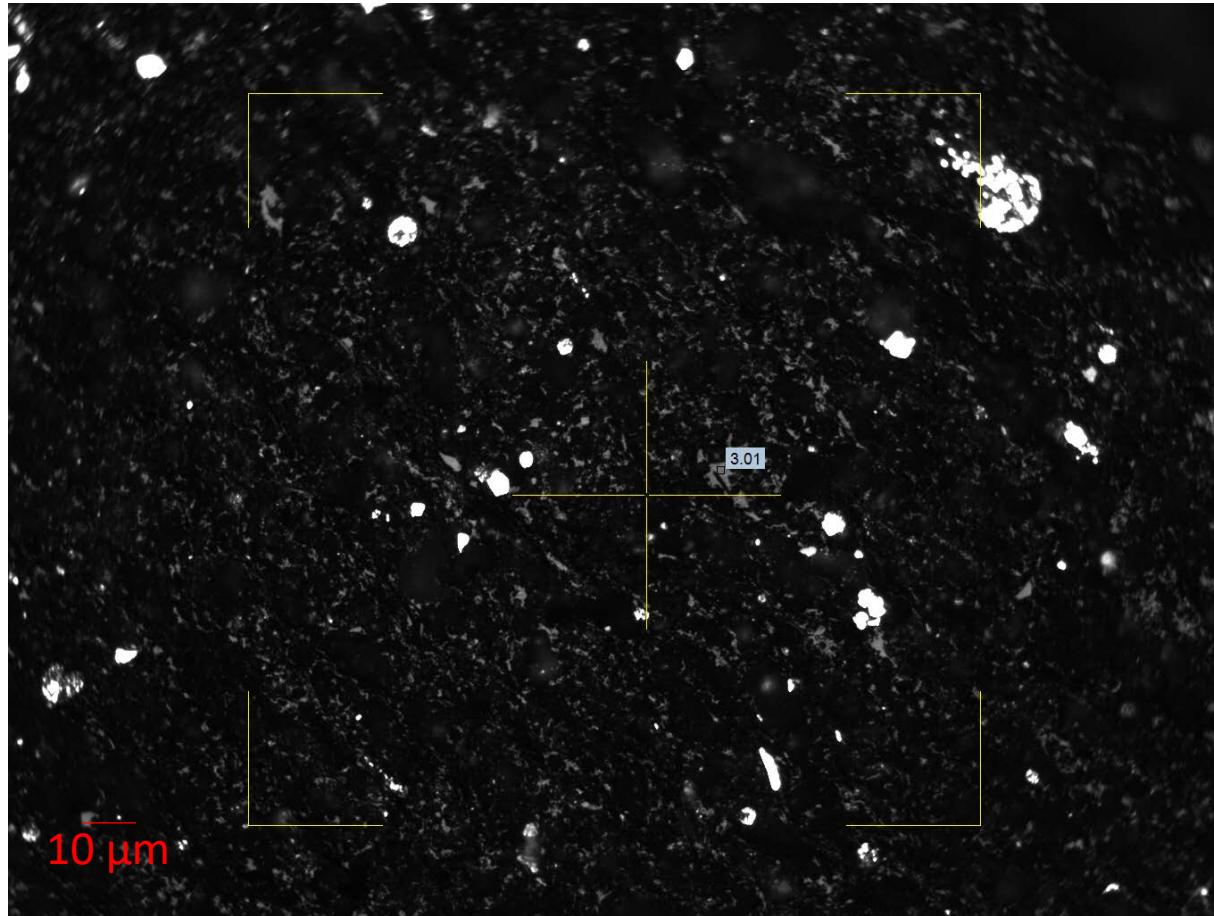
Measure count = 20 Date 2/24/2020 1:08 PM
Reflectance Rr = 2.842 % Operator Javin
s = 0.102 % Printed 3/2/2020

2.60 - 2.65 % R	5.0 %	2.85 - 2.90 % R	15.0 %
2.65 - 2.70 % R	5.0 %	2.90 - 2.95 % R	10.0 %
2.70 - 2.75 % R	5.0 %	2.95 - 3.00 % R	5.0 %
2.75 - 2.80 % R	15.0 %	3.00 - 3.05 % R	10.0 %
2.80 - 2.85 % R	30.0 %		

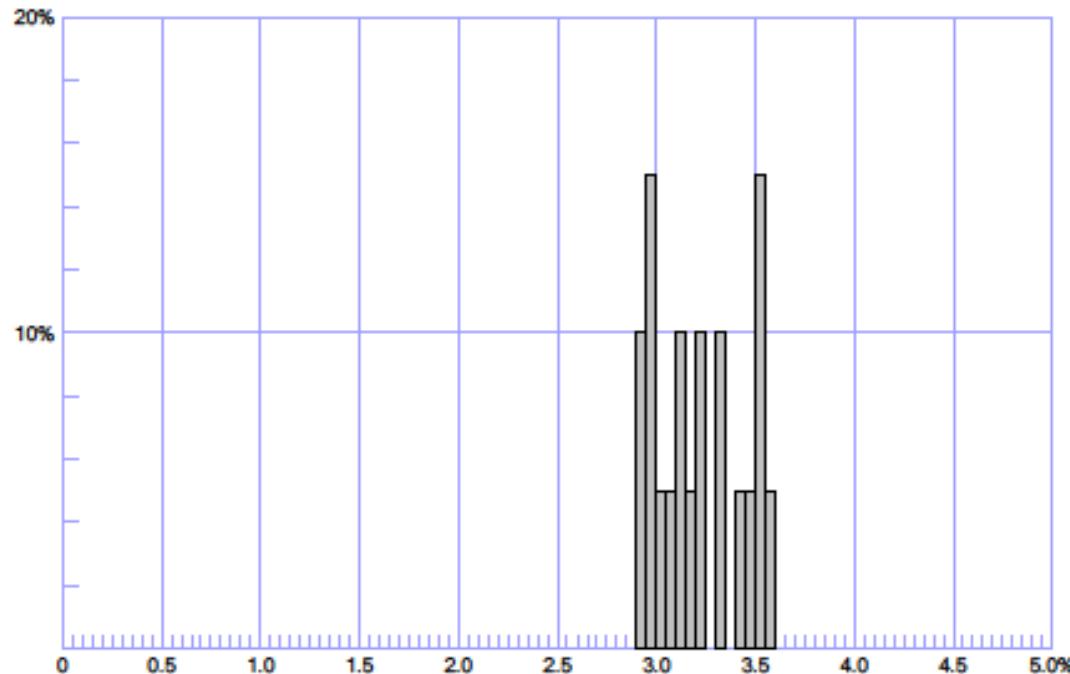




10 μm

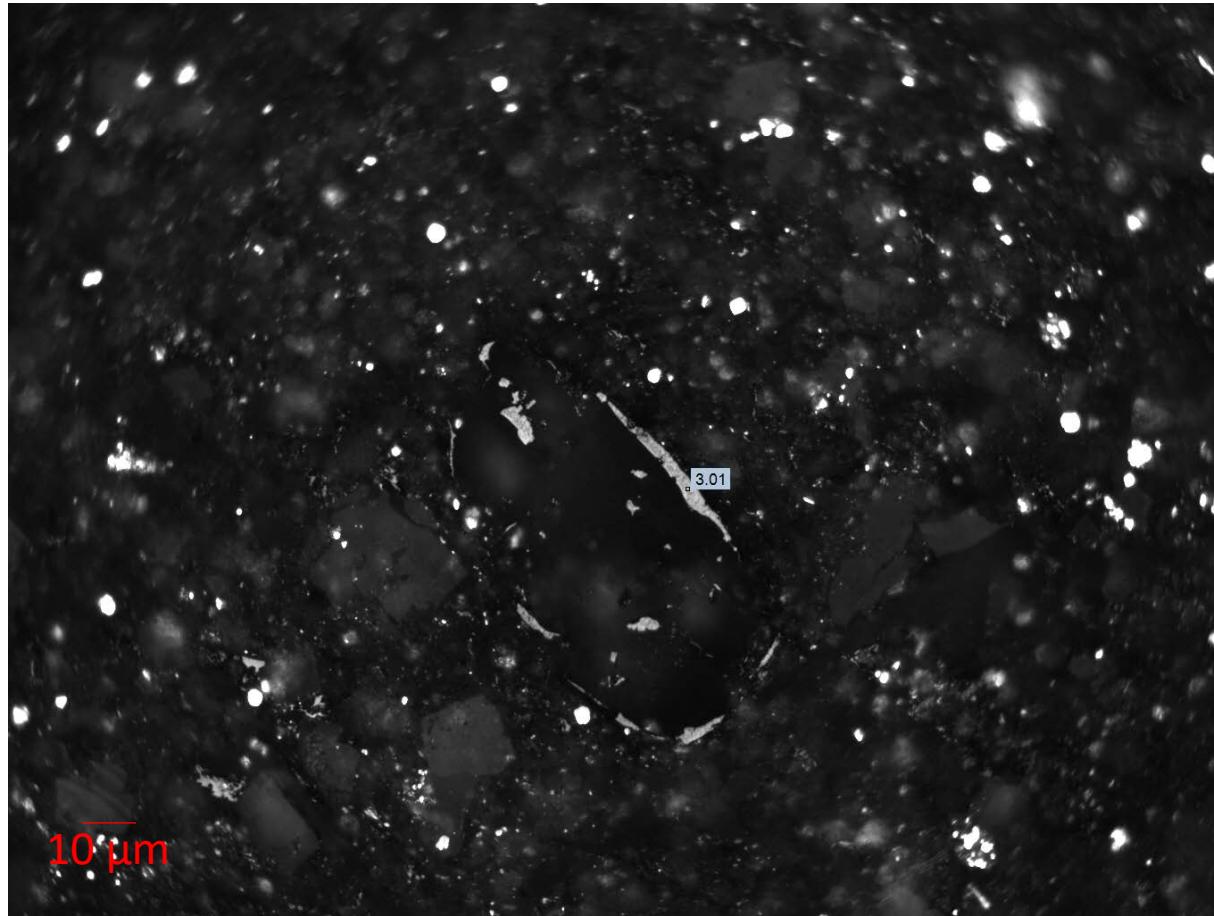


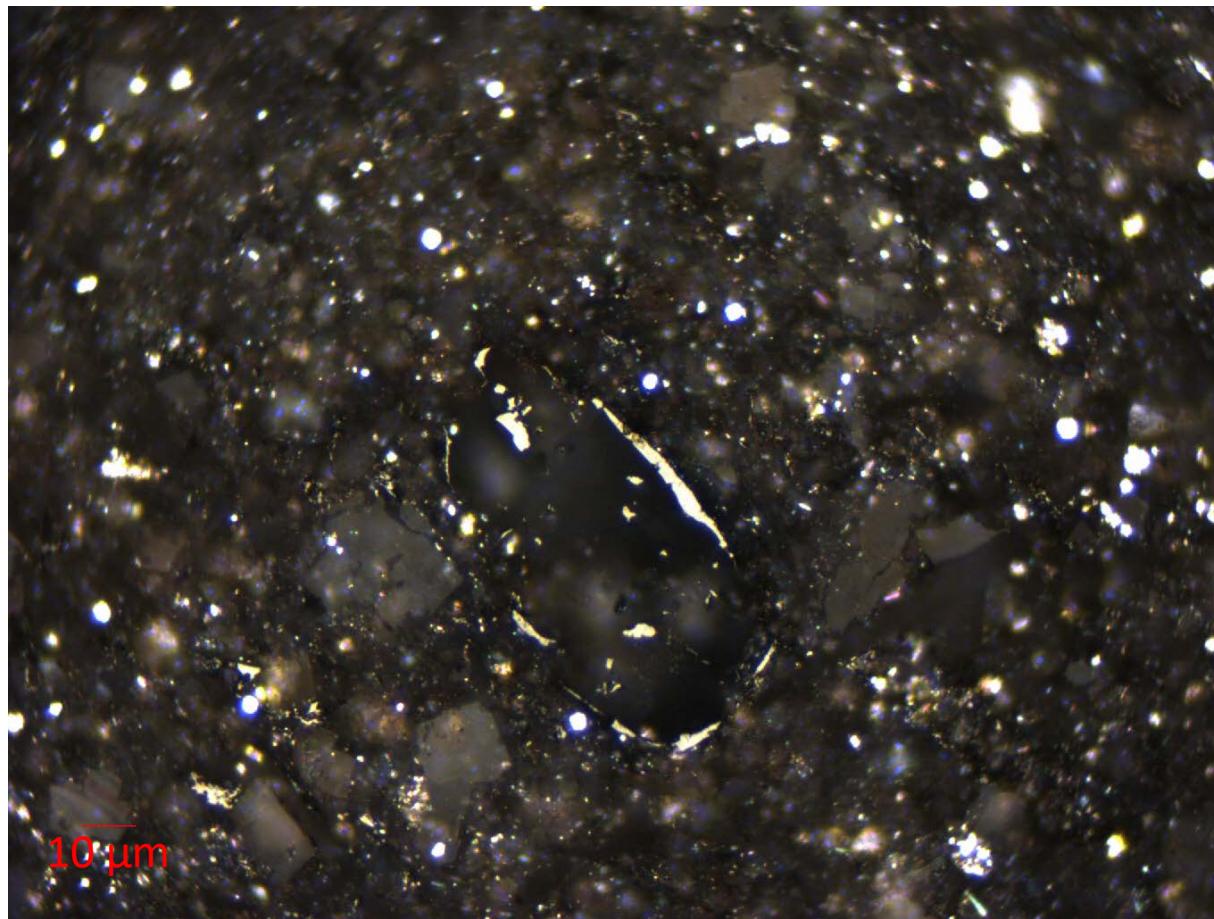
Sample : E200205_003_Tattoo_3182_81_VR1

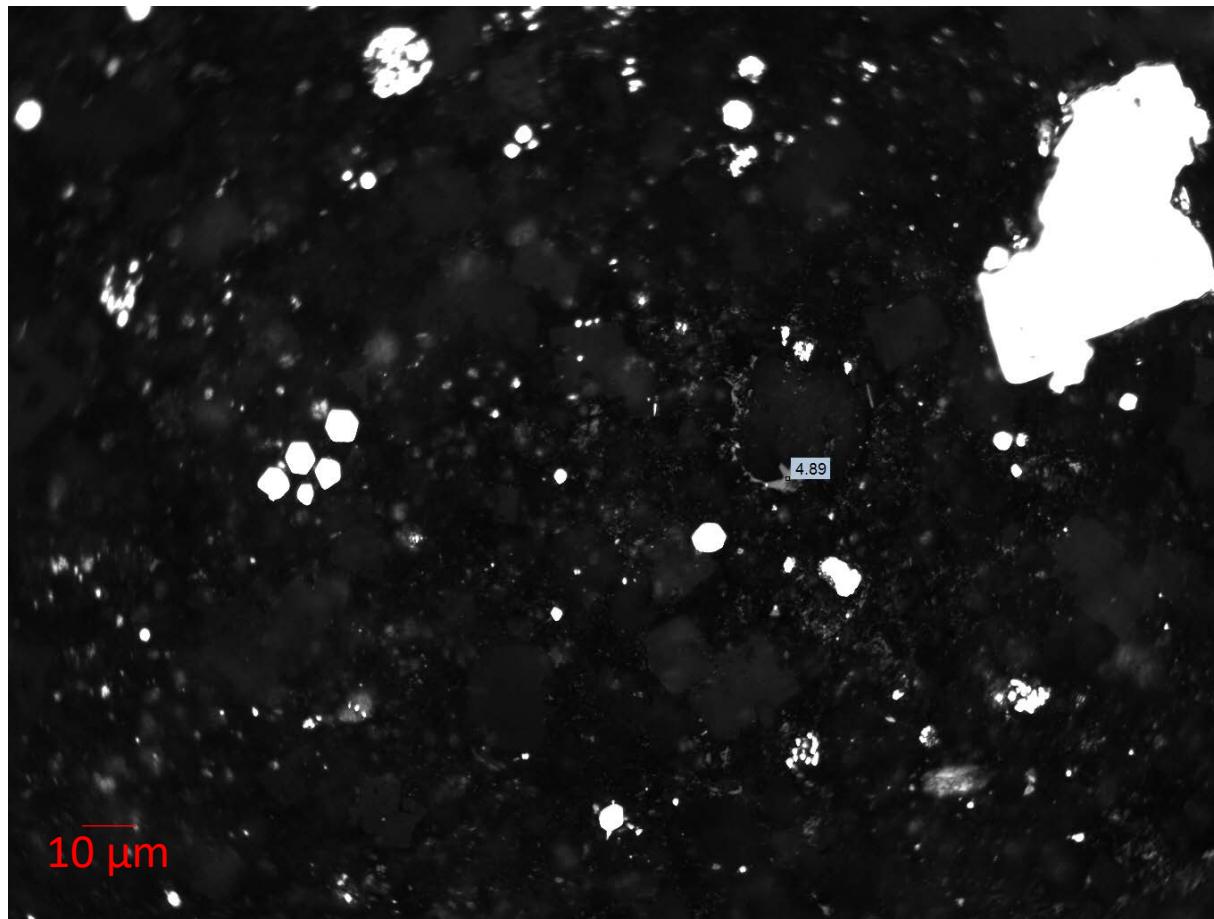


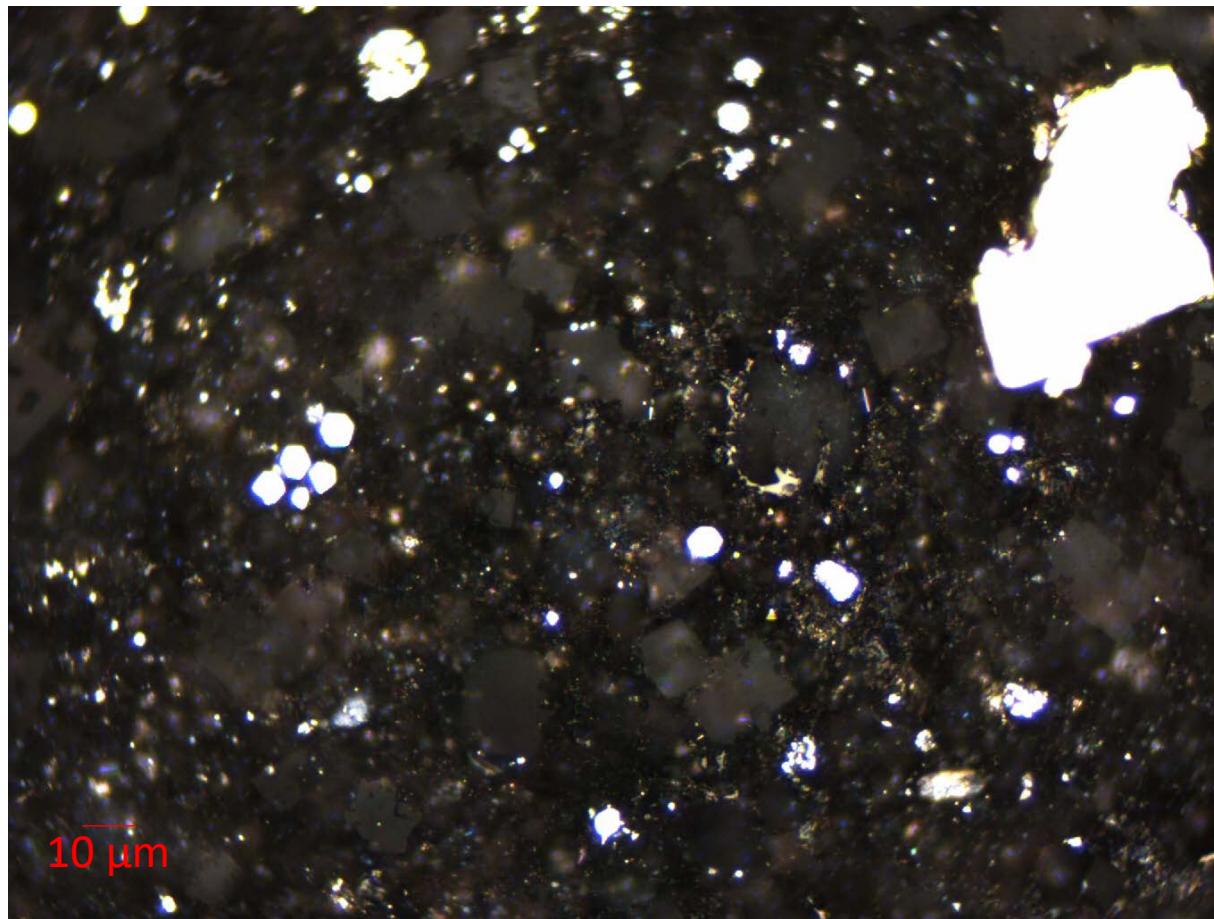
Measure count =	20	Date	2/24/2020	3:58 PM
Reflectance Rr =	3.221 %	Operator	Javin	
s =	0.219 %	Printed	3/2/2020	
2.90 - 2.95 % R	10.0 %	3.20 - 3.25 % R	10.0 %	
2.95 - 3.00 % R	15.0 %	3.30 - 3.35 % R	10.0 %	
3.00 - 3.05 % R	5.0 %	3.40 - 3.45 % R	5.0 %	
3.05 - 3.10 % R	5.0 %	3.45 - 3.50 % R	5.0 %	
3.10 - 3.15 % R	10.0 %	3.50 - 3.55 % R	15.0 %	
3.15 - 3.20 % R	5.0 %	3.55 - 3.60 % R	5.0 %	

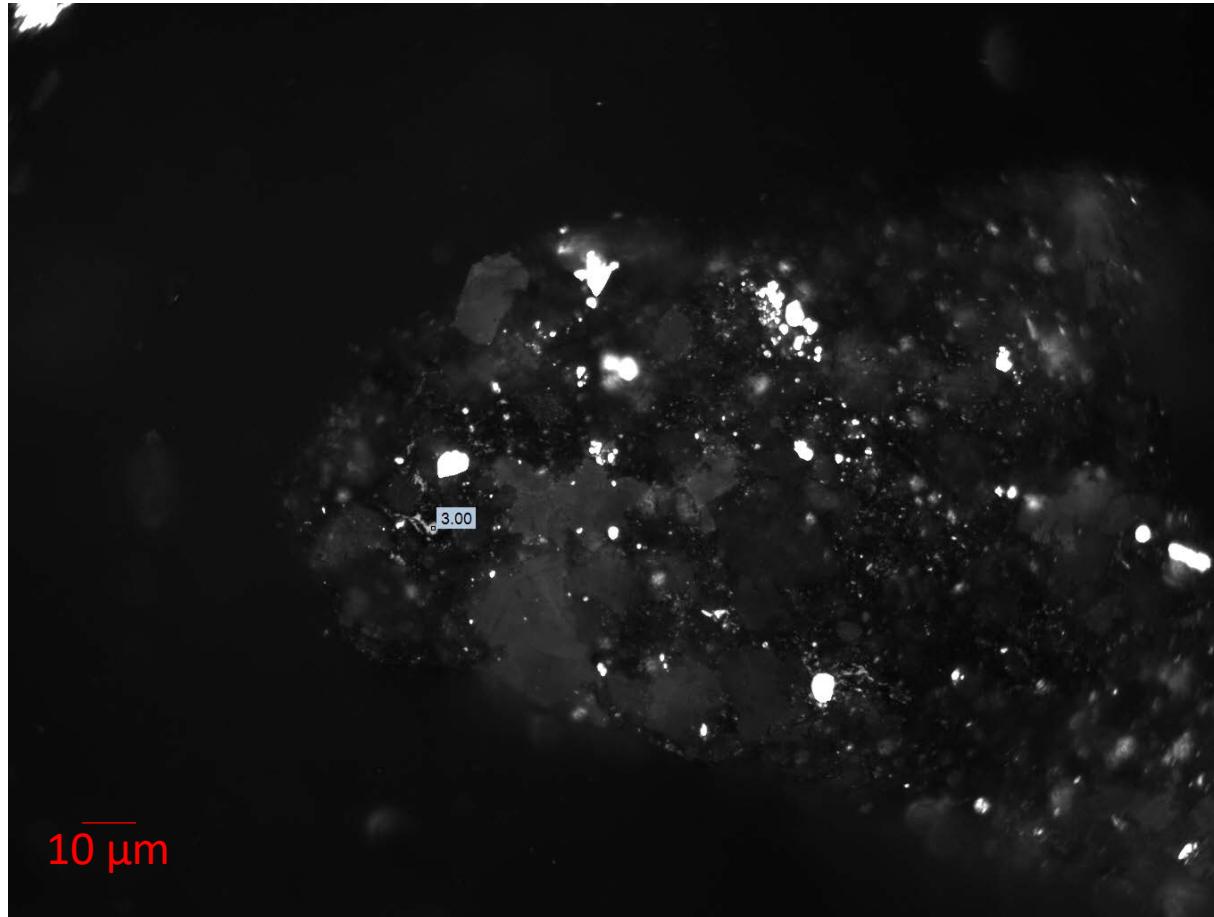
F=0.6143

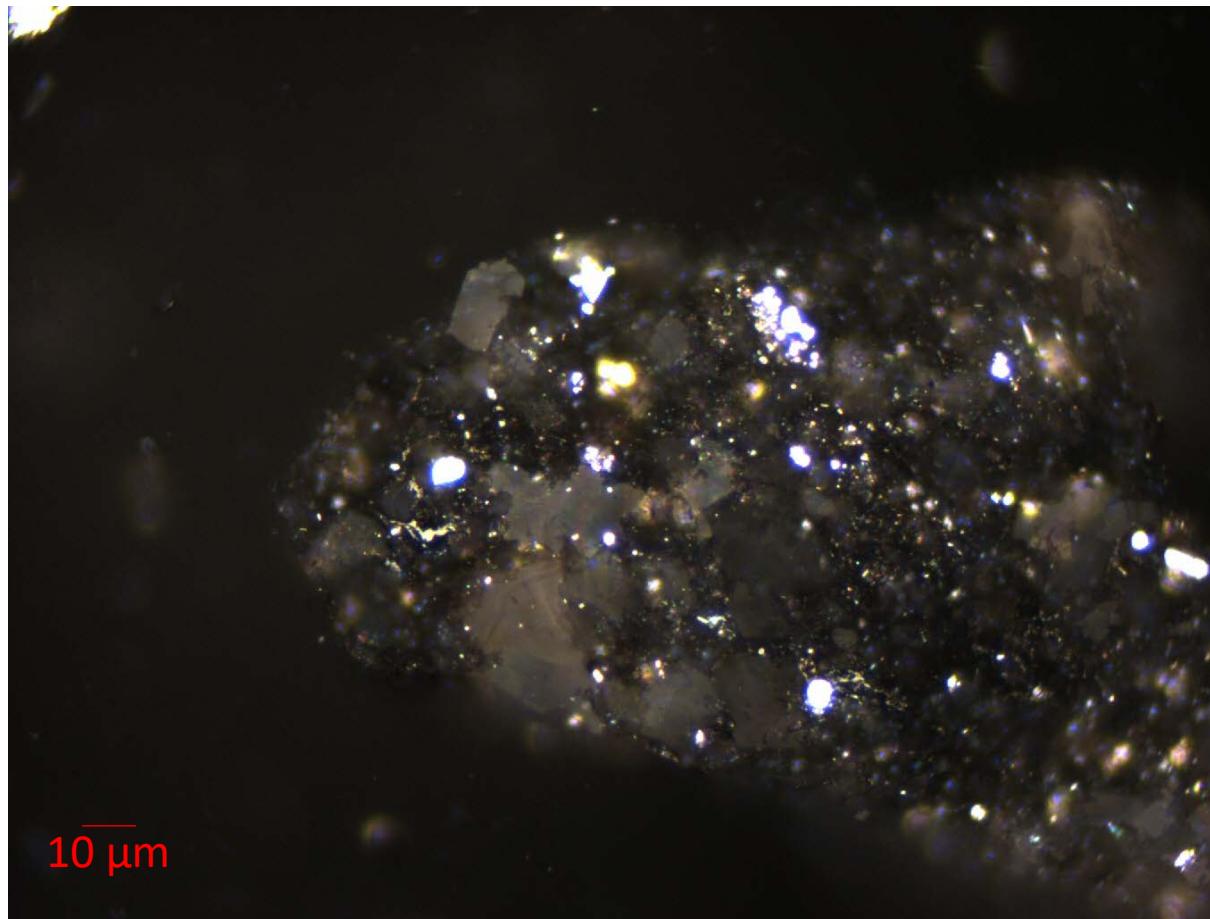




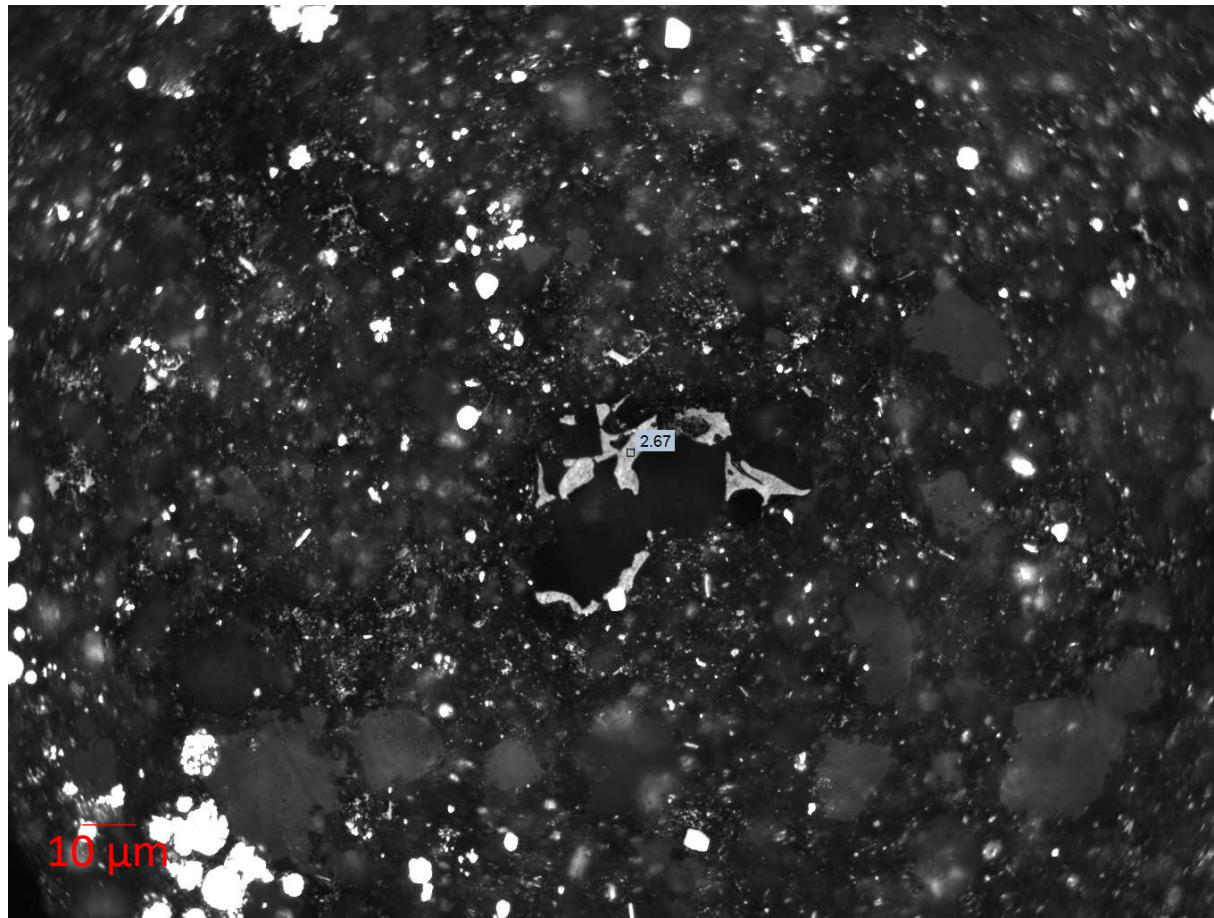


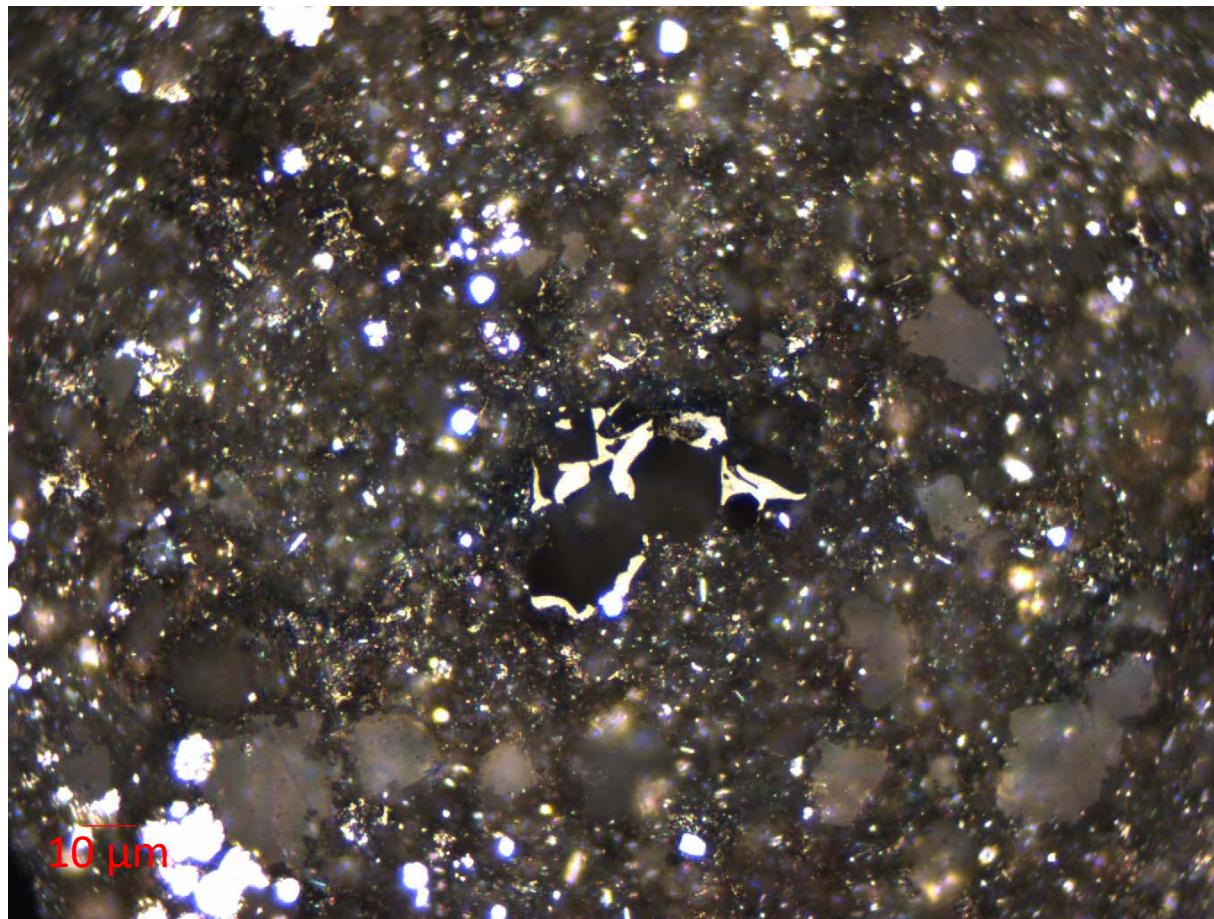


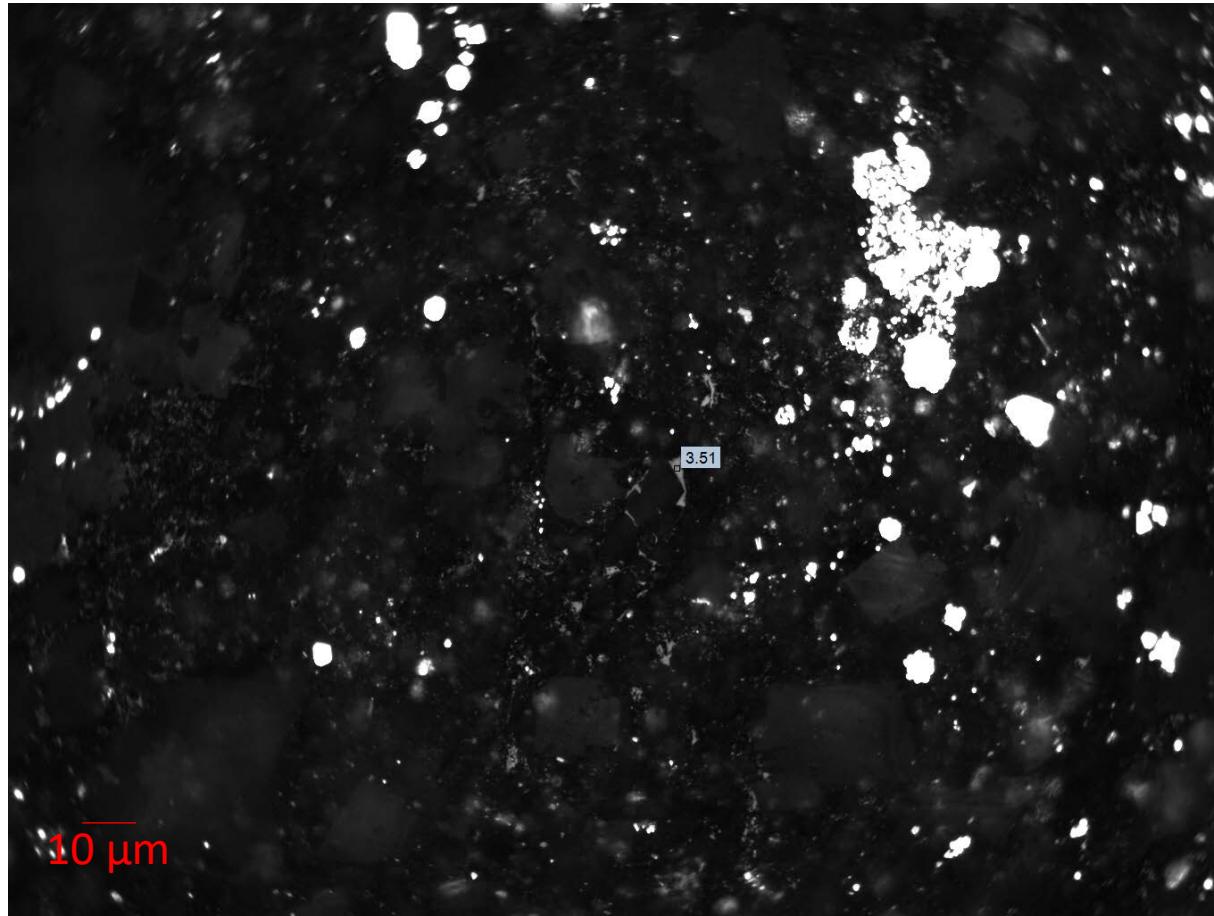


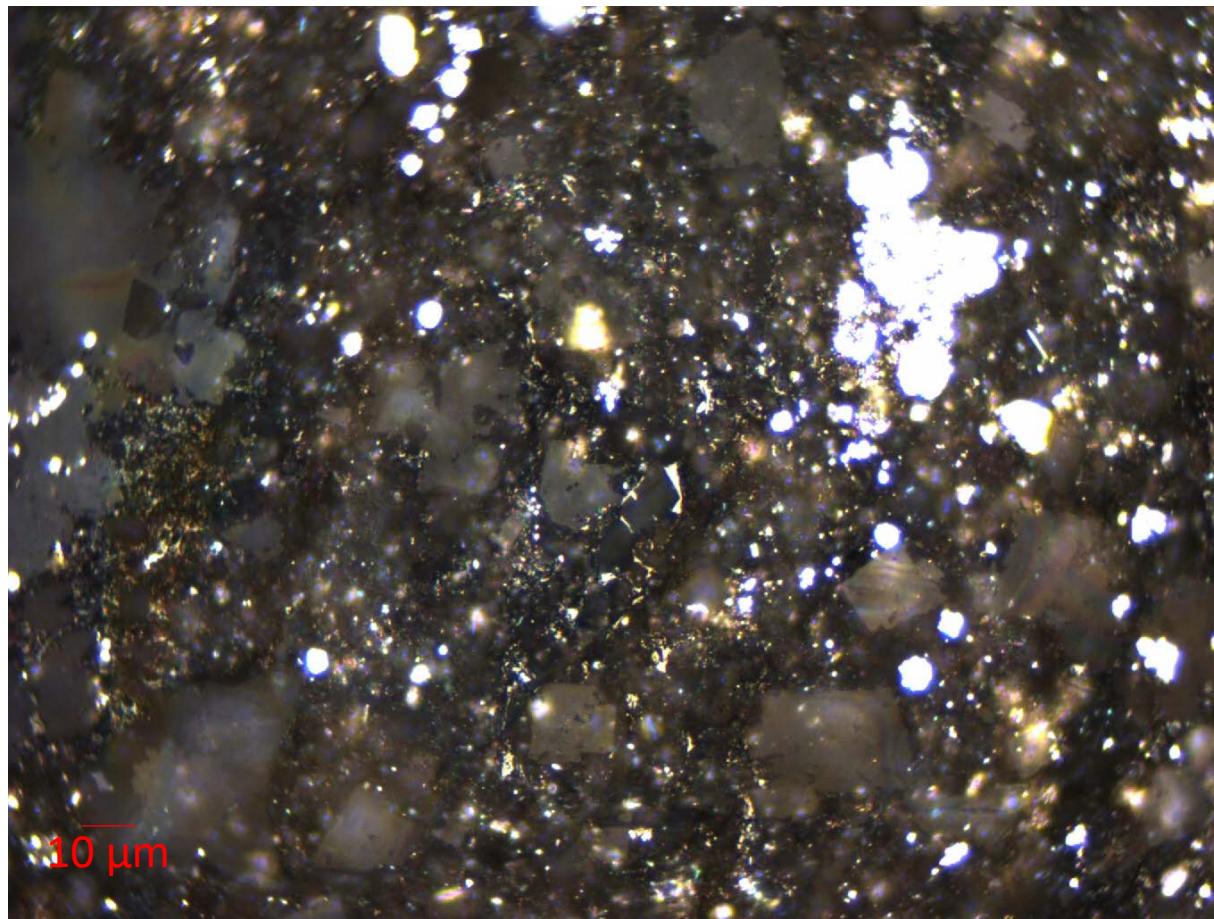


10 μm

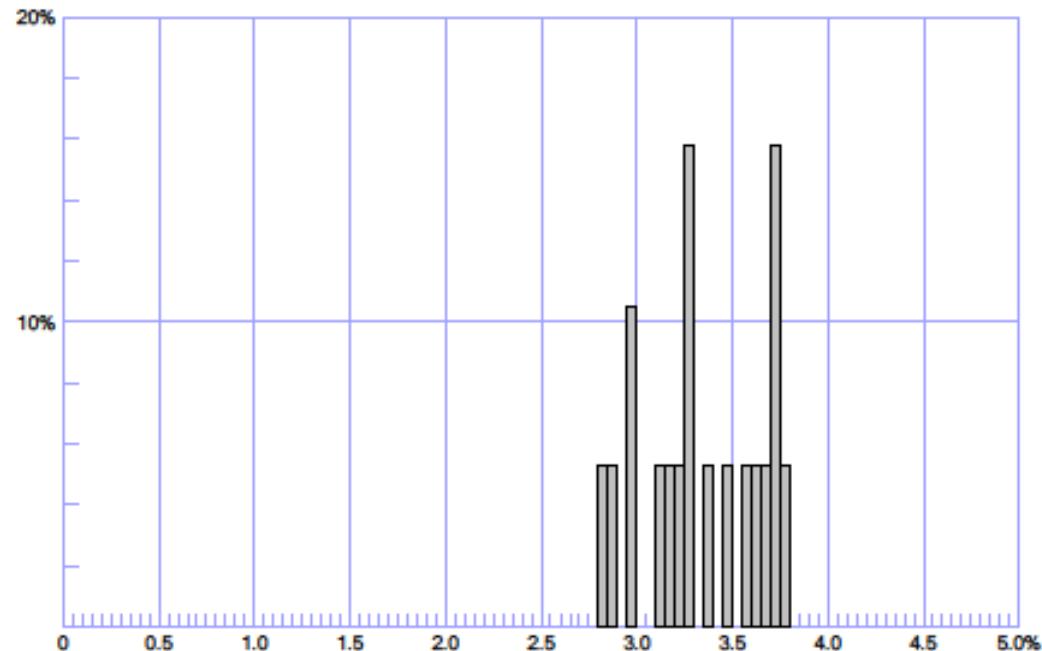




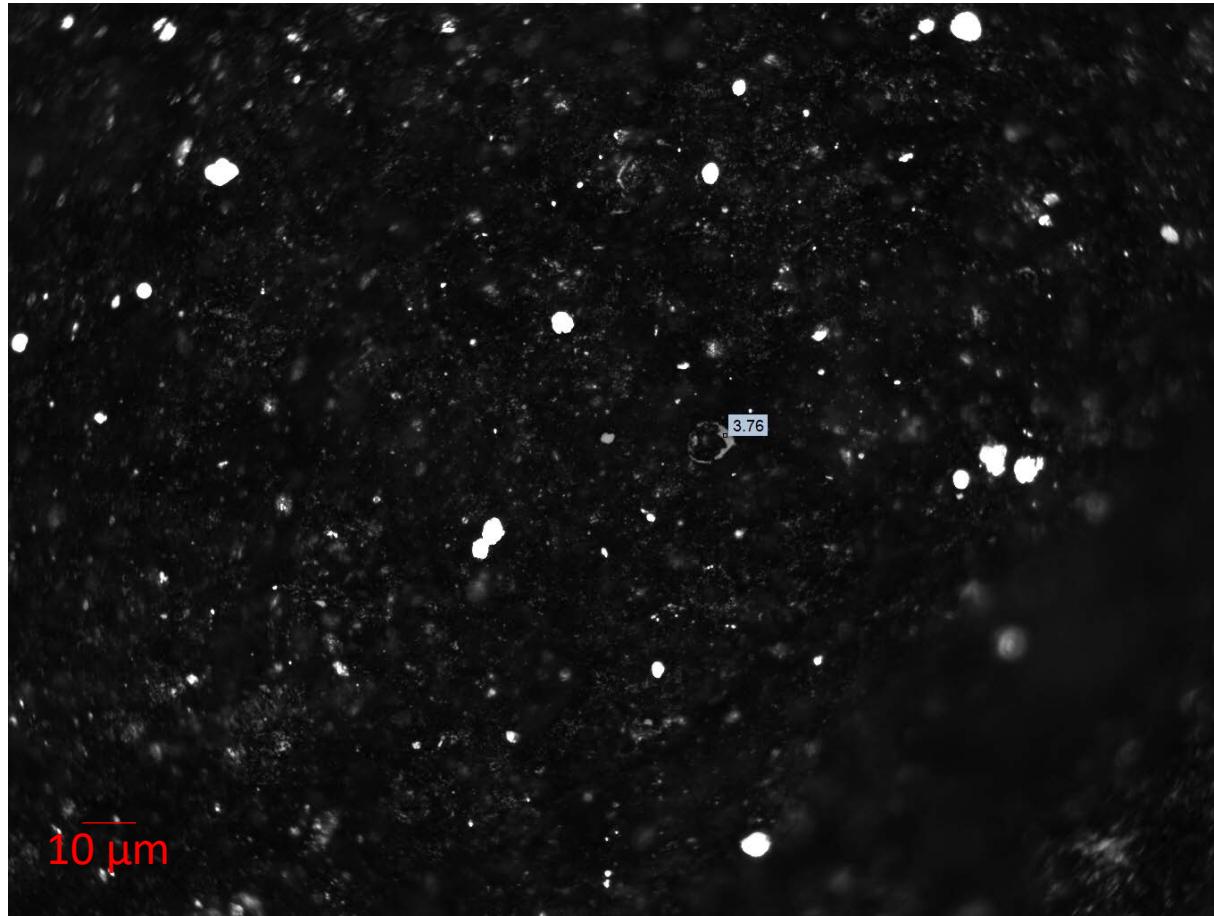


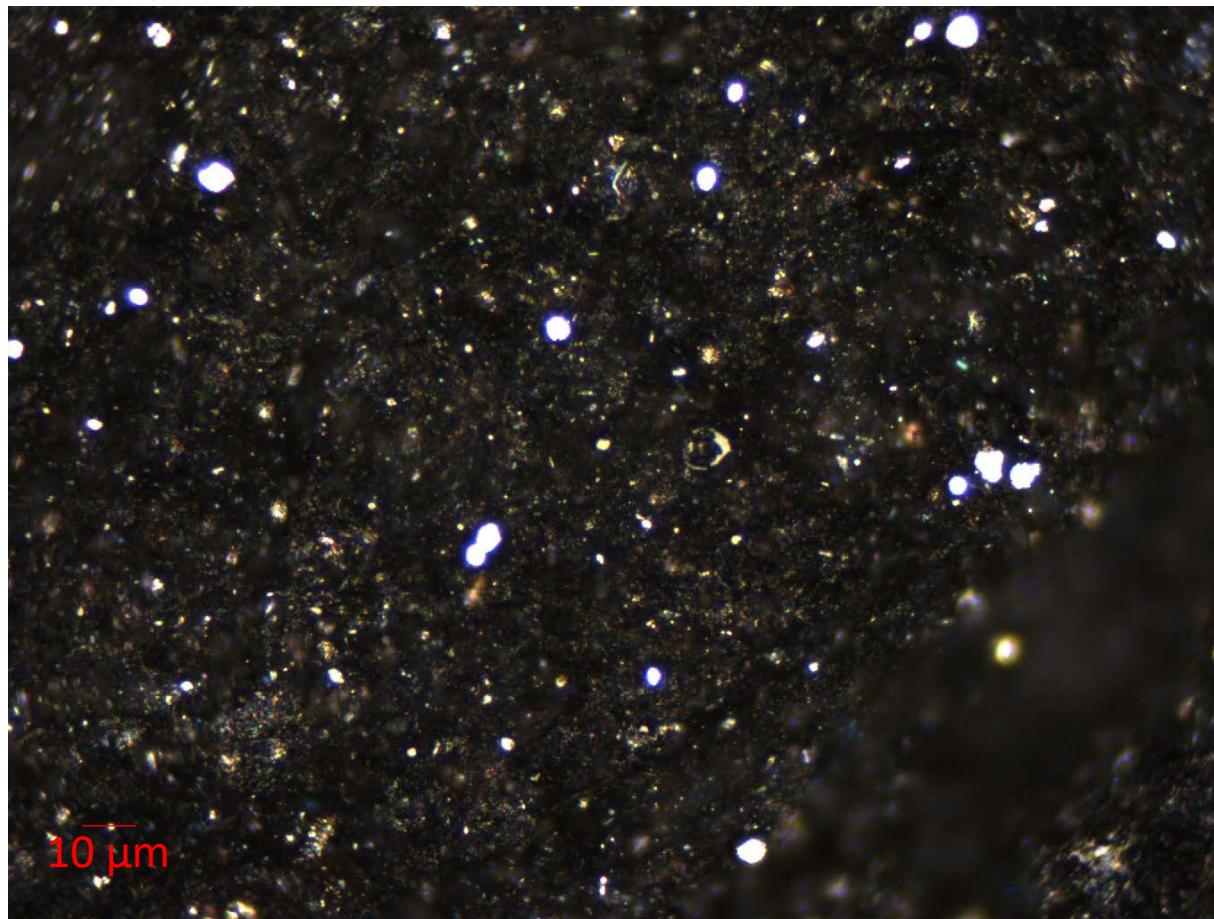


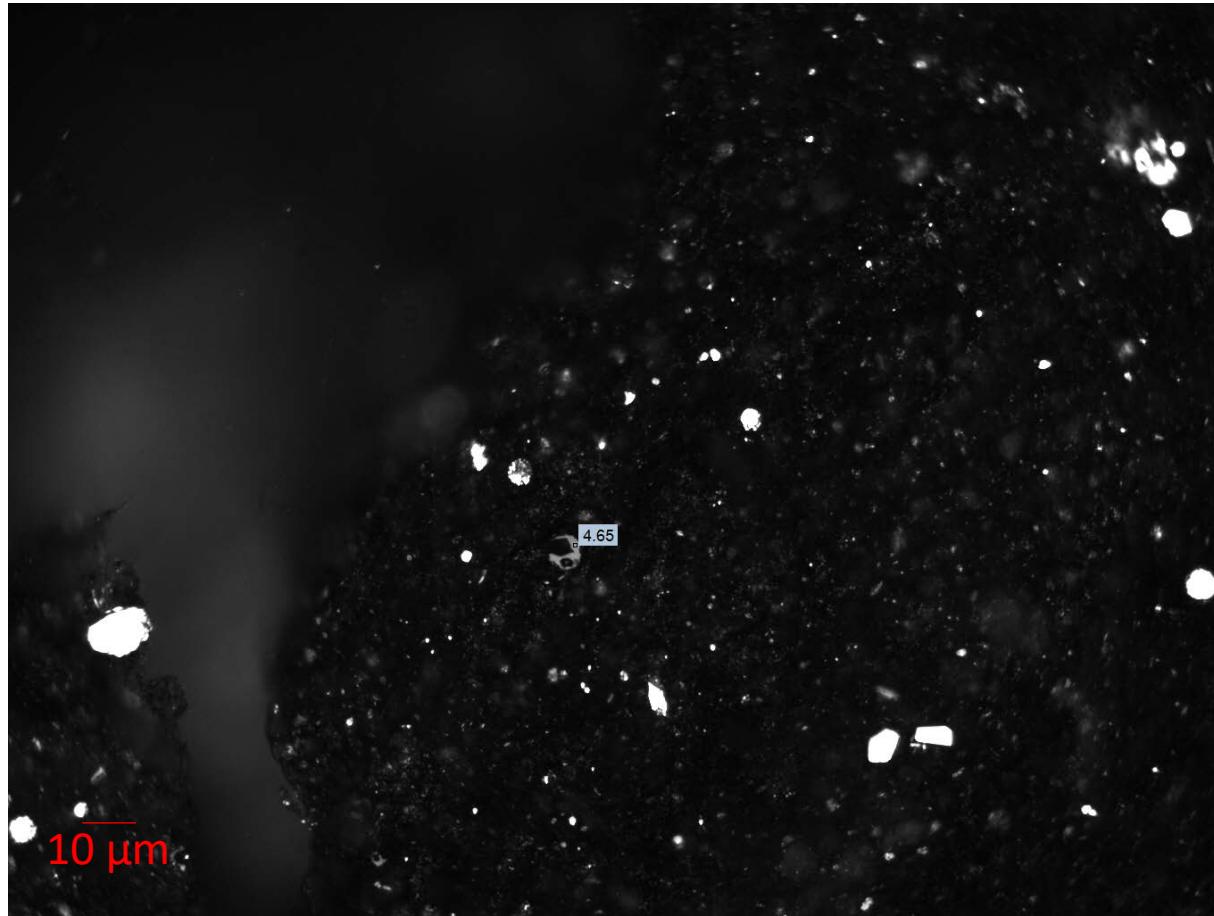
Sample : E200205_004_Tattoo_3218_55_VR1

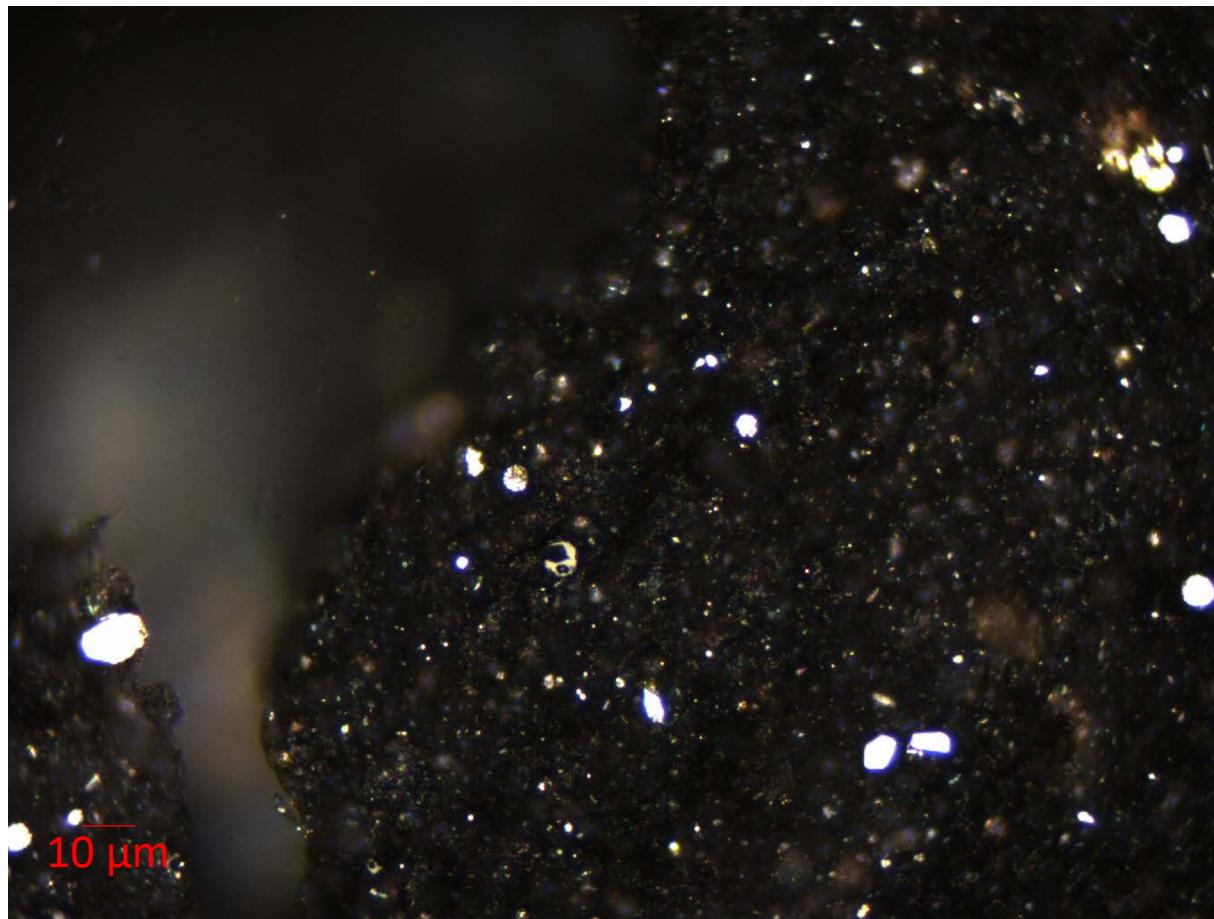


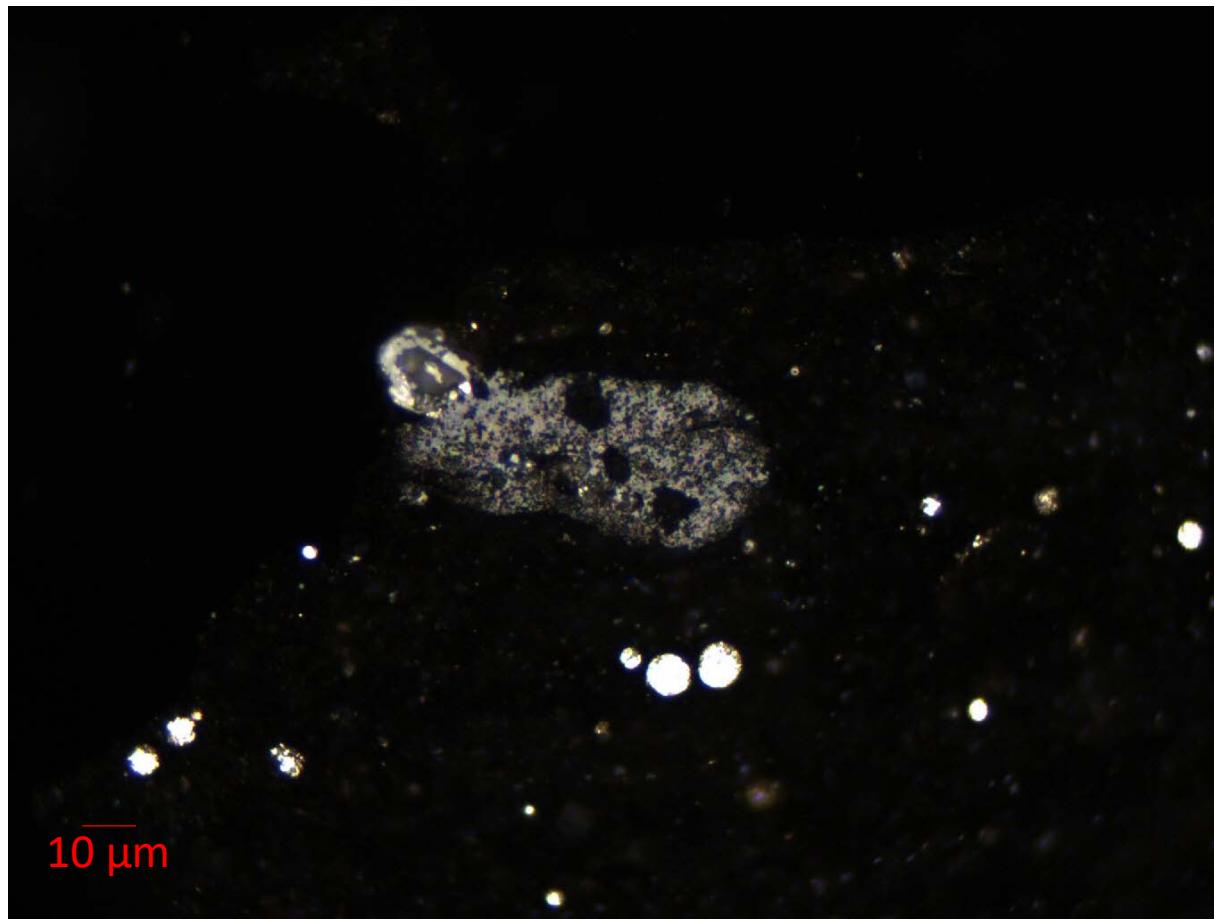
Measure count =	19	Date =	2/26/2020 10:06 AM
Reflectance Rr =	3.349 %	Operator =	Javin
s =	0.297 %	Printed =	3/2/2020
2.80 - 2.85 % R	5.3 %	3.35 - 3.40 % R	5.3 %
2.85 - 2.90 % R	5.3 %	3.45 - 3.50 % R	5.3 %
2.95 - 3.00 % R	10.5 %	3.55 - 3.60 % R	5.3 %
3.10 - 3.15 % R	5.3 %	3.60 - 3.65 % R	5.3 %
3.15 - 3.20 % R	5.3 %	3.65 - 3.70 % R	5.3 %
3.20 - 3.25 % R	5.3 %	3.70 - 3.75 % R	15.8 %
3.25 - 3.30 % R	15.8 %	3.75 - 3.80 % R	5.3 %

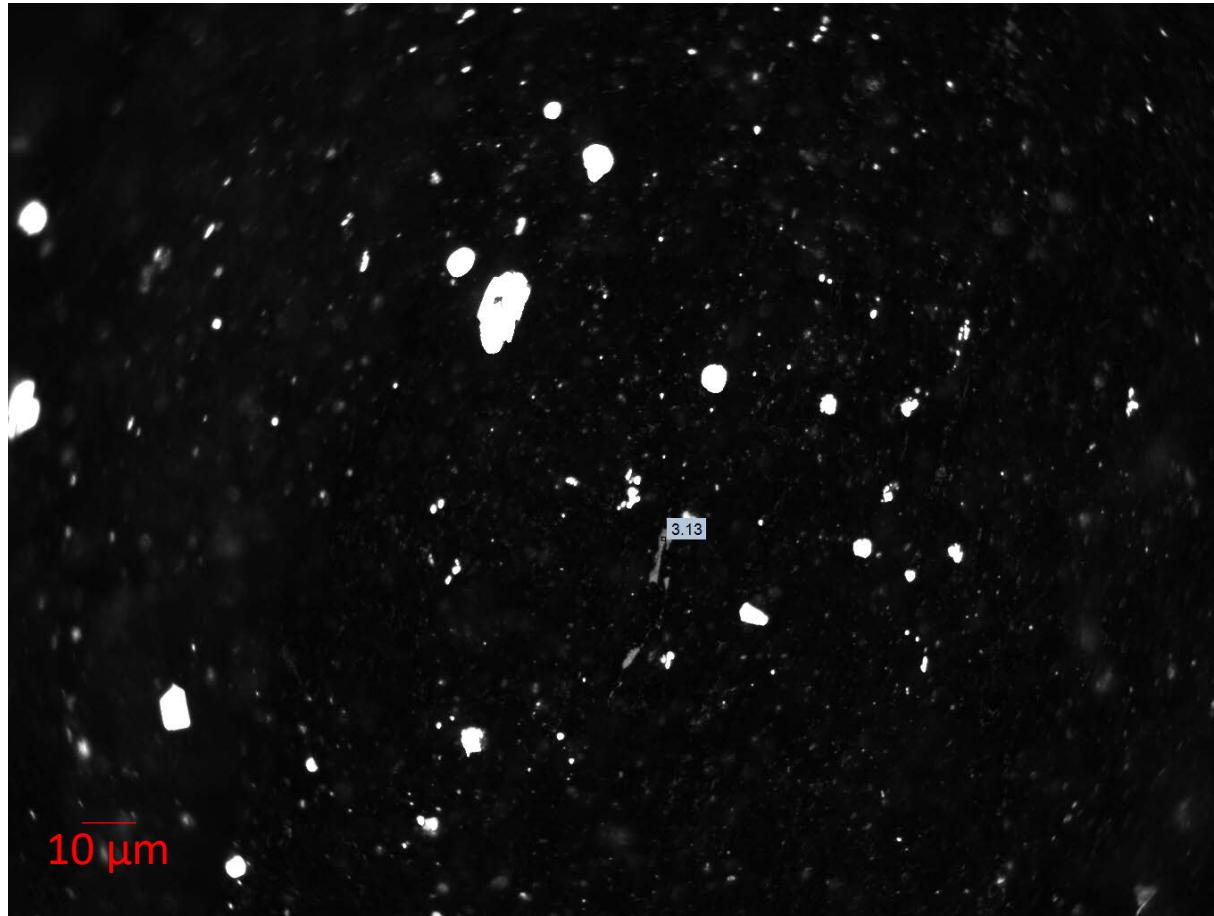


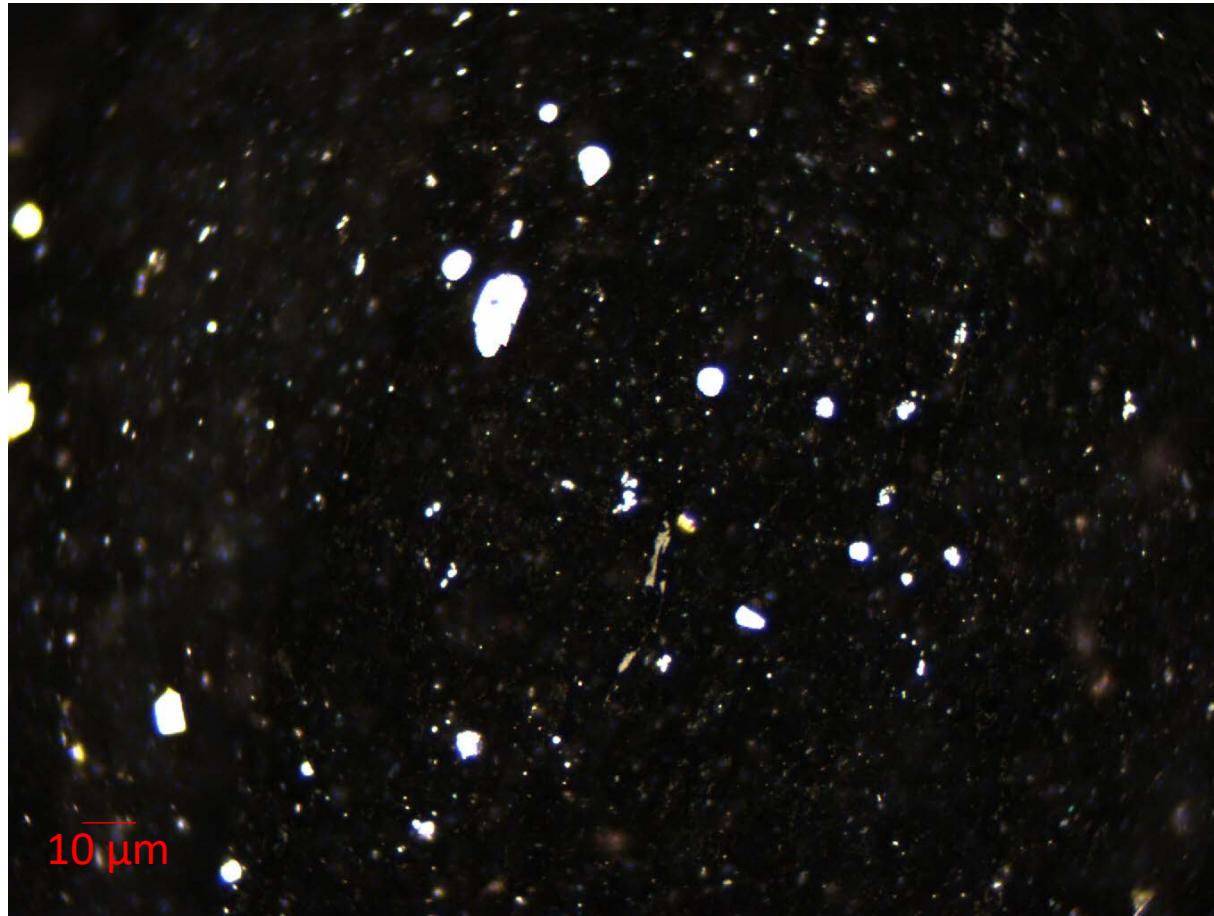




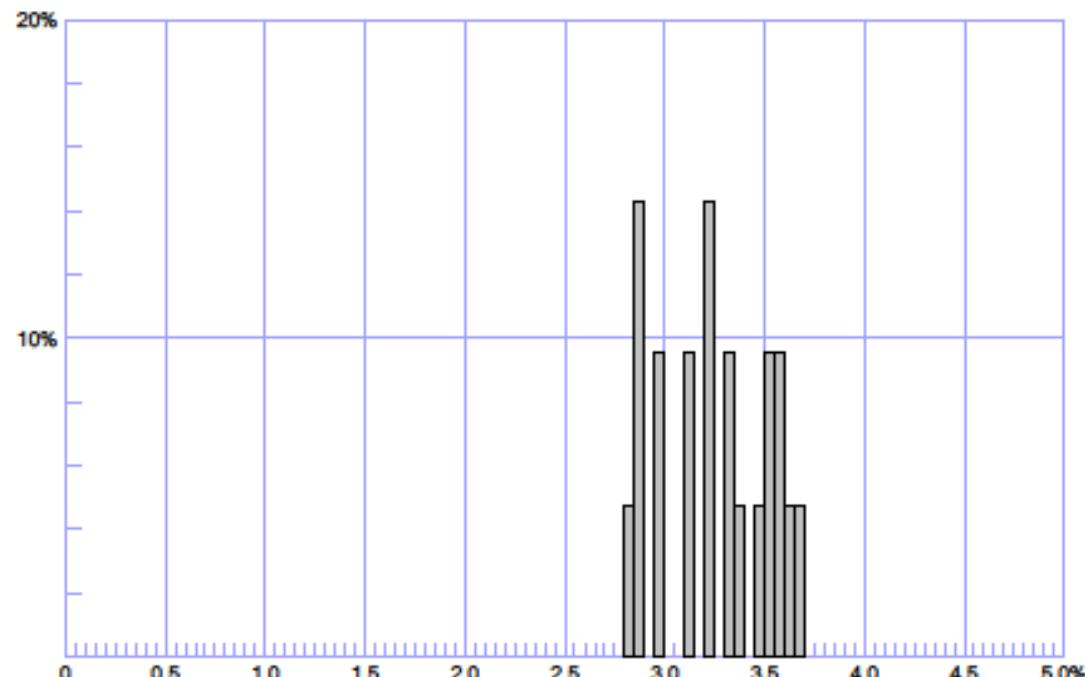




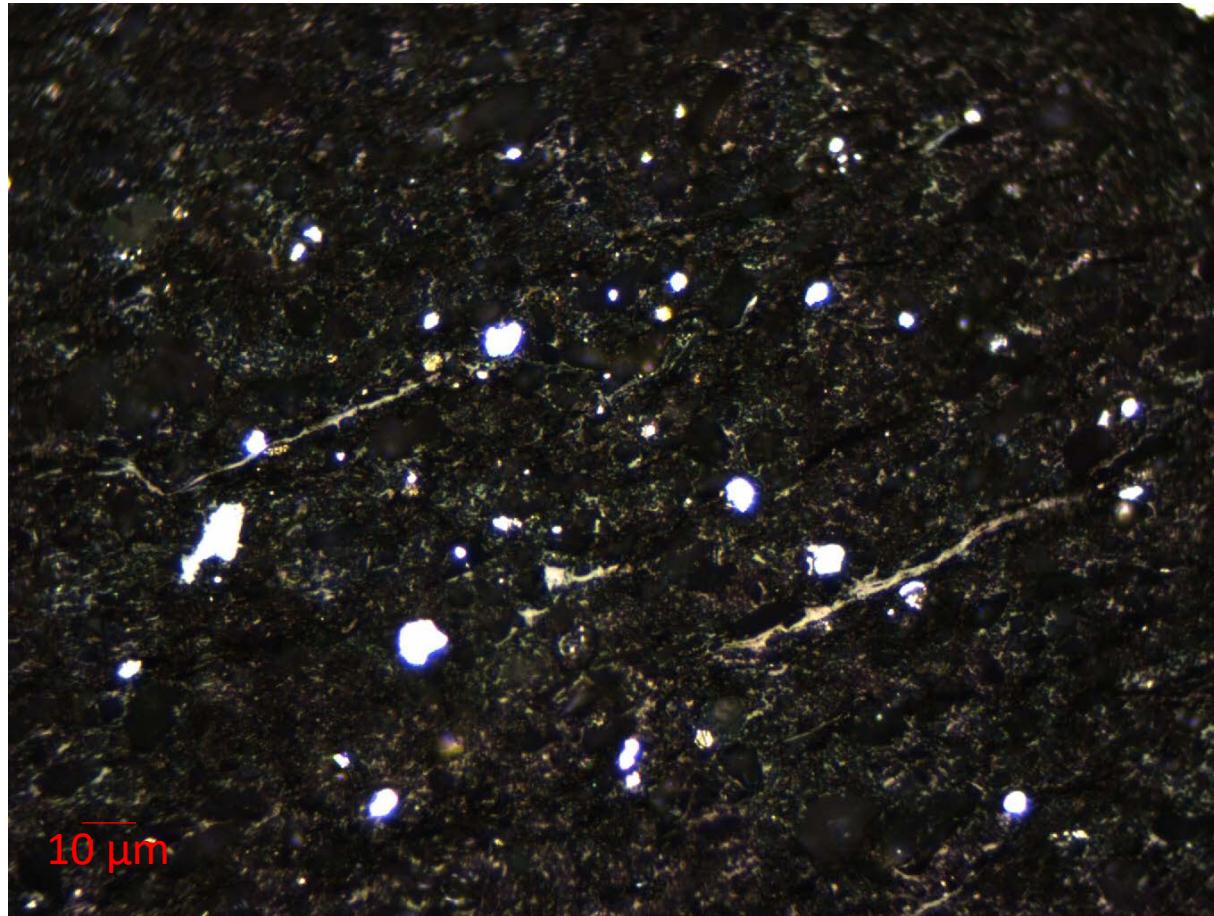




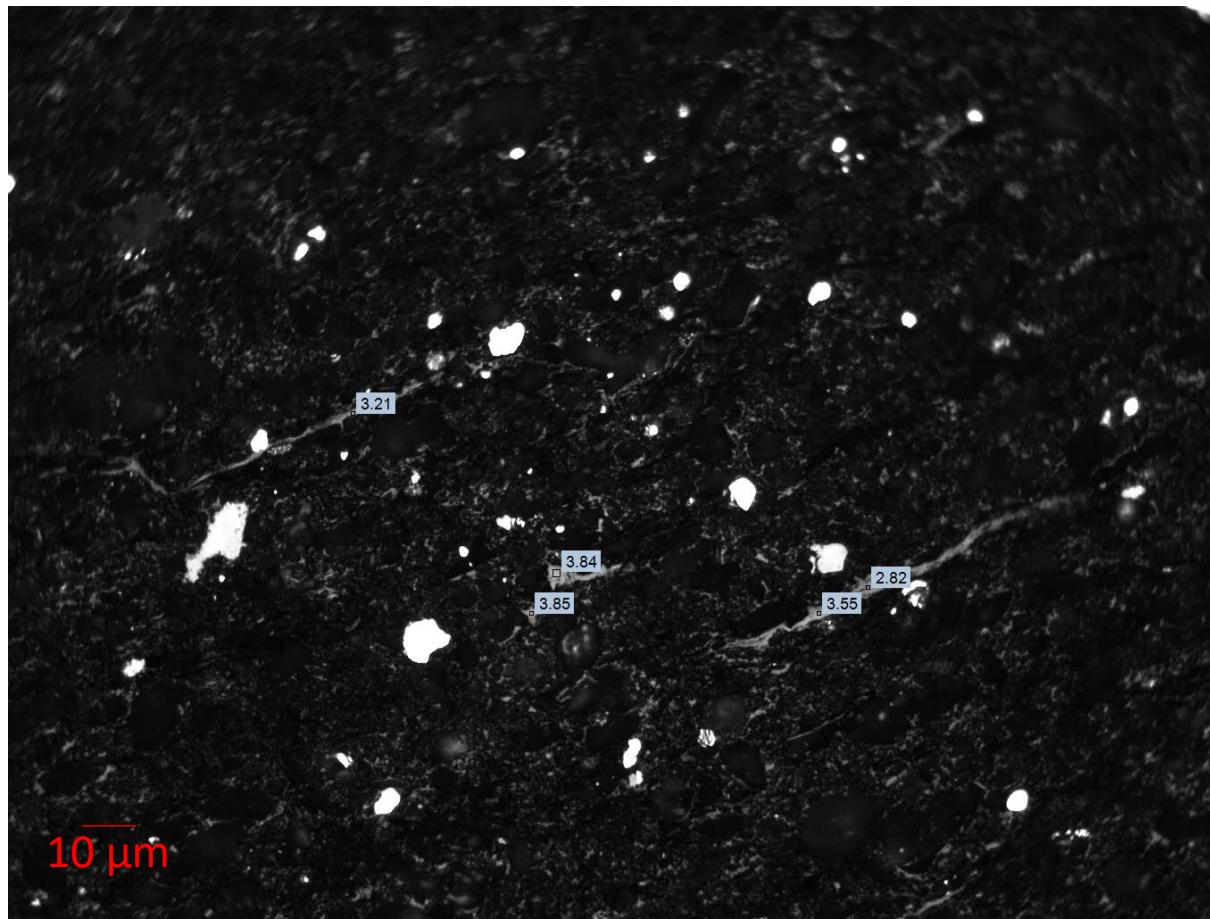
Sample : E200205_005_Tattoo_3251_48_VR1

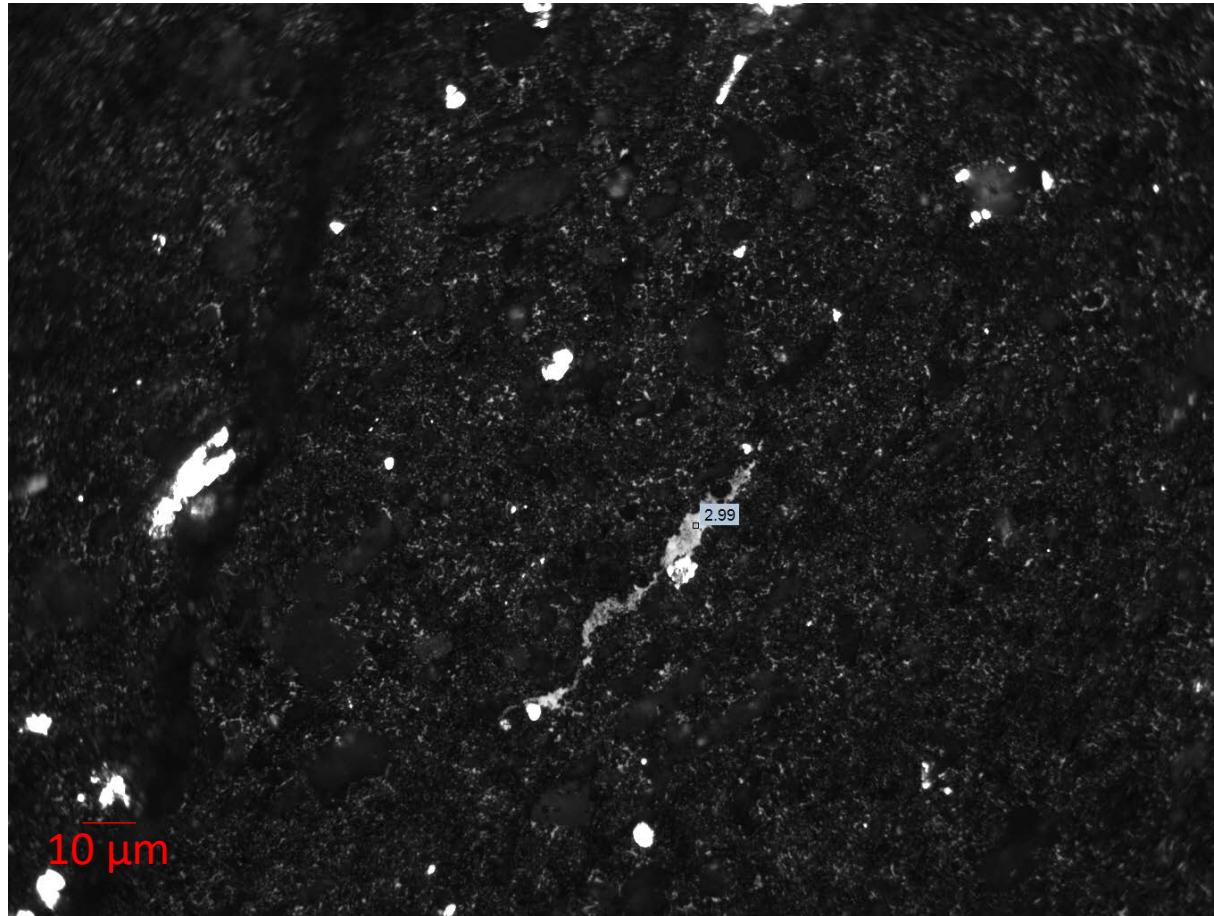


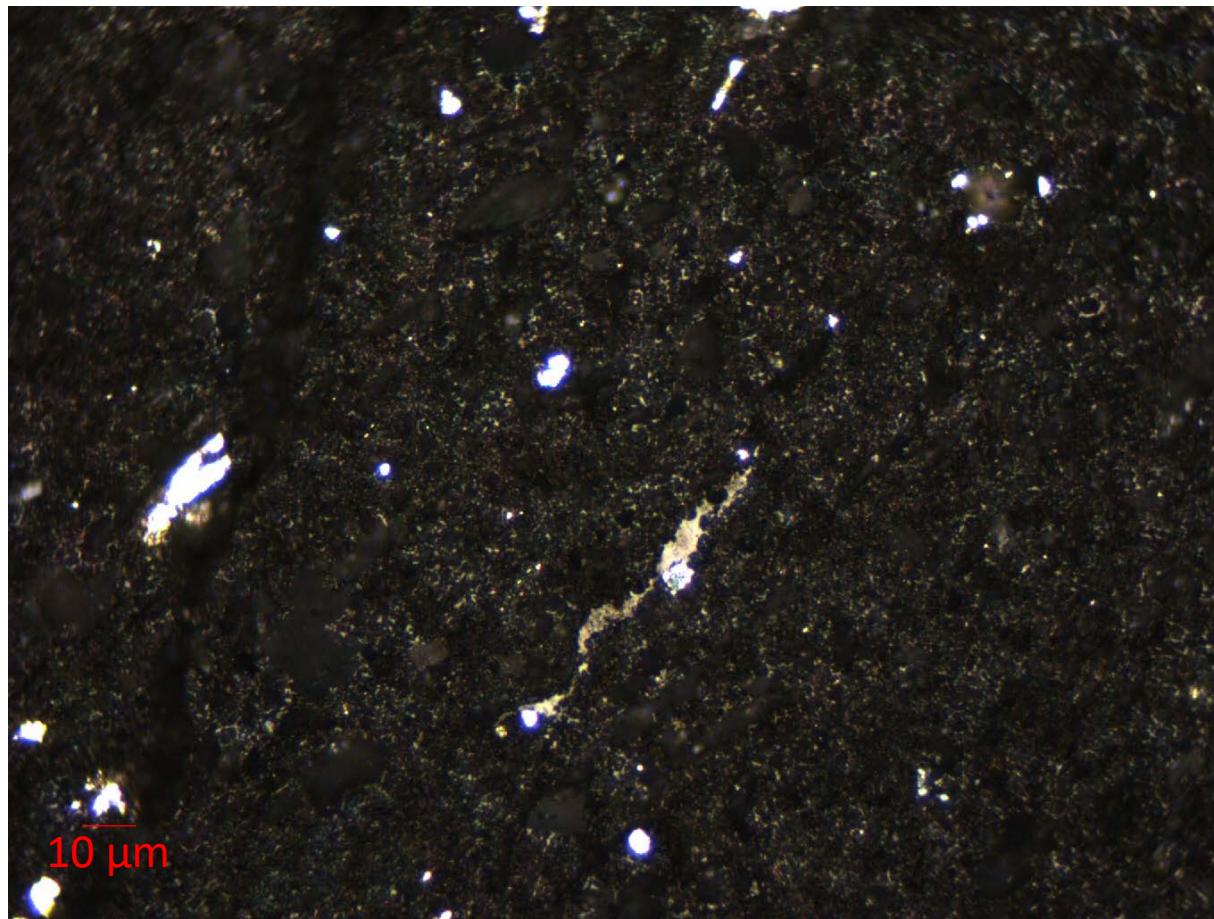
Measure count =	21	Date	2/26/2020	12:01 PM
Reflectance Rr =	3.253 %	Operator	Javin	
s =	0.268 %	Printed	3/2/2020	
2.80 - 2.85 % R	4.8 %	3.35 - 3.40 % R	4.8 %	
2.85 - 2.90 % R	14.3 %	3.45 - 3.50 % R	4.8 %	
2.95 - 3.00 % R	9.5 %	3.50 - 3.55 % R	9.5 %	
3.10 - 3.15 % R	9.5 %	3.55 - 3.60 % R	9.5 %	
3.20 - 3.25 % R	14.3 %	3.60 - 3.65 % R	4.8 %	
3.30 - 3.35 % R	9.5 %	3.65 - 3.70 % R	4.8 %	

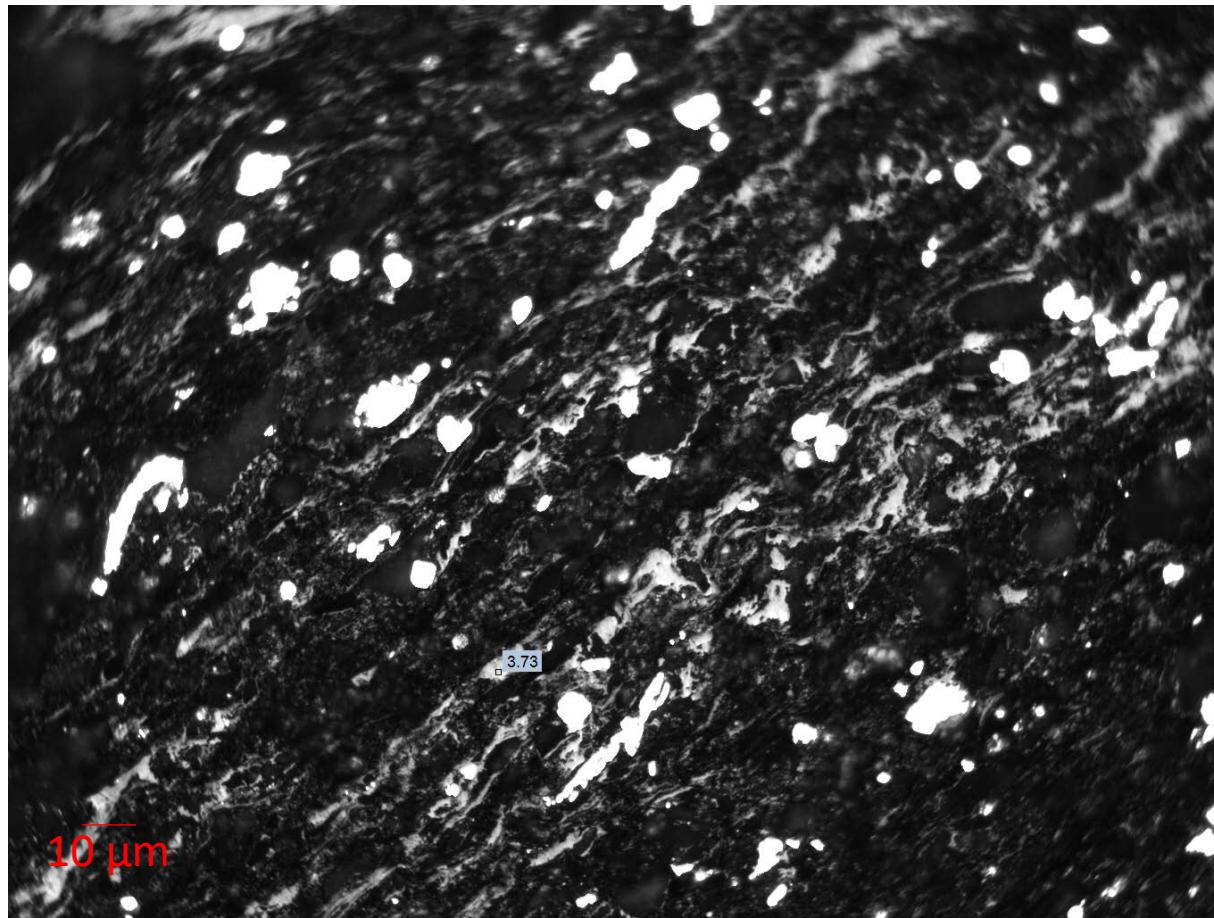


10 μ m



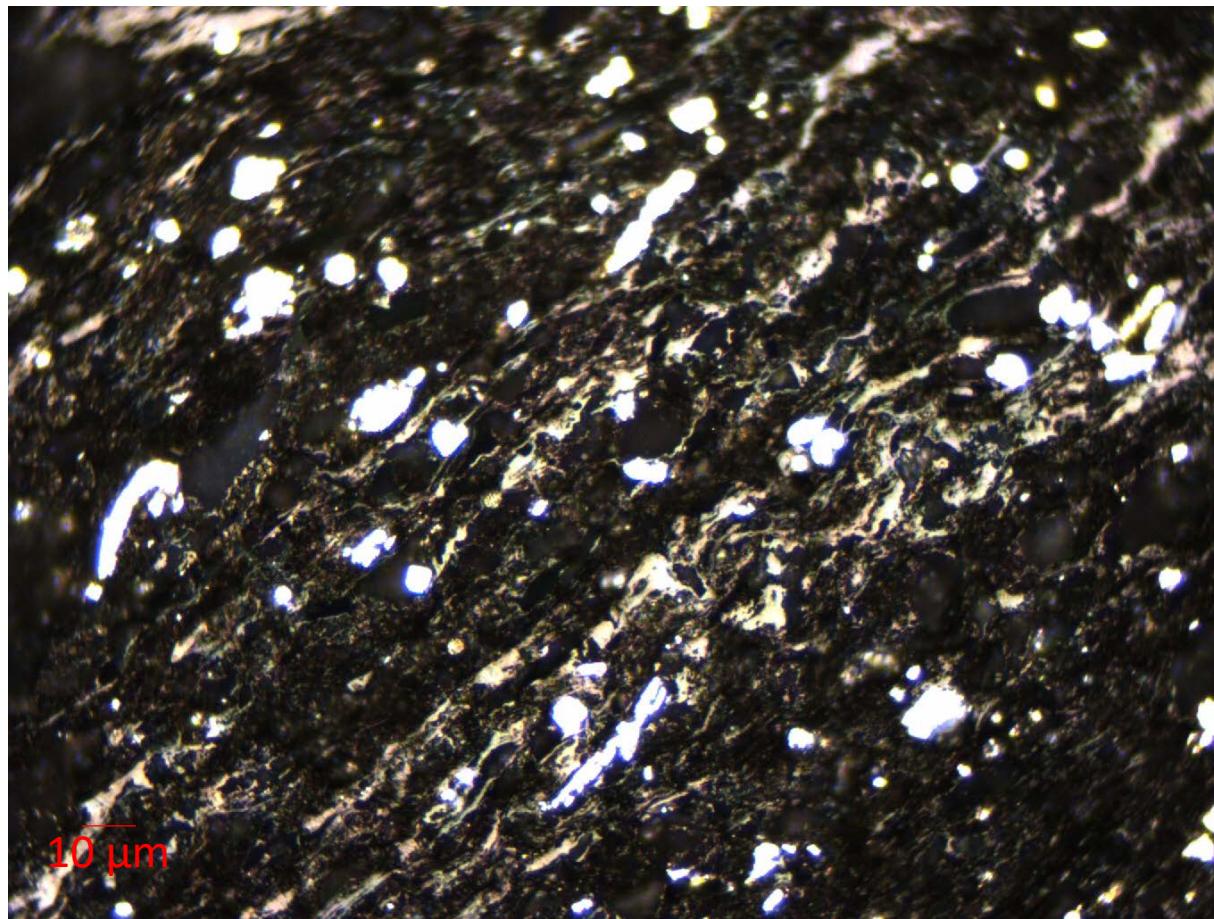






10 μm

3.73



10 μm