CORE-BASED X-RAY DIFFRACTION, X-RAY FLUORESCENCE, AND PYROLYSIS DATA FOR THE TOROK, HUE, AND HRZ SHALE FORMATIONS IN THE COLVILLE BASIN ON THE NORTH SLOPE, ALASKA

Contributions by: Timothy Scott Williams[1], Kelsey Anderson[1], and Shuvajit Bhattacharya[1]

Geologic Materials Center Data Report 468

GMC data reports provide analytical and interpretive data resulting from testing by third parties on material borrowed from samples housed at the Alaska Geologic Materials Center. These files are produced by the third-party agency or company that conducted the sampling and analysis. The results and interpretations have not undergone technical review and should not be cited as reviewed data or as an authoritative information source.

July 2020
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
GEOLOGIC MATERIALS CENTER

[1] University of Alaska Anchorage

Keywords
Analytical Laboratory Results; Total Organic Carbon; X-Ray Diffraction; X-Ray Fluorescence; Torok, Hue; HRZ; Pyrolysis; Shale; Mudstone

Core-based X-Ray Diffraction, X-Ray Fluorescence, and Pyrolysis data for the Torok, Hue and HRZ Shale formations in the Colville Basin on the North Slope, Alaska

Timothy Scott Williams[1], Kelsey Anderson[1], and Shuvajit Bhattacharya[1]
[1]University of Alaska Anchorage

Objectives

Core samples from the Alaska Geologic Materials Center (GMC) are used to measure the mineral abundance, elemental abundance, and pyrolysis data to determine petrophysical properties of the Torok, Hue, and high radioactive zone (HRZ) Shale on the North Slope, Alaska. Core samples were sent to Wildcat Laboratories/Geomark for Hawk pyrolysis (total organic carbon, TOC), and Activation Laboratories for x-ray diffraction (XRD) and x-ray fluorescence (XRF) analysis.

Core Samples

Figure 1 shows the location of the wells from which core samples were taken. Table 1 shows specific information regarding the samples from each well and the analyses performed on them.

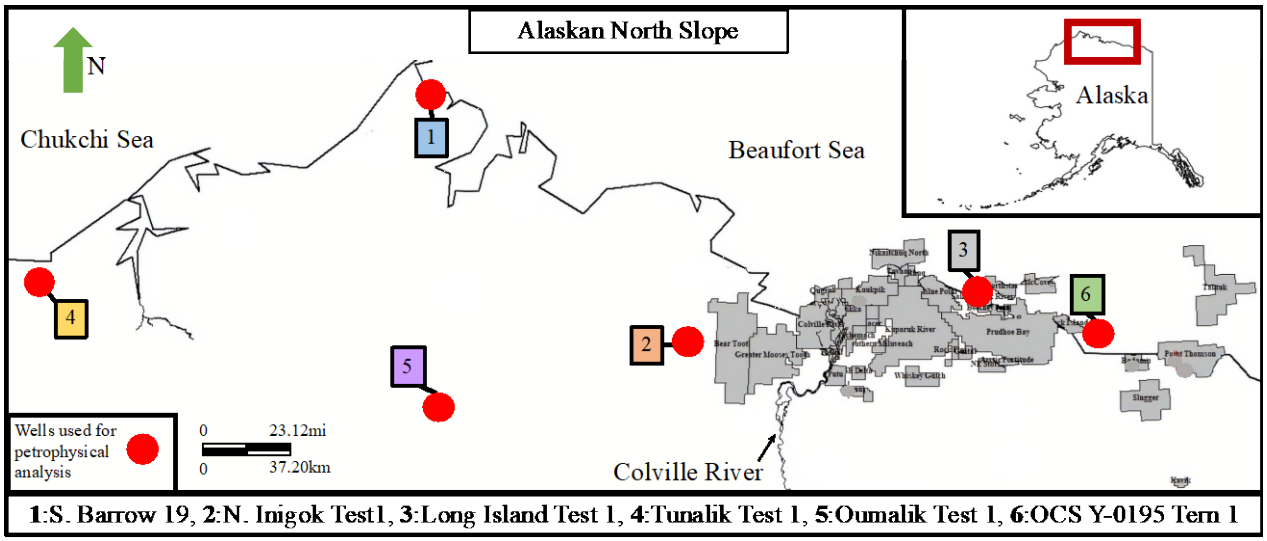

Figure 1. Map of the North Slope, Alaska, with wells selected for core sampling. Samples 1-5 are from the S. Barrow 19 (1), 6-9 from N. Inigok Test 1 (2), 10-15 from Long Island Test 1 (3), 16-19 from Tunalik Test 1 (4), 20-24 from Oumalik Test 1 (5), and 25-36 from OCS Y-0195 Tern 1 well (6).

Number	API #	Well Name	Depth (ft. MD)	Analysis
1	50023200120000	S. Barrow 19	1348	XRD, XRF, TOC
2	50023200120000	S. Barrow 19	1353	XRD, XRF, TOC
3	50023200120000	S. Barrow 19	1355	XRD, XRF, TOC
4	50023200120000	S. Barrow 19	1357	XRD, XRF, TOC
5	50023200120000	S. Barrow 19	1359	XRD, XRF, TOC
6	50103200170000	N. Inigok Test 1	7488	XRD, XRF, TOC
7	50103200170000	N. Inigok Test 1	7495	XRD, XRF, TOC
8	50103200170000	N. Inigok Test 1	7503	XRD, XRF, TOC
9	50029210430000	Long Island Test 1	7999	XRD, XRF, TOC
10	50029210430000	Long Island Test 1	8001	XRD, XRF, TOC
11	50029210430000	Long Island Test 1	8003	XRD, XRF, TOC
12	50029210430000	Long Island Test 1	8005	XRD, XRF, TOC
13	50029210430000	Long Island Test 1	8008	XRD, XRF, TOC
14	50029210430000	Long Island Test 1	8012	XRD, XRF, TOC
15	50301200010000	Tunalik Test 1	10672	XRD
16	50301200010000	Tunalik Test 1	10674	XRD, XRF, TOC
17	50301200010000	Tunalik Test 1	10678	XRD, XRF, TOC
18	50301200010000	Tunalik Test 1	10680	XRD
19	50119100050000	Oumalik Test 1	10235	XRD
20	50119100050000	Oumalik Test 1	10236	XRD
21	50119100050000	Oumalik Test 1	10992	XRD, XRF, TOC
22	50119100050000	Oumalik Test 1	10994	XRD, XRF, TOC
23	50119100050000	Oumalik Test 1	11852	XRD

24	55201000030000	OCS Y-0195 Tern 1	11804	XRD, XRF, TOC
25	55201000030000	OCS Y-0195 Tern 1	11808	XRD, XRF, TOC
26	55201000030000	OCS Y-0195 Tern 1	11812	XRD, XRF, TOC
27	55201000030000	OCS Y-0195 Tern 1	11823	XRD, XRF, TOC
28	55201000030000	OCS Y-0195 Tern 1	11826	XRD, XRF, TOC
29	55201000030000	OCS Y-0195 Tern 1	11829	XRD, XRF, TOC
30	55201000030000	OCS Y-0195 Tern 1	11924	XRD
31	55201000030000	OCS Y-0195 Tern 1	11927	XRD
32	55201000030000	OCS Y-0195 Tern 1	11943	XRD, XRF, TOC
33	55201000030000	OCS Y-0195 Tern 1	11949	XRD, XRF, TOC
34	55201000030000	OCS Y-0195 Tern 1	11951	XRD
35	55201000030000	OCS Y-0195 Tern 1	11954	XRD

Table 1. Information regarding core samples used in the analysis.

Results
XRD data by well

Depth (ft)	1348	1359	7488	7503	7999	8005	8008	8012	11804	11829
Well Name	S. Barrow 19	S. Barrow 19	N. Inigok Test1	N. Inigok Test1	Long Island Test 1	Long Island Test 1	Long Island Test 1	Long Island Test 1	OCS Y0195 Tern 1	OCS Y0195 Tern 1
Quartz	43.2	16.1	30.0	16.7	18.6	14.7	18.5	4.7	28.4	28.3
Plagioclase	14.3	1.2	9.7	5.0	4.2	6.0	n.d.	n.d.	2.2	4.2
Muscovite/Illite	17.4	20.0	29	35.0	27.6	23.9	n.d.	n.d.	15.6	48.6
Kaolinite	5.6	3.1	3.6	8.7	1.7	6.3	n.d.	n.d.	n.d.	n.d.
Chlorite	6.7	2.3	5.0	4.6	1.6	n.d.	n.d.	n.d.	n.d.	n.d.
Siderite	3.1	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	85.2	n.d.	n.d.
Dolomite	1.0	n.d.	0.8	1.6	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Calcite	n.d.	n.d.	n.d.	n.d.	1.0	n.d.	n.d.	n.d.	n.d.	n.d.
Kutnohorite	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	3.4	n.d.	n.d.
Pyrite	n.d.	6.0	3.7	8.6	4.9	3.2	18.4	0.8	1.3	n.d.
Natrojarosite	n.d.	6.7	n.d.	n.d.	n.d.	4.0	n.d.	n.d.	0.5	n.d.
Rozenite	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	3.6	n.d.
Szomolnokite	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	4.0	n.d.
Gypsum	n.d.	1.1	n.d.	n.d.	0.7	trace	n.d.	n.d.	n.d.	n.d.
Apatite	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	36.2	n.d.	n.d.	n.d.
Amorphous and poorly crystalline	8.7	43.5	18.2	19.8	39.7	41.9	26.9	5.9	44.4	18.9

Table 2. First round of samples for XRD analysis showing the major mineral abundances.

Depth (ft)	10672	10680	11924.5	11954	11927	11951	10235	10236	11852
Well Name	Tunalik Test 1	Tunalik Test 1	OCS Y0195 Tern 1	OCS Y0195 Tern 1	OCS Y0195 Tern 1	OCS Y0195 Tern 1	Oumalik Test 1	Oumalik Test 1	Oumalik Test 1
Quartz	43.2	19.1	37.3	34.0	33.9	21.0	20.1	55.2	61.2
Plagioclase	2.4	1.0	3.8	1.6	3.3	n.d.	8.2	23.8	n.d.
Muscovite/Illite	19.2	25.8	20.9	22.9	25.7	8.6	26.7	10.0	1.3
Kaolinite	4.5	4.9	1.3	1.8	2.6	n.d.	n.d.	n.d.	1.5
Chlorite	3.1	3.8	n.d.	n.d.	n.d.	n.d.	5.5	4.5	n.d.
Siderite	n.d.	1.0	n.d.	n.d.	2.3	n.d.	n.d.	n.d.	n.d.
Dolomite	2.0	2.3	4.0	n.d.	n.d.	n.d.	0.8	5.8	30.5
Pyrite	3.0	3.6	3.1	3.4	1.2	0.8	4.9	0.7	n.d.
Gorceixite	n.d.	n.d.	n.d.	n.d.	0.6	1.0	n.d.	n.d.	n.d.
Rozenite	n.d.	n.d.	n.d.	n.d.	n.d.	8.1	n.d.	n.d.	n.d.
Szomolnokite	n.d.	n.d.	n.d.	n.d.	n.d.	14.9	n.d.	n.d.	n.d.
Gypsum	n.d.	n.d.	n.d.	n.d.	n.d.	4.7	n.d.	n.d.	n.d.
Amorphous and poorly crystalline	35.7	38.5	29.6	36.3	30.4	40.9	33.8	n.d.	5.5

Table 3. Second round of samples for XRD analysis showing the major mineral abundances.

Depth (ft)	7492	8001	8003	11823	11826	11943	11949
Well Name	N. Inigok Test1	Long Island Test 1	Long Island Test 1	OCS Y0195 Tern 1	OCS Y0195 Tern 1	OCS Y0195 Tern 1	OCS Y0195 Tern 1
Quartz	16.8	17.9	22.7	31.4	45.1	30.6	29.3
Plagioclase	3.3	2.2	3.4	6.5	8.3	1.3	2.6
K-Feldspar	n.d.	2.5	3.6	1.0	trace	n.d.	n.d.
Muscovite/Illite	12.2	7.8	11.3	24.7	28.4	19.1	26.7
Kaolinite	3.8	n.d.	n.d.	n.d.	n.d.	n.d.	2.4
Chlorite	3.2	n.d.	2.6	n.d.	n.d.	n.d.	n.d.
Siderite	1.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Dolomite	n.d.	n.d.	n.d.	n.d.	n.d.	2.1	n.d.
Pyrite	15.4	11.9	5.3	n.d.	n.d.	9.1	9.9
Gorceixite	n.d.	n.d.	n.d.	n.d.	n.d.	0.9	0.7
Rozenite	n.d.	4.2	n.d.	9.5	n.d.	n.d.	8.1
Natrojarosite	3.3	6.0	n.d.	4.9	n.d.	3.8	n.d.
Gypsum	n.d.	2.1	1.0	2.4	n.d.	0.9	0.7
Amorphous and poorly crystalline	40.8	45.4	49.1	19.6	18.2	31.1	28.4

Table 4. Third round of samples for XRD analysis showing the major mineral abundances.

XRF DATA BY WELL

S.Barrow 19

Depth (ft)	Well	Al (%)	As	B	Ba	Be	Bi	Ca (%)	Cd	Ce	Co	Cs	Cu	Dy	Er
1348	S. Barrow 19	8.5	17	120	558	3	2	0.75	3	72.4	18.1	7.6	45	5.2	2.9
1353	S. Barrow 19	9.72	65	140	582	3	2	0.75	3	81	21.5	10.4	46	4.9	2.9
1355	S. Barrow 19	9.6	23	140	585	3	2	0.82	3	78.7	17.8	10	48	4.9	3
1357	S. Barrow 19	9.98	18	140	598	3	2	0.72	3	83.5	17.9	10.4	48	5.3	3.1
1359	S. Barrow 19	8.2	126	130	524	3	2	0.62	8	72.7	48.2	9	101	5.2	3.1

Table 4.1. S. Barrow 19 XRF from Al to Er. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Eu	Fe (%)	Ga	Gd	Ge	Ho	Hf	In	K (%)	La	Li	Mg (%)	Mn	Nb
1348	S. Barrow 19	1.4	4.93	22.3	6	0.7	1	10	0.2	2.1	35.9	61	1.22	620	14
1353	S. Barrow 19	1.4	4.67	26.4	5.9	0.9	1	10	0.2	2.5	40.9	76	1.23	244	14.6
1355	S. Barrow 19	1.4	4.98	25.9	6.2	1.7	1	10	0.2	2.5	39.6	76	1.33	411	14.7
1357	S. Barrow 19	1.5	4.85	26.6	6.6	1.3	1.1	10	0.2	2.5	41.7	76	1.3	380	14.5
1359	S. Barrow 19	1.5	8.07	23.6	6.6	2.4	1	10	0.2	2	36.1	73	0.94	179	10.9

Table 4.2. S. Barrow 19 XRF from Eu to Nb. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Nd	Pb	Pr	Rb	S (%)	Sb	Se	Si (%)	Sm	Sn	Sr	Ta	Tb	Te
1348	S. Barrow 19	33.5	23.1	8.8	110	0.07	2	7.7	27.9	6.3	9.9	155	0.7	0.8	6
1353	S. Barrow 19	35.7	24.6	9.7	140	1.74	2	7.6	25.5	6.5	9.3	159	0.8	0.8	6
1355	S. Barrow 19	35.4	26.1	9.5	136	1.08	2	7.1	25.7	6.4	9.2	152	0.7	0.8	6
1357	S. Barrow 19	37.6	22.4	10.1	142	0.81	2	6	26.8	6.9	8.3	164	0.7	0.9	6
1359	S. Barrow 19	33.5	35.7	8.9	115	6.47	3	7.9	18.8	6.6	3	135	0.6	0.9	6

Table 4.3. S. Barrow 19 XRF from Nd to Te. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Th	Ti (%)	Tl	Tm	U	V	W	Y	Yb	Zn	Cr (%)	Ni (%)	Mo (%)
1348	S. Barrow 19	11.1	0.5	0.4	0.4	3.1	160	2.8	28.1	2.9	130	0.01	0.006	0.005
1353	S. Barrow 19	12.4	0.51	0.9	0.4	4.5	256	1.9	27.1	2.8	140	0.01	0.006	0.005
1355	S. Barrow 19	12.1	0.53	0.7	0.4	3.3	198	2.1	27.2	2.9	130	0.01	0.008	0.005
1357	S. Barrow 19	12.4	0.53	0.7	0.5	3.4	206	2	29.1	2.8	130	0.01	0.005	0.005
1359	S. Barrow 19	10.7	0.42	3.7	0.4	17.3	527	1.1	30.7	3.1	270	0.01	0.014	0.005

Table 4.4. S. Barrow 19 XRF from Th to Mo. Element concentrations with no percentage symbol are reported in parts per million.

N. Inigok Test 1

Depth (ft)	Well	Al (%)	As	B	Ba	Be	Bi	Ca (%)	Cd	Ce	Co	Cs	Cu	Dy	Er
7488	N. Inigok Test 1	8.87	60	130	719	3	2	0.7	24	68.1	31.9	9.4	102	5.4	3.3
7492	N. Inigok Test 1	7.83	107	210	697	< 3	< 2	1.18	13	68.5	53.8	7.7	147	4.9	3
7495	N. Inigok Test 1	9.07	54	150	786	3	2	0.95	10	70.3	37.5	9.2	95	4.8	2.9
7503	N. Inigok Test 1	10.6	99	160	803	3	2	0.97	19	70.3	36.8	8.8	143	5.3	3.1

Table 5.1. N. Inigok Test 1 XRF from Al to Er. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Eu	Fe (%)	Ga	Gd	Ge	Ho	Hf	In	K (%)	La	Li	Mg (%)	Mn	Nb
7488	N. Inigok Test 1	1.5	4.27	24.4	6.2	2.1	1.1	10	0.2	2.3	34.4	70	1.08	212	15.4
7492	N. Inigok Test 1	1.3	9.63	20.1	4.8	1.9	0.9	< 10	< 0.2	2.2	37.6	68	1.1	188	10.5
7495	N. Inigok Test 1	1.4	4.28	25.7	5.8	1.4	1	10	0.2	2.3	34.6	72	1.07	208	15.3
7503	N. Inigok Test 1	1.3	6.01	23.8	6.1	1.5	1	10	0.3	2.1	33.5	126	0.99	290	14.9

Table 5.2. N. Inigok Test 1 XRF from Eu to Nb. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Nd	Pb	Pr	Rb	S (%)	Sb	Se	Si (%)	Sm	Sn	Sr	Ta	Tb	Te
7488	N. Inigok Test 1	32.5	30	8.7	123	2.34	13	14	25.9	6.5	8.3	167	0.7	0.9	6
7492	N. Inigok Test 1	30.7	31.5	8.2	111	8.66	11	14	17.9	5.4	5	137	1.2	0.8	6
7495	N. Inigok Test 1	30.2	34.2	8.5	119	2.89	8	7.7	26	6.2	8	147	0.7	0.8	6
7503	N. Inigok Test 1	32.1	71.9	8.6	112	5	20	30.8	22.2	6.3	12.8	148	1.9	0.8	6

Table 5.3. N. Inigok Test 1 XRF from Nd to Te. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Th	Ti (%)	Tl	Tm	U	V	W	Y	Yb	Zn	Cr (%)	Ni (%)	Mo (%)
7488	N. Inigok Test 1	10.6	0.51	7.5	0.5	18.9	586	1.2	31.3	3.1	1080	0.01	0.033	0.011
7492	N. Inigok Test 1	11.2	0.37	4.6	0.4	31.5	955	1.8	26.5	3.2	610	0.01	0.03	0.01
7495	N. Inigok Test 1	10.7	0.51	5.8	0.4	15.5	538	1.4	26.1	3	730	0.01	0.029	0.01
7503	N. Inigok Test 1	40.9	0.4	10.2	0.5	26.5	1200	1	29.2	3.1	930	0.01	0.039	0.016

Table 5.4. N. Inigok Test 1 XRF from Th to Mo. Element concentrations with no percentage symbol are reported in parts per million.

Long Island Test 1

Depth (ft)	Well	Al (%)	As	B	Ba	Be	Bi	Ca (%)	Cd	Ce	Co	Cs	Cu	Dy	Er
7999	Long Island Test 1	7.8	97	90	945	3	2	0.86	17	72.6	12.4	6.2	257	6.2	3.1
8001	Long Island Test 1	4.89	165	120	682	< 3	< 2	0.9	17	75.1	46	5.6	174	6	3
8003	Long Island Test 1	7.55	79	170	849	4	< 2	1.03	26	61.9	15.3	7.3	362	5	2.8
8005	Long Island Test 1	5.84	63	70	802	3	2	1.23	90	65.7	16.6	6.4	359	7	3.9
8008	Long Island Test 1	0.72	37	10	2200	3	2	16.4	16	28.3	2.6	0.7	75	6.6	6.5
8012	Long Island Test 1	0.94	5	10	996	3	2	5.81	3	15.8	4.6	1.2	24	1.3	0.8

Table 6.1. Long Island Test 1 XRF from Al to Er. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Eu	Fe (%)	Ga	Gd	Ge	Ho	Hf	In	K (%)	La	Li	Mg (%)	Mn	Nb
7999	Long Island Test 1	1.9	5.12	16.8	8.6	2	1.2	10	0.2	2	38.2	33	0.83	143	14.1
8001	Long Island Test 1	1.6	10.6	16.4	7.6	1.9	1.2	< 10	< 0.2	1.5	43.6	24	0.63	154	12.7
8003	Long Island Test 1	1.7	4.24	20	6.7	2.3	1	< 10	< 0.2	2.2	36.9	39	0.87	189	14.6
8005	Long Island Test 1	1.8	2.97	18.4	8.7	2.3	1.4	10	0.2	1.6	33.4	28	0.72	127	10
8008	Long Island Test 1	0.7	15.1	1.8	4.8	0.7	1.9	10	0.2	0.2	34.4	15	0.1	397	2.4

8012	Long Island Test 1	0.4	28.8	2.8	1.7	0.7	0.3	10	0.2	0.3	9.2	16	3.68	4020	2.4

Table 6.2. Long Island Test 1 XRF from Eu to Nb. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Nd	Pb	Pr	Rb	S (%)	Sb	Se	Si (%)	Sm	Sn	Sr	Ta	Tb	Te
7999	Long Island Test 1	37.7	59.3	10	94.7	4.11	10	30.2	21	8.2	4.2	242	0.8	1.1	6
8001	Long Island Test 1	36.3	33.6	8.8	72.4	10.5	25	18	16.3	7.2	2.4	155	1.1	1.2	6
8003	Long Island Test 1	35.2	33.4	8.6	103	3.15	18	31	22.7	7.4	9.1	173	1	0.9	6
8005	Long Island Test 1	35.8	28.8	9	82.2	3.05	27	39.5	17.9	7.8	2.3	162	0.4	1.1	6
8008	Long Island Test 1	12.3	15	3.1	7.2	17.5	15	28.1	7.64	2.3	3.6	1380	0.2	0.7	6
8012	Long Island Test 1	8	2.9	2	13.4	0.6	2	8.2	4.04	1.5	5.8	265	0.2	0.2	6

Table 6.3. Long Island Test 1 XRF from Nd to Te. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Th	Ti (%)	Tl	Tm	U	V	W	Y	Yb	Zn	Cr (%)	Ni (%)	Mo (%)
7999	Long Island Test 1	21.8	0.3	1.8	0.4	9.3	851	1.8	32.3	2.8	610	0.02	0.013	0.005

8001	Long Island Test 1	10	0.25	7.1	0.5	27	1110	2.7	34.7	3.1	910	0.01	0.021	0.01
8003	Long Island Test 1	11.9	0.36	3.1	0.4	16.2	1510	4.6	27.2	2.9	1200	0.01	0.014	0.002
8005	Long Island Test 1	9.9	0.29	9.7	0.6	44.3	3210	1.5	42.7	3.6	3950	0.01	0.021	0.017
8008	Long Island Test 1	0.9	0.03	3	1	6.1	192	0.7	99.4	7.4	800	0.01	0.005	0.005
8012	Long Island Test 1	1.7	0.05	0.1	0.1	0.7	153	1.4	10	0.8	30	0.01	0.005	0.005

Table 6.4. Long Island Test 1 XRF from Th to Mo. Element concentrations with no percentage symbol are reported in parts per million.

Tunalik Test 1

Depth (ft)	**Well**	**Al (%)**	**As**	**B**	**Ba**	**Be**	**Bi**	**Ca (%)**	**Cd**	**Ce**	**Co**	**Cs**	**Cu**	**Dy**	**Er**
10674	Tunalik Test 1	9.86	46	120	739	3	2	0.82	8	109	14.8	10.2	87	7.7	4.4
10678	Tunalik Test 1	10.8	9	140	938	3	2	0.68	3	140	16.3	11.7	72	6.9	3.8

Table 7.1. Tunalik Test 1 XRF from Al to Er. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Eu	Fe (%)	Ga	Gd	Ge	Ho	Hf	In	K (%)	La	Li	Mg (%)	Mn	Nb
10674	Tunalik Test 1	2.2	4.42	26.4	9.7	2.6	1.4	10	0.2	2.3	53.7	163	1.04	182	22.8
10678	Tunalik Test 1	2.1	4.97	28	9	3.2	1.3	10	0.2	2.8	53.1	184	1.15	207	24

Table 7.2. Tunalik Test 1 XRF from Eu to Nb. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Nd	Pb	Pr	Rb	S (%)	Sb	Se	Si (%)	Sm	Sn	Sr	Ta	Tb	Te
10674	Tunalik Test 1	49.8	29	13.5	126	2.61	6	20	24.5	9.5	2.7	188	1	1.2	6
10678	Tunalik Test 1	51.1	22.1	13.7	151	2.21	2	7.5	24.9	9.6	7.7	222	1	1.2	6

Table 7.3. Tunalik Test 1 XRF from Nd to Te. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Th	Ti (%)	Tl	Tm	U	V	W	Y	Yb	Zn	Cr (%)	Ni (%)	Mo (%)
10674	Tunalik Test 1	13.2	0.58	1.1	0.6	8.7	532	1.8	44.1	3.8	280	0.02	0.012	0.005
10678	Tunalik Test 1	15.5	0.54	0.7	0.5	4.6	305	1.7	35	3.4	130	0.01	0.006	0.005

Table 7.4. Tunalik Test 1 XRF from Th to Mo. Element concentrations with no percentage symbol are reported in parts per million.

Oumalik Test 1

Depth (ft)	Well	Al (%)	As	B	Ba	Be	Bi	Ca (%)	Cd	Ce	Co	Cs	Cu	Dy	Er
10992	Oumalik Test 1	4.83	5	60	349	3	2	0.74	3	44.1	8.1	3.3	15	4	2
10994	Oumalik Test 1	4.63	5	60	375	3	2	0.68	3	44	9	3.4	17	3.6	1.9

Table 8.1. Oumalik Test 1 XRF from Al to Er. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Eu	Fe (%)	Ga	Gd	Ge	Ho	Hf	In	K (%)	La	Li	Mg (%)	Mn	Nb
10992	Oumalik Test 1	0.8	3.09	11.9	4.5	0.7	0.7	10	0.2	1.2	21.4	53	0.55	324	14.3
10994	Oumalik Test 1	0.8	3.1	10.9	4.5	1.4	0.7	10	0.2	1.1	21.6	58	0.5	318	14.2

Table 8.2. Oumalik Test 1 XRF from Eu to Nb. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Nd	Pb	Pr	Rb	S (%)	Sb	Se	Si (%)	Sm	Sn	Sr	Ta	Tb	Te
10992	Oumalik Test 1	17.7	15	5	54.9	0.03	2	3.3	30	3.7	5.8	124	0.6	0.7	6
10994	Oumalik Test 1	18.1	19.3	5	52.5	0.06	2	4.1	30	3.6	4.5	121	0.6	0.6	6

Table 8.3. Oumalik Test 1 XRF from Nd to Te. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Th	Ti (%)	Tl	Tm	U	V	W	Y	Yb	Zn	Cr (%)	Ni (%)	Mo (%)
10992	Oumalik Test 1	6.1	0.33	0.3	0.3	2	76	0.9	21	2	60	0.01	0.005	0.005
10994	Oumalik Test 1	6.3	0.29	0.3	0.3	1.9	74	0.7	18.9	1.8	70	0.01	0.005	0.005

Table 8.4. Oumalik Test 1 XRF from Th to Mo. Element concentrations with no percentage symbol are reported in parts per million.

OCS-0195 Tern 1

Depth (ft)	Well	Al (%)	As	B	Ba	Be	Bi	Ca (%)	Cd	Ce	Co	Cs	Cu	Dy	Er
11804	OCS-0195 Tern 1	6.23	42	60	757	3	2	0.08	7	61.2	31.9	17.6	87	3.7	2.1
11808	OCS-0195 Tern 1	4.22	24	20	504	4	2	2.58	3	50.9	3	10.5	40	6.5	3.9
11812	OCS-0195 Tern 1	10.9	49	150	852	3	2	0.08	3	110	6.6	33.1	89	6.6	3.9
11823	OCS-0195 Tern 1	7.46	76	190	1190	< 3	< 2	0.74	< 2	55.1	24.4	15.7	61	4.2	2.4
11826	OCS-0195 Tern 1	9.98	7	250	834	3	< 2	0.17	< 2	86.2	12.9	28.6	57	5.7	3.2
11829	OCS-0195 Tern 1	10	5	130	824	3	2	0.11	4	88.6	12.1	31	63	5.8	3.5
11943	OCS-0195 Tern 1	6.43	112	210	1710	< 3	< 2	1.8	8	60.2	48.4	17.7	133	9.4	5.3
11949	OCS-0195 Tern 1	8.86	100	310	1990	3	< 2	0.55	19	85.1	39.4	24.1	173	5.3	3.3

Table 9.1. OCS-0195 Tern 1 XRF from Al to Er. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Eu	Fe (%)	Ga	Gd	Ge	Ho	Hf	In	K (%)	La	Li	Mg (%)	Mn	Nb
11804	OCS-0195 Tern 1	1	5.22	17	4.6	1.2	0.7	10	0.2	2.1	30	34	0.39	454	11
11808	OCS-0195 Tern 1	1.1	30	9.3	6.6	0.7	1.4	10	0.2	1.3	25.6	22	5.15	3990	3
11812	OCS-0195 Tern 1	1.9	1.03	29.5	8.7	2.3	1.3	10	0.2	3.5	53.9	51	0.53	26	13.9
11823	OCS-0195 Tern 1	1	6.36	18.7	5.5	1.5	0.8	< 10	< 0.2	2.4	29.1	52	0.74	797	9.4
11826	OCS-0195 Tern 1	1.4	1.41	26.8	6.9	1.7	1.1	< 10	< 0.2	3.7	43.4	53	0.63	73	13.4
11829	OCS-0195 Tern 1	1.6	1.47	27.2	7.2	1.5	1.2	10	0.2	3.5	44.6	52	0.69	73	14.4
11943	OCS-0195 Tern 1	2.1	7.95	22.1	8.6	1.7	1.9	< 10	< 0.2	2.1	28.4	47	0.96	382	7.5
11949	OCS-0195 Tern 1	1.7	5.33	22.7	5.6	2	1.2	< 10	< 0.2	2.8	44.5	60	0.6	146	13.8

Table 9.2. OCS-0195 Tern 1 XRF from Eu to Nb. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Nd	Pb	Pr	Rb	S (%)	Sb	Se	Si (%)	Sm	Sn	Sr	Ta	Tb	Te
11804	OCS-0195 Tern 1	26.5	22.5	7.4	114	4.73	4	10.5	20.7	5.2	8.7	99	0.4	0.6	6
11808	OCS-0195 Tern 1	23.9	7.7	6.2	47.6	0.28	2	3.2	8.89	5.1	3.3	91	0.2	0.9	6
11812	OCS-0195 Tern 1	47.9	18.5	13.4	200	0.19	2	6.1	30	9.1	9.5	144	0.8	1.1	6
11823	OCS-0195 Tern 1	25.8	20.5	6.9	117	4.96	4	13	21.4	5.1	7.1	120	1.3	0.7	6
11826	OCS-0195 Tern 1	39.6	18.9	10.1	187	0.13	2	16	> 30.0	7.3	6.4	128	1.8	1	6
11829	OCS-0195 Tern 1	40.1	17.5	10.8	203	0.1	2	10.4	30	7.5	9	130	0.7	0.9	6
11943	OCS-0195 Tern 1	32	24.5	7.5	93.5	7.7	6	12	19.3	8.5	3.5	191	0.9	1.5	6
11949	OCS-0195 Tern 1	36.6	38.4	9.9	136	5.36	21	36	21.8	6.5	3.1	321	1.1	0.9	6

Table 9.3. OCS-0195 Tern 1 XRF from Nd to Te. Element concentrations with no percentage symbol are reported in parts per million.

Depth (ft)	Well	Th	Ti (%)	Tl	Tm	U	V	W	Y	Yb	Zn	Cr (%)	Ni (%)	Mo (%)
11804	OCS-0195 Tern 1	7.3	0.29	1	0.3	5	181	1.2	18.9	2	230	0.01	0.011	0.005
11808	OCS-0195 Tern 1	6.6	0.16	0.2	0.6	3.6	61	0.7	48.3	3.8	50	0.01	0.005	0.005
11812	OCS-0195 Tern 1	19	0.43	0.6	0.6	6.6	194	4.7	36	3.6	90	0.01	0.005	0.005
11823	OCS-0195 Tern 1	8.5	0.36	1.2	0.4	9	179	3	25.2	2.3	150	0.01	0.007	0.002
11826	OCS-0195 Tern 1	12.7	0.47	1	0.6	5.2	232	3.9	35	3.8	100	0.01	0.011	0.0002
11829	OCS-0195 Tern 1	12.9	0.52	0.7	0.5	4.9	220	2	32.9	3.4	140	0.01	0.005	0.005
11943	OCS-0195 Tern 1	7.8	0.4	3.6	0.8	14.9	752	2.3	48.3	5.2	510	0.01	0.016	0.004
11949	OCS-0195 Tern 1	11.5	0.43	6.4	0.5	18.1	1080	2.6	31.4	4	800	0.01	0.02	0.007

Table 9.4. OCS-0195 Tern 1 XRF from Th to Mo. Element concentrations with no percentage symbol are reported in parts per million.

Pyrolysis data by well

Depth (ft, MD)	Well Name	Rock-eval TOC (%)	Hawk TOC (%)	S1 (mg HC/g)	S2 (mg HC/g)	S3 (mg CO2/g)	Tmax (°C)
1348	S. Barrow 19	1.7	1.75	0.14	0.59	1.05	439.7
1353	S. Barrow 19	1.6	1.86	0.13	0.48	0.34	426.7
1355	S. Barrow 19	1.6	1.81	0.21	0.73	0.62	437.2
1357	S. Barrow 19	1.5	1.97	0.22	0.73	0.7	441
1359	S. Barrow 19	3.9	4.15	0.59	3.21	1.04	414.1

Table 10.1. S. Barrow 19 pyrolysis data

Depth (ft, MD)	Well Name	Rock-eval TOC (%)	Hawk TOC (%)	S1 (mg HC/g)	S2 (mg HC/g)	S3 (mg CO2/g)	Tmax (°C)
7488	N. Inigok Test 1	4.3	5.02	1.29	11.04	0.12	447.3
7492	N. Inigok Test 1	N/A	4.5	1.13	4.83	0.27	436
7495	N. Inigok Test 1	4.2	4.73	0.74	8.65	0.31	448.6
7503	N. Inigok Test 1	4	4.69	1.15	7.28	0.2	443.9

Table 10.2. N. Inigok Test 1 pyrolysis data

Depth (ft, MD)	Well Name	Rock-eval TOC (%)	Hawk TOC (%)	S1 (mg HC/g)	S2 (mg HC/g)	S3 (mg CO2/g)	Tmax (°C)
8001	Long Island Test 1	N/A	5.51	0.36	13.64	0.7	412
8003	Long Island Test 1	N/A	11	1.12	56.39	1.04	418
8005	Long Island Test 1	7	6.63	0.4	21.38	0.89	420.8
7999	Long Island Test 1	18.4	19.2	1.66	105.14	1.3	417.3
8008	Long Island Test 1	1.8	1.43	0.09	0.49	0.51	425
8012	Long Island Test 1	1.6	0.93	0.06	0.4	1.68	424.3

Table 10.3. Long Island Test 1 pyrolysis data

Depth (ft, MD)	Well Name	Rock-eval TOC (%)	Hawk TOC (%)	S1 (mg HC/g)	S2 (mg HC/g)	S3 (mg CO2/g)	Tmax (°C)
10674	Tunalik Test 1	4	5.31	0.18	0.71	0.12	487.1
10678	Tunalik Test 1	1.4	1.79	0.07	0.07	0.1	478.1

Table 10.4. Tunalik Test 1 pyrolysis data

Depth (ft, MD)	Well Name	Rock-eval TOC (%)	Hawk TOC (%)	S1 (mg HC/g)	S2 (mg HC/g)	S3 (mg CO2/g)	Tmax (°C)
10992	Oumalik Test 1	1.9	1.85	0.26	0.28	0.47	526.2
10994	Oumalik Test 1	2	2	0.35	0.29	0.82	536.2

Table 10.5. Oumalik Test 1 pyrolysis data

Depth (ft, MD)	Well Name	Rock-eval TOC (%)	Hawk TOC (%)	S1 (mg HC/g)	S2 (mg HC/g)	S3 (mg CO2/g)	Tmax (°C)
11804	OCS-0195 Tern 1	5.6	6.33	1.14	16.72	0.42	422.6
11808	OCS-0195 Tern 1	1.1	1.29	0.03	0.13	1.66	442.4
11812	OCS-0195 Tern 1	1	1.35	0.06	0.39	0.11	433.9
11823	OCS-0195 Tern 1	N/A	2.37	0.34	2.4	0.5	422
11826	OCS-0195 Tern 1	N/A	0.91	0.13	0.62	0.26	434
11829	OCS-0195 Tern 1	1.1	1.33	0.09	0.46	0.11	433.6
11943	OCS-0195 Tern 1	N/A	3.51	0.77	6.55	0.6	423
11949	OCS-0195 Tern 1	N/A	5.04	1.76	14.7	0.3	423

Table 10.6. OCS-0195 Tern 1 pyrolysis data

N/A indicates samples not used for Rock-eval pyrolysis. Apart from TOC values, all other parameters are from the Hawk pyrolysis method.