Supplementary Material

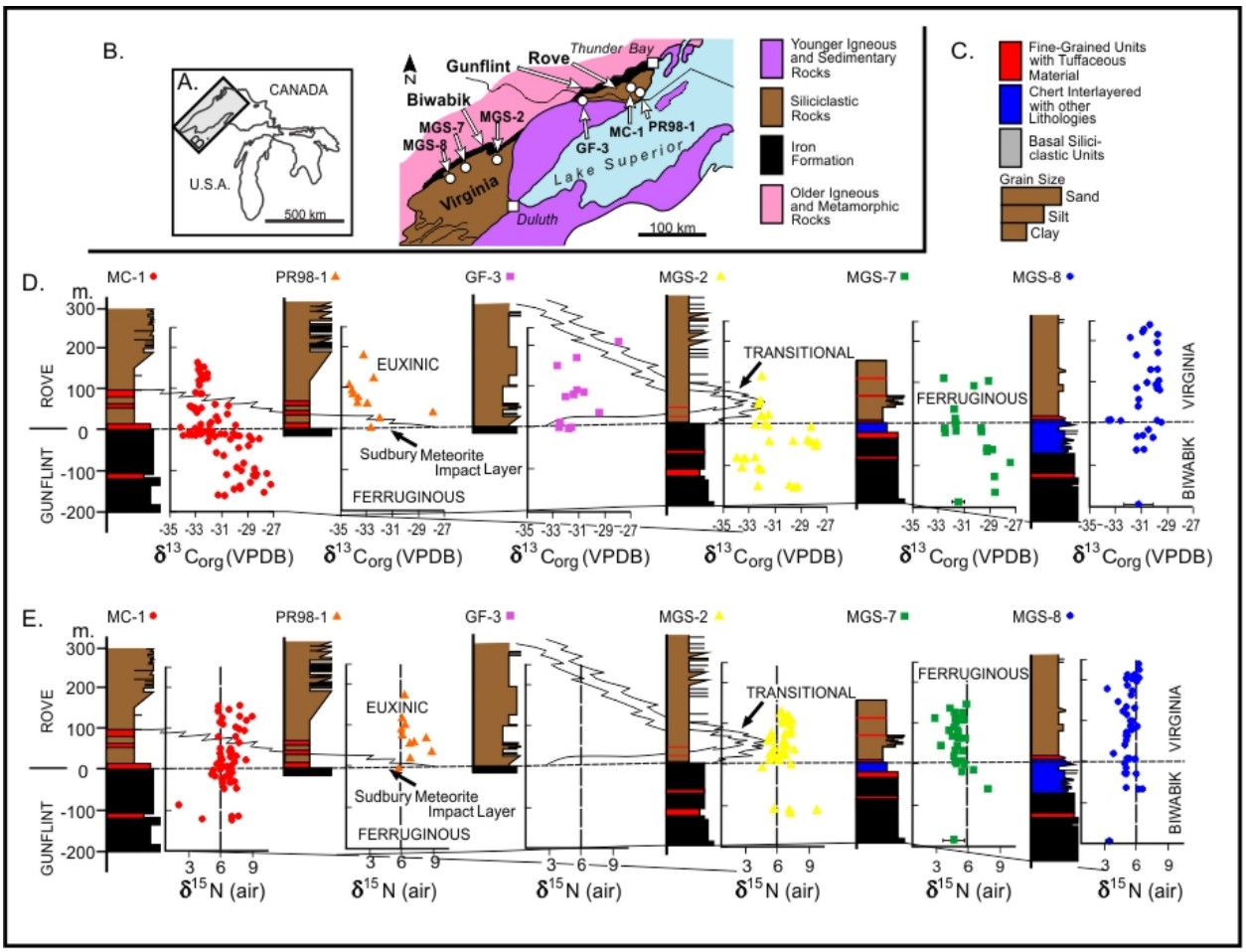

Figure DR1. Expanded version of Figure 1 showing the six cores plotted separately against their stratigraphic column from the margin of the Superior Province, North America (A) constitute a transect of samples across the Animikie Basin margin (B) and consist of iron formation and siliciclastic material interspersed with occasional other lithologies (C). Ejecta from the Sudbury meteorite impact provide a correlative layer across the basin from shallow water at core MC-1 to distal shelf at core MGS-8. Ferruginous versus euxinic conditions are from Poulton et al. (2010). $\delta^{13}C_{org}$(VPDB) (D) and $\delta^{15}N$ (E) exhibit persistent gradients across the margin.

Analytical Methods

Rock fragments which did not include cut surfaces were ground in a tungsten carbide ball mill. Nitrogen bound in carbonaceous material was isolated from exchangeable or fixed NH_4^+ by digesting 200mg of decalcified sample in 50 mL polypropylene centrifuge tubes in 20 mL of 3N HCl- 15N HF at 50ºC. The samples were centrifuged, the acid poured off and the samples rinsed with 0.5N KCl three times to remove any remaining acid. The carbonaceous material was floated off in chloroform into a 4 mL polypropylene centrifuge tube. Filters from the extraction protocols were dried and then segments taken from them with a clean razor blade for N-analysis. Samples analyzed for $\delta^{13}C_{org}$ had carbonate removed with 2N HCl, and were washed thoroughly with water, and then dried at 60°C.

Whole rock N and C_{org} samples were wrapped in tin capsules and anlaysed for their isotope composition using a GVI Isoprime CF-IRMS at Rutgers University. Multiple blank filters and isotope standards (IAEA N-1 = 0.43‰, IAEA N-3 = 4.72 ‰, NBS 22 = -30.03‰) were included in every sequence for isotope analyses. The blanks and standards were spaced between blocks of no more than 12 unknowns throughout the run. An in-house sediment standard (Triassic organic-rich marine shale) was run between blocks of 6 unknowns. Nitrogen and C_{org} concentration data were acquired using the major beam (mass 28 or 44) signal calibrated against acetanilide. The standard deviations for $\delta^{13}C$ and $\delta^{15}N$ of the in-house standard over the period of analysis was 0.21‰, and standard deviations of samples run in triplicate were 0.15‰ and <0.3‰ for bulk sediment. The carbonaceous material was analyzed for N isotope composition at Lehigh University using a ThermoFinnigan 252 mass spectrometer according to the high sensitivity method described in Bebout et al. (2007). Sample $\delta^{15}N$ uncertainty was better than 0.2‰

Preservation of Primary $\delta^{15}N$ Compositions

Sedimentary N isotopes can be sensitive to diagenesis, and in ancient sediments, to the effects of metamorphism. Most nitrogen is released from organic matter as ammonia with little change in $\delta^{15}N$ (Macko, 1993). Clays can trap this NH_4^+ or it can diffuse out of the sediments with or without oxidation, but will elevate C:N. In oxic systems, decay of OM on the ocean floor causes $\delta^{15}N$ to increase, but in anoxic systems, such as the one we study, no change in $\delta^{15}N$ is expected. High C:N ratios in the iron formation compared to the siliciclastic sediments (See GSA Data Repository) probably arises due to the lack of layered silicates (e.g., illite) and other sites to trap NH_4^+. It appears that $\delta^{15}N$, on the whole, has not been disturbed, as there is no correlation between N concentration and $\delta^{15}N$ in either iron formation or siliciclastic sediments (Fig. S2) show that n has not been devolatilized (Bebout and Fogel, 1992). $\delta^{15}N$ values of neighboring silt and shale samples are within 1‰ of each other, indicating that differences in wet sediment irrigation did not substantially affect $\delta^{15}N$. Kerogen extracted from the sediments has much

higher C/N than the bulk sediment (Fig. S3, Table S1), but in general has $\delta^{15}N$ similar to that of the whole rock, indicating graphitization around an unaltered kerogen core (Boudou et al., 2008). The exception is core GF-3, which has very high C/N ratios, with high $\delta^{15}N$ whole rock but very low $\delta^{15}N_{kerogen}$. The top of GF3 contacts the Duluth Complex and exhibits hornfels metamorphism for several tens of meters, with graphitization occurring up to 3 km from the contact (French, 1968). Because of its elevated C/N ratios and high $\delta^{15}N$, together suggesting altered $\delta^{15}N$ signals, N isotope data from GF3 are not used.

References

Bebout, G.E., and Fogel, M.L., 1992, Nitrogen-isotope compositions of metasedimentary rocks in the Catalina Schist, California: Implications for metamorphic devolatilization history, Geochimica et Cosmochimica Acta, v. 56, p. 2839-2849.

Bebout, G.E., Idleman, B.D., Li L., and Hilkert, A., 2007, Isotope-ratio-monitoring gas chromatography methods for high-precision isotopic analysis of nanomole quantities of silicate nitrogen, Chemical Geology, v. 240, p. 1-10.

Boudou, J.-P., Schimmelmann, A. Ader, M., Masterlerz, M., Sebilo, M., Gengembre, L., 2008. Organic nitrogen chemistry during low-grade metamorphism, Geochimica et Cosmochimica Acta, v. 72, p. 1199-1221.

French, B.M., 1968, Progressive contact metamorphism of the Biwabik Iron Formation, Mesabi Range, Minnesota: Minnesota Geological Survey Bulletin, v. 45, 103 pp.

Macko, S.A. (1993), Early diageneisis of organic matter in sediments: Assessment of mechanisms and preservation by the use of isotopic molecular approaches, in Organic Geochemistry, edited by M. H. Engel and S. A. Macko, pp. 211–236, Springer, New York.

Silva, J.A., Bremner, J.M., 1966. Determination and isotope-ratio analysis of different forms of nitrogen in soil: 5. Fixed ammonium. Soil Science Society of America Proceedings, v. 30, p. 587-594.

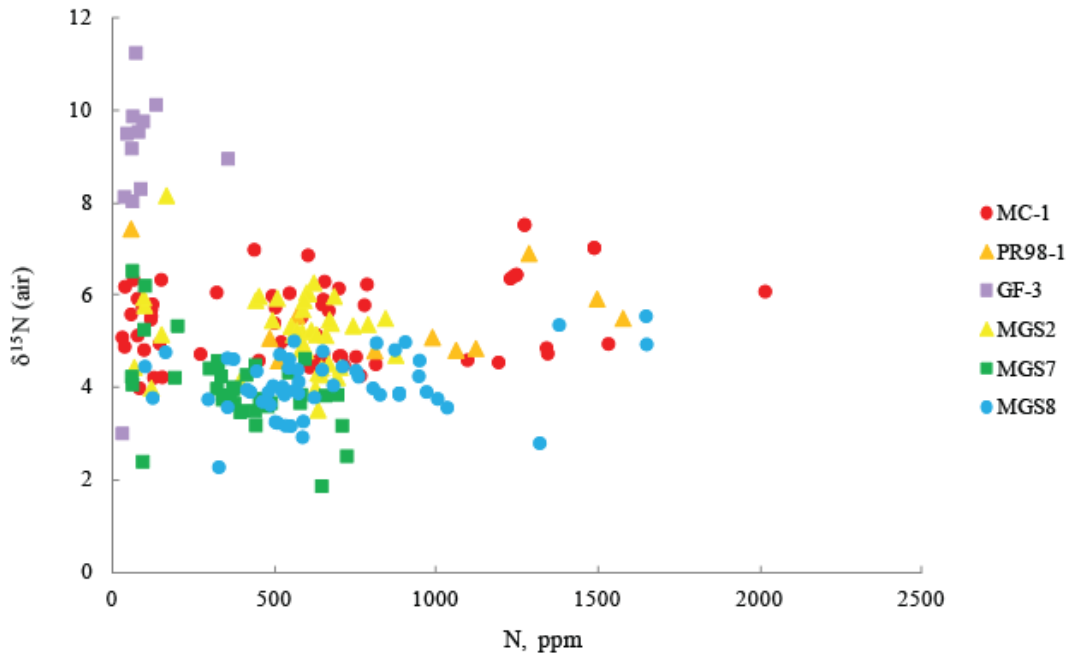

Figure S2. Cross plot of $\delta^{15}N$ versus N conentration. The lack of correlation indicates that the two papramters are independent of eachother and N loss is not accompanied by change in $\delta^{15}N$, except for samples from GF-3 where metasomatisms associated with the Duluth Complex.

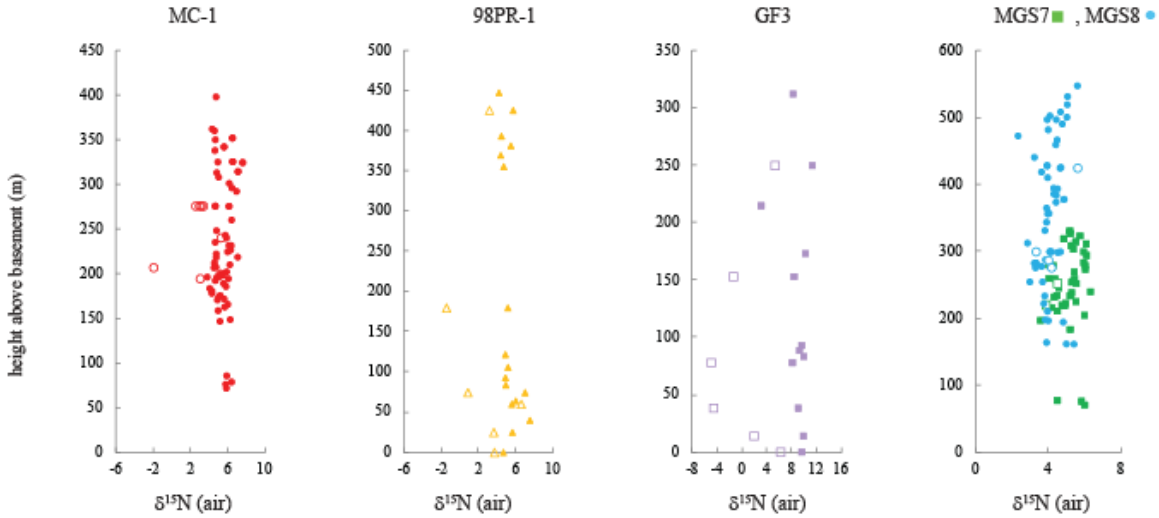

Figure S3. Carbonaceous material (open symbols) and whole sediment (closed symbols). Persistent and large differences in $\delta^{15}N$ between carbonaceous material and whole sediment, combined with low N concentrations in GF-3 suggest disturbance of the N isotope in this core.

Data Table DR1. The cores are listed from nearshore proximal to outer distal shelf.

89MC-1	Height above basement m	Ht relative to basal tuff m	Organic C wt %	N ppm	C/N mol/mol	$\delta^{13}C$ (‰) bulk organic	$\delta^{13}C$ (‰) kerogen	$\delta^{15}N$ (‰) bulk	$\delta^{15}N$ (‰) kerogen
05-54	402	209.4							
9-74	398.6	206		750				4.68	
05-53	395	202.4							
9-67 shale silt	362.6	170		764				4.27	
9-68 shale	360.6	168		811				4.52	
R40	352.5	159.9	2.22	1240	20.9	-33.04		6.44	
R40	352.5	159.9	2.22	1240	20.9	-33.04		6.44	
9-66	350.6	158		1094				4.61	
R39	344	151.4	1.7			-32.88			
R39	344	151.4	1.7			-32.88			
R38	342.5	149.9	0.48	581	9.6	-32.54		5.54	
R38	342.5	149.9	0.48	581	9.6	-32.54		5.54	
9-65	338.6	146		1190				4.56	
R37	338	145.4	1.75			-32.94			
R37	338	145.4	1.75			-32.94			
R36	326	133.4	2.14	1245	20.1	-32.84		6.46	
R36	326	133.4	2.14	1245	20.1	-32.84		6.46	
9-64	325.6	133		1338				4.87	
R35	325	132.4	1.7	1270	15.6	-32.35		7.54	
R35	325	132.4	1.7	1270	15.6	-32.35		7.54	
R34	323	130.4	1.75			-32.47			
R34	323	130.4	1.75			-32.47			
R33	317	124.4	3.14			-32.32			
R33	317	124.4	3.14			-32.32			
R32	315	122.4	3.22	1485	25.3	-32.63		7.04	
R32	315	122.4	3.22	1485	25.3	-32.63		7.04	
R31	314	121.4	3.93			-32.72			
R31	314	121.4	3.93			-32.72			
9-63	313.6	121		1341.5				4.75	
R30	310.5	117.9	2.7			-32.95			
R30	310.5	117.9	2.7			-32.95			
R29	310	117.4	2.8			-33.03			
R29	310	117.4	2.8			-33.03			
9-62	308.6	116		1529				4.96	
9-72	301.6	109		2012.5				6.095	
9-71	296.6	104		1226.5				6.375	

R28	296.5	103.9	2.5			-32.98			
R28	296.5	103.9	2.5			-32.98			
9-69 shale	292.6	100		602				6.88	
9-70 sand	289.6	97		22					
R27	279	86.4	3.81			-33.16			
R27	279	86.4	3.81			-33.16			
R26l	276.146	83.546	4.95	644	89.7			4.6	3.1
R26l	276.146	83.546	4.95	644	89.7			4.6	2.9
R26h	276.078	83.478	2.39		11153.3		-33.2	6.075	2.5
R26h	276.078	83.478	2.39	320	87.1		-33.2	6.075	3.34
R26b	276.015	83.415	2.52			-32.72			
R25	275.5	82.9	4.68			-32.85			
9-61	260.6	68		149				6.35	
9-59	248.6	56		648				4.73	
R24	248.5	55.9	1.31			-31.75			
R23	247	54.4	0.59			-30.68			
R22	243.5	50.9	1.05	666	18.4	-33.59		5.68	
R21	242	49.4	1.47			-33.52			
R20	241	48.4	1.68			-33.53			
R19	240.5	47.9	1.39	776	20.9	-33.12	-33.56	5.8	5.24
R18	239.5	46.9	1.36			-32.80			
R17	239.2	46.6	2			-33.16			
R16	239	46.4	2.09			-33.40			
9-58	235.6	43		632				4.59	
R15b	232.1	39.5	0.37	545	7.9			6.06	
R15a	232	39.4	1.64	653	29.3	-33.02		6.31	
R14	228.75	36.15	1.62						
R13	227	34.4	0.16	784	2.4			6.25	
R12	225	32.4	0.38	649	6.8	-30.87		5.92	
9-57	222.6	30		703				4.7	
R11	219	26.4	0.54	436	14.4	-31.59		7	
9-56	218.6	26		698				4.69	
9-55	212.6	20		712.7				4.5	
R10	210.5	17.9	1.76	697	29.5	-31.52		6.16	
T35	209	16.4	1.5						
T34	208	15.4	2.68	705	44.3			4.66	
T33	207.1	14.5	2.04	607	39.2	-31.99		4.455	-2
R9	202.5	9.9	2.59	646	46.8	-31.96		5.81	
R8	200	7.4	2.38	627	44.3	-32.11	-32.5	5.16	5.14
R7	198.7	6.1	1.39	498	32.6	-31.80		5.41	
T32	197	4.4	0.93	519	20.9	-30.14		5	
9-53	196.6	4		362				3.74	
T31	196	3.4	1.06	270	45.8	-32.77		4.74	
R6	194.75	2.15	0.65	492	15.4	-32.74		6	3
T29	192.6	0	1.53	450	39.7	-34.35		4.6	
T26	189.5	-3.1	0.54	117	53.8	-32.76		5.49	
T25	187	-5.6	2.85			-33.20			

R5	186.8	-5.8	1.61			-32.68	
T24	186	-6.6	2.15	501	50.1	-32.65	5.75
R4	184.3	-8.3	0.57			-32.18	
T22	184	-8.6	0.46	82.1	65.4	-31.94	4
R3	183.7	-8.9	0.44			-32.07	
T21	182	-10.6	0.57			-32.40	
T20	181	-11.6	0.79	152	60.6	-33.20	4.24
T19	180.5	-12.1	0.38	68.6	64.6	-32.06	
R2	179.5	-13.1	0.52			-32.96	
T18	178.5	-14.1	0.43	126	39.8	-33.62	4.23
R1	178.05	-14.55	0.42			-32.73	
T17	178	-14.6	0.2	46.8	49.9	-32.13	
T16	177.5	-15.1	0.12	38.8	36.1	-30.33	
T15	176.5	-16.1	0.3			-31.25	
T14	176	-16.6	0.3	76	46.1	-30.95	5.14
T13	175.5	-17.1	0.84			-33.76	
T12	174.5	-18.1	0.81	144	65.6	-33.50	4.97
T11	173	-19.6	0.41			-31.70	
T10	172.5	-20.1	0.27			-29.89	
T9	172	-20.6	0.3	118	29.7	-30.09	5.56
S25	171.5	-21.1	0.7			-34.15	
T8	171	-21.6	0.22	96	26.7	-29.09	4.83
S24	170.5	-22.1	0.34			-33.21	
T7	166	-26.6	0.2	76	30.7	-28.33	5.94
T6	163	-29.6	0.22	56	45.8	-28.89	5.6
S23	162.5	-30.1	0.19			-30.50	
T5	159	-33.6	0.35	36	113.4	-32.22	4.9
T4	149	-43.6	0.16	37	50.5	-29.10	6.2
T2	147	-45.6	0.17	29	68.4		5.1
T1	142.5	-50.1	0.09			-29.87	
S22	130.5	-62.1	0.39			-31.57	
S21	122.5	-70.1	0.26			-31.11	
9-52	107.6	-85		100.1			
S20	105	-87.6	0.12	23.5	59.6	-29.57	
S19	94.5	-98.1	0.17			-30.02	
S18	89.5	-103.1	0.16	21	88.9	-28.65	
S17	86	-106.6	0.24	122	23.0	-29.67	5.82
S16	79	-113.6	0.12	63	22.2	-27.73	6.35
S15	77.5	-115.1	0.16			-28.50	
S14	76.5	-116.1	0.24	119	23.5	-30.81	5.72
9-50	73.6	-119		35.6			
S13	73.5	-119.1	0.16			-28.56	
S12	72	-120.6	0.19	91	24.4	-28.78	5.78
9-49	71.6	-121		633			
S11	56.5	-136.1	0.19	19.9	111.4	-29.02	
S10	53	-139.6	0.14	29	56.3	-27.44	
S9	48	-144.6	0.3	43.8	79.9		

S8	47.5	-145.1	0.21	73.1	33.5	-29.84
S7	44	-148.6	0.18	62.5	33.6	-29.74
S6	41.5	-151.1	0.28	66.5	49.1	-30.31
S5	33	-159.6	0.1	32.4	36.0	-27.98
S4	29.5	-163.1	0.06	11.4	61.4	
S3	27	-165.6	0.24	39.2	71.4	
S2	25.5	-167.1	0.32	26.7	139.8	-31.49
S1	22	-170.6	0.25	41.5	70.3	-30.98

PR98-1	Height above basement m	Ht above basal tuff m	Organic C wt %	N ppm	C/N mol/mol	$\delta^{13}C$ (‰) bulk organic	$\delta^{13}C$ (‰) kerogen	$\delta^{15}N$ (‰) bulk	$\delta^{15}N$ (‰) kerogen
05-36	448	327	0.25	441	4.0	-31.89		4.13	
05-34	426	305	0.25	514	3.6	-31.21	-31.69	5.65	3.11
05-31	394	273	0.43	692	5.1	-32.91		4.39	
05-29	382	261	0.25	558	3.1	-31.32		5.41	
05-27	370	249	0.39	627	5.8	-33.84		4.31	
05-23	356	235	0.32	761	2.1	-32.78		4.64	
05-19	180	189	0.44	484	8.0	-33.22		5.08	-1.5
05-16	122	131	0.29	808	2.7	-32.49		4.81	
05-15			0.41						
05-14	106	115	2.07	986	26.9	-34.35		5.1	
05-13	93	102	1.88	1059	22.4	-34.15		4.82	
05-12	84	93	2.05	1120	23.4	-34.09		4.86	
05-11	74.5	83.5	3.78	1284	27.9	-33.67	-33.29	6.92	0.8
05-10	64	73	3.33	1494	27.1	-33.74		5.93	
05-9	60	69	2.95	1574	19.0	-32.97		5.51	6.52
05-7	40	49	1.85	56	329.2	-27.96		7.45	
05-4	25	34	1.75	568	41.9	-32.00	-32.08	5.57	3.57
05-2			3.47			-31.93			
05-1	0	9	1.88	510	40.5	-32.66		4.59	3.65

GF-3	Height above basement m	Ht above basal tuff m	Organic C wt %	N ppm	C/N mol/mol	$\delta^{13}C$ (‰) bulk organic	$\delta^{13}C$ (‰) kerogen	$\delta^{15}N$ (‰) bulk	$\delta^{15}N$ (‰) kerogen
GF3-34	312.7	312.7	2.75	35.5	759.8	-33.41		8.15	
GF3-33	301		2.61	55.8					
GF3-32	259		1.81	49.1					
GF3-31	250.2	250.2	1.04	70.4	127.6	-32.76	-32.85	11.26	5.27
GF3-29	231		0.94	39.1					
GF3-27	215.2	215.2	0.12	29.2	47.9	-28.04		3.02	

GF3-25	201		1.41	18.3					
GF3-23	173.4	173.4	0.35	133.3	27.1	-31.26		10.14	
GF3-22	171		0.28	67.3					
GF3 -19	153.3	153.3	0.44	85.5	46.4	-32.77	-33.12	8.32	-1.43
GF3-18	150		0.71			-31.57			
GF3-15	93.3	93.3	1.93	42.8	499.1	-31.25		9.51	
GF3 -14	89	89	2.53	57.1	510.9	-30.66		9.19	
GF3-13	83.8	83.8	2.12	61.3	388.3	-31.46		9.89	
GF3 -12	78.3	78.3	1.43	60.2	265.7	-32.10	-32.33	8.05	-4.99
GF3-11	69	69	1.7	72.6					
GF3-10	64	64	1.85	59.9					
GF3 -8	38.7	38.7	0.46	355.1	12.2	-29.56	-30.05	8.97	-4.63
GF3-6	26	26	1.85	19.2					
GF3-4	18	18	2.72	63.3					
GF3 -3	14.3	14.3	2.92	93.2	365.5	-32.46	-32.6	9.78	1.9
GF3-2	5	5	1.67			-32.50			
GF3 -1	0.3	0.3	1.27	78.7	154.2	-31.75	-31.96	9.55	6.16

MGS-2	Height above basement m	Ht above basal tuff m	Organic C wt %	N ppm	C/N mol/mol	$\delta^{13}C$ (‰) bulk organic	$\delta^{13}C$ (‰) kerogen	$\delta^{15}N$ (‰) bulk	$\delta^{15}N$ (‰) kerogen
5 34	331.4	142.4	1.29	657	22.9			5.14	
5 33	327.2	138.2	0.82	557	17.2			5.16	
5 32	323.8	134.8	0.69	586	13.7			5.7	
5 31	319.5	130.5	1.77	595	34.7			4.81	
5 30	315	126	0.32	492	7.6			5.47	
5 29	311.9	122.9	1.87	604	36.1	-32.13		6.04	
5 28	309.2	120.2	0.81	584	16.2			5.22	
5 27	304	115	0.38	550	8.1			5.34	
5 26	300	111	0.58	441	15.3			5.9	
5 24	294.5	105.5	1.24	598	24.2			6.07	
5 21	283.9	94.9	1.5	590	29.7			5.9	
9-41 sandy silt	280.14	91.14		624.8				4	
9-40 shale	279.52	90.52		692.3				4.23	
5 19	279.3	90.3	2.14	683	36.6			5.99	
5 18	273.8	84.8	0.28	451	7.2			5.99	
5 17	269.9	80.9	2.8	787	41.5			5.38	
9-44 sand	260.32	71.32		118.6				4	
9-43 shale	259.71	70.71		632.6				4.32	
5 15	259.5	70.5	1.05	674	18.2			5.4	
5 14	256.4	67.4	2.57	741	40.5			5.35	
5 13	254.6	65.6	0.37	568	7.6			5.25	
MGS2-12	252.7	61.7	2.59	841	35.9	-32.32		5.51	4.46

MGS2-11	246.3	55.3	3.44	666	60.3	-32.37		4.53	
5 10	240.3	51.3	1.4	620	26.3			6.28	
5 9	238.8	49.8	1.16	612	22.1			5.25	
9-42	234.42	45.42		643.4				4.43	
5 8	234.2	45.2	2.55	628	47.4			5.16	
9-45	232.28	43.28		641.6				4.29	
5 6	225.7	36.7	2.79	668	48.7			5.48	
V12	223	32	1.68	589	33.3	-31.66		4.91	
V16a	220.6	29.6	4.12	873	55.1	-32.20	-32.34	4.71	3.84
V17a	219.1	28.1	3.45	580	69.4	-32.07		4.85	
9-46	216.43	27.43		390.8				4.14	
V18	218	27	0.56						
5 4	211.3	22.3	3.84	701	63.9			4.45	
5 2	205.2	16.2	0.16	507	3.7			5.95	
5 1	197.3	8.3	0.47	633	8.7	-32.65		3.53	
B1	184.1	-6.9	0.45	150	35.0	-29.28		5.16	
B3	181	-10	0.25	17.2	169.6	-31.86			
B4	177.4	-13.6	0.4	20.7	225.4	-31.63			
B5	176.8	-14.2	0.08	6.4	145.8	-28.39			
B6	142.9	-48.1	0.1	19.4	60.1	-31.57			
B7	142.3	-48.7	0.14	25.8	63.3	-28.67			
B8	141.7	-49.3	0.09	24.6	42.7	-29.76			
B9	140.5	-50.5	0.1	17.4	67.0	-27.97			
B10	139.3	-51.7	0.09	13.6	77.2	-28.33			
B11	132.6	-58.4	0.02	8.3	28.1	-28.02			
B12	101.5	-89.5	0.15	9.8	178.6	-32.65			
B13	100.9	-90.1	0.81	50	189.0	-34.09			
B14	100.3	-90.7	0.35	18.7	218.4	-33.52			
B15	99.4	-91.6	0.32	18.5	201.8	-33.40			
9-48	75.92	-113.08		165.4				8.17	
B16	77.7	-113.3	1.24	66	219.2	-33.65		4.45	
B17	76.5	-114.5	1.33	98	158.3	-32.44		5.79	
B18	71	-120	1.04	95	127.7	-32.18		5.96	
B19	35.1	-155.9	0.15	10.8	162.0	-30.03			
B20	32	-159	0.27	21.2	148.6	-32.47			
B21	30.5	-160.5	0.11	8.2	156.5	-29.27			
B22	29	-162	0.16			-29.70			

MGS-7	Height above basement m	Ht above basal tuff m	Organic C wt %	N ppm	C/N mol/mol	$\delta^{13}C$ (‰) bulk organic	$\delta^{13}C$ (‰) kerogen	$\delta^{15}N$ (‰) bulk	$\delta^{15}N$ (‰) kerogen
09-31	356	152		721.4				2.53	
09-30	354.05	150.05		400.4				3.51	
KV31	353.6	149.6	0.17						

KV32	351.1	147.1	1.17	592	23.1		4.64
KV33	347.2	143.2	0.83				
09-29	341.72	137.72		707.3			3.19
09-27 shale	330.44	126.44		488			3.68
09-28 sand	330.13	126.13		190.5			4.23
09-26	317.03	113.03		643.7			1.88
09-25 silt	313.67	109.67		59.9			4.08
09-24 shale	313.37	109.37		692.9			3.86
KV34	310.3	106.3	1.46	543	31.4	-32.64	4.34
09-23	307.88	103.88		375.1			3.67
KV35	307.8	103.8	0.17	452.8	4.4	-29.23	3.77
09-22	295.39	91.39		477.8			3.61
KV37	292.4	88.4	0.2	374.5	6.2	-30.32	4.02
09-21	284.72	80.72		440.9			3.2
KV38	281.9	77.9	0.2	370	6.3		3.97
09-20	272.83	68.83		393.2			3.48
KV39	269.7	65.7	0.13	356.7	4.3		3.85
KV40	269.1	65.1	1.19	439	31.6		4.5
09-36 shale	250.28	46.28		655.8			3.84
09-37 sand							
Sand	247.53	43.53		91.8			2.41
KV41	236.8	32.8	0.94	412	26.6	-31.84	4.29
09-35	236.56	32.56		577.4			3.68
09-34	224.98	20.98		438.5			3.51
09-33	213.39	9.39		360.4			3.76
KV42	212.4	8.4	0.88	333.9	30.7	-31.76	4.26
09-32	206.08	2.08		580.1			3.86
KV44	204.2	0.2	0.45	325	16.2	-31.78	4.45
KV45	197.5	-6.5	0.44	298.2	17.2	-31.47	4.43
KV46a	189.9	-14.1	0.45	322.7	16.3	-31.53	4.59
KV46b	189.8	-14.2	0.15	199.5	8.8	-30.73	5.35
KV47	189.6	-14.4	0.57	320.7	20.7	-31.89	3.99
KV48	188.7	-15.3	0.46	337.4	15.9		3.76
KV50	183	-21	0.53	98.7	62.6	-31.97	6.22
B23	175.9	-28.1	0.24			-29.80	
B24	175.3	-28.7	1.16	96	141.0	-32.61	5.27
B26	169.8	-34.2	0.14			-31.76	
B27	167.9	-36.1	0.31	18.9	191.4	-29.77	
B28	166.7	-37.3	0.36			-32.49	
B29	166.4	-37.6	0.83	58	167.0		4.25
09-39	162.8	-41.2		43.9			
B30	127.1	-76.9	0.15	21.7	80.6	-29.35	
09-38	126.83	-77.17		59.7			6.54
B32	126.8	-77.2	0.15	5.5			
B33	125.6	-78.4	0.2	32.8		-28.93	
B34	125	-79	0.21	36.4		-29.33	
B35	94.5	-109.5	0.05			-27.59	

B36	60	-144	0.17			-28.81
B38	22.6	-181.4	0.3	15.4		
B39	22.2	-181.8	0.19	16.1		-28.75

MGS-8	Height above basement m	Ht above basal tuff m	Organic C wt %	N ppm	C/N mol/mol	$\delta^{13}C$ (‰) bulk organic	$\delta^{13}C$ (‰) kerogen	$\delta^{15}N$ (‰) bulk	$\delta^{15}N$ (‰) kerogen
CV1	548	249	0.18	1645	1.3	-29.90		5.56	
CV2	532	233	0.75	559	15.7	-30.47		5.02	
CV3	520	221	1.19	902	15.4	-30.85		5.00	
CV5	515	216	1.25			-30.95			
CV6	509	210	0.37	543.8	7.9	-29.87		4.63	
09-15	503.03	204.03		493.9				4.05	
CV7	501	202	0.23	813.1	3.3	-31.91		4.98	
09-14 shale	497.54	198.54		570.1				4.4	
09-13 silt	497.54	198.54		883.6				3.89	
CV9	491	192	0.29	515.2	6.6	-29.92		4.73	
09-12	482.3	183.3		559.6				3.95	
09-11	473.16	174.16		326.8				2.29	
CV10	467	168	0.53	541.9	11.4	-29.83		4.44	
CV11	460	161	1.4	443.3	36.8	-31.43		4.37	
09-10	441.15	142.15		531.7				3.19	
09-8 silt	428.96	129.96		572.3				3.89	
09-9 shale	428.35	129.35		883.6				3.89	
CV12	426	127	0.25	353.3	8.3	-29.85		4.65	
CV13	425	126	1.28	946	15.8	-30.40	-30.6	4.6	5.58
9-7	419.21	120.21		1031.5				3.58	
9-6	410.67	111.67		967.8				3.92	
CV14	395	96	0.24	758	3.7	-29.67		4.25	
CV15	394	95	0.42	708.3	6.9	-30.66		4.47	
CV16	386.5	87.5	2.08	944	25.7	-29.89		4.26	
CV18	384.5	85.5	0.16	645.5	2.9	-29.81		4.4	
CV20	378.4	79.4	1.06	870.3	14.2	-31.43		4.83	
CV21	378	79	0.19	647.6	3.4	-29.91		4.8	
CV22	374	75	0.15	749.9	2.3	-29.65		4.38	
9-5	365.26	66.26		824				3.86	
9-3 shale	357.33	58.33		802.5				4	
9-4 silt	356.72	57.72		424				3.92	
CV23	352	53	0.8			-31.24			
9-2	344.22	45.22		882.9				3.86	
CV24	334	35	0.97			-31.39			
9-1	331.73	32.73		1001.9				3.77	
CV25	313	14	3.36	1317	29.8			2.81	
CV26a	300	1	1.74	680.1	29.8	-33.39		4.06	

CV26b	299.99	0.99	1.19	573.25	24.2	-32.68	-32.96	4.14	
CV26c	299.96	0.96	0.12	372.1	3.8	-29.85		4.63	
CV26d	299.93	0.93	1.56	523.5	34.8	-33.58		4.03	3.29
CV27	299	0	0.14	98.7	16.5	-29.58		4.47	
CV28	288	-11	0.44	621.6	8.3	-31.66		3.8	
CV29	287	-12	0.25	413	7.1	-30.84	-31.53	3.97	3.98
CV30a	283	-16	0.17	500.8	4.0	-30.01		3.27	
CV30b	282.99	-16.01	0.32	587.2	6.4	-31.47		3.28	
CV30c	282.98	-16.02	0.18	548.9	3.8	-30.19		3.18	
CV31	278	-21	0.35	353.6	11.5	-31.84		3.59	
CV32	276	-23	0.22	507	5.1	-31.05	-31.3	3.25	4.14
CV33	271.5	-27.5	0.33				-31.3		
CV34b	254.97	-44.03	2.21	585	44.1	-33.89		2.94	
CV34c	254.96	-44.04	0.58	485.2	13.9	-32.07		3.64	
CV35	234	-65	0.25	293.8	9.9	-30.84		3.76	
CV36	222.5	-76.5	0.25	461.4	6.3	-30.66		3.71	
B40	211	-88	1	479.4	24.3	-30.53		3.91	
B41	198.2	-100.8	1.1	122.9	104.4	-30.91		3.79	
B42	197	-102	1.38	520.7	30.9	-31.42		3.96	
B43	194.8	-104.2	0.55	162.1	39.6	-30.14		4.78	
B44	164.4	-134.6	2.48	529	54.7	-30.89		3.86	
9-16	162.26	-136.74		1646.9				4.95	
B45	161.9	-137.1	4.23	1377	35.8	-31.43		5.37	