



Date Submitted: 15-Jun-15
Invoice No.: A15-04300
Invoice Date: 24-Jun-15
Your Reference: COOK AREA TILL SAMPLING

MINNESOTA DEPT OF NAT RESOURCES
500 LAFAYETTE RD BOX 45
ST PAUL MN 55155-4045
United States

ATTN: Don Elsenheimer

CERTIFICATE OF ANALYSIS

33 Heavy Mineral Concentrates samples were submitted for analysis.

The following analytical package was requested:

REPORT **A15-04300**

Code 3A-Large HMC INAA(INAAGEO)
Code 3A-Medium HMC INAA(INAAGEO)
Code 3A-Small HMC INAA(INAAGEO)

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Notes:

CERTIFIED BY:

A handwritten signature in black ink, appearing to read "Emmanuel Esemé".

Emmanuel Esemé , Ph.D.
Quality Control



Results

Analyte Symbol	Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb	Sc	Se	Sr	Ta	Th
Unit Symbol	ppb	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
Lower Limit	5	5	2	200	5	1	5	10	2	0.02	1	5	50	20	0.05	200	50	0.2	0.1	20	0.2	1	0.5
Method Code	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA
CATS- 301- MHMC	< 5	< 5	8	< 200	< 5	< 1	66	3800	< 2	47.6	3	< 5	< 50	< 20	0.19	< 200	< 50	< 0.2	14.9	< 20	< 0.2	< 1	4.6
CATS- 302- MHMC	< 5	< 5	8	< 200	< 5	< 1	66	9550	< 2	65.8	< 1	< 5	< 50	< 20	0.15	< 200	< 50	0.4	5.0	< 20	< 0.2	< 1	6.4
CATS- 303- MHMC	< 5	< 5	4	< 200	< 5	< 1	28	2260	< 2	47.5	< 1	< 5	< 50	< 20	0.11	< 200	< 50	0.3	7.4	< 20	< 0.2	< 1	3.1
CATS- 304- MHMC	< 5	< 5	< 2	< 200	< 5	5	16	350	< 2	31.8	2	< 5	< 50	< 20	0.22	< 200	< 50	< 0.2	55.8	< 20	< 0.2	< 1	< 0.5
CATS- 305- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	48	5250	< 2	62.8	< 1	< 5	< 50	< 20	0.22	< 200	< 50	< 0.2	7.1	< 20	< 0.2	< 1	4.8
CATS- 306- MHMC	< 5	< 5	3	< 200	< 5	< 1	36	3070	< 2	46.9	2	< 5	< 50	< 20	0.12	200	< 50	< 0.2	8.9	< 20	< 0.2	< 1	6.5
CATS- 307- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	55	5030	< 2	68.5	< 1	< 5	< 50	< 20	0.17	< 200	< 50	0.4	9.1	< 20	< 0.2	< 1	4.0
CATS- 308- MHMC	< 5	< 5	6	< 200	< 5	< 1	44	2300	< 2	58.9	< 1	< 5	< 50	< 20	0.14	< 200	< 50	< 0.2	6.1	< 20	< 0.2	< 1	3.4
CATS- 309- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	49	3550	< 2	62.3	< 1	< 5	< 50	< 20	0.14	< 200	< 50	< 0.2	5.8	< 20	< 0.2	< 1	3.7
CATS- 310- MHMC	< 5	< 5	2	< 200	< 5	< 1	27	470	< 2	52.4	< 1	< 5	< 50	< 20	0.08	< 200	< 50	< 0.2	3.2	< 20	< 0.2	< 1	2.9
CATS- 311- MHMC	< 5	< 5	14	< 200	< 5	< 1	50	1740	< 2	53.8	< 1	< 5	< 50	< 20	0.07	< 200	< 50	0.8	4.0	< 20	< 0.2	< 1	14.4
CATS- 312- MHMC	< 5	< 5	11	< 200	< 5	< 1	31	200	< 2	57.7	< 1	< 5	< 50	< 20	0.06	< 200	< 50	0.9	3.3	< 20	< 0.2	< 1	3.8
CATS- 313- MHMC	16	< 5	18	< 200	< 5	< 1	34	370	< 2	64.5	< 1	< 5	< 50	< 20	0.05	< 200	< 50	1.0	2.5	< 20	< 0.2	< 1	4.5
CATS- 314- MHMC	< 5	< 5	9	< 200	< 5	< 1	18	240	< 2	56.6	< 1	< 5	< 50	< 20	0.05	< 200	< 50	0.8	1.9	< 20	< 0.2	< 1	2.2
CATS- 315- MHMC	< 5	< 5	14	< 200	< 5	< 1	75	16300	< 2	46.4	15	< 5	< 50	< 20	0.08	< 200	< 50	< 0.2	13.6	< 20	< 0.2	< 1	94.1
CATS- 316- MHMC	< 5	< 5	6	< 200	< 5	< 1	17	450	< 2	55.8	< 1	< 5	< 50	< 20	< 0.05	< 200	< 50	1.0	1.9	< 20	< 0.2	< 1	3.6
CATS- 317- MHMC	< 5	< 5	5	< 200	< 5	< 1	10	110	< 2	62.4	< 1	< 5	< 50	< 20	< 0.05	< 200	< 50	< 0.2	1.6	< 20	< 0.2	< 1	3.4
CATS- 318- MHMC	< 5	< 5	9	< 200	< 5	< 1	17	170	< 2	50.0	< 1	< 5	< 50	< 20	0.10	< 200	< 50	0.2	2.3	< 20	< 0.2	< 1	3.6
CATS- 319- MHMC	< 5	< 5	12	< 200	< 5	< 1	40	1420	< 2	56.1	< 1	< 5	< 50	< 20	0.16	< 200	< 50	< 0.2	6.1	< 20	< 0.2	< 1	7.0
CATS- 320- MHMC	< 5	< 5	9	< 200	< 5	< 1	35	960	< 2	60.9	< 1	< 5	< 50	< 20	0.17	< 200	< 50	0.7	3.5	< 20	< 0.2	< 1	3.1
CATS- 321- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	48	1970	< 2	56.3	< 1	< 5	< 50	< 20	0.16	< 200	< 50	0.7	3.8	< 20	< 0.2	< 1	4.4
CATS- 322- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	23	1040	< 2	64.5	< 1	< 5	< 50	< 20	0.07	< 200	< 50	< 0.2	9.1	< 20	< 0.2	< 1	1.3
CATS- 323- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	19	1400	< 2	66.0	< 1	< 5	< 50	< 20	0.09	< 200	< 50	< 0.2	3.9	< 20	< 0.2	< 1	7.9
CATS- 324- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	27	1570	< 2	67.8	< 1	< 5	< 50	< 20	0.11	< 200	< 50	0.3	3.2	< 20	< 0.2	< 1	5.3
CATS- 325- MHMC	< 5	< 5	4	< 200	< 5	< 1	44	590	< 2	56.9	< 1	< 5	< 50	< 20	0.16	< 200	< 50	0.4	13.1	< 20	< 0.2	< 1	< 0.5
CATS- 326- MHMC	< 5	< 5	7	< 200	< 5	< 1	38	2660	< 2	67.3	< 1	< 5	< 50	< 20	0.10	< 200	< 50	< 0.2	4.0	< 20	< 0.2	< 1	4.0
CATS- 327- MHMC	< 5	< 5	11	< 200	< 5	< 1	28	570	< 2	66.4	< 1	< 5	< 50	< 20	0.07	< 200	< 50	0.9	2.7	< 20	< 0.2	< 1	8.8
CATS- 328- MHMC	< 5	< 5	23	< 200	< 5	< 1	27	580	< 2	51.6	< 1	< 5	< 50	< 20	0.05	< 200	< 50	2.0	4.3	< 20	< 0.2	< 1	55.4
CATS- 329- MHMC	< 5	< 5	19	< 200	< 5	< 1	27	350	< 2	72.7	< 1	< 5	< 50	< 20	0.06	< 200	< 50	0.8	3.0	< 20	< 0.2	< 1	5.0
CATS- 332- MHMC	< 5	< 5	< 2	< 200	< 5	< 1	17	690	< 2	54.8	< 1	< 5	< 50	< 20	< 0.05	< 200	< 50	< 0.2	2.7	< 20	< 0.2	< 1	4.3
CATS- 333- MHMC	< 5	< 5	9	< 200	< 5	< 1	15	550	< 2	55.2	< 1	< 5	< 50	< 20	< 0.05	< 200	< 50	0.4	1.8	< 20	< 0.2	< 1	6.2
CATS- 334- MHMC	< 5	< 5	12	< 200	< 5	< 1	28	250	< 2	66.3	< 1	< 5	< 50	< 20	0.11	< 200	< 50	0.5	3.1	< 20	< 0.2	< 1	3.1
CATS- 335- MHMC	< 5	< 5	12	< 200	< 5	1	11	280	< 2	> 75.0	< 1	< 5	< 50	< 20	< 0.05	< 200	< 50	< 0.2	2.1	< 20	< 0.2	< 1	3.8

Results

Analyte Symbol	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass
Unit Symbol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	g
Lower Limit	0.5	4	200	1	3	10	0.1	0.2	2	0.2	0.05	
Method Code	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA
CATS- 301- MHMC	< 0.5	< 4	600	11	32	< 10	1.7	0.4	< 2	1.1	0.16	1.15
CATS- 302- MHMC	< 0.5	< 4	500	8	51	< 10	1.2	< 0.2	< 2	< 0.2	< 0.05	2.67
CATS- 303- MHMC	< 0.5	< 4	200	9	24	< 10	1.4	0.4	< 2	0.9	0.15	1.91
CATS- 304- MHMC	< 0.5	< 4	< 200	5	5	< 10	2.4	0.8	< 2	2.4	0.07	26.9
CATS- 305- MHMC	< 0.5	< 4	400	9	27	< 10	1.5	< 0.2	< 2	< 0.2	< 0.05	2.43
CATS- 306- MHMC	< 0.5	< 4	200	12	40	< 10	1.7	0.3	< 2	0.9	< 0.05	1.99
CATS- 307- MHMC	< 0.5	< 4	< 200	8	15	< 10	1.5	< 0.2	< 2	0.8	< 0.05	5.15
CATS- 308- MHMC	< 0.5	< 4	< 200	7	11	< 10	1.2	< 0.2	< 2	1.2	0.11	3.92
CATS- 309- MHMC	< 0.5	< 4	300	7	20	< 10	1.3	< 0.2	< 2	< 0.2	0.11	3.16
CATS- 310- MHMC	< 0.5	< 4	< 200	4	6	< 10	0.7	0.2	< 2	0.8	0.10	1.85
CATS- 311- MHMC	< 0.5	< 4	< 200	26	56	30	3.0	0.4	< 2	0.9	0.10	1.68
CATS- 312- MHMC	< 0.5	< 4	< 200	7	16	< 10	1.1	0.6	< 2	1.1	0.18	1.29
CATS- 313- MHMC	< 0.5	< 4	< 200	10	20	< 10	1.2	0.6	< 2	0.5	0.18	10.1
CATS- 314- MHMC	< 0.5	< 4	< 200	9	< 3	< 10	0.8	< 0.2	< 2	0.7	0.13	14.2
CATS- 315- MHMC	< 0.5	< 4	3300	125	238	< 10	14.8	< 0.2	< 2	< 0.2	< 0.05	0.0800
CATS- 316- MHMC	< 0.5	< 4	< 200	8	10	< 10	1.0	< 0.2	< 2	0.8	0.10	16.2
CATS- 317- MHMC	< 0.5	< 4	< 200	10	4	< 10	0.9	< 0.2	< 2	1.1	0.11	14.5
CATS- 318- MHMC	< 0.5	< 4	< 200	11	24	< 10	1.4	0.6	< 2	0.8	0.16	1.86
CATS- 319- MHMC	< 0.5	< 4	< 200	12	32	< 10	1.9	< 0.2	< 2	1.1	0.26	3.81
CATS- 320- MHMC	< 0.5	< 4	< 200	7	5	< 10	0.9	< 0.2	< 2	0.6	0.07	7.11
CATS- 321- MHMC	< 0.5	< 4	< 200	6	14	< 10	1.1	< 0.2	< 2	< 0.2	0.19	3.60
CATS- 322- MHMC	< 0.5	< 4	< 200	10	5	< 10	1.5	< 0.2	< 2	1.6	0.14	6.25
CATS- 323- MHMC	< 0.5	< 4	< 200	15	20	< 10	1.7	< 0.2	< 2	0.7	0.07	7.53
CATS- 324- MHMC	< 0.5	< 4	< 200	7	< 3	< 10	1.2	< 0.2	< 2	< 0.2	0.05	3.11
CATS- 325- MHMC	< 0.5	< 4	300	8	14	20	1.4	0.6	< 2	0.8	0.17	10.8
CATS- 326- MHMC	< 0.5	< 4	< 200	7	16	< 10	1.1	< 0.2	< 2	< 0.2	< 0.05	3.37
CATS- 327- MHMC	< 0.5	< 4	< 200	16	37	< 10	1.8	< 0.2	< 2	< 0.2	0.12	8.44
CATS- 328- MHMC	< 0.5	< 4	< 200	105	216	110	10.1	1.0	< 2	0.8	0.11	0.460
CATS- 329- MHMC	< 0.5	< 4	< 200	10	33	< 10	1.5	< 0.2	< 2	0.8	0.21	5.42
CATS- 332- MHMC	< 0.5	< 4	< 200	10	22	< 10	1.1	< 0.2	< 2	0.7	0.05	17.7
CATS- 333- MHMC	< 0.5	< 4	< 200	12	28	< 10	1.2	0.4	< 2	0.8	0.15	16.6
CATS- 334- MHMC	< 0.5	< 4	< 200	7	< 3	< 10	1.0	< 0.2	< 2	0.8	0.08	11.3
CATS- 335- MHMC	< 0.5	< 4	< 200	9	< 3	< 10	1.2	< 0.2	< 2	< 0.2	0.19	5.45

QC

Analyte Symbol	Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb	Sc	Se	Sr	Ta	Th
Unit Symbol	ppb	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
Lower Limit	5	5	2	200	5	1	5	10	2	0.02	1	5	50	20	0.05	200	50	0.2	0.1	20	0.2	1	0.5
Method Code	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA
DMMAS 118 Meas	1750		1720	1300			42	80		3.48					2.27			6.1	6.0				
DMMAS 118 Cert	1729		1661	1264			45	83		3.25					2.21			6.6	6.1				
DMMAS 118 Meas	1690		1630	1300			48	90		3.46					2.25			7.2	6.2				
DMMAS 118 Cert	1729		1661	1264			45	83		3.25					2.21			6.6	6.1				
DMMAS 118 Meas	1710		1780	1300			42	80		3.41					2.26			6.8	6.6				
DMMAS 118 Cert	1729		1661	1264			45	83		3.25					2.21			6.6	6.1				
DMMAS 118 Meas	1610		1640	1300			47	90		3.27					2.32			6.4	6.5				
DMMAS 118 Cert	1729		1661	1264			45	83		3.25					2.21			6.6	6.1				
DMMAS 118 Meas	1620		1660	1100			45	80		3.30					2.18			6.6	5.9				
DMMAS 118 Cert	1729		1661	1264			45	83		3.25					2.21			6.6	6.1				
DMMAS 118 Meas	1760		1760	1300			49	90		3.29					2.15			6.4	5.9				
DMMAS 118 Cert	1729		1661	1264			45	83		3.25					2.21			6.6	6.1				
Method Blank	< 5	< 5	< 2	< 200	< 5	< 1	< 5	< 10	< 2	< 0.02	< 1	< 5	< 50	< 20	< 0.05	< 200	< 50	< 0.2	< 0.1	< 20	< 0.2	< 1	< 0.5
Method Blank	< 5	< 5	< 2	< 200	< 5	< 1	< 5	< 10	< 2	< 0.02	< 1	< 5	< 50	< 20	< 0.05	< 200	< 50	< 0.2	< 0.1	< 20	< 0.2	< 1	< 0.5

QC

Analyte Symbol	U	W	Zn	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Mass
Unit Symbol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	g
Lower Limit	0.5	4	200	1	3	10	0.1	0.2	2	0.2	0.05	
Method Code	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA
DMMAS 118 Meas	15.4			17	33		2.3					
DMMAS 118 Cert	15.9			16.9	30		2.2					
DMMAS 118 Meas	16.5			16	34		2.0					
DMMAS 118 Cert	15.9			16.9	30		2.2					
DMMAS 118 Meas	16.4			17	29		2.4					
DMMAS 118 Cert	15.9			16.9	30		2.2					
DMMAS 118 Meas	16.3			17	33		2.3					
DMMAS 118 Cert	15.9			16.9	30		2.2					
DMMAS 118 Meas	16.4			17	32		2.1					
DMMAS 118 Cert	15.9			16.9	30		2.2					
DMMAS 118 Meas	15.4			17	32		2.3					
DMMAS 118 Cert	15.9			16.9	30		2.2					
Method Blank	< 0.5	< 4	< 200	< 1	< 3	< 10	< 0.1	< 0.2	< 2	< 0.2	< 0.05	30.0
Method Blank	< 0.5	< 4	< 200	< 1	< 3	< 10	< 0.1	< 0.2	< 2	< 0.2	< 0.05	10.0