

Mineral Occurrence Revenue Estimation & Visualization Tool

www.mtri.org/mineraloccurrence.html

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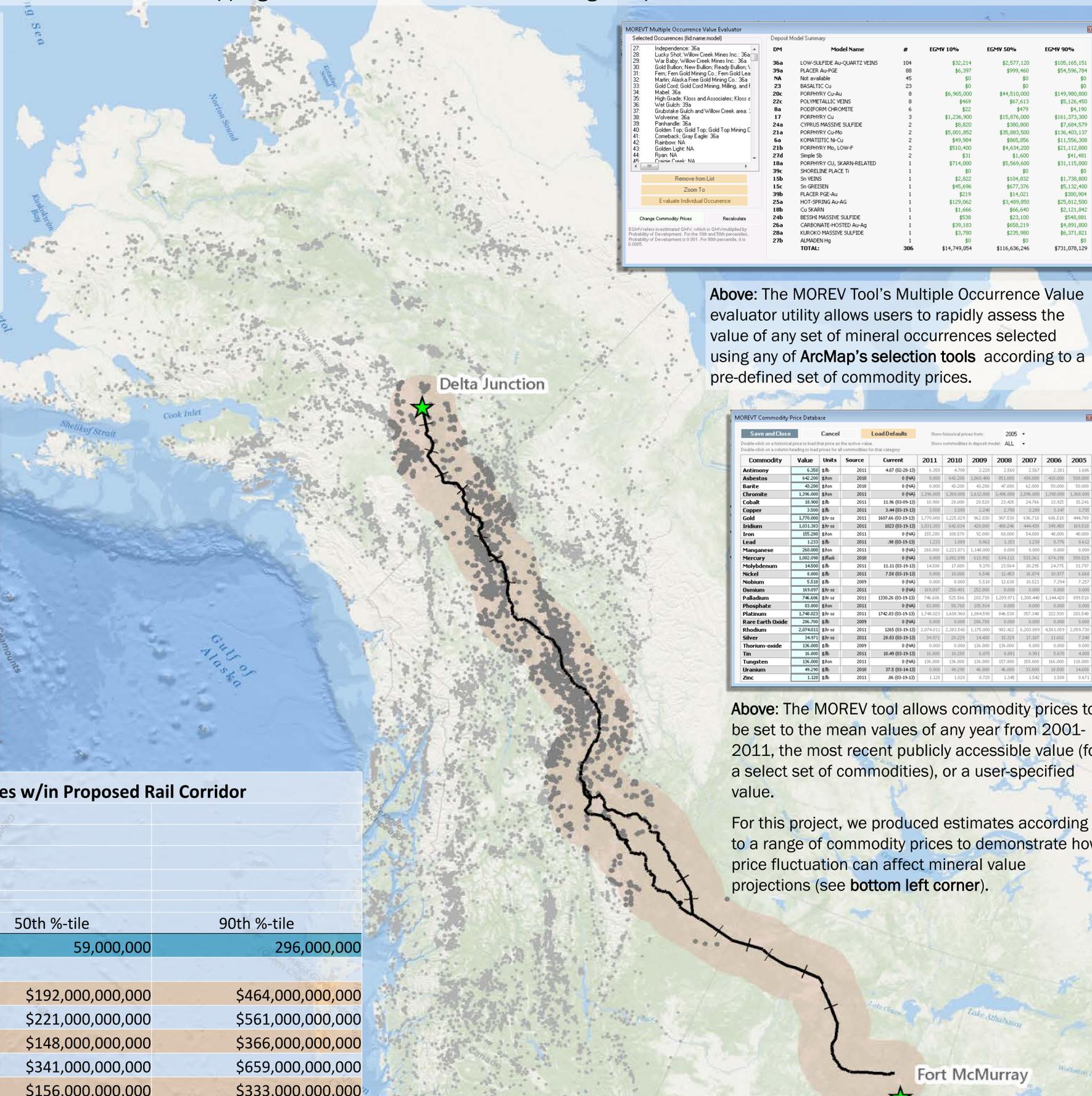
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The flexible and map-based Mineral Occurrence Revenue Estimation and Visualization (MOREV) tool was developed under a cooperative project between MTRI and University of Alaska-Fairbanks (UAF), with UAF professor Paul Metz. The tool is used to produce estimates of revenue, costs, freight volumes, and carbon emissions associated with the development of and multi-modal shipping of mineral commodities for existing and planned Alaska and Canadian railroads.

MTRI and UAF recently partnered with the Vanhorne Institute, G7G, AECOM, and the Yukon and Alberta Governments to produce a prefeasibility report on the proposed G7G Railway that would connect Alberta to Alaska. MTRI and UAF's role was to provide estimates of mineral occurrence value within a 50 mile radius of the proposed route as part of an analysis of the anticipated economic impact of the transportation corridor.



MOREV Multiple Occurrence Value Evaluator

Selected Occurrences (Id: name: model)

DM	Model Name	#	EGMV 10%	EGMV 50%	EGMV 90%
36a	LOW-SULFIDE Au-QUARTZ VEINS	104	\$2,214	\$2,577,120	\$105,165,151
39a	PLACER Au-PGE	88	\$6,397	\$999,460	\$54,596,794
NA	Not available	45	\$0	\$0	\$0
23	BASALTIC Cu	23	\$0	\$0	\$0
28c	POORHY Cu-Au	8	\$6,955,000	\$44,510,000	\$149,980,000
22c	POLYMETALLIC VEINS	8	\$469	\$67,613	\$5,126,450
17	PODIFORM CHROMITE	6	\$22	\$479	\$4,190
8a	PORPHYRY Cu	3	\$1,236,900	\$15,876,300	\$161,373,300
24a	CYRUS MASSIVE SULFIDE	2	\$8,620	\$30,800	\$7,684,579
21a	POORHY Cu-Au	2	\$5,001,862	\$35,883,500	\$136,402,137
6a	KOMATIITIC Ni-Cu	2	\$49,984	\$85,856	\$11,556,308
21b	PORPHYRY Mo, LOW-F	2	\$510,400	\$4,634,200	\$21,112,000
27d	Simple Sb	2	\$31	\$1,600	\$41,461
18a	PORPHYRY Cu, SKARN-RELATED	1	\$714,000	\$5,569,600	\$31,115,000
39c	SHORELINE PLACER Ti	1	\$0	\$0	\$0
15b	Sn VEINS	1	\$104,832	\$1,738,800	\$1,738,800
15c	Sn GREISEN	1	\$45,696	\$677,376	\$5,132,400
39b	PLACER PGE-Au	1	\$219	\$14,021	\$300,904
25a	HOT-SPRING Au-Ag	1	\$129,662	\$5,469,660	\$25,012,500
10b	Cu SKARN	1	\$1,666	\$66,640	\$2,121,842
24b	BESSE MASSIVE SULFIDE	1	\$538	\$23,100	\$548,881
26a	CARBONATE-HOSTED Au-Ag	1	\$39,183	\$658,219	\$4,891,800
28a	KUROKO MASSIVE SULFIDE	1	\$3,780	\$25,980	\$6,371,821
ALMADEN	Almaden Ag	1	\$0	\$0	\$0
27b	TOTAL:	306	\$14,749,054	\$116,636,246	\$731,078,129

Above: The MOREV Tool's Multiple Occurrence Value evaluator utility allows users to rapidly assess the value of any set of mineral occurrences selected using any of ArcMap's selection tools according to a pre-defined set of commodity prices.

MOREV Commodity Price Database

Commodity	Value	Units	Source	Current	2011	2010	2009	2008	2007	2006	2005
Antimony	6.350	\$/lb	2011	4.87 (03-13)	6.350	4.700	2.220	2.550	2.567	2.381	1.606
Asbestos	442.200	\$/ton	2010	0 (04)	0.000	542.200	1,080.400	951.000	502.000	403.000	1,068.000
Baite	42.200	\$/ton	2010	0 (04)	0.000	42.200	42.200	47.000	42.000	50.000	50.000
Chromite	1,396.000	\$/ton	2011	0 (04)	1,396.000	1,396.000	1,812.000	3,496.000	2,096.000	1,390.000	1,368.000
Cobalt	18.900	\$/lb	2011	11.96 (03-13)	18.900	20.000	20.520	23.405	24.764	13.925	15.241
Copper	3.500	\$/lb	2011	3.44 (03-13)	3.500	3.500	2.240	2.780	3.288	3.147	1.738
Gold	1,770.000	\$/oz	2011	1607.66 (03-13)	1,770.000	1,225.023	962.020	907.530	696.718	608.518	444.710
Iridium	1,021.392	\$/oz	2011	1021.392 (03-13)	1,021.392	1,424.094	800.000	480.246	844.400	340.460	183.910
Iron	155.200	\$/ton	2011	0 (04)	155.200	108.570	92.000	68.000	54.000	48.000	40.000
Lead	1.233	\$/lb	2011	0 (03-13)	1.233	1.089	0.862	1.153	1.238	0.776	0.612
Manganese	260.000	\$/ton	2011	0 (04)	260.000	1,221.071	1,140.000	0.000	0.000	0.000	0.000
Mercury	1,082.098	\$/lb	2010	0 (04)	0.000	1,082.098	613.932	634.112	633.261	674.198	658.628
Molybdenum	14.500	\$/lb	2011	11.11 (03-13)	14.500	17.000	9.370	23.564	30.235	24.775	31.217
Nickel	8.800	\$/lb	2011	7.58 (03-13)	8.800	10.000	5.546	12.463	16.874	10.977	5.648
Niobium	5.518	\$/lb	2009	0 (04)	0.000	0.000	5.518	12.638	10.523	7.294	7.257
Osmium	169.097	\$/oz	2011	0 (04)	169.097	250.491	252.000	0.000	0.000	0.000	0.000
Palladium	746.606	\$/oz	2011	1330.26 (03-13)	746.606	525.566	203.720	1,209.971	1,108.440	1,144.420	899.510
Phosphite	82.800	\$/ton	2011	0 (04)	82.800	58.763	1,055.316	0.000	0.000	0.000	0.000
Platinum	1,740.023	\$/oz	2011	1740.023 (03-13)	1,740.023	1,698.960	1,034.570	446.526	357.340	322.920	203.540
Rare Earth Oxide	286.700	\$/lb	2009	0 (04)	0.000	0.000	286.700	0.000	0.000	0.000	0.000
Rhodium	2,074.011	\$/oz	2011	1265 (03-13)	2,074.011	2,383.543	1,175.000	982.422	6,203.089	4,561.059	2,659.730
Silver	34.971	\$/oz	2011	28.83 (03-13)	34.971	29.223	14.400	15.329	17.107	11.602	7.340
Thorium-oxide	136.000	\$/lb	2009	0 (04)	0.000	0.000	136.000	136.000	0.000	0.000	0.000
Ti	18.800	\$/lb	2011	18.49 (03-13)	18.800	18.250	6.000	8.883	9.981	8.297	4.808
Tungsten	136.000	\$/ton	2011	0 (04)	136.000	136.000	136.000	157.000	158.000	164.000	119.000
Uranium	49.290	\$/lb	2010	37.5 (03-13)	49.290	46.000	46.000	46.000	33.000	18.500	14.600
Zinc	1.120	\$/lb	2011	86 (03-13)	1.120	1.020	0.720	1.346	1.542	1.588	0.671

Above: The MOREV tool allows commodity prices to be set to the mean values of any year from 2001-2011, the most recent publicly accessible value (for a select set of commodities), or a user-specified value.

For this project, we produced estimates according to a range of commodity prices to demonstrate how price fluctuation can affect mineral value projections (see bottom left corner).

MOREV Tool eGMV Analysis of Mineral Occurrences w/in Proposed Rail Corridor

Probability of development, all percentiles = 1%

100 mile corridor (50 mile radius)

Total occurrences: 1717

	10th %-tile	50th %-tile	90th %-tile
Concentrate tonnage	46,000,000	59,000,000	296,000,000
2013 prices	\$174,000,000,000	\$192,000,000,000	\$464,000,000,000
2011 prices	\$200,000,000,000	\$221,000,000,000	\$561,000,000,000
2009 prices	\$135,000,000,000	\$148,000,000,000	\$366,000,000,000
2007 prices	\$320,000,000,000	\$341,000,000,000	\$659,000,000,000
2005 prices	\$143,000,000,000	\$156,000,000,000	\$333,000,000,000

Our delivered estimates show the range of estimated Gross Metal Values (eGMV) of all the mineral occurrences within the corridor. A "Probability of development" is applied to account for the fact that only a very small percentage of these mineral occurrences will be developed within an economically meaningful time period.

Collaborators

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MTRI: Dr. Robert Shuchman, Colin Brooks, Helen Kourous-Harrigan, Eric Keefauver, Michael Billmire, Richard Dobson, Nathaniel Jessee, Michelle Wienert, and Angela Yu