Mineral Occurrences and Potential Sources of Freight for the Alaska Railroad Extensions – Fairbanks to the Canadian Border

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Objectives

- Estimation of the expected tonnage of mineral concentrates that would be generated within a 200 km wide corridor along the proposed route of the railroad extensions from Fairbanks to the Canadian Border over the next 50 years.
- Estimation of the expected economic impact of the mines that would generate those mineral concentrates.


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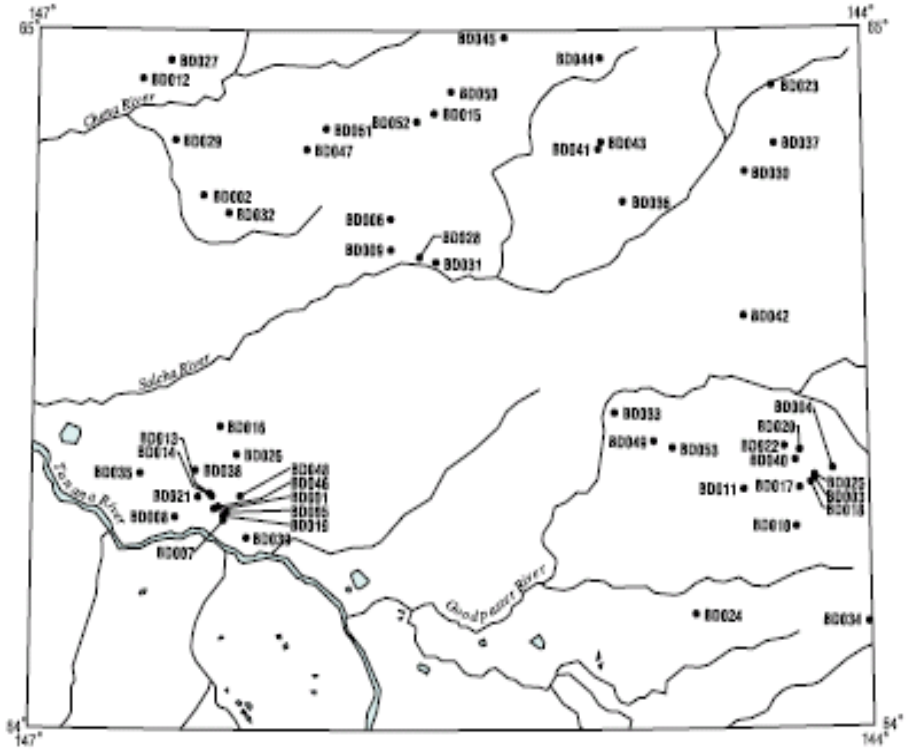
Streaming 100%

Sources of Data

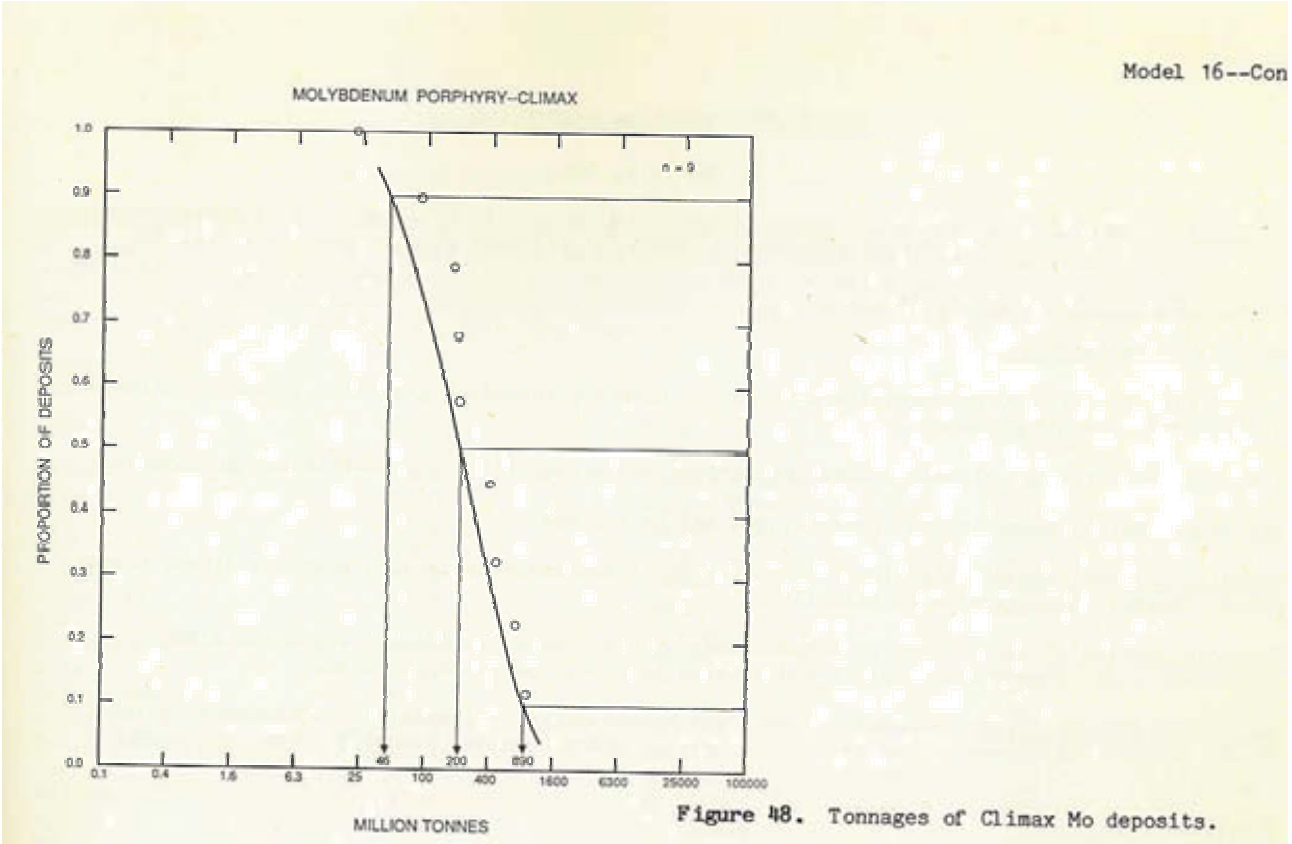
- Alaska Resources Data Files (ARDF)
- Mineral Deposit Models in ARDF from Cox and Singer (1986).
- Mineral Evaluation Models developed for each mineral deposit model utilizing U.S. Bureau of Mines Cost Estimating System adjusted for current costs and mineral commodity prices.

Example of Alaska Resource Data Files Mineral Locations



Distribution of mineral occurrences in the Big Delta 1:250,000-scale quadrangle, Alaska

Example of Tonnage Curve for Mineral Deposit Model from Cox and Singer 1986



Example of Grade Curve from Cox and Singer 1986

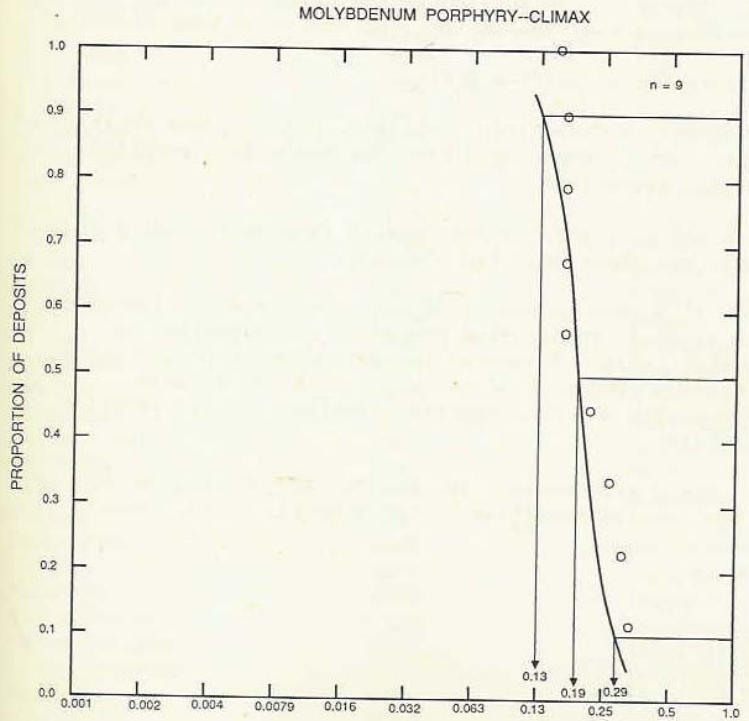


Figure 49. Molybdenum grades of Climax Mo deposits.

Mineral Valuation Models
Input and Output Data

- Mineral valuation models for 50 and 90 percentile tonnage and grade for 43 different mineral deposit types.
- Deposit type.
- Surface or underground mining method.
- Total tonnage/grade.
- Extraction rate.
- Dilution/waste rate.
- Proposed mine life.
- Daily production.
- Maximum ore depth.
- Stripping ratio.
- Site haulage distance.
- Distance to power.
- Beneficiation method.

Mineral Valuation Models
Input and Output Data

- Mine capital and operating cost estimates
- Mill capital and operating cost estimates
- Infrastructure and operating cost estimates.
- Revenue estimates based on current commodity prices
- Cash flow analysis base on current taxation rates.
- Minimum rate of return on capital = 10%.

Mineral Occurrences in Each Quadrangle Transected by Proposed Railroad Extension Corridor

Quadrangle	No. Min. Occur.
Livengood	155
Fairbanks	115
Circle	2
Big Delta	14
Healy	37
Mt Hayes	153
Gulkana	29
Eagle	17
Tanacross	21
Nabesna	45
Total	588

Mineral Deposit Model Types
(After Cox and Singer, 1986)

- 1. Stillwater Ni-Cu
- 7a. Synorogenic-synvolcanic Ni-Cu
- 8a. Minor podiform Cr
- 8b. Major podiform Cr
- 8c. Limassol Forest Co-Ni
- 8d. Serpentine hosted asbestos
- 10. Carbonatite
- 14a. W skarn
- 14b. Sn skarn
- 14c. Replacement Sn
- 15a. W veins
- 16. Climax Mo
- 17. Porphyry Cu

Mineral Deposit Model Types
(After Cox and Singer, 1986)

- 18b. Cu -skarn
- 18c. Zn-Pb skarn
- 18d. Fe skarn
- 20c. Porphyry Cu-Au
- 21a. Porphyry Cu-Mo
- 21b. Porphyry Mo low-F
- 22a. Volcanic hosted Cu-As-Sb
- 22b. Au-Ag-Te veins
- 22c. Polymetallic veins
- 23. Basaltic Cu
- 24b. Besshi massive sulfide
- 25a. Hot-springs Au-Ag
- 25c. Comstock epithermal veins

Mineral Deposit Model Types
(After Cox and Singer, 1986)

- 26a. Carbonated-hosted Au-Ag
- 27d. Sb deposits
- 28a. Kuroko massive sulfide
- 29a. Quartz-pebble conglomerate Au-U
- 36a. Low-sulfide Au-quartz veins
- 36b. Homestake Au
- 37a. Unconformity U-Au
- 39a. Gold on flat faults

Mineral Commodity Prices

(as of February 2006)

Metal Prices Use in this Investigation (February 2006)		
Commodity	Units	Price
Aluminum	$/lb	1.16
Antimony	$/lb	0.85
Arsenic	$/lb	0.45
Asbestos	$/ton	125.00
Barite	$/ton	23.00
Bismuth	$/lb	0.18
Cadmium	$/lb	0.25
Chromite	$/lb	2.18
Cobalt	$/lb	18.00
Columbium	$/lb	8.07
Copper	$/lb	2.20
Fluorite	$/lb	152.00
Germanium	$/lb	391.00
Gold	$/tr oz	560.00

Mineral Commodity Prices
(Continued)

Iron	$/ton-unit	0.60
Lead	$/lb	0.58
Mercury	$/flask	700.00
Molybdenum	$/lb	23.00
Nickel	$/lb	6.75
Palladium	$/tr oz	286.00
Rhodium	$/oz	3095.00
Platinum	$/tr oz	1050.00
Silver	$/tr oz	9.30
Tantalum	$/lb	182.62
Tin	$/lb	2.48
Titanium	$/lb	1.30
Tungsten	$/lb	1.82
Vanadium	$/lb	1.75
Zinc	$/lb	1.03

Probabilities

- Probabilities of discovery and development at a given tonnage and grade
  - Mineral occurrence not in historic mining district – upper 90 percentile; P = 0.001
  - Mineral occurrence not in historic mining district – upper 50 percentile; P = 0.05
  - Mineral occurrence in historic mining district – upper 90 percentile; P = 0.01
  - Mineral occurrence in historic mining district – upper 50 percentile; P = 0.5
  - Mineral occurrence in historic mining district, adjacent to major mine – upper 90 percentile; P = 0.1

Expected Tonnage of Concentrates

- 50 Percentile tonnage and grade; Expected Tonnage = 100,000 tons per year.
- 90 Percentile tonnage and grade: Expected Tonnage = 1,000,000 tons per year (equivalent tonnage from the development of only one porphyry Mo deposit or one layer mafic complex Cu-Ni deposit).

Expected Economic Benefits from the Development of the Mineral Occurrences in the Extension Corridor

- Economic benefits of the Fort Knox Mine – Information Insights, 1999 estimated $100 million per year to Fairbanks North Star Borough
- Over 12 year mine life the mine would provide economic benefits equivalent to the gross metal value of the deposit at the time of completion of the feasibility study.
- Gross metal value at 50 percentile = $20 billion
- Gross metal value at 90 percentile = $101 billion.