Today

1:30 to 2:30 p.m.

20-year outlook for Alaska's hard rock mining industry

Tentative Oct. 25

2 to 3 p.m.

Building a cultural corridor

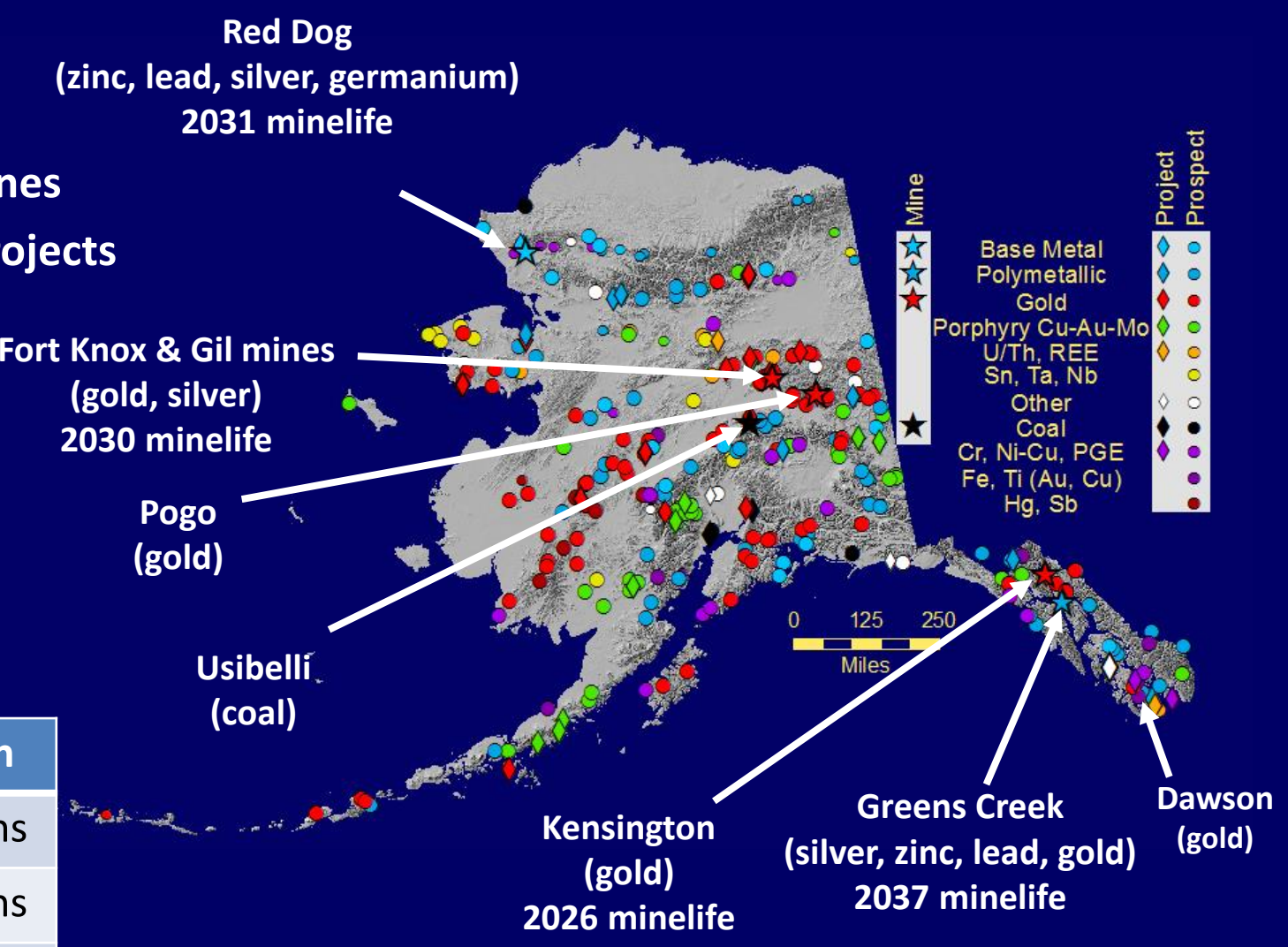
20-year outlook for Alaska's hard rock mining industry

1:30 to 2:30 p.m.

- Bob Loeffler, Research Professor, UAA's Institute of Social and Economic Research
- Brett Watson, Assistant Professor of Economics, UAA's Institute of Social and Economic Research
- Dave Szumigala, Geologist IV, Alaska Division of Geological & Geographical Surveys
- Moderator: Dan Robinson, Research Chief, Research and Analysis

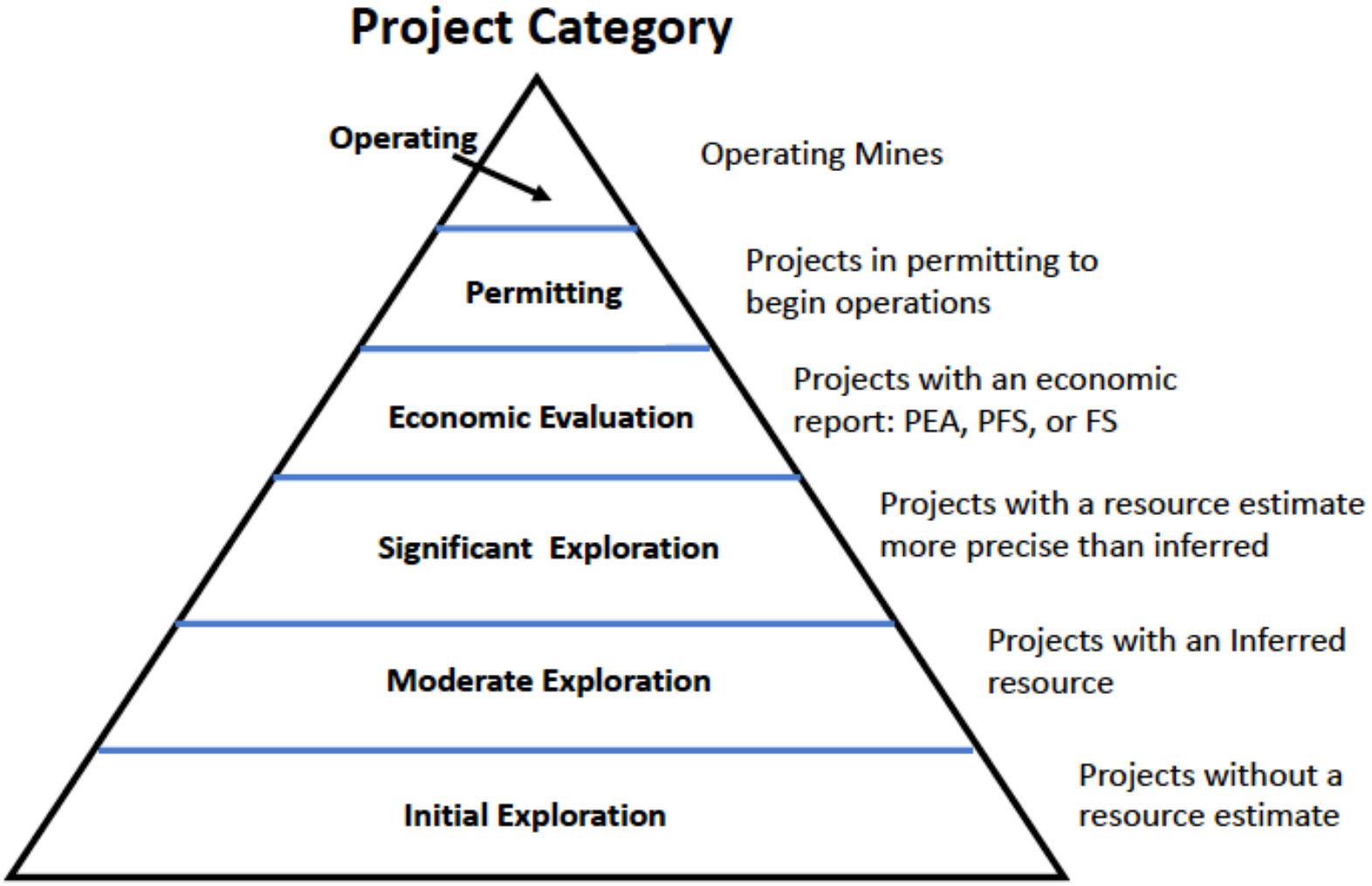
2023 Alaska Mines & Mineral Production

- 7 lode mines
- 1 coal mine
- ~ 145 placer Au mines
- ~ 32 exploration projects



Est	2023 Production
Zn	650-680,000 tons
Pb	107-119,000 tons
Au	686-700,000 oz.
Ag	15.3-16.6 M oz.

The Mine Development Pyramid

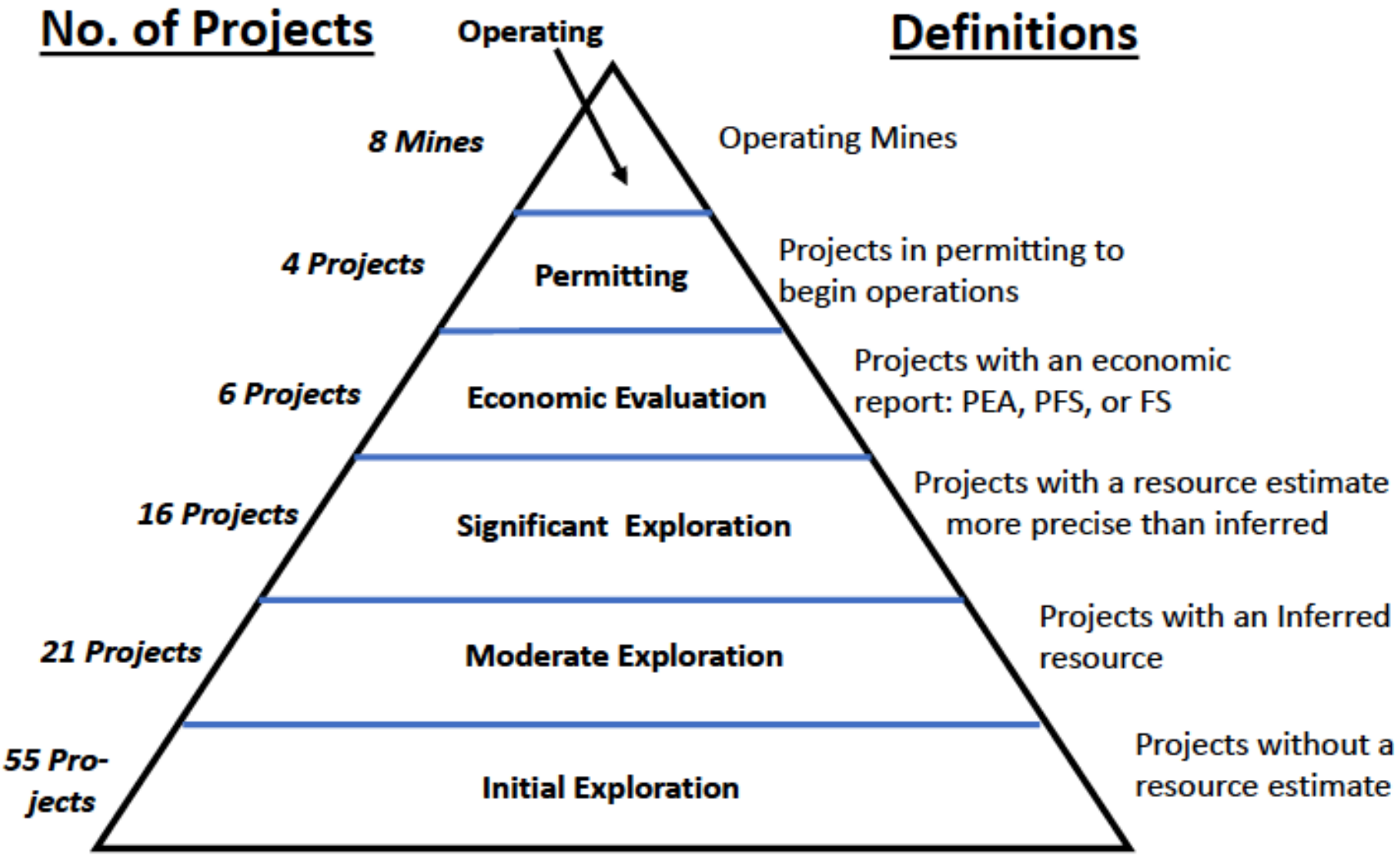


The Odds of Succeeding: *Academic Literature*

Table 1. Exploration Projects to Operating Mines: Data from Literature

Original Data Source	**BCMC[1]**	**Cominco[2]**	**RTZ[1]**	**SOQUEM[3]**	**Potter[4]**	**Sykes/Trench[5]**
Time Frame of Study		**40 yrs.**		**10 yrs.**	**20 yrs.**	
Operating Mines	1	18*	1	3	6	66
Projects with Economic Evaluation	5		1		8	92
Significant/Moderate Exploration	60	78	10	192	67	664
Recon/Initial Exploration	1649	1000	3000		159	2870

The Mine Development Pyramid



Alaska's Operating Mines

Table 2. Operating Mines

Mine	Primary Minerals	Resource *(in Short Tons)*	Employment
Red Dog	Zinc, Lead	75,397,000	700
Pogo	Gold	21,306,000	450
Kensington	Gold	6,465,000	383
Greens Creek	Zinc, Lead, Silver, Gold	21,213,000	426
Fort Knox	Gold	571,654,000	655
Usibelli	Coal	450,000,000	100
Dawson	Gold	1,000,000	50
Calder	Limestone	Unknown	12

Alaska: Mines in Permitting

Table 3. Projects in Permitting, plus those Permitted but not Operating

Mine	Minerals	Resource Short Tons	Estimated Employment
Donlin	Gold	698,366,574	900
Lucky Shot	Gold	292,661	76
Nixon Fork	Gold	542,949	45
Wishbone Hill	Coal	14,000,000	100

Alaska: Mines with Econ Evaluation

Table 4. Projects with a PEA, PFS, or FS

Project	Status	Minerals	Resource Metric Tons	Expected Employment
Arctic (Upper Kobuk Projects)	Feasibility	Zinc, Copper, Lead, Gold	51,299,303	378
Bokan Mountain	PEA	Rare Earth	6,435,000	118
Golden Summit	PEA	Gold	146,561,808	299
Graphite Creek	PEA	Graphite	113,360,000	269
Money Knob (Livengood)	Pre-Feasibility	Gold	637,334,353	331
Palmer	PEA	Zinc, Copper, Gold	15,731,066	94

Recently completed:

Korbel	PEA	Gold

MINERAL INDUSTRY MARKETS

Brett Watson

Assistant Prof of Applied and Natural Resource Economics

ISER/UAA

By-products metals and minerals have higher price volatility

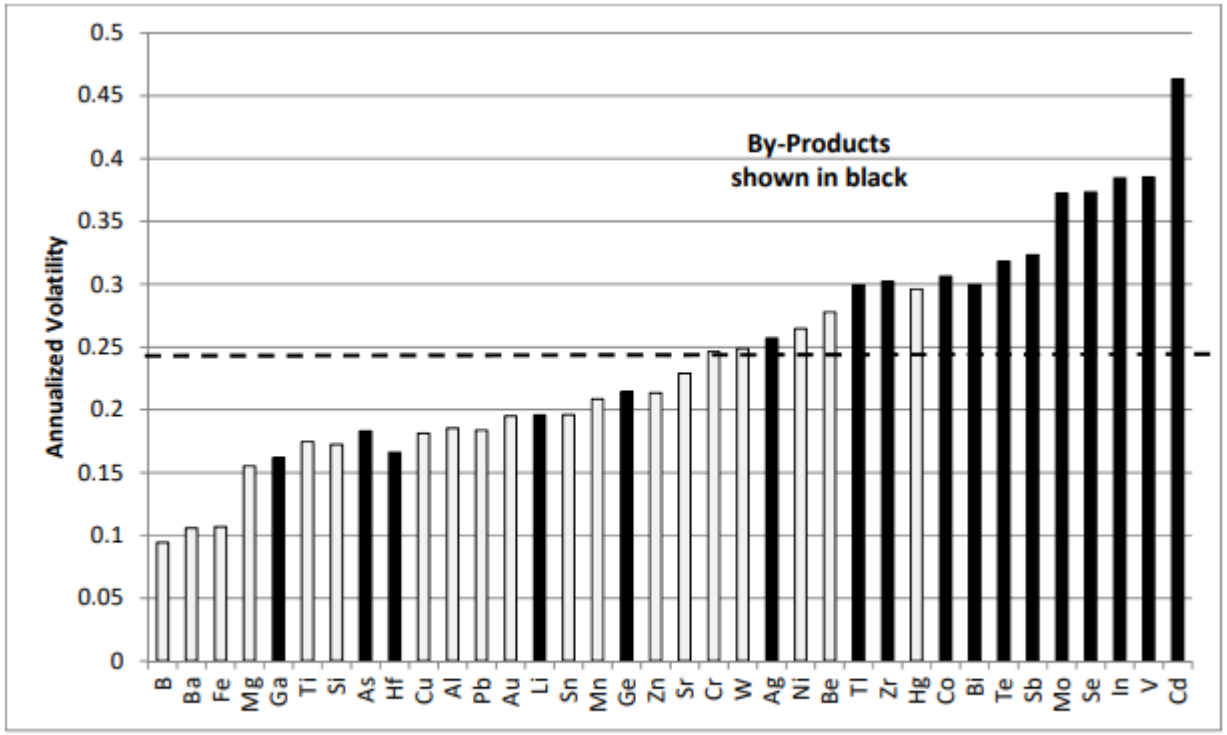


Figure 3. Historical Volatility of Annual Metal and Mineral Prices, 1960 - 2013. The dashed line represents the average volatility for this sample over this time period.

Table 1 Regression Results- Volatility of USGS Annual Price Data (1960-2013)

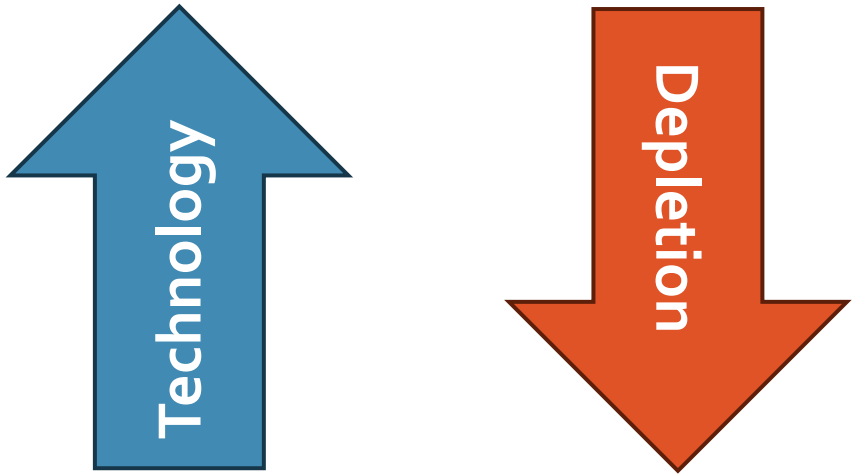
	Equation 1 Volatility	Equation 2 Volatility	Equation 3 Volatility	Equation 4 Volatility
ByProd	0.092***			
	(0.027)			
Minor	0.015	0.012		
	(0.022)	(0.024)		
ByPartial		0.077		
		(0.046)		
ByFull		0.097***		
		(0.031)		
ByShare			0.001***	0.001***
			(0.000)	(0.000)
LnVal			0.004	
			(0.007)	
LnProd				-0.001
				(0.004)
Constant	0.188***	0.190***	0.106	0.210***
	(0.014)	(0.015)	(0.161)	(0.052)
N	36	36	36	36
R^2	0.327	0.330	0.321	0.314
F	8.003	5.189	6.958	6.419

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Redlinger, M., & Eggert, R. (2016). Volatility of by-product metal and mineral prices. *Resources Policy*, *47*, 69-77.

Long run mining industry productivity

- Monotonic:
  - Technology marches forward (limited forgetting)
  - We mine the good stuff first (Herfindahl rule)



Copper case study: Tech v Depletion

Tech. Advances

2000s+

Computer controls/modelling scheduling

1990s

Advanced Geologic Modeling

SXEW

1950-1980

Economies of Scale

1900-1950

Froth Floatation

Recovery Improvements

Better Smelting and Refining

Schodde, R. (2010, March). The key drivers behind resource growth: an analysis of the copper industry over the last 100 years. In MEMS Conference Mineral and Metal Markets over the Long Term, Joint Program with the SME Annual Meeting, Phoenix, USA (Vol. 3).

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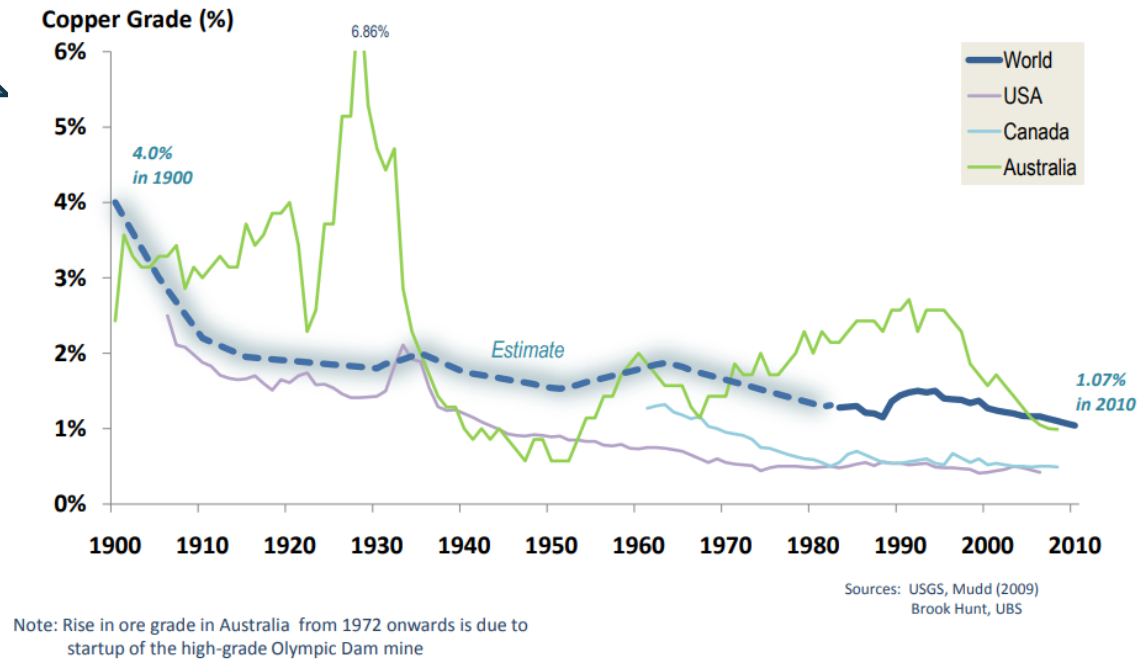
Technology



Depletion

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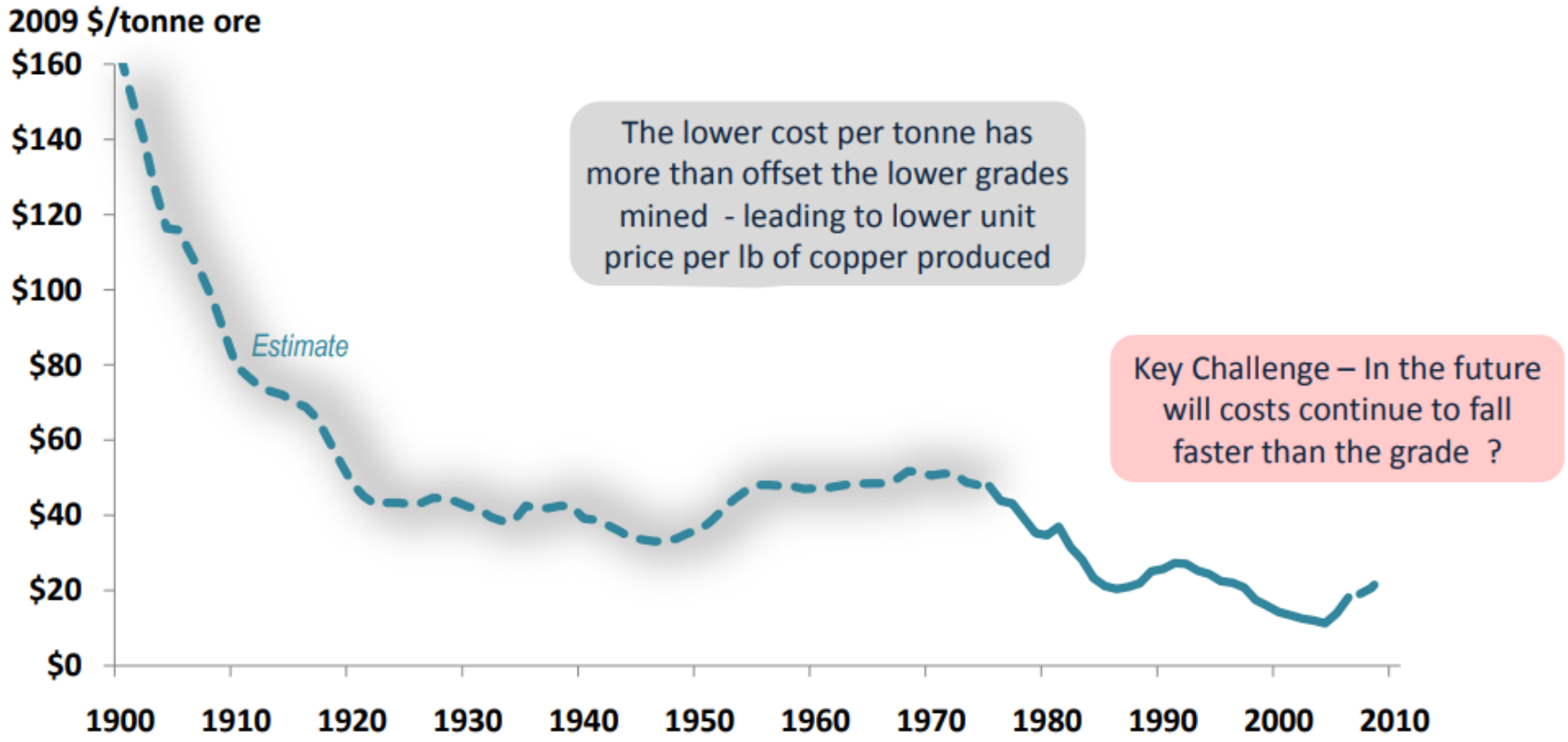
Technology winning, for now



Sources: Brook Hunt, CRU , Historical reports
MinEx Consulting estimates (for 1900-1974)

Includes, transportation, smelting & refining and marketing costs

Case Study: Appalachian Coal Productivity

Line up all the mines from most productivity to least (hrs/ton, proxy for labor cost per ton)

What's the productivity of the mine that produces the 25 millionth ton?

1985: 0.246

1995: 0.136

2000: 0.09

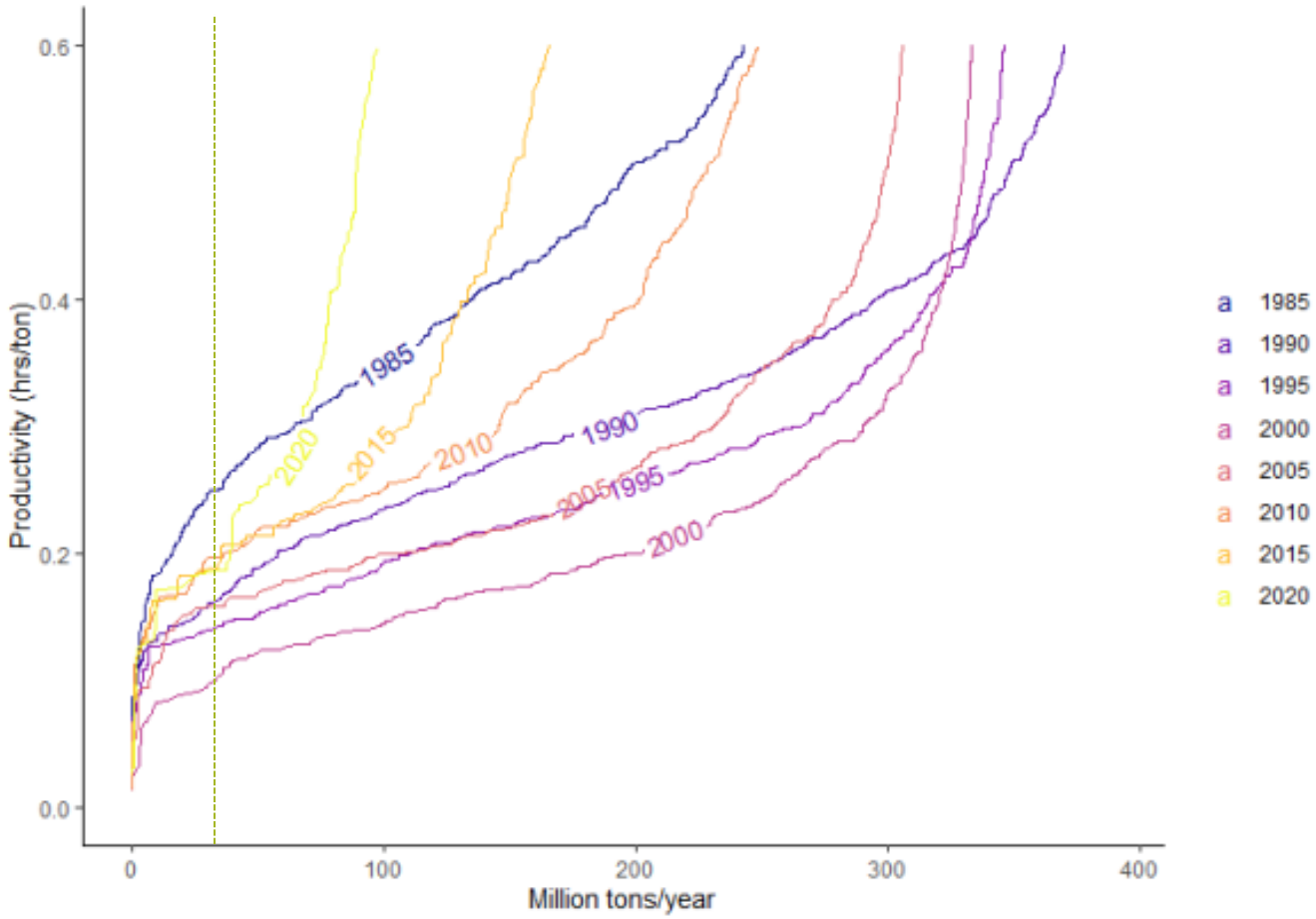
2005: 0.157

2010: 0.183

2015: 0.183

2020: 0.183

Figure E.4: Relationship between Production and Median Productivity over Time



Watson, B., Lange, I., & Linn, J. (2023). Coal demand, market forces, and US coal mine closures. *Economic Inquiry*, *61*(1), 35-57.