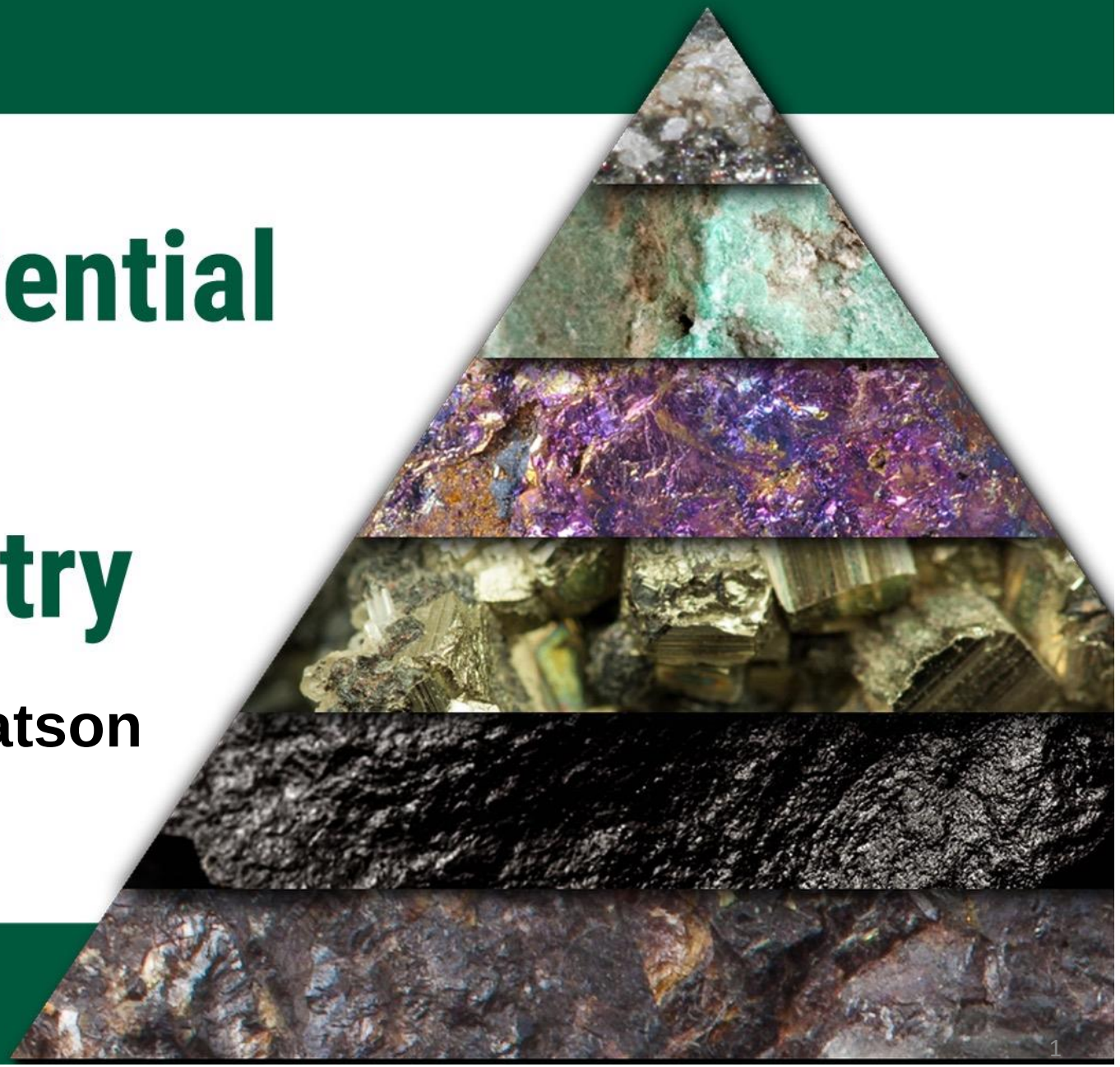
Economic Potential of Alaska's Mineral Industry



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April 17, 2023

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University of Alaska Anchorage

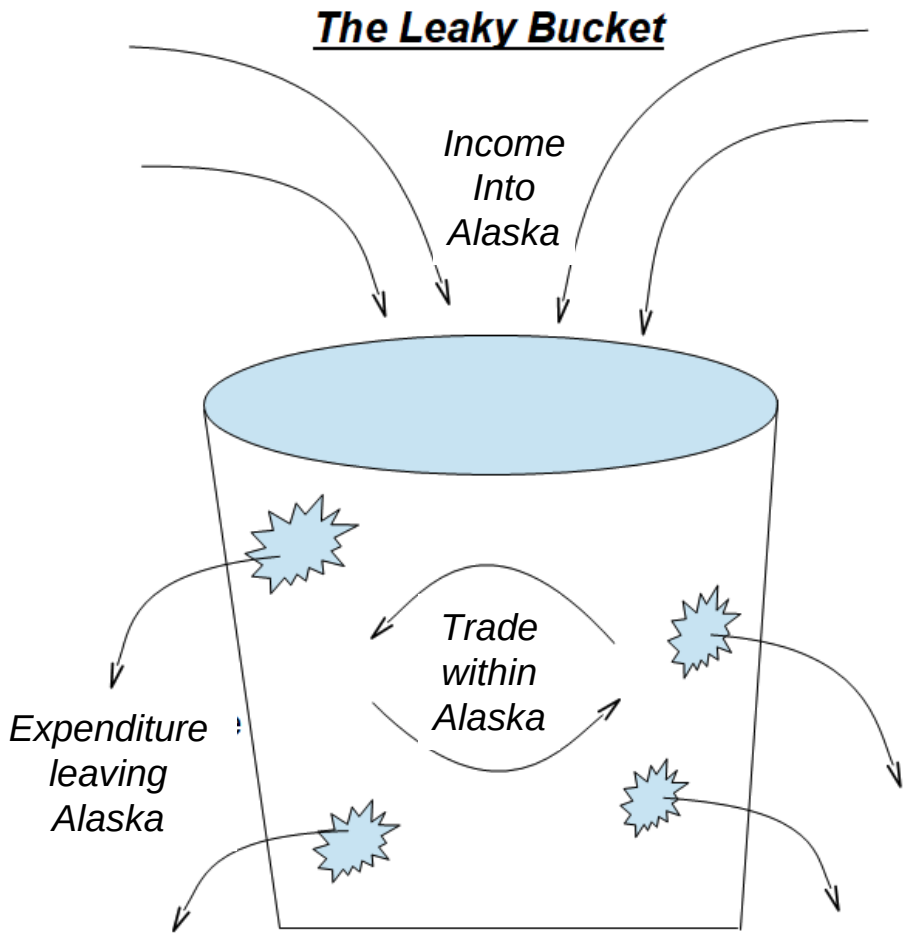
Disclosure

- Mr. Loeffler and Dr. Watson would like to thank Power The Future for funding a portion of work presented today. However, Power The Future had no editorial control over associated methodology, results, or conclusions.
- The data assumption and conclusions are the responsibility of the authors and do not represent opinions of UAA, ISER, or the funder.
- Mr. Loeffler and Dr. Watson are not advocating for or against any particular mine, and their paper takes no position about whether any project can or should be developed.

Key Points

- The mining industry & Alaska's economy
- What might change in the future?
- Policy opportunities and challenges

The Role of Exports

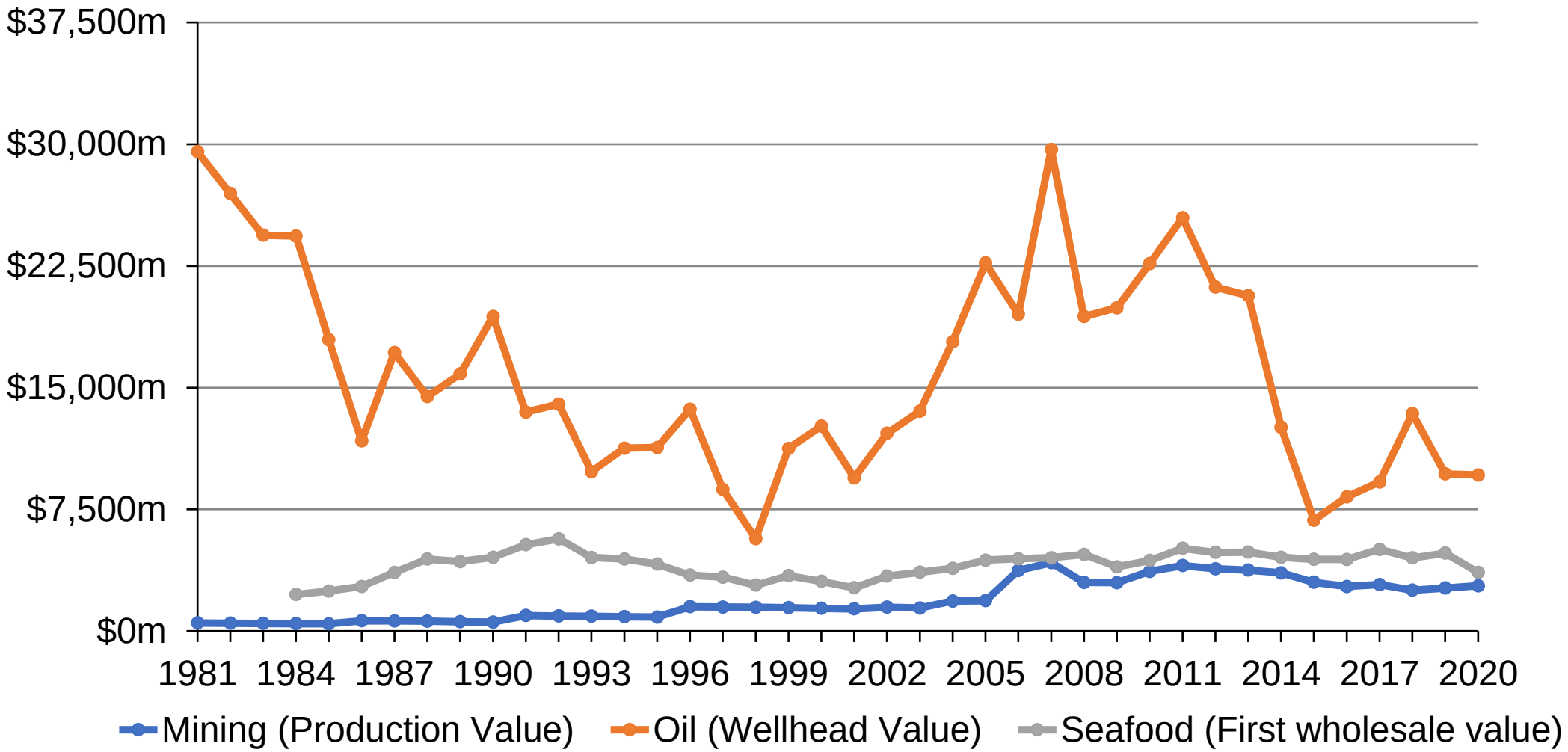


- The money circulating in our economy comes from what we sell to others.
- What we buy from outside is money that leaks out
- Alaska has two major “export industries”:
  - Oil & federal spending
- Other major exports:
  - seafood, minerals, tourism, air cargo

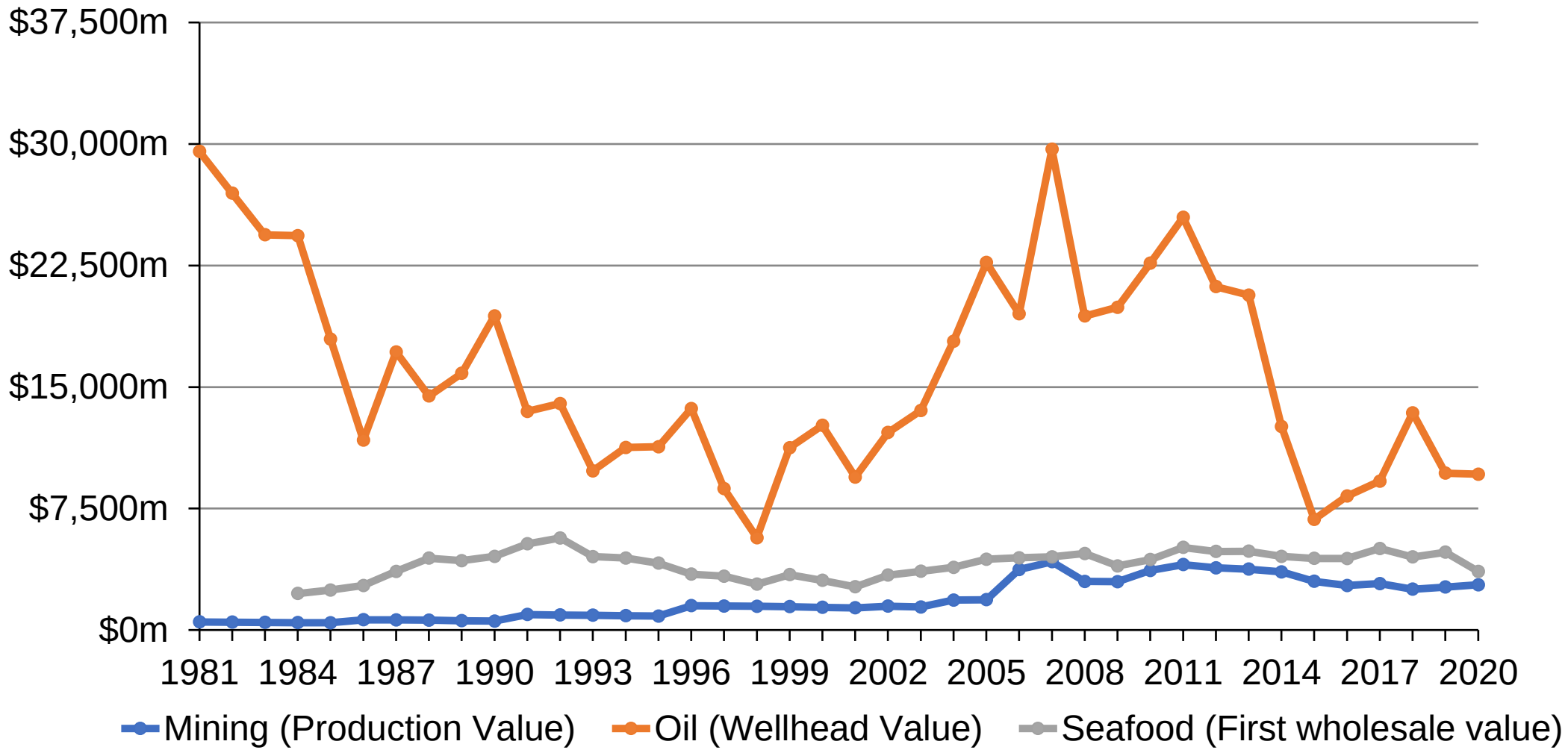
The Role of Exports

- 1/3 Federal Government Spending
- < 1/3 Oil and Gas
- > 1/3 Everything Else:
  - Fishing
  - Mining
  - Tourism
  - Air Cargo
  - Permanent Fund

Minerals as an export



Minerals as an export - *10%* of All Base Industries



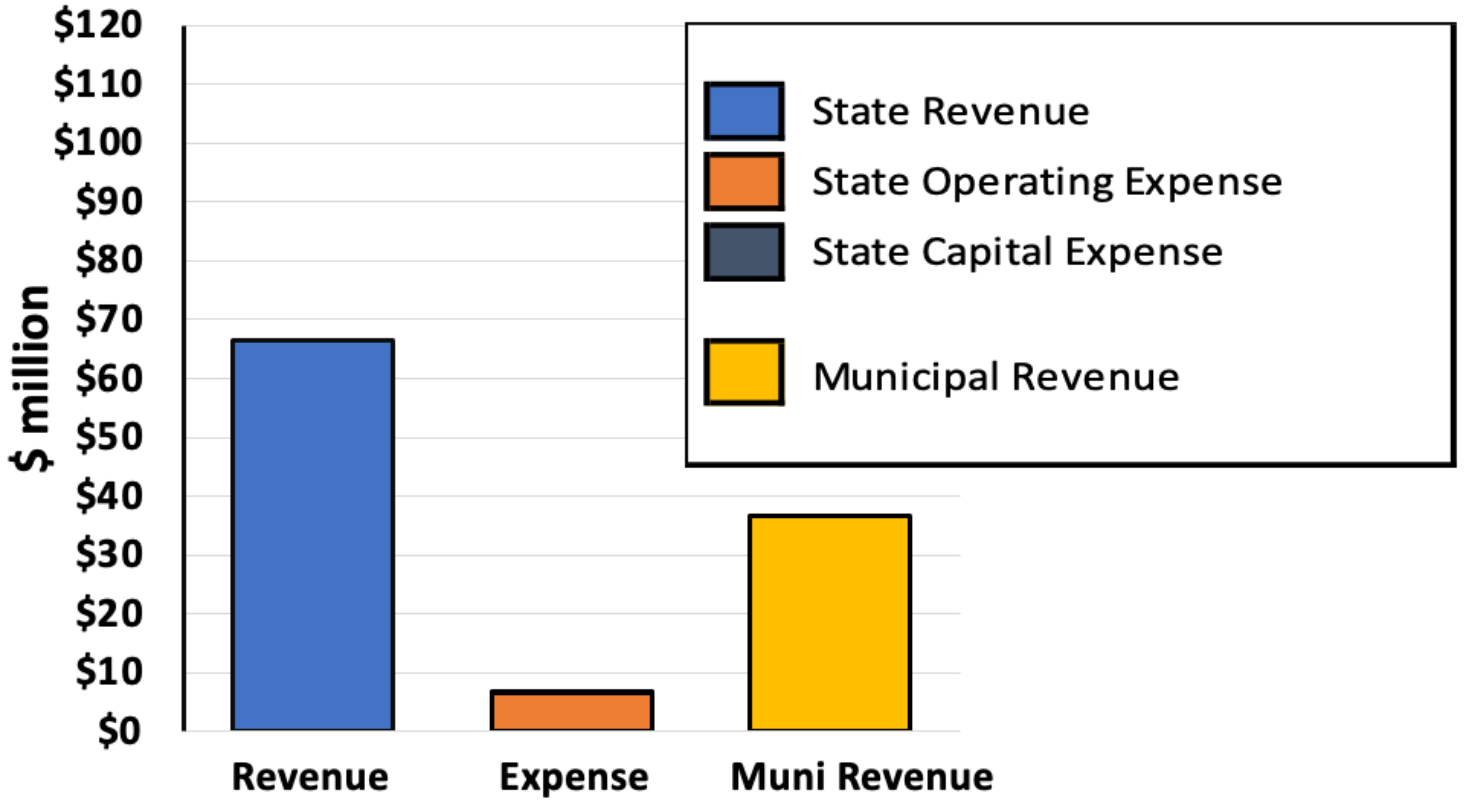
Wages & Employment

- Average mining wages were $130,000 in 2021,
  - double the average statewide wage
- Total wages and salaries $625m in 2021
  - $985m including indirect & induced
- Statewide: 5,400 direct jobs in 2021
  - 10,800 including indirect and induced jobs

Source: McKinley Research Group 2022

Impact on Government Revenue

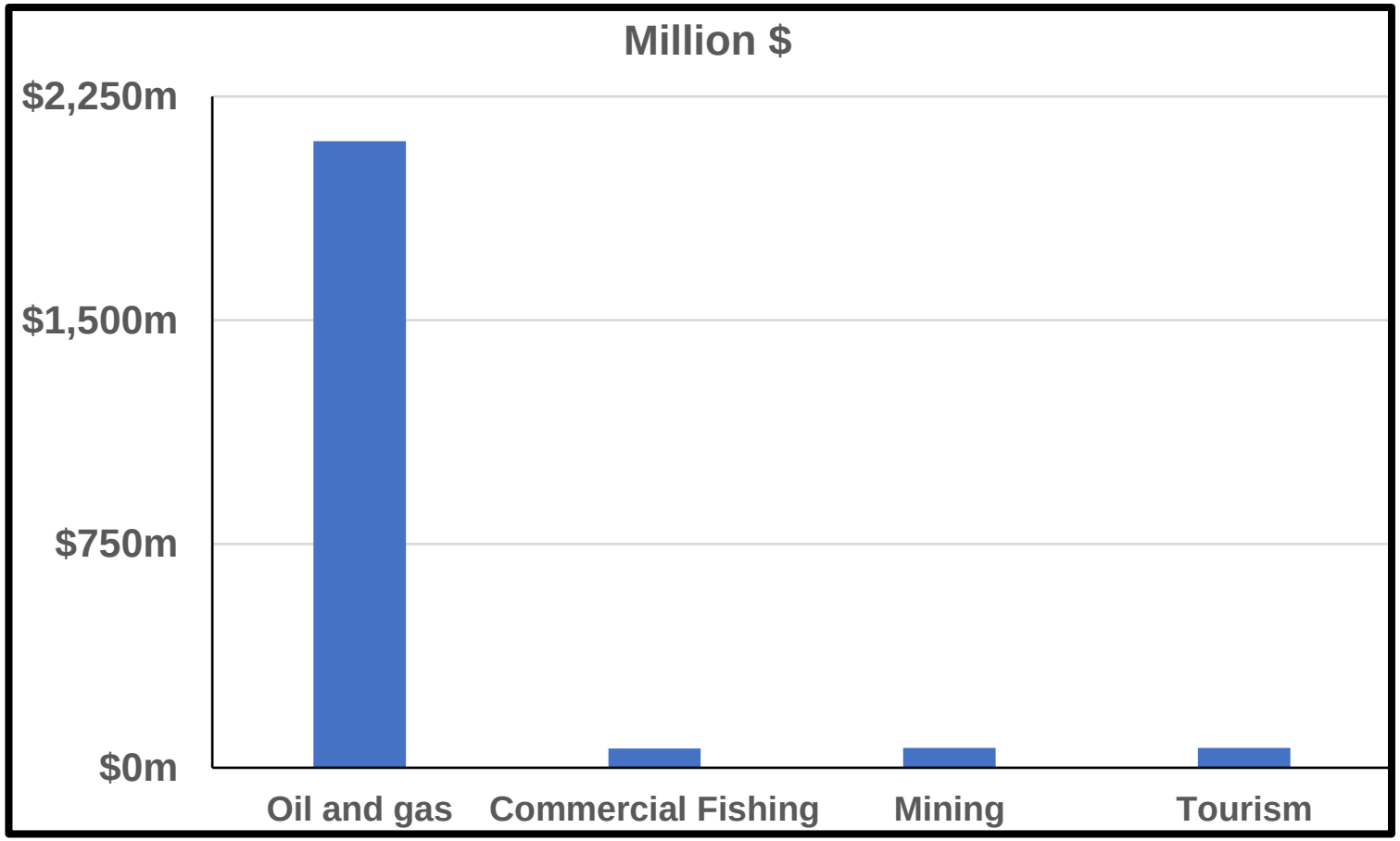
Comparison of Revenue and Expenditures
Fiscal Years 2016-2019, Millions of Dollars



Impact on State Government Revenue

State Revenue Comparison: FY 2016-2019

Oil vs Commercial Fishing, Mining, and Tourism



Conclusions: Mining & the Alaska Economy

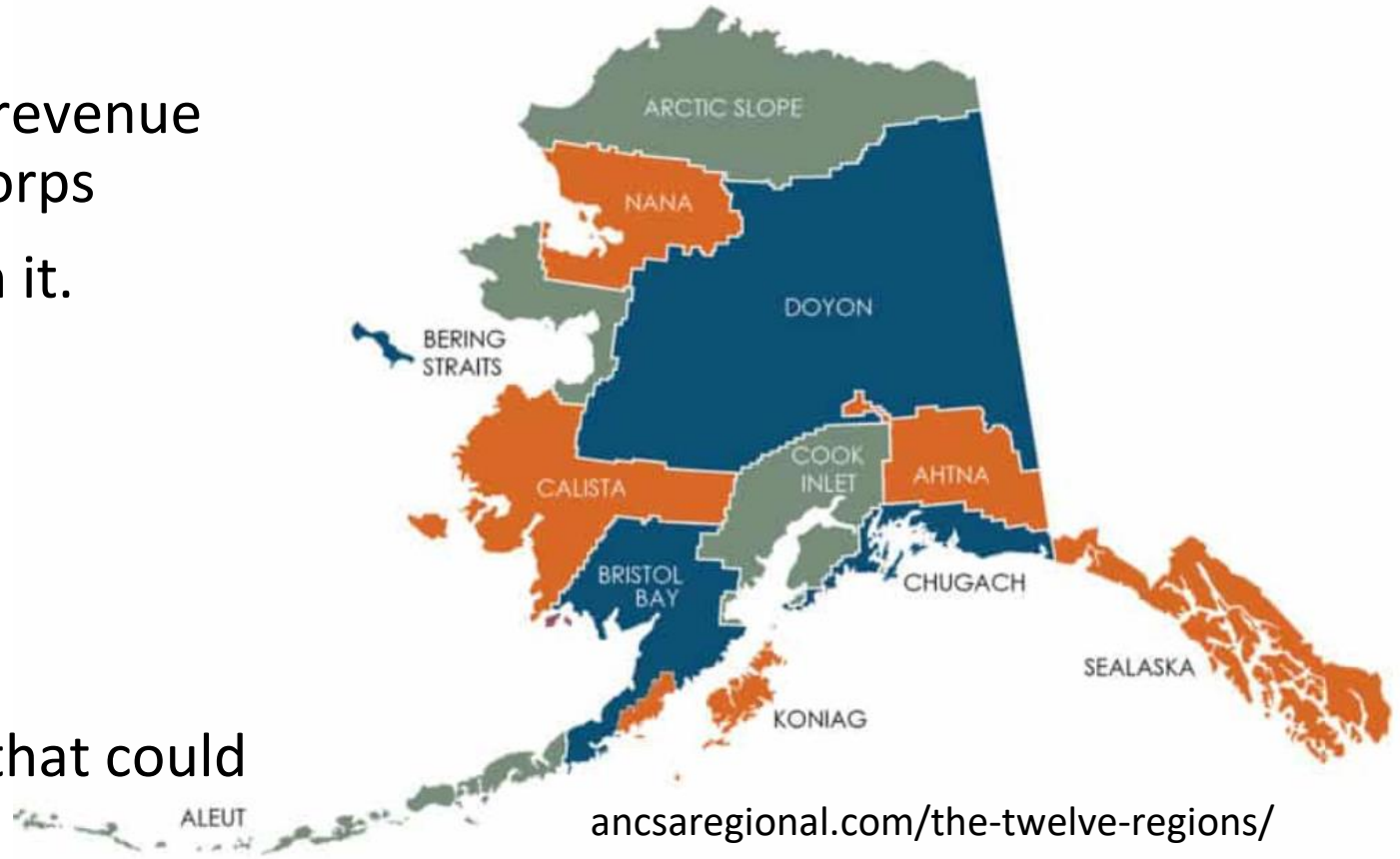
- Mining statewide impact is important but relatively small:
  - Mining does not compare to oil, or federal government spending
  - Mining – along with fishing, tourism, air cargo, and the permanent fund (POMV) – make up 1/3 of our economy
- Mining's impact on Alaska's state revenues is small
  - No revenue source compares to Oil or POMV
  - Mining revenues are 6-10 times what the state spends to regulate or promote the industry
- *Mining has a large impact on local economies*

Conclusions: Mining & Local Economies

- Large employer, in communities where large mines exist
- Largest taxpayer in those communities
  - Only taxpayer in Northwest Arctic Borough
  - Largest two taxpayers in Juneau
  - 2nd largest taxpayer in Fairbanks
- Large, high-paying employers in the community
  - Average wage $130,000 (large mines), ~ double statewide average
  - Red Dog responsible for 30% of private wages in the Borough
  - Mining employees live in ~ 90 communities statewide
- 7i funding for Alaska's Native Corporations

Funding for Alaska Native Corporations

- Mines on ANCSA land provide revenue to Alaska Native Corps
- ANCSA 7(i), redistributes 70% of revenue among all Regional and Village Corps
- Most Village Corps dependent on it.
- Red Dog Mine
  - generated $2.4B for NANA
  - 69% of 7(i) from 2014-2020
  - May end in 2031
- Donlin is only near-term project that could provide significant 7(i) revenue



ancsaregional.com/the-twelve-regions/

Alaska's main types of operations

- Large mines (metal & fuel)
  - 5 metal mines
  - 1 coal mine
  - Bulk of employment 2,088 (86%)
  - Most of presentation will focus on large mines
- Placer gold mining
  - 5% of state gold production
  - 150 reported operations in 2020, estimated 141 FTE
- Aggregate material quarries: Sand, gravel, stone
  - mostly supplies in-state construction
  - ~150 such operations
  - 200 jobs

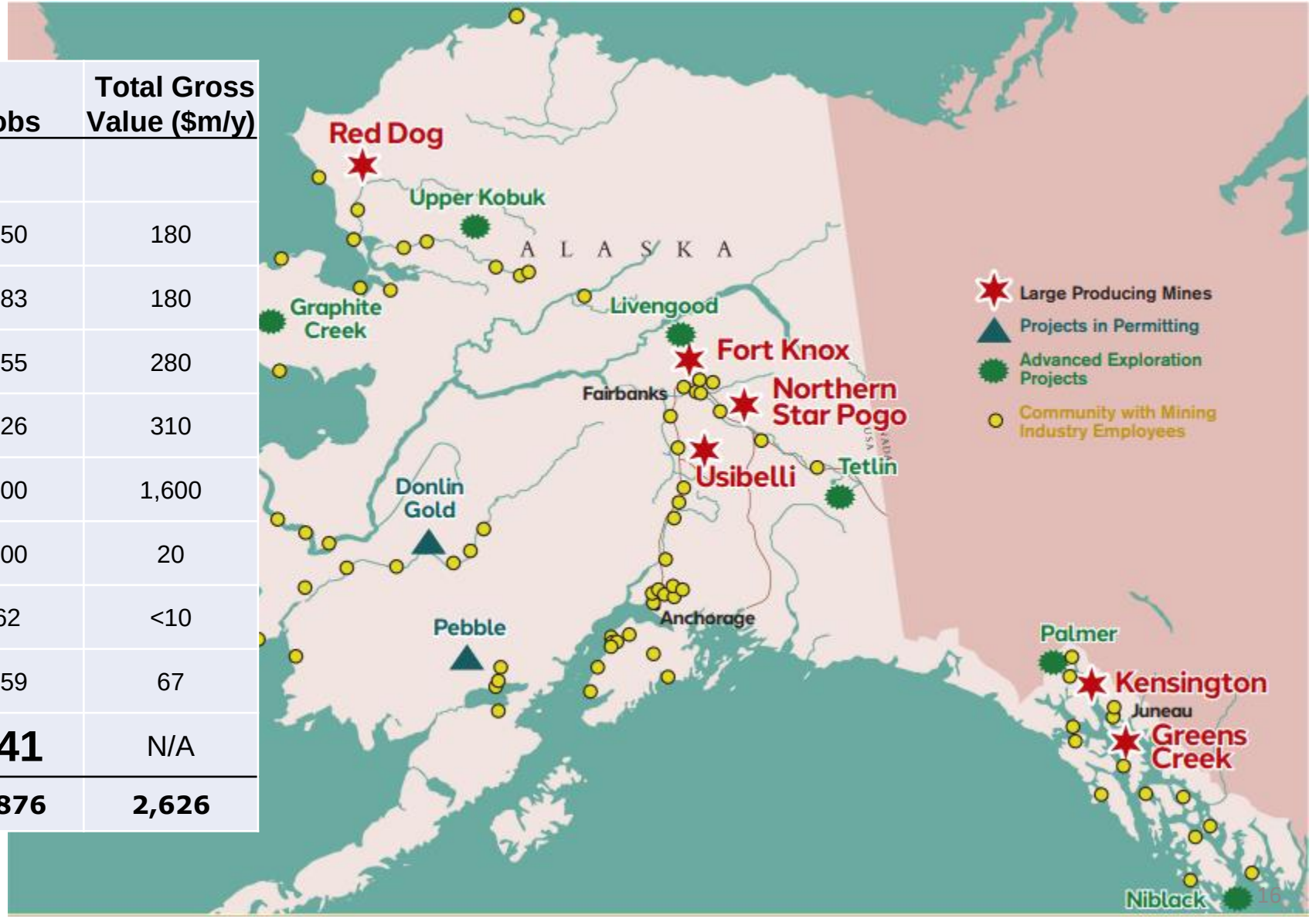
(All data from Alaska DNR Mineral Industry 2020 Report)

Alaska's Six Large, Producing Mines

Name	Product	Jobs	Total Gross Value ($m/y)
Hard Rock/Coal			
Pogo	Au	450	180
Kensington	Au	383	180
Fort Knox	Au	655	280
Greens Creek	Zn, Ag, Au, Pb	426	310
Red Dog	Zn, Ag, Pb	700	1,600
Usibelli	Coal	100	20

Exploration jobs and advanced projects

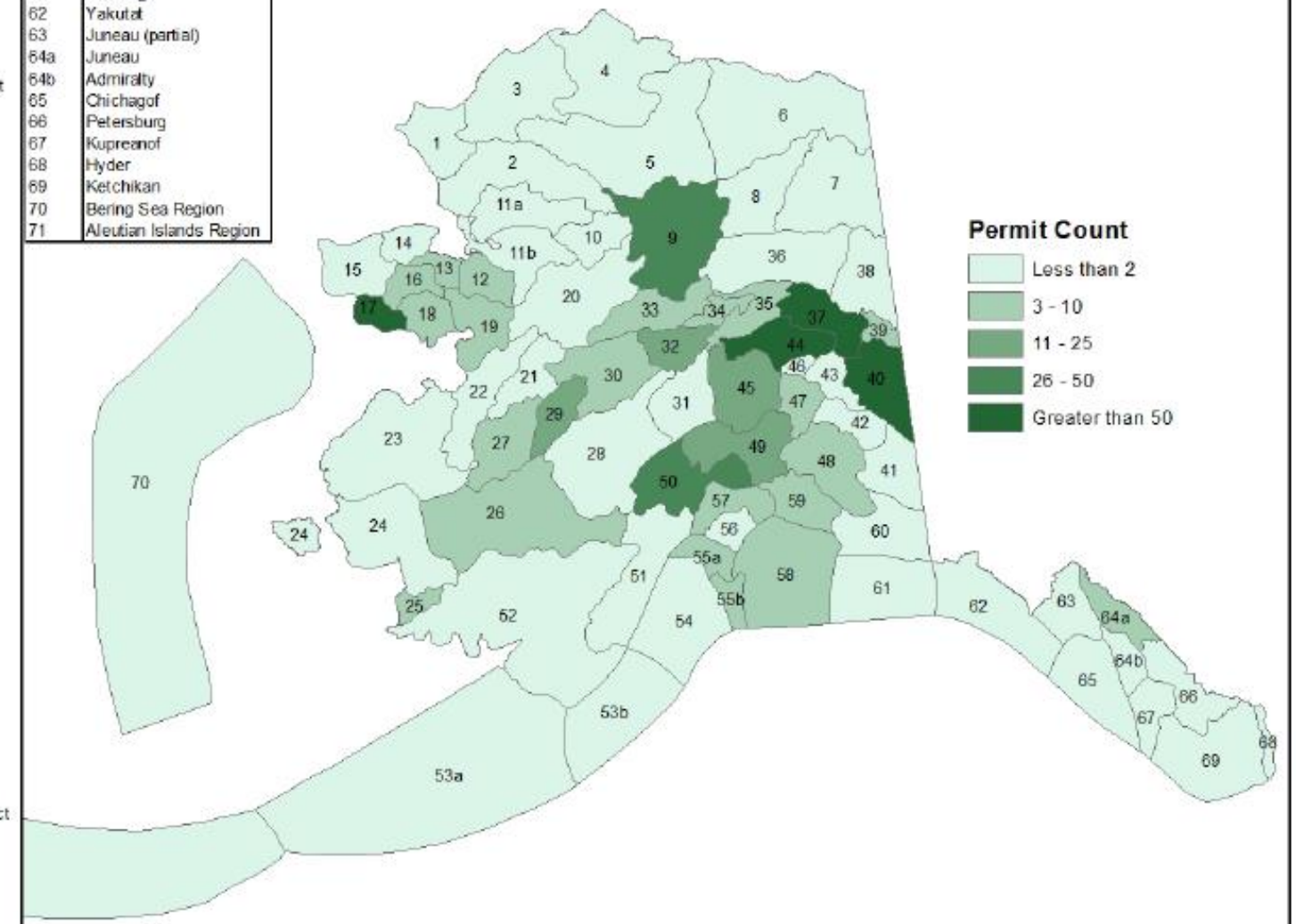
Name	Commod. Symbol	Jobs	Total Gross Value ($m/y)
Hard Rock/Coal			
Pogo	Au	450	180
Kensington	Au	383	180
Fort Knox	Au	655	280
Greens Creek	Zn, Ag, Au, Pb	426	310
Red Dog	Zn, Ag, Pb	700	1,600
Usibelli	Coal	100	20
Other		62	<10
Placer	Au	159	67
Exploration		**941**	N/A
Total		**3,876**	**2,626**



Source: www.mcdowellgroup.net/wp-content/uploads/2021/02/ama-summary-brochure-web-version-2.15.2021.pdf

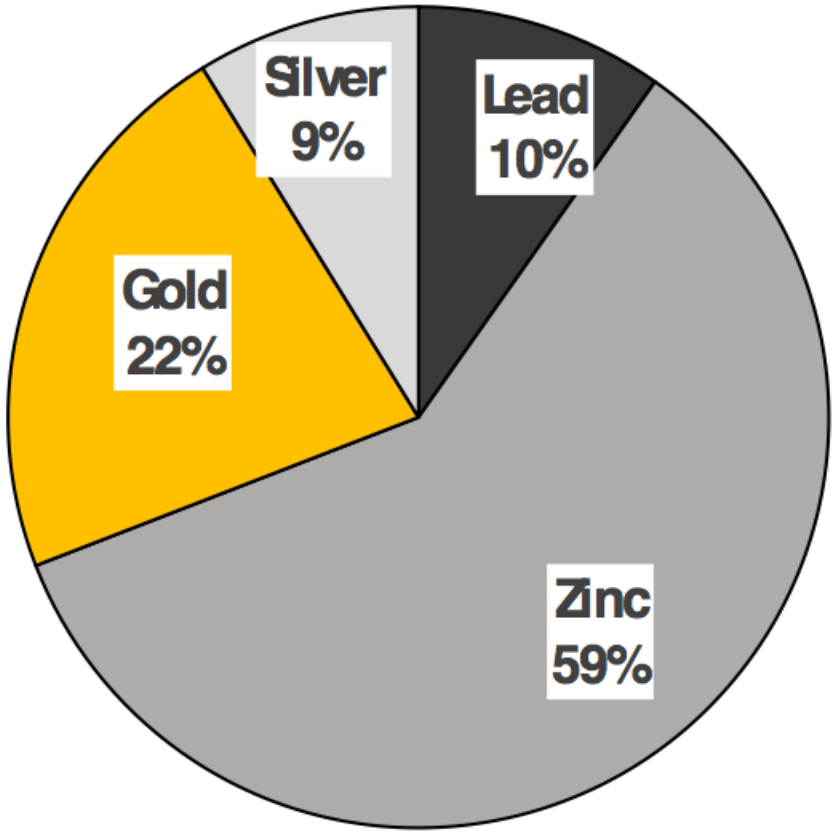
Dist. #	Dist. Name
1	Lisburne
2	Noatak
3	Wainright
4	Barrow
5	Colville
6	Canning
7	Sheenjek
8	Chandalar
9	Koyukuk
10	Shungnak
11a	Kiana
11b	Selawik
12	Fairhaven - Candle subdistrict
13	Fairhaven - Inmachuck subdistrict
14	Serpentine
15	Port Clarence
16	Kougarok
17	Nome (Cape Nome)
18	Council
19	Koyuk
20	Hughes
21	Kaiyuh
22	Anvik
23	Marshall
24	Bethel
25	Goodnews Bay
26	Aniak
27	Iditarod
28	McGrath
29	Innoko
30	Ruby
31	Kantishna
32	Hot Springs
33	Melozitna
34	Rampart
35	Tolovana
36	Yukon Flats
37	Circle
38	Black
39	Eagle
40	Fortymile
41	Chisana
42	Tok
43	Goodpaster
44	Fairbanks
45	Bonnifield
46	Fairbanks - Richardson subdistrict
47	Delta River
48	Christochina
49	Valdez Creek
50	Yentna
51	Redoubt
52	Bristol Bay Region
53a	Alaska Peninsula region
53b	Kodiak
54	Homer
55a	Hope
55b	Seward
56	Anchorage
57	Willow Creek
58	Prince William Sound
59	Nelchina
60	Nazina
61	Yakataga
62	Yakutat
63	Juneau (partial)
64a	Juneau
64b	Admiralty
65	Chichagof
66	Petersburg
67	Kupreanof
68	Hyder
69	Ketchikan
70	Bering Sea Region
71	Aleutian Islands Region

Number of Placer Mining Permits, by District, 2014



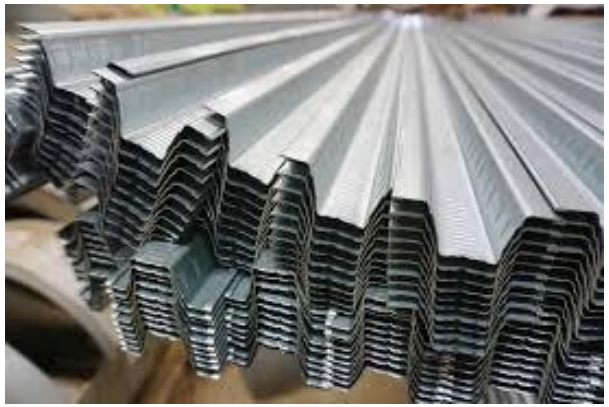
Alaska's Production Today

- Alaska's primary products (by value) are zinc and gold
- Coal & aggregates within state



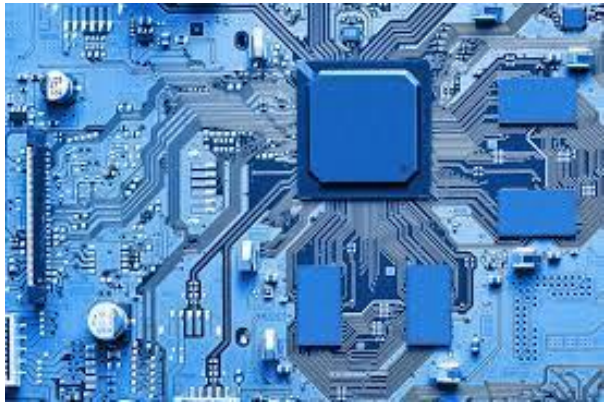
Percent of Gross Value Production, 2019

What are Alaska's minerals used for?



Zinc: galvanized steel

Gold: investment & jewelry



Silver:
Investment, electronics, jewelry

Lead: Car batteries

What could the future bring?

- Mines
- Employment,
- Critical Minerals

Mining Is A Multi-Stage Process

- (1) Identify a geologic anomaly
- (2) Exploration
- (3) Advanced Exploration
- (4) Economic evaluation
- (5) Permitting
- (6) Construction & Operation

Mining Is A Multi-Stage Process

- (1) identify a geologic anomaly
  - With powerful testing, entire periodic table likely detectable in a sample from the parking lot.
  - Less common: geologic processes concentrate enough material into a single location and a form which is technologically and economic feasible to exploit
  - Cast wide net looking for something “weird”
  - Radiation, magnetic, visual observation (USGS/DGGS)

Mining Is A Multi-Stage Process

- (2) Initial Exploration
  - As cheaply as possible: How big? What quality?
  - Only if results are positive, companies raise more money to expand drilling and the cycle repeat
  - Mining is a lottery business
- (3) Advanced Exploration
  - Eventually information warrants larger investments
  - Goal: geologic model allows companies to say:
    - “we’re pretty sure X amount is below the surface, and we might have more”

Mining Is A Multi-Stage Process

- (4) Economic evaluation
  - Economic and engineering evaluation
  - The ultimate result is a net present value (NPV) for the property
    - Compare profitability with other opportunities investors have
- Favorable Preliminary Economic Assessment (PEA) -> Pre-feasibility study -> feasibility study

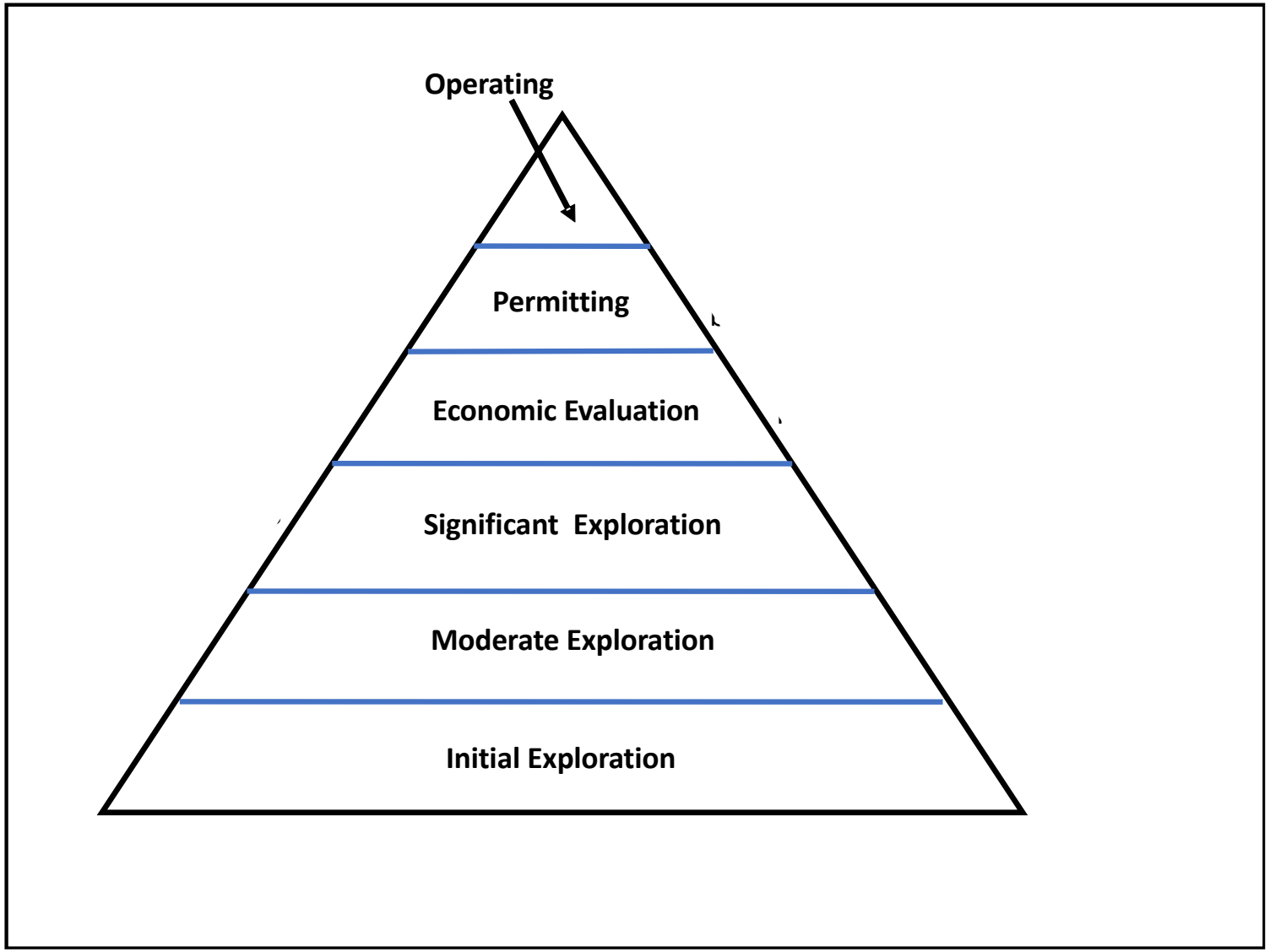
Mining Is A Multi-Stage Process

- (5) Permitting
  - Mines must secure several permits in order to operate
  - Mine and associated access & energy infrastructure
  - Who has the property rights?
  - Time is money
  - Time depends on company motivation, project complexity, impact, and stakeholder sentiment

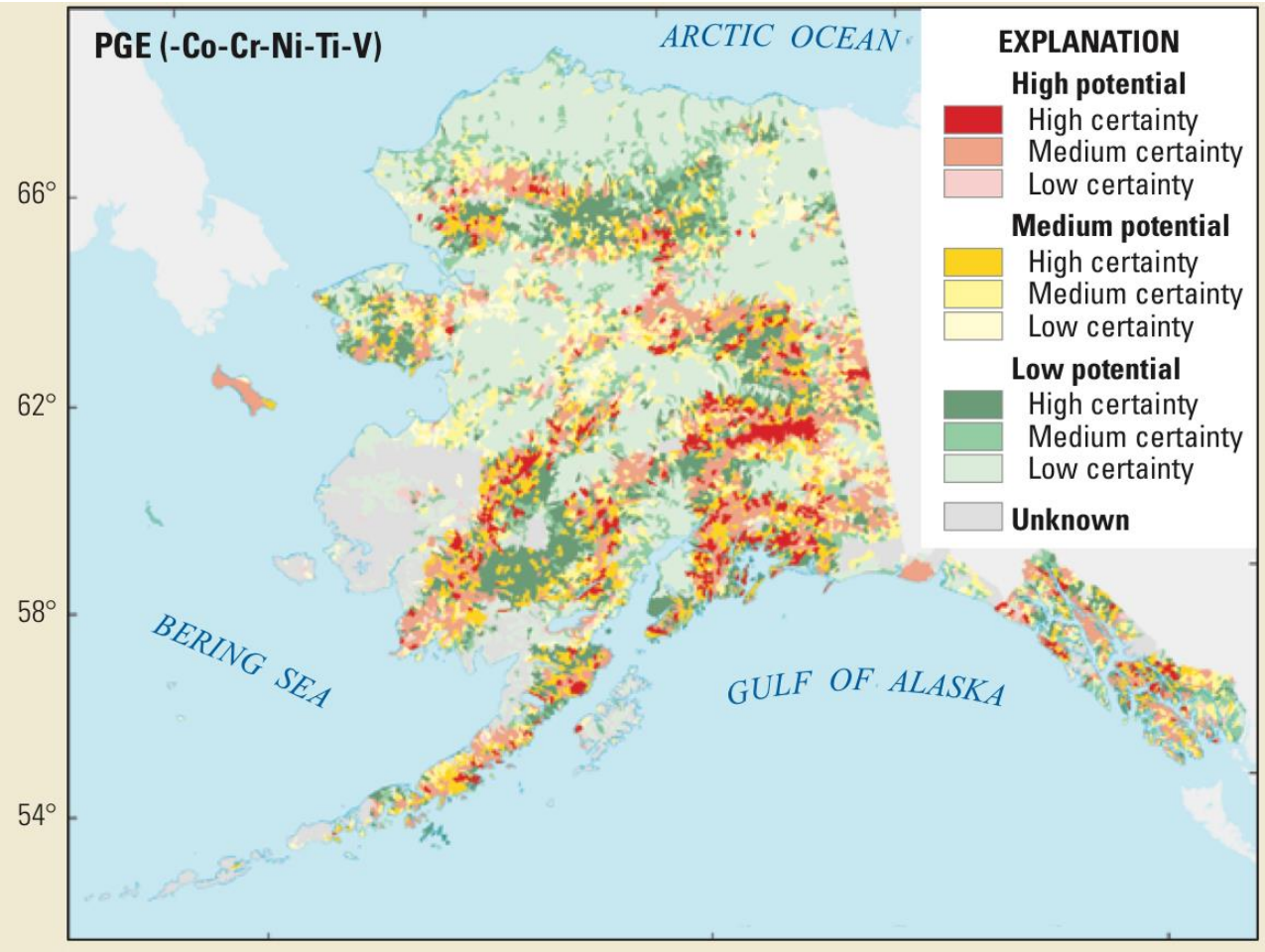
Mining Is A Multi-Stage Process

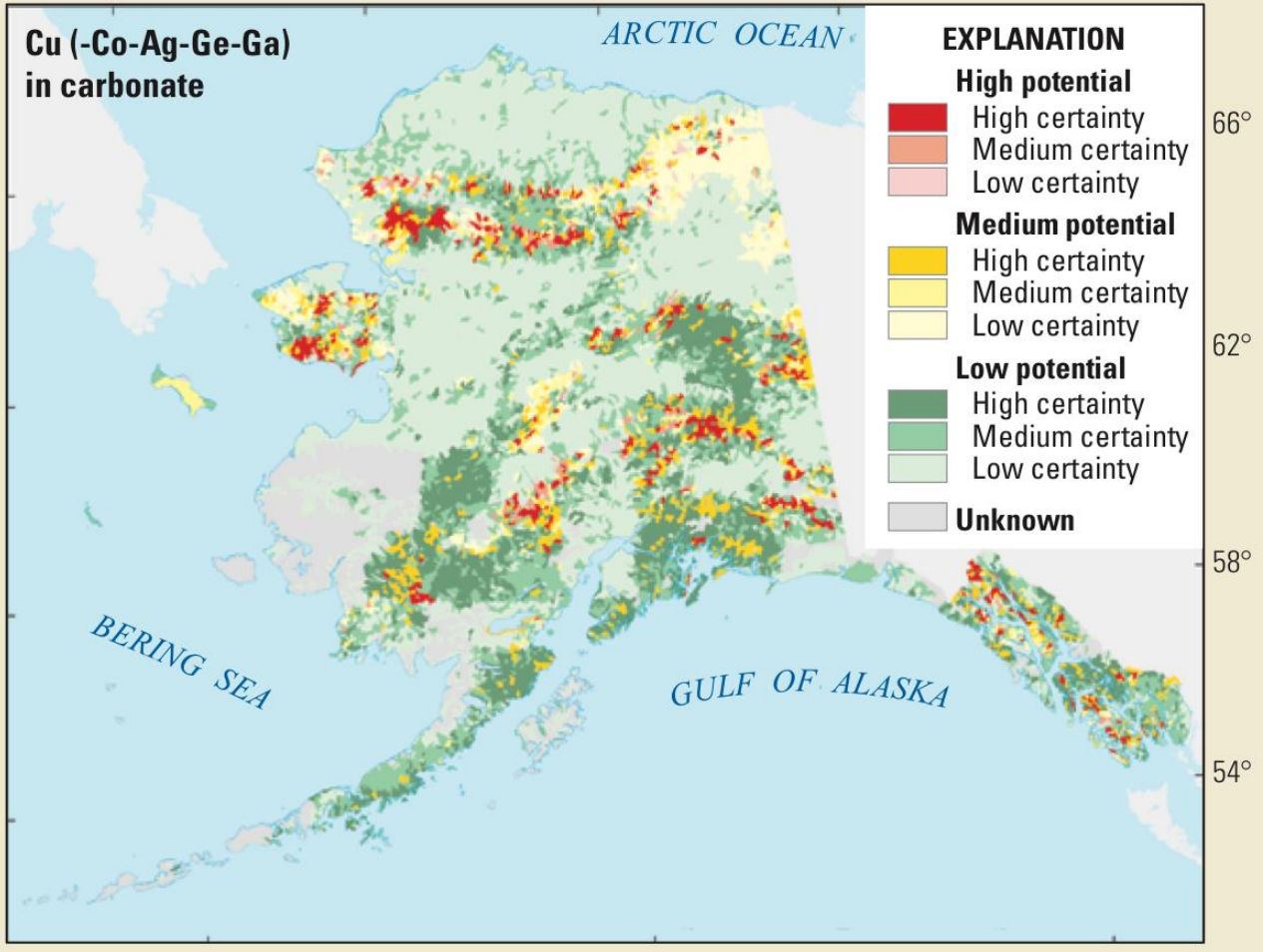
- (6) Operations
  - Once constructed, mines a typically mine will aim to operate for 20 years
  - Operating might extend if additional resources are found on adjacent properties

Method


Operating
Permitting
Economic Evaluation
Significant Exploration
Moderate Exploration
Initial Exploration

Lots of *potential* in AK, but what might become a mine in 20 years?

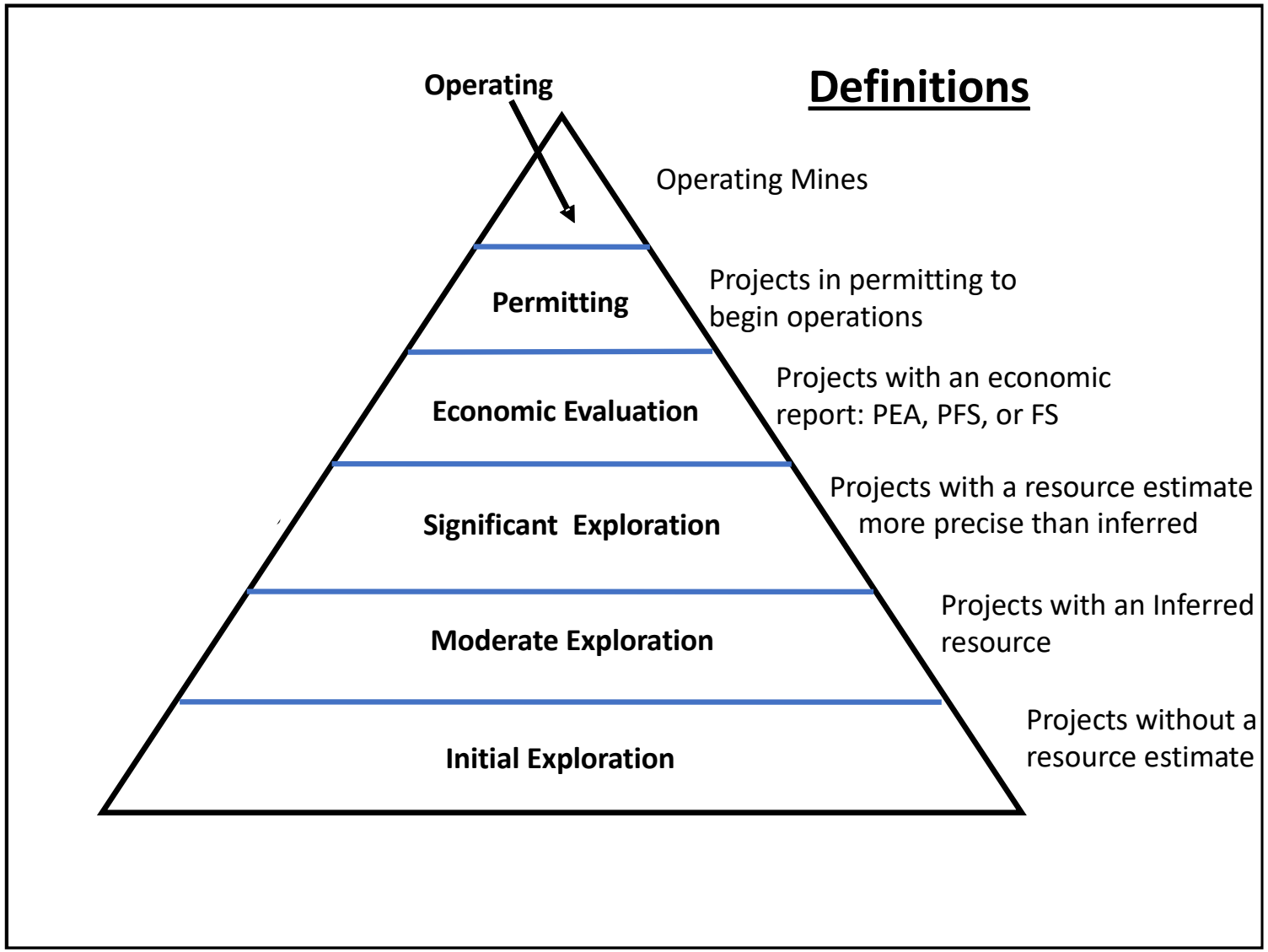




https://pubs.usgs.gov/fs/2017/3012/fs20173012.pdf

Method

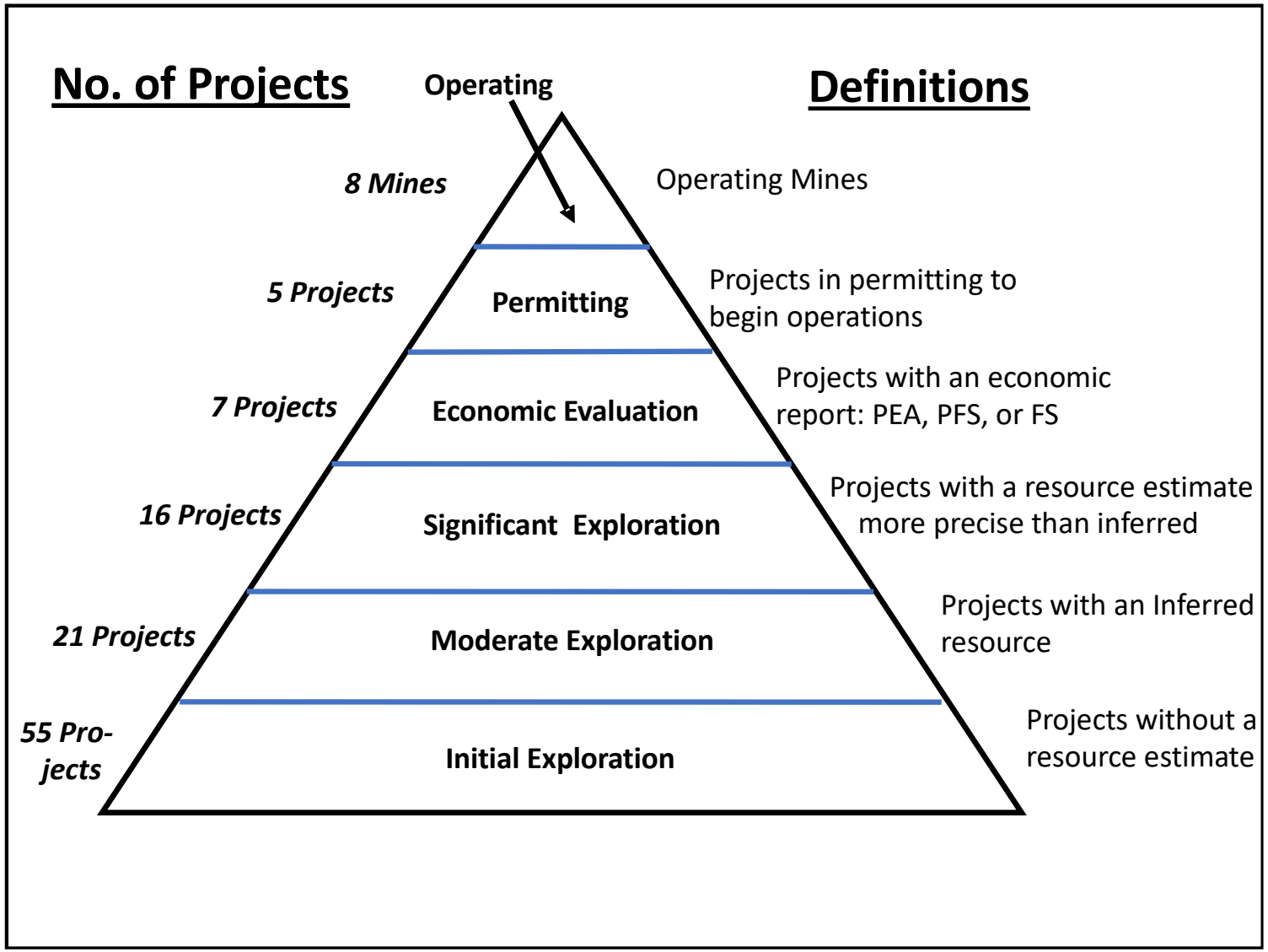
Likelihood of Becoming a Mine in 20 years



Number of Properties

Method

Likelihood of Becoming a Mine in 20 years



Number of Properties

Possible Futures

- Look forward 20 years
- Consider scenarios (not forecasts) of possible futures
- From the perspective of the mining industry, 3 scenarios:
  - Favorable: What if market, policy, and geologic conditions are favorable?
  - Status Quo: What if conditions mostly stay the same?
  - Unfavorable: What if conditions degrade?

Probabilities by pyramid tier & scenario

From literature:

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

This study: expert judgement, but:

- probabilities decrease moving down the pyramid
- large uncertainty, consider these ‘order of magnitude’ estimates
- Favorable > status quo > unfavorable
- We assigned probabilities for hard rock, coal, and placer/suction dredge projects separately

3 Scenarios for the Development Pyramid

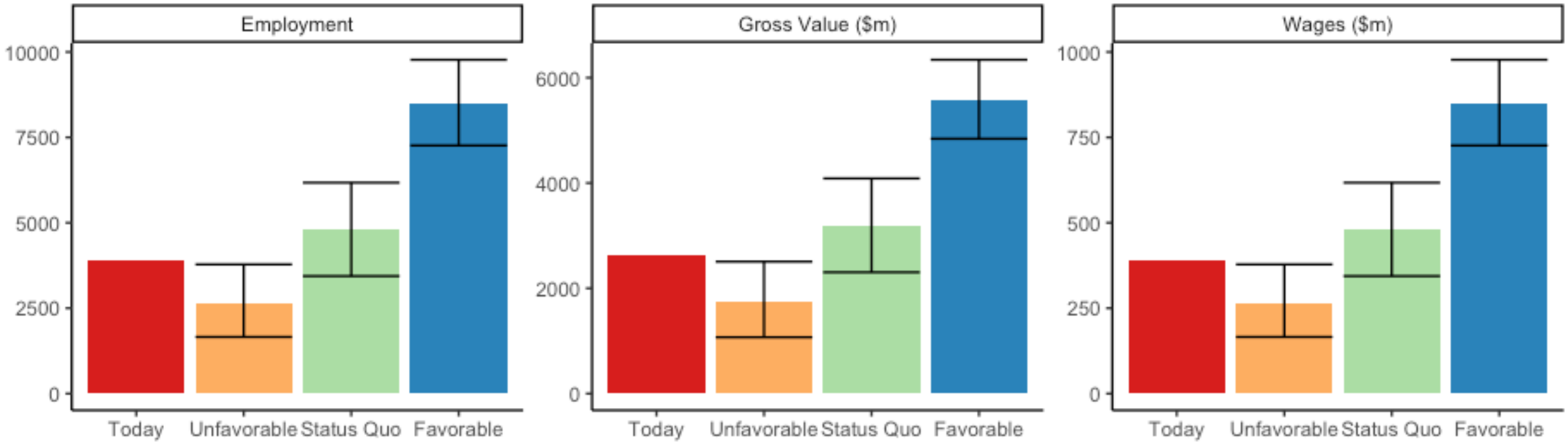
- Unfavorable
- Status quo
- Favorable
- Factors:
  - Outside of anyone's control: Geology/metalurgy
  - Markets: financing, metal prices/demand
  - Public opinion
  - State and Federal Policy: regulations, environmental, tax, and land use policy; infrastructure

3 Scenarios for the Development Pyramid

- 2020 Fraser Institute identifies main challenges for AK mining investment
- AK ranked 13th out of 77 jurisdictions in the Policy Perception Index

  lower than ID, WY, NV, UT, AZ, NM
- Of 15 factors, >25% of survey respondents cite five as mild or strong deterrent
  - 29%: Uncertainty Concerning the Administration, Interpretation and Enforcement of Existing Regulations
  - 35%: Uncertainty Concerning Environmental Regulations
  - 40%: Regulatory Duplication and Inconsistencies
  - 45%: Uncertainty Concerning Protected Areas
  - 59%: Quality of Infrastructure

Results


Employment
10000
7500
5000
2500
0
Today
Unfavorable
Status Quo
Favorable
Gross Value ($m)
6000
4000
2000
0
Today
Unfavorable
Status Quo
Favorable
Wages ($m)
1000
750
500
250
0
Today
Unfavorable
Status Quo
Favorable

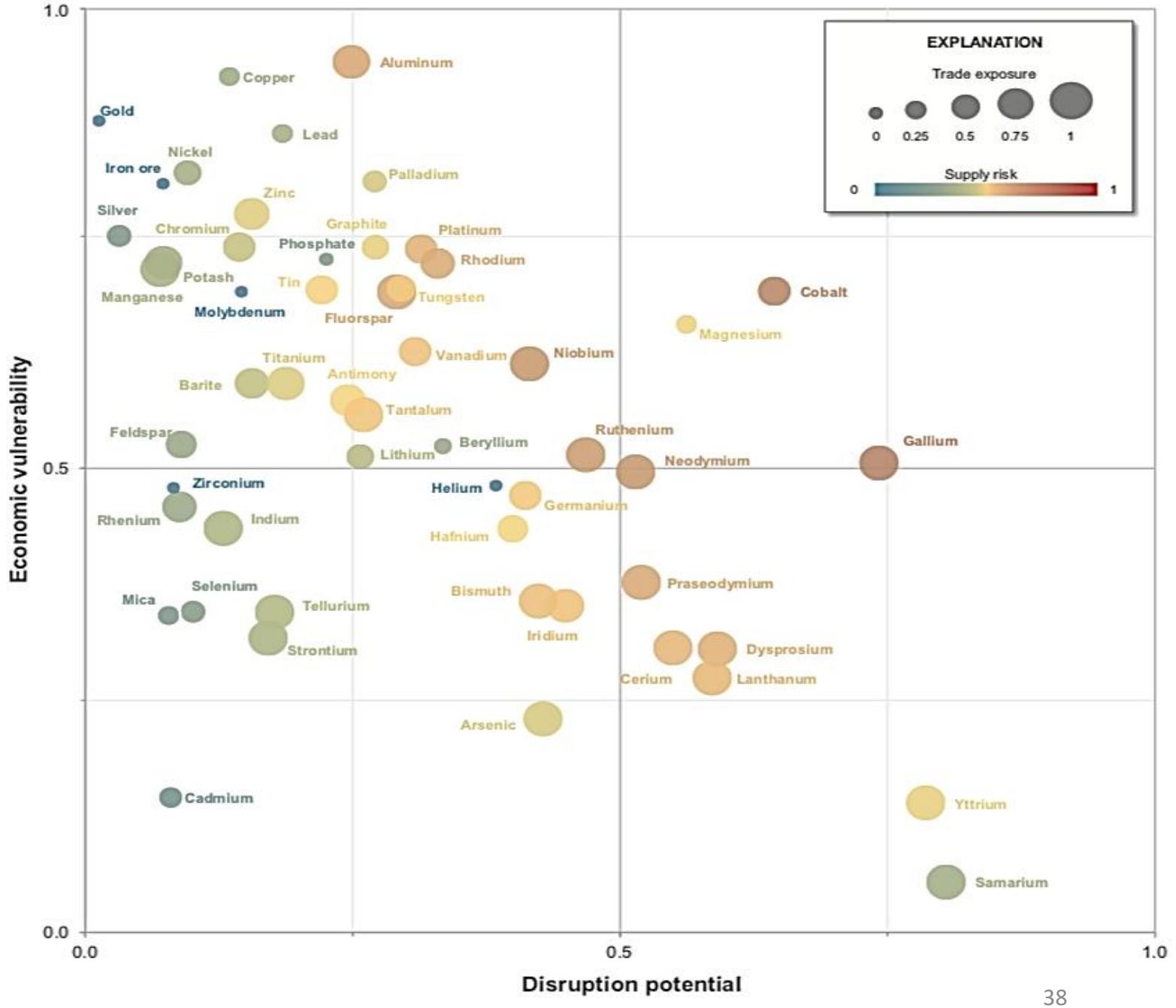
Mining Industry Employment in 20 years, by Scenario

	Today	Unfavorable		Status Quo		Favorable	
		Emp.	(Range)	Emp.	(Range)	Emp.	(Range)
Hard Rock & Coal	**2,776**	**1,833**	(1,141-2,630)	**3,319**	(2,372-4,267)	**5,823**	(5017-6,623)
Exploration	**941**	**733**	(456-1,052)	**1,328**	(949-1,7707)	**2,329**	(2,007-2,649)
Placer Mines	**159**	**80**	(60-100)	**160**	(120-200)	**320**	(240-500)
Total	**3,876**	**2,646**	(1,657-3,782)	**4,807**	(3,440-6,174)	**8,472**	(7,263-9,772)

Critical Mineral Supply

- Critical minerals are defined as being critical for some application but with problematic supply
  - Important & hard to get
- Important: Energy transition:
  - Strong growth in mineral demand for materials
  - Some have historically been only used in small quantities
- Hard to get: supply chain issues
  - competition: Russia, China,
  - geopolitical instability: Africa
  - by-product supply issues

USGS: Economic Importance and Disruption Potential



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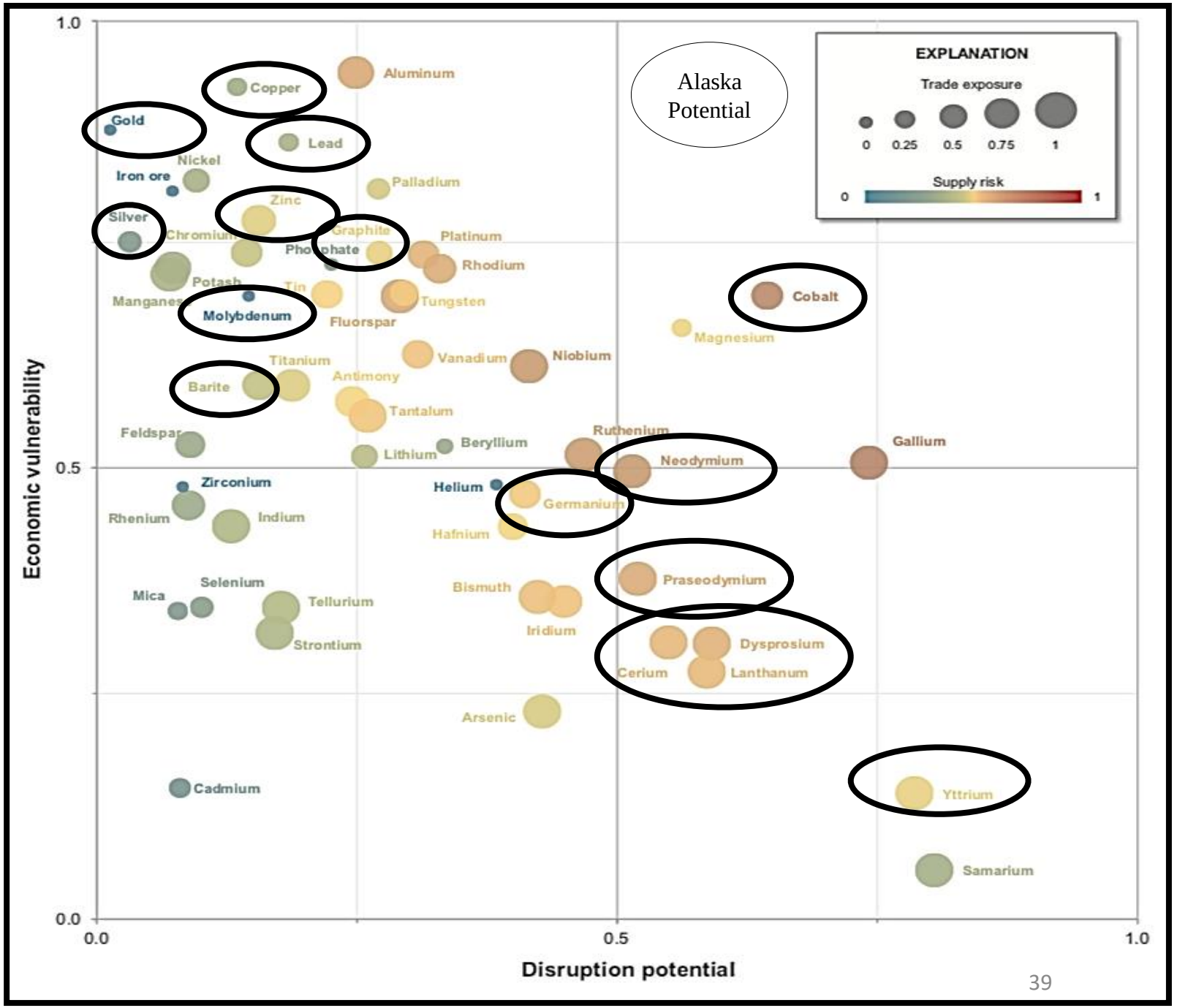


What could Alaska produce?

Copper: electronics/wiring

Germanium: electronics, solar cells, optics

Molybdenum: steel alloy

Rare Earths: permanent magnets (EV motors)

Graphite: EV Batteries

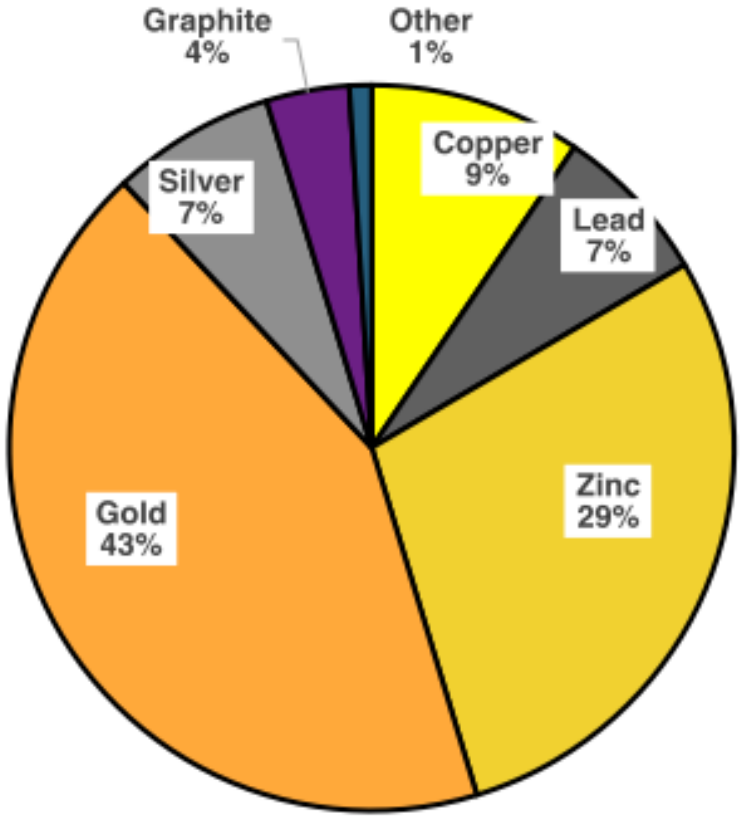
Cobalt: EV Batteries

Results: Energy & Critical Minerals

	Today			'Favorable' Scenario			
	Production		% of 2019 US	Production		% 2019 US	% 2019 World
Cu				114	ktons	9%	1%
Pb	121	ktons	44%	215	ktons	79%	5%
Zn	603	ktons	80%	710	ktons	94%	6%
Au	17	tons	9%	80	tons	40%	2%
Ag	501	tons	51%	1,008	tons	103%	4%
Mo				138	tons	0%	0%
Co				518	tons	104%	0%
Barite				237	ktons	57%	3%
TREO				2,227	tons	8%	1%
Graphite				249	ktons	100%	23%

Results: Alaska Mining Industry in 20 years

- Size could double or decrease by 1/3
- In the favorable scenario:
  - Export base: grow to $5.6B or almost 1/3 of Alaska's 2019 exports
  - Export multiple new minerals
  - Alaska's primary products remain zinc and gold



Percent of Gross Value Production in 20 years
Favorable Scenario

Take-aways

- Impacts
  - Potential to double industry size (or decrease by 1/3) in next two decades
  - Mining won't replace oil on its own
- Supply domestic sources of critical & clean energy materials
- Need for infrastructure (physical and state-capacity)
  - Referees: clear, high standards; consistent, timely
  - roads

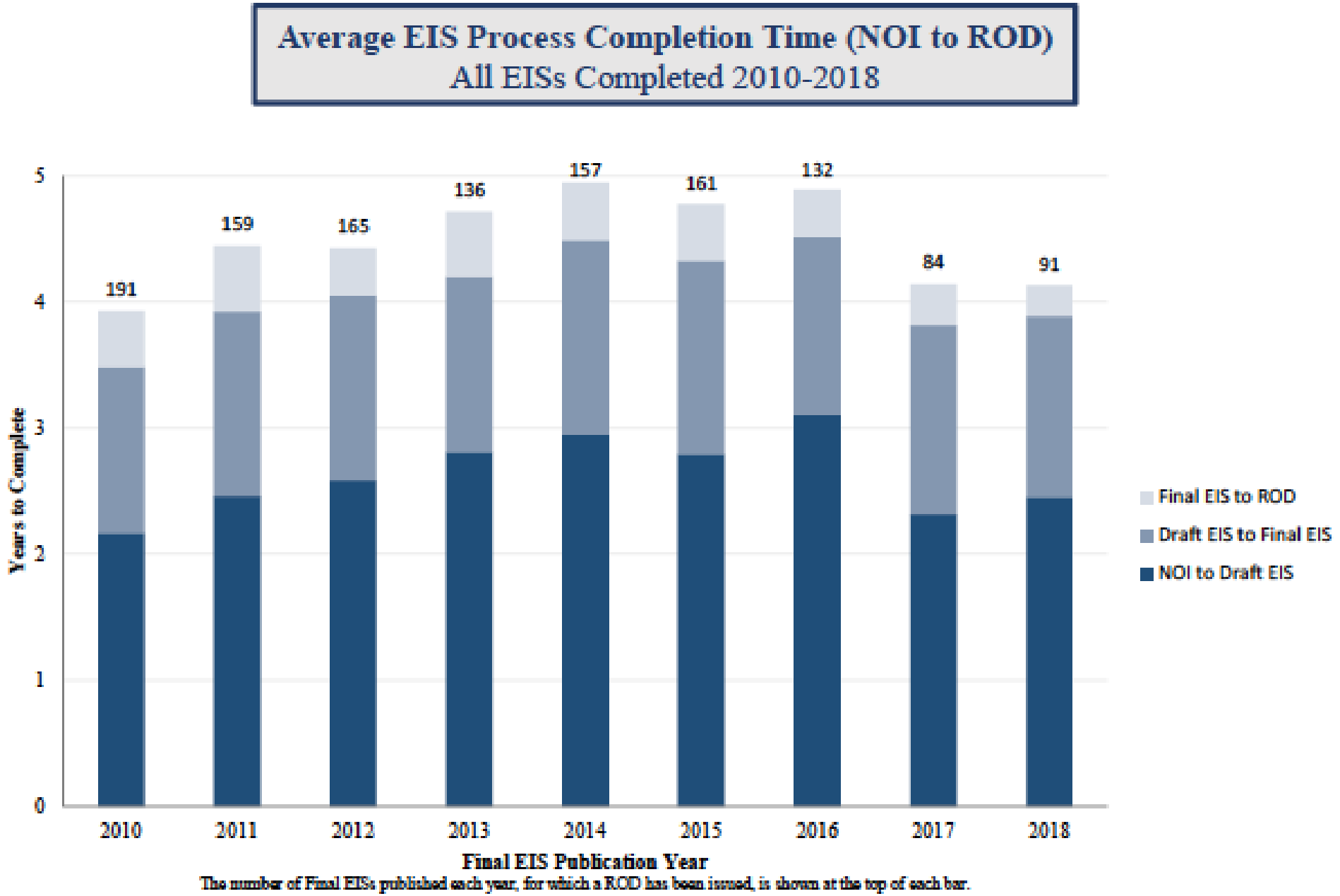
Potential policy levers: *Infrastructure*

- Infrastructure
  - Ambler Road?
  - West Susitna Access?

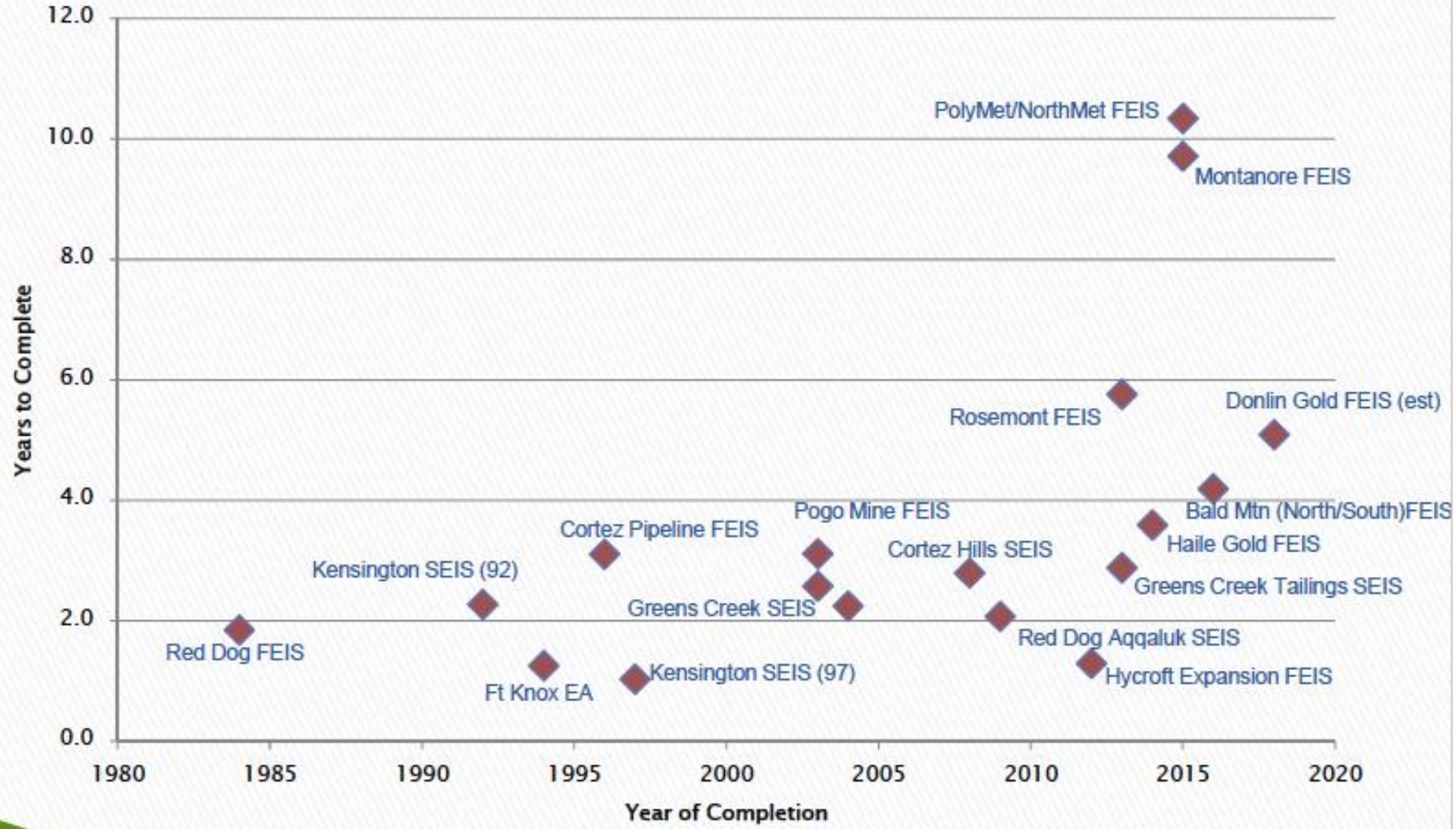

Barrow (Utqiaġvik)
Prudhoe Bay
KOBUK VALLEY NATIONAL PARK
GATES OF THE ARCTIC NATIONAL PARK
Coldfoot
Proposed Ambler Road
Nome
ARCTIC CIRCLE
ALASKA
CANADA
Fairbanks
Chena Hot Springs
Delta Junction
Dawson City
Kantishna
Denali Nat. Park Entrance
DENALI NATIONAL PARK
Proposed West Susitna Access Road
Tok
Talkeetna
Glennallen
WRANGELL - ST. ELIAS NATIONAL PARK
Palmer/Wasilla
Chitina
McCarthy
Anchorage
Valdez
Girdwood
Whittier
LAKE CLARK NATIONAL PARK
Soldotna
Seward
KENAI FJORDS NATIONAL PARK
Homer
Haines Junction
Whitehorse
King Salmon
KATMAI NATIONAL PARK
Skagway
Haines
GLACIER BAY NATIONAL PARK
Juneau
Kodiak

Potential policy levers: ***Permitting***

- In Alaska it takes ~20 years from discovery to production
- Other developed jurisdictions, about half as long
- Alaska's record was Pogo: 15 years
  - That was before the advent of exceptionally long EIS, and guaranteed litigation


Average EIS Process Completion Time (NOI to ROD)
All EISs Completed 2010-2018
Years to Complete
0
1
2
3
4
5
191
159
165
136
157
161
132
84
91
2010
2011
2012
2013
2014
2015
2016
2017
2018
Final EIS Publication Year
Final EIS to ROD
Draft EIS to Final EIS
NOI to Draft EIS
The number of Final EISs published each year, for which a ROD has been issued, is shown at the top of each bar.

"Marathon" NEPA Reviews



DOWL
INSPIRATION | INNOVATION | INTEGRITY

Potential policy levers: ***Permitting***

- Maintaining an efficient permitting regime that protects the environment (not relaxing current standards)
  - State budgets for resource agencies
  - Fixing federal EIS delays (???)

Potential policy levers

- Infrastructure (access and energy)
- Maintaining an efficient permitting regime that protects the environment (not relaxing current standards)
- Workforce training

Thank you

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