

Opportunities in Global Mineral Resources

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Nevada Bureau of Mines and Geology

JONATHAN G. PRICE, LLC

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Opportunities in Global Mineral Resources

Demand is high.

**Resources are global, but
China is #1.**

**The trends will help
guide exploration and
development.**



Round Mountain, NV (2007)

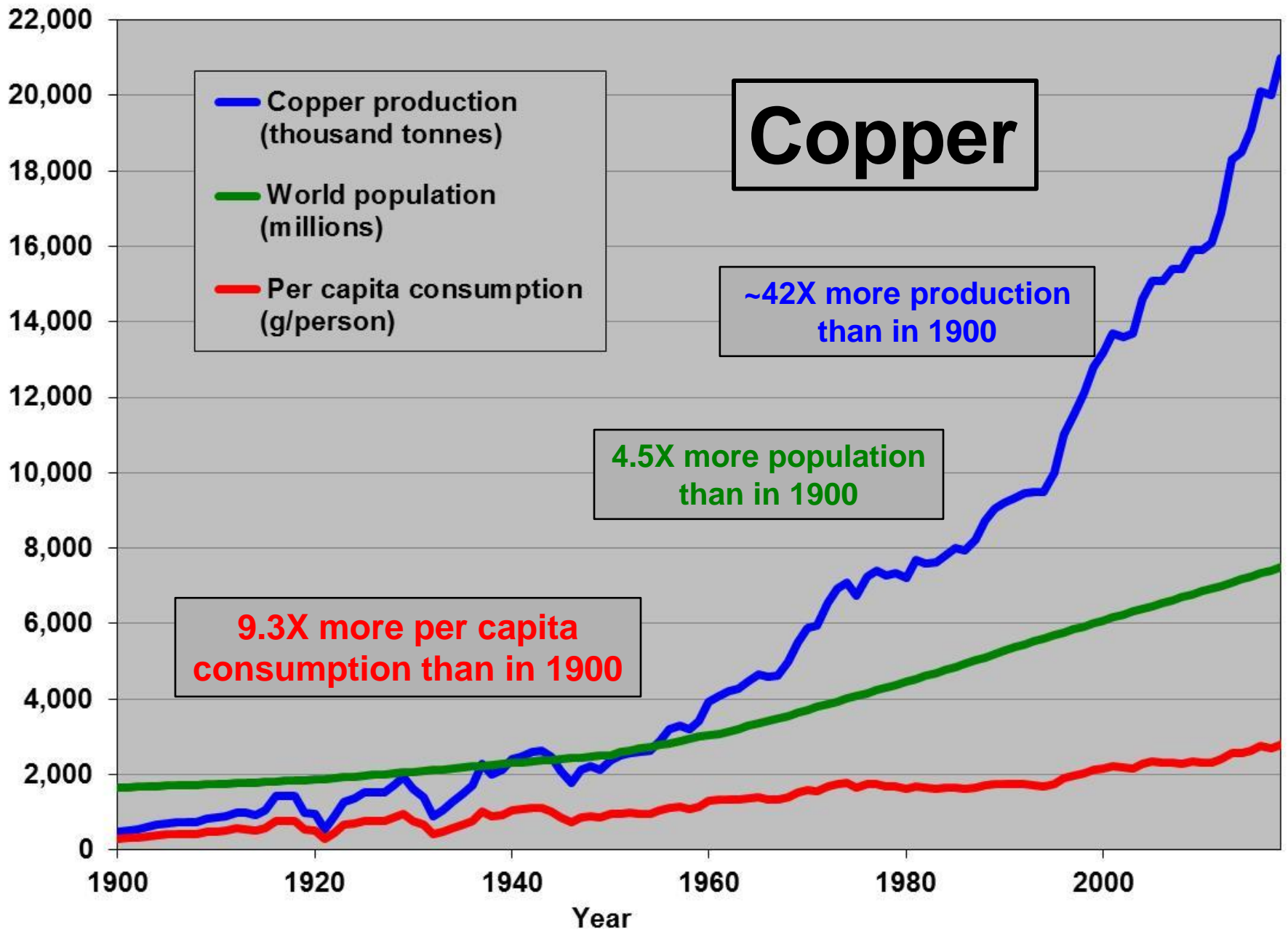
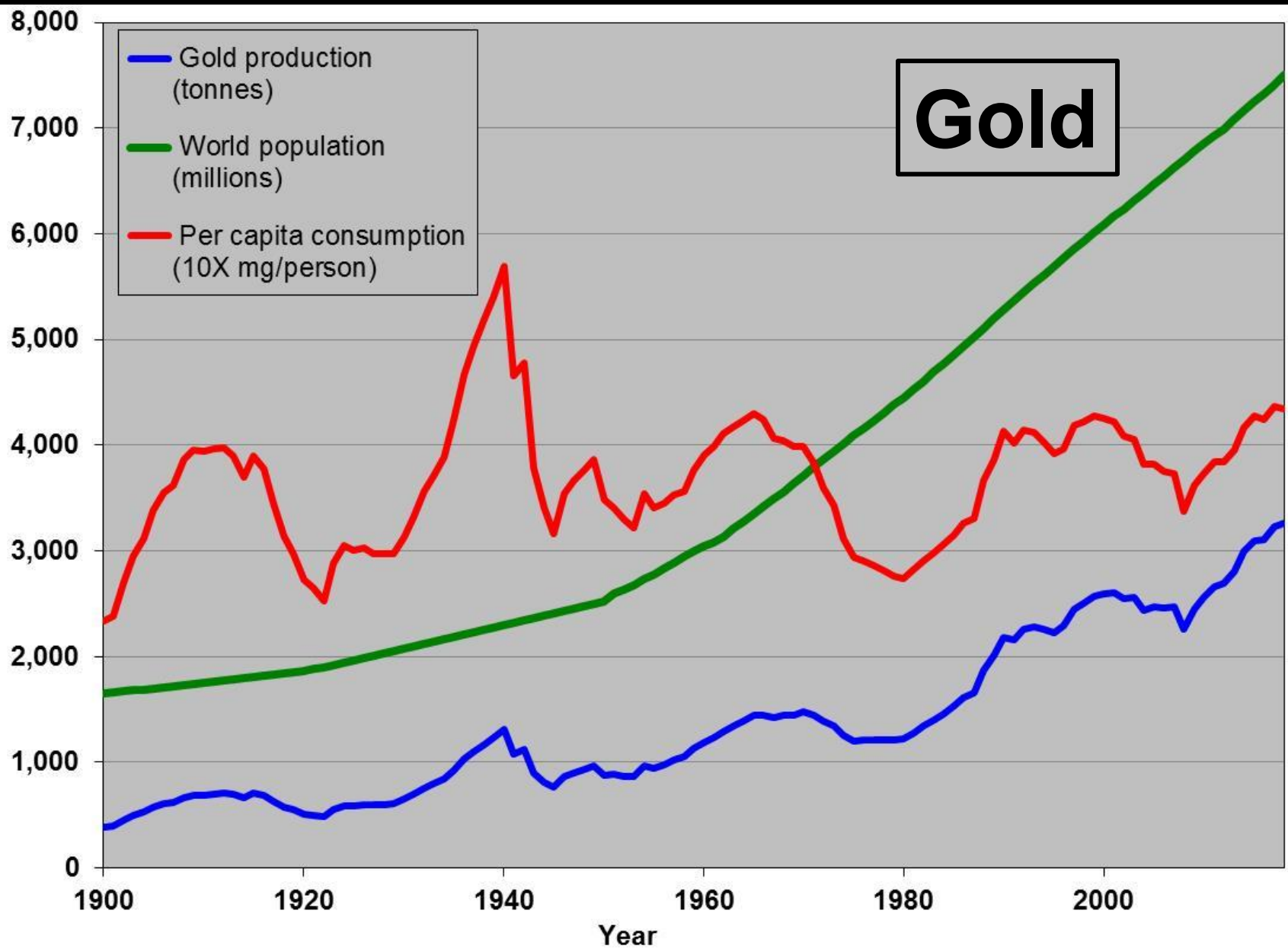




Photo copyrighted by Michael Collier, from the AGI website, Rio Tinto/Kennecott Utah Copper mine; the remaining resource as of 16 May 2008 = 3.06 million metric tons of Cu

Global copper production in 2018 (21 million metric tons) exceeded over 100 years of production from the Bingham Canyon mine (~17 million metric tons).



Demand is high for nearly every mineral resource.

Barrick's Betze pit, 2000

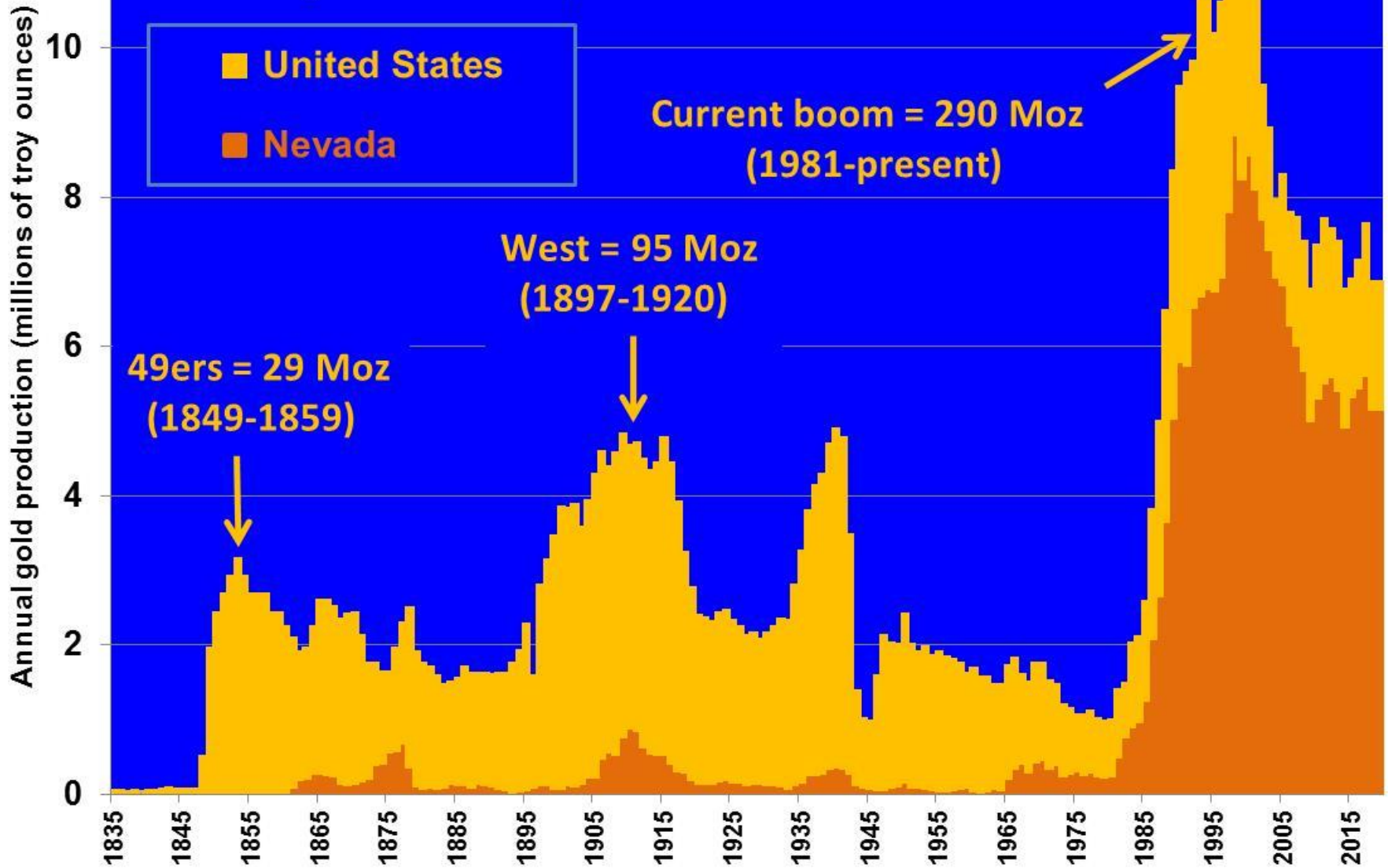


Newmont's Carlin East pit and portal, 2000

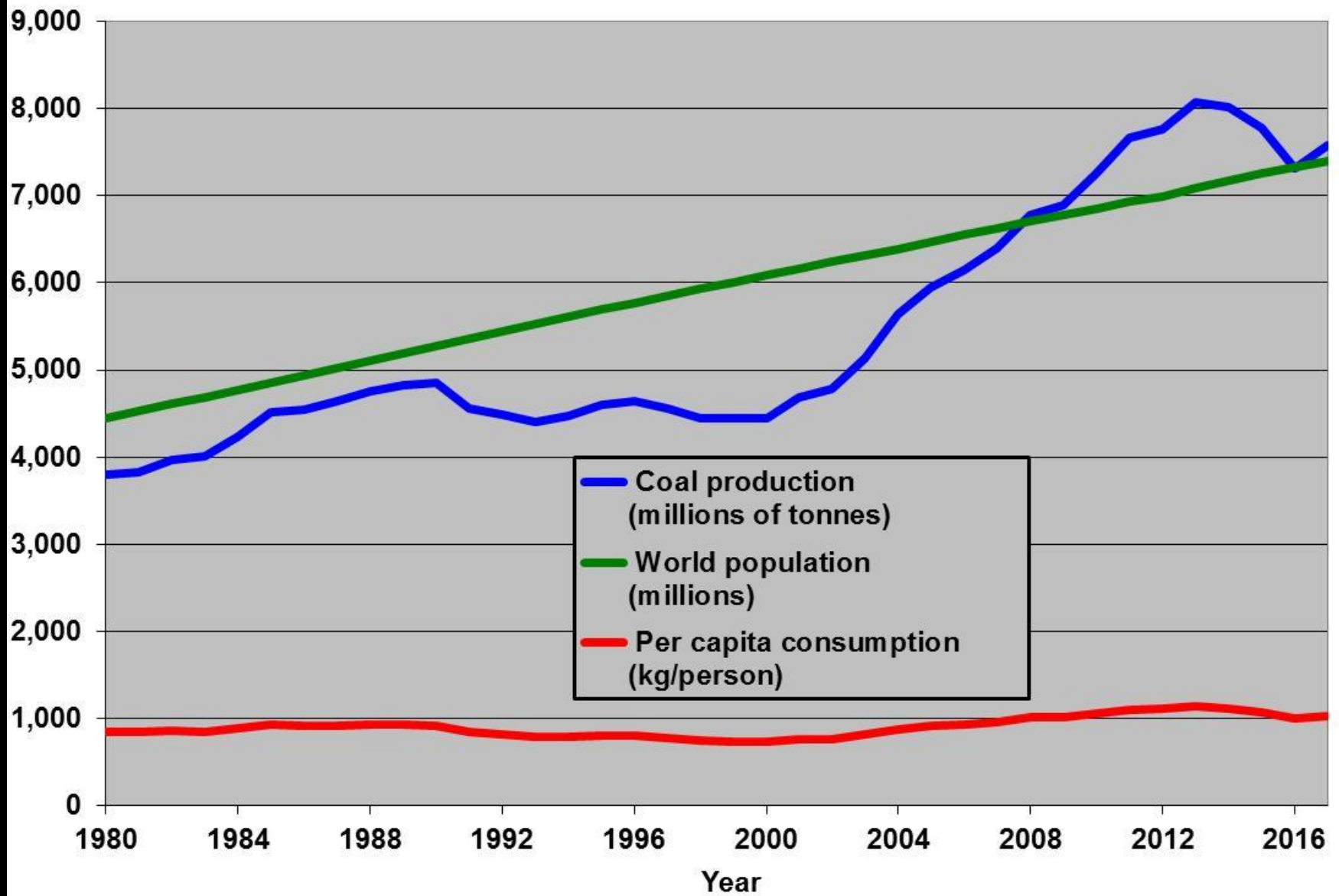


Global gold production in 2018 (3,260 metric tons) exceeded the cumulative production from the Carlin trend in Nevada (~3,000 tons), one of world's top regions.

Gold production, 1835-2018



We are in the midst of the biggest gold-mining boom in history.



**Coal has recently become an exception.
Global demand has fluctuated; per capita consumption is steady.**



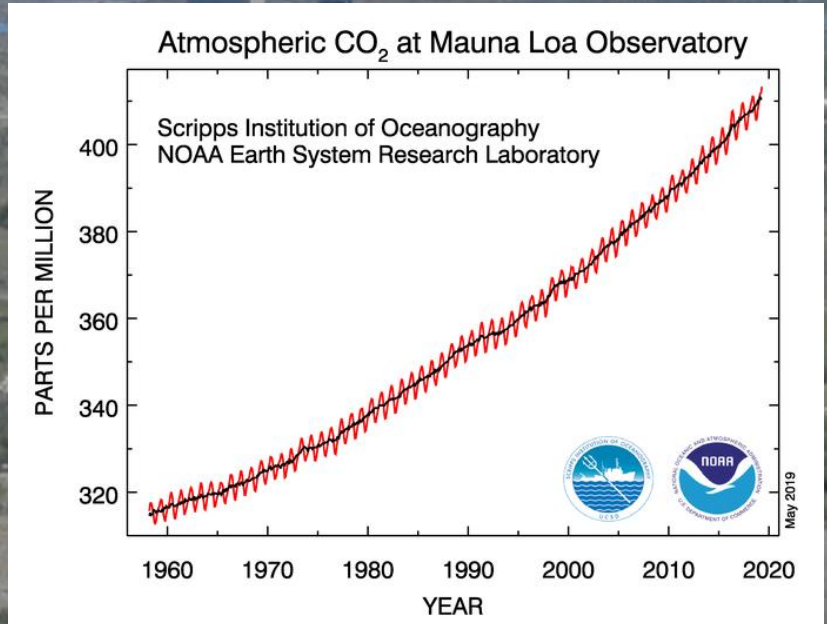
Coal seams near Healy, Alaska

Annual global coal production (~7.6 billion metric tons in 2017) equals approximately 5.2 km³ of coal, or ~1,840 km² of land with an average coal thickness of 3 m.

The amount of CO₂ released from burning of coal in 2017 would have been enough, without natural reduction from plant growth, rain, and other processes, to raise the concentration of CO₂ in the atmosphere by ~2.8 ppmv, a bit more than the recent global trend of CO₂ increasing ~2.2 ppmv per year.

Valmy coal-fired power plant, Humboldt County, Nevada

$$\begin{aligned}
 & (7.585 \times 10^{15} \text{ g coal burned in 2017}) \times (\sim 0.8 \text{ g C/g coal}) \times \\
 & (3.6642 \text{ g CO}_2 / \text{g C}) / (5.15 \times 10^{21} \text{ g air in the atmosphere}) \\
 & \times (28.97 \text{ g air}) / (\text{mole air}) \times (1 \text{ mole CO}_2) / (44.0095 \text{ g CO}_2) \\
 & \times 10^6 \text{ ppmv CO}_2 / (\text{mole CO}_2 / \text{mole air}) \\
 & = \sim 2.8 \text{ ppmv CO}_2 \text{ potentially added to the atmosphere}
 \end{aligned}$$



1 H																2 He						
3 Li	4 Be																5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg																13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr					
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 <i>Tc</i>	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe					
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 <i>Po</i>	85 <i>At</i>	86 <i>Rn</i>					
87 <i>Fr</i>	88 <i>Ra</i>	89 <i>Ac</i>	1932																			

Energy Health Buildings
 Transportation Information Money

58 Ce	59 Pr	60 Nd	61 <i>Pm</i>	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 <i>Th</i>	91 <i>Pa</i>	92 <i>U</i>											

Primary data source: U.S. Bureau of Mines

The number of mineral commodities in demand for products in society has increased markedly in the last 100 years.

1 H											2 He						
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 <i>Tc</i>	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 <i>Po</i>	85 <i>At</i>	86 <i>Rn</i>
87 <i>Fr</i>	88 <i>Ra</i>	89 Ac	TODAY														

58 Ce	59 Pr	60 Nd	61 <i>Pm</i>	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 <i>Th</i>	91 <i>Pa</i>	92 <i>U</i>											

Primary data source: U.S. Geological Survey

The number of mineral commodities in demand for products in society has increased markedly in the last 100 years.

Opportunities in Global Mineral Resources

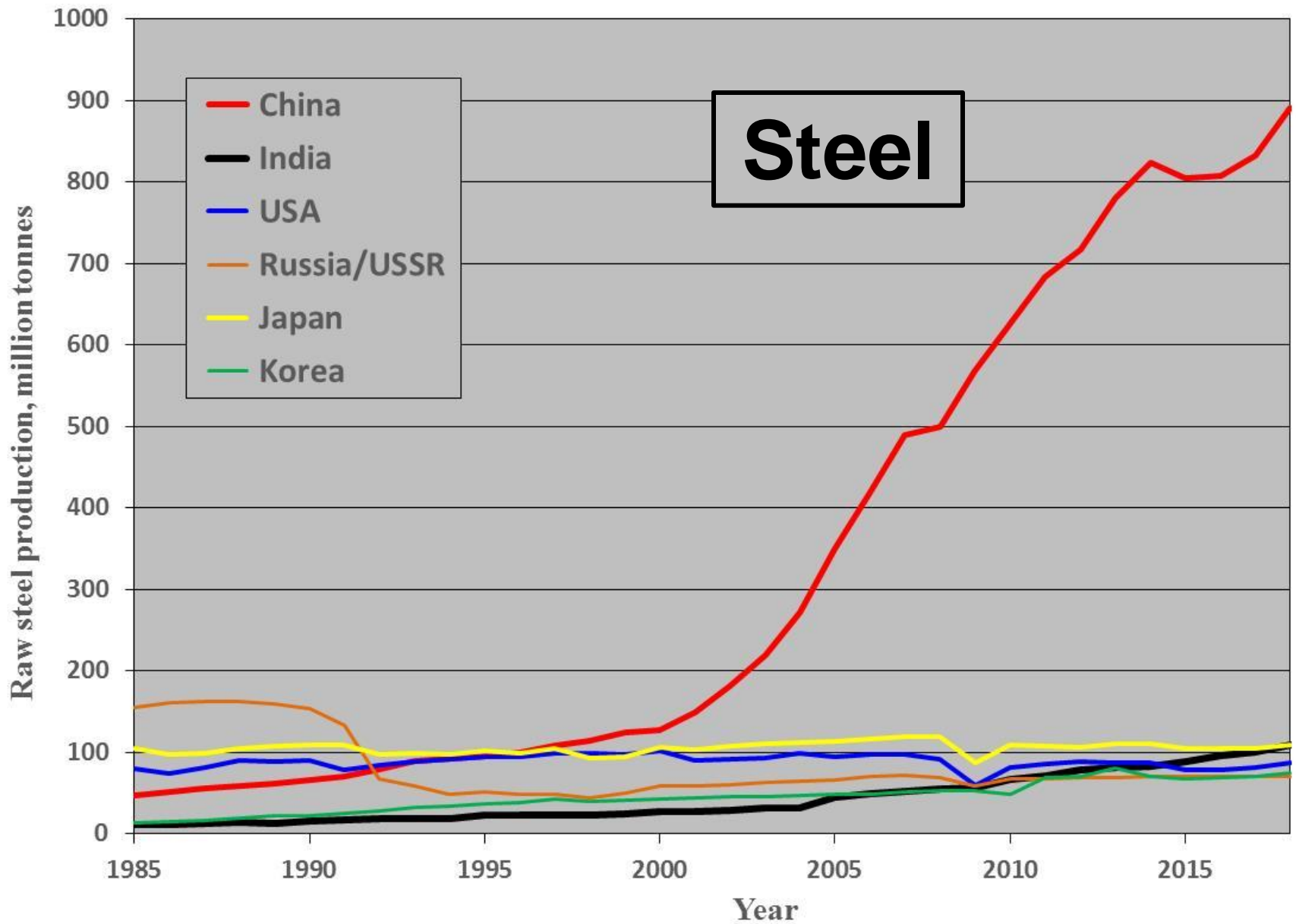
Demand is high.

**Resources are global, but
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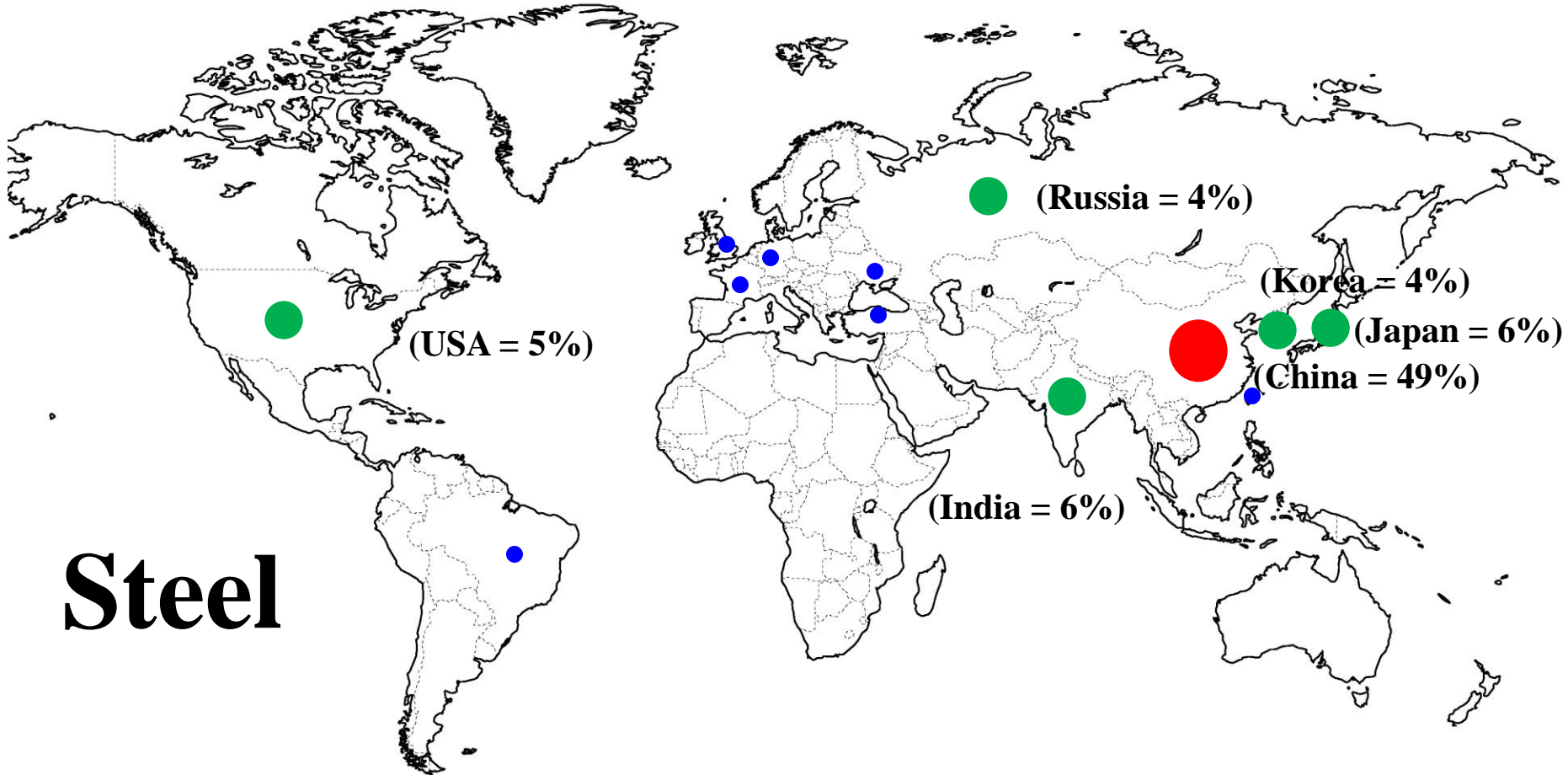


Round Mountain, NV (2007)



From 1997 to 2018, China's production increased by 8.2X; India's increased by 4.6X.

Steel



World's leading producer



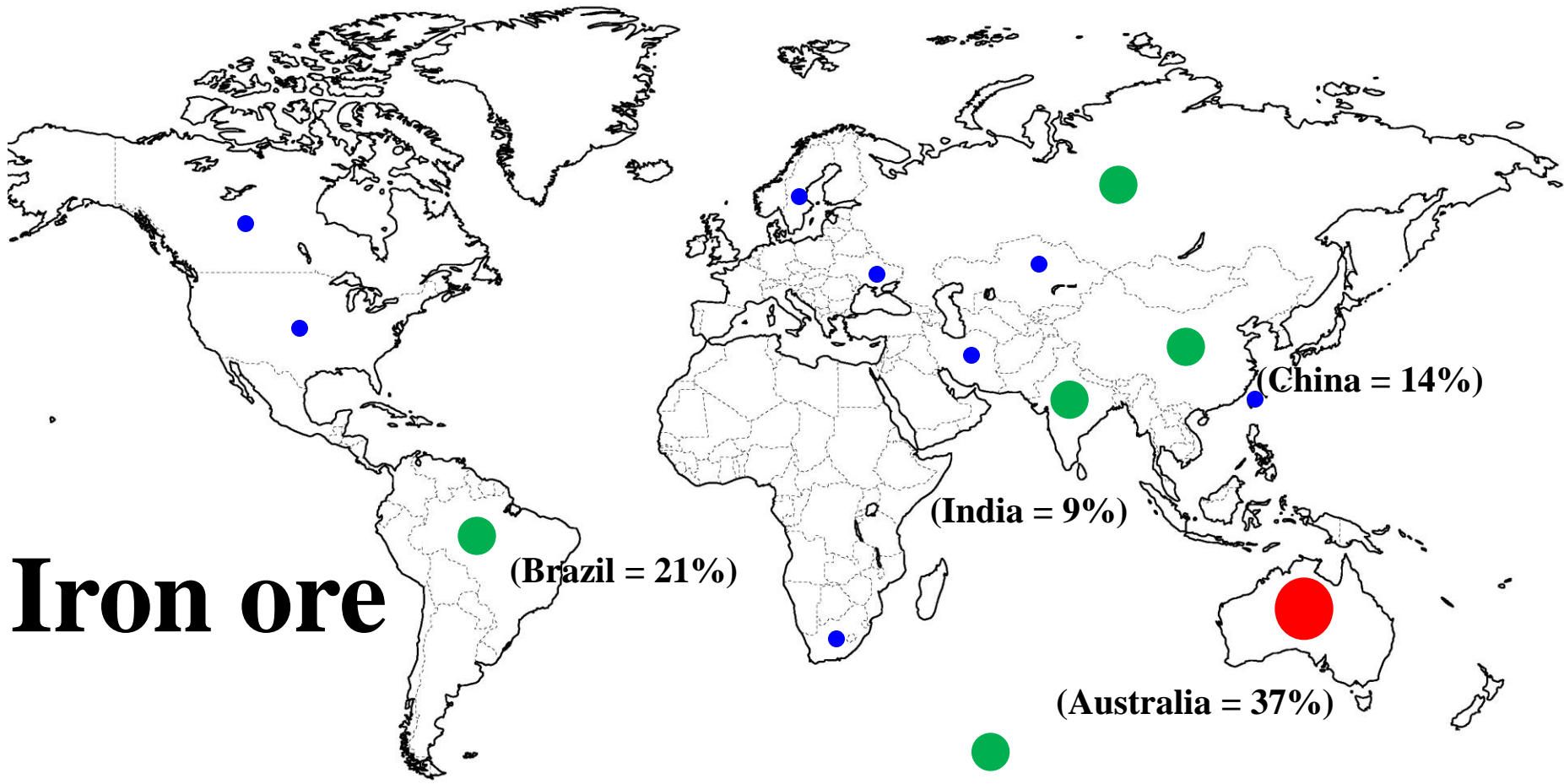
Countries with 4% or more of global production



Other countries with production or major reserves

Data source: USGS

Resources are global, but China is Number One.



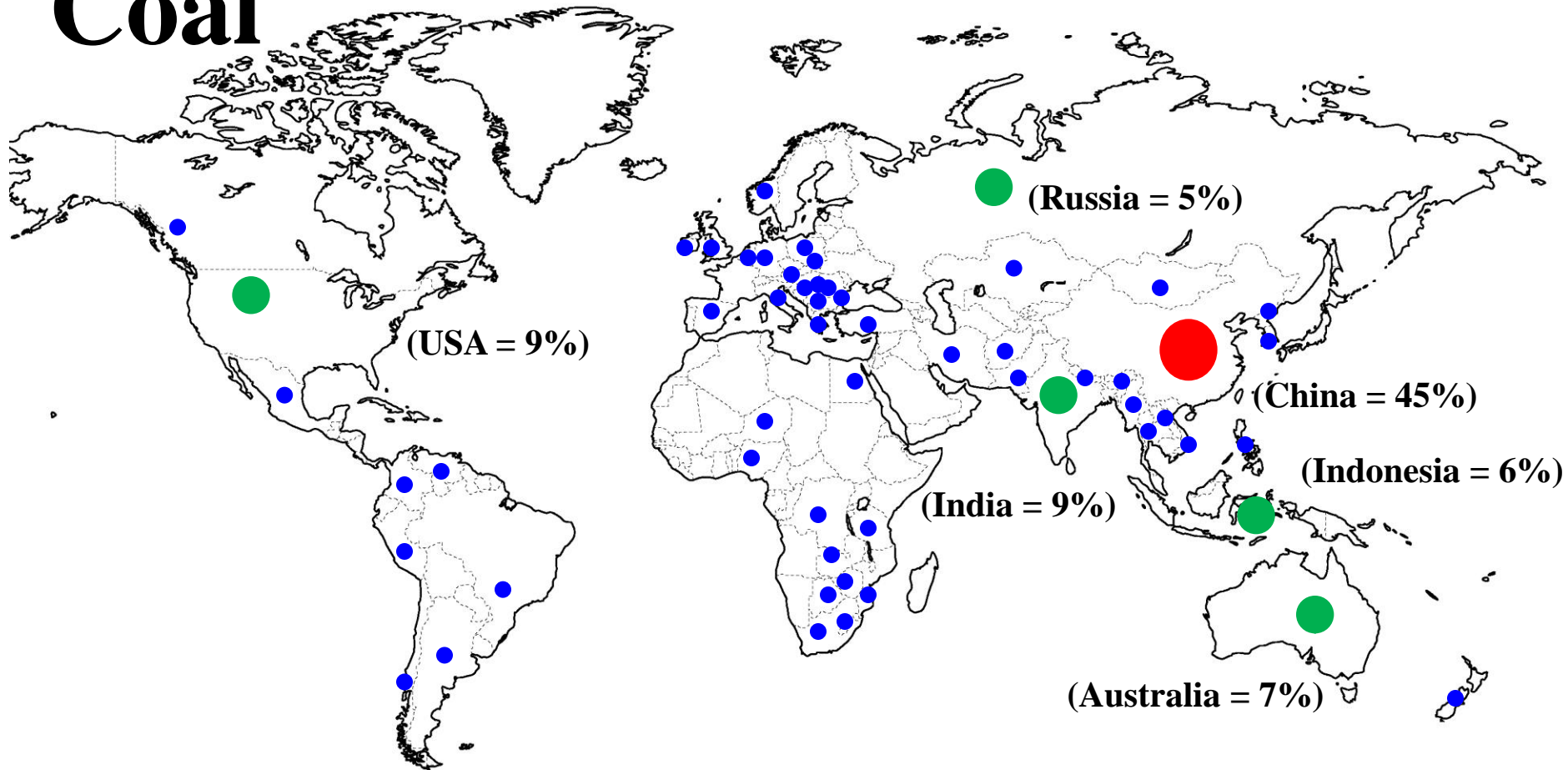
Iron ore

● World's leading producer
 ● Countries with 4% or more of global production
 ● Other countries with production or major reserves

Data source: USGS

China imports iron from Australia & Brazil.

Coal



World's leading producer



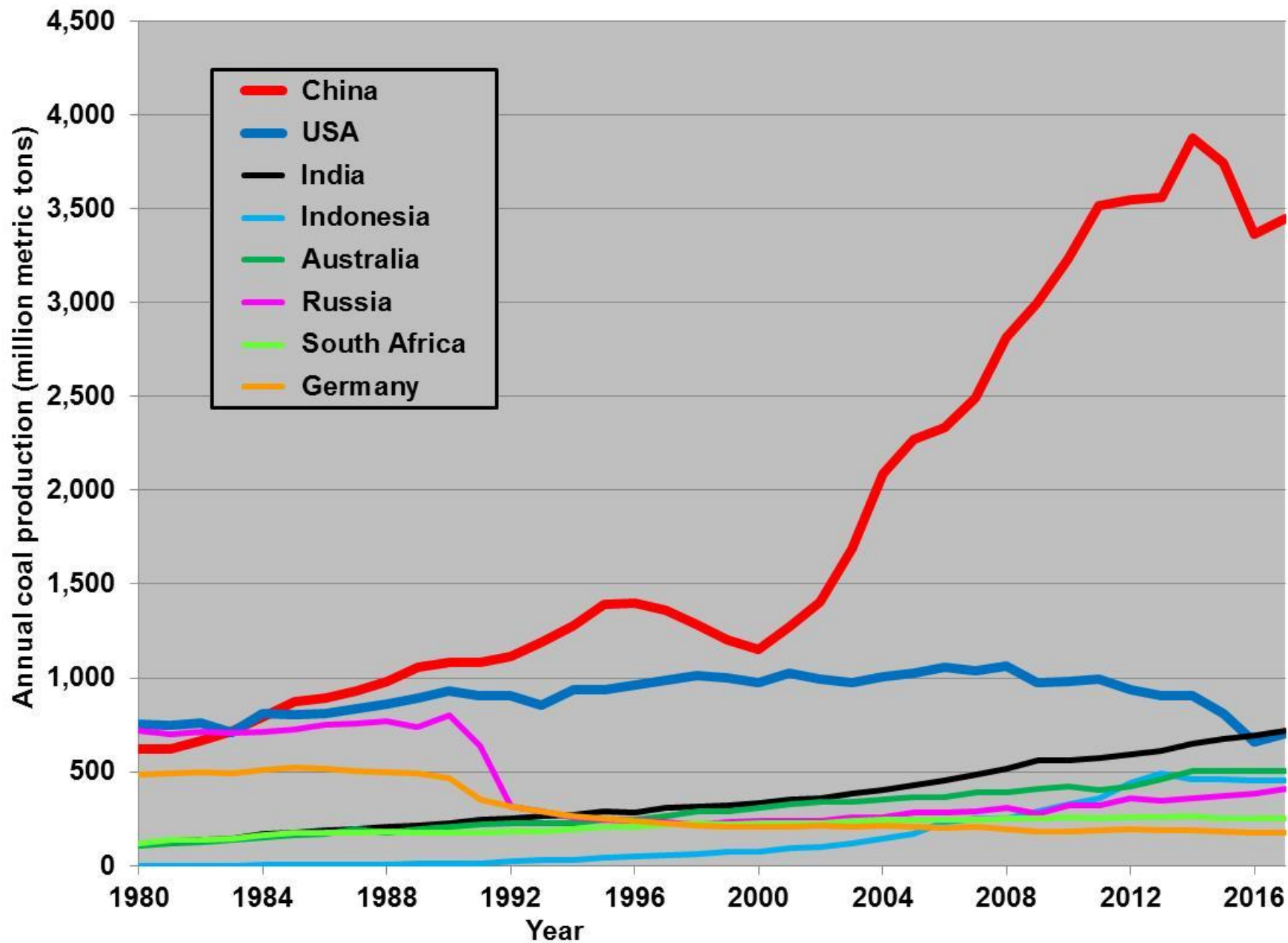
Countries with 4% or more of global production



Other countries with production or major reserves

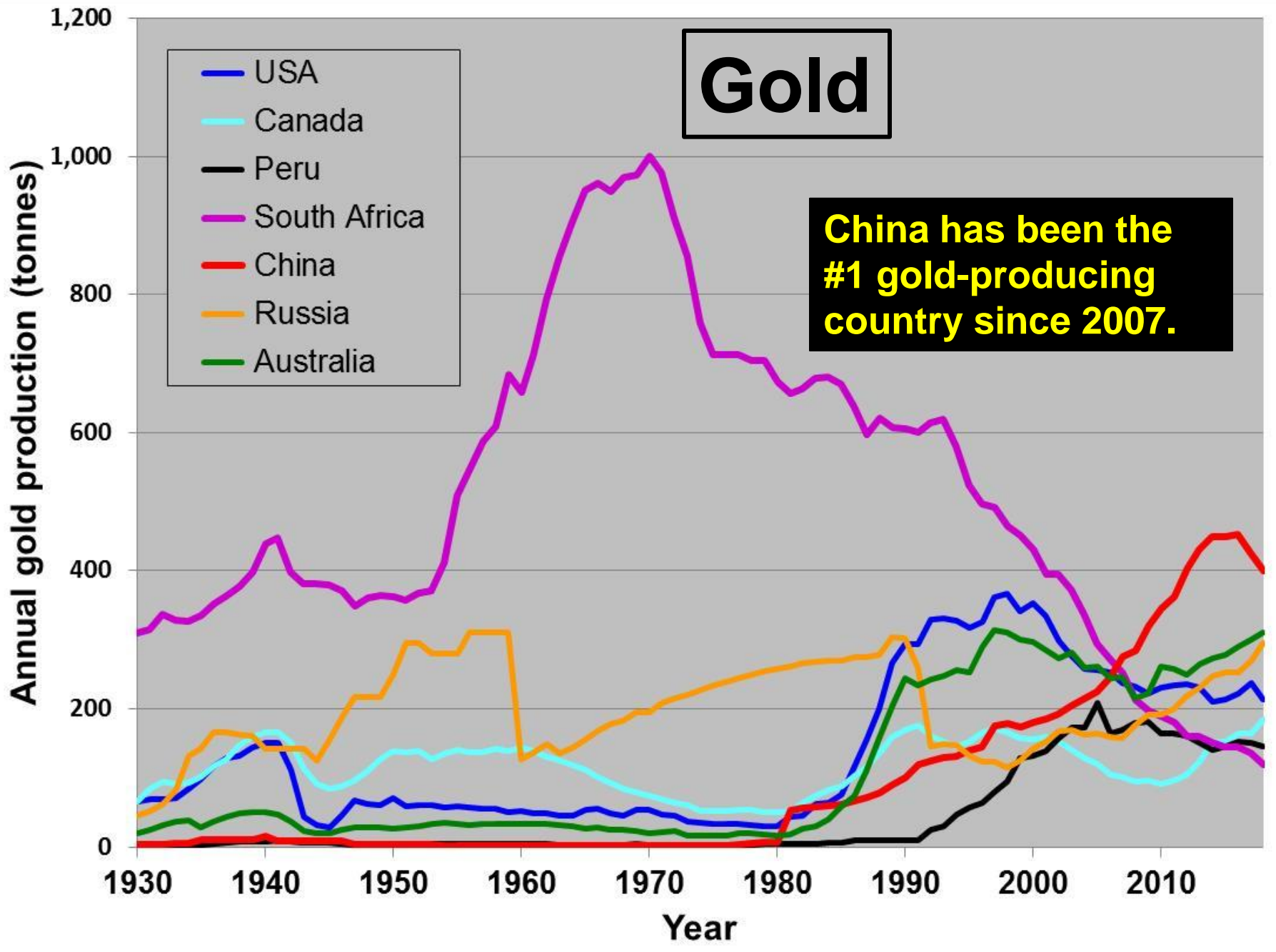
Data source: USGS

Resources are global, but China is Number One.



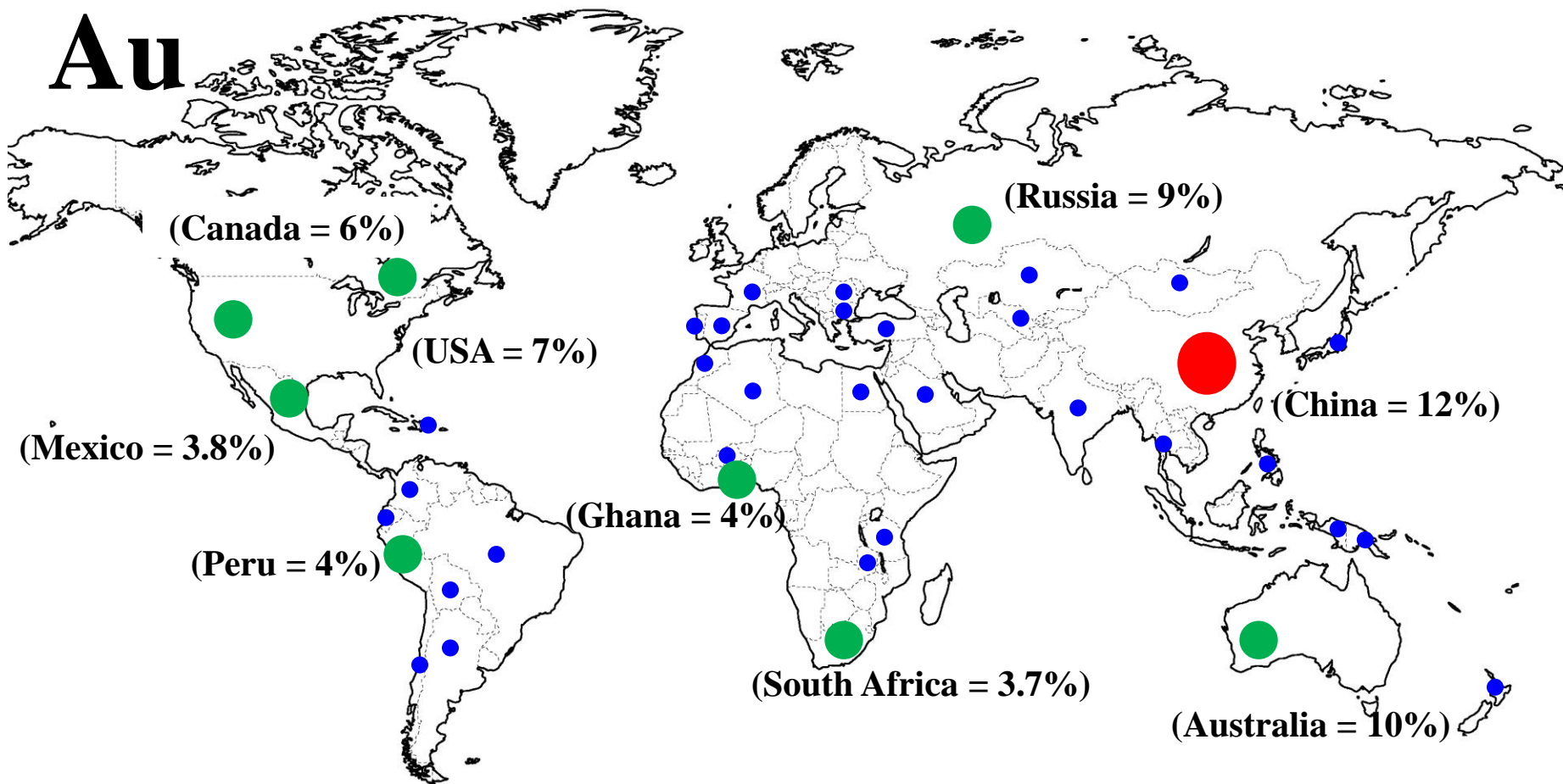
India has been increasing its coal use, while China & USA cut back.

Gold



China has been the #1 gold-producing country since 2007.

Au



World's leading producer



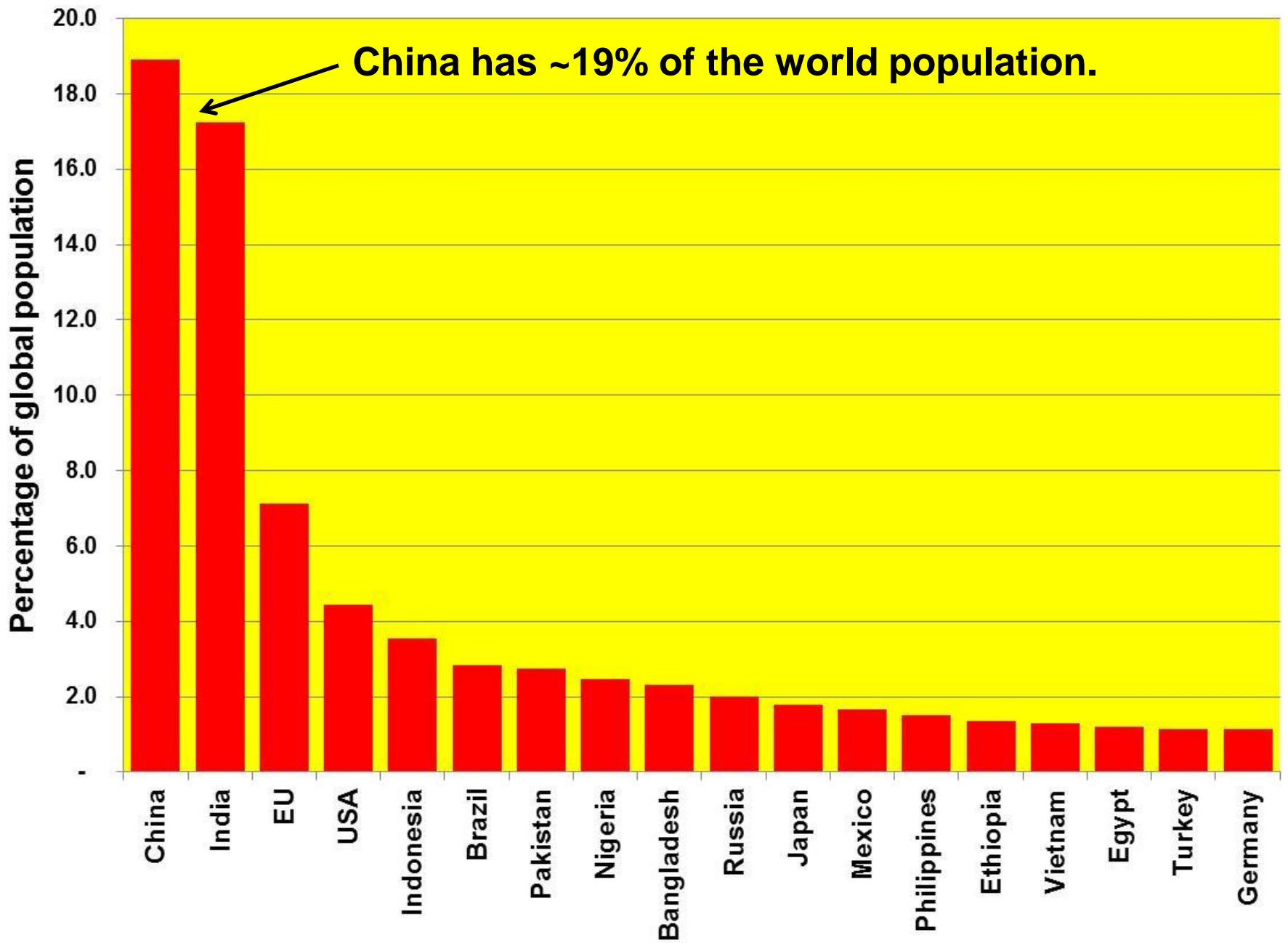
Countries with 4% or more of global production



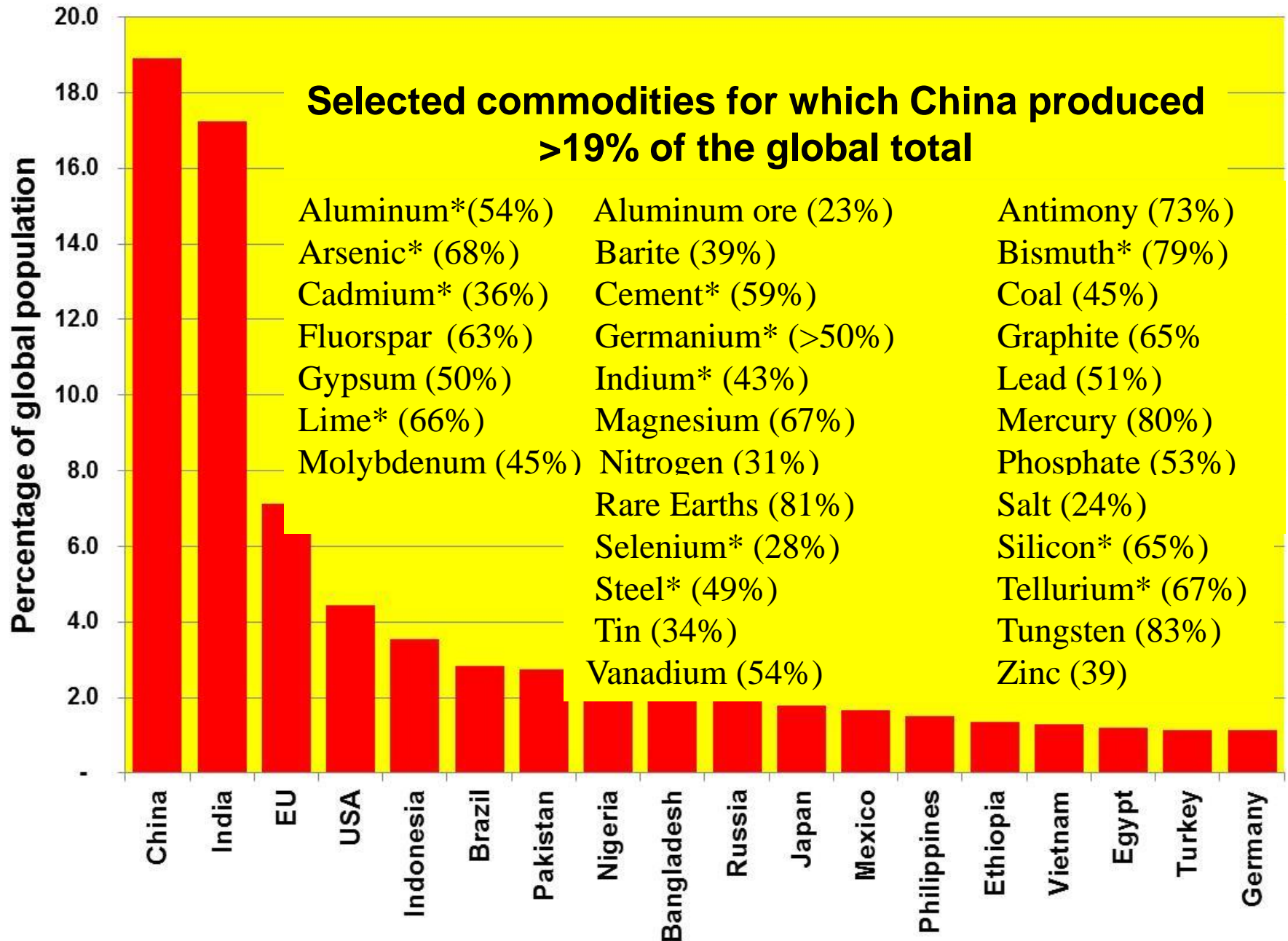
Other countries with production or major reserves

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Resources are global, but China is Number One.



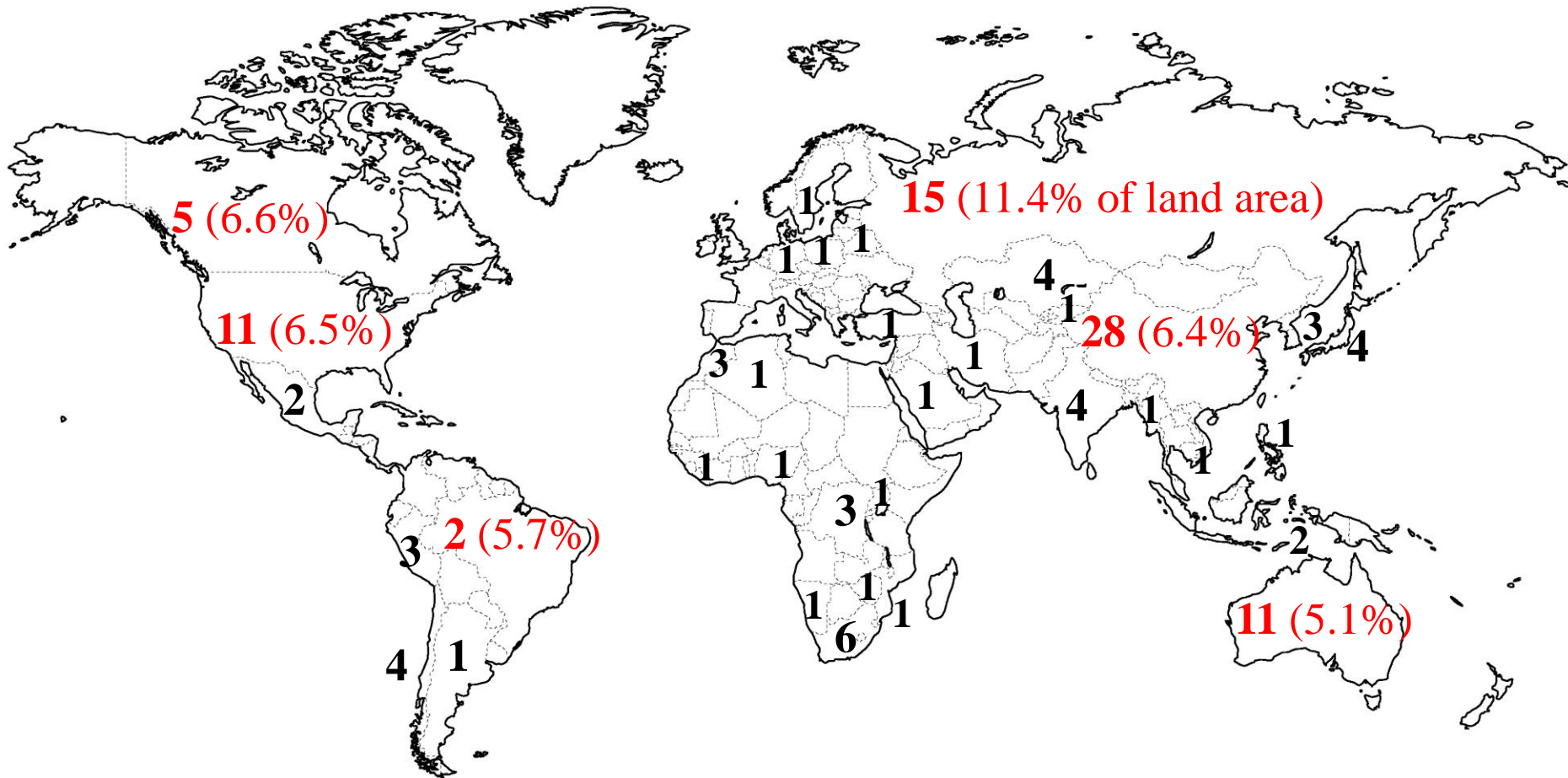
Selected commodities for which China produced >19% of the global total



- Aluminum* (54%)
- Arsenic* (68%)
- Cadmium* (36%)
- Fluorspar (63%)
- Gypsum (50%)
- Lime* (66%)
- Molybdenum (45%)
- Aluminum ore (23%)
- Barite (39%)
- Cement* (59%)
- Germanium* (>50%)
- Indium* (43%)
- Magnesium (67%)
- Nitrogen (31%)
- Rare Earths (81%)
- Selenium* (28%)
- Steel* (49%)
- Tin (34%)
- Vanadium (54%)
- Antimony (73%)
- Bismuth* (79%)
- Coal (45%)
- Graphite (65%)
- Lead (51%)
- Mercury (80%)
- Phosphate (53%)
- Salt (24%)
- Silicon* (65%)
- Tellurium* (67%)
- Tungsten (83%)
- Zinc (39%)

In production of 44 mineral commodities, China ranks well above all others.

Country	Number of commodities for which this country is the #1 producer	Number of commodities for which this country is among the top 3 producers
China	21	28
USA	4	11
South Africa	4	6
Australia	3	11
Chile	2	4
Congo	2	3
Russia	1	15
Canada	1	5
Kazakhstan	1	4
Brazil, Mexico, & Indonesia	1	2



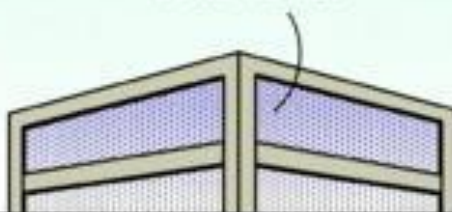
Number of selected mineral commodities (among 44) for which these countries are among the top three global producers (with percentage of land area in parentheses).

OUR CONSULTANT WILL TELL US HOW WE CAN SECURE A LONG-TERM SUPPLY OF RARE EARTH METALS FOR OUR PRODUCTS.



Dilbert.com DilbertCartoonist@gmail.com

CHINA HAS MOST OF THE RARE EARTH METALS. TRY DYING. AND REINCARNATING. THERE'S A 20% CHANCE THAT YOU'LL BE BORN CHINESE.



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WHAT'S PLAN B?



IF THE ONLY PART THAT GOES WRONG IS THE CHINESE PART, YOU CAN TRY DYING AGAIN.



So what?

And who cares?

Opportunities in Global Mineral Resources

Demand is high.

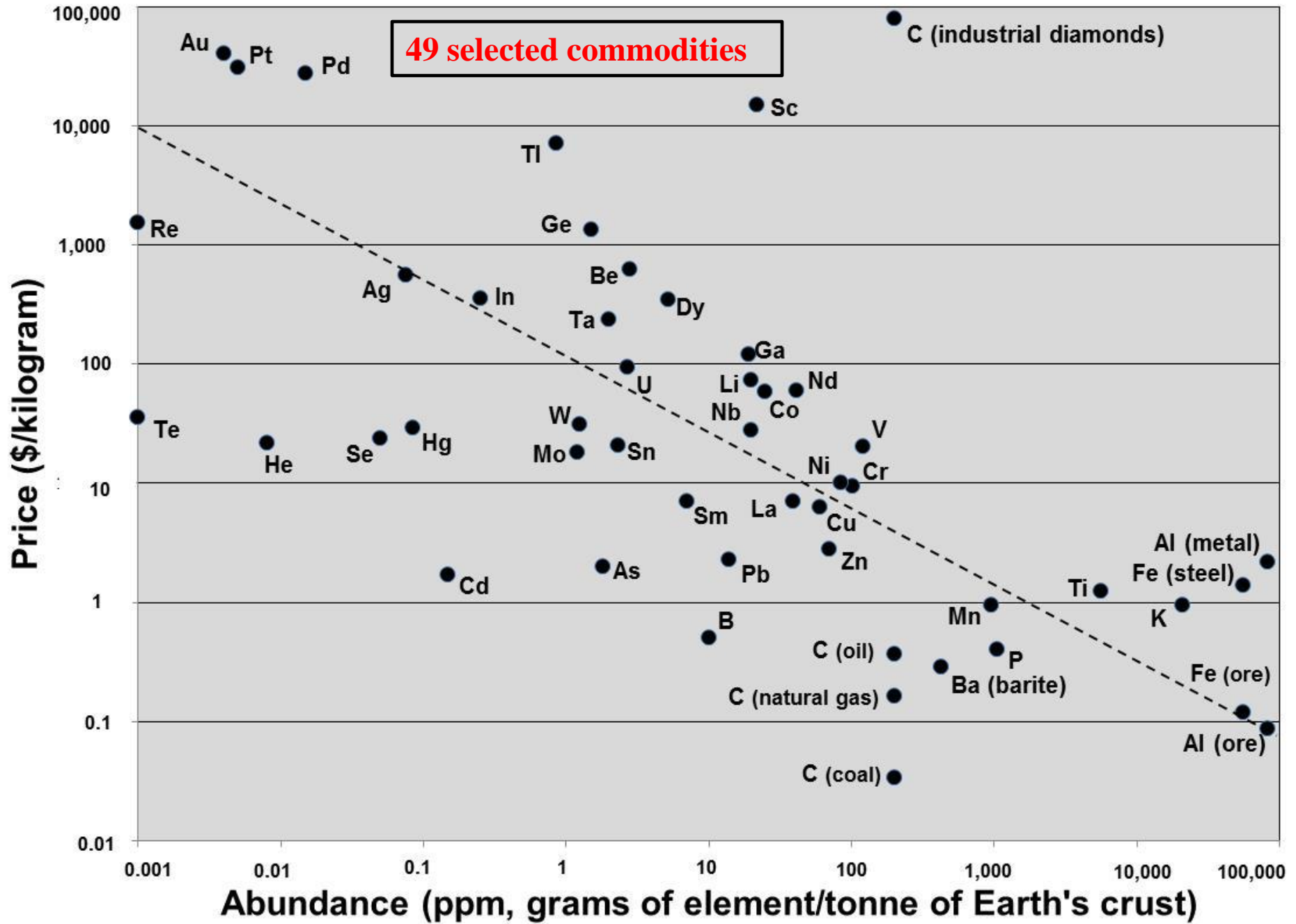
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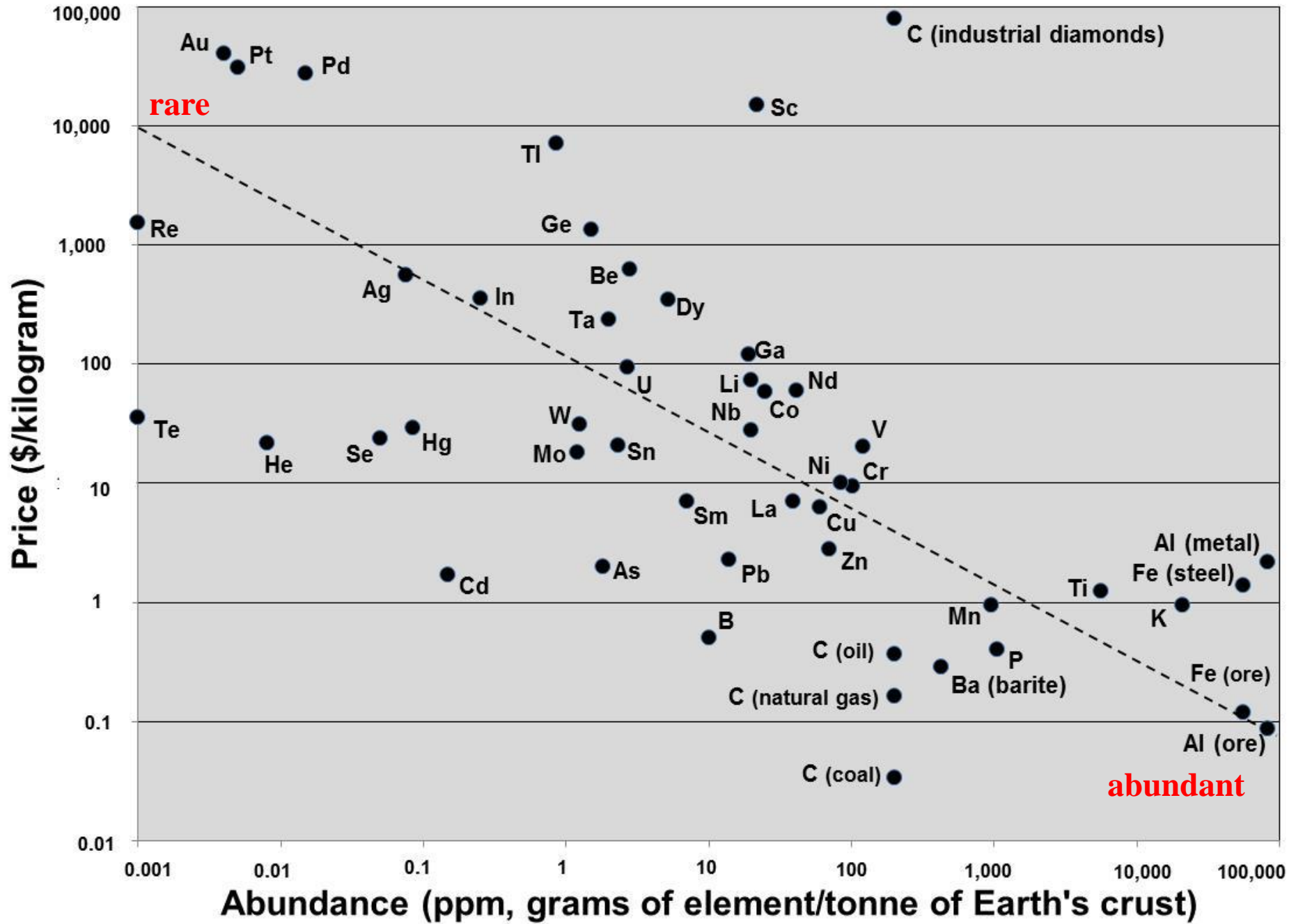
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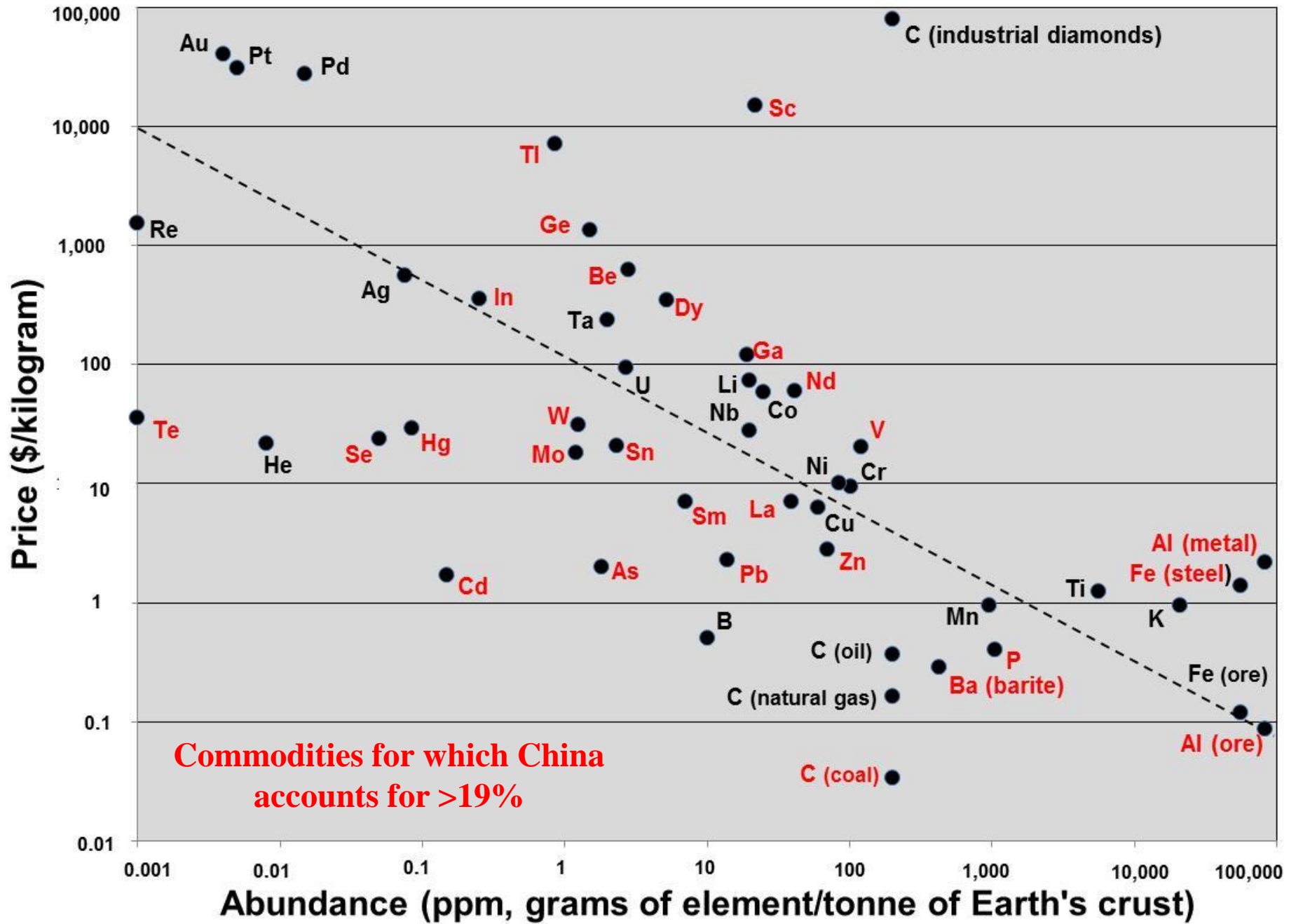


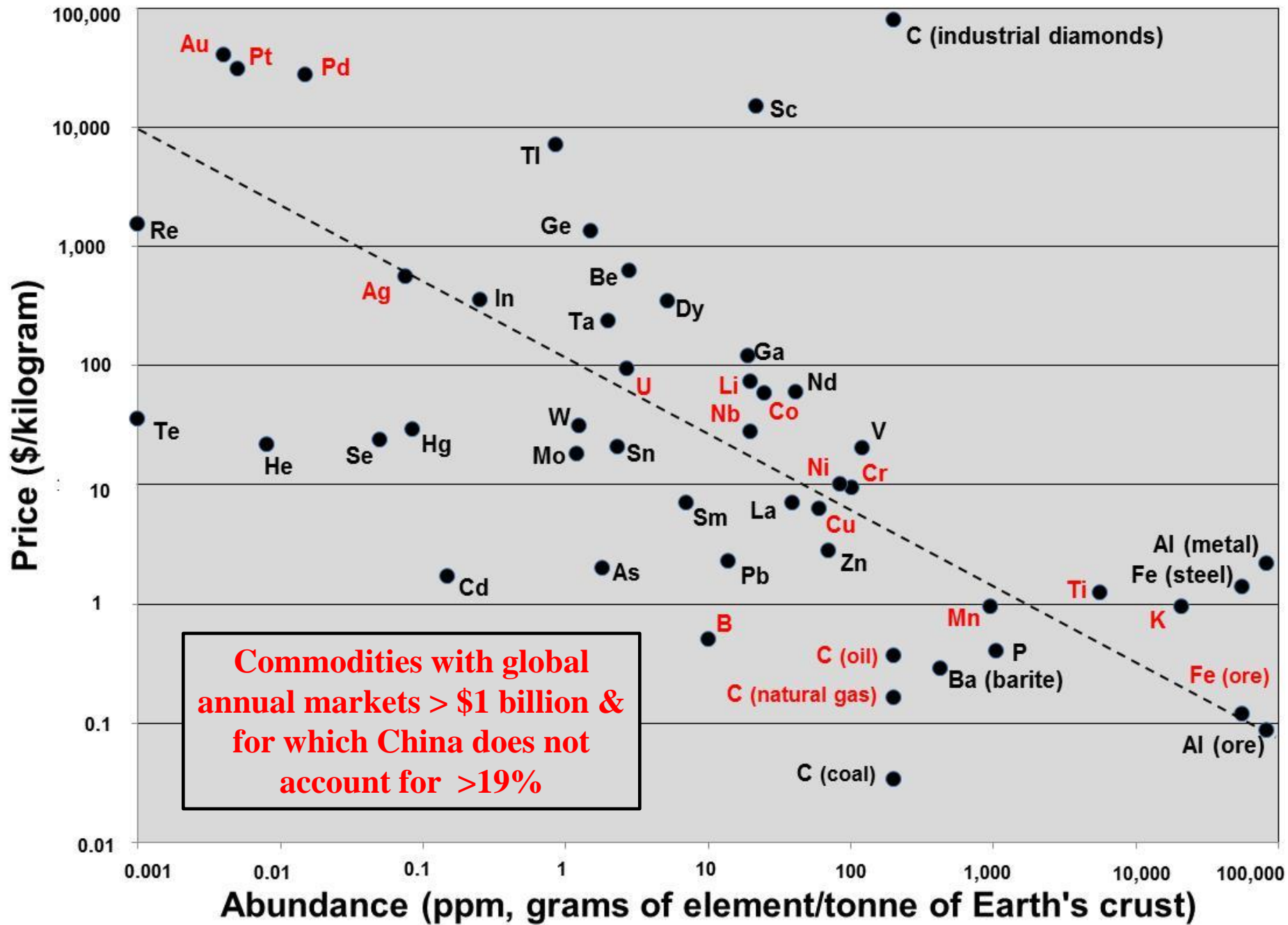
Round Mountain, NV (2007)

- **Which commodities does a country need to sustain or grow its economy?**
- **For which commodities is more research needed on models of formation and methods for extraction?**
- **For which commodities should a company explore?**









Elements with (a) high prices relative to their abundances, (b) large markets, and (c) limited production from China are likely to be most attractive. These include

Gold

Platinum-group elements

Uranium

Lithium

Cobalt

Niobium

Titanium


Potassium

Iron



"Forget gold. Strategic metals are where it's at."

Energy Critical Elements:

					2 He Helium 4.003			
		5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797	
		13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066			
28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160			34 Se Selenium 78.96
46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760			52 Te Tellurium 127.60
78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038			84 Po Polonium [209]
65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967		

Consider exploring for mineral resources that will likely be in higher demand in the future.

Securing Materials for Emerging Technologies


A REPORT BY THE APS PANEL ON PUBLIC AFFAIRS & THE MATERIALS RESEARCH SOCIETY




Energy-critical elements (ECEs) are a class of chemical elements that currently appear **critical to one or more new energy-related technologies**. A shortage of these elements would significantly inhibit large-scale deployment, which could otherwise be **capable of transforming the way we produce, transmit, store, or conserve energy**. We reserve the term ECE for chemical elements that **have not been widely extracted, traded, or utilized in the past, and are therefore not the focus of well-established and relatively stable markets**.

Some ECEs today

1 H Hydrogen 1.01																	2 He Helium 4.00						
3 Li Lithium 6.94	4 Be Beryllium 9.01																	5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
11 Na Sodium 22.99	12 Mg Magnesium 24.31																	13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 72.61	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80						
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.50	53 I Iodine 126.90	54 Xe Xenon 131.29						
55 Cs Cesium 132.91	56 Ba Barium 137.33	57 La Lanthanum 138.91	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)						
87 Fr Francium (223)	88 Ra Radium 226	89 Ac Actinium 227	101 Rf Rutherfordium (261)	102 Db Dubnium 262	103 Sg Seaborgium 266	104 Bh Bohrium 264	105 Hs Hassium 269	106 Mt Meitnerium 268															

 Platinum Group Elements

 Other ECEs

 Rare Earth Elements

 Photovoltaic ECEs

58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.97
90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)



CuIn_xGa_(1-x)Se₂, CdTe, GaAs, Ag, and Si_{1-x}Ge_x
for **solar panels**

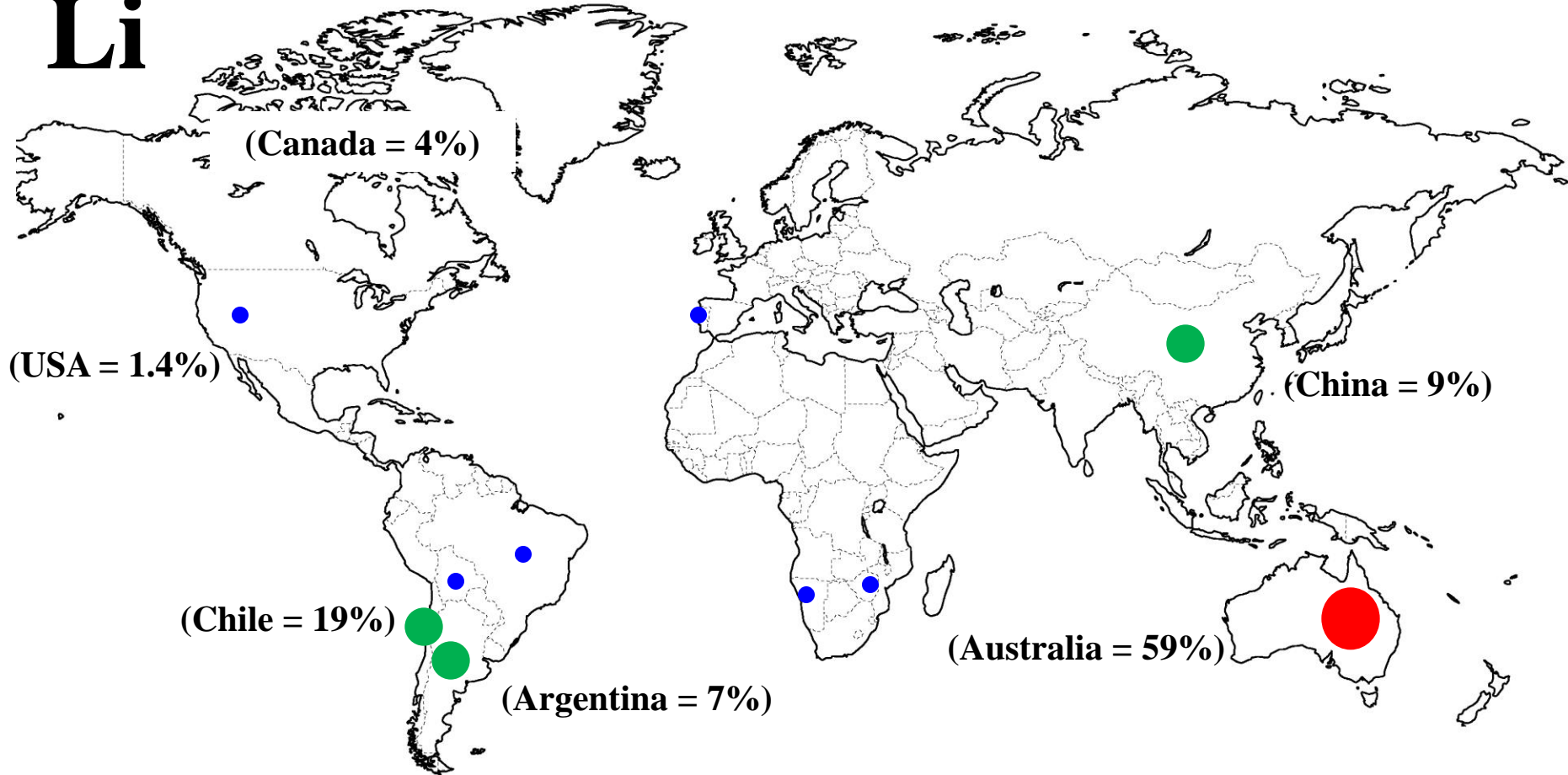
Fe₁₄(Nd,Dy)₂B, SmCo₅, and Sm₂Co₁₇ for
magnets, e.g., in **wind turbines**




Li, Co, La, Ni, and V for **batteries**

Pt, Pd for catalysts in **fuel cells**

Tb, Eu in **fluorescent lights**

Li

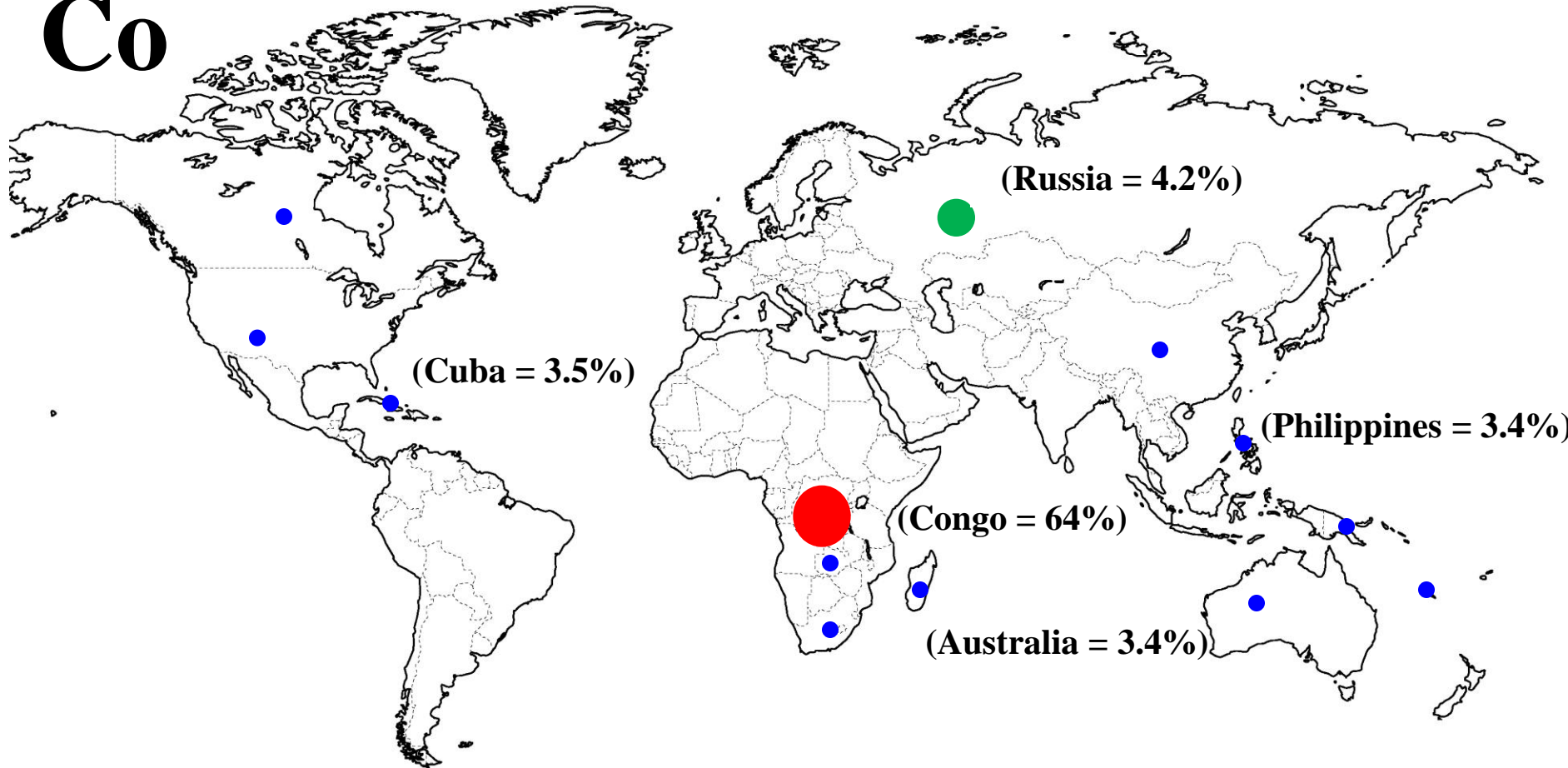


 World's leading producer  Countries with 4% or more of global production  Other countries with production or major reserves

Data source: USGS

Lithium is needed in batteries for electric cars, etc.

Co



World's leading producer



Countries with 4% or more of global production

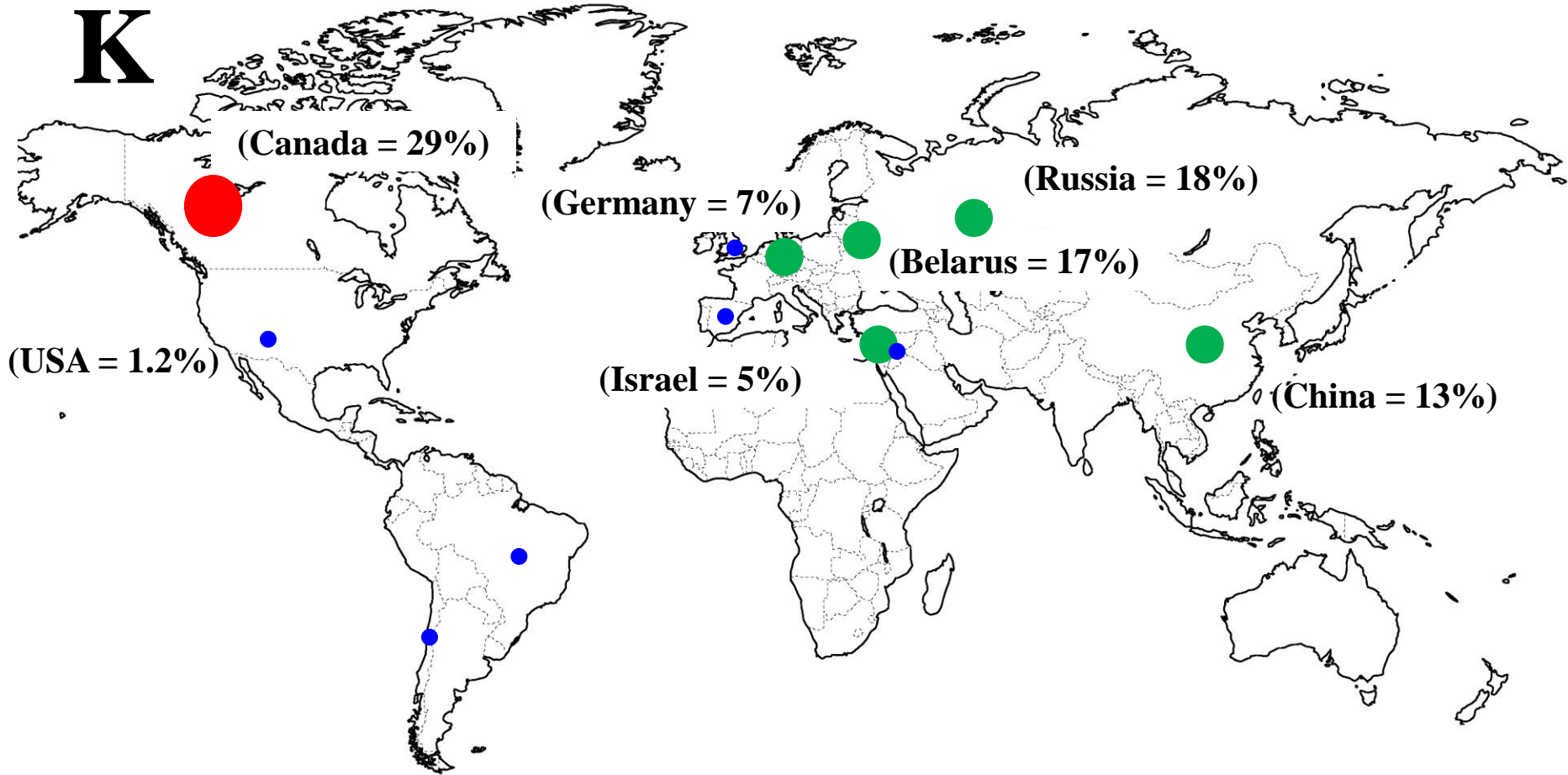





Other countries with production or major reserves

Data source: USGS

Cobalt is also needed in batteries for electric cars.

K

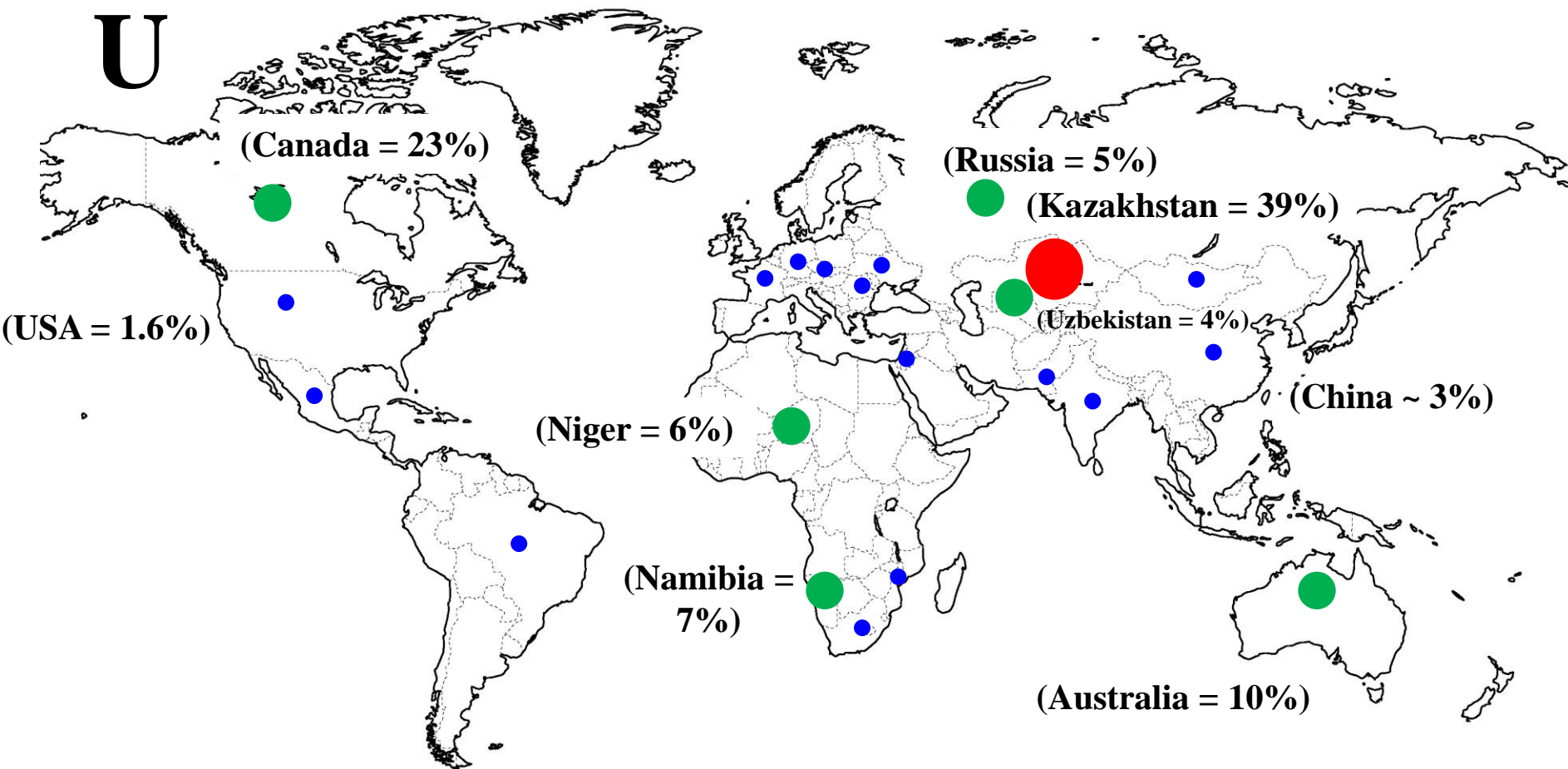





 World's leading producer  Countries with 4% or more of global production  Other countries with production or major reserves

Data source: USGS

Potash (potassium) is used mostly in fertilizer.

U



 World's leading producer  Countries with 4% or more of global production  Other countries with production or major reserves

Data source: World Nuclear Association

Uranium is used mostly in generating electricity.

China's economy will likely drive up the demand for those commodities for which it can't mine enough domestically.

Commodity	% from China	% from Canada	% from US	Leading Producer
Platinum	~0	6	3	South Africa (69%)
Potash	13	29	1	Canada (29%)
Chromium	~0	~0	~0	South Africa (44%)
Copper	8	3	6	Chile (28%)
Nickel	5	7	1	Indonesia (24%)
Cobalt	2	3	0.4	Congo (64%)



For example, the leading producers of nickel are Indonesia (24% of mine production), Philippines (15%), New Caledonia (9%), Russia (9%), Australia (7%), and Canada (7%),

**Mount Keith Ni mine, Western Australia:
323 million metric tons @ 0.56% Ni**

Spinifex texture in serpentinite, Honeymoon Well nickel deposit, Western Australia - indicator of bladed crystals of olivine, from quenching of an ultramafic lava flow



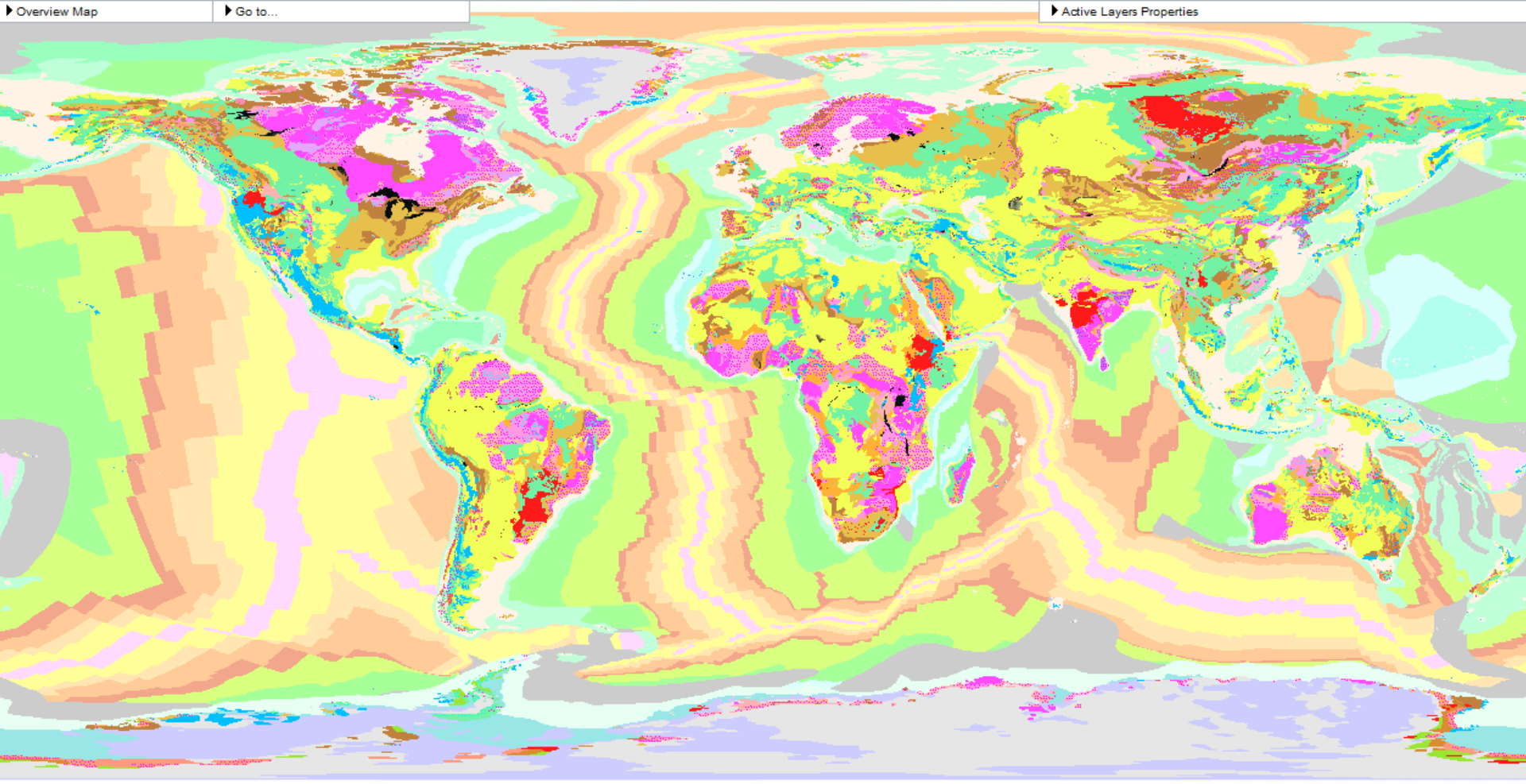
Production statistics from USGS

Watch for competition in the regions of resource-rich Precambrian cratons, which are major sources of iron, manganese, nickel, chromium, titanium, copper, cobalt, zinc, gold, palladium, platinum, and uranium. This includes parts of Africa, Australia, South America (particularly Brazil and Venezuela), Russia, and Canada.





View layers



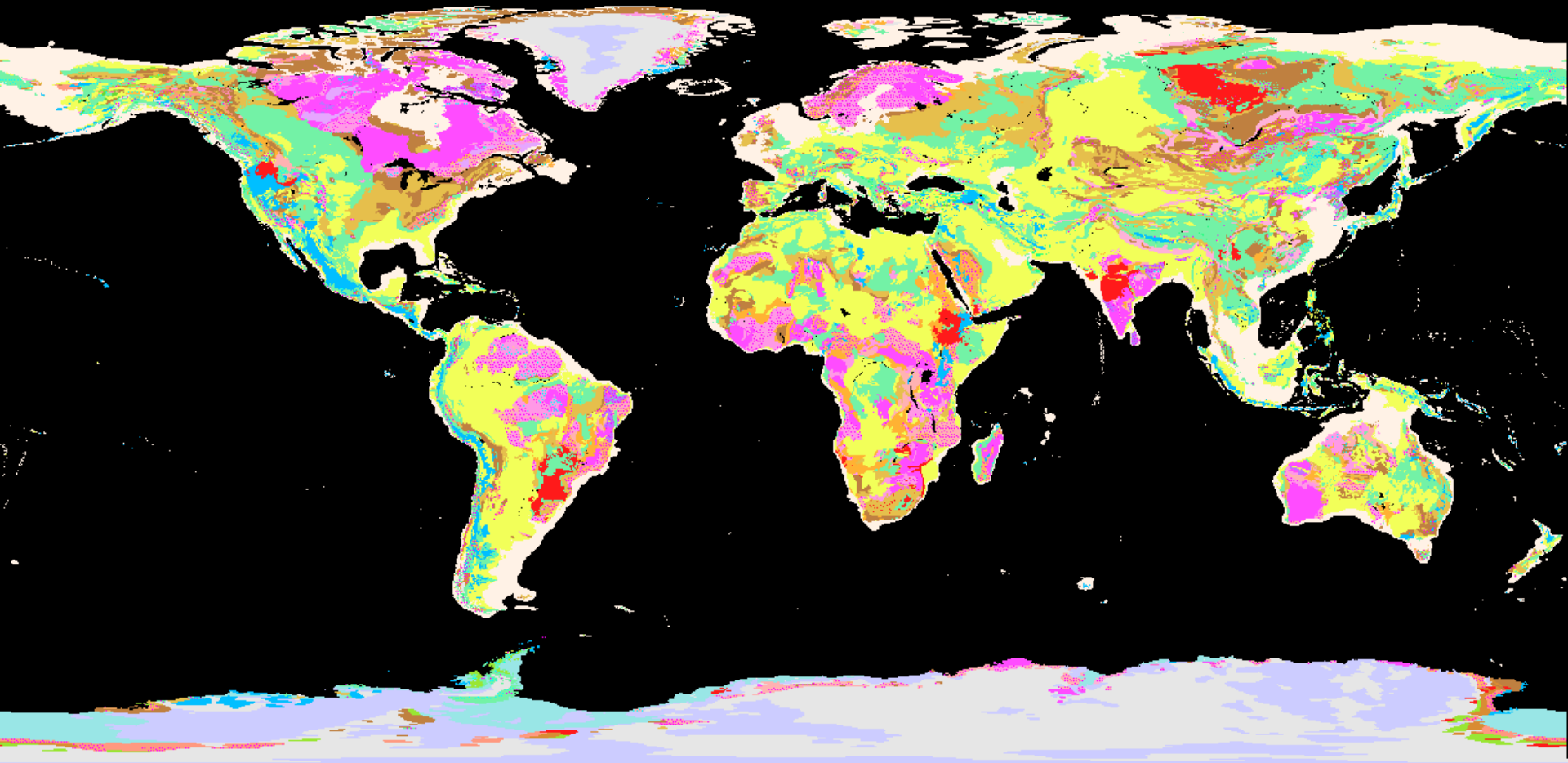
Active Layers Properties

4000 km



Scale: 1 : 89 923 572

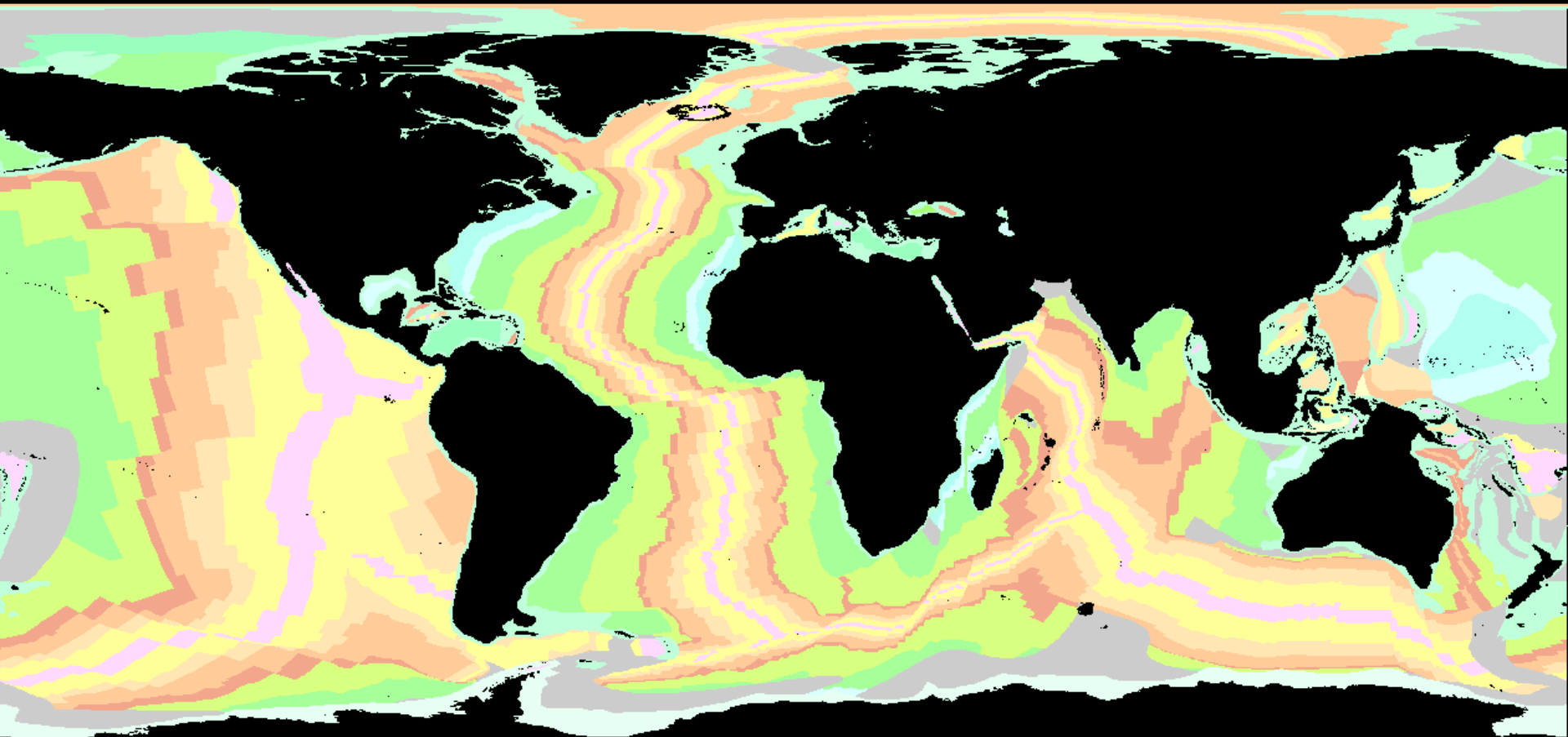
lon : 170.29 lat : 80.22

All data are owned by OneGeology participants and any limits on the use of these data are described by each provider in the Catalogue of Registered Services. This application now supports Firefox 3 and Firefox 4, IE6, IE7 and IE8, Opera, Safari, Chrome.



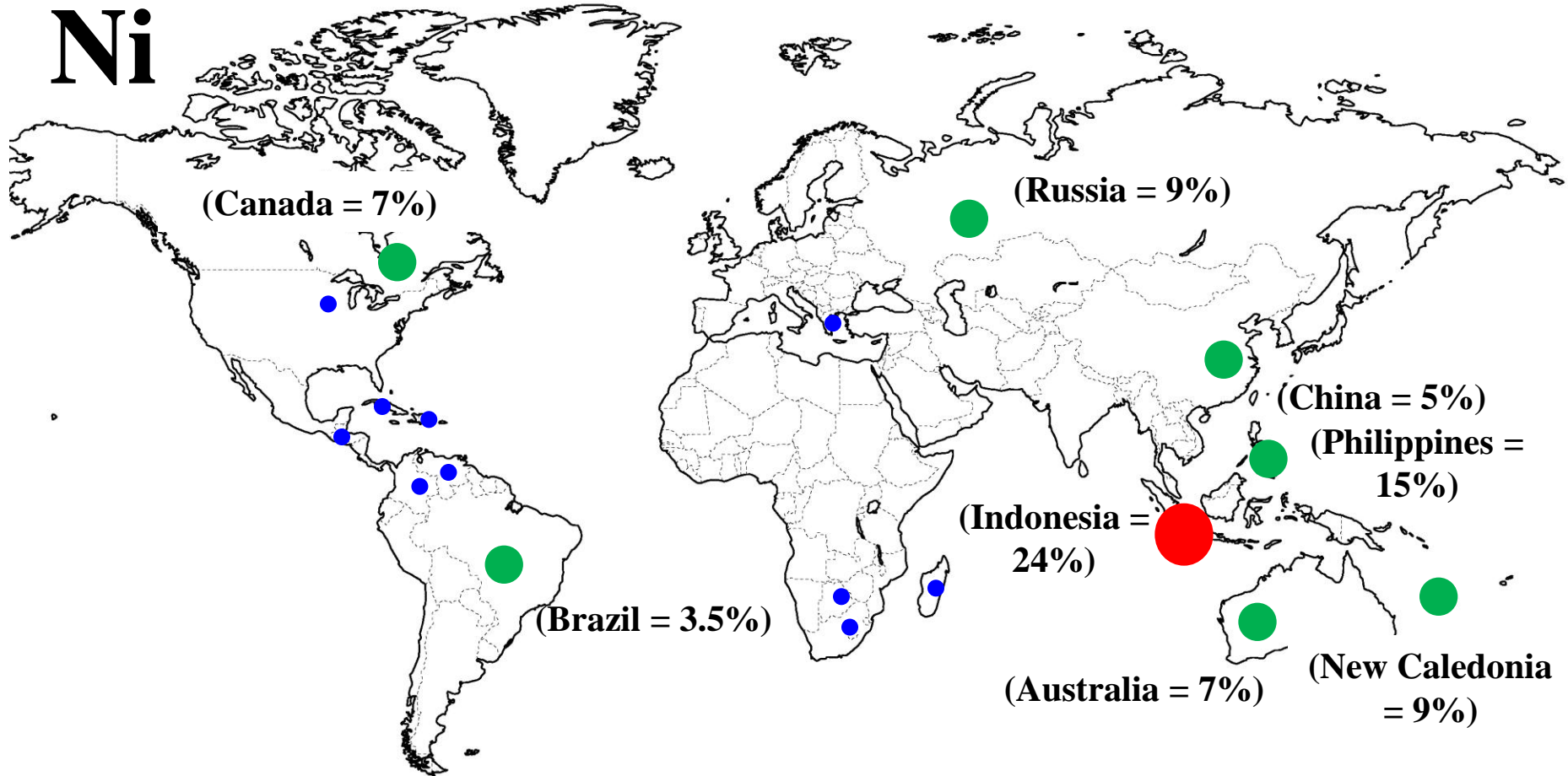
Precambrian cratons

-  **Archean** (2.5 to 4.0 Ga) – **Au, Ni, U**
-  **Proterozoic** (542 Ma to 2.5 Ga) – **Fe, Mn, V, Pt, Pd, Cr, Ni, Au, Cu, Co, U, Ti, diamonds**



Jurassic to Recent oceanic crust – potential for ore deposits of manganese nodules & crusts (Mn, Ni, Co, Cu), massive sulfide deposits & seafloor vents (Cu, Zn, Pb, Au, Ag), and phosphate nodule deposits (P)

Ni



World's leading producer



Countries with 4% or more of global production

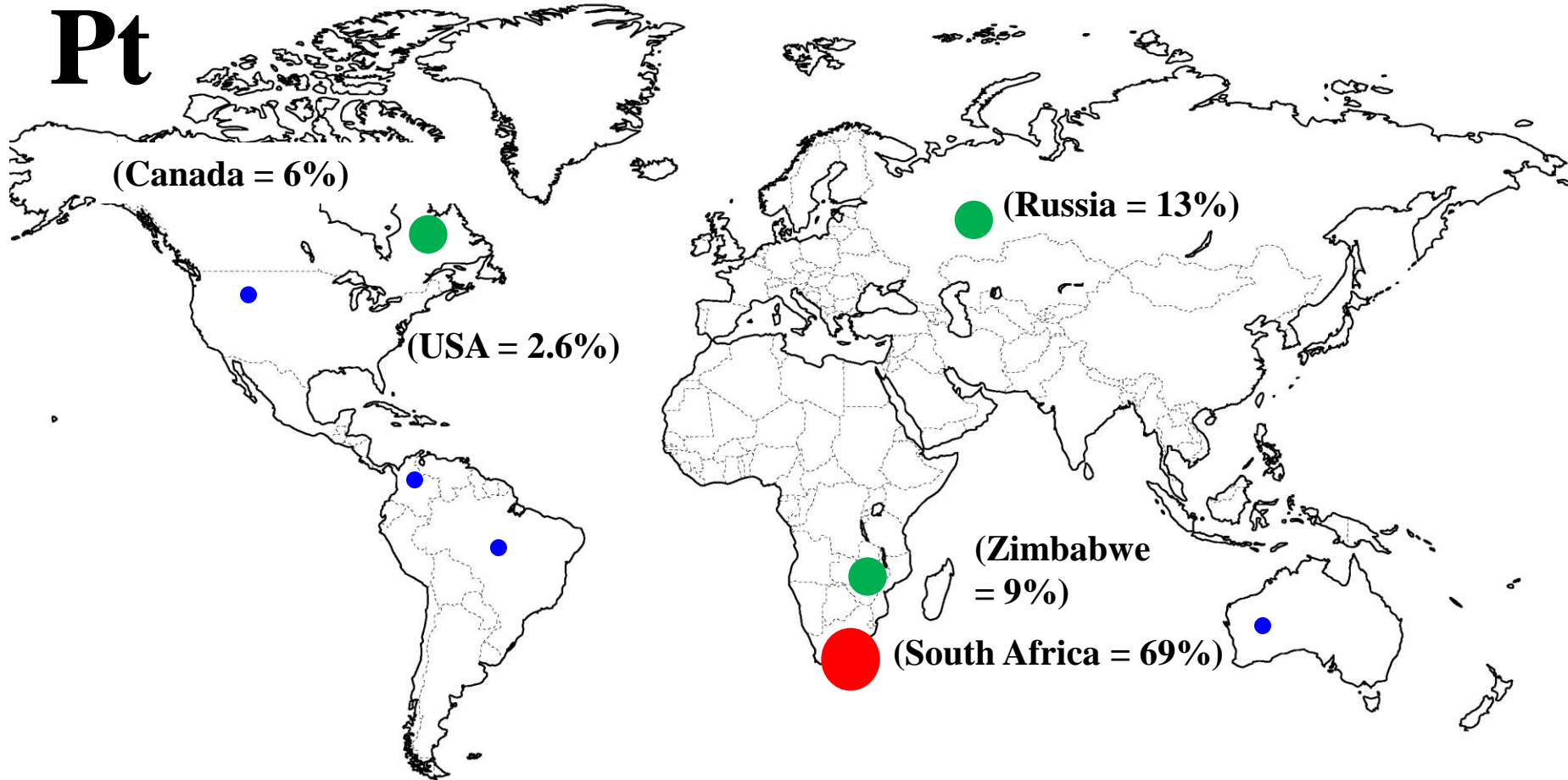


Other countries with production or major reserves

Data source: USGS

Nickel is used mostly in steel.

Pt



World's leading producer



Countries with 4% or more of global production

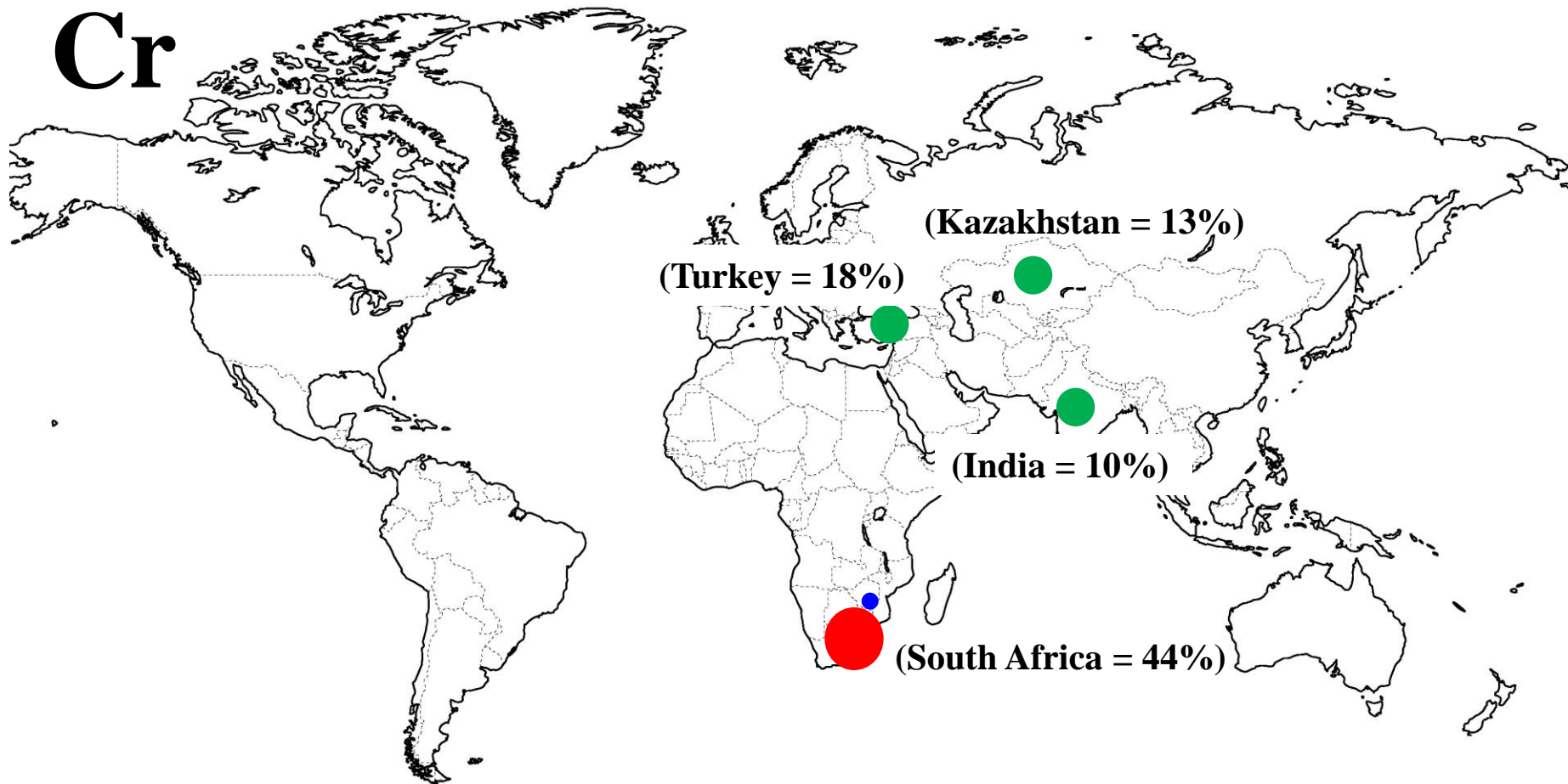


Other countries with production or major reserves

Data source: USGS

Platinum is used mostly in catalytic converters.

Cr



World's leading producer



Countries with 4% or more
of global production

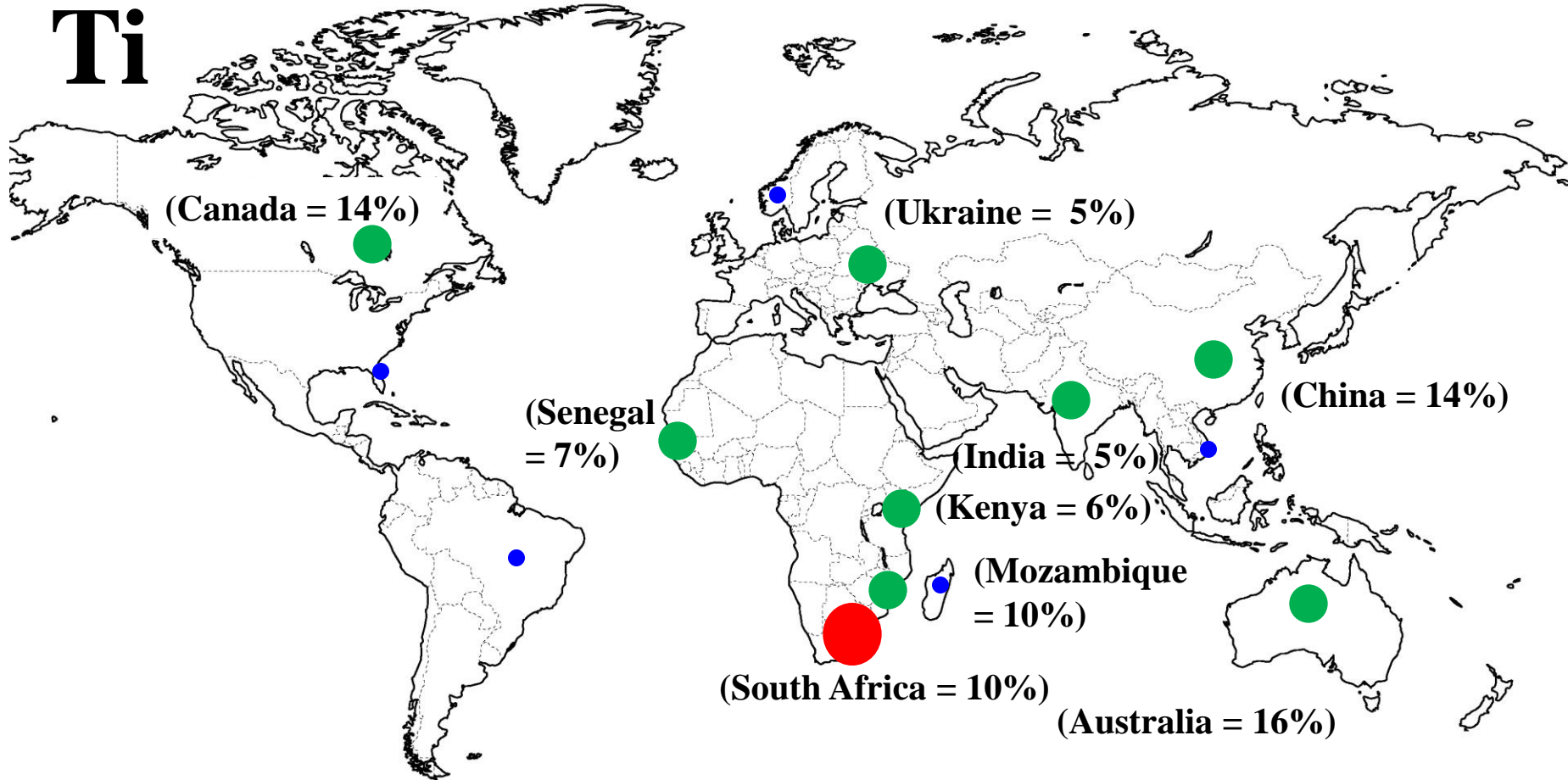





Other countries with production
or major reserves

Data source: USGS

Chromium is used mostly in steel & other alloys.

Ti

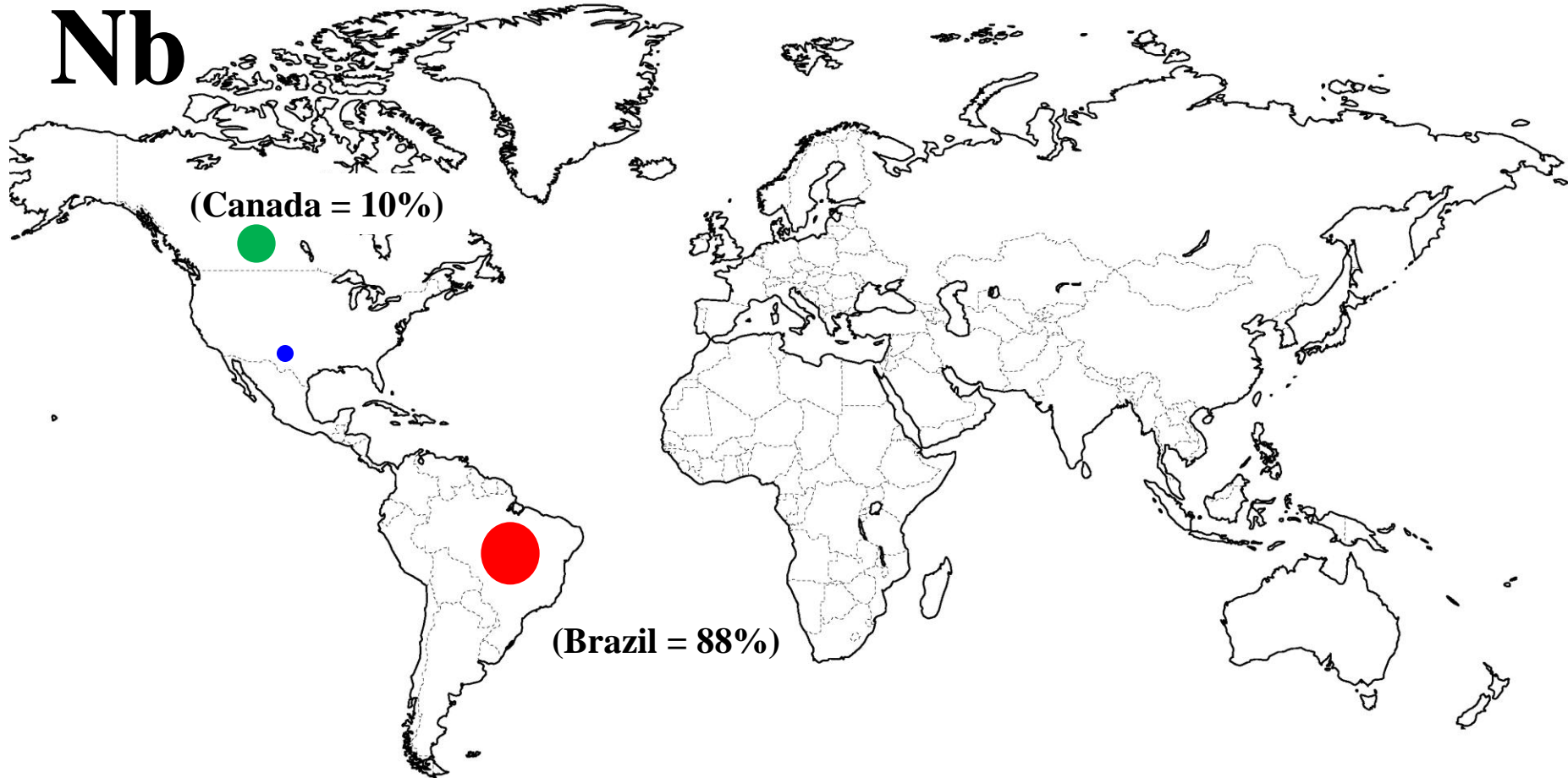


 World's leading producer  Countries with 4% or more of global production  Other countries with production or major reserves

Data source: USGS

Titanium has a variety of uses, including aerospace.

Nb



World's leading producer



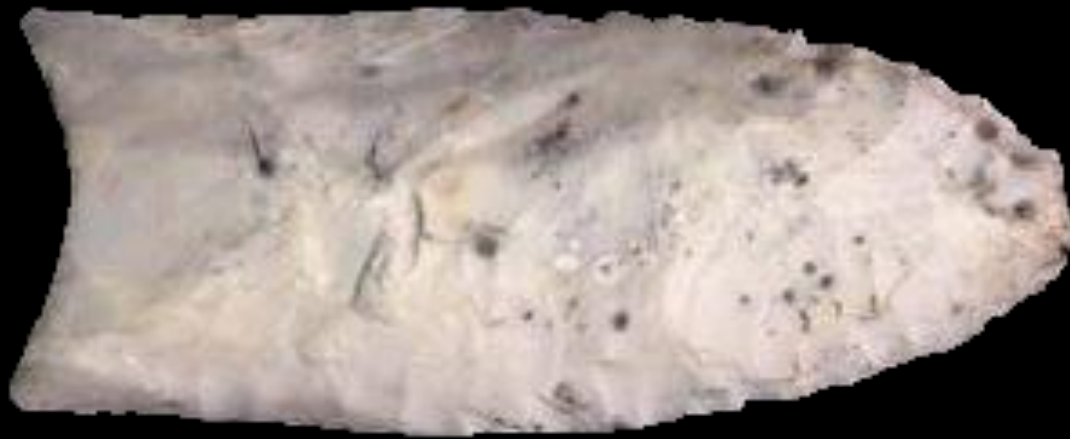
Countries with 4% or more of global production



Other countries with production or major reserves

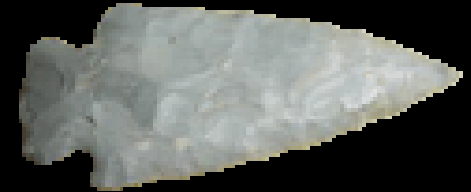
Data source: USGS

Niobium is used mostly in steel & other alloys.



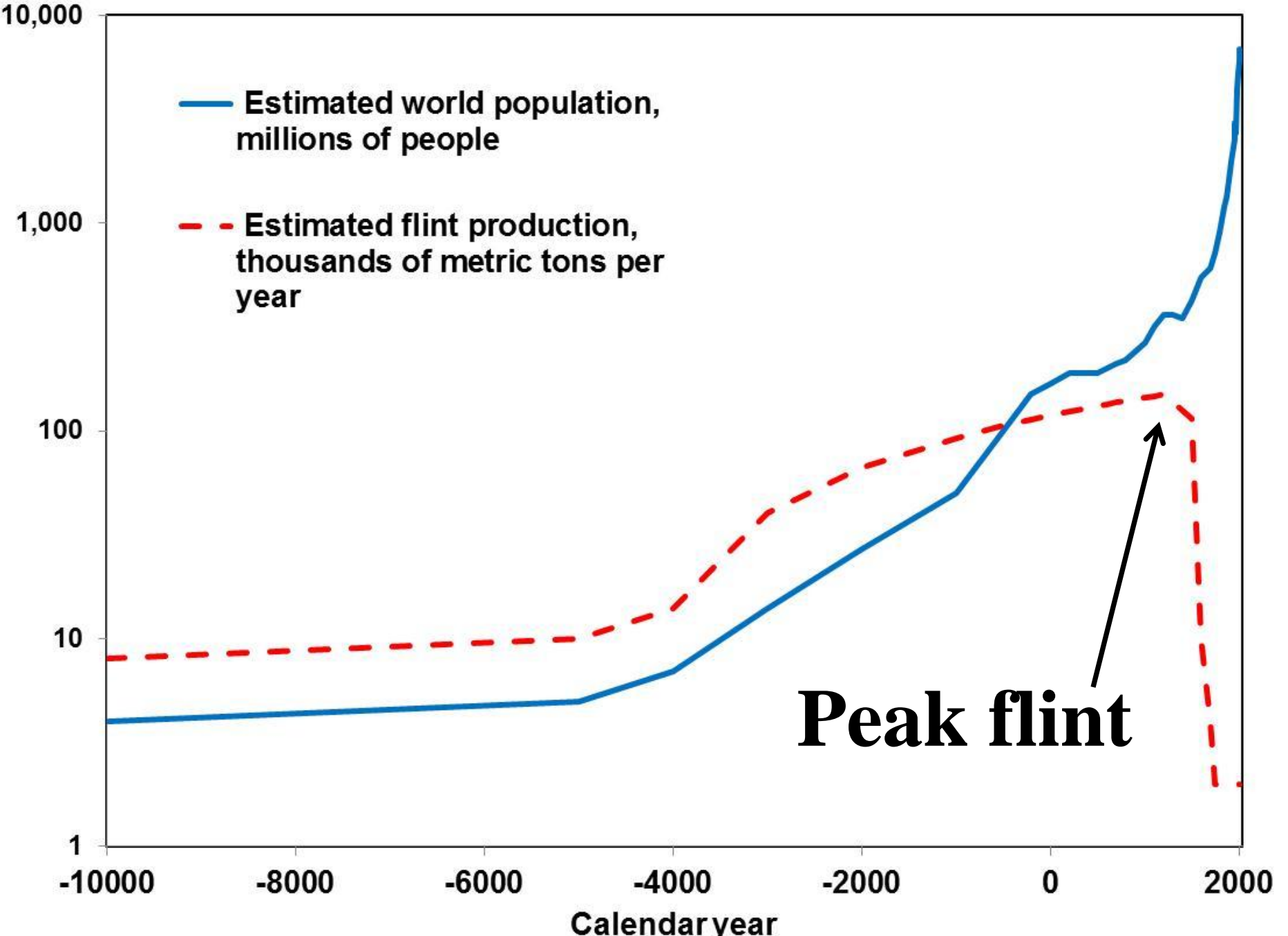
Arrowhead clipart from www.firstpeople.us

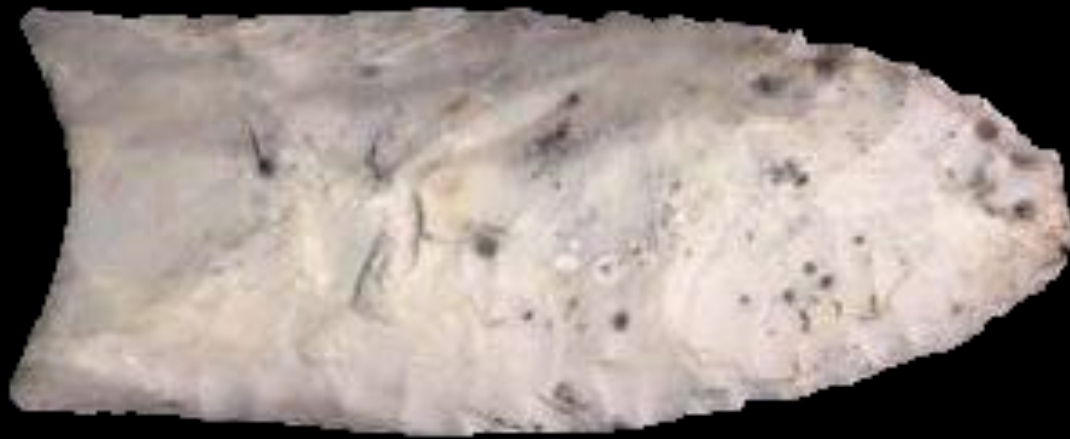
Critical and strategic minerals will change with time.



Avatar

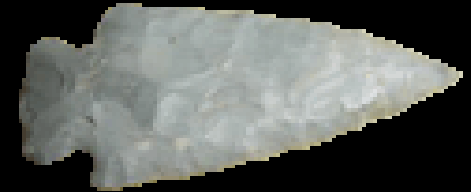






Arrowhead clipart from www.firstpeople.us

Critical and strategic minerals will change with time.



$\text{CuIn}_x\text{Ga}_{(1-x)}\text{Se}_2$ or CIGS, for solar panels?

CdTe, GaAs, and Ge for solar panels?

Nd for magnets for wind and other electrical turbines?

Li, Co, and V for different types of batteries?

More recycling can be accomplished by increasing collection rates of various products, better product design with recycling in mind, and improvements in recycling technologies. - Reck and Graedel (2012).

1 H																	2 He						
3 Li	4 Be																	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg																	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr						
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 <i>Tc</i>	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe						
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 <i>Po</i>	85 <i>At</i>	86 <i>Rn</i>						
87 <i>Fr</i>	88 <i>Ra</i>	89 <i>Ac</i>																					

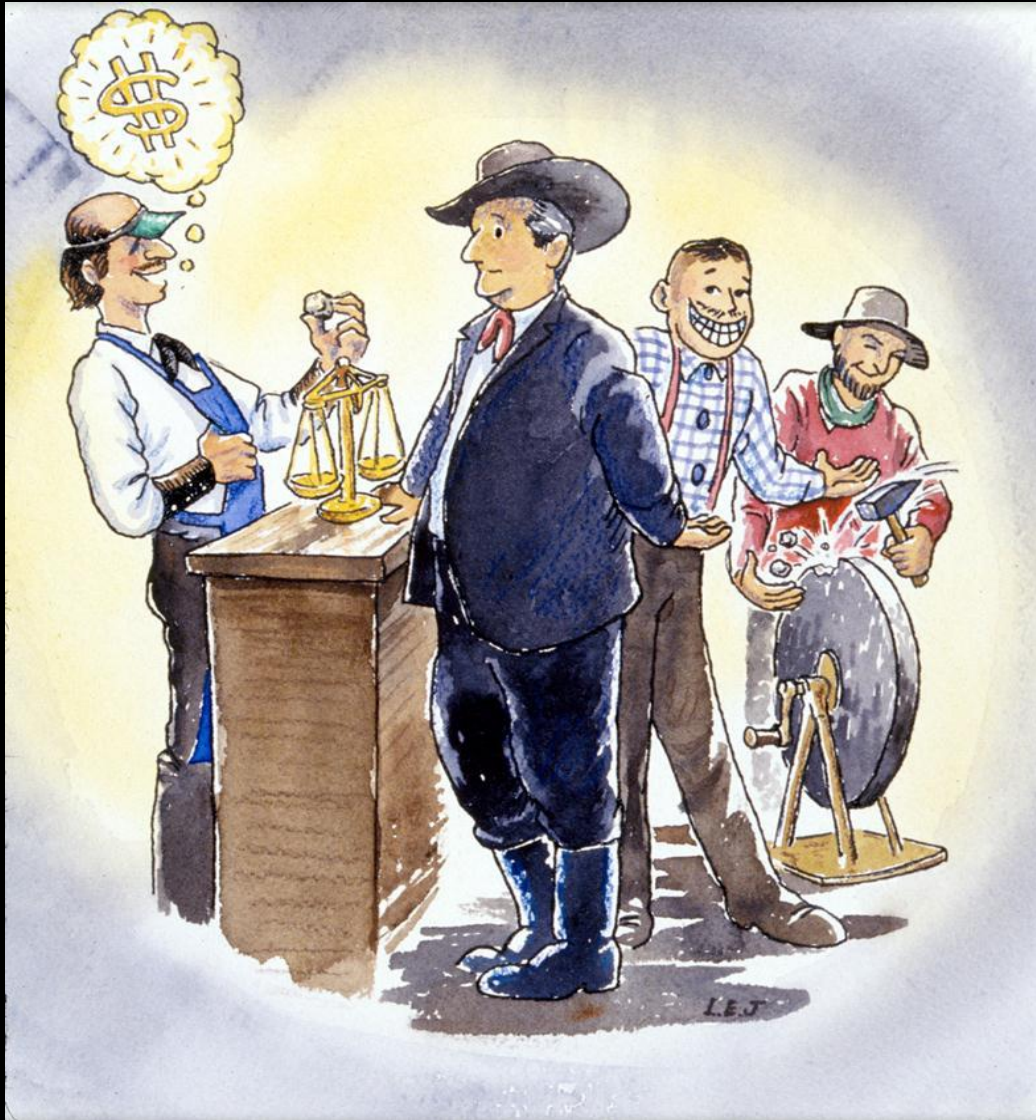
58 Ce	59 Pr	60 Nd	61 <i>Pm</i>	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 <i>Th</i>	91 <i>Pa</i>	92 <i>U</i>											

Source: Graedel et al. (2011)

Social and cultural concerns are part of mining today.

- Sustainability and sustainable development – environment, economy, social and cultural structure
- International Standards Organization environmental management (ISO 14001)
- International Cyanide Management Institute
- Community Outreach and Economic Security
- World Bank
- Stockholder demands
- Governmental regulations

Scams happen.



Mark Twain (1872) described a classic scheme involving an unscrupulous assayer (Fig. 17): (a) “Assaying was a good business, and so some men engaged in it, occasionally, who were not strictly scientific and capable. One assayer got such rich results out of all specimens brought to him that in time he acquired almost a monopoly of the business. But like all men who achieve success, he became an object of envy and suspicion. The other assayers entered into a conspiracy against him, and let some prominent citizens into the secret in order to show that they meant fairly. Then they broke a little fragment off a carpenter's grindstone and got a stranger to take it to the popular scientist and get it assayed.”

“In the course of an hour the result came---whereby it appeared that a ton of that rock would yield \$1,284.40 in silver and \$366.36 in gold! Due publication of the whole matter was made in the paper, and the popular assayer left town 'between two days.’”

The **Bre-X hoax** of the **mid-1990s** led to the development of Canadian National Instrument 43-101, Standards of Disclosure for Mineral Projects. The Calgary-based junior mining company supposedly discovered a major gold deposit at Busang, Indonesia. The assayed samples were salted, and investors lost \$2 billion.



Opportunities in Global Mineral Resources

Demand is high.

**Resources are global, but
China is #1.**

**The trends will help
guide exploration and
development.**



Round Mountain, NV (2007)

Opportunities in Global Mineral Resources

Thank you!



Azurite & Malachite, Ely, NV (J. Scovil photo)



Round Mountain, NV (2007)

Artisanal mining will likely continue as a health, safety, and environmental challenge for society, governments, and industry.



Four artisanal miners (galamsey) work unsafely, without personal protective equipment or ground support, near Kyerebosu in Ghana in 2008.



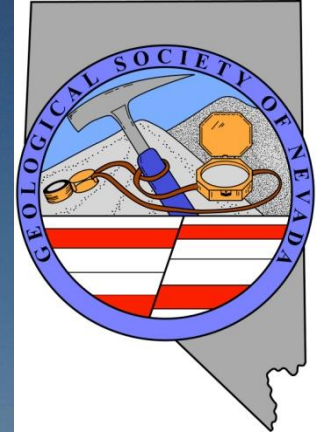
Gold mill in Sulawesi (Larry James photo)



Using blowtorch to
remove mercury
from amalgam,
Sulawesi (Larry
James photo)



Why explore in Nevada?

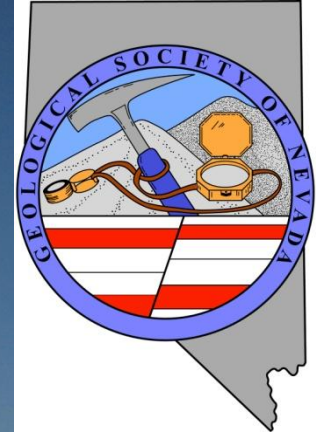


Among many other reasons, Nevada is the US leader in gold, barite, and lithium; a significant historical producer of copper, silver, and zinc; and a key source of industrial minerals for construction (gypsum, cement resources, aggregate).

Lithium-brine evaporation pond, 2008,
Clayton Valley (Silver Peak), Nevada



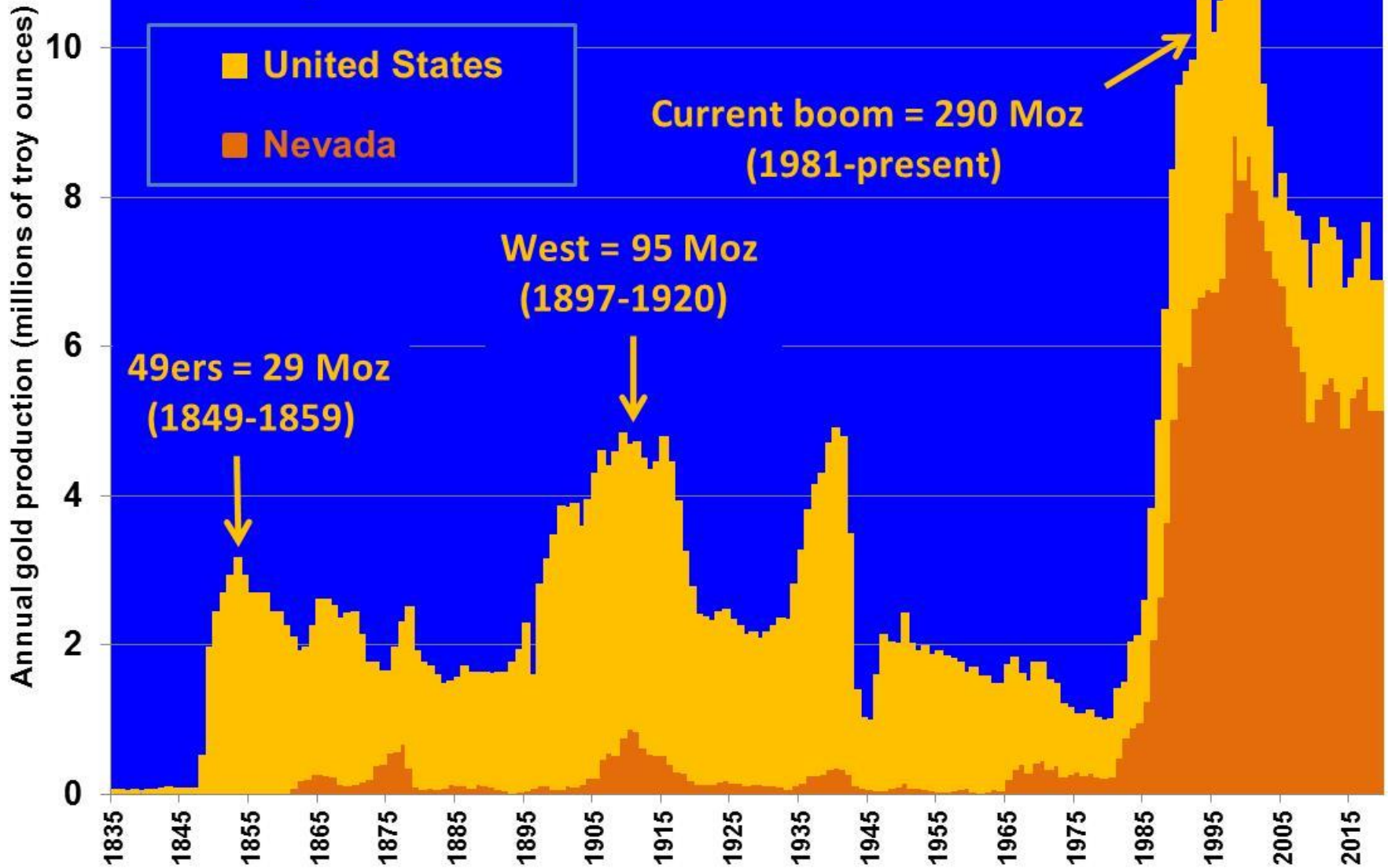
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Lithium-brine evaporation pond, 2008,
Clayton Valley (Silver Peak), Nevada

Gold production, 1835-2018



We are in the midst of the biggest gold-mining boom in history.

Thank you!

JONATHAN G. PRICE, LLC
 Nevada State Geologist Emeritus
 Certified Professional Geologist, Ph.D.
 2210 Andromeda Way
 Reno, Nevada 89509-3802 USA

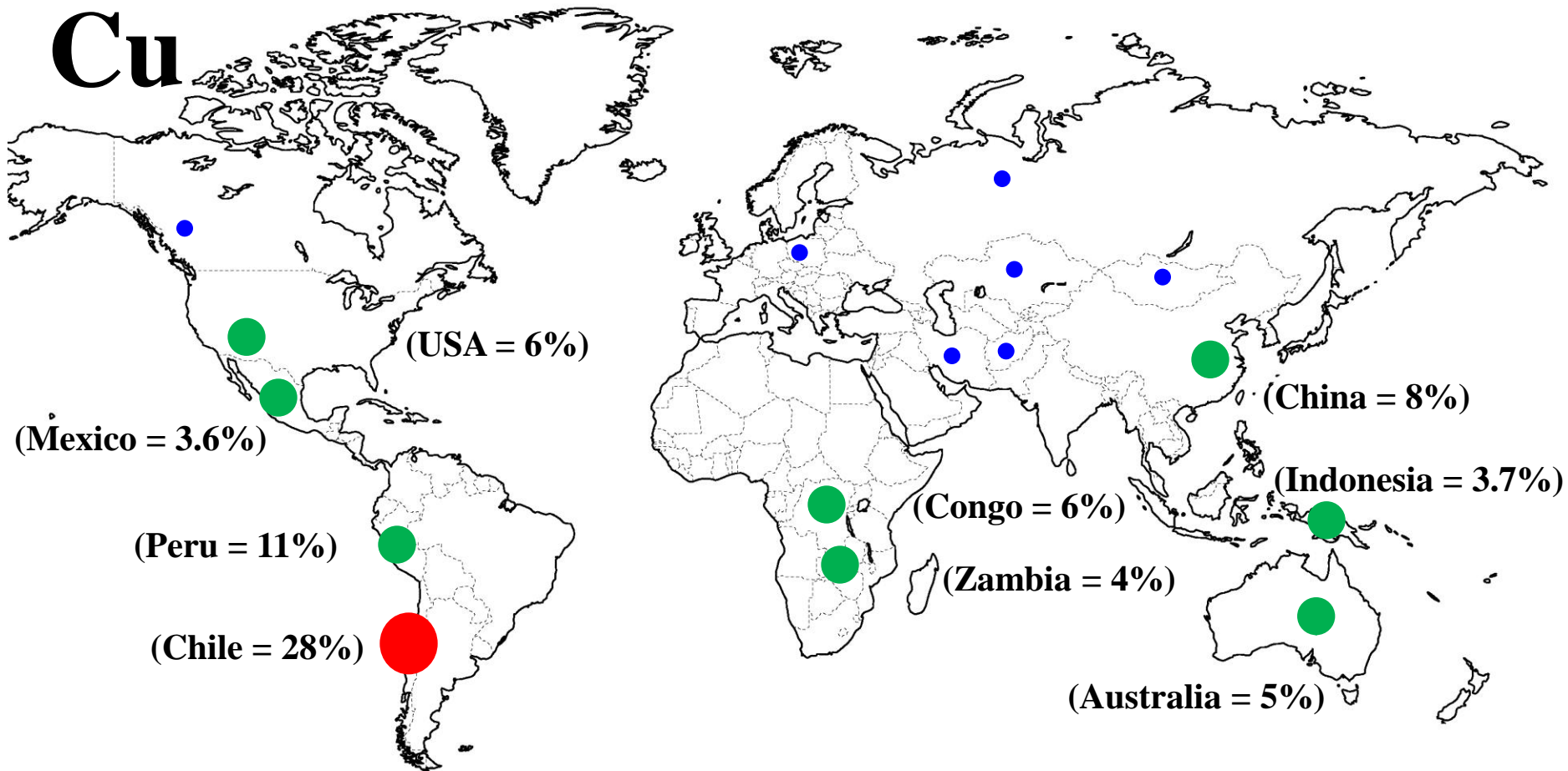
1 H 1.00794																	2 He 4.0026				
3 Li 6.941	4 Be 9.0122															5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.180
11 Na 22.9898	12 Mg 24.305															13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.066	17 Cl 35.453	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.8				
37 Rb 85.4678	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 <i>Tc</i> 97.9	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.71	51 Sb 121.757	52 Te 127.60	53 I 126.904	54 Xe 131.29				
55 Cs 132.905	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.98	84 <i>Po</i> 208.98	85 <i>At</i> 209.99	86 <i>Rn</i> 222.0176				
87 <i>Fr</i> 223.02	88 <i>Ra</i> 226.0254	89 <i>Ac</i> 227.0278																			

Cell: 775-200-8077

58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 <i>Pm</i> 144.913	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
90 Th 232.038	91 <i>Pa</i> 231.036	92 U 238.0289											

jprice@unr.edu

Cu



World's leading producer



Countries with 4% or more of global production

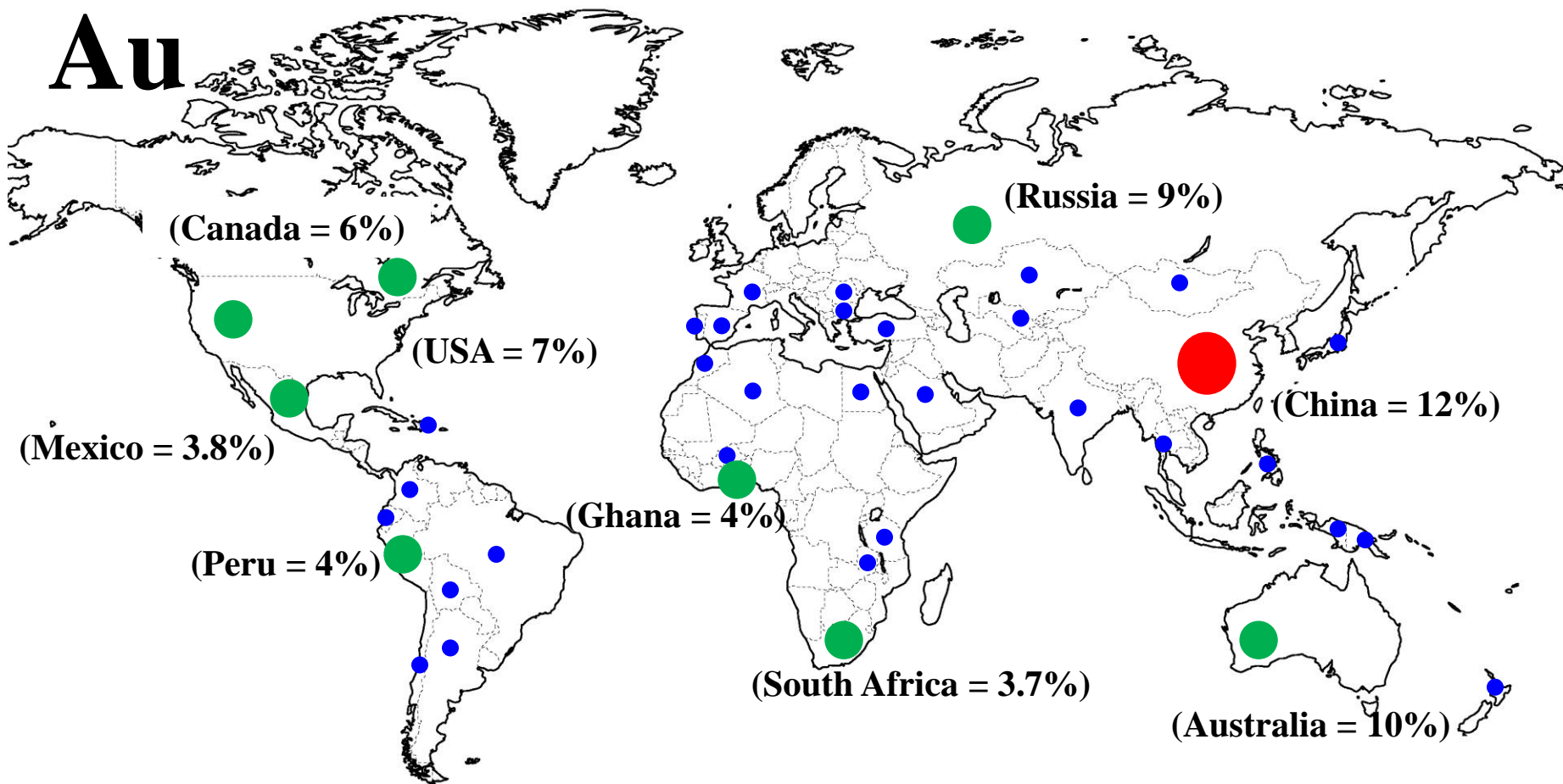


Other countries with production or major reserves

Data source: USGS

Resources are global.

Au



World's leading producer



Countries with 4% or more of global production



Other countries with production or major reserves

Data source: USGS

Resources are global, but China is Number One.