

# Managing Community Metals Poisoning in the Global Economy

International Scientific Symposium on Emerging Issues in Environmental and  
Occupational Health: Mining and Construction in Transition Economies

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# Lead Poisoning -The World's Worst are Becoming Worse

More Children at More Places are  
being More Severely Poisoned  
(Other Metals to Follow)



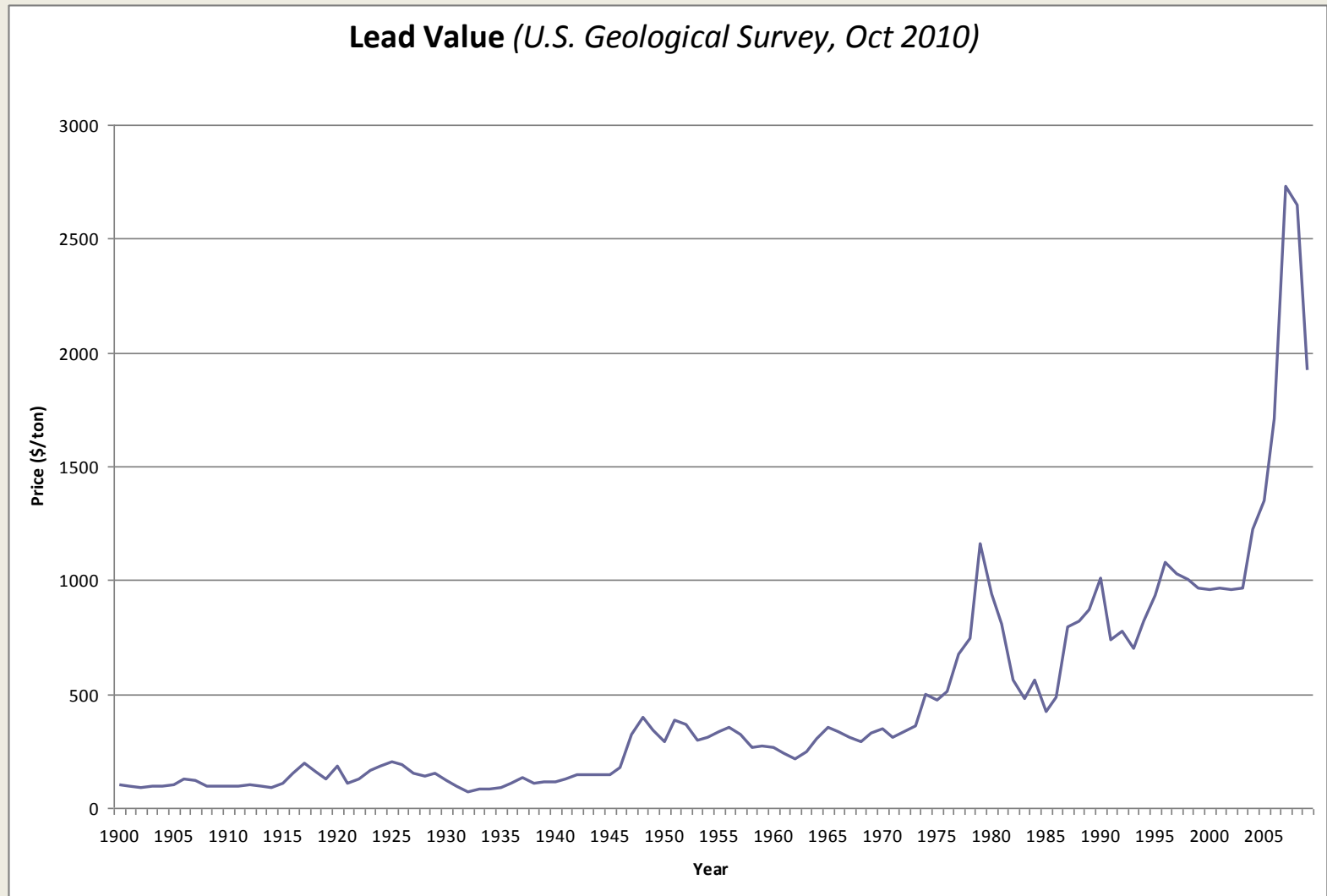


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# Price of Lead 1900-2010



# World's Worst Lead Sites 1970s

**Bunker Hill Smelter – Idaho USA 1973-75**

**Smelter Kosovo, Yugoslavia 1972-1975**

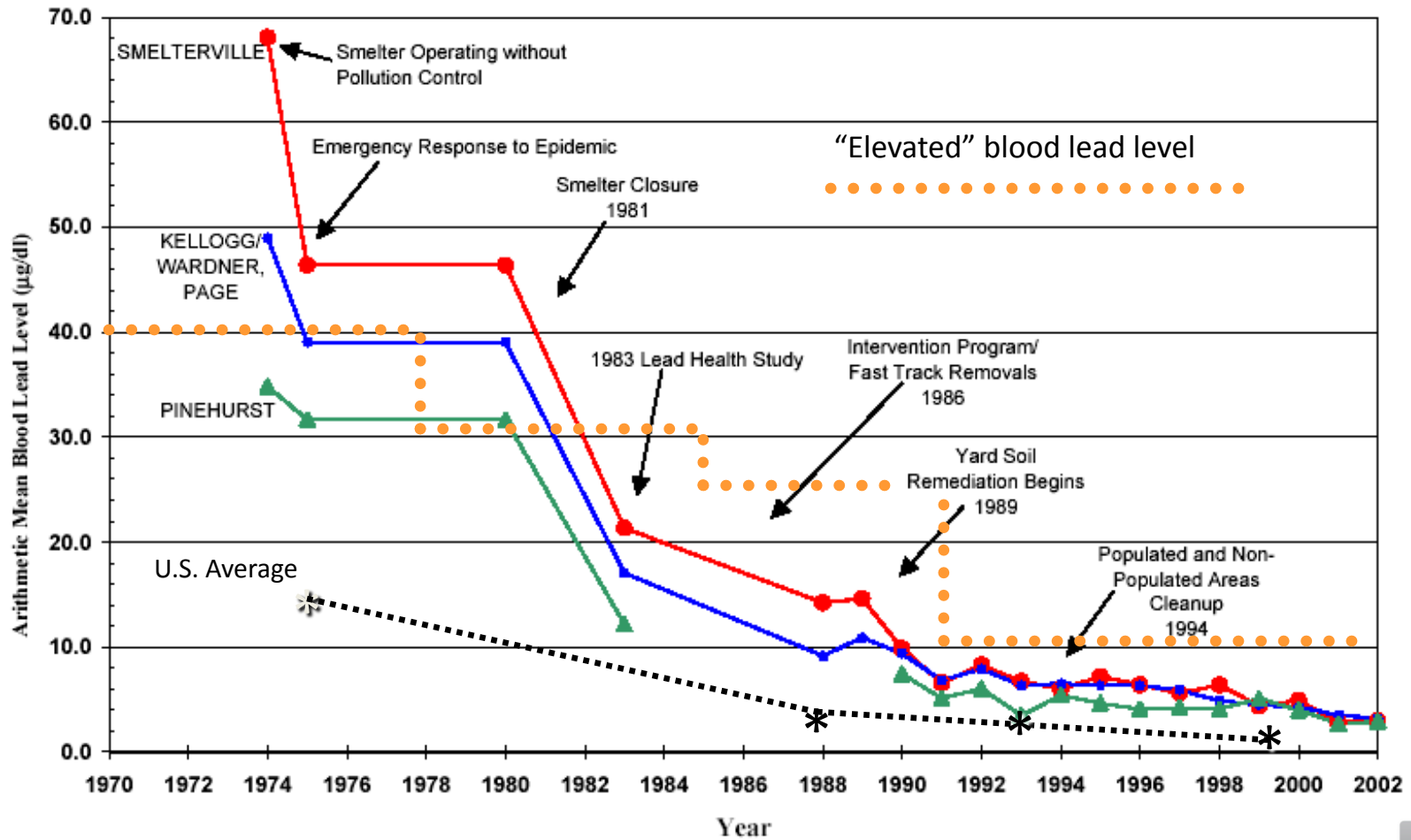
**Broken Hill Smelter – Kabwe, Zambia 1972-75**

- ❑ Thousands of children poisoned in surrounding areas
- ❑ Blood lead levels 40-200 ug/dl
- ❑ Some mortality, several comatose in Kabwe, extensive CNS / brain damage
- ❑ All coincided with high lead price in 1970's



# Bunker Hill Site Idaho US

## Mean Blood Lead Levels: 1974-2002



# Bunker Hill Smelter, Idaho US



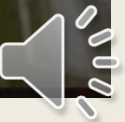
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# Kabwe, Zambia



Pollutants: lead

Type: Soil

Source: lead mine, smelter

Legacy

Cleanup effort: Early Progress



# Kabwe, Zambia



## Health

On average, childrens' blood levels in Kabwe are 5 to 10 X allowable levels



# Kabwe, Zambia



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# Kabwe, Zambia



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# Trepca Smelter, Mitrovica, Kosovo



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# Trepca Smelter, Mitrovica, Kosovo

Legacy waste and tailings piles



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# Trepca Smelter, Mitrovica, Kosovo

Contaminated residential areas near smelter



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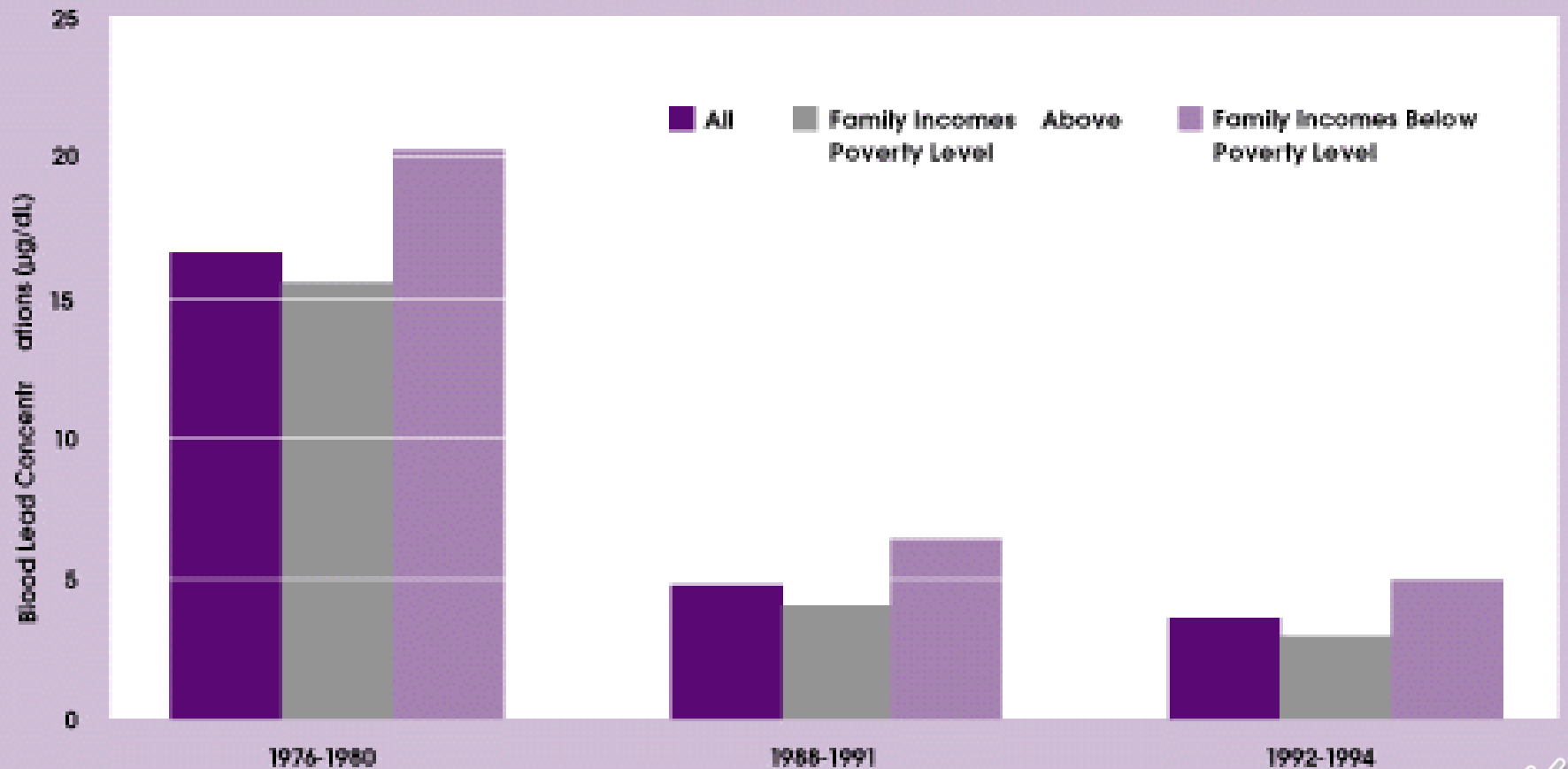
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# United States Historic Childhood Blood Lead Levels

## Measure B1

Average concentrations of lead in blood for children 5 and under



SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health and Nutrition Examination Survey.



# New World Order

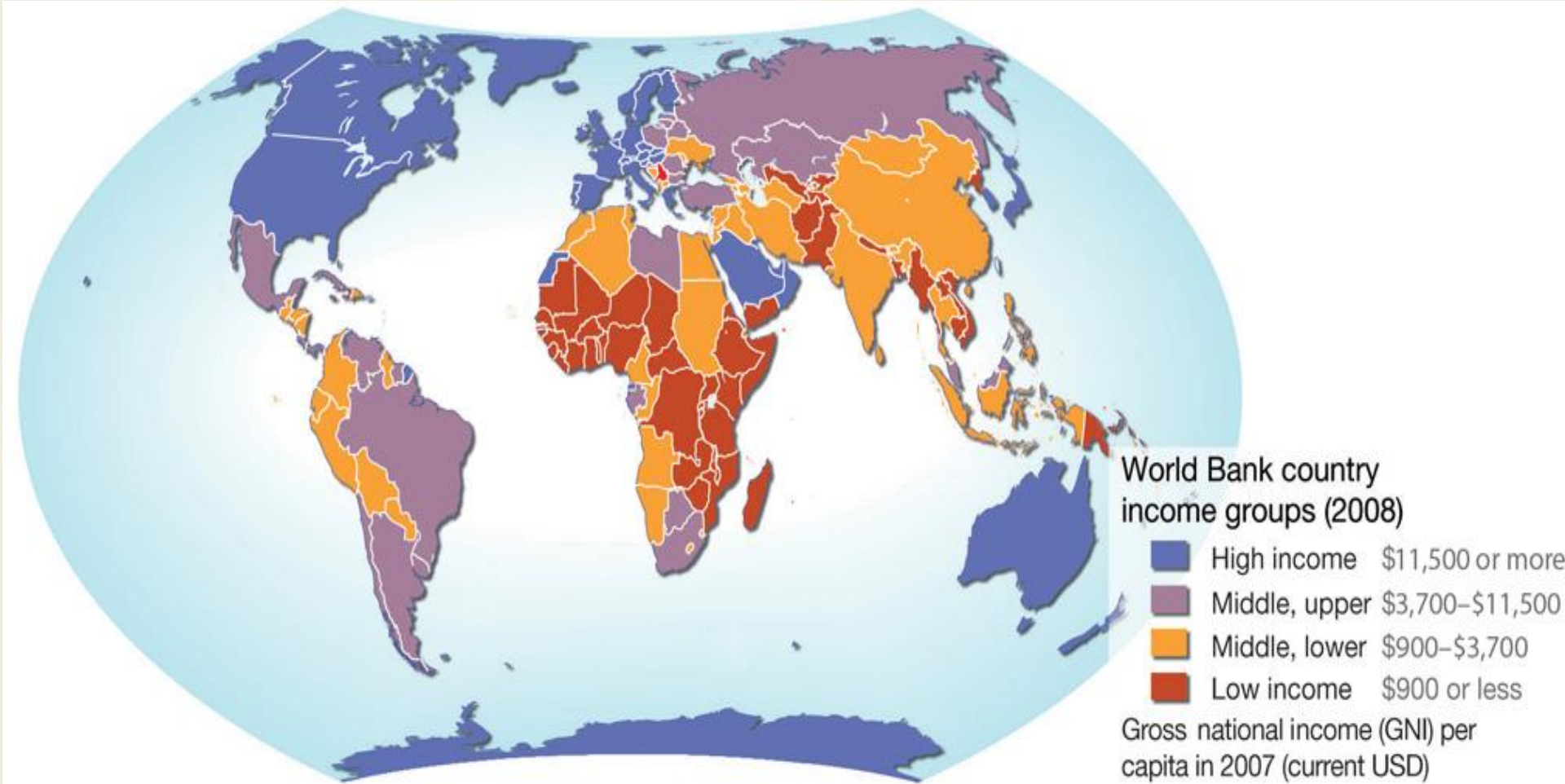
Developed Countries (High Income)

Middle Income Countries

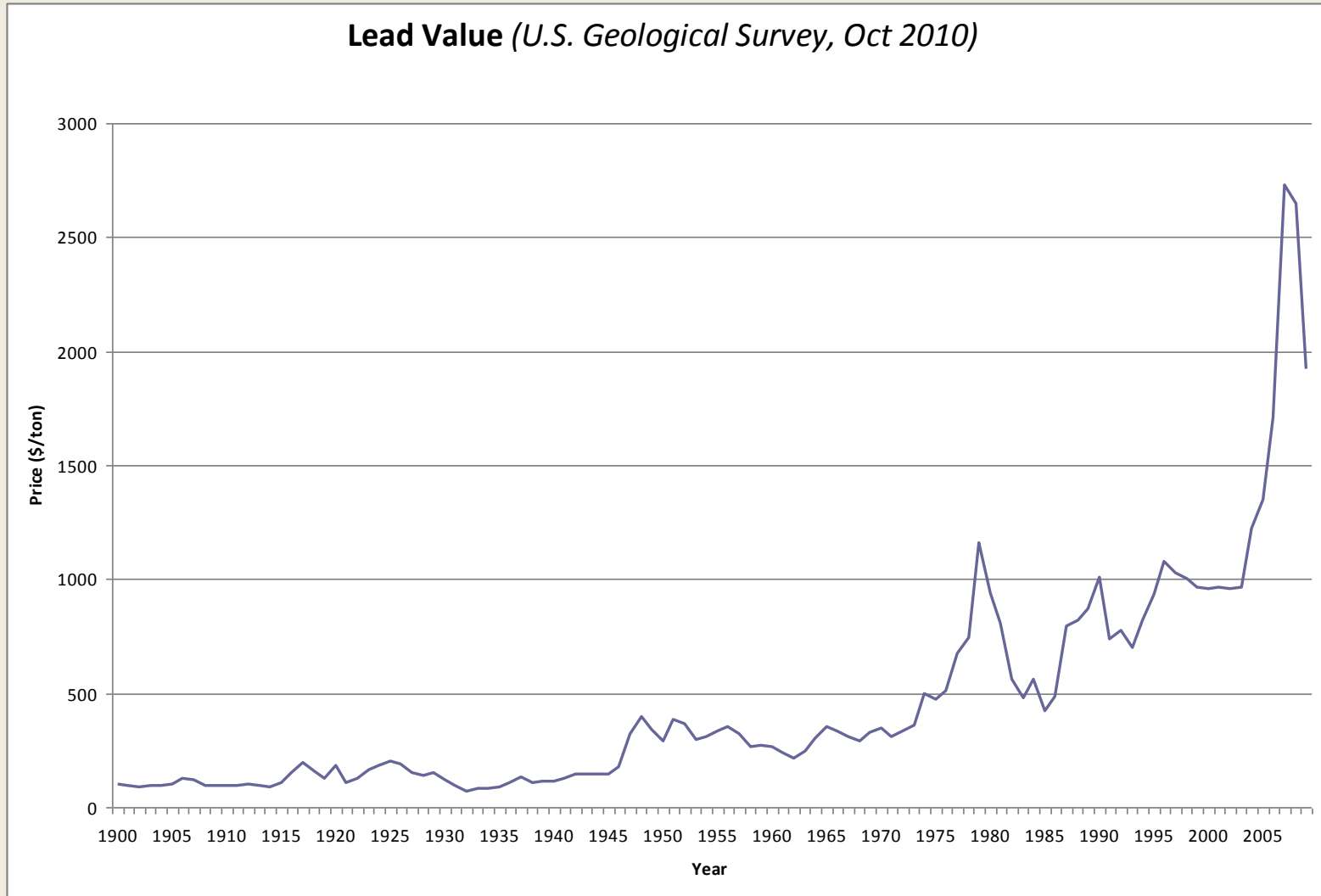
Low Income Countries (Poor)



# New World Order



# Price of Lead 1900-2010



**LEAD PRICE**  
0.94 USD/LB  
11 APR '13



**COPPER PRICE**  
3.41 USD/LB  
11 APR '13



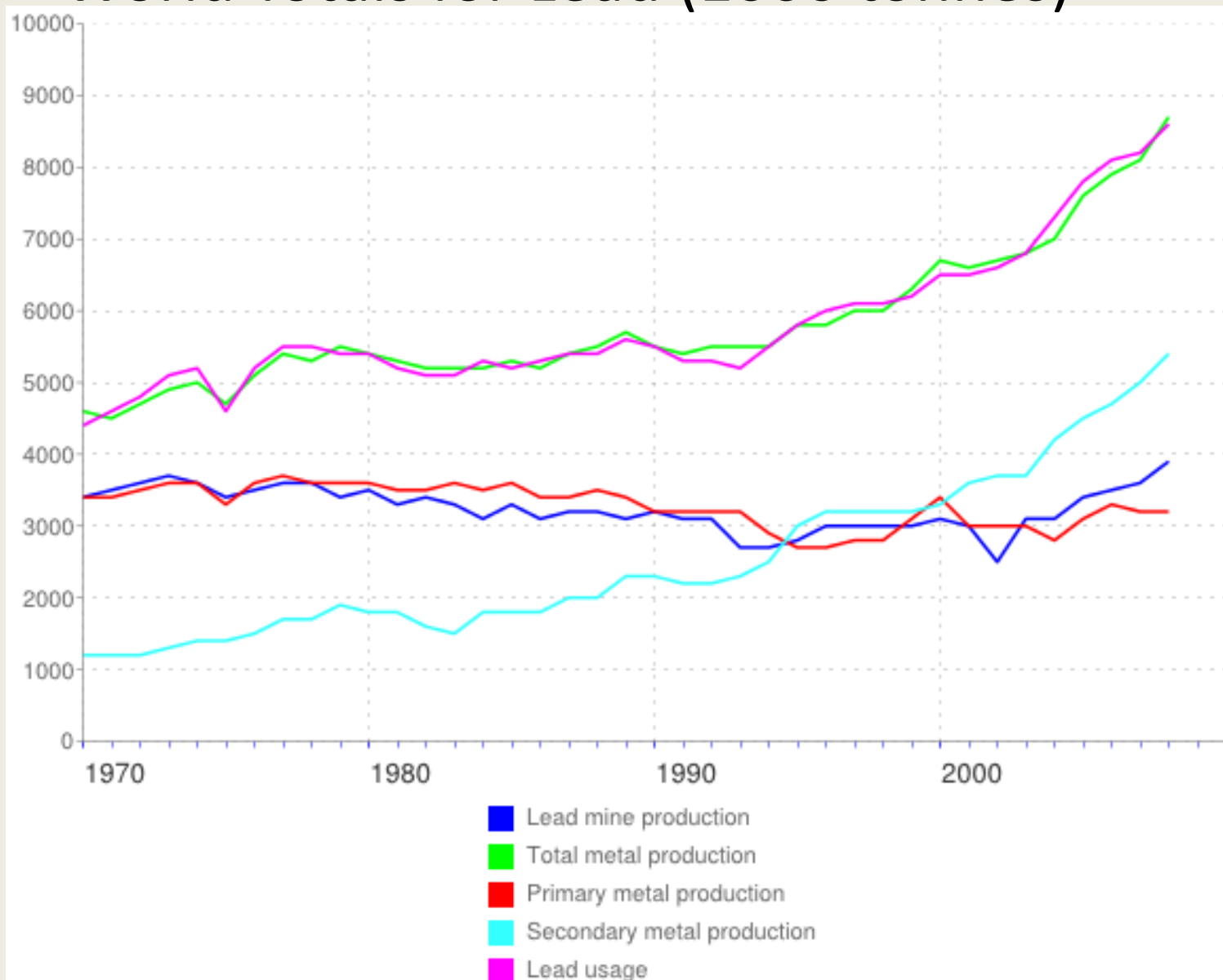
**GOLD PRICE**  
1,478.10 USD/OZ  
12 APR '13



Gold prices continue to rise



# World Totals for Lead (1000 tonnes)

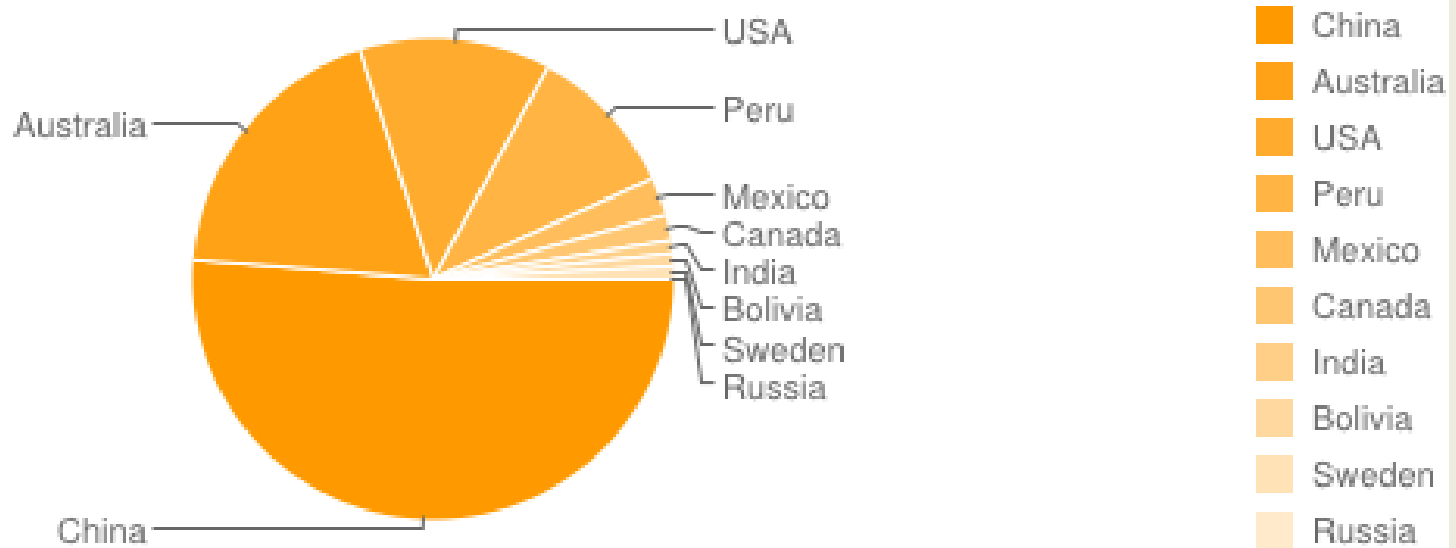


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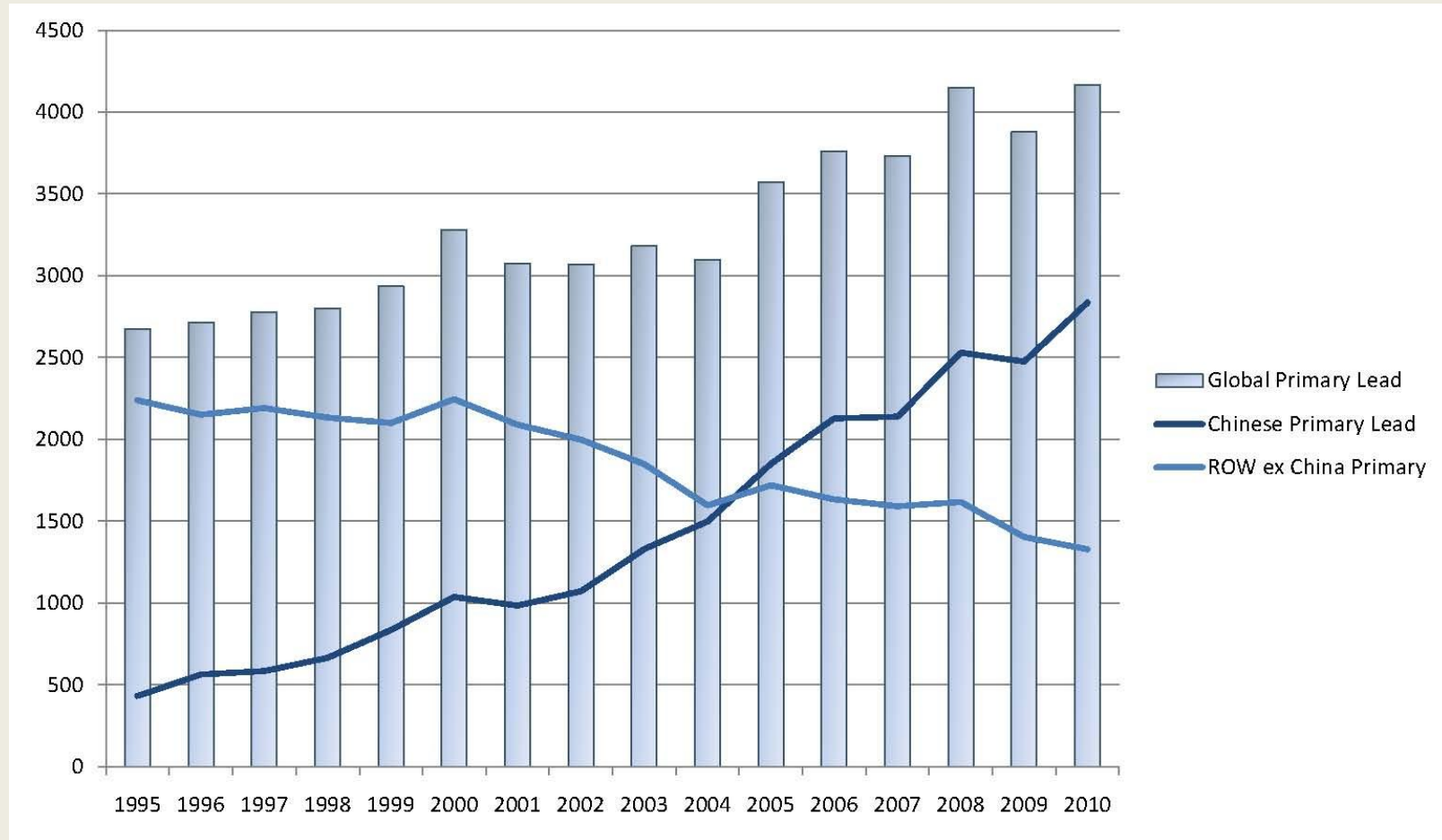


Lead mining('000 tonnes)





# Primary Lead Production by Region



ILZSG

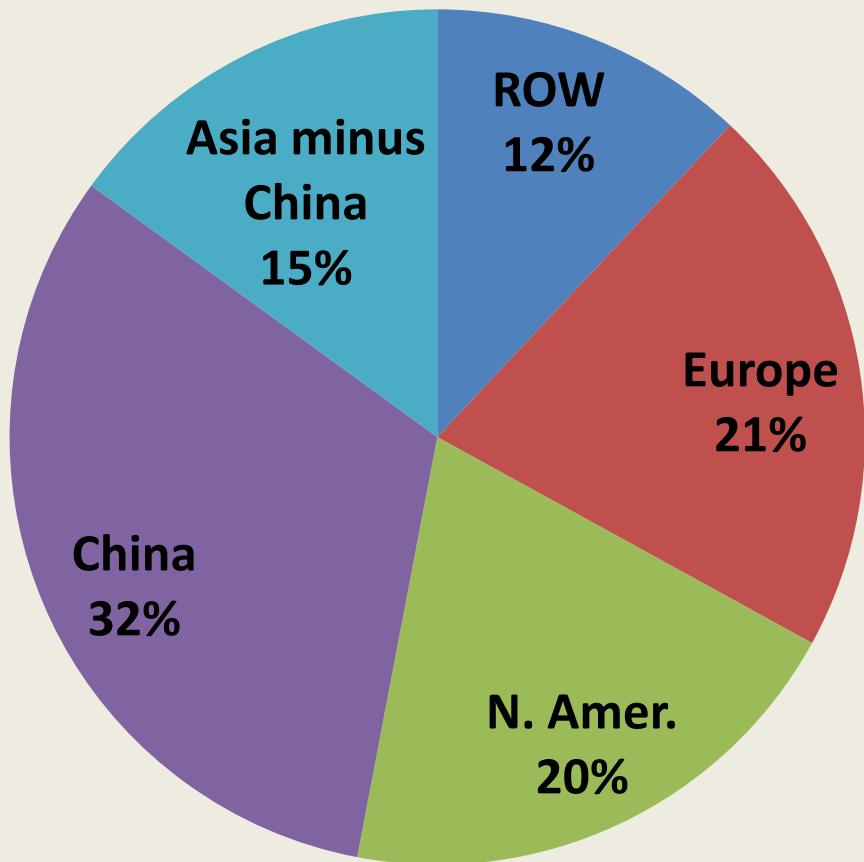
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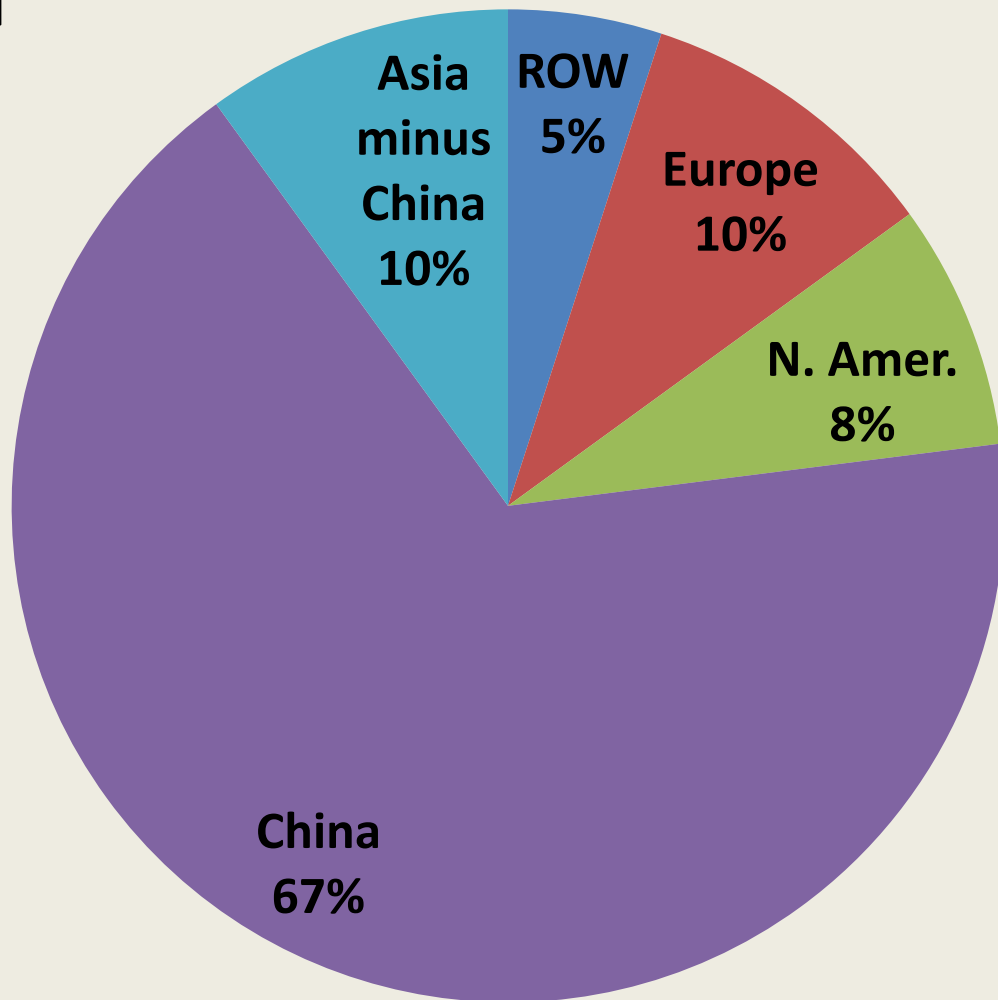


# Shift in Location of Lead Production

2



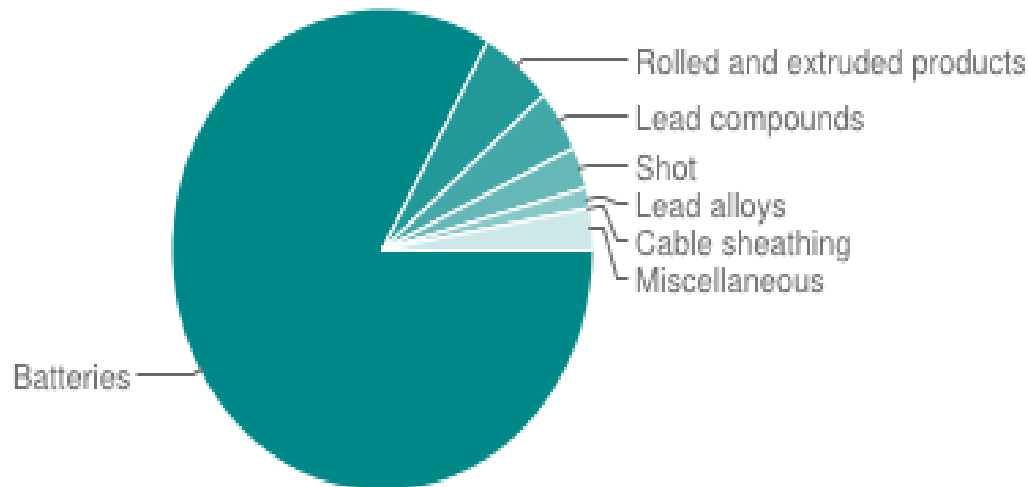
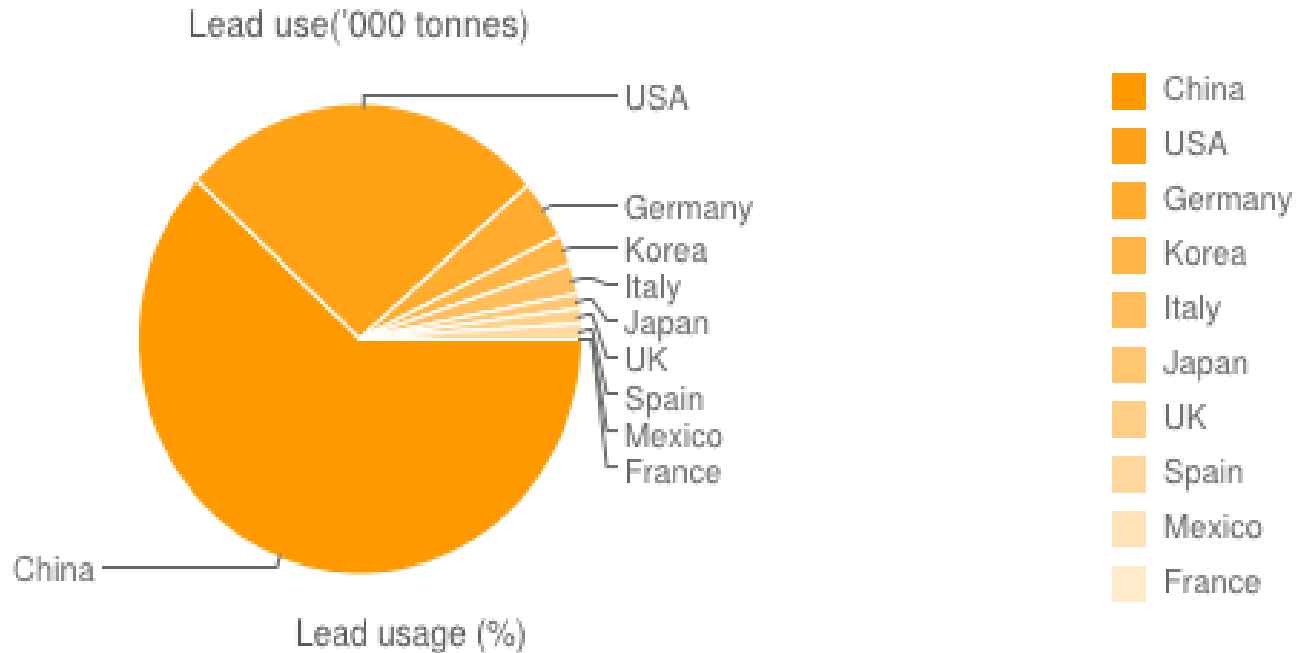
2000



2010



# Lead Consumption 2010



# Summary of Primary Lead Smelting Industry Perspective

1. Primary lead smelting has moved from the West to China
2. Primary lead demand is fueled by “new” uses -primarily vehicle growth as new vehicles need new lead
3. Lead recycling is essentially a closed loop and cannot address growth
4. Forecast mined lead output will not keep pace with new lead demand resulting in supply deficits
5. Very little new mine production is coming on-stream post 2010
6. Combination of limited lead concentrate availability and excess smelting capacity in China will increase competition for concentrates and keep TC's low
7. So will primary lead production survive in the recycling era?

Unequivocally YES!



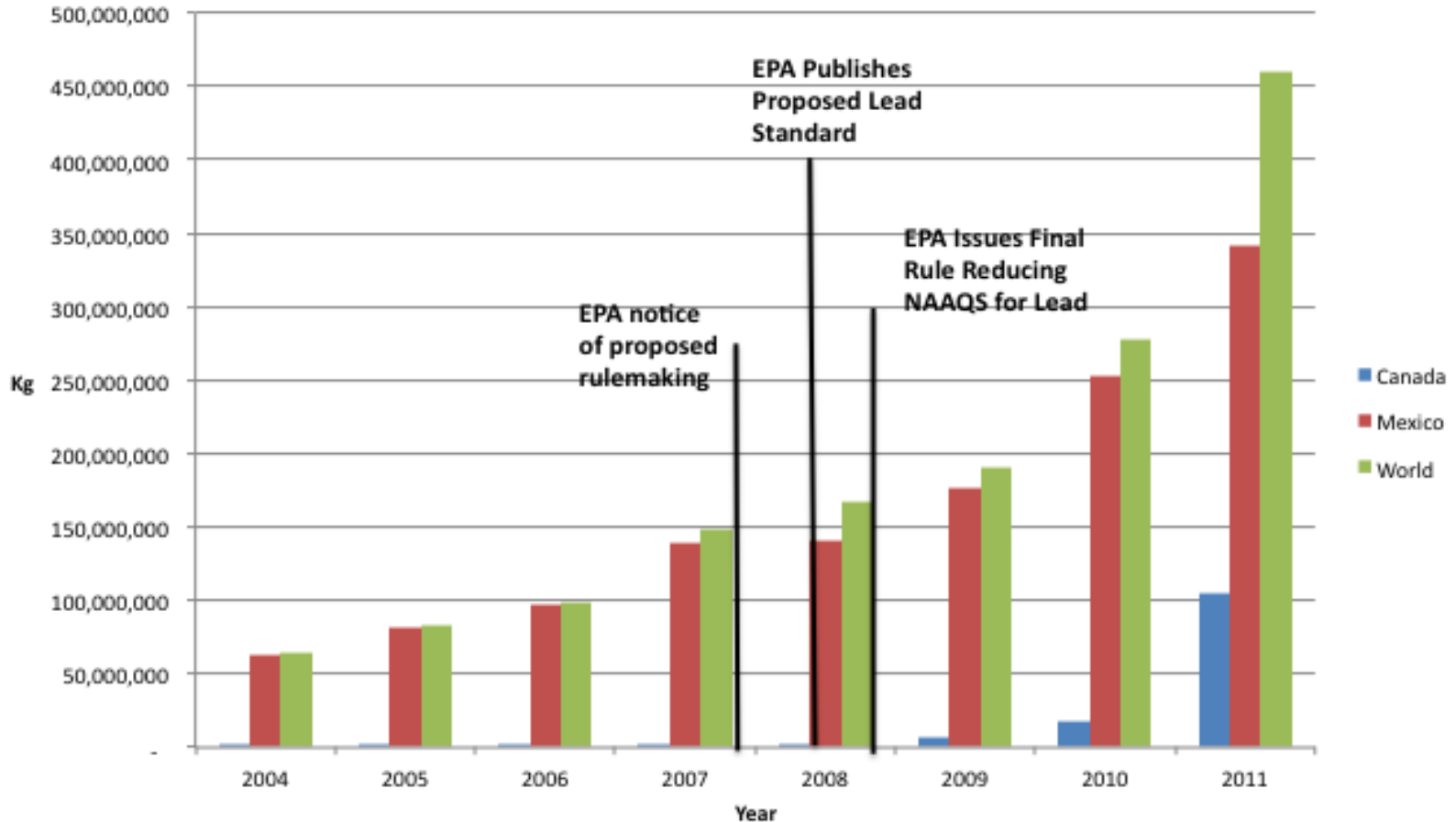
# Summary of Mining and Primary Smelting Health and Environment Perspective

- ❑ Mining – controlled in Developed Countries; varied in Middle Income countries; lax in Poor Countries
- ❑ Primary Smelting – Leaving Developed Countries; varied in Middle Income Countries; absent in Poor Countries; most in China



# Recycling and Recovery – Secondary Smelting The Formal Sector

**U.S. SLAB Exports (source: CEC “corrected” Data)**  
HT codes 8548100540 and 8548100580



# Summary of Lead Pollution / Exposure Secondary Smelting Formal Sector

- Controlled in Developed Countries leaving the US for lesser controlled Middle Income Countries
- Varied in Middle Income Countries
- Absent in Poor Countries



# Other Metals and Ores - Historic Production

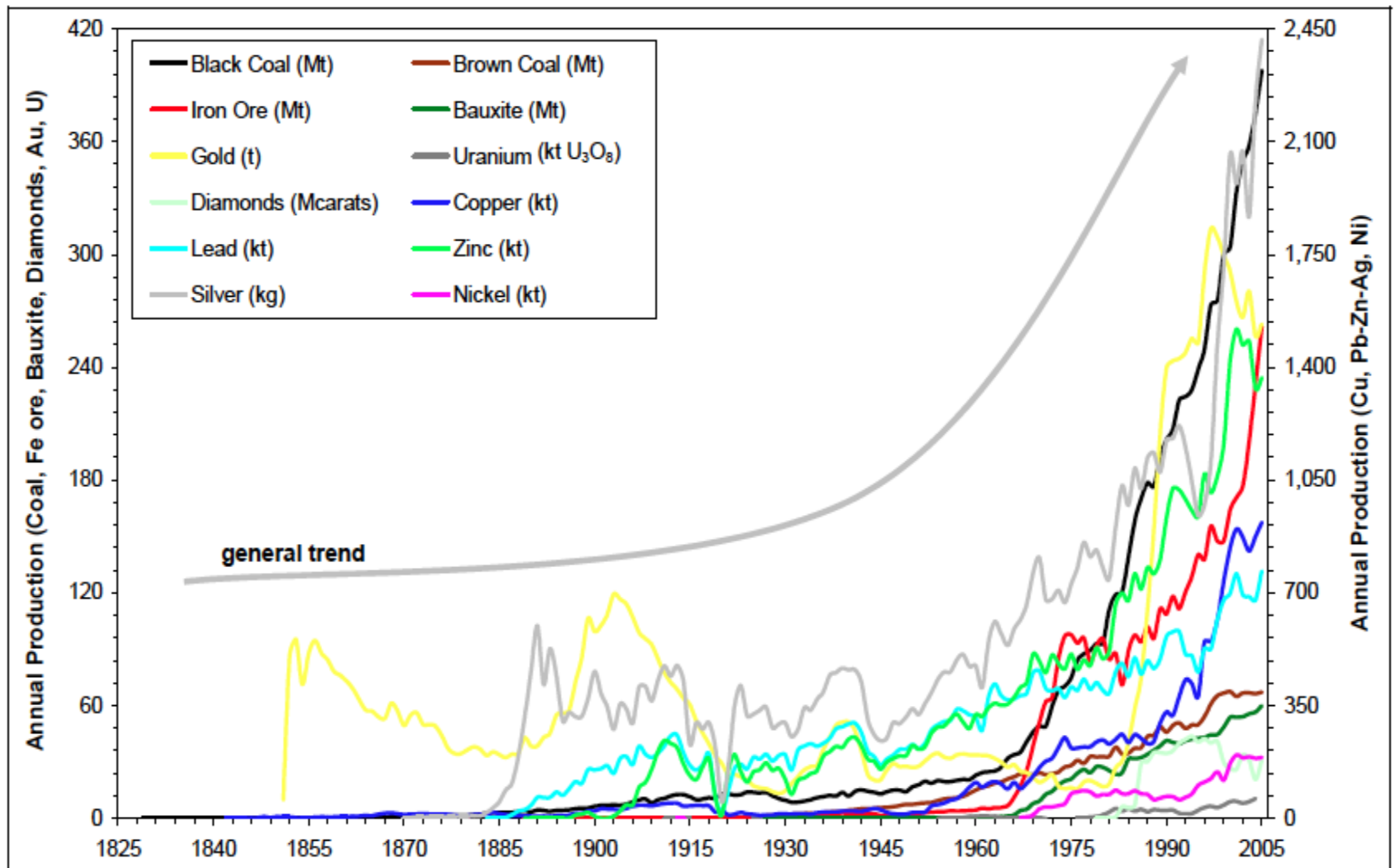
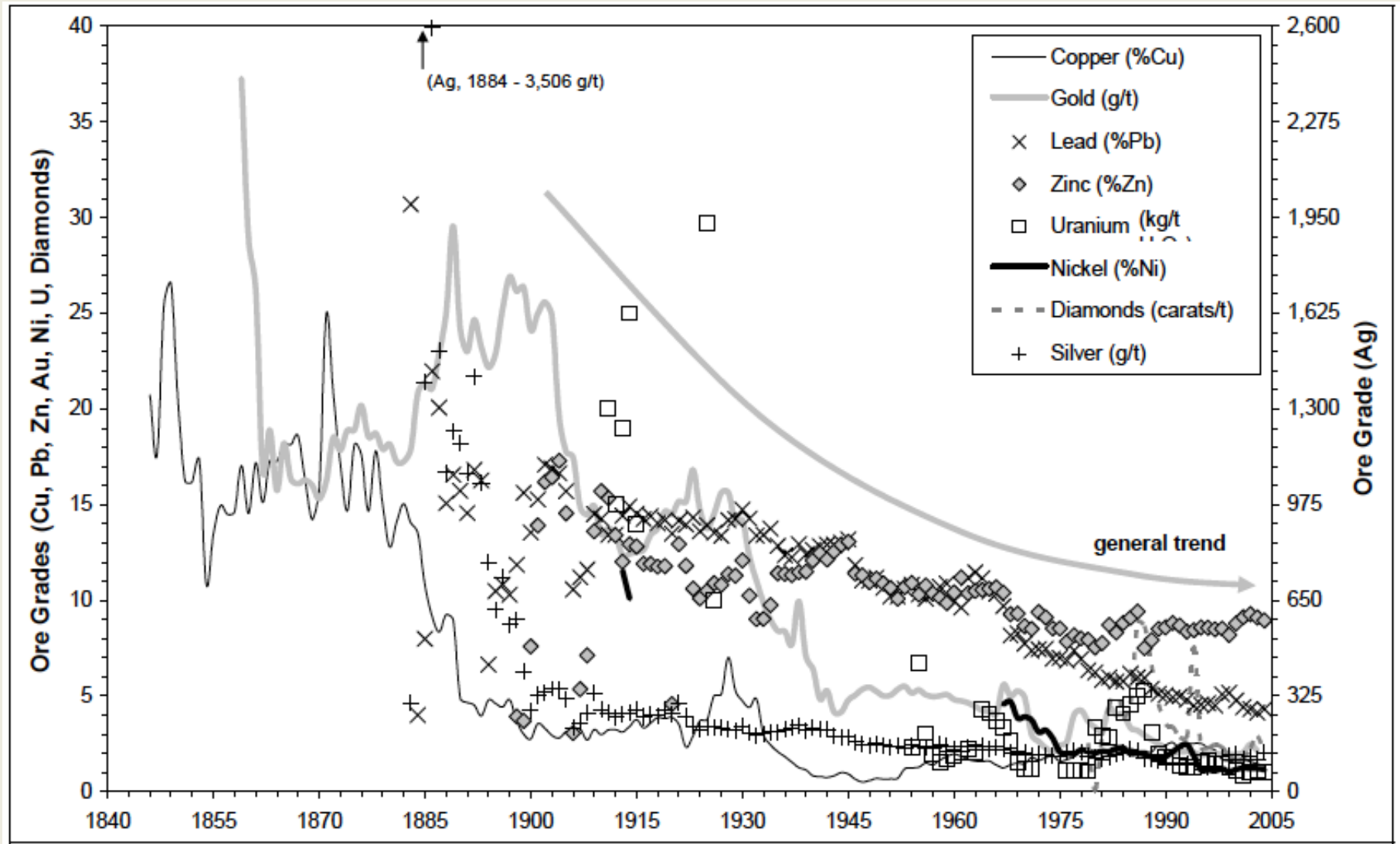


Figure 1. Historical Australian metal and mineral production (1825-2005) (Mudd. 2007d)





# Other Metals and Ores - Historic Ore Quality



# Summary of Lead Pollution / Exposure Secondary Smelting and Other Metals Recovery in the Informal Sector

- Absent in Developed Countries
- Varied in Middle Income Countries
- Rampant and Uncontrolled in Poor Countries



# Rare Earth Elements-The Next Generation

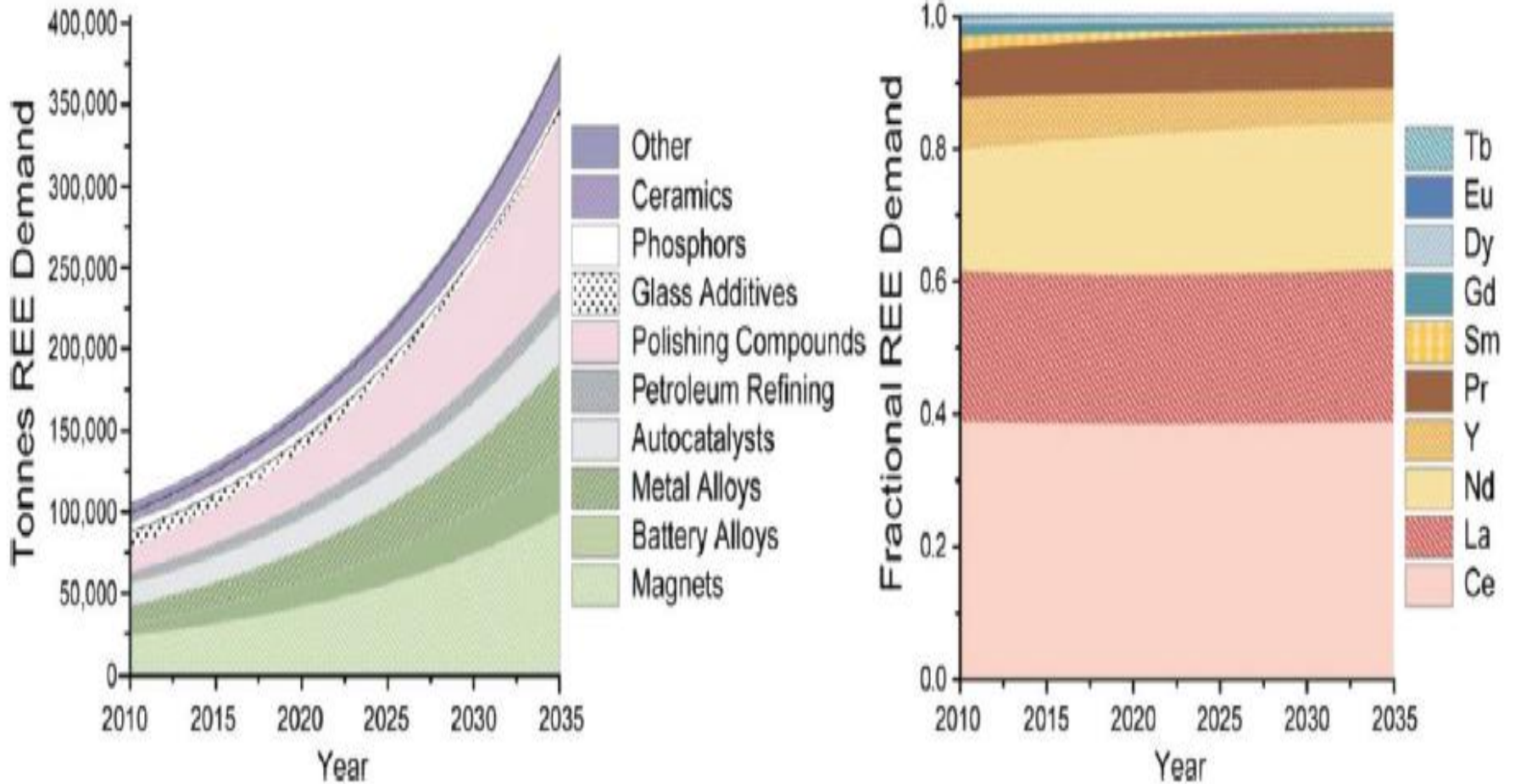
**The periodic table of elements**

1 <b>H</b> 1.008																	18 <b>He</b> 4.003	
3 <b>Li</b> 6.941	4 <b>Be</b> 9.012											5 <b>B</b> 10.811	6 <b>C</b> 12.011	7 <b>N</b> 14.007	8 <b>O</b> 15.999	9 <b>F</b> 18.998	10 <b>Ne</b> 20.180	
11 <b>Na</b> 22.990	12 <b>Mg</b> 24.305											13 <b>Al</b> 26.981	14 <b>Si</b> 28.086	15 <b>P</b> 30.974	16 <b>S</b> 32.065	17 <b>Cl</b> 35.453	18 <b>Ar</b> 39.948	
19 <b>K</b> 39.098	20 <b>Ca</b> 40.078	21 <b>Sc</b> 44.956	22 <b>Ti</b> 47.867	23 <b>V</b> 50.942	24 <b>Cr</b> 51.996	25 <b>Mn</b> 54.938	26 <b>Fe</b> 55.845	27 <b>Co</b> 58.933	28 <b>Ni</b> 58.693	29 <b>Cu</b> 63.546	30 <b>Zn</b> 65.409	31 <b>Ga</b> 69.723	32 <b>Ge</b> 72.641	33 <b>As</b> 74.922	34 <b>Se</b> 78.963	35 <b>Br</b> 79.904	36 <b>Kr</b> 83.798	
37 <b>Rb</b> 85.468	38 <b>Sr</b> 87.621	39 <b>Y</b> 88.906	40 <b>Zr</b> 91.224	41 <b>Nb</b> 92.906	42 <b>Mo</b> 95.942	43 <b>Tc</b> [98]	44 <b>Ru</b> 101.072	45 <b>Rh</b> 102.906	46 <b>Pd</b> 106.421	47 <b>Ag</b> 107.868	48 <b>Cd</b> 112.412	49 <b>In</b> 114.818	50 <b>Sn</b> 118.711	51 <b>Sb</b> 121.760	52 <b>Te</b> 127.603	53 <b>I</b> 126.904	54 <b>Xe</b> 131.293	
55 <b>Cs</b> 132.905	56 <b>Ba</b> 137.327	57-71	72 <b>Hf</b> 178.492	73 <b>Ta</b> 180.948	74 <b>W</b> 183.841	75 <b>Re</b> 186.207	76 <b>Os</b> 190.233	77 <b>Ir</b> 192.217	78 <b>Pt</b> 195.084	79 <b>Au</b> 196.966	80 <b>Hg</b> 200.592	81 <b>Tl</b> 204.383	82 <b>Pb</b> 207.21	83 <b>Bi</b> 208.980	84 <b>Po</b> [209]	85 <b>At</b> [210]	86 <b>Rn</b> [222]	
87 <b>Fr</b> [223]	88 <b>Ra</b> [226]	89-103	104 <b>Rf</b> [261]	105 <b>Db</b> [262]	106 <b>Sg</b> [266]	107 <b>Bh</b> [264]	108 <b>Hs</b> [277]	109 <b>Mt</b> [268]	110 <b>Ds</b> [271]	111 <b>Rg</b> [272]								
<b>Lanthanoids</b>		57 <b>La</b> 138.905	58 <b>Ce</b> 140.116	59 <b>Pr</b> 140.908	60 <b>Nd</b> 144.242	61 <b>Pm</b> [145]	62 <b>Sm</b> 150.362	63 <b>Eu</b> 151.964	64 <b>Gd</b> 157.253	65 <b>Tb</b> 158.925	66 <b>Dy</b> 162.500	67 <b>Ho</b> 164.930	68 <b>Er</b> 167.259	69 <b>Tm</b> 168.934	70 <b>Yb</b> 173.043	71 <b>Lu</b> 174.967		
<b>Actinoids</b>		89 <b>Ac</b> [227]	90 <b>Th</b> 232.038	91 <b>Pa</b> 231.036	92 <b>U</b> 238.029	93 <b>Np</b> [237]	94 <b>Pu</b> [244]	95 <b>Am</b> [243]	96 <b>Cm</b> [247]	97 <b>Bk</b> [247]	98 <b>Cf</b> [251]	99 <b>Es</b> [252]	100 <b>Fm</b> [257]	101 <b>Md</b> [258]	102 <b>No</b> [259]	103 <b>Lr</b> [262]		

Sources: IUPAC, TMR



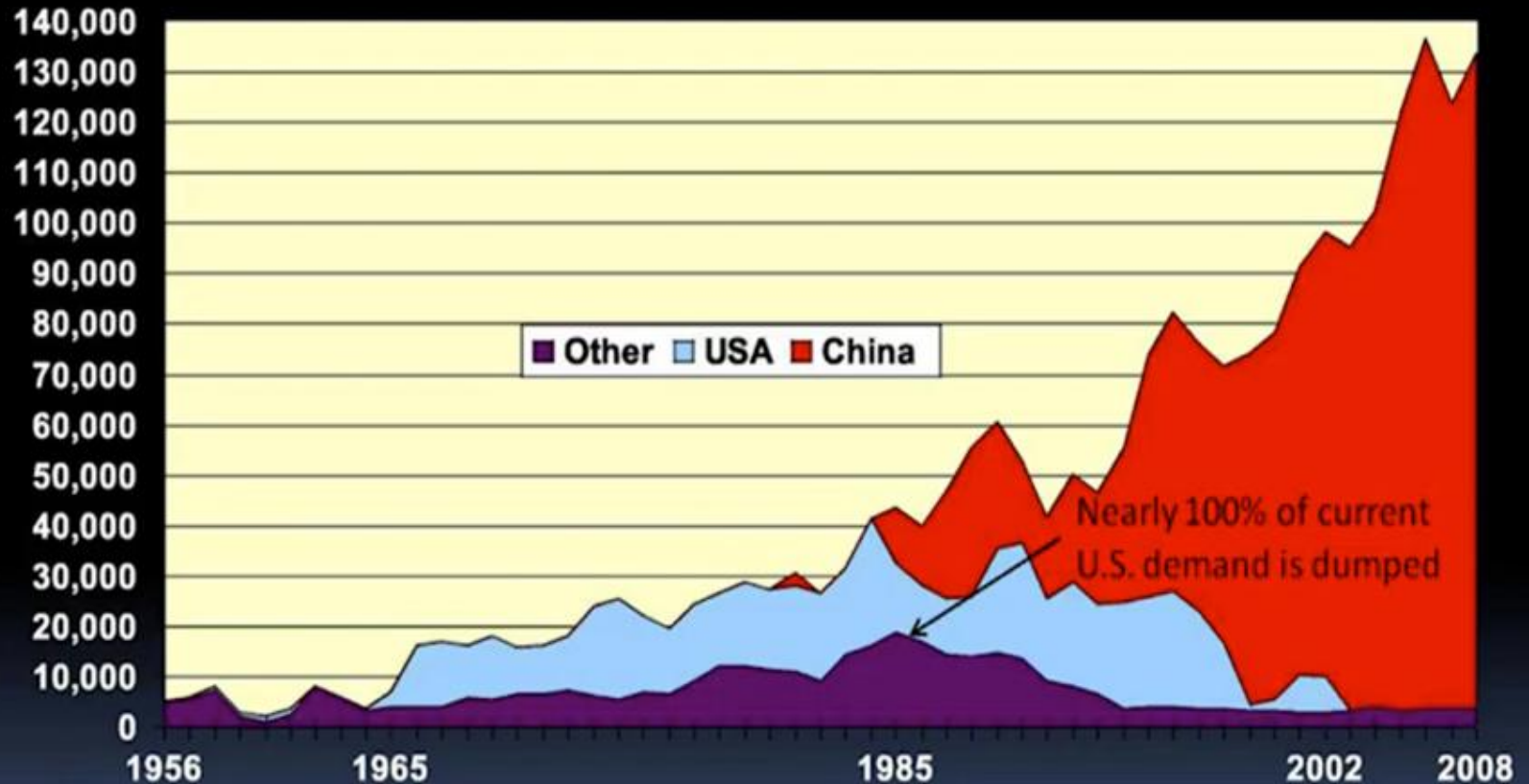
# Uses and Demands for Rare Earth Elements



by Gordon Haxel, Greta Orris, and James Hedrick, updated by Hedrick

Nearly all REE came from the heavy Mineral Sands mining industry as a Monazite byproduct.

In 1985 the Mineral Sands industry was producing over 10,000 tpy of REEs as a byproduct



# Conclusions

- ❑ Mineral Exploitation will Continue at an Exponential Rate
- ❑ Lower Grade Ores and Wastes will become more Valuable
- ❑ Developed Countries are Exporting their Pollution
- ❑ Middle Income Countries are Incentivized to Lower Standards to Attract Business
- ❑ Poor Countries are Desperate to Undertake Severe and Dangerous Practices to Mine and Recover Wastes



# Economic Incentives

- ❑ Developed Countries
  - Export the Pollution Problems
  - Hope that Product Prices Don't Increase
- ❑ Middle Income Countries
  - Compromise Standards to Compete for Business
  - Adopt Lower Standards to Decrease Costs
- ❑ Poor Income Countries
  - Desperate for Any Income
  - No Standards and Corruption



# Last Word

- ❑ The Prognosis is for Evermore Horrific Mining and Informal Recycling Related Environmental Health Catastrophes in Poor Countries
- ❑ Middle Income Countries will Face Increasing Pressure to Compromise their Health, Environment and Worker Protection to Attract Mineral Processing Business
- ❑ Developed Countries will Export their Environmental Health Problems to Avoid Compliance Costs and Lower Commodity Prices







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Soil and Dust in Compounds  
Contaminated Food, Water  
Mining / Processing Waste





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