THE RARE EARTH CRISIS – HOW IT IMPACTS YOU!

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QUIZ

How many rare earth items did you handle or observe this morning since you got up and came to this Lions Club meeting?

None?

One?

Two?

Three?

Four or More?

THE RARE EARTH ELEMENTS IMPACT EVERYONE

Many times a day

They can't be avoided,

except by

packing up a sleeping bag

heading for the deep woods or a cave in the desert

But don't bring your cell phone or lighter flint

As a consumer the largest rare earth containing product (or contains a product derived by using rare earths) you will purchase is the automobile

PRODUCTS

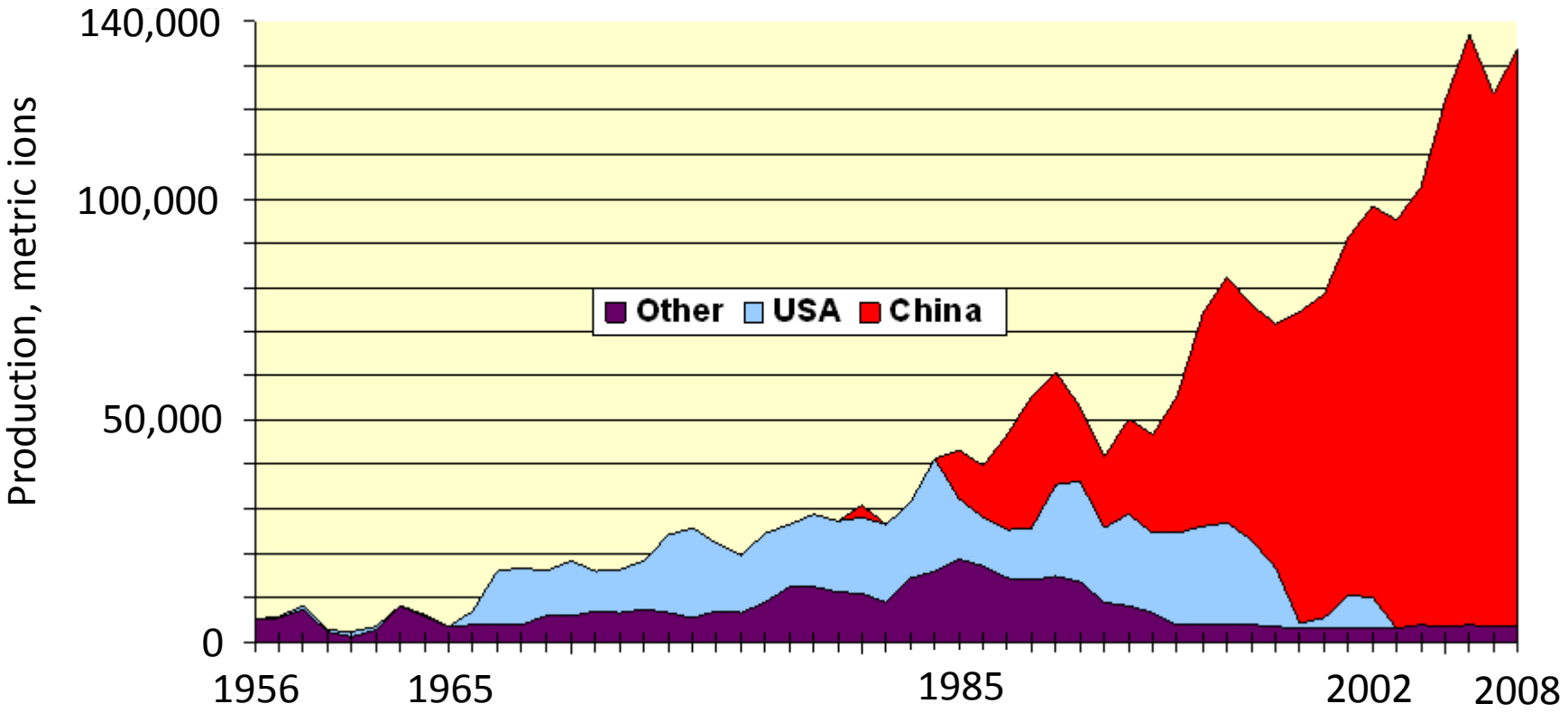
Electric motors (~35 in an average car) [Nd,Pr,Dy]
Speakers for sound system [Nd,Pr,Dy]
Sensors to measure and control oxygen content in burning the fuel (lean/rich mixture) [Y]
3-way catalytic converter [Ce]
Optical displays – phosphors [Y,Eu,Tb]

Ni-metal-hydride battery [Hybrid Vehicles] [La,Mischmetal]
Electric traction motor [Hybrid Vehicles] [Nd,Dy]

DERIVED PRODUCTS

Gasoline – FCC cracking catalysts [La,Ce,mixed REO]
Windshield, mirrors – polishing [Ce]

REE PRODUCTION TRENDS



Monazite-placer era | **Mountain Pass era** | **Chinese era → ?**

Source: USGS Fact Sheet 087-02 updated with recent USGS Minerals Yearbook

In 2010 China produced (mined) 97% of the rare earths utilized in commerce

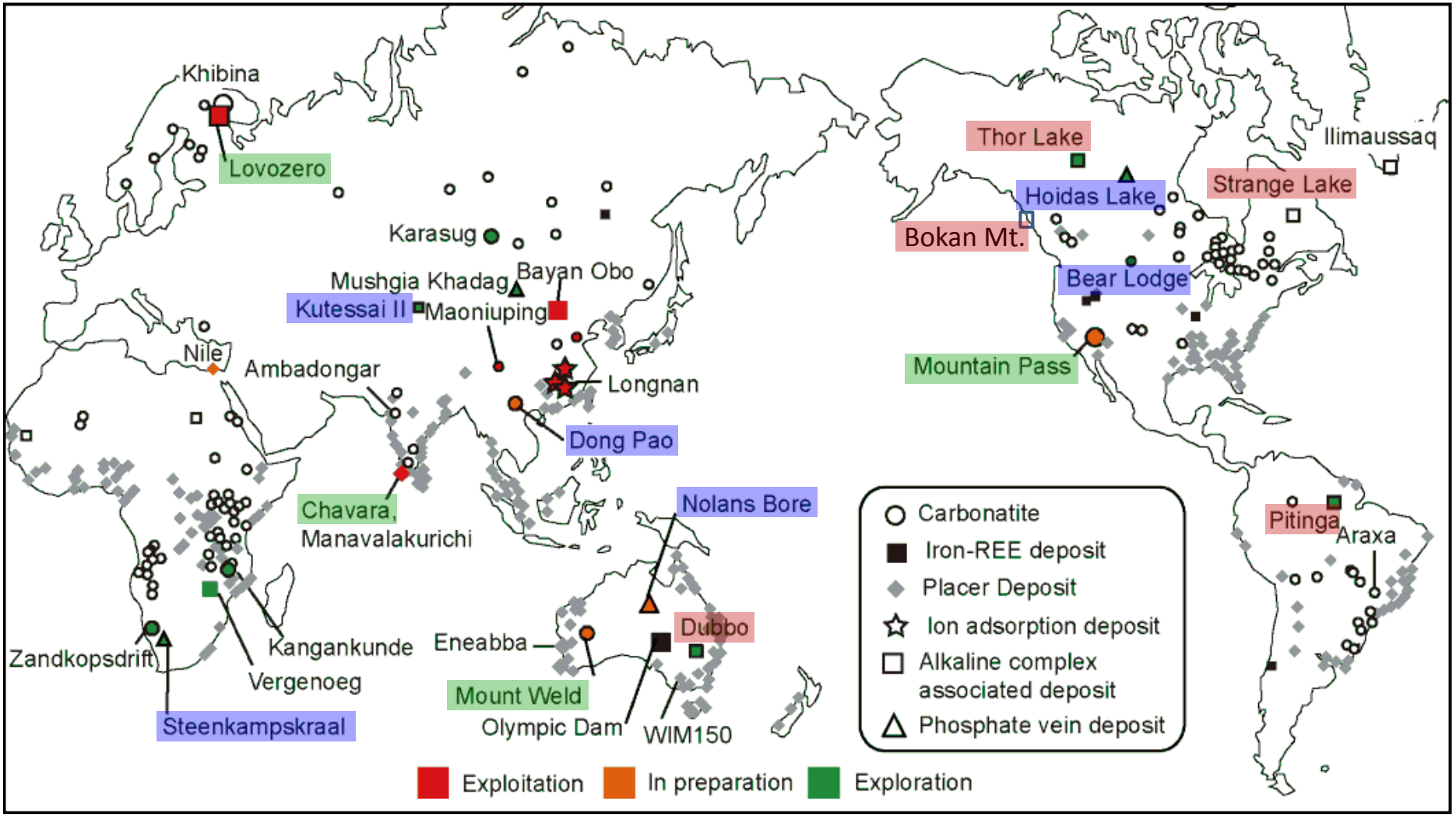
RESERVES
(in percent)

Country	1980[a]	1992	2010
Australia	3	6.1	6.0
China	70[a]	51.3	30.9[b]
India	4	2.7	1.3
CIS	2	0.5	21.8
Malaysia	--	<1	<1
USA	20	15.0	14.9
Other	1	24.4	25.2
Total (M metric tons)	26	84	88

[a]In 1970 it was 75%.

[b]The actual tonnage of the known Chinese reserves increased by almost 300% from 1980 to 2010.

ORE SOURCES AND MINING OPERATIONS



Operational in 2011/12

Operational by 2015/16 (HRE)

Operational by 2015/16 (LRE)

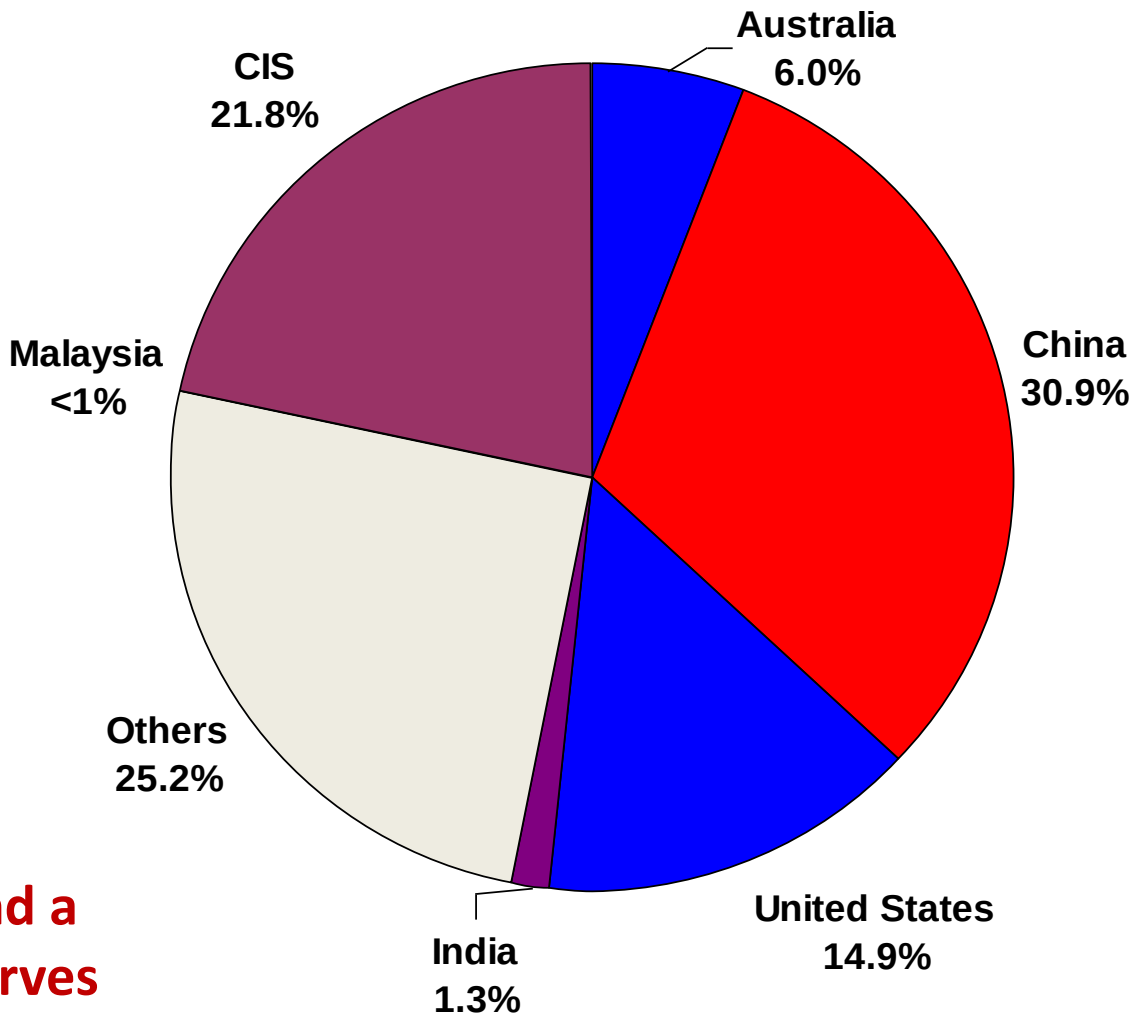
REE MINERAL RESERVES

88 million metric tons of contained rare-earth oxide (REO)

Enough rare earths for >700 years at current production levels

Enough rare earths for ~69 years at a 10% growth rate per annum

Enough rare earths For ~75 years at a 10% growth rate and a 1% increase of reserves per annum

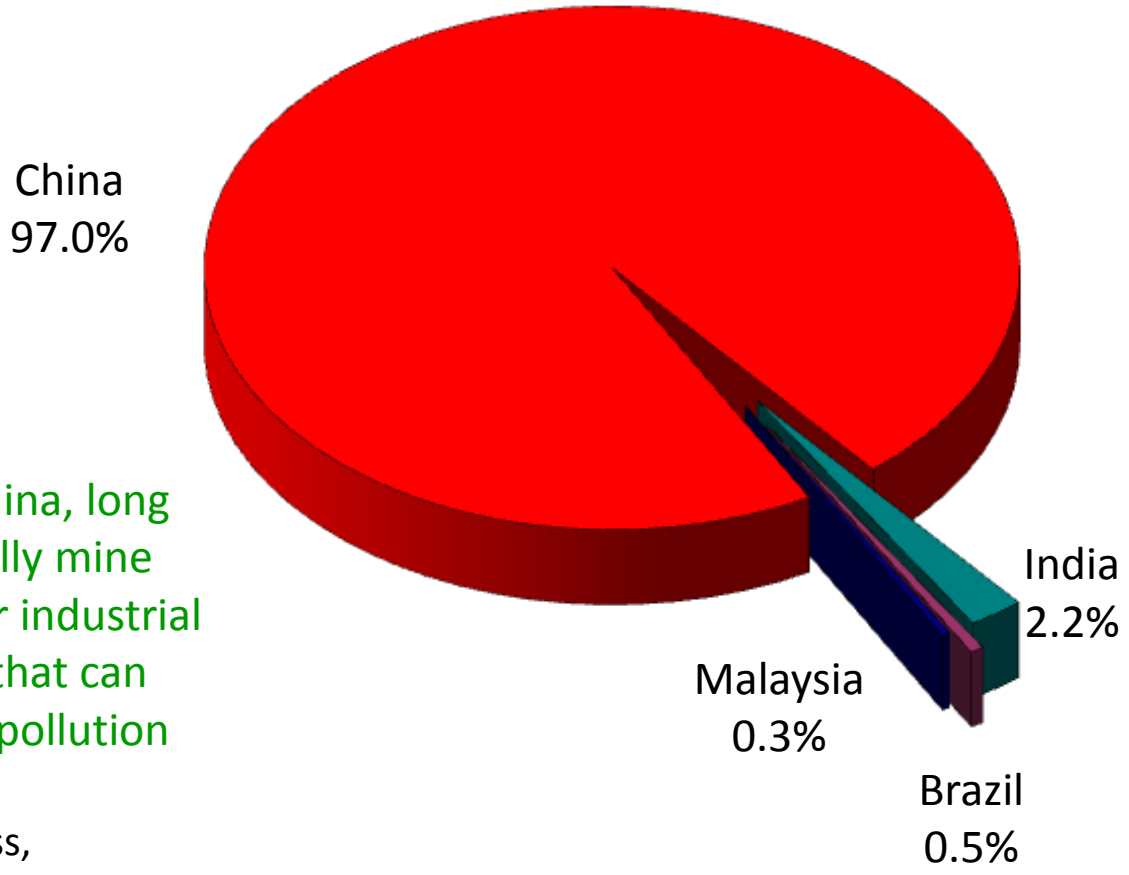


REE WORLD MINERAL PRODUCTION IN 2010

DEMAND: 124,000 metric tons of contained rare-earth oxide (REO)

PRODUCTION: 130,000 metric tons of contained rare-earth oxide (REO)

Black market: 10 to 15% of reported production, mostly smuggled out of China*



*". . . This region of southern China, long plagued by gangsters who illegally mine some of the worlds sought-after industrial metals. The gangs reap profits that can rival drug money, while leaving pollution and violence in their wake."

The New York Times, Global Business, Dec. 30, 2010

China: RE Export Transition

- 1970s: Rare earth mineral concentrates.
- 1980s: Mixed rare earth chemical concentrates.
- Early1990s: Separated rare earth oxides and metals.
- Late 1990s: Magnets, phosphors, polishing powders.
- 2000s: Electric motors, computers, batteries, LCDs, mobile phones.

PROBLEMS FOR USA

Military Security

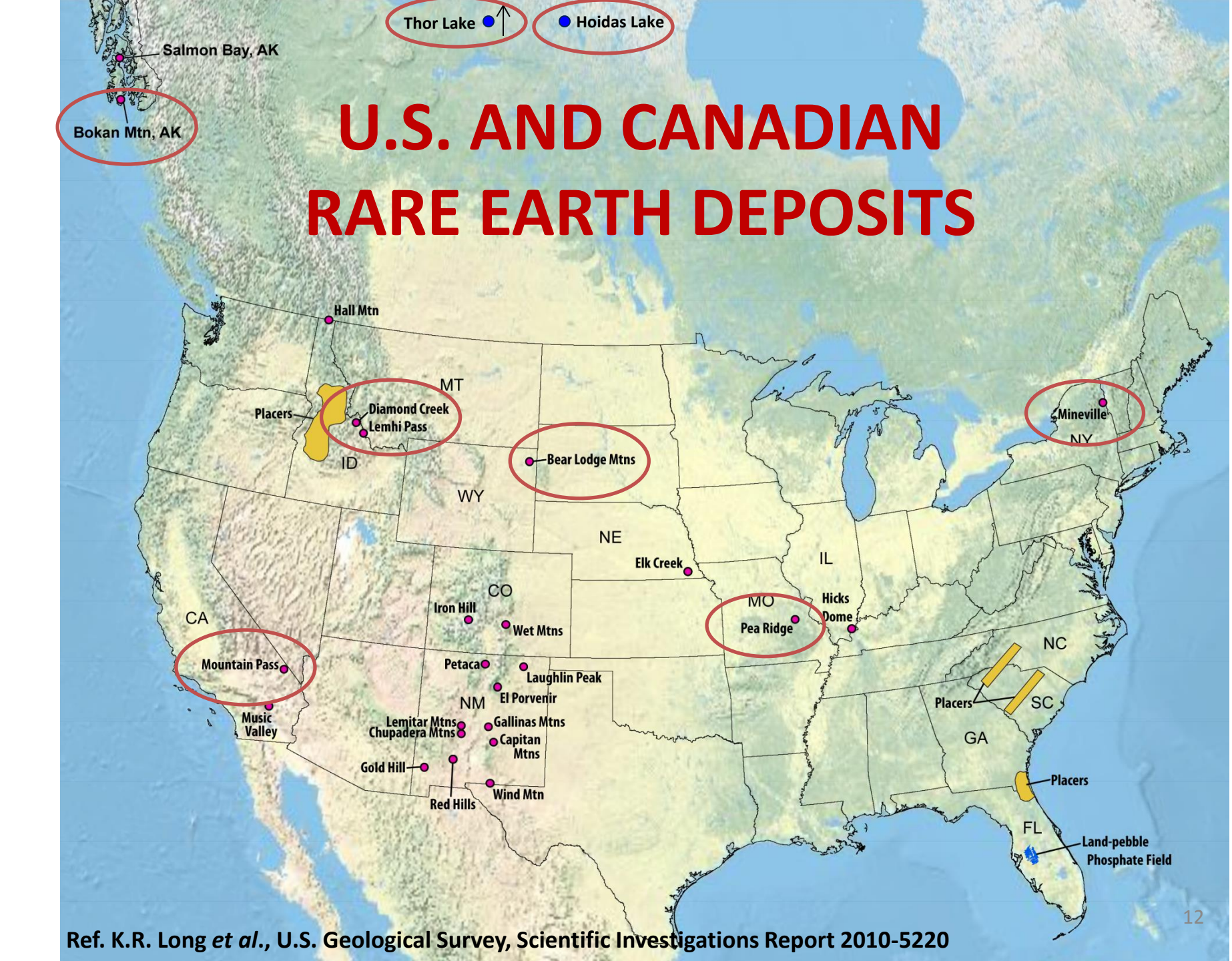
All US weapon systems depend on rare earths – especially $Nd_2Fe_{14}B$ permanent magnets in electric motors, computers, guidance systems

Energy Security

Electric motors and batteries, wind turbines, petroleum refining, optical displays, fluorescent lighting, oxygen and electrical sensors (automotive engines)

U.S. Teenager; Yourself

i-pods, cell phones, TVs, automobiles (gasoline, catalytic converters)



Ref. K.R. Long *et al.*, U.S. Geological Survey, Scientific Investigations Report 2010-5220

SUBSTITUTION

NO SUCH LUCK

People have been looking

- Eu – red color in TV; used for ~50 years – yet no substitute
- Nd – permanent magnets; used for ~27 years – yet no substitute
- Sm – permanent magnets; used for over 30 years – yet no substitute
- Ce – 3-way catalytic converters (automotive exhaust), used for ~30 years – yet no substitute
- Mixed REO FCC catalysts – used for ~47 years (Half-life of a new catalyst is ~5 years) – yet no substitute

RARE EARTH CRISIS – WHERE DO WE STAND TODAY

Part 1: The mining portion is basically solved, just needs time: Molycorp has been mining for nearly one year (since January 2, 2011).

Will mine ~6,000 tons in 2011; 20,000 tons in 2012 and 40,000 tons in 2013.

Lynas started mining on May 14, 2011

Mound Weld, Australia

TODAY America's Crisis is basically parts 2 and 3

PARTS 2 AND 3 OF AMERICA'S (Rest of World's) CRISIS

Rebuilding of rare earth industry, especially beyond mining

- Smaller mining companies – may need assistance
- Loan guarantees to help businesses, manufacturers (parts 2a and 2b) get started
- Tax incentives (federal, state, local)
- This is critical for the military: who would build devices, supply parts for devices in a time of national crisis?

Education and training

- Need to rebuild and then continuously resupply intellectual capital

HOW DOES THE RARE EARTH CRISIS IMPACT YOU DIRECTLY

TODAY

Not at all – you can buy the things you need and desire.

THREE YEARS FROM NOW (2015)

Probably not much different from today; prices may be higher but at the rate of inflation (rare earth generally do not have a big impact on the price of a commodity).

SHOULD WE BE CONCERNED – YES

Military Security

Energy Security

Employment in companies producing high tech products

This is seriously lacking today