

## SPEAKERS

**Joe Gambogi**

U.S. Geological Survey

U.S. Department of the Interior  
U.S. Geological Survey



## **Market Update for Rare Earths**

# **2013 USGS Congressional Briefing Series December 13, 2013**

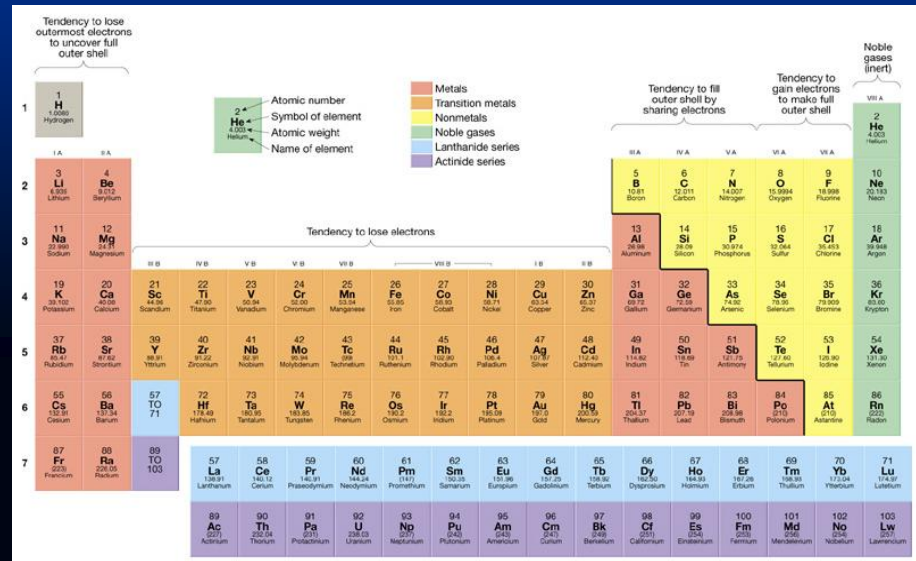
**Joseph Gambogi**  
**Rare Earth Commodity Specialist**  
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# Rare Earths — the Lanthanide Series, Scandium, and Yttrium

|  | Atomic # | Symbol | Name     |
|--|----------|--------|----------|
|  | 21       | Sc     | Scandium |

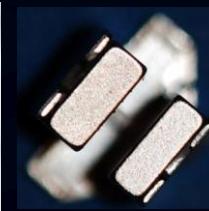
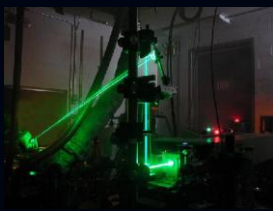
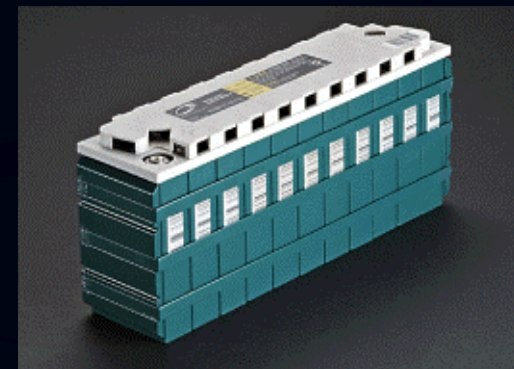
|                           |    |    |              |
|---------------------------|----|----|--------------|
| Light Rare Earth Elements | 57 | La | Lanthanum    |
|                           | 58 | Ce | Cerium       |
|                           | 59 | Pr | Praseodymium |
|                           | 60 | Nd | Neodymium    |
|                           | 61 | Pm | Promethium   |
|                           | 62 | Sm | Samarium     |
|                           | 63 | Eu | Europium     |
| Heavy Rare Earth Elements | 64 | Gd | Gadolinium   |
|                           | 65 | Tb | Terbium      |
|                           | 66 | Dy | Dysprosium   |
|                           | 67 | Ho | Holmium      |
|                           | 68 | Er | Erbium       |
|                           | 69 | Tm | Thulium      |
|                           | 70 | Yb | Ytterbium    |
|                           | 71 | Lu | Lutetium     |
|                           | 39 | Y  | Yttrium      |



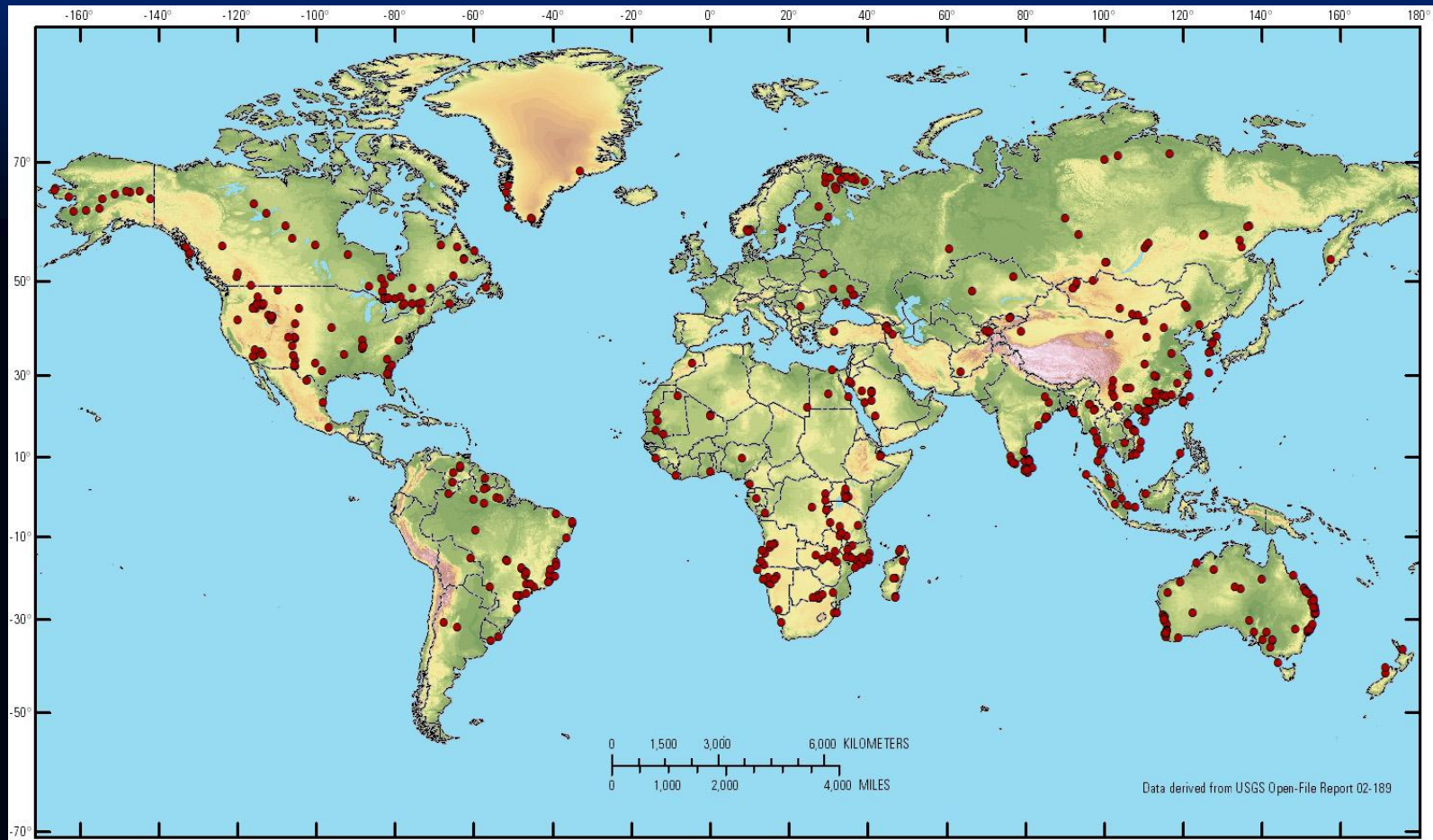


# Uses

- Catalysts: Ce, La, Nd
- Metallurgical
  - Alloys
  - Batteries: La, Ce, Nd, Pr
- Magnets: Nd, Pr, Sm, Dy, Tb
- Polishing: Ce, La, Nd
- Other
  - Ceramics: Y
  - Phosphors: Eu, Y, Tb
  - Electronics
  - Fiber optics and lasers: Er, Y, Nd, Yb, Tm, Pr, Ho
  - Glass additives: Ce, La, Nd, Er
  - Neutron absorption: Nd

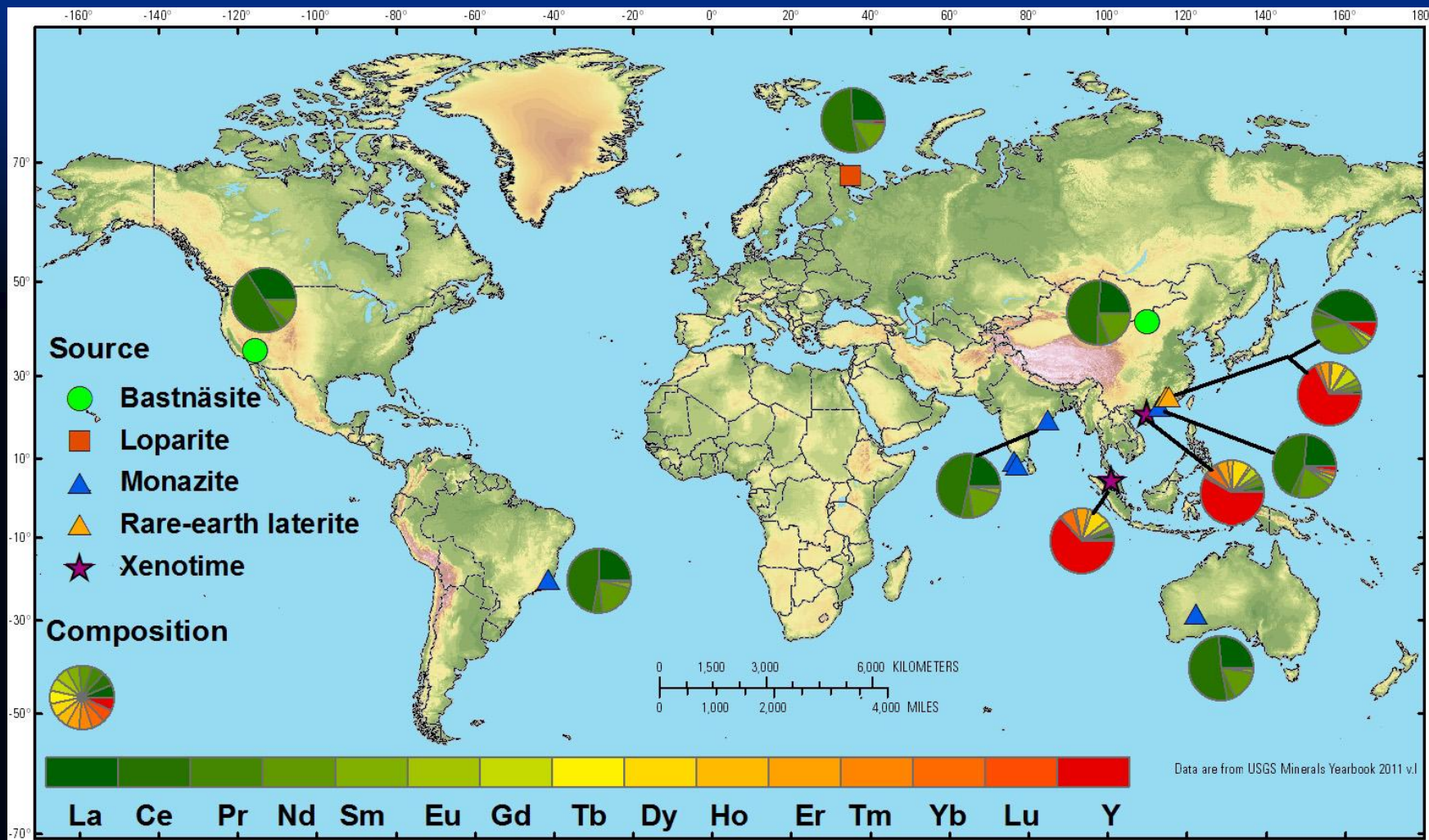


# Global Rare-Earth Deposits and Occurrences

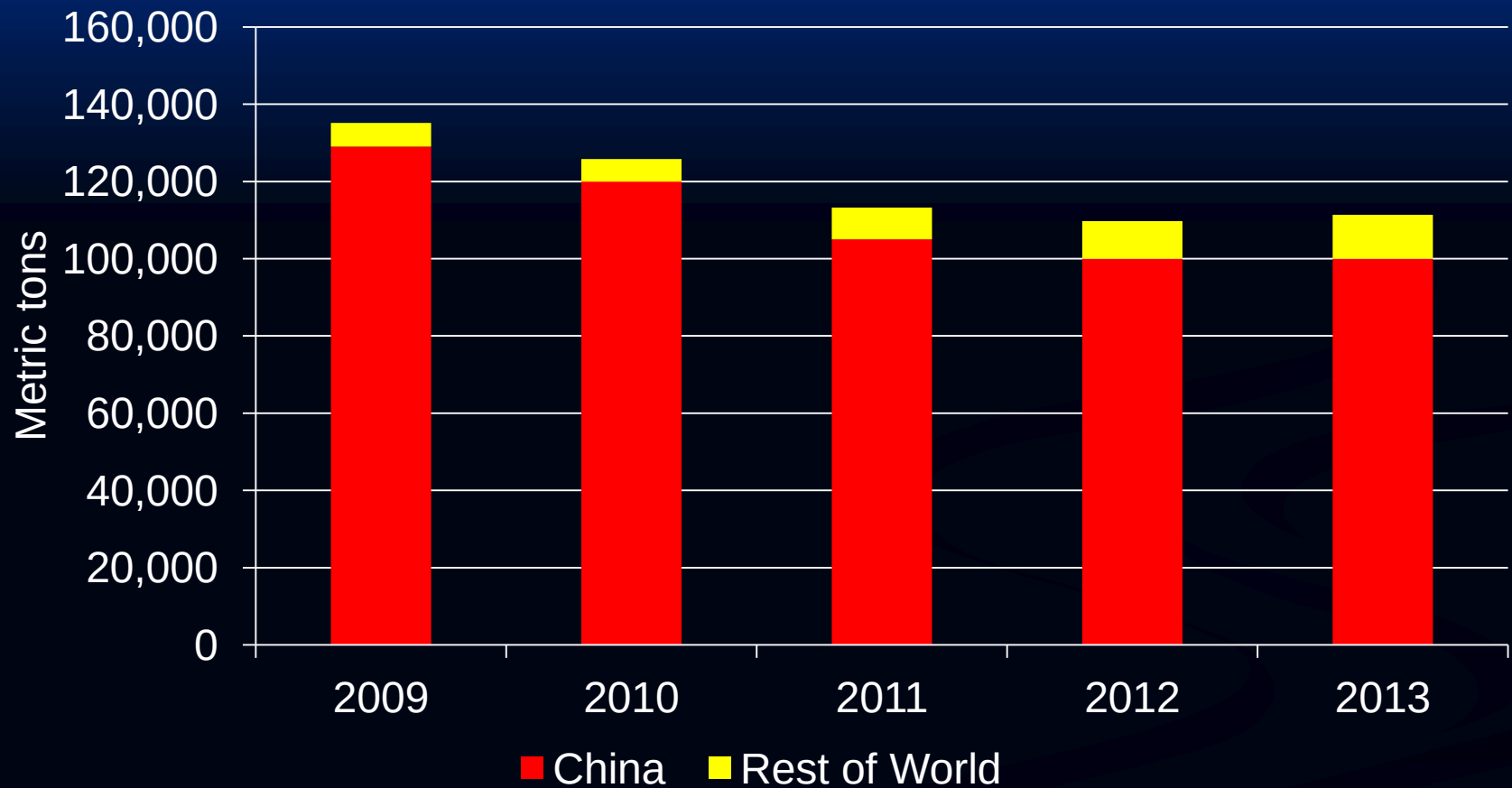




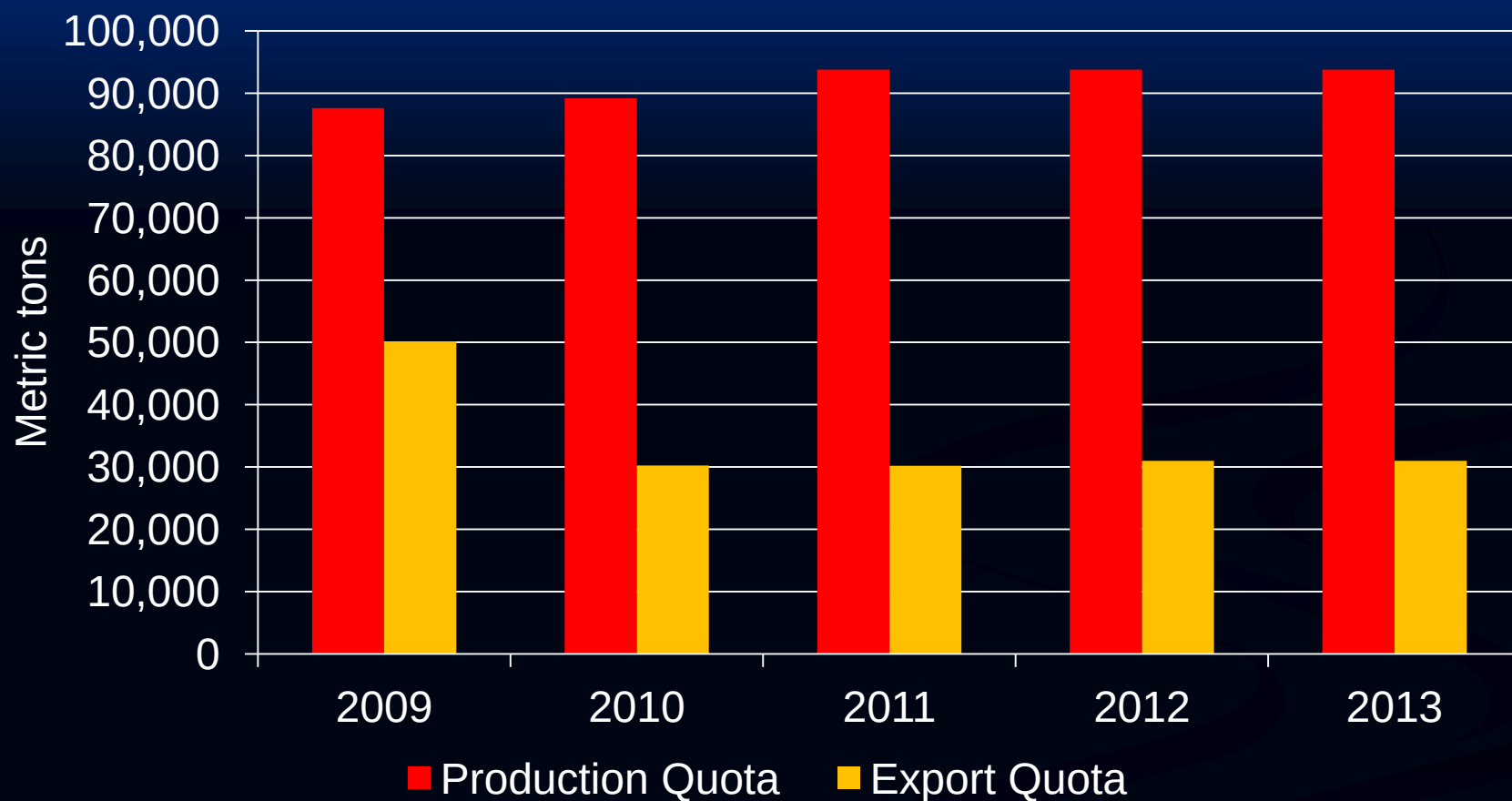
# Rare-Earth Mining Locations



# Supply—Rare-Earth Oxide World Mineral Production Trends 2009–2013

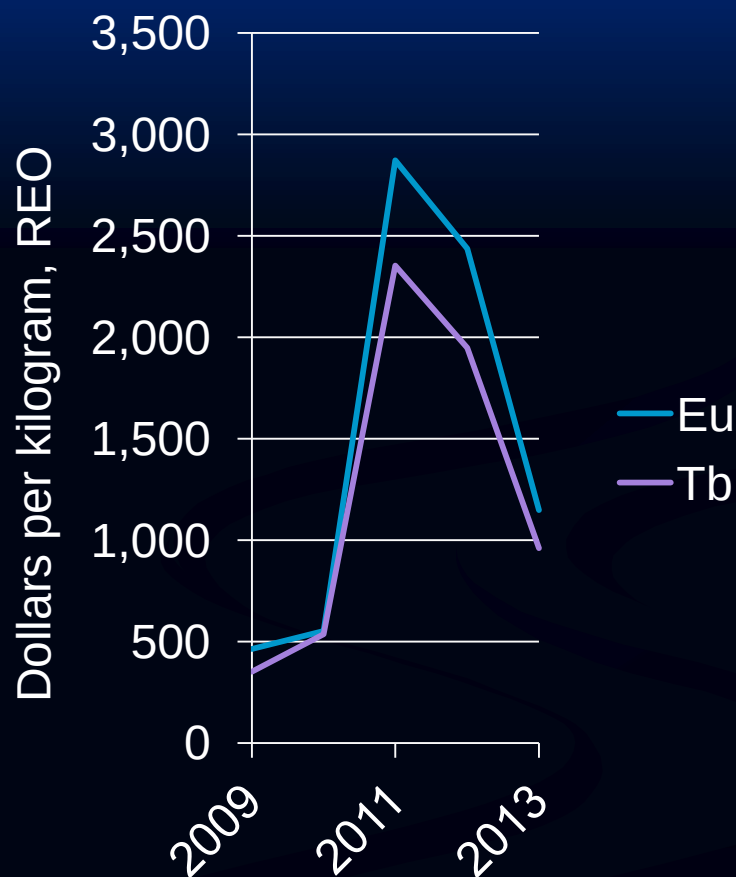
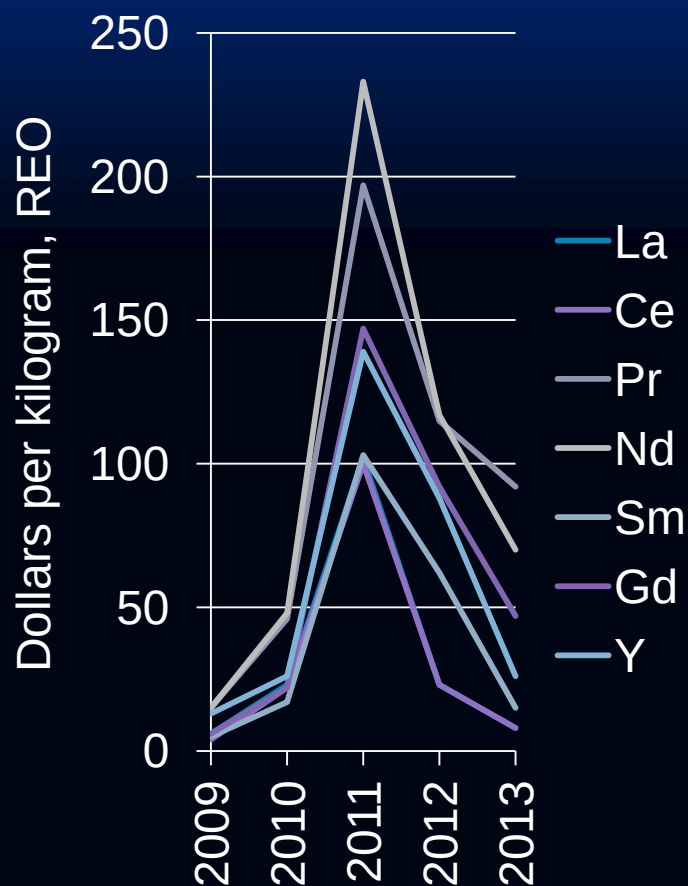


# China's Rare-Earth Production and Export Quotas

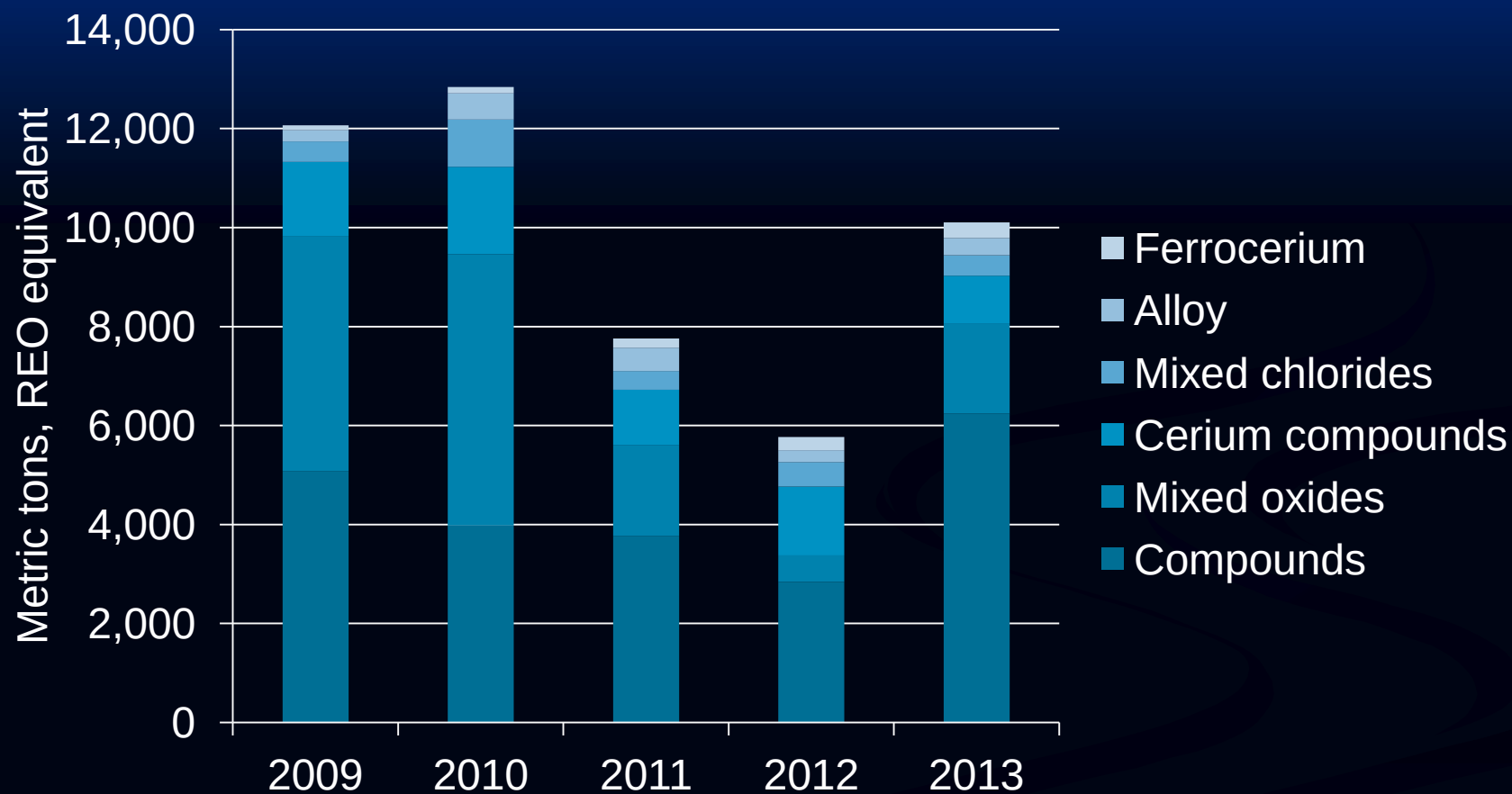




# Average Prices of Selected Rare-Earth Oxides (REO)



# U.S. Imports for Consumption of Rare-Earth Materials



# Closing Thoughts

- China continues to dominate rare-earth supply
- Numerous projects for mining and separation underway
- Prices of rare-earths have decreased significantly
- U.S. imports of rare-earths increased in 2013
- Consumers pursuing conservation and recycle programs



# Contact Information

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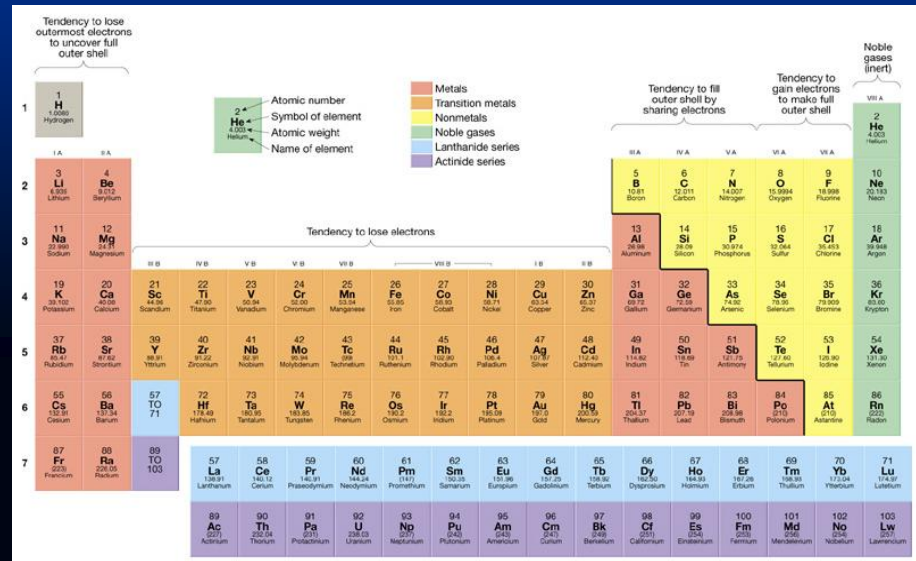
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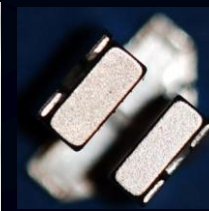
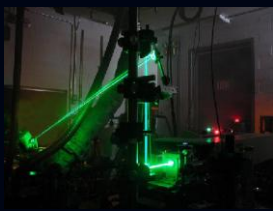
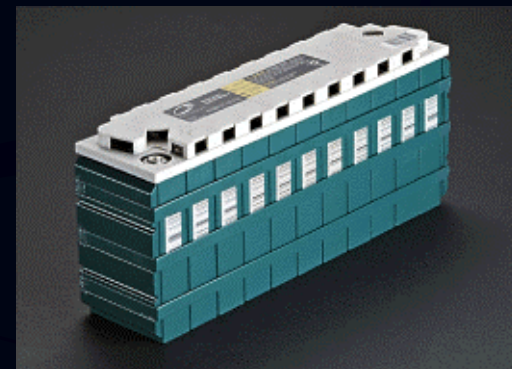
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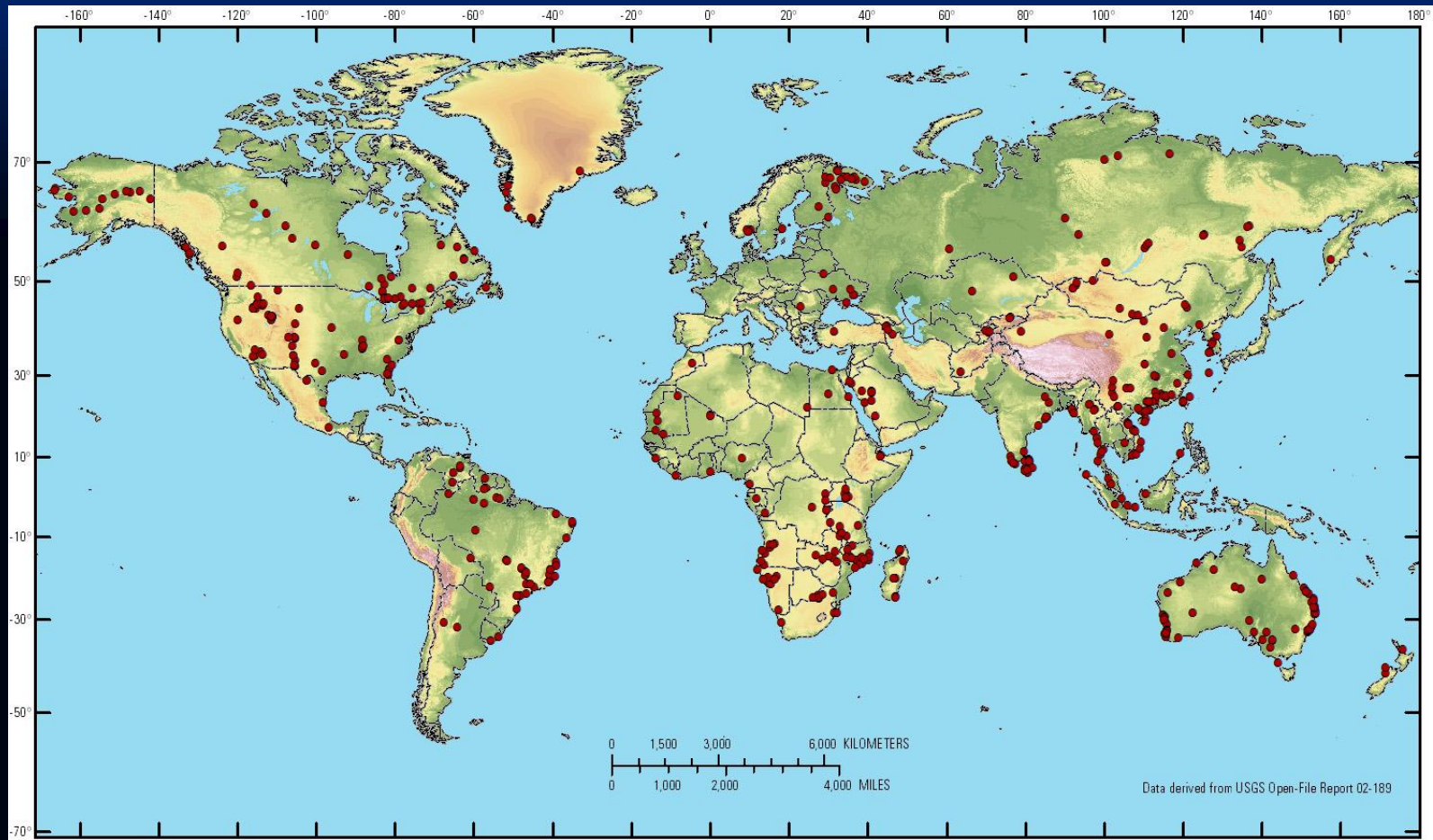
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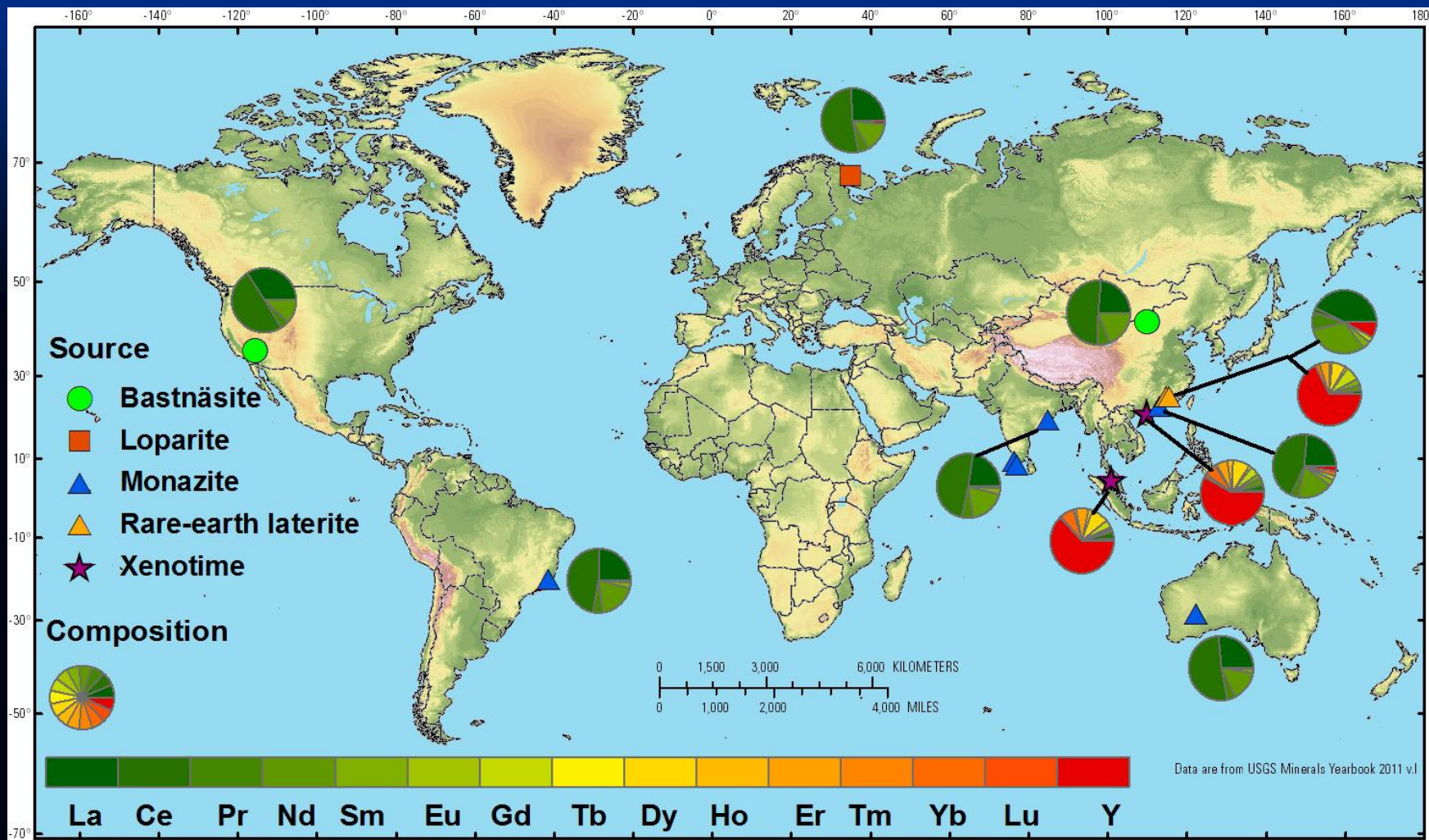




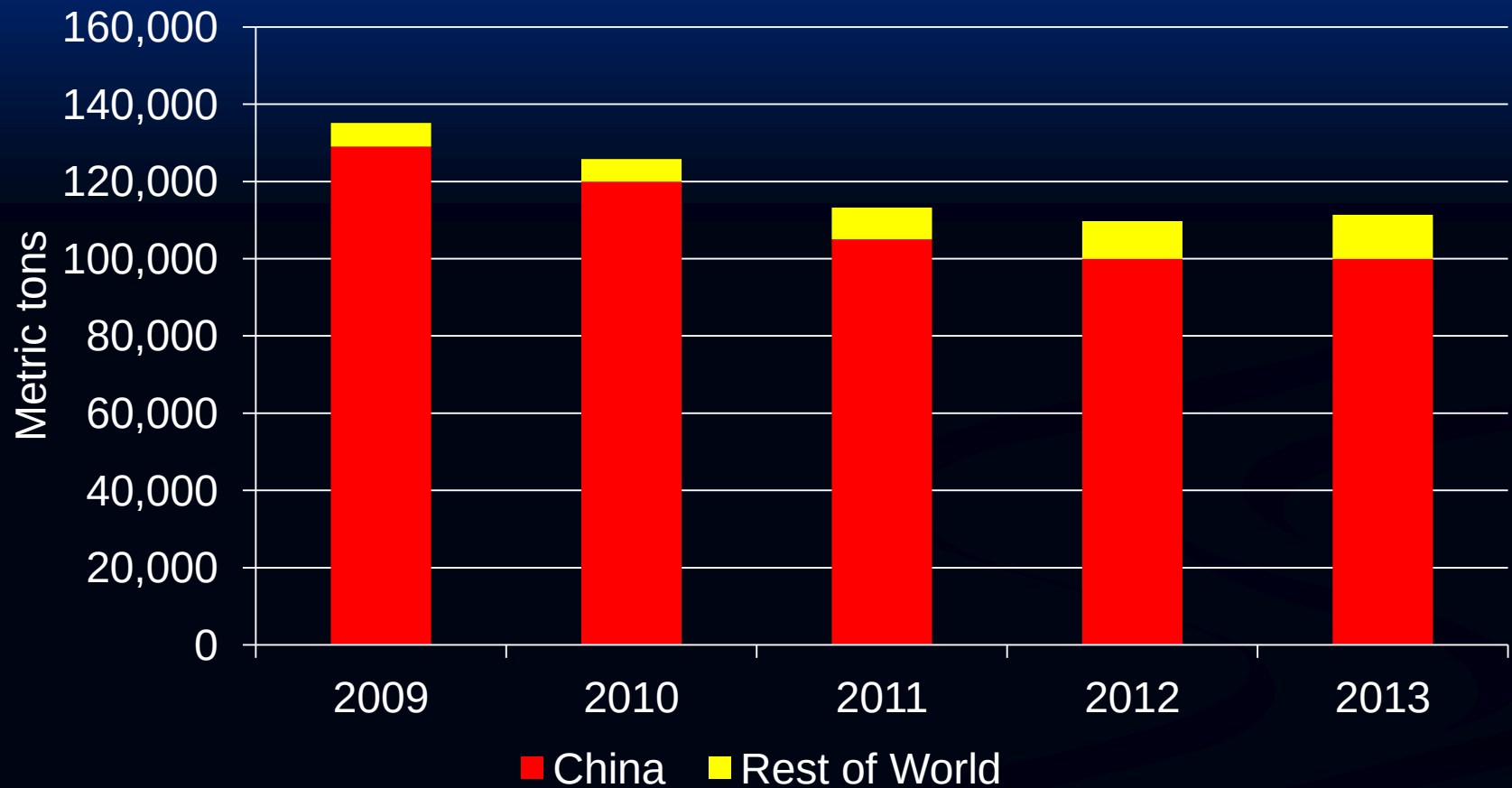
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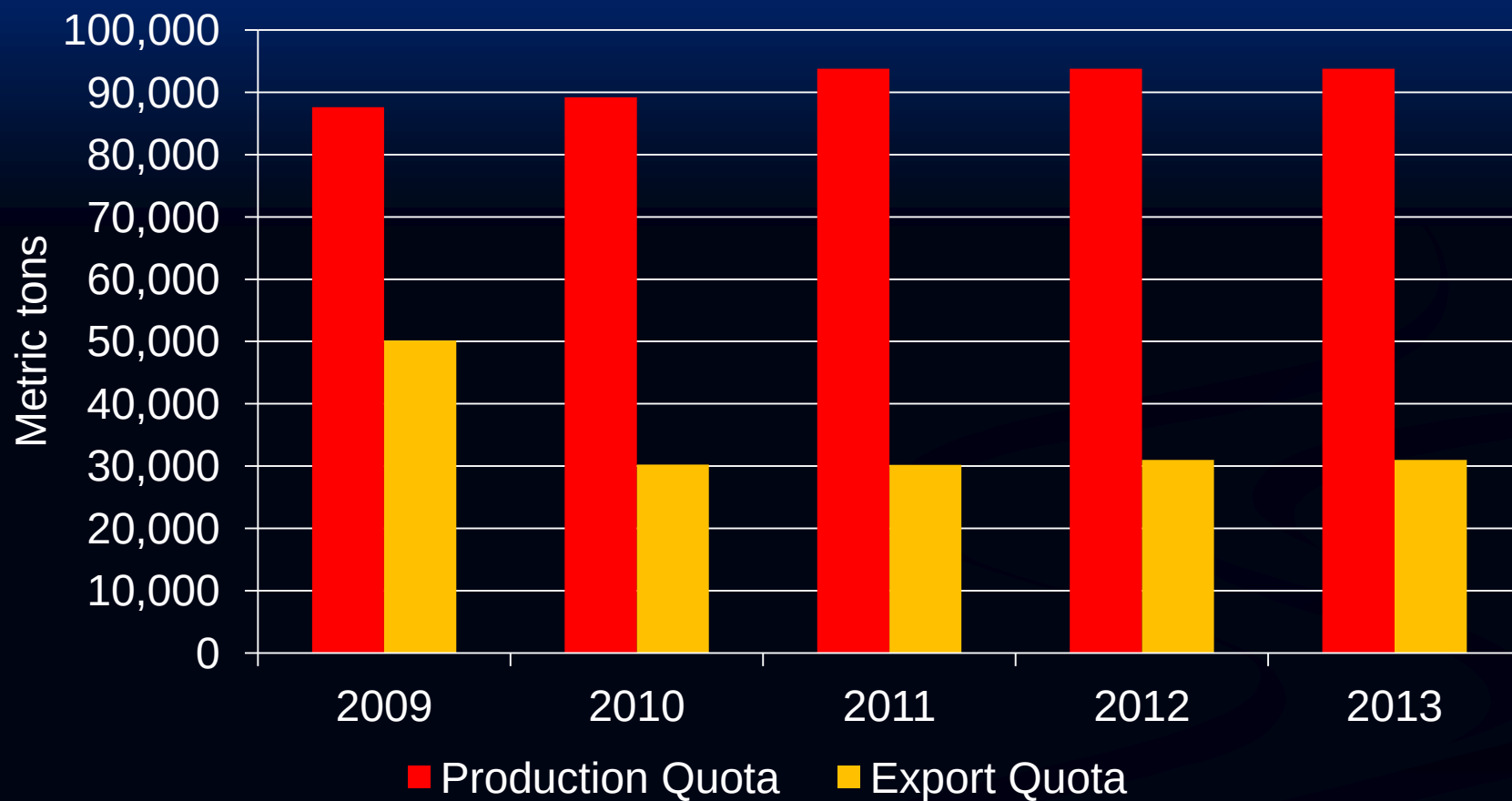
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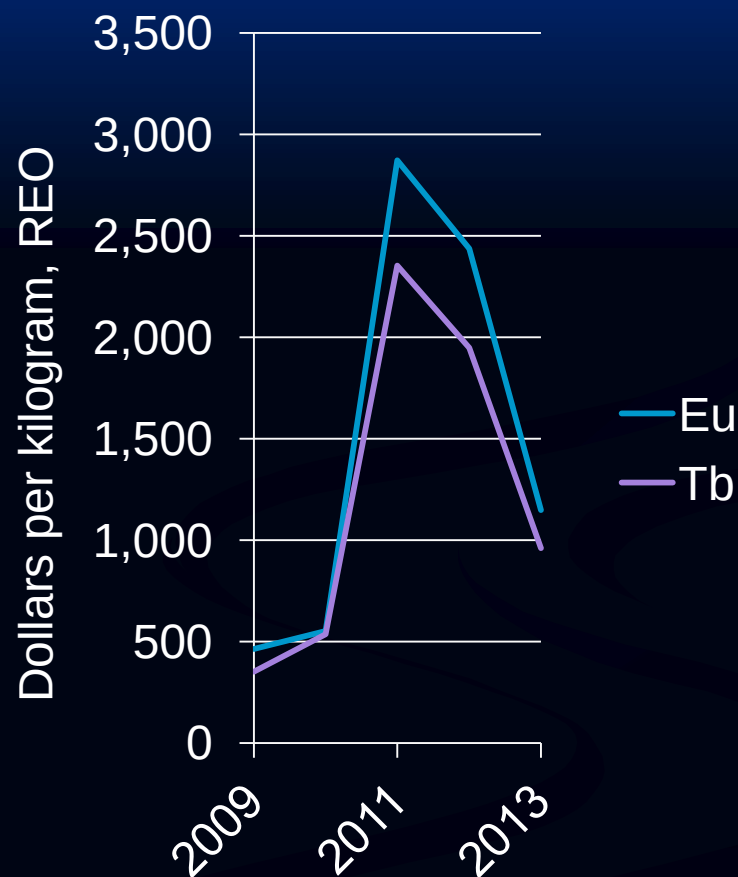
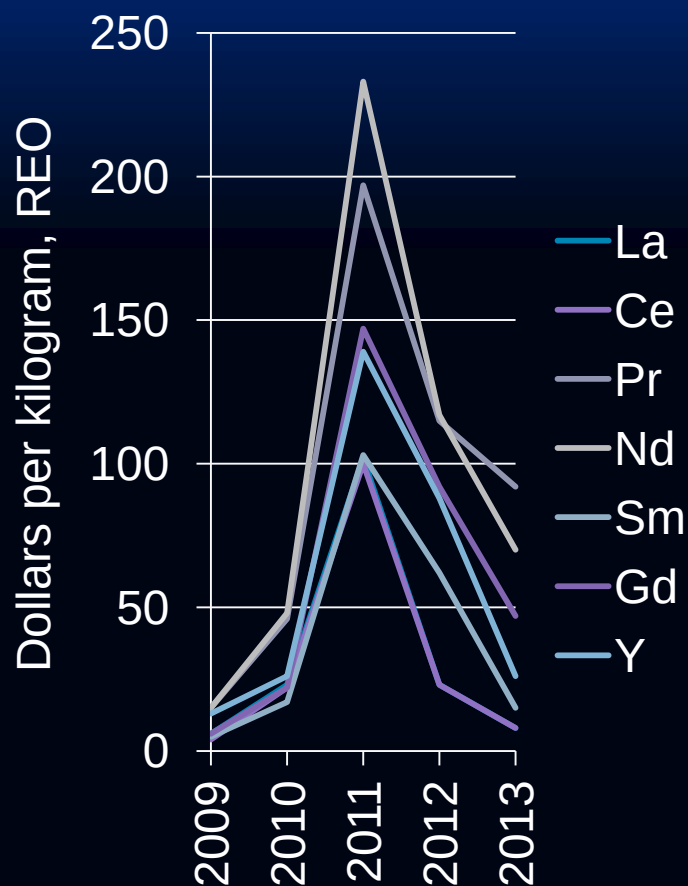
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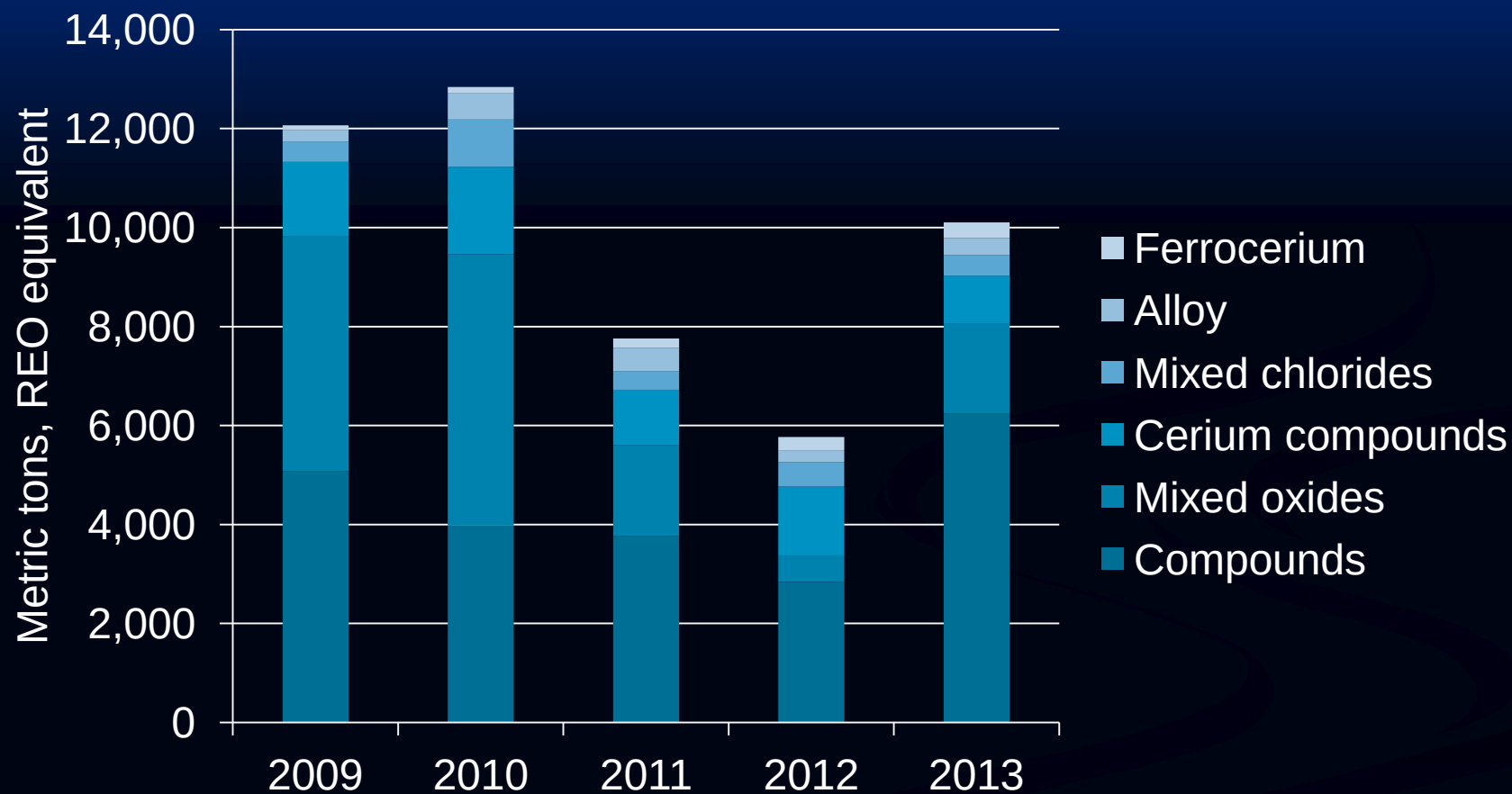


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