

SPEAKERS

Larry Meinert U.S. Geological Survey

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



2013 USGS Congressional Briefing Series

Critical Minerals – Ensuring America's Future

Larry Meinert Mineral Resources Program

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

The New York Eimes

Chinese Civilian Boats Roil Disputed Waters

By EDWARD WONG October 5, 2010 BEIJING – The <u>diplomatic</u> discord set off by Japan's recent detention of a Chinese fishing trawler captain points to what foreign military officials say is a growing source of friction along <u>China</u>'s borders: civilian vessels plying disputed waters and sometimes acting as proxies for the Chinese

The New York Times

China Is Said to Halt Trade in **Rare-Earth Minerals With** Japan

By KEITH BRADSHER and HIROKO TABUCHI September 24, 2010

HONG KONG – Akihiro Ohata, the Japanese trade minister, said Friday that his ministry The New York Eimes were comple Specialists in Rare Earths Say a from China Trade Case Against China May that the gov By KEITH BRADSHER investigatii March 13, 2012 The Chine HONG KONG – Even as the United Ministry h States, the European Union and <u>Japan</u> jointly filed a trade case Tuesday against <u>China</u> over its export restrictions on strategic <u>rare earth</u> metals,

The New York Times

China Consolidates **Grip on Rare Earths**

By KEITH BRADSHER September 15, 2011

BEIJING — In the name of fighting pollution, <u>China</u> has sent the price of <u>compact</u> fluorescent light ing in the

> closing pzens of are hich are ficient other

Historical Perspective

> WWI & WWII

- War Dept., 1922: antimony, chromium, graphite, iodine, manganese, mercury, mica, nickel, platinum, potash, tin, tungsten, vanadium
- 1939: plus aluminum, asbestos, cadmium, cryolite, fluorspar, titanium
- Strategic and Critical Materials Stock Piling Acts of 1939,1946

> Oil Embargo of 1970s

- Rising commodity prices
- Strategic and Critical Materials Stock Piling Revision Act of 1979
- National Materials and Minerals Policy, Research and Development Act of 1980

Resource War of 1980s

- Concern that USSR was denying access to strategic resources needed for U.S. economy and defense
- Concern about increasing import dependence
- Research by government and academia on Chromite, Cobalt, Manganese, ...
- International Strategic Mineral Inventory (ISMI)
- The National Critical Materials Act of 1984

Rise of Developing Economies in the 21st Century

- Concerns about reliable supply
- National critical mineral strategy development multiple OSTP working groups
- Currently several bills pending in 113th Congress



World Trade

Although the US is a major producer and exporter of many commodities such as molybdenum and beryllium, it relies on world trade for most mineral resources and is >90% reliant on imports for 24 commodities, including REE

Source: USGS Mineral Commodity Summaries (2013)



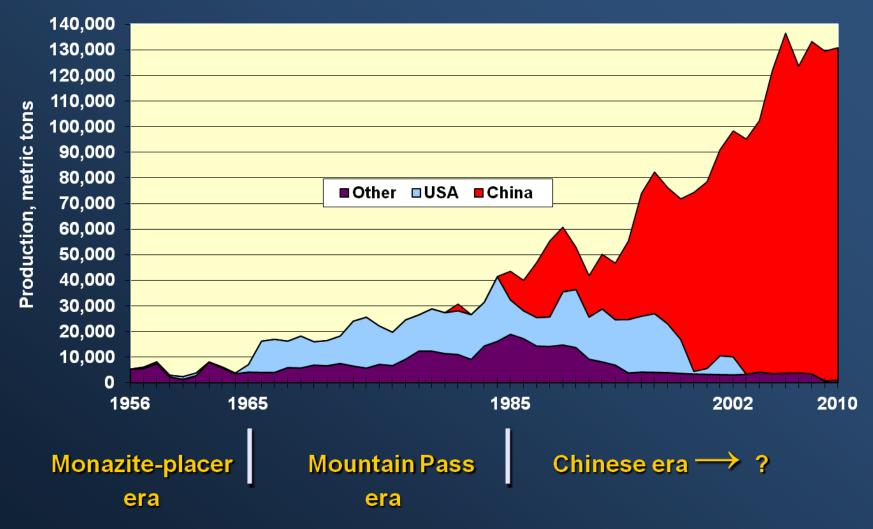
Commodity Pe ARSENIC (trioxide) ASBESTOS BAUXITE and ALUMINA CESIUM FLUORSPAR GRAPHITE (natural) INDIUM MANGANESE MICA, sheet (natural) NIOBIUM (columbium) QUARTZ CRYSTAL (industrial) RUBIDIUM SCANDIUM STRONTIUM TANTALUM THALLIUM THORIUM GALLIUM GEMSTONES VANADIUM BISMUTH PLATINUM GERMANIUM IODINE ANTIMONY DIAMOND (dust, grit, and powder) STONE (dimension) POTASH BARITE COBALT RHENIUM TITANIUM MINERAL CONCENTRATE TIN SILICON CARBIDE (crude) ZINC CHROMIUM GARNET (industrial) TITANIUM (sponge) PEAT SILVER PALLADIUM NICKEL MAGNESIUM COMPOUNDS TUNGSTEN SILICON COPPER NITROGEN (fixed), AMMONIA MAGNESIUM METAL MICA, scrap and flake (natural) VERMICULITE PERLITE ALUMINUM SALT SULFUR PUMICE

GYPSUM

2012 U.S. NET IMPORT RELIANCE¹

ercent		Major Import Sources (2008–11) ²
100		Morocco, China, Belgium
100		Canada, Zimbabwe
100		Jamaica, Brazil, Guinea, Australia
100		Canada
100		Mexico, China, South Africa
100		China, Mexico, Canada, Brazil
100		China, Canada, Japan, Belgium
100		South Africa, Gabon, Australia, China
100		China, Brazil, Belgium, India
100		Brazil, Canada, Germany
100		China, Japan, Russia
100		Canada
100		China
100		Mexico, Germany, China
100		China, Estonia, Germany, Kazakhstan
100		Germany, Russia
100		India, France
99		Germany, United Kingdom, China, Canada
99		Israel, India, Belgium, South Africa
96		Rep. of Korea, Canada, Austria, Czech Republic
92		China, Belgium, United Kingdom
91		Germany, South Africa, United Kingdom, Canada
90		China, Belgium, Russia, Germany
88		Chile, Japan
87		China, Mexico, Belgium, Bolivia
85		China, Ireland, Republic of Korea, Russia
85		China, Brazil, Italy, Turkey
81		Canada, Russia
80		China, India, Morocco
78		China, Norway, Russia, Finland
78		Chile, Netherlands, Germany
ES 77		South Africa, Australia, Canada, Mozambique
75		Peru, Bolivia, Indonesia, China
73		China, South Africa, Romania, Netherlands
72		Canada, Mexico, Peru, Spain
70		South Africa, Kazakhstan, Russia, Mexico
65		India, Australia, China, Canada
64		Japan, Kazakhstan, China, Ukraine,
62		Canada
57		Mexico, Canada, Peru, Poland
54		Russia, South Africa, United Kingdom, Norway
49		Canada, Russia, Australia, Norway
46		China, Canada, Brazil, Australia
42		China, Bolivia, Canada, Germany
36		Brazil, Russia, China, Canada
35		Chile, Canada, Peru, Mexico
35		Trinidad and Tobago, Russia, Canada, Ukraine
31		Israel, Canada, China Canada, China India, Finland
31		Canada, China, India, Finland
30		South Africa, China, Brazil, Australia
24		Greece
20		Canada, Russia, China, Mexico
19		Canada, Chile, Mexico, The Bahamas
19	207	Canada, Mexico, Venezuela
15		Greece, Iceland, Mexico, Montserrat
12		Canada, Mexico, Spain

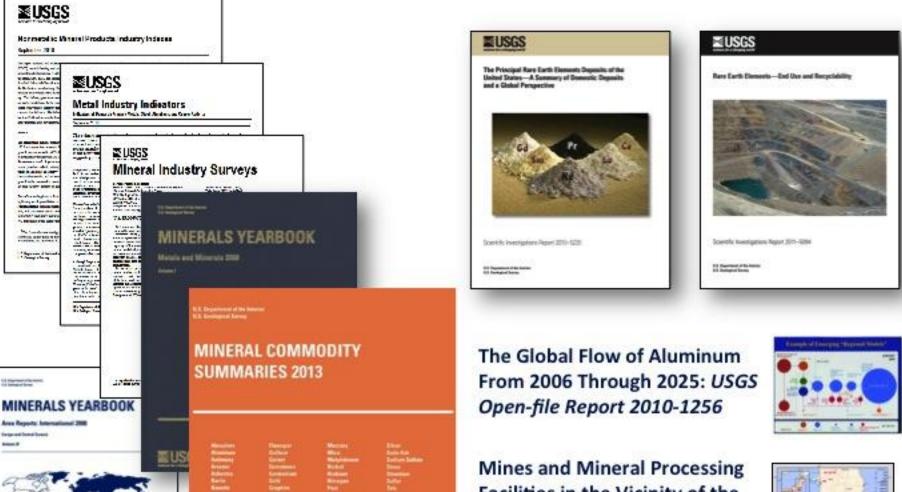
REE Production Trends – 1956 to 2010



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



Information is Critical



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Facilities in the Vicinity of the March 11, 2011, Earthquake in Northern Honshu: USGS Openfile Report 2011-1069



Minerals Information

Materials Flow Studies

Materials Flow of Indium in the United States in 2008 and 2009



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Wind Energy in the United States and Materials Required for the Land-Based Wind Turbine Industry From 2010 Through 2030





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Circular 1365

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Byproduct Mineral Commodities Used

for the Production of Photovoltaic Cells

ALILAS MAX

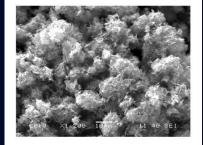
Byproduct Metals and Rare-Earth Elements Used In the Production of Light-Emitting Diodes— Overview of Principal Sources of Supply and Material Requirements for Selected Markets

Provide Law under State Provide Law Under Sta



≊USGS

Lithium Use in Batteries



Circular 1371

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Mines and Mineral Processing Facilities in the Vicinity of the March 11, 2011, Earthquake in Northern Honshu, Japan

By W. David Merszie, Michael S. Belyer, Dorreld I. Bleisens, and Chin Kup





Recent Strikes In South Africa's Platinum-Group Metal Mines: Effects Upon World Platinum-Group Metal Supplies

By Thomas P. Yagar, Yadaw Solo-Virset, and Jamos J. Barry

Open-File Report 2012-1273

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

Supply Disruption

Facilities in impact zone of March 11, 2011, magnitude 9.0 earthquake and associated tsunami :

- 9 cement plants
- 8 iodine plants 4 limestone mi
- 4 iron and steel plants 3 copper refineries
- 2 lead refineries
- 4 limestone mines 2 gold refineries 2 zinc refineries
- 1 titanium dioxide plant

1 titanium sponge processing facility.

These facilities have the capacity to produce the following percentages of the world's nonfuel mineral production:

25 % of iodine (Japan is world's second leading producer (after Chile))
10 % of titanium sponge (metal)
3 % of refined zinc
2.5 % of refined copper
1.4 % of steel

The 9 cement plants produce 30% of Japan's annual cement production



Menzie, W.D., Baker, M.S., Bleiwas, D.I., and Kuo, Chin, 2011, Mines and mineral processing facilities in the vicinity of the March 11, 2011, earthquake in northern Honshu, Japan: U.S. Geological Survey Open-File Report 2011–1069, 7 p. (Available only at http://oubs.usgs.gov/of/2011/1069/.)

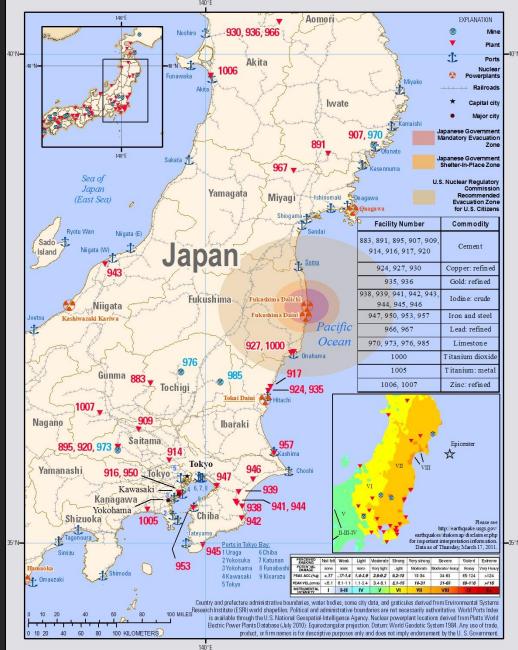


Figure 1.—Map showing the location of mines and mineral facilities in Japan. Modified from Baker and others (2010).

Inventory

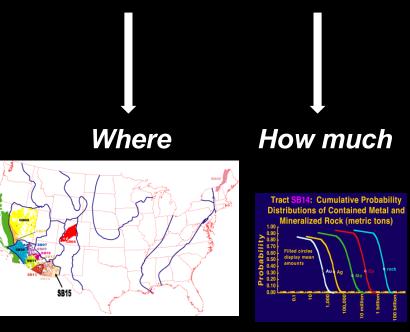
VS

Identified resources Near- and medium-term supply Often classified by commodity Important first step for assessment

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Undiscovered resources Long-term potential supply Classified by mineral deposit type Qualitative and Quantitative

Assessment





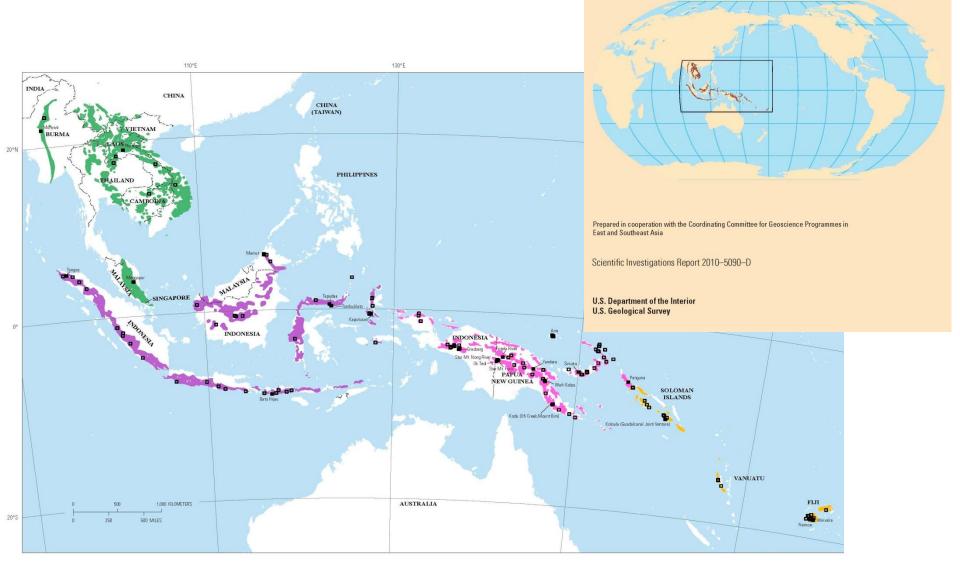
Probabilistic

Indonesia is included in a report on parts of Southeast Asia and Melanesia

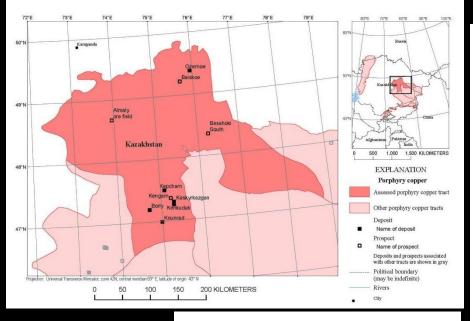


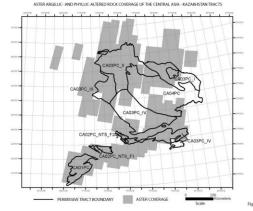
Global Mineral Resource Assessment

Porphyry Copper Assessment of Southeast Asia and Melanesia

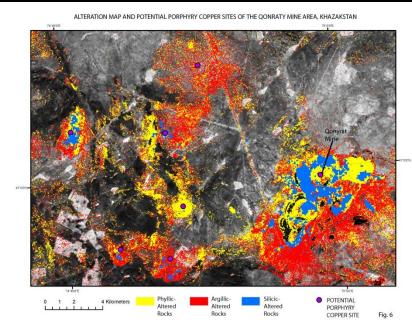


ASTER alteration mapping as a guide for porphyry copper estimates in Central Asia

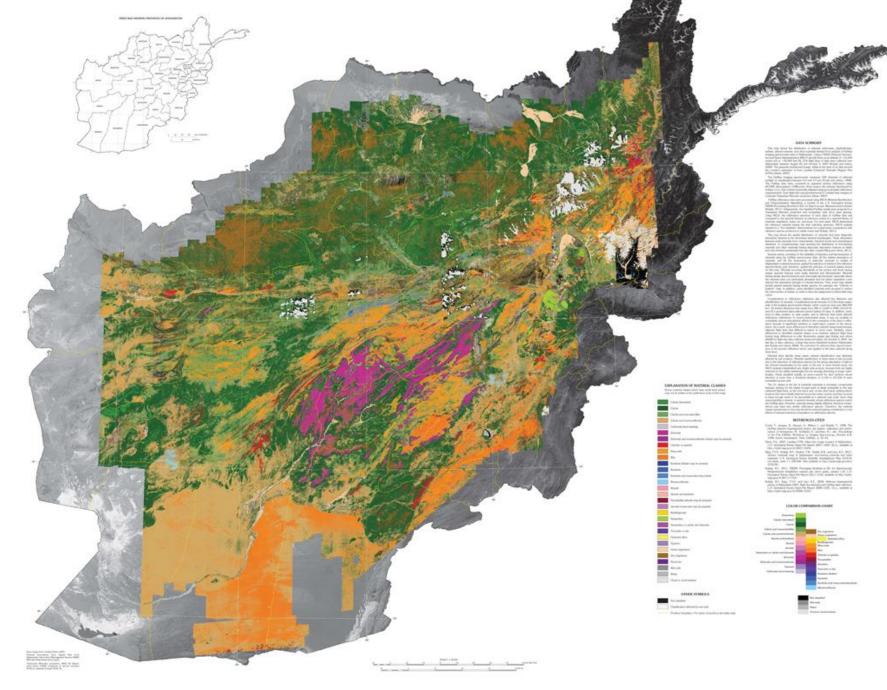






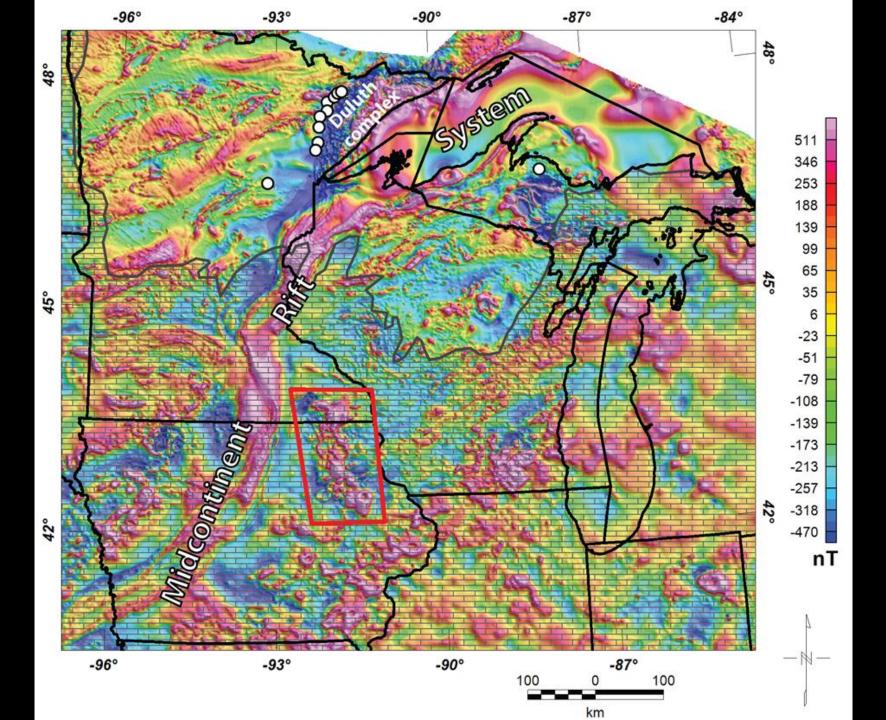


Tract area: 79,500 km² 5 known deposits 90-50-10 Estimate: 1-5-12 5.8 expected undiscovered

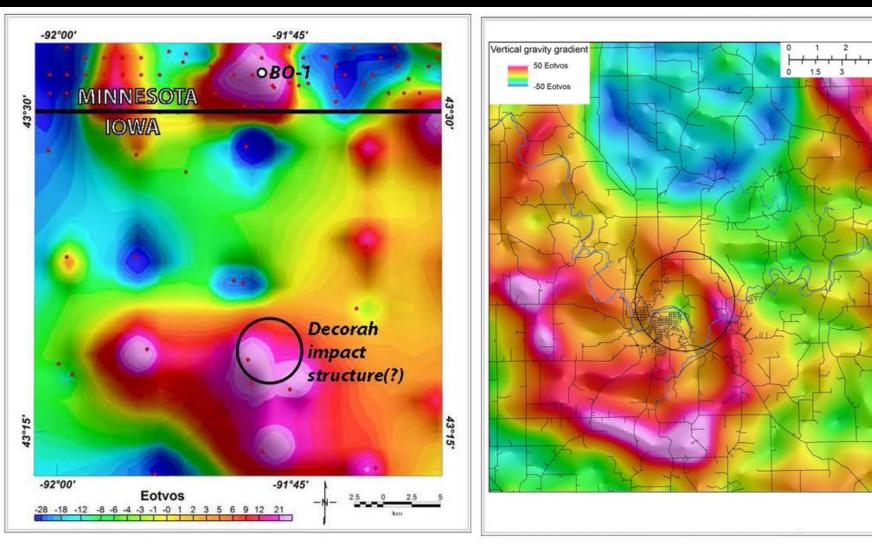


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SURFACE MATERIALS MAP OF AFGHANISTAN: CARBONATES, PHYLLOSILICATES, SULFATES, ALTERED MINERALS, AND OTHER MATERIALS







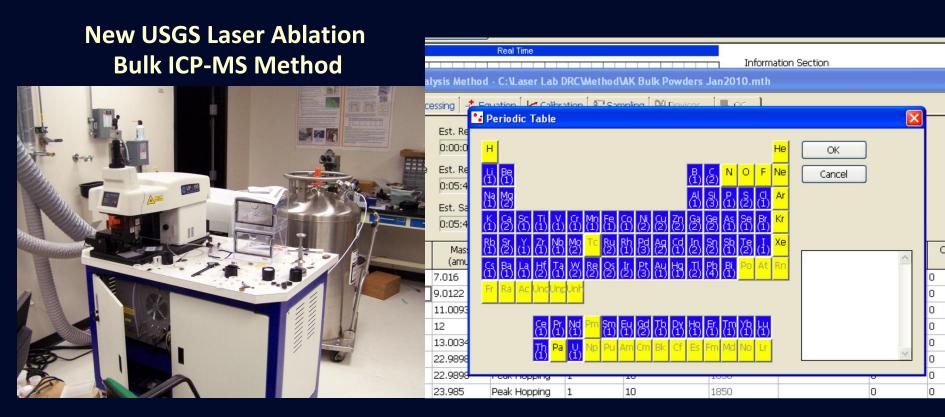
Old ground vertical gradient, calculated

New airborne vertical gradient, measured

4 Miles

6 Kilometers

Inventory and Characterization of Byproduct Critical Mineral Resources Critical Metal Content of Domestic Mineral Deposits



- Low cost, efficient, and accurate analytical method
- Entire periodic table (minus H, He, N, O and F) in a single rapid analysis
- Trace and ultra trace detection (ultra trace to less than 10 ppb in some cases)



100+ analyses per day



New National-scale Soil Geochemical and Mineralogical Data for the Conterminous United States



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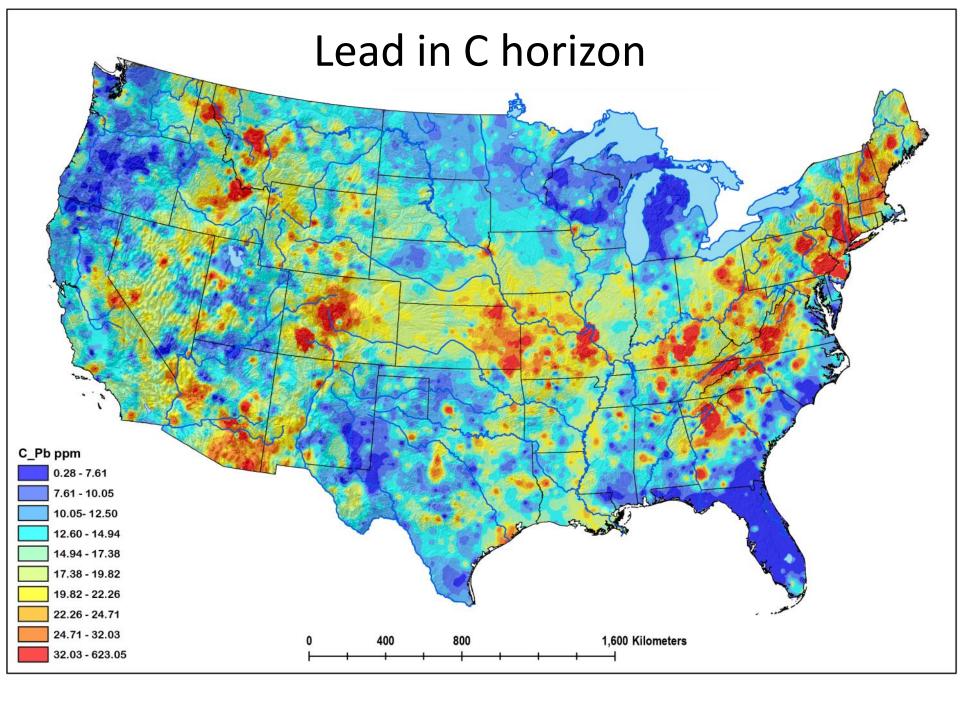
Geochemical and Mineralogical Data for Soils of the Conterminous United States

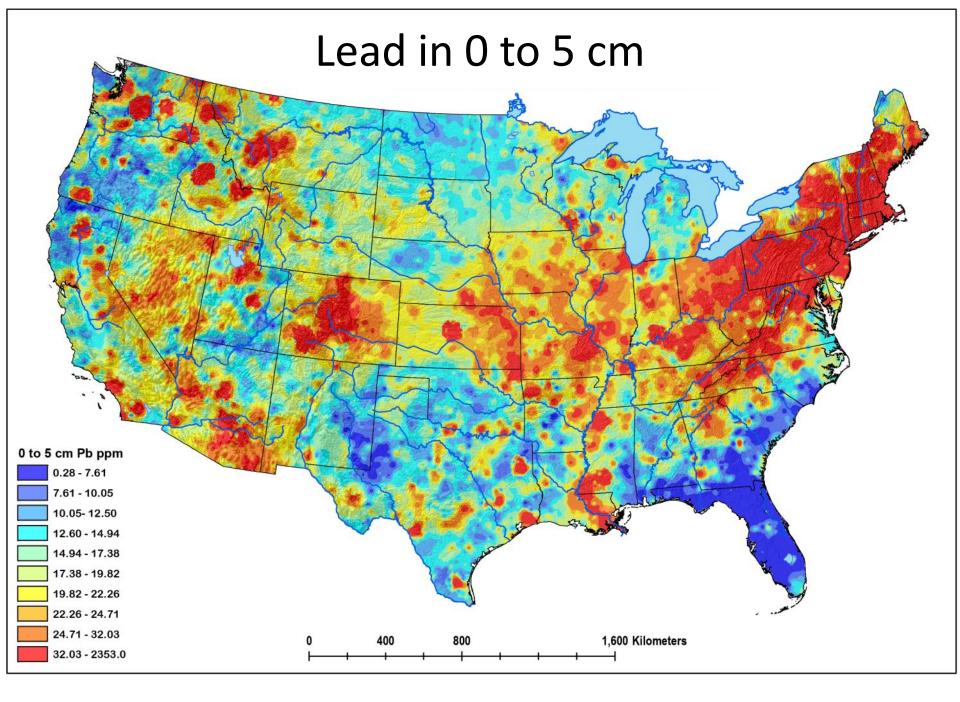


http://pubs.er.usgs.gov/publication/ds801

Data Series 801

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Larry Meinert Mineral Resources Program U.S. Geological Survey 989 National Center Reston, VA 20192 voice: 703-648-6100 e-mail: Lmeinert@usgs.gov