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Testimony on "Examining the Spending Priorities and the Missions of the U.S. Geological Survey and the President's FY 2012 Budget Proposal"

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
NATURAL RESOURCES COMMITTEE
UNITED STATES HOUSE OF REPRESENTATIVES
March 9, 2011

My name is Jonathan G. Price. I am the Nevada State Geologist and Director of the Nevada Bureau of Mines and Geology, which is the state geological survey and a research and public service unit of the Nevada System of Higher Education at the University of Nevada, Reno. As past president of the Association of American State Geologists, I am testifying today on behalf of that organization, which represents the geological surveys in the 50 states and Puerto Rico.

Thank you for this opportunity to comment on the budget of the U.S. Geological Survey (USGS) and the value of their programs.

The President's budget would devastate many of the most successful and effective programs run by the USGS. These are programs that stimulate economic development, save lives and property from natural disasters, and protect the environment and public health. Cutting these programs would cost the government money through loss of general revenue that is created from the economic stimulation that these programs provide.

These are also federal programs that directly benefit from collaboration with experts outside the federal government. Through competitive grants, which would be eliminated or reduced in the President's budget, the USGS is engaging some of the Nation's best and brightest scientists and local-area experts in their mission-oriented work.

Foremost of concern to the Association of American State Geologists is the National Cooperative Geologic Mapping Program (NCGMP), a subactivity within the Core Science Systems Activity, funded at $28.2 million in FY 2010. The President's budget proposes cutting this by 10% in FY 2012, but disproportionately cuts the cooperative components with states and universities, which bring non-federal matching dollars to the projects, by 14%, while cutting the federal component by 8%. We believe that this program should not be cut at all in FY 2012. Given its proven record in stimulating economic development and generation of tax revenues for federal, state, and local governments, the program should grow to its fully authorized level of $64 million per year in the upcoming years. Large parts of the United States do not have modern, detailed geologic maps. The program locates, characterizes, and assembles the vital information upon which economic decisions involving land and water are made. Virtually all mineral, energy, water, industrial construction, public works, and urban development projects require a geologic map.

Geologic mapping at the scale and overall coverage done by the USGS and the state geological surveys is clearly a role for government, because the public benefits in many ways, and the private sector must limit its work to small areas of immediate interest to their businesses. Geologic mapping generally engages the use of private-sector base-mapping efforts (such as aerial photography and topographic mapping, nowadays using light detection and ranging, LiDAR) but must rely on the knowledge of geologists at government agencies and universities to build the geological history and four-dimensional framework of an area.

Cost-benefit studies show that the existence of a modern geologic map saves developers and engineers about $50,000 for every project occurring within a standard mapping area of 56 square miles. Typically, many projects utilize a single map, multiplying these cost savings many times over. The maps, and data collected to make them, are of great value because society can use them in perpetuity. A cost-benefit analysis done on a state fortunate to have completed modern geologic map coverage calculated the value of the geologic maps to be 25 to 39 times the cost of the mapping. Therefore a FY 2012 program of $28 million has the potential to generate $700 million to $1.1 billion in value. Also, through this program, 850 students at 140 universities have been trained in the essential skills of geologic mapping, skills that are much in demand in the United States.

The Colorado State Geologist, Dr. Vince Matthews, has documented some recent successes in economic development (and increased state and federal revenue) through geologic mapping. Geologic mapping in Archuleta and La Plata Counties along the northern outcrop of the San Juan Basin provided industry and regulators with sound science on how to most efficiently and safely develop coalbed methane, which currently accounts for approximately 40% of Colorado's natural gas production. Geologic mapping by the Colorado Geological Survey is a key component of an $11 million research project on carbon capture and storage centered in northwestern Colorado. Partners include the Colorado Geological Survey, Tri State Generation and Transmission, Shell Production Company, Schlumberger Carbon Services, and other state geological surveys and universities.

The New Jersey State Geologist, Dr. Karl Muessig, provided the following example of how geologic mapping saves the federal government money. Mapping data gathered under the NCGMP guided the drill testing at the Picatinny Arsenal for a new underground explosives testing facility. It resulted in drilling into competent crystalline rocks (compared to the initial fractured rock target), saving the Army the cost of extra exploration drilling and millions of dollars for a possible failed facility or for additional grouting.

Geologic maps and related reports on applied research are excellent incentives for economic development. As another example, geologic mapping and related interpretation of the regional geological structures were an integral part of the discovery of the Carlin gold deposit in 1961. The geologic mapping was done by USGS geologists in a cooperative program with the Nevada Bureau of Mines and Geology, but the discovery was made through the additional investment by the private sector for drilling and assaying. In the last 35 years, mining companies in Nevada have produced tens of billions of dollars' worth of gold and silver from deposits of this type and have directly and indirectly provided tens of thousands high-paying jobs. There is still much mineral wealth to be found in the United States. In 1988, I estimated that the undiscovered

mineral resources in Nevada were likely to have a value in the range of $120 billion to $1.2 trillion, and those figures still provide a reasonable estimate of the untapped mineral wealth of that one state. Nevada's gold production of over 167 million troy ounces since the Carlin deposit began operation in 1965 would have a value of over $230 billion at current prices.

Another reason why the STATEMAP and EDMAP components of the National Cooperative Geological Mapping Program should be increased, rather than cut, is the fact that these components require that non-federal dollars be added to the federal investments, thereby at least doubling the overall effort. In addition, each state engages stakeholders (including federal land managers, resource and urban development industries, local governments, water districts, other state agencies, and conservation groups) in setting priorities for new geologic maps, thereby assuring that the highest priority areas are covered as soon as possible.

The President's budget proposes elimination of the National Geological and Geophysical Data Preservation Program (NGGDPP), also a subactivity within the Core Science Systems Activity, funded at $1.0 million in FY 2010. This is another cooperative program with states, which double the federal investment. The 2002 National Academy of Sciences report on *Geoscience Data and Collections – National Resources in Peril* made the case for preserving these irreplaceable data and physical samples and led to Congressional authorization of this program at $30 million per year within the Energy Policy Act of 2005. We have seen uses for these data and samples in exploration for domestic mineral and energy resources (including renewable geothermal energy sources), groundwater protection, and investigation of the potential for carbon storage in geological formations. The program should grow, not suffer elimination.

An example of how both data preservation and geologic mapping create jobs in the private sector and revenues for the federal government comes from New Jersey. Coastal mapping supported by NCGMP and offshore mapping by the Department of Interior, along with drilling data preserved through the NGGDPP, have provided baseline data for siting proposed offshore wind energy facilities. This is generating jobs in the alternative energy industry and future federal leasing revenues.

Many states have considerable amounts of public land managed by the federal government. In contrast to Canada and Australia, which help stimulate exploration for natural resources and eliminate unnecessary environmental degradation that can occur from duplication of efforts on the ground, the United States has no significant program to preserve information gathered from leases or mining claims on public lands, other than the National Geological and Geophysical Data Preservation Program. We have experienced many cycles of exploration, when commodity prices rise and fall. Preserving data from past exploration clearly stimulates private investment and economic development when commodities are in high demand.

In making the case for support of the Energy and Minerals Programs of the USGS, please refer to four graphs at the end of this testimony. The continuing historical rise in demand for copper, an example of a mineral commodity needed for modern society, is documented in Figure 1. To meet global demand, the world needs to mine the equivalent of one huge copper deposit each year and find a new one to replace the depleted reserves. Although conservation and recycling can lessen the demand for newly mined copper, the increases in both global population and

average standard of living require more mining. Domestic resources for most mineral commodities occur in the United States, where they are mined using the world's best practices for environmental stewardship and health and safety for workers and the public. The USGS has a vital role in documenting domestic production and reserves and in assessing the likelihood of future discoveries that will add to the mineral and energy resources of our country.

Global iron-ore production and, by that measure, the rise of China as a major economic power, is shown in Figure 2. The dominance of China as a producer of mineral and energy commodities today is illustrated in Figures 3 and 4. These graphs use critical data collected and reported by the USGS. No other agency, foreign government, or private company does this. Although foreign governments, domestic state governments, and private companies collaborate with the USGS in the data collection, only the USGS compiles the vast amount of mineral-resource data used by our decision makers. China's dominance in the minerals arena, as documented by the USGS data, presents challenges, threats, and opportunities for the United States.

Within the USGS's Energy, Minerals, and Environmental Health Activity, the Mineral Resources Subactivity would be cut 18% below the FY 2010 level, from $53.8 million to $44.2 million in FY 2012. The Mineral Resources External Research Program (only $250,000 in FY 2010) would be eliminated, thereby losing collaboration with subject experts that can fill gaps in expertise within the USGS. The Minerals Information Function, considered to be an essential government function in two 2008 National Academy of Sciences reports (titled *Minerals, Critical Minerals, and the U.S. Economy*, and *Managing Materials for a Twenty-first Century Military*) and in a 2011 report by the American Physical Society (titled *Energy Critical Elements: Securing Materials for Emerging Technologies*), would suffer a 17% cut. These recent external reports have documented the importance of continuing to collect and analyze these data for both the economic health and national security of America. We believe these are programs and functions that should not be cut.

The President's budget for the USGS's Energy Resources Subactivity would be approximately the same as last year (increasing from $27.2 million in FY 2010 to $27.4 million in FY 2012), but funding for the State Coop to maintain and improve the National Coal Resources Data System would be eliminated. Coal continues to be a major supplier of inexpensive electricity for America. Research on new technologies for reducing carbon dioxide emissions, storing carbon dioxide underground, and adapting to climate changes is needed, because coal and other carbon-based energy fuels (including unconventional sources of oil and natural gas) are likely to dominate the global energy supplies for many years. Whereas the Energy Information Administration in the Department of Energy does a good job of collecting statistics on domestic energy production, the USGS's role in long-term forecasting of energy supplies (including fossil fuels, nuclear fuels, and geothermal resources) is unique and necessary for long-term planning. Much of this work is done in collaboration with states, and the Association of American State Geologists supports this working relationship.

There are several other USGS programs that we believe are vital to the nation and should not be reduced. The President's budget for the Earthquake Hazards Program (within the Natural Hazards Activity) calls for an 8% overall decrease and a much larger percentage cut to the external Earthquake Grants program, which has successfully engaged leading scientists and

engineers through a peer-reviewed grant process. The President's budget would also put on hold progress to build a prototype earthquake early warning system. This system would warn people within seconds after a major earthquake starts to shake the ground, in time for many people to take cover, protect their children, and automatically implement electronic safety measures (such as opening firehouse doors, slowing trains, and backing up computers). Japan already has a functional system in place, but the President's budget calls for the United States to stall its efforts. The system that we need would surely save lives and facilitate a rapid recovery after the inevitable earthquakes that will strike not only California, Alaska, Nevada, Hawaii, Oregon, Utah, and Washington, but many other states, including ones in the eastern and central parts of the country. The Earthquake Hazards Program also needs funding to take advantage of new technologies (such as better seismic instrumentation, more geodetic measurements, and more use of LiDAR in mapping faults) that are improving our abilities to reduce risks from earthquakes.

The National Science Foundation's EarthScope-US Array experiment, which has been deploying seismic instruments across the country, but for only 18 months at a given site, has demonstrated how useful a robust national seismic network could be. For example, the US Array instruments helped to detect a magnitude 3.7 earthquake in the same area as, but approximately one year before, the magnitude 6.0 earthquake that damaged the town of Wells, Nevada on February 21, 2008. Unfortunately, the US Array instruments in most western United States have been moved eastward in NSF's experiment, and the USGS-supported seismic network can no longer detect the small events that might help us eventually predict earthquakes or that might be critical for an early warning system for many urban areas throughout the country. That is, USGS support of a national seismic and geodetic network, with collaboration from state and university-based regional networks, is vital.

The Landslide Hazards Subactivity and the Volcano Hazards Subactivity of the USGS's Natural Hazards Activity are slated for 4% reductions in the President's budget. As indicated in recent USGS and National Academy of Sciences studies, landslides (and related land-surface movements such as debris flows, shrink-swell soils, sinkholes, and subsidence) cause billions of dollars of damage per year, yet not enough has been done to map and understand the hazards, a key step to risk reduction. The Association of American State Geologists strongly supports increased funding of USGS hazards programs, including earthquakes, volcanoes, and landslides. Geologic mapping is a key to reducing risks from these hazards, which brings me back to our key concern – funding for the National Cooperative Geologic Mapping Program. It and the comparably important National Geological and Geophysical Data Preservation Program, are housed in the USGS's Core Science Systems Activity. They both provide the basis for other USGS activities. They are integral to economic development through work that stimulates the responsible development of energy, mineral, and water resources; reduces risks from natural hazards; and guides our stewardship of the environment.

Thank you, again, for this opportunity to comment on the value of USGS programs.

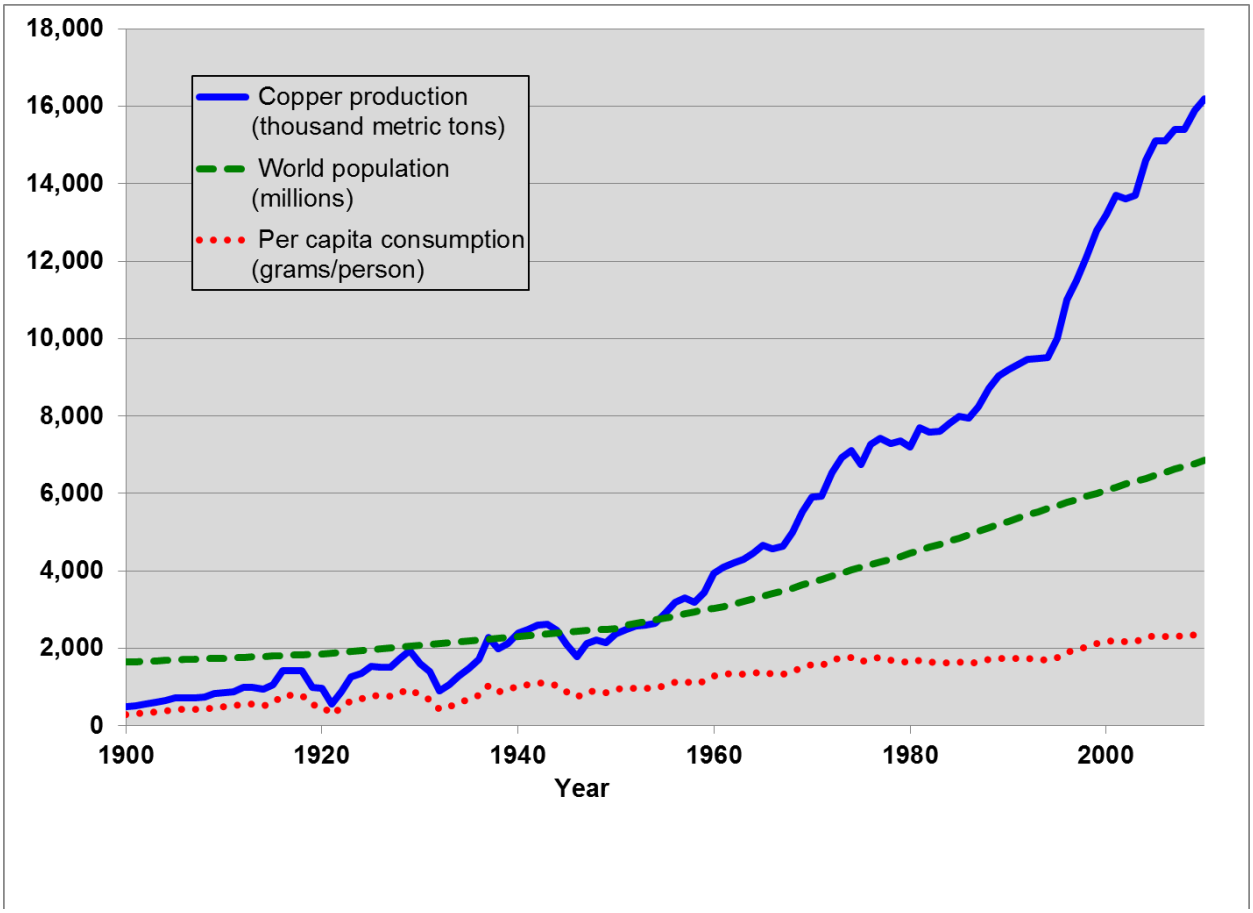

Figure 1. Global production of copper compared with world population and per capita consumption (production divided by population), a measure of average standard of living, from 1900 to 2010 (mineral production data from USGS). Demand for nearly every mineral and energy commodity is high, in part because of increasing world population and in part because of increasing standards of living in many parts of the world. While world population increased four-fold from 1900 to 2010, per capita copper consumption increased eight-fold, such that annual copper production in 2010 was 33 times more than in 1900. Global copper production in 2010 was a record high, at 16.2 million metric tons, approximately the same as the cumulative historical production, since 1906, from the Bingham Canyon copper mine in Utah. Copper is used primarily to conduct electricity.

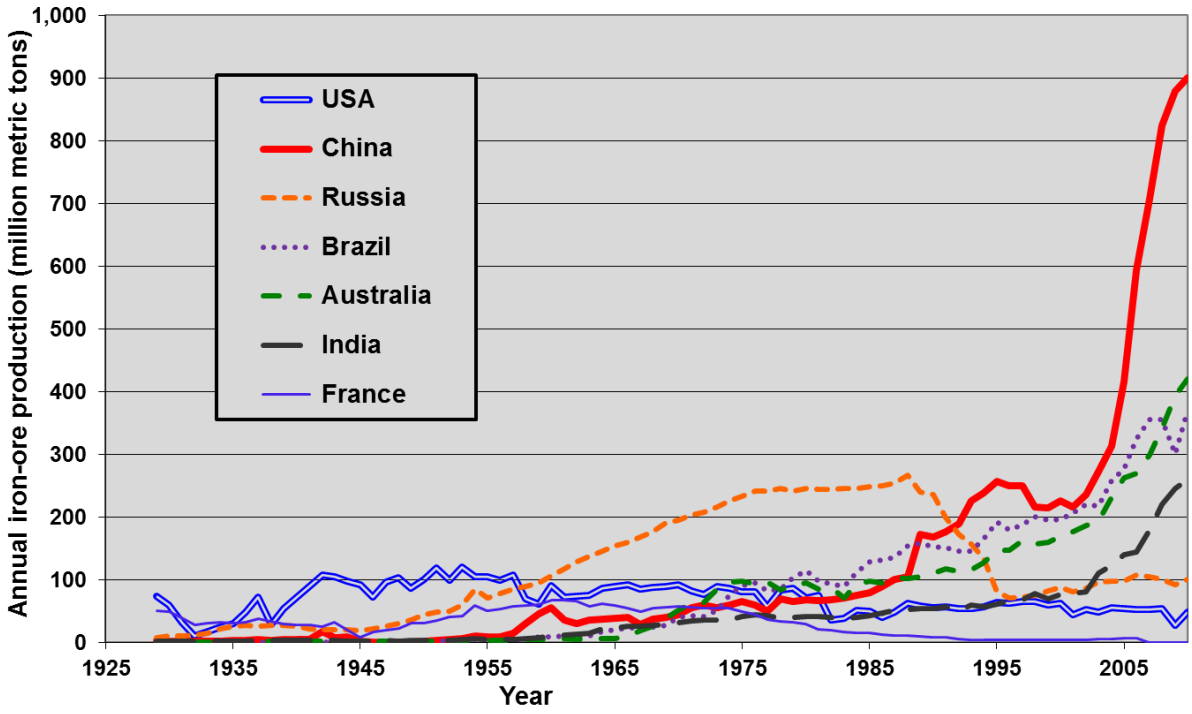

Figure 2. Iron-ore production by country (in millions of metric tons) from 1929 to 2010 (data from USGS). Global annual iron-ore production also reached an all-time high in 2010. Iron is used primarily in steel. Most of the iron-ore production from Australia and Brazil has fed the steel industry in China.

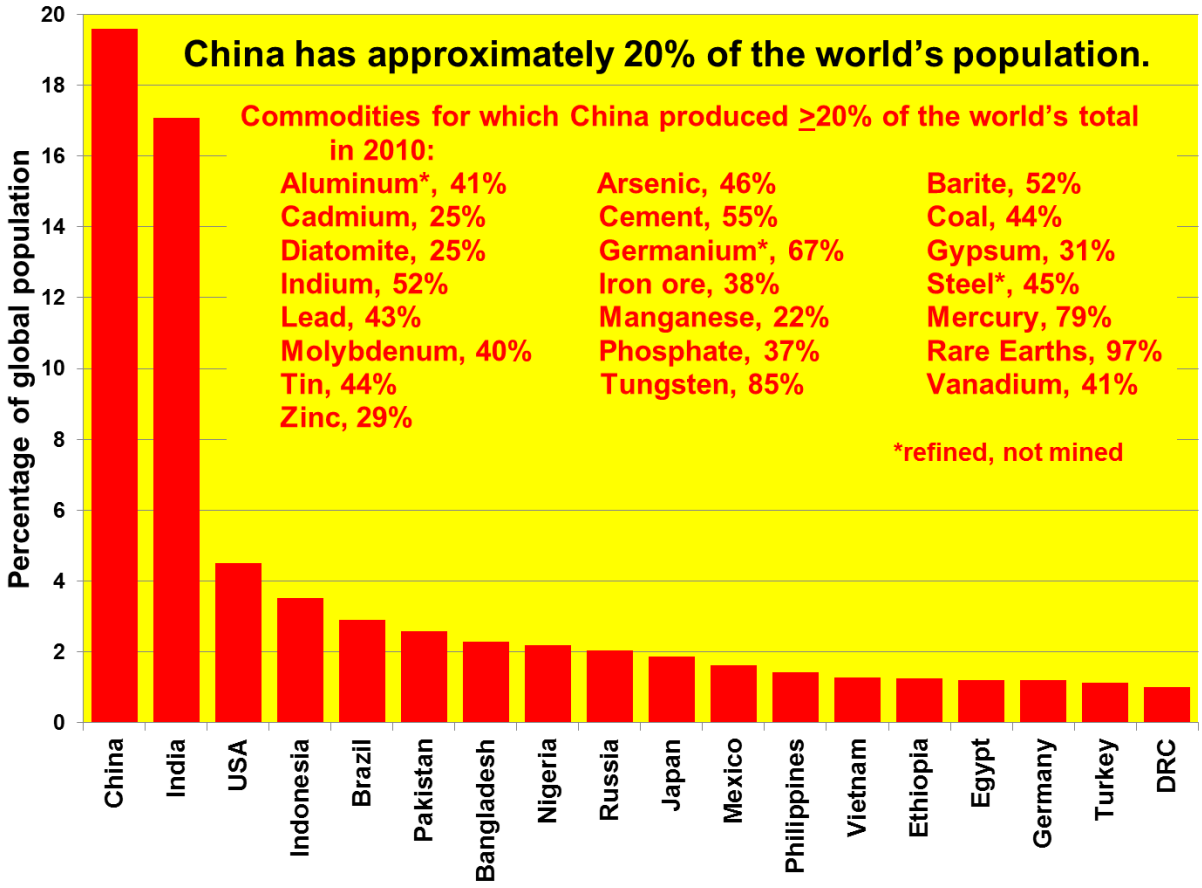

Figure 3. Percentage of global population by country. With approximately 20% of the world's population, China produces well over 20% of the world's supply of many mineral and energy commodities, some of which are highlighted on this graph (population data from CIA, coal production data from EIA, other mineral commodity data from USGS; DRC = Democratic Republic of Congo).

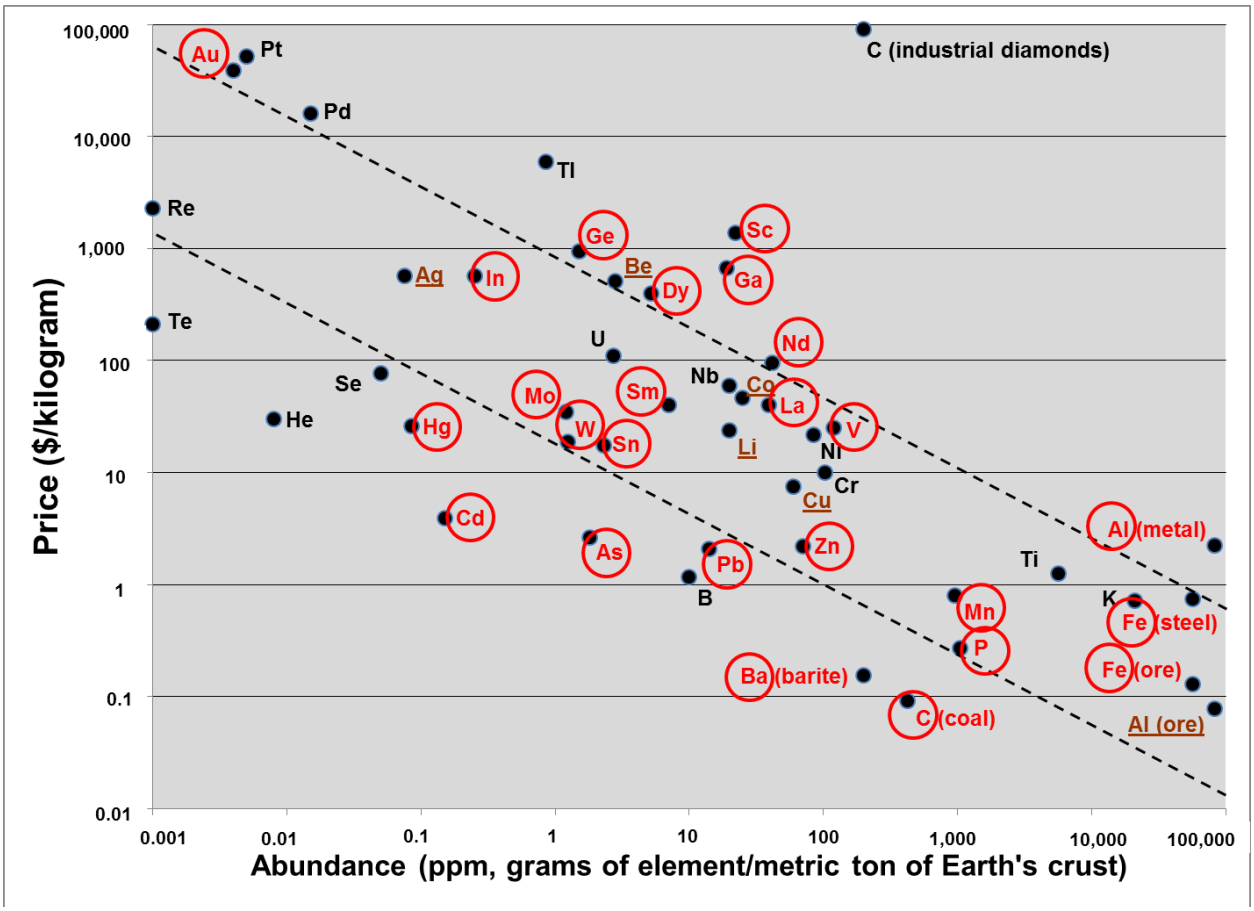

Figure 4. Average price in 2010 versus abundance of various chemical elements (data are mostly from USGS *Mineral Commodity Summaries 2011* for prices and from the 85th edition of the *CRC Handbook of Chemistry and Physics* for abundances). The dashed lines illustrate the general trend of increasing price for rarer elements. In 2010, China was the leading producer of 25 (circled) of the 46 mineral commodities plotted and among the top three producers of another five (underlined). These include silver (Ag), aluminum (Al) metal and ore, arsenic (As), gold (Au), barium (Ba), beryllium (Be), cadmium (Cd), carbon (C, as coal), cobalt (Co), copper (Cu), iron (Fe) as both ore and steel, gallium (Ga), germanium (Ge), mercury (Hg), indium (In), lithium (Li), manganese (Mn), molybdenum (Mo), phosphorus (P), lead (Pb), scandium (Sc), tin (Sn), vanadium (V), tungsten (W), zinc (Zn), and the rare earth elements, with dysprosium (Dy), lanthanum (La), neodymium (Nd), and samarium (Sm) shown on this graph. The United States was the top producer of two, beryllium (Be) and helium (He), and among the top three producing countries for 13 commodities. Russia was the top producer of three, industrial diamonds (another form of carbon, C), nickel (Ni), and palladium (Pd), and among the top three for 12. Australia was the top producer of two, aluminum (Al) ore and titanium (Ti), and among the top three for 10 mineral commodities. Other global leaders include Chile for copper (Cu), lithium (Li), and rhenium (Re); South Africa for chromium (Cr) and platinum (Pt); Democratic Republic of Congo for cobalt (Co); Mexico for silver (Ag); Turkey for boron (B); Brazil for niobium (Nb); Canada for potassium (K); Kazakhstan for uranium (U); and Japan, from its smelting of imported copper ores, for selenium (Se) and Tellurium (Te). Thallium (Tl) is a byproduct of copper, zinc, and lead processing.