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America's Metals, Minerals, and Materials Misery

A Monday Morning Musing from Mickey the Mercenary Geologist

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Today I revisit a subject that was prominent in the American conscious post-global economic crisis and brought to the forefront by the rare earth element and lithium bubbles from 2009 to 2011:

The United States of America depends on imported supplies for most of its industrial metals, minerals, and materials demand.

I spoke and wrote extensively about the US of A's dearth of domestic production and dependence on risky, corrupt, unstable, and/or unfriendly sources in 2011 and 2012. Here are selected examples: (**Mercenary Interview March 4, 2011**; **Mercenary Musing, August 6, 2012**; **Mercenary Video, June 9, 2012**).

Over the past 14 months, the Trump administration has rolled back government regulations, streamlined bureaucracies, cut taxes, and proposed major infrastructure buildouts and tariffs on imports of aluminum, steel, and Chinese goods. Combined with a stronger economy, booming stock markets, and higher commodity prices, it seems likely that mineral demand will increase in the short to midterm. So this is an opportune time to provide an update on our overwhelming reliance on foreign sources to meet domestic mineral demand.

The United States Geological Survey publishes an annual compendium of mineral and material commodities and documents domestic production, imports, exports, apparent consumption, and official government stockpiles among other data (**USGS Mineral Commodities Summaries**).

Let's start with a chart from the 2017 publication that shows US net import reliance for the 64 industrial metals, minerals, and materials with ≥25% dependence:

2017 U.S. NET IMPORT RELIANCE[1]

Commodity	Percent	Major import sources (2013–16)[2]
ARSENIC (trioxide)	100	Morocco, China, Belgium
ASBESTOS	100	Brazil, Russia
CESIUM	100	Canada
FLUORSPAR	100	Mexico, China, South Africa, Vietnam
GALLIUM	100	China, Germany, United Kingdom, Ukraine
GRAPHITE (natural)	100	China, Mexico, Canada, Brazil
INDIUM	100	Canada, China, France, Republic of Korea
MANGANESE	100	South Africa, Gabon, Australia, Georgia
MICA, sheet (natural)	100	China, Brazil, Belgium, Austria
NEPHELINE SYENITE	100	Canada
NIOBIUM (columbium)	100	Brazil, Canada, Russia
QUARTZ CRYSTAL (industrial)	100	China, Japan, Romania, United Kingdom
RARE EARTHS	100	China, Estonia, France, Japan
RUBIDIUM	100	Canada
SCANDIUM	100	China
STRONTIUM	100	Mexico, Germany, China
TANTALUM	100	Brazil, Rwanda, Australia, Canada
THALLIUM	100	Russia, Germany
THORIUM	100	India, United Kingdom
VANADIUM	100	Czechia, Austria, Canada, Republic of Korea
YTTRIUM	100	China, Estonia, Japan, Germany
GEMSTONES	99	Israel, India, Belgium, South Africa
BISMUTH	95	China, Belgium, Peru
POTASH	92	Canada, Russia, Israel, Chile
TITANIUM MINERAL CONCENTRATES	91	South Africa, Australia, Canada, Mozambique
ANTIMONY (oxide)	85	China, Belgium, Bolivia
ZINC	85	Canada, Mexico, Peru, Australia
STONE, dimension	83	China, Brazil, Italy, Turkey
RHENIUM	80	Chile, Belgium, Germany, Poland
ABRASIVES, fused aluminum oxide (crude)	>75	China, Canada, France
ABRASIVES, silicon carbide (crude)	>75	China, Netherlands, South Africa, Romania
BARITE	>75	China, India, Mexico, Morocco
BAUXITE	>75	Jamaica, Brazil, Guinea, Guyana
TELLURIUM	>75	Canada, China, Belgium, Philippines
TIN	75	Peru, Indonesia, Malaysia, Bolivia
COBALT	72	Norway, China, Japan, Finland
PEAT	71	Canada
DIAMOND (dust, grit, and powder)	70	China, Ireland, Russia, Romania
CHROMIUM	69	South Africa, Kazakhstan, Russia
PLATINUM	68	South Africa, Germany, United Kingdom, Russia
SILVER	62	Mexico, Canada, Peru, Poland
ALUMINUM	61	Canada, Russia, United Arab Emirates, China
NICKEL	59	Canada, Norway, Australia, Russia
TITANIUM (sponge)	53	Japan, China, Kazakhstan, Ukraine
GERMANIUM	>50	China, Belgium, Russia, Germany
IODINE	>50	Chile, Japan
IRON OXIDE PIGMENTS (natural)	>50	Cyprus, Spain, France, Austria
IRON OXIDE PIGMENTS (synthetic)	>50	China, Germany, Canada, Brazil
LITHIUM	>50	Chile, Argentina, China
TUNGSTEN	>50	China, Canada, Bolivia, Germany
BROMINE	<50	Israel, China, Jordan
ZIRCONIUM MINERAL CONCENTRATES	<50	South Africa, Australia, Senegal
ZIRCONIUM	<50	China, Germany, Japan
MAGNESIUM COMPOUNDS	47	China, Canada, Australia, Brazil
GARNET (industrial)	46	Australia, India, South Africa, China
PALLADIUM	45	South Africa, Russia, Italy, United Kingdom
MICA, scrap and flake (natural)	42	Canada, China, India, Finland
LEAD	40	Canada, Republic of Korea, Mexico, India
ALUMINA	37	Australia, Suriname, Brazil, Jamaica
SILICON	35	Russia, Brazil, Canada, China
COPPER	33	Chile, Canada, Mexico
VERMICULITE	30	Brazil, South Africa, China, Zimbabwe
PUMICE	27	Greece, Iceland, Mexico
FELDSPAR	26	Turkey, Mexico, Spain

From the chart and footnote listings in **the USGS document**:

- The US imports 100% of 21 mineral commodities, 50% or more of 29, and more than 25% of another 14.

- The country imports less than 25% of apparent consumption for the following 17 materials: beryllium, cadmium, cement, industrial diamonds, gypsum, iron and steel, iron and steel slag, lime, magnesium metal, fixed nitrogen-ammonium, perlite, phosphate rock, construction sand and gravel, salt, crushed stone, sulfur, and talc.

- The US of A is a net exporter of 16 commodities: metallic abrasives, boron, clays, diatomite, gold, helium, iron and steel scrap, iron ore, kyanite, molybdenum, industrial sand and gravel, selenium, soda ash, titanium dioxide pigment, wollastonite, and zeolites.

The 2017 United States net import reliance data for 97 minerals is summarized in the following table:

Net Import Reliance	
100%	21
75% - 99%	14
50% - 74%	15
25% - 49%	14
1% - 24%	17
Net Exporter	16

Americans should be concerned not only because of our dependence on other countries for the majority of essential industrial commodities but also because of some of the countries that we are most dependent on.

Let's look at countries that are unfriendly, unstable, and/or corrupt and the number of materials for which we import a quarter or more (25%) of annual demand:

- China is our primary, secondary or tertiary source for 31 commodities, mainly specialty metals and industrial minerals with small markets.

- Russia is an important source for 12 commodities, including five major metals and one major agricultural mineral.

- South Africa is the largest supplier of six major metals and a significant supplier of two industrial minerals.

- Other countries with high geopolitical risk that supply one or more minerals include Bolivia, Gabon, Georgia, Guinea, Kazakhstan, Mozambique, Philippines, Rwanda, Senegal, and Ukraine.

The United States, despite being >25% dependent on foreign sources for 64 materials, holds strategic stockpiles of only 14.

The National Defense Stockpile (NDS) is the government program designed to be America's insurance policy for commodities in times of national emergency. Its primary mandate is to eliminate or reduce

dangerous and costly dependence on foreign nations for strategic and critical mineral resources during disruption of supplies. Stockpiled materials must meet three distinct criteria:

- They must be essential for the common defense, whether for the military or industry.
- Materials must be insufficiently available in the United States.
- All materials must have the distinct capability of actually being stockpiled.

Let's review the 100-year history of United States mineral stockpile policy to facilitate understanding of the present supply situation:

During and after our entry into World War I, it became apparent that the United States was deficient in many strategic minerals. In 1917, the War Industries Board recommended that future materials problems should be anticipated and ameliorated in advance.

In 1922, the Army and Navy Munitions Board was established by the War Department to plan for industrial mobilization and procurement of munitions and supplies. It established a list of 14 strategic minerals where supply was wholly or substantially dependent on foreign sources and an additional 15 critical minerals that were available to some degree from domestic sources. But there was no procurement of these 29 strategic minerals.

In 1938-1939, two Congressional acts resulted in an authorization of $100 million for a stockpile of 42 strategic and critical raw materials. However at the beginning of World War II, only $54 million had been purchased.

America's strong industrial and manufacturing base was fully mobilized to support the war effort in 1942. Massive quantities of ferroalloys, manganese, tin, natural rubber, and other materials were imported and stockpiled. Of 15 materials in the stockpile, only three were produced domestically. The USGS and Bureau of Mines were tasked with exploring, developing, and producing domestic sources of and substitutes for critical minerals. These evaluations resulted in many new mineral discoveries and mines.

Immediately after the war, Congress passed the Strategic and Critical Minerals Stockpiling Act of 1946. The act was designed to "prevent a dangerous and costly dependence of the United States on foreign nations for supplies of these materials in times of national emergency".

The Act funded a program to procure five years of supply based on estimated wartime consumption. It also encouraged development of domestic sources with government buying programs, credits, grants, and subsidies. By the beginning of the Korean War in 1952, stockpile objectives consisted of 75 commodities with a value of $8.9 billion. It grew to $10.4 billion in1956.

Based on assumptions by military war planners of short nuclear wars versus longer-lived conventional wars, the program was reduced to three years supply in 1958, and 63 of 75 stockpiled materials were declared in excess. In 1962, the value of these materials was $7.7 billion with only $3.4 billion required under then current war scenarios.

Due to worldwide base metal shortages, the government reduced the inventory by $1.6 billion by the end of 1965 via sales of antimony, cadmium, copper, lead, and zinc to support domestic industries. Meanwhile, the strategic and critical list had grown to 89 materials.

The stockpiling requirement was reduced to one year supply in 1970 to pay off federal budget deficits and then was changed back to a three-year goal by an Act of Congress in 1979. That act specifically prohibited using stockpile sales to reduce budget deficits.

In the early 1980s, the world was in recession, the US metals mining industry was in decline, and the stockpile was maintained. Between 1984 and 1994, it was upgraded by replacing chromite and manganese ores with ferrochrome and ferromanganese alloys and paid for by disposal of excess materials.

In 1988, management of the stockpile was transferred from the Federal Emergency Management Agency (FEMA) to the Department of Defense (DOD). Concurrent with the collapse of communism in 1989 that culminated in dissolution of the Soviet Union in late 1991, the DOD reevaluated its war scenarios and decided "to modernize the stockpile".

This decision led to a paradigm shift in the National Defense Stockpile.

By 1992, the DOD was viewing foreign suppliers as more reliable, downsizing the military, requesting less budget money to maintain the stockpile, and lobbying to sell many stockpiled minerals to offset post-Cold War defense budget reductions. Congress approved sales of 26 minerals including cobalt, chromium, manganese, and platinum; i.e., four commodities where we were almost wholly dependent on imports from notoriously unstable countries in southern Africa and post-Soviet, crime-ridden Russia.

During the Clinton and Bush Jr administrations from 1993 to 2005, most of the remaining stockpiles were sold off to fund military benefits, health care, and retirement, war monument programs, minting of commemorative silver coins, and the general treasury to the tune of $5.9 billion.

In 1994, the National Defense Stockpile of 91 strategic minerals and materials contained only 55% of the three-year supply required by the 1979 act, with a total value of $8.9 billion versus the $16.1 billion earmarked.

In 1997, the Defense Department once again planned for one-year wars thus enabling stockpile sales to continue unabated:

- In 1999, the earliest year for which annual reports are easily obtainable, the stockpile consisted of 40 minerals and materials with a market value of $3.5 billion.
- In 2001, the stockpile consisted of 33 minerals and materials with a market value of $2.5 billion.
- In 2006, the stockpile consisted of 22 minerals with a market value of $1.6 billion.
- In 2011, the stockpile consisted of 14 minerals with a market value of $1.4 billion.

The end of fiscal year 2016 (September 30) is the latest posted annual report from the **National Defense Stockpile Center** documenting individual commodities and overall value of the stockpile. At that time, the strategic and critical stockpile contained 18 minerals and materials with a market value of less than $1.2 billion.

Note that for my count of 18, I grouped various stockpiled materials for specific elements (e.g., three chromium products), "columbium" (Nb) metal and ferroniobium alloy, and the platinum group metals (Pt and various alloys).

The 2016 stockpile list also shows surplus materials offered for sale:

Inventory Quantities and Market Value as of September 30, 2016 (Millions of Dollars)

Material	Unit	Total Inventory	Avail For Sale	Market Value
Beryl	ST	1		$0.00
Beryllium Metal Vac Cast	ST	7	15^	$2.64
Beryllium Metal HPP	ST	72	15^	$26.05
Beryllium Rods	LB	13		$0.01
Beryllium Structerd Powder	LB	8,927		$3.58
Chromium - Ferro High Carbon	ST	63,231	23,500*	$68.98
Chromium - Ferro Low Carbon	ST	33,884	23,500*	$76.76
Chromium Metal-combo electro & alumin	ST	4,304	200	$33.93
Cobalt	LB Co	663,709		$8.43
Columbium Metal Ingots	LB Cb	22,156		$0.97
Ferroniobium	LB	129,961		$1.65
Germanium Metal	kg	13,364		$22.70
Germanium Scrap	kg	834		$1.13
Germanium Wafers	EA	101,899		$7.65
Inconel 718	LB	535		$0.00
Lithium Ion - LCO	kg	241		$0.36
Lithium Ion - LNCA	kg	990		$1.31
Lithium Ion - MCMB	kg	1,266		$1.35
Manganese - Ferro High Carbon	ST	263,056	50,000	$185.94
Manganese - Metallurgical Grade Ore	SDT	322,025		$0.63
Mercury	LB	9,781,604		$307.24
Plastic Bonded Explosive (TATB)	LB	2,400		$0.31
Platinum	Tr Oz	8,380		$9.98
Platinum - Iridium	Tr Oz	489		$0.27
Platinum - Palladium	Tr Oz	0		$0.00
Palladium Group Alloys - PD-CO Wire	Tr Oz	4		$0.00
Platinum Group Compounds - Iridium Allo	LB	46		$0.08
Quartz Crystals	LB	15,759		$0.00
Tantalum Carbide Powder	LB Ta	3,777		$0.35
Tantalum Metal Scrap	LB	186		$0.02
Tantalum Metal Scrap - Drum Alloy	LB	3		$0.00
Tin	MT	4,041		$76.39
Titanium Alloy Scrap	LB	155		$0.00
Tungsten Metal Powder	LB W	275,738		$4.20
Tungsten Ores & Concentrates	LB W	25,656,528		$295.31
Yttrium Oxide	kg	8,800		$0.13
Zinc	ST	7,993		$14.49
Total Inventory Market Value:				**$1,152.83**

In fiscal year 2014, the National Defense Stockpile Center had outstanding orders to purchase Cd-Zn-Te substrate materials, ferroniobium alloy, Li-ion precursors, plastic explosives, and yttrium oxide. Those orders have now been filled except for Cd-Zn-Te substrate.

In fiscal year 2018, the NDSC has orders to accumulate boron carbide, carbon fiber, europium, germanium, tantalum, tungsten-rhenium metal, and silicon carbide fiber.

Now let's do a comparative analysis of the USGS chart and the 2016 NDSC table:

The 2016 National Defense Stockpile holds 14 of the 64 mineral commodities that are on the USGS' chart with >25% net import reliance; it holds one with <25% import dependence (Be); and one that was declared toxic by the EPA in 2001 (Hg), and discontinued as part of the USGS import reliance compilation.

Note that I have eliminated Inconel (Ni-Cr-Nb-Mo superalloy) and plastic explosives in this discussion.

- The US government is selling two stockpiled metals for which we are significantly reliant on imports from unstable or unfriendly sources: chromium at 69%, sourced from South Africa, Russia, and Kazakhstan; and manganese at 100%, sourced from South Africa, Gabon, and Georgia, plus Australia.

- Of the 21 minerals for which we are 100% import dependent, five are held in the stockpile: niobium, manganese (selling), quartz crystals, tantalum, and yttrium.

- Of the 31 for which we are dependent on China as the first, second, or third largest supplier, seven are stockpiled: cobalt, germanium, lithium, quartz crystals, titanium, tungsten, and yttrium.

- Of the nine for which we are dependent on Russia as the first, second, or third largest source, three are stockpiled: chromium (selling), germanium, and niobium.

- Of the 10 for which we are strongly dependent on South Africa as a major source, there are stockpiles of four: chromium (selling), manganese (selling), platinum, and titanium.

The import dependence of the United States of American for major and minor industrial mineral resources is alarming. Moreover, many essential minerals are sourced from countries with geopolitically risky, unfriendly, unreliable, unstable, and/or corrupt, fascist governments. These countries include China, Russia and its former Soviet satellites, those in southern Africa, and select countries in other parts of the Third World.

The National Defense Stockpile is designed to ameliorate US vulnerability on foreign sources if geopolitical events disrupt or cut off access to strategic and critical minerals. That said, the stockpile is now geared for short duration wars imagined by Department of Defense gamers.

It is apparent the DOD has little to no concern for industries that would not be involved directly or peripherally in an armed conflict.

To illustrate these myopic military views, the NDS is currently selling two major steel-making alloys of which we are 100% import reliant on South Africa, Kazakhstan, and Russia in one instance (ferrochromium) and South Africa, Gabon, Georgia, plus Australia in the other (ferromanganese).

That seems a recipe for disaster and in my opinion, our current situation is untenable.

That said, I am hopeful that President Trump's rollback of onerous regulations, reduction of bloated bureaucracies, reinstatement of lands in the Western US to mineral entry, and streamlining of permitting and development processes will continue to lead to a stronger market economy and help revive domestic extractive mineral and energy industries as the coming bull market for commodities develops.

Ciao for now,

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Mickey worked for junior explorers, major mining companies, private companies, and investors as a consulting economic geologist for over 20 years, specializing in geological mapping, property evaluation, and business development. In addition to Mickey's professional credentials and experience, he is high-altitude proficient, and is bilingual in English and Spanish. From 2003 to 2006, he made four outcrop ore discoveries in Peru, Nevada, Chile, and British Columbia.

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