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Rare Earths In Review

A Decade of Decline & Deception

*How Wall Street Darling Molycorp Undermined
the U.S. Economy, Degraded our National
Security and Distorted the Global Economic
Balance and How These Falsehoods Continue to
be Promoted Even Today*

A Story of Fraud and Deception

- It all started with a false narrative designed to concentrate and maximize financial returns towards a single wall street Initial Public Offering (IPO).
- The consequences resulting from the universal promotion of this false narrative has greatly contributed to the ongoing decline of the U.S. economy and our national security.
- The damage is not limited to the U.S, but has effected and degraded all technologically advanced non-Chinese economies.

Deception In Plain Sight

- The geochemistry of the Mt. Pass deposit was thoroughly documented and freely available in the public domain
 - Heavy Lanthanides were not recoverable from the Bastnasite ore

Meaning that 7 of the 16 rare earths were not recoverable

- Nearly 85% of the RE distribution was comprised of Lanthanum and Cerium
 - Low value REs historically subject to oversupply

IPO Documents Contained Obvious Falsehoods

- Molycorp's IPO documents contained falsehoods regarding recoverability of various heavy rare earths that were critical to its stated business plan
 - Excerpt: Page 5, Molycorp SEC filing 'SRK Consulting and Engineering' documents provided to all IPO investors
<https://www.sec.gov/Archives/edgar/data/1489137/000095012310065239/d74323fwfwp.htm>

2.1 Rare Earth Elements

The mineral deposit of Mountain Pass is comprised of the Lanthanide Group of rare earth elements. Bastnasite is the primary mineral in the Mountain Pass deposit. Bastnasite is a mixed Rare Earth fluoro-carbonate mineral comprised of the following:

- 50% (by weight) Cerium
- 33% Lanthanum
- 12.4% Neodymium
- 4% Praseodymium
- Recoverable amounts of samarium, europium, gadolinium, dysprosium, terbium and other REEs.

All historical data on the deposit was unambiguous:
Dysprosium and Terbium were not recoverable

Molycorp's *Business Plan* Was Based On Capabilities It Did Not Have & Markets That Did Not Exist !

Excerpt: Inside Cover, Molycorp SEC filing 'SRK Consulting and Engineering' document
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Table1: Base Case TEM Parameters	Annual Production		Percentage of	
Product	(k-lbs)	Price (USD/lb)	Net Revenue	
Lanthanum Oxide	6,829	3.00	4.1%	
Cerium Oxide (Glass Products)	3,196	1.86	1.2%	
Cerium – Water Filters	7,456	6.00	8.9%	Undeveloped Market
Cerium Hexahydrate	10,652	4.50	9.5%	
Europium Oxide	42	215.00	1.8%	
Lanthanum Metal	5,515	6.00	6.6%	No Capabilities
Neodymium/Praseodymium Metal	255/688	17.27	3.3%	No Capabilities
Nd-Iron-Boron Alloy	18,000	16.00	57.2%	No Capabilities
Samarium Cobalt Alloy	1,668	23.00	7.6%	No Capabilities

83.6 of projected income was based on phantom capabilities and markets (74.7% metallurgical and 8.9% water filtration).

Molycorp had no metallurgical capabilities and the Cerium Water Filter market was not a developed market (SorbX).

In Review

Over 80% of its projected revenues were based on capabilities and markets that did not exist

Over 80% of its rare earth distribution was low value, light rare earths that were historically in over-supply

Over half of its distribution was Cerium, a rare earth that was typically priced below its production cost

The Mt. Pass deposit did not contain recoverable levels of heavy REs critical to technology & defense applications and Molycorp's stated business model

Fraud or Wishful Thinking ?

In Truth, It Does Not Matter

- Molycorp sold itself to investors, the Department of Defense and Members of Congress as '*the*' solution for all U.S. economic and National Security needs
 - despite the fact that it could not produce any of the critical heavy lanthanides and had no metallurgical capabilities

In fact, Molycorp was never a key supplier of technology resources to the metallurgical RE value chain.

Its historical core business was:

- 1) a supplier of Lanthanum to W.R. Grace, used in petroleum refining,
- 2) a supplier of Europium used in the Cathode Ray Tube (TV) market,
- 3) a swing supplier of Cerium when prices were above its production cost

Despite Its Overwhelming Shortcomings, Failure Was Inevitable For Much Broader Reasons

What follows is a cursory list of known and observable fundamental macro-industry issues that were never disclosed, or adequately disclosed, to investors, Congress or the Pentagon:

1. At the time Chinese rare earth industry publications disclosed that the Chinese mining industry maintained rare earth mining capacity equal to three-times global demand
 - Various Chinese publications, available on-line and in English, outlined China's internal production capacity and capabilities. Credible sources listed Chinese internal rare earth production capacity at three-times global demand (*much of this would later manifest as 'black market' production)
 - According to these same sources one-third of this capacity was decommissioned, beginning sometime in 2013*
2. Most of China's rare earth production was a byproduct of iron ore mining: having no direct mining cost

Circa 2010 – 2013: China's combined production capacity of rare earths exceeds three times global demand: Association of China Rare Earth Industry, Chinese Society of Rare Earths and other Chinese publications

Continued

3. Various commodities producers in the U.S. mining industry were already dumping the recoverable equivalent of at least 85% of global demand each year to avoid regulatory changes first implemented in 1980 (Part 75 of U.S. 10 CFR 40). These regulatory changes were ultimately responsible for transferring the rare earth industry to China in the first place
4. Raw rare earth resources and oxides had no high-value uses until they were converted into a useful form, such as metals, alloys, magnets, garnets, phosphors, etc.
5. China has the only fully integrated value chain with capacity to produce metals, alloys, magnets, garnets and other value added products from oxides
6. Japan has a limited value chain with no available capacity and Japanese industry continues to rely heavily on China to meet its internal / domestic needs

Continued

7. Japan was reluctant to expand internal rare earth value chain capabilities because Chinese pricing and control over the market for value added goods offered little or no profit and was ultimately subject to Chinese monopoly price and supply manipulation
8. The U.S. had no metallurgical or other value chain capabilities, because;
 - a) China acquired, idled or bankrupt all U.S. value adding capabilities; as a consequence of the same-said regulations above
 - b) U.S. corporations had no interest in investing or developing their own rare earth value chain capabilities because China provided these materials at reasonable prices and the cost of establishing their own value chains would greatly exceed any one company's projected demand of these materials over any time or return measure.

The Molycorp Narrative

Molycorp's False Narrative was that the rare earth issue was a resource and mining issue and that Molycorp's long history, proven resource and capabilities made it America's best option

Failure Was Inevitable On Multiple Levels

Level 1: The entire IPO business plan was constructed on elemental resources, metallurgical capabilities and commodity markets that Molycorp did not have or did not exist

Level 2: The economics were based on bubble pricing, steep demand curves and limited supply

Level 3: The business plan was never subjected to predictable Chinese monopoly influence

Level 4: Molycorp nor its investment bankers ever communicated (or considered ?) the potential risk of China protecting and enforcing its broader economic, defense and geopolitical goals and objectives to its investors, Congress or the Pentagon

The False Narrative Distorted Public Policy & Investment

All other rare earth mining projects adopted the "resource" narrative

Hired lobbyists delivered and controlled the message to think tanks, policy groups, the Pentagon and members of Congress

For 10 years Congress responded to this message by offering one bill after the next, designed to stimulate production by lowering environmental protections and standards

These facts were first pointed out to members of Congress and to the Department of Defense in 2009 and presented at the Society for Mining, Metallurgy and Exploration (SME) conference in 2009, 2010, 2011, 2012 and 2013 by this author.

Over the last 8 years this author continued to press the point with the previous two Administrations, Members of Congress, House and Senate Armed Services Committee Staff, Energy and Natural Resource Staff, the Department of Defense, Energy Department & National Lab staff and Washington DC Think Tanks, resulting in over 40 trips to Washington DC and over 300 meetings.

Ultimately reality overcame the narrative, but this ruse allowed China a full decade of unchallenged market dominance and technology capture.

The full scope of damage to U.S., EU, Japanese and Korean economic and National Security is beyond measure.

The Molycorp Narrative Deflected Rational Action

It was never a Resource Issue, it is a multi-leveled strategy of global hegemony over commercial & military production.

China's rare earth monopoly operates on 4 levels:

- 1. Mining: Basic Resource Production Monopoly**
- 2. Value Chain: Integration Monopoly**
- 3. Industry & IP Capture: Leverage & Control over All End-Users**
- 4. Supplication & Resource Redirection**

1. Mining: Basic Resource Production Monopoly

- a. Mining REs without a supporting domestic value chain is pointless because RE concentrates & oxides are useless to technology & defense end-users
- b. Consequently, these RE resource would need to pass through China which has the world's only fully integrated value chain and necessary capacity
- c. Realistically, China will undercut western production costs, resulting in bankruptcies, as evidenced by Molycorp's bankruptcy and all other '*ongoing*' non-Chinese producers

2. Value Chain: Integration monopoly:

- a. Free market actors cannot be expected to establish any part of the value chain through independent action because the capital required is significantly higher than what is required for resource production (mining), and is at risk of bankruptcy through Chinese manipulation at the value chain level and indirectly through the resource supply level.
- b. China's value chain consists of over 400 companies that produce over 1000 ultra-high specification products spanning two cities, referred to by the Chinese government as '*rare earth cities*', with a combined population of 17 million people.
- c. U.S. Corporations are exclusively motivated by short term profits. Relocating to China typically results in higher profits in the short-term.
 - i. Short term profit incentives for publicly traded companies outweigh long term consequences. This fuels China's aggressive mercantilist strategy of knocking off non-Chinese producers through relocation and the incremental capture of their technologies and industries
- d. China can bankrupt the value chain directly or bankrupt the resource supplier (the rare earth mine(s)): a two-tiered strategy.

3. Industry & IP Capture: Leverage & Control over End-Users

- a. China is the only country that can guarantee an uninterrupted flow of value added rare earths.
- b. China uses its monopoly control over rare earths to incrementally capture non-Chinese technologies and manufacturing: first by capturing the production of rare earth dependent components, then component sub-assemblies, then product lines, then entire industries.
 - China has already captured much of the world's RE dependent technology and RE end-users because most of the world's leading technologies, consumer goods, commercial goods, industrial goods and defense systems are rare earth dependent.
- c. Now under China's control, China can use carrot-and-stick incentives to force these Chinese dependent companies to continue to use Chinese only value added rare earth products and prevent these companies from developing or supporting the emergence of alternative non-Chinese supply lines through the implied threat of supply disruption.
 - This threat is greatly compounded for defense contractors who may be utilizing Chinese materials without federally required 'waivers' to do so (a federal crime)
- d. As time goes on, China's relative position in all of the above increases. Eventually all rare earth related technology, IP and manufacturing ends up in China
 - Japan is the only exception, but they are losing ground to China
- e. Soon China's control over global technology, markets and economics will become unassailable as it continues to expand far outside the confines of rare earth related technologies, products and industries

Supplication & Resource Redirection:

- a. China will eventually run out of rare earths, but before that happens,
- b. China's next play will be to make the rest of the world its resource supplier
- c. China will allow supplicant non-Chinese producers to feed China's rare earth value chain, but China will retain its monopoly at the value adding, metallurgy, component, system, product, industry and IP level.
 - Molycorp was an example of resource supplication, as it became a supplier to China's metallurgical value chain.
 - All new non-Chinese resource producers can be expected to follow the same strategy.

The potential viability of any other stand-alone RE projects is no different without China's sanction; as China *is the market and sets price*

Why Dwell On Past Failures ?

Until industry and policy makers understand:

1. Resources are useless without a corresponding value chain
 - China has demonstrated that RE resource production is subject to Chinese price manipulation and control
2. Developing a value chain is pointless without first establishing an uninterrupted source of REs, as the enterprise would be subject to supply manipulation, disruption or supply termination
3. Small scale value chain production will be subject to China's large scale efficiencies and ultimately its state sponsored monopoly pricing strategy

Continued

4. The cost of creating a large-scale fully integrated value chain exceeds the technical and financial capacity of any one company, industry or even nation (outside of war time constructs)
5. Furthermore, without fixed off-take agreements China can use its state sponsored monopoly to intermediate – selling value added REs below its cost
6. Opening new RE mines, with non-competitive operating cost structures (most of China's REs come from no-cost byproduct production) that rely on high RE prices is a proven failure.

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7. Historically all U.S. heavy and technology metal RE supply came from byproduct production

The supply was terminated under the regulatory application of 10 CFR 40, part 75 in 1980 and is the origin of failure for the U.S. rare earth industry

8. Those resources remain abundant and available under a structured solution

9. Under a structured solution those resources would be uninterruptable

10. With the establishment of an uninterruptable flow of RE resources the establishment of a fully integrated value chain is possible

Continued

11. A structured solution would allow for multi-national governments, corporations and industries to combine capital to establish a fully integrated rare earth value chain cooperative
12. The cooperative structure would allow for the owner / end-users to make firm commitments for value added goods at cost
13. All surplus would be sold to non-owner / members at 'market'
14. The structured solution would be impervious to Chinese manipulation and pricing

Continued

15. All thorium and other actinides would be transferred to a 'Thorium Bank', a co-located facility that would provide safe long-term storage and act as a multi-national platform for the development of "uses and markets for thorium, including energy"

This can be done within the existing regulations by allowing for the sale and transfer of byproduct RE resources to the cooperative and the thorium and its corresponding liability to the Thorium Bank

Questions ?

Background on NRC / IAEA Regulations: In 1980 the Nuclear Regulatory Commission (NRC) and the International Atomic Energy Agency (IAEA) agreed to apply “source material” regulations specific to uranium mining across the entire mining industry. The U.S. regulatory change was part 75 of U.S. 10 CFR 40 regulations. The NRC regulatory term “source material” defines any processed or refined material with a thorium or uranium concentration above .05% as an input to nuclear fuel. Due to the application of this NRC and IAEA rule towards all mining companies in any IAEA member states – the production of all heavy rare earth resource outside of China were indiscriminately defined as “source material”. To avoid the onerous regulations, costs and liabilities associated with source material all of the world’s heavy rare earth producers eventually terminated the sale of this material – as it was primarily a byproduct of their primary mining operations.

Note: Heavy rare earths are always associated with thorium or uranium, with the exception of Ionic Clays that are exclusively mined in China.

10 CFR 40, and the corresponding IAEA regulations, define any 'processed or refined material' with thorium and or uranium concentration above .05% as "source material". These regulations regarding source material were originally only applied and enforced within the uranium mining and processing industry. In 1980 the NRC implemented part 75 of 10 CFR 40 to mirror similar regulatory changes under the IAEA's regulatory regime. The application of part 75 brought all mining operations and material processing under 10 CFR 40 or its IAEA counterpart.

In nature heavy rare earths and thorium are companion elements. Historically global heavy rare earth production was typically a byproduct of some other commodity or came from thorium rich deposits. As a result of part 75 of 10 CFR 40, and its IAEA counterpart, every heavy rare earth producer outside of China met the technical definition of a source material producer.

The cost and liabilities associated with managing source material far exceeded the value of the corresponding rare earths. In order to protect their primary business of mining titanium, zircon, phosphates or some other commodity, the mining companies diverted the rare earth rich thorium back into the ground or into tailings storage facilities.

This resulted in the eventual termination of all rare earth byproduct production in all IAEA compliant countries and the U.S.

Consequently all operating rare earth value chain producers lost access to the critical heavy rare earths that only came from these sources on a global basis. The result was that rare earth resource mining and value chain production quickly shifted to China.

Technical Notes: To conform with state and federal environmental regulations and not exceed the threshold standards of the NRC these mining operations devised various processes to dilute the thorium bearing rare earths below threshold and background radiation levels. This costly diversion continues today even though these materials are easily recoverable at little or no cost (less cost than the existing dilutive process).

Even light rare earths, like those found in Molycorp's Mt. Pass deposit, contain low levels of thorium. For the record, it was a thorium spill that caused Mt. Pass to shut down in 1998, not lower cost rare earth products from China: a key feature of the dominant narrative.