Rare Earth Materials

The rare earths consist of 15 elements; lanthanum(La), cerium(Ce), praseodymium(Pr), neodymium(Nd), promethium(Pm), samarium(Sm), europium(Eu), gadolinium(Gd), terbium(Tb), dysprosium(Dy), holmium(Ho), erbium(Er), thulium(Tm), ytterbium(Yb) and lutetium(Lu). All of the rare earths except promethium(Pm) occur naturally along with scandium(Sc) and yttrium(Y) which are not rare earths but are normally found in the same ore deposits. The rare earths are not rare. They are just unfamiliar to most people. As an example of their abundance, lutetium(Lu) is 200 times more abundant than gold(Au).

Rare earths are essential for such familiar technologies as cell phones and computer screens, and are also found in many emerging technologies, including alternate energy sources such as hybrid cars and rechargeable batteries. Many defense applications, including missile guidance systems, mine detection, anti-missile defense and communications systems, also require rare earth elements.

Because of the large number of high-technology and defense applications that require rare earths, dependable, quality resources are important to the U.S. economy and critical to continued manufacturing and production.

La – Lanthanum

Lanthanum, a silvery white soft metal is one of the most reactive rare earth elements. When exposed to air, Lanthanum oxidizes quickly. It has a wide variety of uses in many commercial applications. It is used in carbon lighting, camera and telescope lenses, electron microscopes, cast iron, and lighter flints. Lanthanum has biological and chemical applications as well, serving as a catalyst in petroleum cracking and as a phosphate binder in the treatment of hyperphosphatemia.

Ce – Cerium

Cerium, the most abundant of all the rare earth metals, is a highly reactive, malleable and ductile, silvery-colored metal. It oxidizes very rapidly at room temperature, especially in moist air.

Pr – Praseodymium

Praseodymium is a soft, malleable silvery metal. It is used primarily in rare earth magnets and pigment

Nd – Neodymium

Neodymium is one of the more reactive of the rare earths, tarnishing rapidly when exposed to air. It is soft and silvery in color. Magnets containing Neodymium are among the strongest and lightest manufactured today. Neodymium is also a key component in Misch metal, used to make flint for lighters.

Sm – Samarium

Samarium is a rare earth metal with a bright silver luster. Although it is relatively stable in air, it eventually forms a grayish-yellow layer of oxidation. Samarium is commonly used with other rare earths in carbon-arc lighting. It is also used with Cobalt to make permanent magnets.

Sm – Samarium

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Eu – Europium

Europium, the most reactive of all the rare earth elements, rapidly oxidizes in air. It ignites in air between 150 C - 180 C, and is quite ductile. There are not many commercial uses for Europium metal, but Europium oxide is frequently used in television sets and fluorescent lamps.

Gd – Gadolinium

Gadolinium is silvery white and has a metallic luster. It is relatively stable in dry air, but in moist air it quickly forms a coating of oxidation which spalls off. Gadolinium has an extremely high thermal neutron capture cross-section, but its fast burn out rate limits its effectiveness as a nuclear control rod material. Because it is strongly paramagnetic, solutions containing Gadolinium are often used as intravenous radioactive contrast agents. It is also found in nuclear marine propulsion systems, compact discs and computer memory

Tb – Terbium

Terbium is a silver-white metal that is soft enough to be cut with a knife. It is malleable, ductile and reasonably stable in air. It is combined with other elements for use in solid-state devices and can be combined with ZrO2 as a crystal stabilizer of fuel cells. Terbium oxide is used in fluorescent lamps and color television tubes. Terbium is also used in rare earth magnets.

Dy – Dysprosium

A silver metal with a bright luster, Dysprosium is soft, and can be machined without sparking if it is not overheated. Although it is relatively stable in air, it dissolves easily in mineral acids, giving off hydrogen. It should be noted that even small amounts of impurities can greatly affect Dysprosium's properties. Dysprosium is used in laser materials, nuclear control rods, compact discs, magnetic devices, and as a contrast agent in magnetic resonance imaging

Er – Erbium

Erbium is a malleable silvery metal. It is a trivalent element that is relatively stable in air and less prone to oxidation that many of the other rare earths. Oxidation is pink, and used to give color to art glass and jewelry. Erbium is also used in photographic filters, lasers and optical communications.

Yb – Ytterbium

A malleable, ductile silvery soft metal, Ytterbium oxidizes in air, slowly dissolves in water, and rapidly dissolves in mineral acids. It has been used as a radiation source for portable X-ray machines when electricity isn't available. Ytterbium could also used to improve the quality of stainless steel.

Lu - Lutetium

Lutetium is a silvery white trivalent metal. The heaviest and hardest of the rare earth elements, it is also fairly corrosion-resistant. Although it has relatively few commercial uses, it is used as a catalyst in petroleum cracking applications.

Y – Yttrium

Yttrium is a silver, lustrous transitional metal, common in rare earth minerals. It is relatively stable in air, unless finely divided. Yttrium shavings can ignite at 400 C. The element and its compounds have many commercial uses. Yttrium oxide is widely used to make phosphors that give the red color in television picture tubes. It is also used in the production of microwave filters, and cubic zirconia. Other forms of Yttrium are used in gas mantles for lanterns, white LEDs, aluminum and magnesium alloys, and the radioimmunotherapy drug Zevalin®. Yttrium is used in specialty alloys for high temperature applications.

Rare Earth Stocks In Classic Uptrends

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What Are "Rare Earth Elements"?

Rare Earths these days are about as abstruse as the name of the salesperson who sold Nikita Khrushev the shoe he banged on his table at the United Nations on 12 Oct 1960.

But this special group of elements has the unique properties becoming exceptionally useful in emerging technologies, such as electric cars, windmills, solar panels, cell phones and other products requiring small motors and batteries. Rare Earths are also used in many items from iPods to bicycle frames. As examples, neodymium is used for *permanent magnets* in wind turbines, ocean energy turbines and electric drives and lanthanum for nickel-metal-hydride batteries. (Rare metals such as gallium, germanium and indium are used in solar panels while precious metals platinum and palladium are in automotive catalytic converters). We predict the impact of such growth on these commercial areas will especially send Rare Earth prices soaring, even as China is reserving increasing amounts of them for its domestic markets even while it has been increasing export taxes and reducing export quotas.

The "REE" Rare Earth Elements group is considered to include these 15 lanthanide elements: lanthanum, cerium, praseodymium, promethium (does not occur naturally), neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium. The elements yttrium and scandium are also lumped in with Rare Earths because they have similar chemical properties, making 17 REE's in total. In the oxide form, the group is collectively discussed as Rare Earth Oxides (REOs).

Three of the many reasons we are so bullish on Rare Earths are: 1) Their rarity in the face of soaring demand for devices that are considered "green" makes upward price pressures likely despite deflation. 2) The geopolitical urge to *stockpile* Rare Earths for demand by many countries, as a hedge against future shortages that might interfere with commercial production, and 3) military demand, for example to use in "smart bombs" (precision-guided missiles), as many governments would pay virtually any price for them.

TDL led you to investing in Rare Earths so early that most other investment advisers were caught flatfooted, and are still discovering what our having spent years studying them had gleaned.

We must avoid sticky-fingered governments in our analysis of the geopolitical situation for our TDLrs, so our first-choice Rare Earth deposits are in Australia, Canada and the United States. Metallurgy is another very exacting consideration, as separating the different Rare Earth Elements in each deposit is a specialized field requiring quality staff adept at disentangling the genetic code of each mine, if you will. Another aspect is that Rare Earths are frequently found associated with radioactive elements, such as uranium and thorium, making mining them dangerous and, while the mined uranium would be a credit, thorium is virtually worthless these days due to its unexciting near-term commercial prospects. While there are a significant number of companies involved with Rare Earths, we have tried to lead you to drink upstream from the herd toward companies that have the best reserves, managements and prospects for early production.

We ourselves are still buying Rare Earths and will try to hold much of our positions for a minimum of two years, as we are looking for historic "killings" rather than trying to grab small profits here and there. This newsletter's "style" is to go for long-haul home runs rather than base hits.

Please keep in mind that all mining stocks are speculative and should not be bought with money that cannot afford to be lost. Always remain in the High State of Appropriateness when investing.

Editor's Note: James Dines is editor of ***The Dines Letter***, P.O. Box 22, Belvedere, CA 94920, 1 year, 14 issues $295. The *Interim Bulletin Warning* rate is $249 annually. For more information visit the website at www.DinesLetter.com.

Rare Earths Something To Ponder

Here are few interesting facts about rare earth metals.

- China produces about 97% of the world's rare earth metals.
- China wants to use its resources mainly for its domestic consumption while getting global companies to set up high-tech operations in its regions, such as Inner Mongolia.
- In late 1990s, Chinese companies expanded their mining operations, leading to the country's control of most of the world's rare earth production.
- China regulates its exports with quotas and duties. Since 2004, exports from China have shrunk by about 10% each year. Analysts say the export quotas for this year could range between 32,000 tonnes to 34,000 tonnes.
- Demand for rare earth metals is likely to increase between 10% and 20% each year, on back of growing demand for metals such as neodymium, used to make hybrid electric vehicles and generators for wind turbines.