Glossary

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ASSAY: Analysis (as of an ore) to determine the presence, absence, or quantity of one or more components.
CONFLUENCE: In geography, describes the meeting of two or more bodies of water. It usually refers to the point where a tributary joins a more major river, called the mainstream, when that major river is also the highest order stream in the drainage basin. HECTARE: A unit of area equal to 10,000 square meters. Equivalent to 2.471 acres. RARE EARTH: Rare earth elements and rare earth metals are a collection of sixteen chemical elements in the periodic Table, namely scandium, yttrium, and fourteen of the fifteen lanthanides (excluding promethium), which naturally occur on the Earth. The former two are included as they tend to occur with the latter in the same ore deposits. Some definitions additionally include the actinides. The terms "rare earth" and "rare earth metal" are trivial names that fall outside the official IUPAC nomenclature system. Outside of a strict scientific context, however, the terms retain their stability; for instance, the United States Patent and Trademark Office (USPTO) includes the term "rare earth" in the classification of metal alloys and other compounds, as well as distinguishing rare-earth magnets from other types of magnet. The thirty rare earth elements are composed of the lanthanide and actinide series. One element of the lanthanide series and most of the elements in the actinide series are called trans-uranium, which means synthetic or man-made. All of the rare earth metals are found in group 3 of the periodic table, and the 6th and 7th periods. The Rare Earth Elements are made up of two series of elements, the Lanthanide and Actinide Series.
The Rare Earth Elements are:
Lanthanide Series
* Lanthanum Cerium Praseodymium Neodymium Promethium
* Samarium Europium Gadolinium Terbium Dysprosium
* Holmium Erbium Thulium Ytterbium Lutetium Actinide Series
* Actinium Thorium Protactinium Uranium Neptunium
* Plutonium Americium Curium Berkelium Californium
* Einsteinium Fermium Mendelevium Nobelium Lawrencium
What are Rare Earth Elements (REEs)?
The rare earth elements (or "rare earths") are also known as the lanthanide series of elements and include the 15 elements in the lanthanide series of the Periodic Table of the Elements, plus yttrium and scandium. The better known elements are cerium, lanthanum, neodymium, praseodymium, gadolinium, europium, and samarium.
What are REEs used for?
Rare earth elements are used in a wide range of applications, from everyday household items, such as rechargeable cell phone batteries, to cutting-edge technologies such as superalloys used in the aerospace industry. The following are just a few of the many applications for REEs. CATALYSTS: Historically, about half of the rare earths produced were used as catalysts in the petroleum and automotive Industries. For example, cerium is a critical component in both gasoline and the newer diesel catalytic converters found on automobiles and trucks. Among other things, the cerium protects the platinum group metals in the converter from oxidation. In 2005, the proportionate use of REEs as catalysts dropped to 22%, not because of reduced REE consumption but because of increased consumption in other areas. MAGNETS: One of the main areas of increased consumption is the magnet industry. Rare earth magnets are the world's strongest permanent magnets. Approximately 18% of REE demand is for permanent magnets. Neodymium magnets are key components in the electric motors and regenerative braking systems used in hybrid vehicles. Neodymium magnets are also important in the miniaturization of high-technology applications such as
* hard-disc drives,
* CD-ROMS,
* DVDs,
* cell phones, and
* iPods.
RECHAREABLE BATTERIES: Another area seeing significantly increased demand for REEs is the rechargeable battery Industry. Nickel metal hydride (NiMH) rechargeable batteries contain cerium and lanthanum in a form called "mischmetal". NiMH batteries are the battery of choice for many hybrid vehicles, and demand for these batteries is expected to grow with the demand for hybrids. A typical hybrid vehicle may contain 20Kg of REEs between the rechargeable battery pack and the permanent magnet motor and regenerative braking system.
TV, Computer, and Other Screens: REEs are also important in television screens, computer monitors, and other visual displays that employ cathode ray tube (CRT), liquid crystal display (LCD) or plasma display panel (PDP) technologies. The colours you see on the display are from phosphors that contain europium, yttrium, and terbium; the glass contains cerium and yttrium; the faceplates were polished with cerium and lanthanum; the electronics contain neodymium; and the microchips were polished with cerium.
Superalloys, Lasers, Superconductors, etc.: Other areas of growing demand for REEs include metallurgical applications, to produce
* superalloys for the aerospace and building industries;
* medical and dental lasers;
* superconductors;
* water treatment; and

* some forms of fertilizer. Where are REEs found?
The rare earth elements are not, in fact, truly rare. Gold, for instance, is much more rare, and even lead is less common than some REEs. What IS rare, though, is their occurrence in economic quantities compared with other mineral commodities. The REEs are usually found in commercial quantities in the minerals monazite and bastnaesite.
China produces over 97% of the world's rare earths, with 77% of world production coming from one mine. The United States used to produce approximately 6% of the world's supply from one of the only in-situ rare earth mines in the world, at Mountain Pass, California. However, Mountain Pass — the only producing mine in North America - ceased operations several years ago, creating a situation where there is no REE production taking place in North America, or anywhere significant outside of China.
The Hoidas Lake, SK, rare earth showings are unique, in that the REEs are found in the silicate mineral allanite and the phosphate mineral apatite, as opposed to the monazite and bastnaesite mined in China and California. Should the project prove feasible, Hoidas Lake could become the only producer in North America operating at full capacity and, like Mountain Pass, be a unique in the world as an in-situ rare earth mine. Are REEs valuable?
In a word, yes. Typically, once the rare earth ore is mined and concentrated, it is further processed (either by the mining company or a third party) into a mixed rare earth powder (e.g., as oxides or chlorides). This mixed rare earth product may be sold as is, or processed further by separating the individual REEs into a purer product (e.g., cerium oxide or neodymium oxide).
The value of rare earth powders depends on the purity of the rare earth powder, the lot size, and how it was refined. Here are two examples of price variance:
* Oxide powder varies in price from US$3.00 per kg, for cerium oxide in a one tonne lot size, to US$15,000 per kg, for scandium oxide in 100-g quantities.
* Individual powders further refined into metal, depending on purity and lot size, may range in price from US$15.00 per kg, for lanthanum metal, to US$30,000 per kg, for scandium metal.
To put this into perspective, gold is currently worth about US$20,000 per kg. However, a high-grade gold deposit might have a gross value of only US$120 per tonne, while a high-grade rare earth deposit could easily have a gross value of US$1,000 per tonne or more. Because REEs may be distributed in different proportions within a particular deposit, another way to look at value is
to consider the value of one tonne of rare earth oxide (REO) produced.
Hoidas Lake has a higher proportion of the "heavier" rare earths than other deposits. Because these "heavy" rare earths are more valuable, Hoidas demonstrates a higher value for one tonne of REO produced. Based on recent pricing for simple oxides:
* Hoidas would produce one tonne of REO, valued at US$8,600;
* one tonne of REO at Mountain Pass would be worth US$4,400;
* one tonne at Baotou, in China, would be worth US$5,500; and
* one tonne at Mt. Weld, in Australia, would be worth US$6,800.
Who consumes REEs?
The major consumers of rare earths are Southeast Asia (Japan, Korea, Thailand, China) and the USA. The USA used to be the world's largest single consumer of rare earths, at approximately 27% of the world's total. However, during the past few years, China has become the world's largest consumer, surpassing even US consumption. The USA currently imports nearly 100% of its RE requirement, and the value of rare earth products consumed in the USA is estimated to be in excess of US$1 billion per year. Could a Saskatchewan-based Rare Earth Industry compete with China?
Yes. Great Western Minerals has established contacts in Japan, Europe, and the USA who have indicated that they would be prepared to purchase significant quantities of specific rare earth products from a North American producer in order to reduce their reliance on a single source.
Quality, proximity to market and security of supply are the major selling points with both Japanese and North American consumers. However, GWMG believes that the best strategy for establishing an RE industry is to pursue a "mine-to-market " philosophy with the "market" being those products with a significant value-added component targeted to specific users and industries. As China and India (who is close behind) modernize at an unprecedented rate, they are consuming a greater percentage of their own natural resources internally and importing greater quantities of metal and other commodities from the West. China will undoubtedly increase its own use of rare earth elements, which will pave the way for a North American producer to become a major source of rare earth elements for Western consumers. in terms of promoting its resources, Saskatchewan has no shortage of global marketing experience. Uranium, potash, and farm machinery are a few of the province's better-known export successes. A rare earth industry would be well supported in Saskatchewan — in mining and processing, and also in research and development for new applications at state-of-the-art research facilities available in the City of Saskatoon.
TERRACE: sediment from an old stream, usually in an elevated aspect relative to the current streamway. A terrace deposit is a geological term for a flat platform of land created alongside of a river or sea, where, at some Time in the past, the river has cut itself a deeper channel. The former floodplain of the river is therefore at a higher point and is known as a terrace. Rivers can create a sequence of terraces over millennia as they erode away more material. Terraces are formed by river rejuvenation, when the river gains in gravitational potential energy. The terraces themselves are often made from alluvial material previously dumped by the river to create the earlier floodplain, these terrace deposits are broadly horizontal layers of gravel, sand and finer sediments that can sometimes contain prehistoric archaeological finds.
Another notable source of stream terracing is the aggradation of legacy sediments behind dams. These sediment deposits can accumulate very rapidly, in under 300 years, and can be observed to be in excess of five meters in height.