Rare Earth Elements: vital commodities
21 January 2017

Speakers and Abstracts

Prof Frances Wall

Currently Professor of Applied Mineralogy at Camborne School of Mines. BSc Hons first class Geochemistry Queen Mary College, London 1984. PhD Mineral chemistry and petrogenesis of rare earth rich carbonatites, University of London, 2000. Fellow of the Mineralogical Society (F.Min.Soc.), Fellow of the Geological Society (FGS), Chartered Scientist (Csci).

RESEARCH INTERESTS INCLUDE

- Formation of ore deposits, including rare earths, niobium, tantalum and phosphate deposits
- Issues of critical metals
- Carbonatites and alkaline rocks: fundamental controls on their petrogenesis, including mantle metasomatism, formation of graphite and diamond-bearing carbonatites and rapidly erupted extrusive carbonatites.
- Responsible mining including ethical sourcing of metals, public perception of mining and energy issues in mining.

The Geology of Rare Earths

Rare earths are around us all the time, usually in small amounts but making many of our digital and environmentally-friendly technologies work; from computers to catalytic converters, smartphones to wind turbines. In nature, they are also all around us in small quantities in most rocks because they 'follow' elements such as calcium into many rock forming minerals. At these trace element levels, rare earths have been really useful to geologists trying to track the story of geological processes. However, these levels are too low to be worth mining. The highest concentrations of rare earth elements occur in rocks that have some of the most extreme compositions of any rocks on Earth. Carbonatites and alkaline rocks are formed by very small amounts of melting in the mantle. This fundamental process sets the scene and then fractionation of magmas in the crust and exsolution of fluids near the surface produce enrichments of rare earths so that in some cases they can form 10% of the rock. The largest carbonatite-related deposit in the world is in inner Mongolia, China, and supplies the majority of industry's needs for 'light' rare earths. There are also other geological mechanisms to concentrate earth earths. One of the first types of rare earth ore to be mined was mineral sand. Quartz and much smaller amounts of the rare earth mineral, monazite, plus zircon and other resistant minerals survive weathering and erosion inland, are transported by rivers, and deposited as sand on beaches. India is still mining beach sands for rare earths today. In southern China, an even more unusual deposit is being mined, and supplies most of the world's 'heavy' rare earth elements. As granitic rocks weather, rare earths are released from soluble minerals. Instead of forming their own new minerals, some of the rare earths become adsorbed onto the surface of clays. The advantage of this type of deposit is that the rare earths are easy to leach using chemical reagents, mining can even be done 'in situ' without the need to move any material at all by routing the leaching reagents down through the weathering profile.

Robert Pell

My current research topic covers '**Responsible sourcing of rare earth elements**', I am part of the SoS Rare cohort, working with Prof Frances Wall (University of Exeter) as my primary supervisor, and Dr Xiaoyu Yan (University of Exeter) and Dr Kathryn Goodenough (British Geological Society) as my secondary supervisors for the project. Previously I worked as Assistant Editor at International Mining, a globally distribution magazine covering technical innovations and project case studies for the mining industry. I am also President for the Camborne School of Mines Society of Economic Geologists (http://csmseg.com/)

Using a Life Cycle Assessment for rare earth production

My talk will introduce the concept of life cycle assessments (LCA), and highlight how you would approach an LCA for rare earth production. I will use case studies to identify when an LCA can be useful at different scales (from government level, to individual project level) and highlight some of the challenges that exist in this field.

Suzanne Shaw

Suzanne graduated with an MSc in Geoscience from Royal Holloway, University of London in 2006 and joined Roskill in 2007. She specialises in analysis of rare earths, natural graphite and bentonite and is the author of numerous Roskill reports on these industries. Suzanne developed and maintains supply/demand models for rare earths, natural and synthetic graphite and for bentonite. Roskill has been a leader in international metals and minerals research since starting life as one of the UK's first management consultancies in 1930.

Rare earths in the real world – from separation plant to market

Rare earth elements are used in a large number of applications and have gained significant attention thanks to their use in green technologies such as wind turbines and new energy vehicles. Although rare earths are not actually rare at all, they are difficult to separate from one another and there is a critical balance between supply from separation plants and demand from the various markets. From oxides to chemicals to alloys, rare earths are used in many different ways with varying requirements on grade, specification and price. But how are price and the availability of rare earths changing and will supply from new projects keep up?