

Critical Resources - Rare Earth Elements (G530)



Tutor(s)

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Overview

This course covers all aspects of rare earth elements (REE) as critical resources, both in terms of technological advancement and combating climate change. We shall delve into the major sources of these elements, their tectonic settings and the enrichment processes that lead to deposit formation. The characteristics of major REE deposits shall be investigated, using international case studies, to determine typical exploration methods and factors affecting processing.

Duration and Logistics

Classroom version: A 1.5-day course comprising a mix of lectures, case studies and exercises. The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Three 3.5-hour interactive online sessions presented over 3 days. A digital manual and exercise materials will be distributed to participants before the course. Some reading and exercises are to be completed by participants off-line.

Level and Audience

Intermediate. The course is intended for anyone with an intermediate knowledge of geological processes and exploration techniques.

Objectives

You will learn to:

1. Understand the characteristics and behavior of REE in these geological environments.
2. Understand the geological processes leading to formation of different deposit types.
3. Understand and identify the multiple enrichment mechanisms that lead to REE-enrichment.
4. Identify typical rocks and minerals associated with REE deposits.
5. Evaluate typical features of REE deposits to determine appropriate exploration techniques.
6. Interpret geochemical and exploration data associated with REE deposits.
7. Assess the economic viability of deposits using typical characteristics.

Course Content

Course Details

This course will focus on understanding the geological processes and enrichment mechanisms that lead to the formation of REE deposits. This course shall focus on carbonatite and alkaline-silicate sources of REE. The exploration methods and factors that affect the economic viability of these deposits, such as mineralogy and environmental implications, shall also be addressed.

Practical exercises and international case studies shall be utilized during each session to enhance learning and provide valuable real-life examples.

Session 1: Carbonatite-hosted REE deposits

This session shall start by providing a brief overview of the REE deposit types to prepare you for the following two sessions. The main focus of the session will be to investigate the enigmatic carbonatites that are the main source of global REE production. We shall cover the tectonic environments in which these rocks are found, their formation mechanisms and the processes that lead to their REE-enrichment.

Session 2: Alkaline-silicate-hosted REE deposits

Alkaline-silicate rocks are mineralogically and chemically diverse, but are another major category of REE deposits. Again, we shall discuss the characteristics of the alkaline rock suite, their association with carbonatites, formation mechanisms and enrichment processes.

Session 3: REE exploration, extraction and processing

Finally, the last session shall identify how the characteristics of carbonatites affect the exploration and extraction methods. Finding a carbonatite does not necessarily mean finding a REE deposit, therefore we also investigate key indicators of REE-enrichment. This session shall address the major factors leading to the economic viability of REE deposits, before briefly touching on processing techniques and the environmental impacts of REE exploitation.