



Rare earth elements exploitation, geopolitical implications and raw materials trading

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Rare earth elements (REE) correspond to seventeen elements of the periodic table. They are used in high technology, cracking, electric cars' magnet, metal alloy for batteries, and also in phone construction or ceramics for electronic card. REEs are an important resource for high technology. This project targets 16 years old students in the subject "personalized aid" and will last six weeks. The purpose of this project is to develop autonomy and research in groups for a transdisciplinary work. This project gathers knowledge in geology, geography and economics.

During the first session students analyze the geology applications of the REE. They begin the analysis with learning the composition in different rocks such as basalt and diorite to make the link with crystallization. Then they compare it with adakite to understand the formation of these rocks.

In the second session, they study REE exploitation. We can find them as oxides in many deposits. The principal concentrations of rare earth elements are associated with uncommon varieties of igneous rocks, such as carbonatites. They can use Qgis, to localize this high concentration.

In the third session, they study the environmental costs of REE exploitation. Indeed, the exploitation produces thorium and carcinogenic toxins: sulphates, ammonia and hydrochloric acid. Processing one ton of rare earths produces 2,000 tons of toxic waste. This session focuses, first, on Baotou's region, and then on an example they are free to choose.

In the fourth session, they study the geopolitical issues of REE with a focus on China. In fact this country is the largest producer of REE, and is providing 95% of the overall production. REE in China are at the center of a geopolitical strategy. In fact, China implements a sort of protectionism. Indeed, the export tax on REE is very high so, as a foreign company, it is financially attractive to establish a manufacturing subsidiary in China in order to use REE. As a matter of fact, establishing a company in China can lower the production cost (since the company buys the products used in its production at a lower price).

In the fifth session, they study the raw materials trading based on the futures contracts example. A producer, to avoid a rise in prices of raw materials used in his production can use derivative products on the financial market: futures contracts for instance. This product ensures a quantity and quality for a price and a delivery date agreed upon today. Actually, producers can use a method called Fix price hedging in order to fix the price of a specific product. The main idea is to balance out the "physical position" (spot market) and the "paper position" (futures market). Even if the REE are commercialized in form of a non-perishable's oxide, the flow of the stock must be guaranteed and this is why it is important for producers to secure their supply of raw materials.

In the last session, students search local companies that use REE in their production process and study their strategy on the market.