

New geomodels to explore deeper for High-Technology critical raw materials in Alkaline rocks and Carbonatites



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**Call: GROWING A LOW CARBON, RESOURCE EFFICIENT
ECONOMY WITH A SUSTAINABLE SUPPLY OF RAW MATERIALS**
New sustainable exploration technologies and geomodels. SC5-11d-2015

Title of Proposal:

HiTech AlkCarb

New geomodels to explore deeper
for High-Technology critical raw materials in Alkaline rocks and Carbonatites

Participant No		Participant organisation name	Country
1 (Coordinator)	UNEXE	University of Exeter (Camborne School of Mines)	UK
2	GEOAF	GeoAfrica	Namibia*
3	NERC	Natural Environment Research Council (British Geological Survey)	UK
4	TERRA	Terratec Geophysical Services	Germany
5	EKUT	University of Tübingen	Germany
6	MENDELU	Mendel University in Brno	Czech Rep
7	USTAN	University of St Andrews	UK
8	UdA	University G. d'Annunzio	Italy
9	LANC	Lancaster Exploration Ltd	UK
10	NHM	Natural History Museum	UK
11	ASEC	A. Speiser Environmental Consultants	Namibia*
12	GEUS	Geological Survey of Denmark and Greenland	Denmark

1.1 Objectives

The objectives of the project are to:

1. Develop new geomodels to explore for 'hi-tech' raw materials (critical and related elements – REE, Sc, Nb, Ta, Zr, Hf, fluorspar) associated with alkaline rocks and carbonatites. The aim is to distinguish exploration indicators that suggest mineralisation at depths to 1 km.
2. Improve and develop interpretation of geophysical and downhole data to be able to make better interpretations down to 1 km in alkaline rocks and carbonatites.
3. Transfer into Europe expertise gained in African exploration to improve the chance of more 'hi-tech' element deposits being found within European countries.
4. Give Europe world-leading expertise so that European consultancy businesses can expand, in Europe and worldwide.

1.2 Relation to the work programme

This proposal relates to the Topic of 'New sustainable exploration technologies and geomodels. SC5-11d-2015'. It addresses both areas of interest mentioned in the scope of the call, namely improving the **geomodels** available for alkaline rocks and carbonatites and **new sustainable exploration methods**.

The focus is on one particular and rather rare type of geology, the alkaline igneous - carbonatite association, (0.5% of the world's rocks) which is particularly important in supplying the world's 'high technology' metals. The proposal tackles three of the Challenges outlined in the grant call.

1. - The Challenge that the majority of new deposits will be found at greater depths. This is certainly the case for alkaline rocks and carbonatites in Europe, where there are promising surface expressions that indicate the likelihood of deposits below. The main aim of this project is to be able to explore at greater depths for mineral deposits associated with these rocks.
2. - The Challenge of geological and, especially mineralogical, uncertainty of deposits is a very important factor that hinders exploration of alkaline rocks and carbonatites. This project will help to constrain uncertainties in order to cut the risks and costs of exploration.
3. - The Challenge of mining in densely populated areas is a potential issue if Europe is to secure its supply of 'hi-tech metals'. Work package six considers environmental and social impact and brings lessons in mining from deposits in Africa to Europe. The test drilling case study area has a nature reserve and vineyards and thus serves as a good example of potentially conflicting uses of land.

1.3 Concept and approach

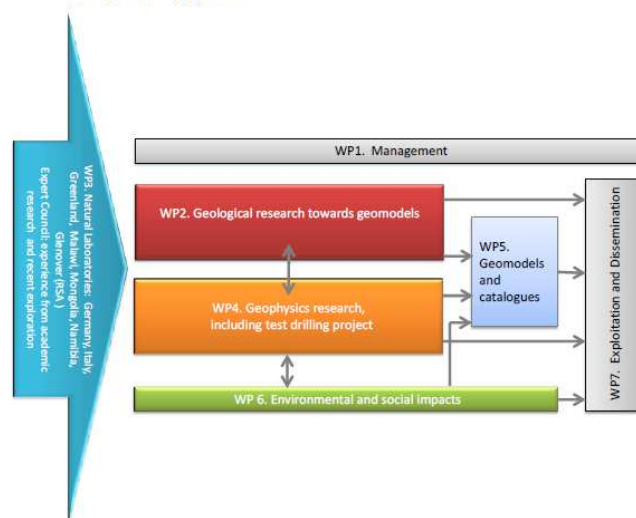


Figure 1 Project diagram showing work packages and work flow. HiTech AlkCarb will harness expertise and experience from key natural laboratories, and also from an Expert Council of external experts (WP3) to carry out geological research (WP2) making use of improved and more effective and cost efficient geophysical techniques (WP4), all aiming to develop new geomodels (WP5) that will provide a framework for exploring deeper in alkaline and carbonatite complexes in Europe. Environmental and social impacts will be considered (WP6) and a substantive programme of dissemination activities and exploitation partners will ensure effective use of the results (WP7).

The need for 'hi-tech' and critical metals and minerals

Rapid technological developments are a feature of modern life, and are dependent on a supply of a growing number of different raw materials. The European Union has recognised twenty of these raw materials as critical (European Commission, 2014), because of their economic importance to the EU combined with risks to supply. Of the critical materials, five are associated with alkaline rocks and carbonatites, mainly heavy and light rare earth elements (REE), niobium, fluorspar and phosphate.

The REE have been the headline of the critical metals agenda because of their risks to supply, in particular the heavy rare earth elements HREE, and because of their use in a very wide range of consumer products. One of the most important and growing uses is in permanent magnets, particularly Nd-Fe-B magnets, which are widely used in applications such as hard disks, speakers, wind turbine motors and electric cars. Nd is the most important of the REE for magnets, but Dy, Tb and Sm are also used. The REE are also used in significant volumes in catalysts, phosphors, glass, polishing, ceramics, batteries and metal alloys, and are critical in a number of defence and medical applications.

Why Carbonatites and AR?

– Scientific value and source of critical metals!

◆ Source of Nb (*pyrochlore*):

Araxá & Catalão, Brazil (478 Mt in reserves at 1-3% Nb₂O₅)

Niobec, Québec (~24 Mt in reserves at 0.7% Nb₂O₅, ~50 M\$/yr in sales)

◆ Source of REE (*fluorocarbonates and monazite*):

Bayan Obo, Inner Mongolia, China (leading producer, 1985-now, 48-135 Mt at 3.5-6 % REE₂O₃)

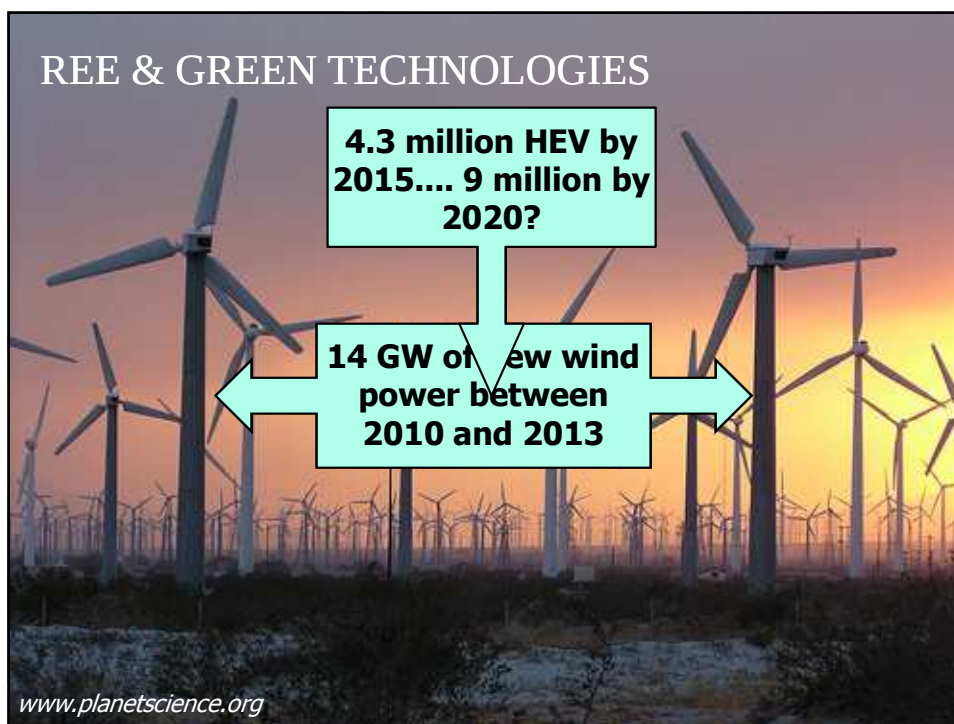
Maoniuping (1978-2007; 1.45 Mt at 8.17% REE₂O₃)

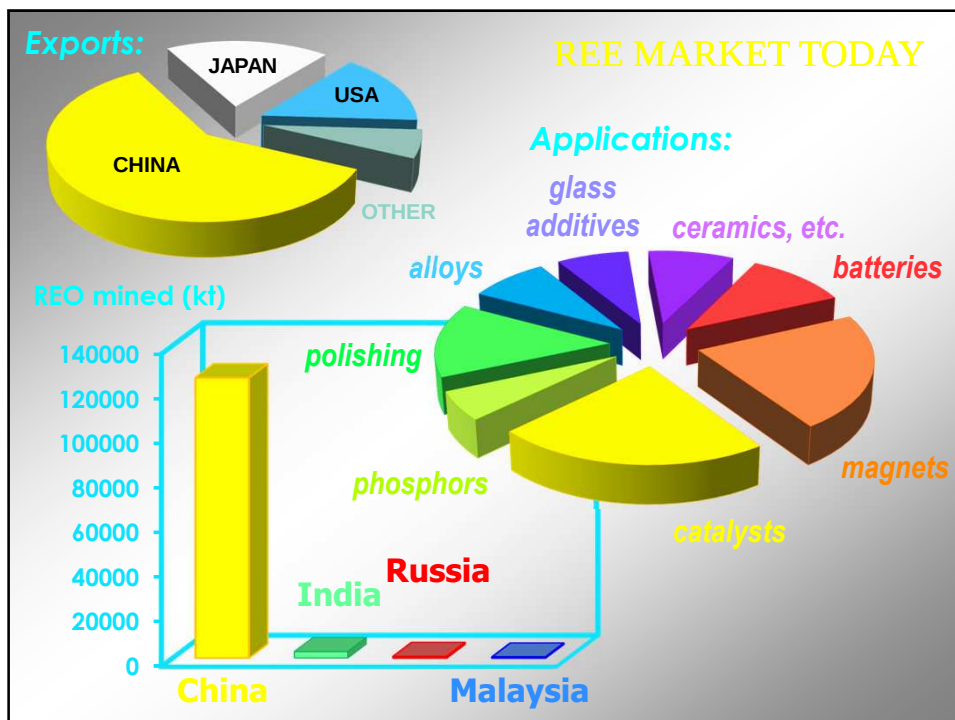
Mountain Pass, California (1965-1985; 16.7 Mt at 8% REE₂O₃)

Bear Lodge, Wyoming (~7.5 Mt at 3.8% REE₂O₃)

www.cambior.com
USGS Minerals Yearbook

www.rareelementresources.com
www.questrareminerals.com





Realistic in EU?

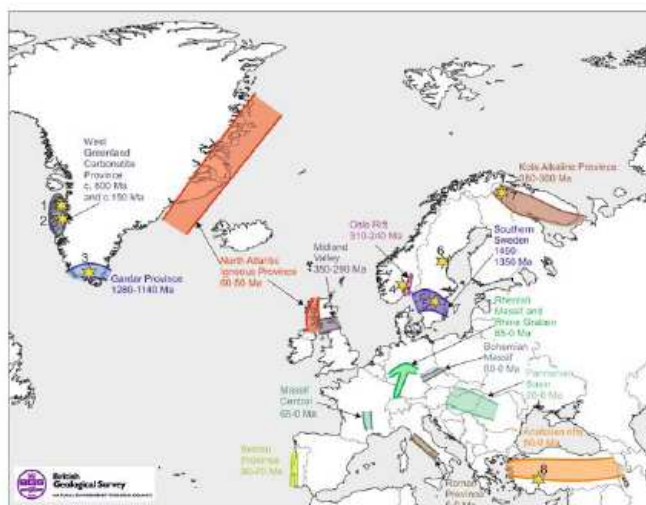


Figure 4 Some of the key alkaline provinces in Europe, showing the approximate age in Ma (millions of years). Map prepared as part of the EURARE project. Numbers refer to active REE exploration projects and mines. Europe has many smaller occurrences of alkaline igneous rocks that are not shown.

Conclusions, recommendations and insights

- Strong and realistic topic
- Strong = hardworking partners
- Strong support of home institution
- Strong = interesting preliminary results
- For more info see also:
- <http://criticalmetalsmeeting.com/>

WARMPEACE OUTDOOR ADVENTURE



MONGOLSKO

VE SLUŽBÁCH VĚDY

Text a foto Jindřich Kynický

Vše začalo již před pěti lety, kdy se na Masarykově univerzitě v Brně zrodil první studentský geologický expediční projekt. Důležitou událostí pro uskutečnění a budoucí pokračování záměru bylo zahájení spolupráce s Technickou univerzitou v Ulaanbaaturu a zahájení spolupráce s tuzemskou firmou Geotest Brno ve rámci jejího projektu pomoci rozvojem zemí při vyhledávání zásob průmyslových a vodních zdrojů v pouštním a polopouštním prostředí.

Při první expedici procestovali mladí výzkumníci téměř 2/3 mongolského území, počtem dohledávali i objevovali velkou škálu výskytů zájmových hornin, minerálů, geologických útvarů i paleontologických nálezků důležitých pro výzkum v následujících letech. Další výpravy se soustředily na podrobný průzkum dlouhý neprozkoumaných lokalit na jihu a západě Mongolska. Vznikla tak další témata diplomových prací, tentokrát i pro studenty Lesnické a dřevařské fakulty Mendelovy zemědělské a lesnické univerzity v Brně. Tato expedice, jako dosud nejrozsáhlejší, byla na rozdíl od předchozích výprav diametrálně odlišná. Hlavní rozdíly byly v tom, že jsme jeli vlastním autem – GAZem, natloženým GAZem 66, a v něm, že jsme zaplňovali kargo na převoz studijního materiálu do ČR.

Z našich cílů jsme po vyčerpávajících měsících nakonec dosáhli téměř všeho, co bylo plánováno v plánu. Tím nejdůležitějším pro nás byly výskumy zkamenných lesů, planetárních šů a neopletitých kůstek mrtvého stromu. Na druhém místě jsme nejvíce času věnovali průzkumu uhelných a fluoritových ložisek. Problémová vznikla a mineralizace mezozoických alkalických žul, ložisek zlata a karbonátů. Již bylo zhruba rozpočteno z předchozích let, a tak šlo všechno, jak po násle!

Gobi

Mnoho lidí ví, že Gobi představuje jednu z nejteplejších, nejlidnatějších a nejstarších pouští na světě. V zemi teploty klesají i pod -50 °C (dokonce i v Ulaanbaaturu bylo před třemi roky naměřeno -72 °C). V létě se teploty pohybují v maximálním intervalu -10 °C v noci až +55 °C ve dne na přehřátém. Přidatě Gobi jako pískovité prostředí je také mylná – písek zabírá z celé rozlohy necelá



Thank you for your attention and have a good luck in all you do with respect to nature!



