HiTech AlkCarb

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

Deliverable D 7.3 Massive open online course development

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Summary

This report covers the development of materials for a massive open online course (MOOC) on the topic of technology metals and a green future, using examples from the HiTech AlkCarb project. https://www.futurelearn.com/courses/technology-metals-for-a-green-future.

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0.1	Kate Smith	July 2019	Course proposal
	UNEXE: Ed Loye, Frances Wall, Kate Smith, Peter Frost, Rob Pell, Karen Hudson-Edwards, TERRA: Klaus Brauch, Ian Higgins, Less Common Metals, Alan Walton, University of Birmingham. Phil Gurr, Digitalcut. Anatole Beams.	16/12/19	Course content draft, including articles, films and graphics content.
	UNEXE: Alexandra Sweeney, Frances Wall, Kate Smith, Peter Frost	16/12/19 – 6/1/20	Review of draft course content
	UNEXE: Kate Smith, Peter Frost, Ed Loye, Frances Wall. Phil Gurr, Digitalcut. Anatole Beams.	28/12/19 – 6/1/20	Edits to course content
	Kate Smith	6/1/20 – 28/01/20	Minor edits to course content in response to learner feedback
	Kate Smith	28/01/20	Report writing
	Frances Wall	29/01/20	Report review
1.0	Kate Smith	30/01/2020	Submitted to EU

Dissemination

Date	Issue	Participants
31/01/2020	1.0	HiTech AlkCarb Participants (26) and online

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Development of materials for massive open online course

What is a massive open online course (MOOC)?

Massive open online courses (MOOCs) are courses on the internet that are generally free, for at least a limited amount of time, and designed to be available to an unlimited number of learners.

These courses often offer an element of social learning, where learners are able to discuss the course in a comments section or discussion forum, creating a 'community of learners' (Harrison and Bergen, 2000; Poole, 2014) which, to some extent, takes the place of social contact in a classroom or traditional learning setting.

An advantage of a MOOC is that it is freely available to those with internet access, and that it can easily be used for self-directed learning, fitting around other daily commitments and tasks, and allowing learners to easily go back to review material that they found challenging, or to skip ahead to topics that interest them later in the course (de Waard et al, 2015).

The FutureLearn platform offers a diverse range of courses produced by Universities and other cultural organisations. The platform is owned by the Open University, a specialist in distance learning and online education, and by The SEEK Group. FutureLearn first launches courses in 2013 and now millions of learners use the platform.

Technology metals for a green future MOOC

The HiTech AlkCarb team in Camborne School of Mines, UNEXE, with input and support from project partners TERRA, LANC, expert councillors and colleagues and collaborators have produced a new MOOC (Massive Open Online Course) to explore the challenges of sourcing these specialist technology metals: see here for further information https://www.futurelearn.com/courses/technology-metals-for-a-green-future. This course was primarily developed by a team of 4 staff from UNEXE, including two staff members employed specifically to develop the course materials.

The first run of the four week course started on 13th January and remains open for learners to join for a six week period. It is free to access on the FutureLearn platform during this time, and learners can pay for extended access should they wish. The course has also been included in the British Council Study UK programme, which permits learners from non-OECD countries to have a free upgrade (with unlimited access and certificate of completion). The e-learning team of the University of Exeter will maintain this course so that it runs several times per year.

The course covers how technology metals are used, where they come from, how they are produced and ways to ensure we can achieve sustainable metals stewardship. The transition from fossil fuels to low carbon technologies will require the mining of more metals, and a wider variety of metals, than ever before. The 'technology metals' such as rare earths, lithium, cobalt, tantalum, tin and indium are especially important for devices such as wind turbines, solar panels and electric cars, as well as all our digital tech – smartphones, TVs, medical imaging, and communications systems.

Throughout the course there are examples from the HiTech AlkCarb project and we have also pointed learners to other EU funded projects on critical raw materials in the further reading suggestions.

Course structure

This MOOC is designed to take learners a total of 16 hours to complete, spread over a 4 week period.

In week 1 learners cover big picture issues and are introduced to the concepts of technology metals and critical raw materials, and the topics that will be covered during the rest of the course. This week involves 21 steps, including articles, 8 films produced for the course (one of which was filmed at Less Common Metals, a metal alloy manufacturer in Port Ellesmere, UK; one was from the University of Plymouth; the others were filmed at the University of Exeter), exercises and discussions on the themes of device and energy use, attitudes to mining, supply and value chains, elements and the periodic table and criticality, among other topics. The discussion forum during the first week of the course has raised enthusiastic conversations between learners about big-picture issues such as the variety of elements used in modern technology, security of supply and responsible mining. The week's learning is rounded off with a glossary, further reading and multiple choice quiz.

The theme of week 2 is geology, ore formation and minerals. This week involves 25 steps and takes students from the basics of different rock types to introductions to alkaline rocks and carbonatites. Students are encouraged to consider the geology in their home area, and to learn about the less well known rock types that can host technology metals, and the ways in which ores form in these geological settings. Four films (produced by University of Exeter and also from project partner LANC and publisher W W Norton) and a series of articles, discussions and activities make up week two. Alkaline rocks, carbonatites, pegmatites and ion adsorption deposits are introduced through a series of 'field trips' with information on case study locations, where possibly using information from the HiTech AlkCarb project. The Songwe Hill Malawi natural laboratory is used as a case study to look at carbonatites, and involves a film from project partners LANC. Students are asked to produce their own case study of an alkaline rock or carbonatite field site by carrying out online research, making use of the Catalogue of alkaline rocks and carbonatites of the world produced as HiTech AlkCarb output from NHM, and reporting in deliverable D5.1. Quizzes of mineral types, a glossary and further reading round up week 2.

Week 3 covers steps from exploration to mining, processing and manufacturing – links between the geology and consumer products. Week 3 involves 21 steps. 5 of these are videos steps, including two from project partner TERRA on geophysics and modelling and 1 from alloy manufacturer Less Common Metals. In addition, students are asked to consider how exploration might be carried out if there was an exploration project near where they live (considering different stakeholders and the challenges of their local environment) and also to reflect on the length and complexity of the supply and value chains for consumer products.

The final week, week 4, focusses on responsible sourcing and involves 29 steps. Many of these involve discussion and reflection on some of the key issues brought up in week 1 about social acceptance of mining, recycling, circular economy and how best to ensure security of supply for raw materials for technological development and manufacture. We use case studies from project partner LANC in Malawi and also from Fairphone and the NGO PACT which is interested in artisanal mining. At the point of writing this report, the course has been running for just under 3 weeks so few learners have reached the fourth week. However, we anticipate that the subjects covered will continue to promote active discussions. To conclude the week and the course, learners are encouraged to reflect on the subjects covered over the 4 weeks and are offered suggestions for further reading.

Course impact to date

As of the time of writing (28/01/2020), which is the start of the third week of the first run of this course, 1,240 learners have joined from 106 different countries (Figure 1).

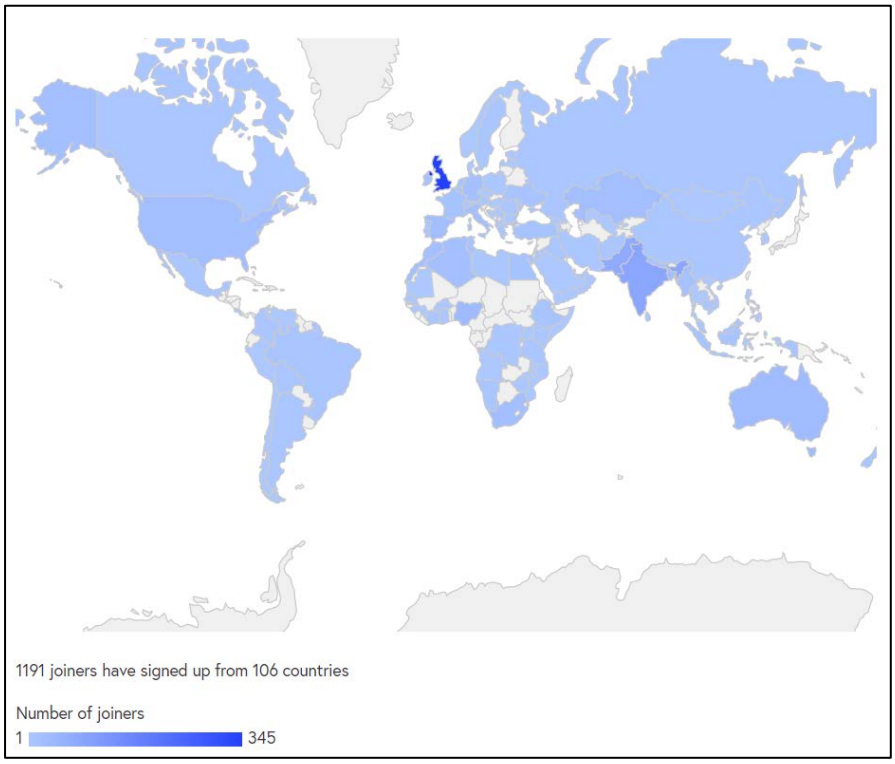

Figure 1: Map of course joiners 28/01/2020 (day 2 of week 3 of 6) (all learners on the course at the time of map production who identified their country in their joiners information, not including any who have left the course).

The age distribution (Figure 2) shows a dominance of people over the age of 65 and also in the age bracket 18-45.

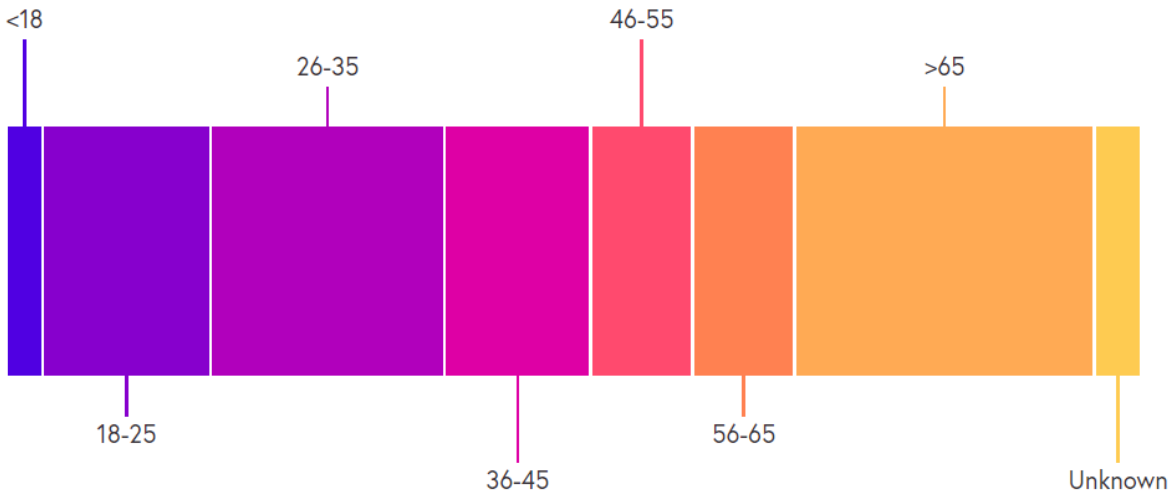

Figure 2: Age distribution of joiners (on 28/1/2020, day 2 of week 3 or 6). Data is based on the joiners who completed the survey and replied to the question "What year were you born?". *Unknown* indicates they left the answer to the question blank. Percentages are rounded to the nearest whole number.

Comments on the welcome page of the course indicate that learners come from a wide range of backgrounds, some of whom have geology or mining experience, but many who do not. Learner backgrounds are very varied and include mining, geology, manufacturing, policymaking, architecture, anthropology, industrial design, engineering, teaching, arts and crafts, ecology, travel and tourism, language studies, chemistry, medicine and defence.

Dissemination and marketing

A press release from UNEXE was distributed to news and trade media, and made available through institutional social media, as well as from HiTech AlkCarb social media and email newsletters, and through messages to individual contacts at European and international organisations. The FutureLearn platform also advertises the course on its website, through its course catalogue and through affiliated online learning sites.

Marketing and press releases associated with the MOOC have also promoted the HiTech AlkCarb project. The course and the materials are identified as being funded by the Horizon 2020 project HiTech AlkCarb and there are links associated with the content to further reading and research information on the HiTech AlkCarb project website.

In addition to the promotion of the online course, HiTech AlkCarb and UNEXE will distribute the materials from the course as a series of pdfs and mp4 files on USB memory sticks. This is likely to be of most use to educational organisations in countries where internet access is limited, or where bandwidth is insufficient to be able to access the online videos effectively, as well as to school teachers who might be interested in using the materials within their classroom teaching.

Summary

The' Technology metals for a green future' online course materials will allow the HiTech AlkCarb project to have a outreach legacy beyond the duration of the project. This will help to disseminate project results, news about the Horizon 2020 EU funding mechanism and wider information about the importance of critical raw materials, security of supply, responsible sourcing and geology's positive role in a low-carbon future to a broad audience around the world and with varied educational backgrounds and interests.

References

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Acknowledgements

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